Appendix I1

Plan: *Managements plans*

MEADOWBANK GOLD PROJECT

Landfarm Design and Management Plan

In Accordance with Water License 2AM-MEA0815

Prepared by:
Agnico-Eagle Mines Limited – Meadowbank Division

Version 3
February 2013

EXECUTIVE SUMMARY

General Information

The Landfarm Design and Management Plan (LDMP) describes the design features and operational procedures for the landfarm constructed at the Meadowbank Gold Project site for the storage and treatment of petroleum hydrocarbon contaminated soil.

Annual Review

The LDMP will be reviewed and updated at least annually if necessary. Completion of the annual review of the LDMP will be documented through signatures of the personnel responsible for reviewing, updating and approving the LDMP.

Record of Changes

A record will document all significant changes that have been incorporated in the LDMP subsequent to the latest annual review. The record will include the names of the persons who made and approved the change, as well as the date of the approval.

Distribution List

Agnico-Eagle Mines Limited (AEM) will maintain a distribution list for the LDMP providing information about all parties that receive the plan including mine personnel, departments, and outside agencies.

IMPLEMENTATION SCHEDULE

As required by Water License 2AM-MEA0815, Part B, Item 16, the proposed implementation schedule for this Plan is effective immediately (February 2013) subject to any modifications proposed by the NWB as a result of the review and approval process.

DISTRIBUTION LIST

AEM - Environmental Superintendent

AEM – Environmental Coordinator

AEM – General Mine Manager

AEM – Site Services Superintendent

AEM – Field Services Supervisor

AEM – Engineering Superintendent

DOCUMENT CONTROL

Table 1 – Document Control

Version	Date (YMD)	Section	Page	Revision
1	08/10/08	2		Remediation guidelines used and the parameters measured
		7		Details on storage and treatment options for metals, solvents, glycol and heavy oils; Measures to prevent damage to the liner during mechanical operation
		4		Contingency plans for exceedances in the amounts of contaminated soil and/or snow/ice
		5		Details describing the design components/specifications of the spillway
		8		Contingency planning and monitoring of sump volumes during the snowmelt period
2	12/10/22	All	All	Comprehensive revision to original plan
3	13/02/28	All	All	Further detail and rationale provided

Version 3

Prepared By: Meadowbank Environment Department

Approved By: _____

Kevin Buck

Environmental Superintendent

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1 INTRODUCTION

1.1 PROJECT HISTORY

Agnico-Eagle Mines Limited (AEM) Meadowbank Division (Project) currently operates an open pit gold mine located on Inuit-owned land in the Kivalliq Region of Nunavut, approximately 70 km north of the hamlet of Baker Lake. In 2008 the Landfarm Design and Management Plan was developed by AEM in accordance with Water License 2AM-MEA0815 to describe the handling and remediation of petroleum hydrocarbon (PHC) contaminated soil at the Meadowbank site. During construction and initial operations (2008-2011, prior to construction of the landfarm facility), soil potentially contaminated with PHCs, as a result of spills, was deposited in two quarries (Q5 and Q22) along the All Weather Access Road (AWAR). The majority of this soil was from a transport tanker spill in 2010 and from the contractor camp used for roadway construction in 2007 and 2008. In 2012 the transport of this soil back to the minesite for treatment/storage began. Landfarm design and management plan modifications (Version 2) were submitted by AEM to the Nunavut Water Board on October 22, 2012. This new plan focuses on minimizing the waste footprint onsite, and maximizing remediation potential through implementation of a pilot bioremediation project. The revisions in this document (Version 3) provide further rationale for the designs presented in Version 2, as well as additional details on the management of contaminated soils onsite. This includes spill prevention and contingency planning.

1.2 OBJECTIVES

Onsite storage and remediation has been established as the preferred method for treatment of petroleum hydrocarbon-contaminated soil that may be generated on the Meadowbank site and Exploration Camp. Specifically, remediation through landfarming has been identified as the primary treatment option and, as such, is the focus of this contaminated soil management plan. A pilot project to enhance rates of bioremediation through addition of a nutrient source is also described. Alternate contingency options in the event that landfarming is not successful or as efficient as planned are also discussed.

This plan is a component of the Meadowbank Environmental Management System. The objectives of this plan are:

1. To provide an overview of contaminated soil management at Meadowbank
2. To describe the physical setting, location and design criteria of the landfarm
3. To define acceptable types of contaminated soils to be placed in the landfarm and conditions for removal of treated soil

4. To define operating procedures and monitoring requirements for the landfarm, including the pilot bioremediation project
5. To describe contingency options for alternate treatment/storage of PHC contaminated soil

2 SPILL PREVENTION

2.1 SPILL MANAGEMENT DOCUMENTATION

Spill prevention is the first stage in contaminated soil management at the Meadowbank site. Three documents describe spill prevention, management and response at this facility: the Spill Contingency Plan, the Emergency Response Plan, and the Oil Pollution Emergency Plan. Specifically, Section 2.1 of the Spill Contingency Plan describes spill prevention measures and can be referred to for further detail. All were updated in July or August of 2012, and spill prevention programming was reviewed.

General spill prevention methods include:

- Daily inspections of fuel/chemical storage areas for leaks
- Training in safe handling procedures
- Keep containers sealed
- Use methods of secondary containment
- Keep overpack drums nearby to contain leaking drums
- Keep storage area secure from unauthorized access, and protected from weathering and damage
- Segregate incompatible materials
- Regular meetings with site departments

2.2 DECREASING SPILL SEVERITY

In 2011, spills of landfarmable materials (fuel and hydraulic oil) at Meadowbank totaled 5338 liters. In 2012, Meadowbank Division Environment Department increased delivery of spill prevention programing. This included more departmental information sessions to maintain awareness about spill prevention methods and reporting procedures. In 2012, spills of fuel and hydraulic oil have been reduced to 3012 liters. In 2013, the Environment Department will be incorporating a site wide training session for every employee on site. In addition, the Emergency Response Team as well as Environment and Road Maintenance staff will have extensive training in spill response by a consultant specializing in spill training (January, 2013). Training will pertain to spill response on the tundra as well as surface water. In addition, AEM will begin use of a new hydraulic fluid (Hydrex^{TM} Extreme; Petro-Canada) that contains no heavy metals and is 40% biodegradable in 28 days. It is therefore estimated that any soil contaminated with the new fluid will be more rapidly remediated in the landfarm than soil contaminated with the previously used fluid.

3 LANDFARM DESIGN

3.1 BACKGROUND

When spills do occur, onsite storage and remediation is the most practical and efficient method of handling contaminated soil, particularly in an isolated location like Meadowbank. For PHC contamination, bioremediation through landfarming has been identified as a viable remedial technique. This method involves spreading, mechanical mixing, and placing the contaminated soil in windrows within a containment area and promoting conditions favourable for the volatilization and aerobic microbial degradation of hydrocarbons. A number of environmental factors and physical properties of the soil affect microbial growth and rates of biodegradation, including temperature, soil moisture, nutrient content, salinity and soil particle size.

Previously, a landfarm options analysis prepared for AEM by Golder (2007a) identified some of these factors, and presented the following information from the literature on landfarming in the north. Although rates of biodegradation decline with temperature, landfarming is still a feasible technique in arctic climates (Reimer et al. 2005). Microbial activity stops between 0 – -5°C (although volatilization continues at this temperature), so degradation in the north is typically restricted to the months of June – September. Nevertheless, degradation was reported at 70% after one year in a study in Alert, NU (Greer et al. 2007), and 90% over two summers on Resolution Island (Paudyn et al. 2005).

3.2 LOCATION

The overall site plan for the Meadowbank Gold Project and the location of the landfarm facility are shown in Figure 3-1. This central location was chosen to minimize the waste footprint on site and the transport distance of contaminated material from spill locations. All of the waste generated at Meadowbank in the form of tailings, wasterock and the site landfill is in close proximity. The location of the new facility is directly north of the future South Cell Tailings Facility (2015). This location will facilitate closure and possible contingency plans (Section 5), because all waste will be located in the same area, and not spread out around the mine site.

3.2.1 Proximity of Surface Water

The facility is located 300 m from the nearest water body, Third Portage Lake (TPL) and immediately adjacent to the current North Cell Tailings Storage Facility (TSF). Surface drainage in this area is easterly, towards the TSF and away from TPL.

3.2.2 Proximity of Groundwater

In the Meadowbank area, the shallow groundwater is estimated to be 1.5 m below surface (active layer July – October), at the average depth of thaw. In order to prevent movement of contaminants from the landfarm facility into groundwater and the surrounding environment, Environment Canada (SAIC, 2006) recommends implementation of a barrier with 10^{-7} cm/s hydraulic conductivity at a thickness of 0.6 m. The Meadowbank facility pad is constructed of 2.7 m of compacted till with a hydraulic conductivity of 10^{-7} m/s. Therefore, no impacts to groundwater are anticipated.

3.3 DESIGN

The landfarm facility is designed with one soil remediation/storage cell. The design volume of the cell is based on allowances for the materials to be treated. This calculation is described in the following section.

3.3.1 Soil Volume Requirements

Between 2008 and 2010, the Meadowbank Gold Mine stored 5,320 m^3 of soil potentially contaminated with hydrocarbons in two quarries along the AWAR (Q5 and Q22), as a contaminated soil storage facility had not yet been built onsite. As discussed above, the majority of this contamination was the result of an overturned tanker in 2010, and spills during the construction and initial operations. A delineation of contamination in the quarries (Qikiqtaaluk Environmental, 2010) indicated approximately 1,000 m^3 of contaminated soil above Government of Nunavut (GN) guidelines in Q22, and 250 m^3 in Q5. In 2011, an additional 250 m^3 of PHC contaminated soil was generated onsite, and placed in Q22. Actual hydrocarbon contaminated soil from January - October 2012 was 400 m^3, and the projected total for 2012 at that time was 480 m^3. The total volume of contaminated soil generated at Meadowbank to date is therefore approximately 1730 m^3, for an annual average of 346 m^3. Currently production will continue through 2017 for an expected additional required landfarm capacity of 1,725 m^3 (5 years x 346 m^3/year). With an additional 20% for contingency, and conservatively assuming that no soil will be remediated and removed before closure, the total capacity of the landfarm should therefore be a minimum of 4,146 m^3.

3.3.2 Design Specifications

Specifications of the landfarm design are shown in Figure 3-2. As built, the landfarm area is constructed with a 1.5 m high berm and a 2.7 m deep compacted till base with hydraulic conductivity of $1x10^{-7}$ m/s. The slope of the base is 1.5%.

The useful landfarm area is 3,712 m^2. Based on landfarm specifications of other northern mines (Ekati Diamond Mine – in Golder, 2007a), contaminated material can be stockpiled up

to 4 m high. Accounting for a 25% loss of area due to sloping at that windrow height, the landfarm area will allow for the storage of a maximum of 11,136m^3. This will readily accommodate the estimated total of 4,146 m^3 of contaminated soil, should all of it need to be stored until closure. In addition, ample room will be available to accommodate a designated area for spreading of contaminated coarse-grained material that cannot be bioremediated (see Section 4.2.2).

Based on the available area, maximum windrow size will be 15 m wide at base x 4 m high x 50 m long, but smaller piles will be used as space allows tomaximize rates of biodegradation and volatilization.

4 LANDFARM OPERATION AND MANAGEMENT

The following presents the operational procedures for the landfarm facility.

4.1 MANAGEMENT RESPONSIBILITY

AEM will be responsible for managing and implementing the operation plan. Operation and monitoring of the facility will come under the responsibility of the Environment Superintendent. Designation of training requirements is the responsibility of Meadowbank Environment Department.

4.2 ACCEPTABLE MATERIAL

4.2.1 Contaminants

The landfarm facility will only treat and/or store petroleum hydrocarbon contaminated soils that have been generated through mine-related activities at the Meadowbank Gold Project and the Meadowbank exploration camp. Material from other sites will not be accepted without approval from the Nunavut Water Board, AANDC Water Resources Officers and the Kivalliq Inuit Association.

The following products may be treated in the landfarm if used onsite and spilled on soil:

- Diesel fuel
- Gasoline
- Aviation fuel (Jet A)
- Hydraulic oil
- Other light oil e.g. engine oil, lubricating oil

In the event that the contaminant source is unknown, soil samples will be analyzed for petroleum hydrocarbons and possibly additional contaminants prior to placement in the landfarm. These additional parameters could include total metals, oil and grease, and volatile organic compounds. Analysis for additional compounds will be determined by the Environment Department on a case-by-case basis. Concentrations of contaminants will be compared to the site background values (for metals) and/or criteria in the GN Guidelines for Contaminated Site Remediation (March, 2009). If this analysis indicates soil contamination above background or GN guidelines with any substances not described in Section 4.2.1 (i.e. non-PHC contaminants), it will not be placed in the landfarm facility. This is to ensure PHC contaminated soil is not contaminated with other products.

Spills of > 100 L of non-PHC material (e.g. solvents, glycol) will be placed in drums and stored in the site Hazmat area for shipment south to approved facilities during barge season. Spills of non-PHC material < 100 L will be placed in the TSF.

4.2.2 Grain Size

While very coarse-grained larger soil material does not readily retain moisture and nutrients, inhibiting bioremediation, volatilization will occur more rapidly (SAIC, 2006). It has been noted that this material likely contains lower concentrations of contaminants due to a lower volume:surface area ratio, and can typically be screened out prior to landfarming (SAIC, 2006). A 2010 study at Meadowbank (Qikiqtaaluk Environmental, 2010) indicated increasing concentrations of PHC with decreasing grain size in one group of samples with soil fractions of 0.5, 0.5-1 and >1" (two other groups sampled were below detection at all grain sizes). Soils and rock material with grain size <1" will be separated from larger-grained material as best as possible. This will occur at the spill location or in the landfarm. If necessary, a screen sieve will be used. The two soil fractions will be treated separately in the landfarm (see Section 4.3.1).

4.3 CONTAMINATED SOIL ADDITIONS

4.3.1 Spill Excavation

Soil contaminated with the above-described petroleum hydrocarbon materials will be excavated from the source and transported to the landfarm facility in dump trucks or by roll-off containers. Care will be exercised to ensure that the entire spill is excavated (verified by olfactory and visual assessment or sampling if necessary) and that none of the contaminated material is lost during transport.

4.3.2 Placement in the Landfarm

As above, larger coarse material (> 1") will be separated from the finer material in the landfarm and assessed visually for PHC staining and product. If the material is saturated it will be spread out for volatilization in the designated area of the landfarm.

Fine-grained materials identified as acceptable in the landfarm should be placed in windrows with dimensions ~15 m wide at base x 2.5 m high x 50 m long. Windrows may be piled higher as space permits. A record will be kept by the on-site Environmental Coordinator of the amount of contaminated soil placed in the landfarm and the location of each load within the facility.

Although Qikiqtaaluk Environmental (2010) indicated 250 m^3 of contaminated soil in Quarry 5, all soil previously deposited in there (1200 m^3) has been removed to the landfarm facility and placed in two windrows (see Photo 1, Appendix B). Including contaminated soil

produced onsite in 2012, the landfarm currently contains approximately 1680 m^3 of contaminated soil. Contaminated soil historically deposited in Quarry 22 (up to a maximum of 1,000 m^3, as delineated in Qikiqtaaluk Environmental, 2010) will be moved to the landfarm in 2013. Coarse, uncontaminated material will be left in Q22 for rehabilitation purposes.

4.4 CONTAMINATED SNOW

For spills < 100 L, PHC-contaminated snow will be placed in a designated area of the landfarm and treated as contact water after snowmelt.

For spills > 100 L, PHC-contaminated snow will be excavated and stored in labeled drums. After snow melt, the contaminated water will be pumped through the site's oil-water separator (carbon filter) to remove PHC residue. The treated water will be sampled per Part F, Item 6 of the Water License, and discharged to the Stormwater Management Pond if criteria are met. If criteria not met, water will be treated as hazardous material and shipped south. Also, after snowmelt, visible product will be cleaned up with absorbent pads or booms.

4.5 REMEDIATION

Remediation of fine-grained PHC-contaminated soil in landfarms occurs naturally through volatilization and aerobic microbial degradation. Soil aeration and nutrient amendment are recognized as methods of improving rates of remediation. To this end, remedial operations at the Meadowbank site include soil mixing (aeration) and a pilot project utilizing onsite nutrient additions. While it is recognized that pH, salinity, moisture content and microbial population density also contribute to rates of degradation, these factors will not be explicitly investigated or managed unless remediation rates are too slow to meet the site closure time period (see Section 5.2).

4.5.1 Absorbent Materials

Coarse-grained soils are not readily bio-remediated, but concentrations of PHC contaminants may still be reduced through volatilization. Oil absorbent pads will be used to help remove visible product from coarse-grained material. Used absorbent materials will be incinerated.

4.5.2 Aeration

In order to promote aerobic conditions throughout the windrows, soil will be mixed mechanically with earth-moving equipment. This turnover of soil piles will occur two to four times per year, during the summer months.

4.5.3 Soil Moisture

Prior to turning, site personnel will ensure that soil is not so dry as to generate significant dust, nor overly saturated. If soil is dry, water from within the landfarm containment area will be used as a moisture source and sprayed on the piles. If no accumulated water is available, a freshwater supply will be used. If the windrows are saturated, aeration will be conducted at a later date.

4.5.4 Nutrient Amendment – Pilot Project

A number of studies have indicated that amendment with nutrients may increase rates of biodegradation in PHC contaminated soils, but the effectiveness of this practice is not well defined in northern climates. For example, in a Resolution Island study by Paudyn et al. (2008), aeration alone reduced concentrations of diesel fuel by 80% over three summers, almost entirely due to volatilization (not biodegradation). One-time amendment with nutrients (C:N:P of 100:7.5:0.5) in combination with aeration resulted in 90% reduction of TPH concentrations over this time, with significant (but undefined) contributions from microbial degradation.

In order to determine effectiveness of nutrient additions, a pilot project has been undertaken at Meadowbank to examine rates of biodegradation with and without nutrient amendment. Two pilot piles in the landfarm facility were treated in 2012 with 400 gallons of sewage sludge as a nutrient source. Sewage sludge was mixed into the pilot piles on October 8th 2012. Each pile consisted of approximately 140 m^3 of soil. Representative composite samples of the non-treated piles were taken in November 2012 (surface and 1 m depth – see Photo 2; Appendix B), and further samples will be taken in spring 2013 of the treated and non-treated piles to determine if this method of nutrient amendment significantly affects rates of PHC degradation. If degradation occurs more rapidly with additions of sewage sludge and it is estimated that sufficient degradation will be achieved through this method before mine closure, the pilot project will be extended to include all soil placed in the facility.

The use of sewage sludge as a nutrient amendment has precedent in the north. This method has been used at Diavik Diamond Mine, as reported in the BSc thesis of Brenda Lee Bailey, Carleton University (in Golder, 2007). It was found in this study that with sewage sludge amendment (12.6 gallons on a 6 m^3 soil pile), aeration by perforated pipe and clear polyethylene covers to retain heat and moisture, TPH concentrations declined from 15,000 mg/kg to less than 2,000 mg/kg in 88 days. Sewage sludge as a nutrient source has also been proposed for the Milne Inlet Mary River Project (EBA, 2010). This material not only provides the benefit of nutrients, but adds organic matter to help retain moisture, and is a source of microorganisms. Furthermore, the re-use of this material produced onsite helps to reduce the waste footprint of the mine by re-directing this material from disposal facilities and avoiding the import of chemical fertilizer.

4.6 REMOVAL OF SOIL FROM THE LANDFARM

When PHC odours are no longer detected, coarse-grained material will be removed to the site waste rock disposal area and disposed of as potentially acid generating (PAG) material. PAG will be covered with a minimum of 2 m of non-potentially acid generating (NPAG) material at closure, such that freeze-back occurs and any potentially remaining contaminants are not mobile in the environment.

Prior to removal of the finer grained soil from the landfarm, soil samples will be analyzed to ensure they meet Government of Nunavut guidelines, as described below.

4.6.1 Remediation Guidelines

In assessing the remediation success of PHC contaminated soils being treated in the landfarm facility, AEM will use the Government of Nunavut (GN) Department of Environment, Environmental Guidelines for Site Remediation (March, 2009) to determine if the soil has been suitably treated. A copy of the guideline document has been included as Appendix A.

The following parameters will be measured and compared with the GN industrial remediation criteria in order to determine whether PHC contaminated soil has been adequately remediated:

- Benzene, toluene, ethylbenzene and xylene (BTEX)
- Petroleum hydrocarbon fractions 1 - 4

GN remediation criteria are characterized for agricultural/wildland, residential/parkland, commercial and industrial land uses. At the Meadowbank site, remediation to agricultural/wildland criteria is targeted. However, if these criteria cannot be met efficiently, industrial criteria will be followed and soil disposed of accordingly (see Section 4.6.3). Remediation criteria for coarse-grained (>75 um) soils will be applied. Table 2 presents the applicable Tier 1 criteria for coarse-grained soil, assuming agricultural/wildland or industrial land uses. For contaminated sites, a Tier 1 analysis involves the most conservative criteria, and may be applied when the proponent does not wish to establish site-specific criteria.

Table 2 - Summary of relevant Government of Nunavut Tier 1 soil remediation criteria for surface soil for industrial land uses.

Parameter	Criteria (mg/kg)	
	Agricultural/ Wildland	*Industrial*
Benzene	0.03	0.03
Toluene	0.37	0.37
Ethylbenzene	0.082	0.082
Xylene	11	11
PHC Fraction 1	30	320
PHC Fraction 2	150	260
PHC Fraction 3	300	1700
PHC Fraction 4	2800	3300

4.6.2 Sampling and Analysis

Landfarm windrows will be sampled annually at the end of the summer season to determine if remediation objectives have been met. Representative composite samples will be taken of each windrow to estimate remaining PHC concentrations. For each 10 m of windrow length, one composite sample will be collected, each consisting of three surface sub-samples and three sub-samples at 1 m depth. Sub-samples will be taken approximately 3.3 m apart, and will be taken from both sides of the windrow.

After two seasons of treatment in the landfarm (Fall 2013), degradation rates will be assessed to estimate the total remediation time required for PHC-contaminated soil under these conditions. If remediation to GN guidelines is feasible within the life-of-mine timeframe, landfarm operations will continue, with aeration and possible nutrient amendments as described above. If rates of TPH degradation are not sufficient through this method, alternate options will be further investigated (see Section 5).

4.6.3 Soil Removal

Coarse-grained material will be assessed near the end of the summer season by Environment Department technicians for PHC product and odour. A PID monitor may be employed to assist in petroleum-based vapour detection . When PHC odours are no longer detected, this material will be removed to the PRSF and disposed of as PAG material.

When sample analysis of fine-grained material at the end of a season indicates that concentrations of contaminants are below Government of Nunavut guidelines, a soil pile or

the appropriate section of a pile will be deemed acceptable for removal from the facility. Interim monitoring may be conducted through measurements of head-space with a portable instrument (e.g. flame ionization detector), but samples will be confirmed by an accredited laboratory prior to soil removal.

Soil remediated to agricultural/wildland criteria will be appropriately delineated by Environment Department staff, and stockpiled outside the landfarm for use in site works or reclamation activities.

Soil remediated to industrial-use criteria will be removed from the landfarm and placed in the Portage Rock Storage Facility (PRSF) as PAG material. This material will be capped with a minimum of 2 m of NPAG at closure, allowing freeze-back and permanent encapsulation to occur.

4.7 WATER MANAGEMENT

Since the landfarm facility is uncovered to facilitate natural weathering, water accumulating inside the bermed area may come into contact with contaminated material. The management plan for handling this potentially contaminated water is described below.

4.7.1 Snow Management

Snow will be removed as much as possible during winter to minimize the quantity of spring melt water inside the berm. Care will be taken to ensure contaminated snow/soil is not disturbed by leaving a base layer of snow (no less than 10 cm) in place. After snowmelt any contaminated product left from winter spill clean-up operations will be padded up. The base soil in these areas will be excavated and added to existing remediation windrows as soon as possible after snow melt to minimize migration into the facility substrate.

4.7.2 Water Management

Monitoring will be conducted for seepage of contact water through the perimeter berm, or accumulation of water within the containment berm through visual inspection by the Environment Department. This will be conducted on a weekly basis, after freshet, from July through October when water is likely to be present. In the event of water accumulation or seepage, the ponded water will be analyzed for BTEX, lead, oil and grease, as described in Part F, Item 6 of the Water License prior to discharge to the adjacent Tailings Storage Facility. Alternatively, ponded water will be sprayed on the windrows to increase moisture content, as required. Water accumulating in the landfarm will not be discharged to the environment.

4.8 LANDFARM ABANDONMENT

After removal of all remediated soil and prior to abandonment/closure of the landfarm, the berm and base will be sampled on a 10 m grid, including at a depth of 1 m in representative locations, to determine if these soils are free from PHC contamination. Results of this analysis will be compared to GN criteria. Since this area will form part of the TSF at closure, no excavation is necessary if industrial criteria are not met. AEM's Closure Plan notes that the tailings facilities will be capped with at least 2 m of NPAG to ensure freeze-back encapsulation. Monitoring of tailings freeze-back is ongoing at the site, and to date the results indicate that tailings are already freezing as planned.

4.9 SUMMARY OF ACTIVITIES

A summary of landfarm activities including monitoring of the physical condition and potential environmental impacts of the landfarm facility is provided in Table 3. A report will be prepared annually, indicating the volume of material added to the facility, amount of material removed and disposal or reuse location, all analysis results, volume and type of nutrient addition, visual inspection results and volume of contact water pumped. This information will be appended to AEM's NWB Annual Report.

Table 3 - Summary of landfarm activities, analyses and records to be kept.

Activity	Analysis	Frequency of Analysis	Record
Excavation of spill and transport of contaminated material	If unsure of full excavation - F1-F4, BTEX	As needed	Date and time of excavation; estimated quantity of excavated soil; storage/disposal location of excavated soil, if applicable; any evidence of remaining product
Contaminated soil additions to landfarm	If contaminant source unknown, F1-F4, BTEX, metals, oil and grease, VOCs (at discretion of Environment Department)	Prior to soil addition at facility	Date and time; quantity of soil; original location; landfarm location; spill/excavation record # or storage container label
Soil aeration	N/A	Two to four times during summer	Date and time; location; soil condition (moisture, odour, etc.)
Soil treatment with sewage sludge as nutrient supplement	Visual inspection to ensure proper incorporation	At least once during summer on selected windrows	Date and time; type of treatment (aeration or nutrient amendment); location in landfarm; any odour noticed during aeration
Sampling for progress of remediation	Hydrocarbon vapour in headspace (by PID); F1-F4, BTEX (laboratory)	Vapour – as needed; Laboratory - annually	Date and time; location; odour; laboratory report;
Soil removal from landfarm	Removal subject to meeting GN criteria	N/A	Date and time; location; quantity of soil removed; final location
Ponded contact water	BTEX, oil and grease, lead – as per Part F, Item 6 of Water License	Prior to any dewatering; if re-used in landfarm, no sampling necessary	Date and time, location, laboratory report, Annual Report
Seepage	Visual inspection; BTEX, oil and grease, lead – as per Part F, Item 6 of Water License	Weekly during summer	Location, extent, approximate depth, evidence of sheen
Identification of maintenance requirements	Visual inspection of facility	Twice annually during summer	Inspected areas; condition of berm and base; previously unidentified safety concerns

5 CONTINGENCY OPTIONS

The following sections describe the contaminated soil management plan, should a large spill event occur, and if landfarm treatment is not successful.

5.1 LARGE SPILL EVENT

Considering that the landfarm is built to hold nearly 3x as much contaminated soil as is expected to be produced, a large spill event producing a quantity of soil that cannot be contained in the landfarm is unlikely. Nevertheless, in this event, soils will be placed in a temporary storage area. A temporary stockpile area would be set up in the PRSF or at another location as approved by the NWB and AANDC. The soil would then be placed in the landfarm as soon as practical. Through extensive spill prevention measures discussed earlier in this Plan AEM is minimizing the probability of this scenario occurring.

5.2 ALTERNATE TREATMENT OPTIONS

Should landfarm treatment not perform as anticipated and it is evident that rates of degradation are not sufficient to meet GN Tier 1 criteria within the life-of-mine and the anticipated closure period (to 2025) the following alternative treatment options will be considered. Implementation will be after development of a more detailed protocol and approval of a revised plan by the NWB.

5.2.1 Soil Amendment

Since pH, salinity, moisture content and microbial population density all affect rates of biodegradation by microbes, these factors may be monitored and adjusted through soil amendments if they are not found to be optimal (see SAIC, 2006). In addition, the height of soil windrows could be reduced to maximize air exposure if space in the facility allows.

5.2.2 Tier 2 – Modified-Criteria Approach

According to the Government of Nunavut Environmental Guideline for Contaminated Site Remediation (Appendix A), in cases where site conditions, land uses, receptors or exposure pathways are different from those assumed in the development of the Tier 1 criteria, modified criteria may be permitted. This process requires the collection of site-specific information on exposure and risk estimates, and is subject to GN approval. In the case of the Meadowbank site, landfarmed soils are to be encapsulated in the PRSF rather than used in surface applications, as assumed in Tier 1, reducing the likelihood of exposure to any remaining contamination. Therefore, the Tier 2 approach could be warranted if Tier 1 criteria cannot be met. Any consideration for this approach would be based on soil sampling results and science based information.

5.2.3 Thermal Desorption

In the thermal desorption process, excavated soils are heated in a chamber to rapidly volatilize PHCs. Gases produced are consumed in an oxidation unit, and particulate matter removed (baghouse). Soil, free of any contamination, can then be replaced, or used in site reclamation or construction processes. The other advantage of this approach is that this equipment is mobile and could be brought to any spill site for remediation activities (e.g. spills along the AWAR). This method is described by Environment Canada (2002). The purchase or rental of a portable thermal desorber unit is under consideration by AEM as a contingency option.

5.2.4 Direct Placement in TSF or PRSF

Another option for management of contaminated soil would be the direct placement of this material in the Tailings Storage Facility or Waste Rock Storage Facility, if bioremediation is not effective. Although the consumption of space in these storage areas is not optimal, the quantity of PHC-contaminated soil created onsite is small in comparison to the quantity of tailings or waste rock. While this method would not result in the treatment of soil, it is a viable contingency option because it would allow for the safe disposal of the contaminated material. The final cover with NPAG will be a minimum of 2 m deep (current closure plan is 4 m of NPAG cover). Total encapsulation and freeze-back would occur, eliminating any movement of contaminants. Over time, this material would undergo natural degradation. Consideration of this option would also include a suitable monitoring program for PHCs, which would be incorporated into the Meadowbank Closure Plan.

6 PLAN REVIEW AND CONTINUAL IMPROVEMENT

The Landfarm Design and Management Plan will be reviewed annually by the Meadowbank Environmental Superintendent in consultation with the Mine General Manager, and updated, if necessary, at least every two years of operation.

A final proposal will be submitted in regards to the feasibility of the pilot project within the next four years. Before submitting the final proposal, time is needed to estimate rates of remediation, and analyze the effectiveness of treatment with and without sewage sludge amendments.

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LIST OF ACRONYMS

AEM Agnico-Eagle Mines Ltd.

CCME Canadian Council of Ministers of the Environment

GN Government of Nunavut

NPAG Non-potentially Acid Generating

PAG Potentially Acid Generating

PPE Personal Protective Equipment

PRSF Portage Rock Storage Facility

SPL Second Portage Lake

TPL Third Portage Lake

TSF Tailings Storage Facility

FIGURES

Figure 3.1 – Location of the landfarm on the Meadowbank site

Figure 3.2 – Specifications of the landfarm design

FORMAT ANSI B – LANDSCAPE

NORTH

RF2

TSF - NORTH TAILING CELL

WASTE DUMP

RF1

TSF - FUTURE SOUTH TAILING CELL

ENVIRONMENT PAD ELEVATION 138

TITLE	# DWG
REFERENCE DRAWINGS	

REV	DESCRIPTION	DATE	BY
REVISIONS			

AGNICO-EAGLE

DRAWN BY	Y.SIMARD	DATE	2012-12-09
CHECKED BY	E.VOYER		
APPROVED BY	K.BUCK		
PROJECT NO.			
DATE			

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TITLE
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ENVIRONMENT PAD
AREA VIEW

SCALE	FILE
N.T.S.	.DWG

DRAWING NO.	REVISION	SHEET
Figugre 3–1		1 / 1

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FORMAT ANSI B – LANDSCAPE

STORMWATER DIKE

N

A

A'

SECTION A-A'

GRADE 1.0% ->

AVG. ELEVATION 138.5 m
VOLUME 3 712 m³

BERM

7215225N
7215250N
7215200N
637675E
637700E
637725E
637750E
637775E
637800E
637825E

PLAN VIEW

BERM

2.7m TILL COMPACTED 1 x 10 - 7 m/s

Elev. 139.7 m
Elev. 138.5 m
Elev. 136.5 m
1.0% ->
Elev. 139.7 m
Elev. 138.13 m
Elev. 135.4 m

SECTION A-A'

1.2
0.5

SECTION B-B'

TITLE	# DWG	REV	DESCRIPTION	DATE	BY

REFERENCE DRAWINGS

REVISIONS

AGNICO-EAGLE

DRAWN BY	P. DAUDELIN	DATE 20/10/2012
CHECKED BY	T.Lépine	20/10/2012
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PROJECT NO.		
DATE		

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TITLE
AGNICO–EAGLE – MEADOWBANK DIVISION
ENVIRONMENT
LANDFARM

SCALE	FILE
N.T.S.	.DWG

DRAWING NO.	REVISION	SHEET
Figure 3–2		1 / 1

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Appendix A

Environmental Guideline for Contaminated Site Remediation
Government of Nunavut
March, 2009

Environmental Guideline for

Contaminated Site Remediation

Department of Environment
Government of Nunavut

GUIDELINE: CONTAMINATED SITE REMEDIATION

Originally Approved on April 1999
Revised January 2002
March 2009

This Guideline has been prepared by the Department of Environment's Environmental Protection Division and approved by the Minister of Environment under authority of Section 2.2 of the *Environmental Protection Act.*

This Guideline is not an official statement of the law and is provided for guidance only. Its intent is to increase the awareness and understanding of the risks and hazards associated with contaminated sites and to assist in the management and remediation of these sites. This Guideline does not replace the need for the owner or person in charge, management or control of the contaminated site to comply with all applicable legislation and to consult with Nunavut's Department of Environment, other regulatory authorities and qualified persons with expertise in the management of contaminated sites.

Copies of this Guideline are available upon request from:

Department of Environment
Government of Nunavut
P.O. Box 1000, Station 1360, Iqaluit, NU, X0A 0H0
Electronic version of this Guideline is available at http://www.gov.nu.ca/env/environment

Cover Photos: GNU Department of Environment

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Introduction

In Nunavut and across Canada, contaminated sites can pose a threat to human health, safety and the environment. Petroleum hydrocarbon contamination in soil is a concern for several reasons. To differing degrees, petroleum hydrocarbons are toxic to plants and animals, and are mobile and persistent in the environment. Petroleum hydrocarbons can also pose a fire or explosion hazard and can create aesthetic problems such as offensive odours and tastes. In some cases the concern may also be financial, because of the loss of property value and the cost of remediating the property.

The intent of this Guideline is to help effectively manage contaminated sites. It helps to provide a consistent approach by describing the process used to manage (e.g. identify, assess, plan and remediate) contaminated or potentially contaminated sites on Commissioner's Land, including private land within municipalities, and by providing soil remediation criteria for petroleum hydrocarbons and other contaminants.

The *Environmental Protection Act (EPA)* gives the Government of Nunavut authority to take measures to ensure the preservation, protection and enhancement of the environment, with the goal of long-term sustainability and stewardship. Section 2.2 of the *EPA* provides the Minister of Environment with authority to develop, coordinate, and administer this Guideline (see Appendix 1).

The Department of Environment is the key territorial agency concerning the management of contaminated sites on Commissioner's Land. In Nunavut however, Indian and Northern Affairs Canada (INAC) retains responsibility for the management of inland waters, including surface water and groundwater. If contaminated water is encountered, INAC should immediately be consulted.

1.1 Definitions

CCME	The Canadian Council of Ministers of the Environment (CCME) is the major intergovernmental forum in Canada for discussion and joint action on environmental issues of national, international and global concern. The 14 member governments work as partners in developing nationally consistent environmental standards and practices (see Appendix 8).
Closure Report	The final report prepared by a qualified person and provided to the Environment Department following successful implementation of the Remedial Action Plan. The report generally includes a description of all site activities conducted, quantity of contaminated material treated or removed, treatment and disposal methods used, and analytical data generated.
Commissioner's Land	Lands that have been transferred by Order-in-Council to the Government of Nunavut. This includes roadways and land subject to block land transfers. Most Commissioner's Land is located within municipalities.

Contaminant	Any noise, heat, vibration or substance and includes such other substance as the Minister may prescribe that, where discharged into the environment, (a) endangers the health, safety or welfare of persons, (b) interferes or is likely to interfere with normal enjoyment of life or property, (c) endangers the health of animal life, or (d) causes or is likely to cause damage to plant life or to property.
Contaminated Site	Areas of land, surface water, groundwater, or sediments that have levels of contaminants exceeding the remediation criteria. Contaminant sources can include on-site burial of wastes, small or frequent drips and spills, stockpiling and storage of materials, major spills, and releases during fires. Contamination may also be caused by illegal dumping of contaminated soil. Contaminated sites may have short or long term consequences to the health and safety of people and the quality of the environment.
Discharge	Includes any pumping, pouring, throwing, dumping, emitting, burning, spraying, spreading, leaking, spilling, or escaping.
Environment	Means the components of the Earth and includes (a) air, land and water, (b) all layers of the atmosphere, (c) all organic and inorganic matter and living organisms, and (d) the interacting natural systems that include components referred to in paragraphs (a) to (c) above.
Inspector	Means a person appointed under subsection 3(2) of the *EPA* and includes the Chief Environmental Protection Officer.
Phase I Environmental Site Assessment	The process, as outlined in the Canadian Standards Association's (CSA) Standard Z768, by which a qualified person determines whether a property is, or may be, contaminated.
Phase II Environmental Site Assessment	The process, as outlined in the CSA Standard Z769, by which a qualified person characterizes and delineates concentrations and quantities of contaminants on a site and compares those levels to acceptable remediation criteria.
Qualified Person	A person who has an appropriate level of knowledge and experience in all aspects of contaminated site investigation, remediation and management.
Remedial Action Plan	A plan that identifies Site-Specific Remedial Objectives for a site, identifies remedial options and outlines their feasibility, and describes a preferred conceptual remediation plan, a performance monitoring plan, and, if appropriate, requirements for ongoing site management.

Remediation	The process to restore a site's environmental condition and reduce any existing hazards to human health and safety to an acceptable level. Remediation involves the development and application of a planned approach that removes, destroys, contains or otherwise reduces the availability of contaminants to people and the environment.
Remediation Criteria	The numerical limits or narrative statements pertaining to individual substances or chemicals in soil, water or sediment which are recommended to protect and maintain the specified uses of the site. When measurements taken at a contaminated site indicate that the remediation criteria are being exceeded, the need for management and remediation is indicated.
Responsible Party	The owner or person in charge, management or control of the contaminant before it is discharged or owner of the contaminated site.

Additional definitions can be found in Appendix 2.

1.2 Roles and Responsibilities

1.2.1 Environment Protection Division, Department of Environment

The Environmental Protection Division of the Department of Environment is the key environmental agency responsible for ensuring the proper management of contaminated sites on Commissioner's Land. Responsibilities include confirming the required level of remediation using the remediation criteria cited in this document, reviewing the submitted Remedial Action Plan, monitoring the progress of the project and issuing a letter of confirmation when no further remedial action is required.

Authority is derived from the *Environmental Protection Act*, which prohibits the discharge of contaminants to the environment and enables the Minister to undertake actions to ensure appropriate management measures are in place. Although programs and services are applied primarily to activities taking place on Commissioner's and municipal lands and to Government of Nunavut undertakings, the *Environmental Protection Act* may be applied to the whole of the territory where other controlling legislation, standards and guidelines do not exist. A complete listing of relevant legislation and guidelines can be obtained by contacting the Environmental Protection Division or visit the web site at http://www.gov.nu.ca/env/environment.

The Environmental Protection Division will provide advice and guidance on remediation measures. However, it remains the sole responsibility of the polluter, facility operator and landowner to provide adequate site management and remediation and to ensure all applicable statutes, regulations, standards and guidelines are fully complied with.

1.2.2 Responsible Party

If the polluter, facility operator or landowner is notified or otherwise has reason to believe that a site is contaminated, or is potentially contaminated, that person must immediately report the incident and ensure an appropriate evaluation of the potential environmental effects and risks is completed to

determine what action, if any, is required under the *EPA* and this Guideline. Exercising timeliness in all matters related to the contaminated site is critical.

The responsibilities of a Responsible Party include the following:

- Reporting the incident to the NWT/Nunavut 24-Hour Spill Report Line (867-920-8130);
- Contacting EPD and other relevant regulatory agencies including the Regional Environmental Health Officer, Office of the Fire Marshal, local fire department, local government, landowner, affected adjacent landowners, 'Designated Inuit Organization', or other parties regarding health and safety concerns;
- Notifying members of the public who may be adversely affected by the contamination;
- Retaining a qualified person (see Section 1.1) to assess the site to determine the presence and extent of contamination; and
- Developing and implementing a Remedial Action Plan.

1.2.3 Other Regulatory Agencies

As there may be other environmental or public and worker health and safety issues to consider, other regulatory agencies may have to be contacted regarding the management of a contaminated site. Some of the other agencies include:

Department of Community and Government Services

The Department of Community and Government Services is responsible under the *Commissioners' Lands Act* for the issuance of land leases, reserves, licenses and permits on Commissioner's Lands. The Department is also responsible for, in cooperation with communities, the planning, funding, operation and maintenance of municipal solid waste and sewage disposal facilities in most Nunavut communities. Emergency planning responsibilities under the *Emergency Measures Act* include developing territorial emergency response plans, coordinating emergency operations at the territorial and regional levels and supporting community emergency response operations.

The Office of the Fire Marshal is responsible for ensuring the safe storage, handling and use of flammable and combustible liquids and the withdrawal of fuel storage tanks from service. The Office of the Fire Marshal derives its authority from the *Fire Prevention Act*, National Fire Code and National Building Code.

Department of Health and Social Services

Contaminated sites may impact adjacent properties, residences or other buildings thereby potentially affecting the health and safety of the public. The Office of the Chief Medical Officer of Health and Regional Environmental Health Officers should be consulted regarding legislated requirements under the *Public Health Act.*

Department of Economic Development and Transportation

The Motor Vehicles Division is responsible for ensuring the safe transport of contaminated soil and other hazardous waste through administration of the *Transportation of Dangerous Goods Act*. The Department is also responsible under the *Motor Vehicles Act* for driver licensing and various other vehicle and load safety matters.

Workers' Safety and Compensation Commission

The Workers' Safety and Compensation Commission is responsible for promoting and regulating worker and work place health and safety in Nunavut. The Commission derives its authority from the *Workers' Compensation Act* and *Safety Act*, which require an employer to maintain a safe work place and ensure the safety and well being of workers. The Work Site Hazardous Materials Information System, or WHMIS, requires information be provided to workers on the safe use of any hazardous materials used in the work place. All responsible parties should consult the Prevention Services Division for further information and guidance.

Local Municipal Governments

The role of local municipal governments is important in the management and safety of contaminated sites. Remediation standards are determined, in part, by how the property is used and how the property may be designated under local government development plans (e.g. land use zoning). Contaminated soil may be deposited for treatment and disposal at municipal landfill sites only with the consent of the local government. The local fire department may also be called upon if a fire or other public safety issue is identified.

Indian and Northern Affairs Canada

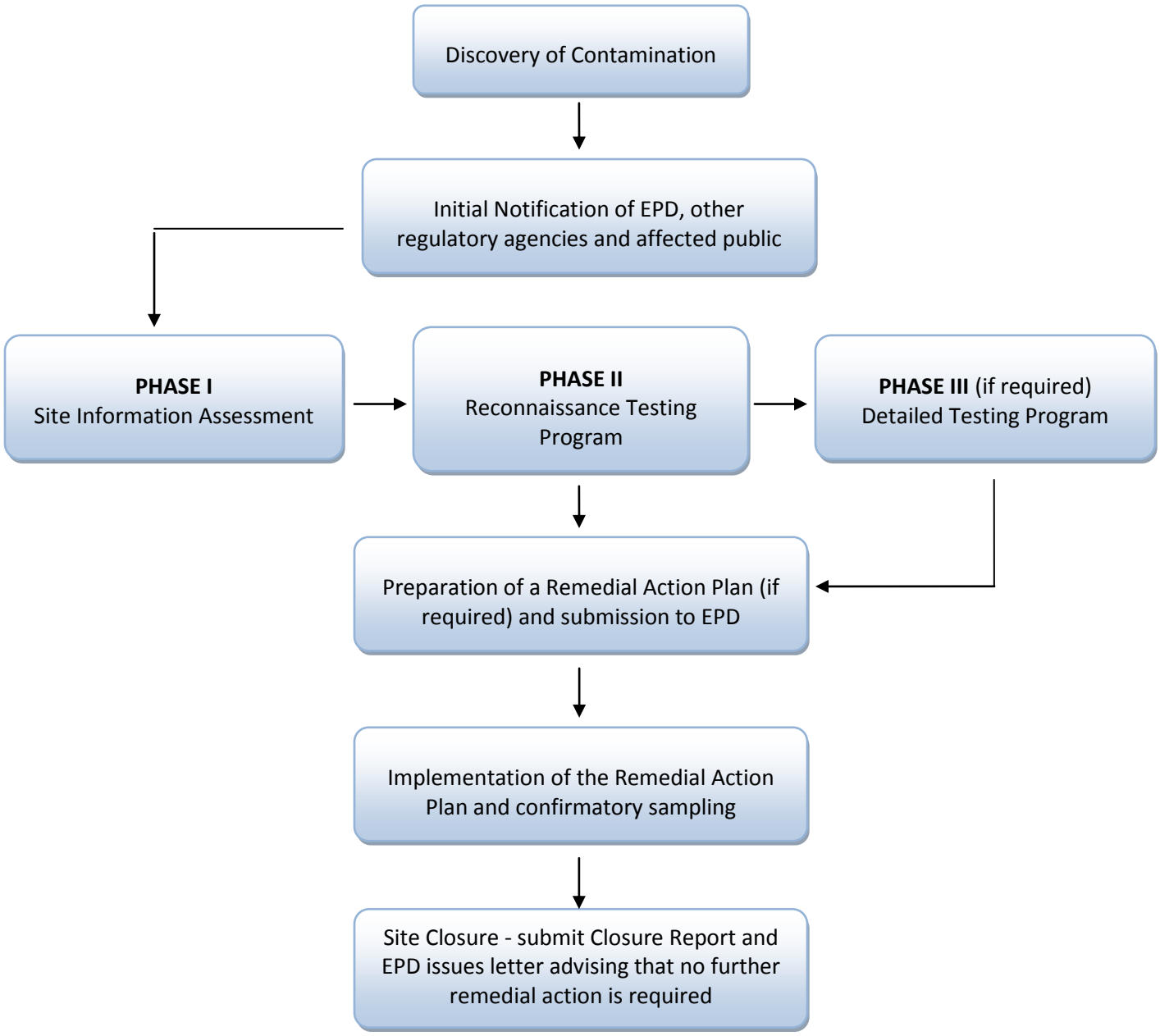
Indian and Northern Affairs Canada is responsible under the *Territorial Lands Act* and *Nunavut Waters and Nunavut Surface Rights Tribunal Act* for the management of federal lands and inland waters. Indian and Northern Affairs should be consulted if contaminated surface water or groundwater is encountered.

Co-management Boards and Agencies

Co-management boards and agencies established under the Nunavut Land Claim Agreement have broad authority for land use planning, impact assessment and the administration of land and water in settlement areas located outside of municipalities. The remediation of contaminated sites may be controlled through the setting of terms and conditions in plans, licenses and permits issued by these boards and agencies.

Contaminated Site Management Process

The management and remediation of a contaminated site consists of a phased approach starting with discovery of the contamination. A well-considered and comprehensive work plan will enable the Responsible Party to make informed decisions, which will result in the safe, effective and cost-efficient remediation of the site. The following flow chart describes the general steps in the overall management process.



2.1 Initial Notification

When a person discovers the presence of contamination, or has reason of believe a site is contaminated, they should immediately notify the Department of Environment and the owner of the facility or property. This discovery may occur as a result of a spill or other accident, an investigation completed for the sale or refinancing of a property, or other actions that identify contamination impacts to the environment.

Section 5.1 of the *EPA* states that where a discharge of a contaminant occurs, or is likely to occur, the owner or person in charge, management or control of the contaminant must immediately:

- report the discharge to the NWT/Nunavut 24-Hour Spill Report Line at (867) 920-8130;
- take all reasonable measures to safely stop the discharge and repair damages; and
- make reasonable efforts to notify any affected public.

Once this notification has occurred, EPD will assess the significance of the reported contamination by having an Inspector conduct a site visit or by reviewing other relevant information (e.g. site assessment report). If it is determined that contamination is present, or may be in the future, and that it poses a risk to human health, safety or the environment, the responsible party must undertake actions to repair the damages in a timely manner. These actions may include identifying the nature and extent of contamination, preparing a Remedial Action Plan and implementing the plan.

If it is determined that the problem cannot be resolved with limited remedial action, the responsible party may be instructed to obtain the services of a qualified person (e.g. environmental engineer or consultant). Obtaining the services of a qualified person is mandatory if there is evidence of groundwater contamination, if explosive vapours are present, or if a neighbouring property is affected. In all cases, the responsible party or its representative must consult the appropriate regulatory agencies (see section 1.2) and notify any affected members of the public. EPD may require the responsible party to provide proof of such consultation and notification.

Issues not related to public health, safety or the environment that arise between the responsible party and affected parties are civil matters, which are to be settled by the parties outside of this management process.

2.2 Site Assessment

Assessing, or characterizing, a contaminated site is a critical phase in the site management process. A well-planned and comprehensive assessment will enable the responsible party to make informed decisions about potential remediation actions.

There are normally up to three phases to an Environmental Site Assessment (ESA). These phases depend on the size and complexity of the contaminated site, and range from the general to the specific. While there are advantages with a phased approach, there may also be economies realized by combining information gathering and testing into a single investigation, particularly at remote locations where mobilization costs are significant.

2.2.1 Phase I: Site Information Assessment

The overall objective of the Phase I ESA is to identify whether actual or potential contamination exists at a site. At a minimum, the Phase I ESA must meet or exceed the Canadian Standards Association (CSA) Standard Z768-01, *Phase I Environmental Site Assessment*.

All available and relevant current and historical information pertaining to the site should be assembled when completing a Phase I ESA. This information will be used to estimate the likelihood, types and locations of contamination that may be present and help to develop a field-testing program, should one be required. Reports and information prepared for legal, transactional or environmental reasons (e.g. spill reporting, ESAs if already conducted) should be reviewed. Phase I ESAs do not involve the carrying out of a sampling plan.

The review frequently includes three broad aspects:

Facility Characteristics - A current and historical description of the site and its facilities is developed, particularly as it relates to the areas of concern (e.g. contaminant sources and potential discharge points). Reviewing facility records and discussions with past and present employees should also be used to gather relevant information. Additional information can be obtained by reviewing above and below ground structures (using blueprints, if available) as possible sources of contamination, as well as considering prior site and surrounding land uses.

Phase 1 - The initial actions undertaken to determine whether a property is, or is not, contaminated. A Phase I site information assessment involves reviewing all available reports, studies and other relevant documents on a site, but does not involve sampling, analysis and measurement of soil and water.

Phase II - Builds upon results of the Phase 1 assessment by sampling soil and water, and sometimes air, on a site to characterize and delineate the concentration of contaminants, and compare those levels to approved remediation criteria. A Remedial Action Plan may be developed following the Phase II reconnaissance testing program if all necessary information about the site has been obtained.

Phase III - The most detailed level of assessment that is intended to address any outstanding issues and information gaps following a Phase II assessment.

Contaminant Characteristics - Hydrocarbons, chemicals and other contaminants that may be stored at the site are identified. Their quantities and concentrations are estimated by visual inspections, reviewing documentation and interviewing past and present employees.

Physical Site Characteristics - The geology, hydrology and hydrogeology of the site and surrounding area are examined using available data. The objective is to develop a comprehensive understanding of local site characteristics and a current and historical description of the area.

Other sources of information can include aerial photographs, geology and groundwater reports; topographical, geological and other maps; the Government of the Northwest Territories' Hazardous Materials Spill Database (this database includes spills that have occurred in Nunavut) and previous site assessment reports.

The review should include a visual inspection of the site and discussions with local residents who may have knowledge of the site and its history. The site inspection will identify signs of contaminant discharge (e.g. leaks and drips, discoloured soil or discoloured building foundation walls), vegetation stress and examine local sensitive habitats (e.g. beaches, ponds, streams) for the presence of hydrocarbons. The proximity of the site to surrounding buildings, surface water bodies and sensitive habitats (e.g. wetlands) should also be identified.

2.2.2 Phase II: Reconnaissance Testing Program

The overall objective of the Phase II ESA is to confirm the presence and characterize the contaminants of concern at the site. At a minimum, the Phase II ESA must meet or exceed the CSA Standard Z769-00, *Phase II Environmental Site Assessment*.

Characterization of the contamination and site conditions require the carrying out of a sampling plan. The plan usually involves one or more field screening methods to identify suitable locations for more intrusive sampling and analysis. Overall, the sampling plan should enable the qualified person to confirm the presence of any contamination, provide an understanding of the nature of the contamination (e.g. location, quantity and direction of movement) and provide an understanding of the relevant site conditions (e.g. soil type, groundwater flow, exposure pathways). This information is necessary in order to develop a Remedial Action Plan or to identify the need for a more specific Phase III assessment, including human health and ecological risk assessments. It may also enable the qualified person to determine that no further action is required.

The Phase II testing program should include the adoption of recognized sampling procedures, quality assurance/quality control procedures and laboratory analytical protocols (see Appendices 5 and 6).

Environmental quality remediation criteria will need to be selected in consultation with EPD during the Phase II ESA. The data collected during the testing program will be compared to the applicable criteria to determine if, and where, exceedances exist on the property. See the CCME *Guidance Document on the Management of Contaminated Sites in Canada, April 1997* for further information.

2.2.3 Phase III: Detailed Testing Program

The results of the Phase II ESA will determine whether a Phase III ESA is required. If sufficient data has been obtained at Phase II to characterize the site and any potential risk to human health, safety and the environment, then the process may move directly to developing a Remedial Action Plan (if it is required).

Alternatively, a detailed Phase III ESA may be necessary if Phase II testing indicates that significant and wide-spread contamination exists. A Phase III ESA will address outstanding issues and information gaps with a view to obtaining enough information to enable development of a Remedial Action Plan. Specifically, the Phase III ESA will:

- target and delineate the boundaries of identified contamination;
- define site conditions and possible contaminant pathways in greater detail, particularly with respect to possible risk assessment;

- provide contaminant and other information necessary to finalize environmental quality remediation criteria or risk assessment; and
- provide all other information that is required in order to develop a Remedial Action Plan and enable contract specifications and tender documents to be prepared.

The Phase III detailed testing program will focus on areas identified in the Phase II program and involves a similar systematic process of sampling, analysis and evaluation. However, a greater number of samples are usually collected and a smaller suite of chemical substances may be analyzed as the program converges on the outstanding environmental issues. Field screening techniques are not usually employed in this testing.

Once the environmental condition of the site has been thoroughly assessed, the qualified person will be able to develop a site-specific Remedial Action Plan.

2.3 Land Use

Remediation criteria (see section 2.4) are presented in the context of four types of land use: agricultural/wildland, residential/parkland, commercial and industrial. The criteria are considered generally protective of human and environmental health for the 'normal' activities associated with each land use. It is important to note that it is the *current and intended future* land use that governs the decision on the level of remediation to be performed at a site. Identifying the appropriate land use will help to assess the extent of human and ecological exposure to contaminants in the soil, and is essential for preparing a Remedial Action Plan. The type of land use found adjacent to the contaminated site may also affect the remediation criteria to be achieved.

Agricultural/Wildland	Land on which the primary activity is related to the productive capability of the land. This includes lands that provides habitat for transitory wildlife and birds as well as greenhouses.
Residential/Parkland	Land on which dwelling, on a permanent, temporary or seasonal basis, is the primary activity. Institutions (e.g. hospitals, schools, daycares) and playgrounds are included under this land use. This land use also includes activity that is recreational in nature and that requires the natural or human designed capability of the land to sustain that activity. Residential/Parkland lands are normally readily accessible to the public.
Commercial	Land on which the primary activity is the commercial buying, selling, or trading of goods or services. Members of the public, including children, normally have free access to these lands.
Industrial	Land on which the primary activity is the production, manufacture, construction or storage of goods. Public access is restricted and children are not permitted continuous access or occupancy.

2.4 Application of Remediation Criteria at Contaminated Sites

There are three basic approaches that may be utilized for the development of site-specific remediation criteria and objectives:

Tier 1 Direct adoption of remediation criteria (Criteria-Based Approach).

Tier 2 Adoption of remediation criteria with modifications based on site-specific information (Modified-Criteria Approach).

Tier 3 Use of site-specific risk assessment (Risk-Based Approach).

The criteria-based approach (Tier 1) is designed to require fewer resources while providing a scientifically defensible basis for protection that is sufficiently flexible to account for certain site-specific factors. In most cases this approach provides an effective alternative to the modified-criteria (Tier 2) or detailed risk-based (Tier 3) approaches. The Tier 2 and Tier 3 approaches can be more complex and costly, and are utilized when the criteria-based approach is not suitable for a site (e.g. large, complex or remote industrial sites).

Regardless of the approach that is ultimately chosen, the level of human health, safety and environmental protection provided by each approach does not change, only the manner in which the level of protection is achieved.

The responsible party should consult with EPD before deciding which approach to take.

Tier 1 - Criteria-Based Approach

Under this approach, the remediation criteria selected for a site are adopted as the remediation objectives. In most cases this approach would involve either the reduction of petroleum hydrocarbon (PHC) concentrations in soil to achieve Tier 1 criteria or the removal and replacement of soil containing PHC concentrations in excess of the criteria. Factors that may bear weight on the decision of whether or not to directly adopt Tier 1 criteria include cost, time, simplicity and other practical and technical considerations (e.g. cost of obtaining additional data to support Tier 2 or Tier 3 approaches, risks associated with residual contamination, cost and commitment to long-term management and monitoring).

The Tier 1 criteria-based approach is applicable only where site conditions, receptors, and exposure pathways are similar with those assumed in the development of the criteria.

A summary of Tier 1 remediation criteria (mg/kg) for PHC in 'surface' soil is provided in Table 1.

Tier 1 criteria may also be used for the remediation of 'subsoil' even though PHC contaminated subsoil usually has a lower level of risk associated with direct human contact, vapour inhalation and ecological soil contact. The responsible party should balance the benefits associated with using Tier 1 criteria for the remediation of subsoil with the additional commitments associated with undertaking a Tier 2 modified-criteria approach. EPD must be consulted in all cases where PHC concentrations in 'subsoil' exceed Tier 1 criteria.

Table 1.

Land Use	Soil Texture	Fraction 1 (C6-C10)	Fraction 2 (>C10-C16)	Fraction 3 (>C16-C34)	Fraction 4 (>C34)
Agricultural/Wildland	Fine-grained soil	210 (170[a])	150	1300	5600
	Course-grained soil	30[b]	150	300	2800
Residential/Parkland	Fine-grained soil	210 (170[a])	150	1300	5600
	Course-grained soil	30[b]	150	300	2800
Commercial	Fine-grained soil	320 (170[a])	260 (230[a])	2500	6600
	Course-grained soil	320 (240[a])	260	1700	3300
Industrial	Fine-grained soil	320 (170[a])	260 (230[a])	2500	6600
	Course-grained soil	320 (240[a])	260	1700	3300

a = Where applicable, for protection against contaminated groundwater discharge to an adjacent surface water body or for protection of potable groundwater.
b = Assumes contamination near residence.

Additional Tier 1 criteria for PHC in soils can be found in Appendix 3. Remediation criteria for other contaminants in soil (e.g. BTEX, metals, PAHs) can be found in Appendix 4.

If the remediation of soil to Tier 1 criteria for the associated land use is not practical from a cost, logistical or technological perspective, then the responsible party will have to move to Tier 2 or Tier 3 site management.

Tier 2 - Modified-Criteria Approach

In certain circumstances, remediation criteria may be modified, within specified limits, and adopted for use as the site-specific remediation criteria when site conditions exist that modify human and ecological exposure to PHC contamination relative to the generic conditions used to derive Tier 1 criteria. In general, this modified-criteria approach is utilized in situations where site conditions, land use, receptors or exposure pathways differ only slightly from those assumed in the development of Tier 1 criteria. However, as pointed out above, the decision to undertake Tier 2 adjustments implies a commitment to increase the accuracy of information on site-specific factors, including exposure and risk estimates.

The acceptability of a Tier 2 approach for evaluation of site-specific impacts is subject to review by EPD. If the impacts also extend off-site, then the responsible party must seek the acceptance of other affected parties before proceeding with a Tier 2 approach.

Specific guidance on situations where modifications are allowed to the Tier 1 criteria, as well as details concerning implementation of the modified-criteria approach are provided in the *Canada-Wide Standard for Petroleum Hydrocarbons in Soil User Guide (CCME 2008).*

Tier 3 - Risk-Based Approach

In certain circumstances, neither the criteria-based or modified-criteria approach may be suitable for a site because pathways of exposure, target chemicals, receptors or other site characteristics differ significantly from those used to develop these more generic approaches. If this is the case, risk assessment procedures may be required to develop site-specific remediation objectives that correspond to an acceptable level of risk to human or ecological receptors. The Tier 3 approach involves completion of a site-specific risk assessment and development of a risk management plan, including long-term monitoring.

A contaminated site is a candidate for the risk-based approach when there are:

- significant ecological concerns (e.g. critical or sensitive habitats for wildlife; rare, threatened or endangered species; parkland or ecological reserves; special hunting or trapping resources);
- unacceptable data gaps (e.g. exposure conditions are particularly unpredictable or uncertain; lack of information about receptors; high degree of uncertainty about hazard levels); or
- special site characteristics (e.g. site is large or remote; the contamination is complex; estimated cost of remediation is prohibitive; site conditions, receptors and/or exposure pathways differ significantly from those assumed in the derivation of Tier 1 and Tier 2 criteria).

Further guidance on human health and ecological risk assessment is beyond the scope of this document. If the reader wishes to proceed with a risk-based approach to site remediation, they are encouraged to contact EPD and professionals competent in the field of human health and ecological risk assessment.

2.5 Preparation of a Remedial Action Plan

At this point the responsible party will review the results of the site assessment and determine whether to remediate the site to the generic Tier 1 criteria or develop site-specific remediation criteria using either a modified-criteria or risk-based approach. The selection should take into consideration factors such as effectiveness in achieving the remediation goals, practicality, safety and cost.

Once remediation criteria have been determined, the responsible party must prepare a Remedial Action Plan for the site which reflects the preferred remediation method. Where practical, the plan should favour permanent remediation solutions, and not solutions that require long-term management and monitoring. The Remedial Action Plan should:

- include names and contact information of all key personnel, consultants and contractors;
- summarize all data collected on contaminants identified during the site investigation(s);
- identify contaminants of concern and the media (e.g. soil, water) affected;
- identify the remediation criteria and the method(s) by which they have been derived;
- identify, quantify and characterize the materials to be treated, removed and disposed;
- summarize remedial options evaluated and the method used to select the preferred remedial strategy;
- describe the selected remediation method and its technical feasibility;
- detail an implementation plan, including a schedule for implementing the plan;

- discuss control measures to minimize fugitive air emissions, surface water control, and worker health and safety;
- identify the fate of any residual contaminants that may remain on-site following remediation; and
- identify remedial verification and long-term monitoring plans (if required).

The Remedial Action Plan should be submitted to EPD, and other regulatory agencies as appropriate, for review prior to the plan being implemented in order to confirm all regulatory requirements are being met.

2.6 Implementation of a Remedial Action Plan

Once all necessary approvals have been obtained, the responsible party shall implement the Remedial Action Plan in a timely manner and submit monitoring reports to EPD on the pre-determined schedule. The responsible party must advise EPD if any activities deviate from the approved Remedial Action Plan. In these cases, EPD will assess the significance of any deviations and advise accordingly.

The completion of remediation activities should be validated by comparing the results of confirmatory samples to the selected remediation criteria. Where the remediation criteria fail to be achieved, the responsible party would be required to re-evaluate the Plan and implement alternative remediation activities.

2.7 Site Closure

When the responsible party and is satisfied that all the requirements of the Remedial Action Plan have been met, a closure report should be prepared and forwarded to EPD. The closure report includes a description of all site activities conducted and remediation methods used, the quantity of contaminated material treated or disposed, and all analytical data generated.

Provided the remediated site complies with all appropriate criteria, management to Tier 1 or Tier 2 would normally enable unrestricted future use of the land within the particular land use designation. This is referred to as ‘unconditional closure’. Where a Tier 3 risk-based approach is used, land use controls and restrictions and long-term monitoring would likely be required to ensure human health, safety and environmental risks do not increase. This is referred to as ‘conditional closure’.

In the case of unconditional closure, EPD will conclude the management process upon receipt and acceptance of the closure report by issuing a letter advising the responsible party that no further remedial action is required. In the case of conditional closure, the letter would state that the management process remains on-going and confirm what land-use controls and restrictions and long-term monitoring is required.

Conclusion

This is a brief introduction to the contaminated site remediation process and is intended to inform the reader about the basic issues involved in contaminated site management. Once a contaminated site has been discovered or verified, the Environmental Protection Division of the Department of Environment must be contacted before proceeding though the contaminated site management process.

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Department of Environment
Inuksugait Plaza, Box 1000, Station 1360
Iqaluit, Nunavut, X0A 0H0

Phone: (867) 975-7729;
Fax: (867) 975-7739
Email: EnvironmentalProtection@GOV.NU.CA
Website: http://www.gov.nu.ca/env/environment

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APPENDICES

APPENDIX 1 - *ENVIRONMENTAL PROTECTION ACT*

The following are excerpts from the *Environmental Protection Act*

1. "Contaminant" means any noise, heat, vibration or substance and includes such other substance as the Minister may prescribe that, where discharged into the environment,
   (a) endangers the health, safety or welfare of persons,
   (b) interferes or is likely to interfere with normal enjoyment of life or property,
   (c) endangers the health of animal life, or
   (d) causes or is likely to cause damage to plant life or to property;

   "Discharge" includes, but not so as to limit the meaning, any pumping, pouring, throwing, dumping, emitting, burning, spraying, spreading, leaking, spilling, or escaping;

   "Environment" means the components of the Earth and includes
   (a) air, land and water,
   (b) all layers of the atmosphere,
   (c) all organic and inorganic matter and living organisms, and
   (d) the interacting natural systems that include components referred to in paragraphs (a) to (c).

   "Inspector" means a person appointed under subsection 3(2) and includes the Chief Environmental Protection Officer.

2.2 The Minister may
   (a) establish, operate and maintain stations to monitor the quality of the environment in the Territories;
   (b) conduct research studies, conferences and training programs relating to contaminants and to the preservation, protection or enhancement of the environment;
   (c) develop, co-ordinate and administer policies, standards, guidelines and codes of practice relating to the preservation, protection or enhancement of the environment;
   (d) collect, publish and distribute information relating to contaminants and to the preservation, protection or enhancement of the environment:

3. (1) The Minister shall appoint a Chief Environmental Protection Officer who shall administer and enforce this Act and the regulations.

   (2) The Chief Environmental Protection Officer may appoint inspectors and shall specify in the appointment the powers that may be exercised and the duties that may be performed by the inspector under this Act and regulations.

5. (1) Subject to subsection (3), no person shall discharge or permit the discharge of a contaminant into the environment.

   (3) Subsection (1) does not apply where the person who discharged the contaminant or permitted the discharge of the contaminant establishes that
   (a) the discharge is authorized by this Act or the regulations or by an order issued under this Act or the regulations;
   (b) the contaminant has been used solely for domestic purposes and was discharged from within a dwelling house;
   (c) the contaminant was discharged from the exhaust system of a vehicle;

(d) the discharge of the contaminant resulted from the burning of leaves, foliage, wood, crops or stubble for domestic or agricultural purposes;
(e) the discharge of the contaminant resulted from burning for land clearing or land grading;
(f) the discharge of the contaminant resulted from a fire set by a public official for habitat management of silviculture purposes;
(g) the contaminant was discharged for the purposes of combating a forest fire;
(h) the contaminant is a soil particle or grit discharged in the course of agriculture or horticulture; or
(i) the contaminant is a pesticide classified and labelled as "domestic" under the *Pest Control Products Regulations* (Canada).

(4) The exceptions set out in subsection (3) do not apply where a person discharges a contaminant that the inspector has reasonable grounds to believe is not usually associated with a discharge from the excepted activity.

5.1. Where a discharge of a contaminant into the environment in contravention of this Act or the regulations or the provisions of a permit or license issued under this Act or the regulations occurs or a reasonable likelihood of such a discharge exists, every person causing or contributing to the discharge or increasing the likelihood of such a discharge, and the owner or the person in charge, management or control of the contaminant before its discharge or likely discharge, shall immediately:
(a) subject to any regulations, report the discharge or likely discharge to the person or office designated by the regulations;
(b) take all reasonable measures consistent with public safety to stop the discharge, repair any damage caused by the discharge and prevent or eliminate any danger to life, health, property or the environment that results or may be reasonably expected to result from the discharge or likely discharge; and
(c) make a reasonable effort to notify every member of the public who may be adversely affected by the discharge or likely discharge.

6. **(**1) Where an inspector believes on reasonable grounds that a discharge of a contaminant in contravention of this Act or the regulations or a provision of a permit or license issued under this Act or the regulations has occurred or is occurring, the inspector may issue an order requiring any person causing or contributing to the discharge or the owner or the person in charge, management or control of the contaminant to stop the discharge by the date named in the order.

7. (1) Notwithstanding section 6, where a person discharges or permits the discharge of a contaminant into the environment, an inspector may order that person to repair or remedy any injury or damage to the environment that results from the discharge.

(2) Where a person fails or neglects to repair or remedy any injury or damage to the environment in accordance with an order made under subsection (1) or where immediate remedial measures are required to protect the environment, the Chief Environmental Protection Officer may cause to be carried out the measures that he or she considers necessary to repair or remedy an injury or damage to the environment that results from any discharge.

APPENDIX 2 - GLOSSARY

Accreditation	Formal recognition of the competence of an environmental analytical laboratory to carry out specified tests. Formal recognition is based on an evaluation of laboratory capability and performance. Site inspections are utilized in the evaluation of capability.
Adverse Effect	An undesirable or harmful effect to an organism, indicated by some result such as mortality, altered food consumption, altered body and organ weights, altered enzyme concentrations or visible pathological changes.
Assess or Assessment	Investigations, monitoring, testing and other information-gathering activities to identify: (1) the existence, source, nature and extent of contamination resulting from a release into the environment of a hazardous material or chemical substance; and (2) the extent of danger to the public health, safety, welfare, and the environment. The term also includes studies, services, and investigations to plan, manage, decommission and clean up a contaminated site.
Background	An area not influenced by contaminants released from the site.
Background Samples	Matrices minus the analytes of interest that are carried through all steps of the analytical procedure. They are used to provide a reference for determining whether environmental test sample results are significantly higher than "unpolluted" samples, which contain "zero", low, or acceptable levels of the analytes of interest. All matrices, sample containers, reagents, glassware, preparations, and instrumental analyses are included in the analysis of background samples.
Blank	The measured value obtained when a specified component of a sample is not present.
Borehole	A hole drilled into the earth, and into which casing or screen can be installed to construct a well.
Chemical	Any element, compound, formulation or mixture of a substance that might enter the environment through spillage, application or discharge. Examples of chemicals are insecticides, herbicides, fungicides, and agents for treating oil spills.
Clean up	The removal of a chemical substance or hazardous material from the environment to prevent, minimize or mitigate damage to public health, safety or welfare, or the environment that may result from the presence of the chemical substance or hazardous material. The clean up is carried out to attain specified remediation criteria.

Concentration	The amount of chemical or substance in a given environmental medium. Concentration is typically expressed as milligrams per litre (mg/L) in water, milligrams per kilogram (mg/kg) in soil and food and micrograms per cubic metre (µg/m^3) in air. Concentrations may also be expressed as parts per million (ppm) or parts per billion (ppb). 1 mg/litre = 1 ppm or 1000 ppb 1 mg/kg = 1 ppm or 1000 ppb
Criteria	Numerical standards that are established for concentrations of chemical parameters in various media to determine the acceptability of a site for a specific land use.
Detection Limit	The smallest concentration of a substance that can be reported as present with a specified degree of precision and accuracy by a specific analytical method.
Environmental Analytical Laboratory	A laboratory engaged in the physical, chemical or biological measurements of either the receiving environment or discharges to the receiving environment.
Ground Penetrating Radar	A geophysical method in which bursts of electromagnetic energy are transmitted downward from the land surface, to be reflected and refracted by velocity contrasts within the subsurface.
Groundwater	All subsurface water that occurs beneath the water table in rocks and geologic formations that are fully saturated.
Guidelines	Statements outlining a method, procedure, process or numerical value which, while not mandatory, should be followed unless there is a good reason not to do so, and includes the numerical limits or narrative statements that are recommended to protect and maintain the specified uses of water, sediment, soil or air. Guidelines also assist in clarifying the intent of the *Environmental Protection Act* and regulations.
Hazardous Material	Material that, because of its quality, concentration, chemical composition or corrosive, flammable, reactive, toxic, infectious or radioactive characteristics, constitutes a present or potential threat to human health and safety or the environment, when improperly stored, treated, transported, disposed of, used or otherwise managed.
Headspace	The empty volume in a container between the cap and the solid or liquid level of the sample.
Migration	The movement of chemicals, bacteria and gases in flowing water or vapour in the subsurface.

Monitoring	The routine (e.g. daily, weekly, monthly, quarterly) checking of quality or collection and reporting of information.
Monitoring Well	A well that is used to extract groundwater for physical, chemical or biological testing, or to measure water levels.
Objective	A numerical limit or narrative statement that has been established to protect and maintain a specified use of water, sediment or soil at a particular site by taking into account site-specific conditions. Objectives may be adopted directly from generic criteria or formulated to account for site-specific conditions.
Quality Assurance/Quality Control (QA/QC)	Those procedures and controls designed to monitor the conduct of a study in order to ensure the quality of the data and the integrity of the study.
Receptor	A person or organism subjected to chemical exposure. An ecosystem component that is, or may be, adversely affected by a pollutant or other stress emanating from a contaminated site. Receptors may include biological or abiotic (e.g. air or water quality) components.
Risk	Risk is a measure of both the severity of effects arising from exposure to a substance and the probability of its occurrence.
Risk Assessment	Procedure designed to determine the qualitative aspects of hazard identification and usually a quantitative determination of the level of risk based on deterministic or probabilistic techniques.
Screening	Rapid analysis to determine if further action (e.g. detailed analysis or clean up) is warranted.
Site-Specific Remedial Objectives	The objectives established for a specific site to be met by implementation of a Remedial Action Plan and, if appropriate, ongoing site management.
Subsoil	Soil which is 1.5 metres (approximately 5 feet) or deeper from the surface.
Surface Soil	Soil which is less than 1.5 metres (approximately 5 feet) from the surface.
Surface Water	Natural water bodies, such as rivers, streams, brooks and lakes, as well as artificial water courses, such as irrigation, industrial and navigational canals.
Test Pit	A shallow pit made to characterize the subsurface.

APPENDIX 3 - REMEDIATION CRITERIA FOR PETROLEUM HYDROCARBONS

The term 'Petroleum Hydrocarbons' (PHC) describes a mixture of organic compounds found in and derived from oil, bitumen and coal. Petroleum products typically contain thousands of compounds in varying proportions, composed predominantly of carbon and hydrogen, with minor amounts of nitrogen, sulphur and oxygen. The properties of PHC contamination in soils varies with the soil type, petroleum source and composition, degree of processing (crude, blended or refined) and the extent of weathering caused by exposure to the environment. Such factors complicate the assessment of the human health, safety and environmental risks associated with PHC contamination. This complicated assessment of risk makes it necessary to evaluate PHC as four fractions: F1, F2, F3, and F4. This differs from the previous guideline (2002) where PHC contamination in soil was assessed using one parameter - Total Petroleum Hydrocarbons.

PHCs are subdivided according to specified ranges of equivalent carbon number (ECN). Each fraction is, in turn, made of subfractions. These subfractions are described according to their relevant physical and chemical properties and toxicological characteristics. These divisions between the fractions have been established in consideration of analytical factors, physical and chemical properties, the expected relevance to biological response in soils and the ability to utilize the definitions and associated properties.

Fraction 1 (F1) The range of ECN from C6 to C10. It includes gasoline and represents the volatile fraction of most hydrocarbon mixtures. The F1 fraction consists of aromatic subfractions in the range C8 to C10, as well as aliphatic subfractions in the ranges of C6 to C8 and >C8 to C10. The fraction is generally considered to be high in mobility, volatility and solubility

Fraction 2 (F2) The range of ECN from >C10 to C16. It includes kerosene, jet fuel and light fuel oils (No. 2 fuel oil, Arctic diesel) and represents the semi-volatile fraction of petroleum hydrocarbons. The F2 fraction is comprised of aromatics and aliphatic subfractions in the ranges >C10 to C12 and >C12 to C16.

Fraction 3 (F3) The range of ECN from >C16 to C34 and includes medium fuel oils (No. 4 fuel oil, Bunker B), heavy fuels oils (Bunker C) and lubricating and motor oils. It is comprised of both aromatics and aliphatics in the ranges >C16 to C21 and >C21 to C34.

Fraction 4 (F4) The range of ECN from >C34 to C50+. PHC within this range often make up a significant proportion of crude oils. The fraction is generally considered to be of low mobility, volatility and solubility.

Some specific aromatic compounds found within the F1 fraction are managed separately from PHC. Benzene ("B") has been excluded because of its carcinogenic properties while toluene, ethylbenzene and xylene ("TEX") have been excluded because of the relatively long history of managing these compounds. Collectively these compounds are referred to as "BTEX".

Tier 1 and Tier 2 remediation criteria are prescribed for coarse-grained and fine-grained soils. As a result, sufficient textural information needs to be obtained through environmental site assessments to permit classification of the soils as either coarse or fine. These classifications are defined as follows:

Fine-grained soil — Soil having a medium grain size of <75 µm as defined by the American Society for Testing and Materials, and includes silts and clays.

Course-grained soil — Soil having a median grain size of >75 µm as defined by the American Society for Testing and Materials, and includes sands and gravels.

Tier 1 remediation criteria for PHC in soils are presented in Tables A3-1, A3-2 and A3-3. Remediation criteria for BTEX are identified separately in Appendix 4.

Table A3-1
Summary of Tier 1 Criteria (mg/kg) for PHC for Surface Soil.*

Land Use	Soil Texture	Fraction 1 (C6-C10)	Fraction 2 (>C10-C16)	Fraction 3 (>C16-C34)	Fraction 4 (>C34)
Agricultural/Wildland	Fine-grained soil	210 (170[a])	150	1300	5600
	Course-grained soil	30[b]	150	300	2800
Residential/Parkland	Fine-grained soil	210 (170[a])	150	1300	5600
	Course-grained soil	30[b]	150	300	2800
Commercial	Fine-grained soil	320 (170[a])	260 (230[a])	2500	6600
	Course-grained soil	320 (240[a])	260	1700	3300
Industrial	Fine-grained soil	320 (170[a])	260 (230[a])	2500	6600
	Course-grained soil	320 (240[a])	260	1700	3300

* EPD must be consulted if PHC concentrations in 'subsoil' exceed these criteria.
a = Where applicable, for protection against contaminated groundwater discharge to an adjacent surface water body or for protection of potable groundwater.
b = Assumes contamination near residence.

Table A3-2. Pathway-Specific Tier 1 Levels (mg/kg) for PHC for Fine-Grained Surface Soils.

Land Use	Exposure Pathways*	F1 (C6-C10)	F2 (>C10-C16)	F3 (>C16-C34)	F4 (>C34)
Agricultural/ Wildland	Direct Contact (Ingestion + Dermal Contact)	12 000	6800	15 000	21 000
	Vapour Inhalation (indoor, basement)	710	3600	NA	NA
	Vapour Inhalation (indoor, slab-on-grade)	610	3100	NA	NA
	Protection of Potable GW	170	230	NA	NA
	Protection of GW for Aquatic Life[a]	RES	RES	NA	NA
	Protection of GW for Livestock Watering	4200	10 000	NA	NA
	Nutrient Cycling	NC	NC	NC	NC
	Eco Soil Contact	210	150	1300	5600
	Eco Soil Ingestion	NC	NC	NC	NC
	Produce, Meat and Milk Ingestion	NC	NC	NC	NC
	Management Limit[b]	800	1000	3500	10 000
Residential/ Parkland	Direct Contact (Ingestion + Dermal Contact)	12 000	6 800	15 000	21 000
	Vapour Inhalation (indoor, basement)	710	3600	NA	NA
	Vapour Inhalation (indoor, slab-on-grade)	610	3100	NA	NA
	Protection of Potable GW	170	230	NA	NA
	Protection of GW for Aquatic Life[a]	RES	RES	NA	NA
	Nutrient Cycling	NC	NC	NC	NC
	Eco Soil Contact	210	150	1300	5600
	Produce Ingestion	NC	NC	NC	NC
	Management Limit[b]	800	1000	3500	10 000
Commercial	Direct Contact (Ingestion + Dermal Contact)	19 000	10 000	23 000	RES
	Vapour Inhalation (indoor)	4600	23 000	NA	NA
	Protection of Potable GW	170	230	NA	NA
	Protection of GW for Aquatic Life[a]	RES	RES	NA	NA
	Nutrient Cycling	NC	NC	NC	NC
	Eco Soil Contact	320	260	2500	6600
	Offsite Migration	NA	NA	19 000	RES
	Management Limit[b]	800	1000	5000	10 000
Industrial	Direct Contact (Ingestion + Dermal Contact)	RES	RES	RES	RES
	Vapour Inhalation (indoor)	4600	23 000	NA	NA
	Protection of Potable GW	170	230	NA	NA
	Protection of GW for Aquatic Life[a]	RES	RES	NA	NA
	Nutrient Cycling	NC	NC	NC	NC
	Eco Soil Contact	320	260	2500	6600
	Offsite Migration	NA	NA	19 000	RES
	Management Limit[b]	800	1000	5000	10 000

NA = Not applicable. Calculated value exceeds 1,000,000 mg/kg or pathway excluded.
RES = Residual PHC formation. Calculated value exceeds 30,000 mg/kg and solubility limit for PHC fraction.
NC = Not calculated. Insufficient data to allow derivation.
a = Assumes surface water body at 10 metres from site.
b = Includes additional considerations such as free phase formation, explosive hazards, and buried infrastructure effects.

Table A3-3. Pathway-Specific Tier 1 Levels (mg/kg) for PHC for Course-Grained Surface Soils.

Land Use	Exposure Pathways*	F1 (C6-C10)	F2 (>C10-C16)	F3 (>C16-C34)	F4 (>C34)
Agricultural/ Wildland	Direct Contact (Ingestion + Dermal Contact)	12 000	6800	15 000	21 000
	Vapour Inhalation (indoor, basement)	40	190	NA	NA
	Vapour Inhalation (indoor, slab-on-grade)	30	150	NA	NA
	Protection of Potable GW	240	320	NA	NA
	Protection of GW for Aquatic Life[a]	970	380	NA	NA
	Protection of GW for Livestock Watering	5300	14 000	NA	NA
	Nutrient Cycling	NC	NC	NC	NC
	Eco Soil Contact	210	150	300	2800
	Eco Soil Ingestion	NC	NC	NC	NC
	Produce, Meat and Milk Ingestion	NC	NC	NC	NC
	Management Limit[b]	700	1000	2500	10 000
Residential/ Parkland	Direct Contact (Ingestion + Dermal Contact)	12 000	6800	15 000	21 000
	Vapour Inhalation (indoor, basement)	40	190	NA	NA
	Vapour Inhalation (indoor, slab-on-grade)	30	150	NA	NA
	Protection of Potable GW	240	320	NA	NA
	Protection of GW for Aquatic Life[a]	970	380	NA	NA
	Nutrient Cycling	NC	NC	NC	NC
	Eco Soil Contact	210	150	300	2800
	Produce Ingestion	NC	NC	NC	NC
	Management Limit[b]	700	1000	2500	10 000
Commercial	Direct Contact (Ingestion + Dermal Contact)	19 000	10 000	23 000	RES
	Vapour Inhalation (indoor)	320	1700	NA	NA
	Protection of Potable GW	240	320	NA	NA
	Protection of GW for Aquatic Life[a]	970	380	NC	NC
	Nutrient Cycling	NC	NC	NC	NC
	Eco Soil Contact	230	260	1700	3300
	Offsite Migration	NA	NA	4300	RES
	Management Limit[b]	700	1000	3500	10 000
Industrial	Direct Contact (Ingestion + Dermal Contact)	RES	RES	RES	RES
	Vapour Inhalation (indoor)	320	1700	NA	NA
	Protection of Potable GW	240	320	NA	NA
	Protection of GW for Aquatic Life[a]	970	380	NC	NC
	Nutrient Cycling	NC	NC	NC	NC
	Eco Soil Contact	320	260	1700	3300
	Offsite Migration	NA	NA	4300	RES
	Management Limit[b]	700	1000	3500	10 000

NA = Not applicable. Calculated value exceeds 1,000,000 mg/kg or pathway excluded.
RES = Residual PHC formation. Calculated value exceeds 30,000 mg/kg and solubility limit for PHC fraction.
NC = Not calculated. Insufficient data to allow derivation.
a = Assumes surface water body at 10 metres from site.
b = Includes additional considerations such as free phase formation, explosive hazards, and buried infrastructure effects.

APPENDIX 4 – REMEDIATION CRITERIA FOR OTHER CONTAMINANTS

Table A4-1. Canadian Soil Quality Guidelines (mg/kg soil).

Substance[y]	Land Use and Soil Texture							
	Agricultural/ Wildland[*]		Residential/ Parkland[*]		Commercial[*]		Industrial[*]	
	Course	Fine	Course	Fine	Course	Fine	Course	Fine
Arsenic (inorganic)	12[b]		12[b]		12[b]		12[b]	
Barium	750[c]		500[c]		2000[c]		2000[c]	
Benzene								
Surface[w]	0.03[t,u]	0.0068[t,u]	0.03[t,u]	0.0068[t,u]	0.03[t,u]	0.0068[t,u]	0.03[t,u]	0.0068[t,u]
Subsoil[w]	0.03[t,u]	0.0068[t,u]	0.03[t,u]	0.0068[t,u]	0.03[t,u]	0.0068[t,u]	0.03[t,u]	0.0068[t,u]
Surface[x]	0.0095[t,u]	0.0068[t,u]	0.0095[t,u]	0.0068[t,u]	0.03[t,u]	0.0068[t,u]	0.03[t,u]	0.0068[t,u]
Subsoil[x]	0.011[t,u]	0.0068[t,u]	0.011[t,u]	0.0068[t,u]	0.03[t,u]	0.0068[t,u]	0.03[t,u]	0.0068[t,u]
Benzo(a)pyrene	0.1[e]		0.7[f]		0.7[f]		0.7[f]	
Cadmium	1.4[b]		10[g]		22[b]		22[b]	
Chromium								
Total chromium	64[b]		64[b]		87[b]		87[b]	
Hexavalent chromium (IV)	0.4[h]		0.4[h]		1.4[h]		1.4[h]	
Copper	63[b]		63[b]		91[b]		91[b]	
Cyanide (free)	0.9[b]		0.9[b]		8.0[b]		8.0[b]	
DDT (total)	0.7[i]		0.7[i]		12[i,j]		12[i,j]	
Diisopropanolamine (DIPA)[z]	180[b]		180[b]		180[b]		180[b]	
Ethylbenzene								
Surface	0.082[t]	0.018[t,u]	0.082[t]	0.018[t,u]	0.082[t]	0.018[t,u]	0.082[t]	0.018[t,u]
Subsoil	0.082[t]	0.018[t,u]	0.082[t]	0.018[t,u]	0.082[t]	0.018[t,u]	0.082[t]	0.018[t,u]
Ethylene glycol	960[k]		960[k]		960[k]		960[k]	
Lead	70[b]		140[b]		260[b]		600[b]	
Mercury (inorganic)	6.6[b]		6.6[b]		24[b]		50[b]	
Naphthalene	0.1[d]		0.6[h]		22[h]		22[h]	
Nickel	50[l]		50[l]		50[l]		50[l]	
Nonylphenol (and its ethyloxylates)	5.7[p]		5.7[p]		14[p]		14[p]	
Pentachlorophenol	7.6[b]		7.6[b]		7.6[b]		7.6[b]	
Phenol	3.8[b]		3.8[b]		3.8[b]		3.8[b]	
Polychlorinated biphenyls (PCB)	0.5[m]		1.3[l]		33[j,l]		33[j,l]	
Polychlorinated di-benzo-p-dioxins/dibenzofurans (PCDD/Fs)	4 ng TEQ/kg[q]		4 ng TEQ/kg[q]		4 ng TEQ/kg[r]		4 ng TEQ/kg[s]	
Propylene glycol	Insuff Info[v]		Insuff Info[v]		Insuff Info[v]		Insuff Info[v]	
Selenium	1[b]		1[b]		2.9[b]		2.9[b]	
Sulfolane[z]	0.8[b]		1[b]		1[b]		1[b]	
Tetrachloroethylene	0.1[e]		0.2[f]		0.5[f]		0.6[f]	
Thallium	1[n]		1[o]		1[o]		1[o]	
Toluene								
Surface	0.37[t]	0.08[t]	0.37[t]	0.08[t]	0.37[t]	0.08[t]	0.37[t]	0.08[t]
Subsoil	0.37[t]	0.08[t]	0.37[t]	0.08[t]	0.37[t]	0.08[t]	0.37[t]	0.08[t]
Trichloroethylene	0.01[b,u]		0.01[b,u]		0.01[b,u]		0.01[b,u]	
Uranium[z]	23[t]		23[t]		33[t]		300[t]	
Vanadium	130[l]		130[l]		130[i]		130[i]	
Xylenes								
Surface	11[t]	2.4[t]	11[t]	2.4[t]	11[t]	2.4[t]	11[t]	2.4[t]
Subsoil	11[t]	2.4[t]	11[t]	2.4[t]	11[t]	2.4[t]	11[t]	2.4[t]
Zinc	200[l]		200[l]		360[l]		360[l]	

Notes (Table 4A-1):

Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health are published in "Canadian Environmental Quality Guidelines (CCME, 1999, updated 2007).

SQG_E = Soil Quality Guideline for Environmental Health
SQG_{HH} = Soil Quality Guideline for Human Health

* For guidelines derived prior to 2004, differentiation between soil texture (coarse/fine) is not applicable.

[a] Guidelines released in 1997 were originally published in a working document entitled "Recommended Canadian Soil Quality Guidelines" (CCME 1997) and have been revised, edited and reprinted here. Guidelines revised/released in 1999 are published here for the first time.
[b] Data are sufficient and adequate to calculate an SQG_{HH} and an SQG_E. Therefore the soil quality guideline is the lower of the two and represents a fully integrated *de novo* guideline for this land use, derived in accordance with the soil protocol (CCME 1996; 2006).
[c] Data are insufficient/inadequate to calculate an SQG_{HH}, a provisional SQG_{HH}, an SQG_E or a provisional SQG_E. Therefore, the interim soil quality criterion (CCME 1991) is retained as the soil quality guideline for this land use.
[d] Data are sufficient and adequate to calculate only a provisional SQG_E. It is greater than the corresponding interim soil quality criterion (CCME 1991). Therefore, in consideration of receptors and/or pathways not examined, the interim soil quality criterion is retained as the soil quality guideline for this land use.
[e] Data are sufficient and adequate to calculate an SQG_{HH} and a provisional SQG_E. Both are greater than the corresponding interim soil quality criterion (CCME 1991). Therefore, in consideration of receptors and/or pathways not examined, the interim soil quality criterion is retained as the soil quality guideline for this land use.
[f] Data are sufficient and adequate to calculate an SQG_{HH} and a provisional SQG_E. Both are less than the corresponding interim soil quality criterion (CCME 1991). Therefore, the interim soil quality guideline supersedes the soil quality criterion for this land use.
[g] The soil-plant-human pathway was not considered in the guideline derivation. If produce gardens are present or planned, a site-specific objective must be derived to take into account the bioaccumulation potential (e.g. adopt the agricultural/wildland guideline as objective). The off-site migration check should be recalculated accordingly.
[h] Data are sufficient and adequate to calculate only a provisional SQG_E, which is less than the existing interim soil quality criterion (CCME 1991). Therefore, the provisional soil quality guideline supersedes the interim soil quality criterion for this land use.
[i] Data are sufficient and adequate to calculate only an SQG_E. An interim soil quality criterion (CCME 1991) was not established for this land use therefore, the SQG_E becomes the soil quality guideline.
[j] In site-specific situations where the size and/or the location of commercial and industrial land uses may impact primary, secondary or tertiary consumers, the soil and food ingestion guideline is recommended as the SQG_E.
[k] Data are sufficient and adequate to calculate only a provisional SQG_E.
[l] Data are sufficient and adequate to calculate only an SQG_E, which is less than the interim soil quality criterion (CCME 1991) for this land use. Therefore the SQG_E becomes the soil quality guideline for this land use.
[m] Data are sufficient and adequate to calculate only an SQG_E, which is greater than the interim soil quality criterion (CCME 1991) for this land use. Therefore the interim soil quality criterion (CCME 1991) is retained as the soil quality guideline for this land use.
[n] Data are sufficient and adequate to calculate a provisional SQG_{HH} and an SQG_E. The provisional SQG_{HH} is equal to the SQG_E and to the existing interim soil quality criterion (CCME 1991) and thus becomes the soil quality guideline for this land use.
[o] Data are sufficient and adequate to calculate a provisional SQG_{HH} and an SQG_E. The provisional SQG_{HH} is less than SQG_E and thus becomes the soil quality guideline for this land use.
[p] Data are sufficient and adequate to calculate only an SQG_E. An interim soil quality criterion (CCME 1991) was not established for these substances therefore, the SQG_E becomes the soil quality guideline.
[q] Data are sufficient and adequate to calculate only a provisional SQG_{HH} which is less than the existing interim soil quality criterion (CCME 1991). Thus the provisional SQG_{HH} becomes the soil quality guideline for this land use.
[r] Data are sufficient and adequate to calculate only a provisional SQG_{HH}. An interim soil quality criterion (CCME 1991) was not established for this land use therefore, the provisional SQG_{HH} becomes the soil quality guideline.
[s] Data are sufficient and adequate to calculate only an SQG_{HH}. An interim soil quality criterion (CCME 1991) was not established for this land use therefore, the SQG_{HH} becomes the soil quality guideline.
[t] Data are sufficient and adequate to calculate an SQG_{HH} and an SQG_E. Therefore the soil quality guideline is the lower of the two and represents a fully integrated *de* novo guideline for this land use.
[u] This guideline may be less than the common limit of detection.
[v] Data are sufficient and adequate to calculate only a provisional SQG_{FWAL} (Soil Quality Guideline for Freshwater Aquatic Life). This value is 6,210 mg/kg.
[w] 10^{-5} incremental risk.
[x] 10^{-6} incremental risk.
[y] Unless otherwise indicated supporting documents are available from the National Guidelines and Standards Office, Environment Canada.
[z] Supporting documents are available from the Canadian Council of Ministers of the Environment.

Table A4-2. Interim Remediation Criteria (mg/kg soil).

These interim remediation criteria should only be used when soil quality guidelines have not yet been developed for a given contaminant (see table A4-1).

Substance	Land Use and Soil Texture			
	Agricultural/ Wildland	Residential/ Parkland	Commercial	Industrial
General Parameters				
Conductivity [dS/m]	2	2	4	4
pH	6 to 8	6 to 8	6 to 8	6 to 8
Sodium adsorption ratio	5	5	12	12
Inorganic Parameters				
Antimony	20	20	40	40
Beryllium	4	4	8	8
Boron (hot water soluble)	2	-	-	-
Cobalt	40	50	300	300
Fluoride (total)	200	400	2000	2000
Molybdenum	5	10	40	40
Silver	20	20	40	40
Sulphur (elemental)	500	-	-	-
Tin	5	50	300	300
Monocyclic Aromatic Hydrocarbons				
Chlorobenzene	0.1	1	10	10
l,2-Dichlorobenzene	0.1	1	10	10
l,3-Dichlorobenzene	0.1	1	10	10
l,4-Dichlorobenzene	0.1	1	10	10
Styrene	0.1	5	50	50
Phenolic Compounds				
Chlorophenols[a] (each)	0.05	0.5	5	5
Nonchlorinated[b] (each)	0.1	1	10	10
Polycyclic Aromatic Hydrocarbons (PAHs)				
Benzo(*a*)anthracene	0.1	1	10	10
Benzo(*b*)fluoranthene	0.1	1	10	10
Benzo(*k*)fluoranthene	0.1	1	10	10
Dibenz(*a,h*)anthracene	0.1	1	10	10
Indeno(l,2,3-c,d)pyrene	0.1	1	10	10
Phenanthrene	0.1	5	50	50
Pyrene	0.1	10	100	100
Chlorinated Hydrocarbons				
Chlorinated aliphatics[c] (each)	0.1	5	50	50
Chlorobenzenes[d] (each)	0.05	2	10	10
Hexachlorobenzene	0.05	2	10	10
Hexachlorocyclohexane (Lindane)	0.01	-	-	-
Miscellaneous Organic Parameters				
Nonchlorinated aliphatics (each)	0.3	-	-	-
Phthalic acid esters (each)	30	-	-	-
Quinoline	0.1	-	-	-
Thiophene	0.1	-	-	-

Notes (Table 4A-2):

All values are in mg/kg soil unless otherwise indicated.

Interim remediation criteria were published in 1991 in "Interim Canadian Environmental Quality Criteria for Contaminated Sites (CCME, 1991).

These interim remediation criteria are considered generally protective of human and environmental health and were based on experience and professional judgement.

These interim criteria (CCME, 1991) should only be used when soil quality guidelines based on the CCME soil protocol (CCME, 1996; 2006) have not yet been developed for a given chemical. Also, because the interim remediation criteria were not developed using the soil protocol and its integral checks, they cannot be modified through the site specific remediation objective procedure.

a = Chlorophenols include
- Chlorophenol isomers (ortho, meta, para)
- Dichlorophenols (2,6- 2,5- 2,4- 3,5- 2,3- 3,4-)
- Trichlorophenols (2,4,6- 2,3,6- 2,4,5- 2,3,4- 3,4,5-)
- Tetrachlorophenols (2,3,5,6- 2,3,4,5- 2,3,4,6-)

b = Nonchlorinated phenolic compounds include
- 2,4-dimethylphenol
- 2,4-dinitrophenol
- 2-methyl 4,6-dinitrophenol
- Nitrophenol (2-,4-)
- Phenol
- Cresol

c = Aliphatic chlorinated hydrocarbons include
- Chloroform
- Dichloroethane (1,1- 1,2-), Dichloroethene (1,1- 1,2-)
- Dichloromethane
- 1,2-dichloropropane, 1,2-dichloropropene (cis and trans)
- 1,1,2,2-tetrachloroethane, tetrachloroethene
- Carbon tetrachloride
- Trichloroethane (1,1,1- 1,1,2-), trichloroethene

d = Chlorobenzenes include
- All trichlorobenzene isomers
- All tetrachlorobenzene isomers
- Pentachlorobenzene

APPENDIX 5 – FIELD SCREENING AND INTRUSIVE SAMPLING

Field screening and sampling methods are to be consistent with current professional standards. Because soils on any given site can be variable and complex (e.g. type of soil, grain size, depth of permafrost), all reasonable efforts must be made to ensure samples provide a true 'representation' of the site. Efforts should also be made to minimize the spread of contamination from one location to another as a result of activities during site assessment and cleanup.

Field screening methods help to identify suitable locations for more intrusive sampling and analysis. Screening with portable instruments is acceptable if the instruments are capable of calibrating measurements to relative or absolute levels of contamination, if the screening is verifiable in regard to procedures and results and finally, if results of such techniques can be correlated to *Canadian Association for Environmental Analytical Laboratories (CAEAL*) accredited laboratory results.

On sites where it cannot be determined through historical records that previous tanks and lines have been removed, an appropriate survey (e.g. ground penetrating radar) should be carried out before drilling, to determine whether tanks and lines are present.

Sample locations should provide an adequately detailed description of the nature and extent of contamination in three dimensions and provide information on potential subsurface contaminant migration pathways. The following are considered minimum requirements:

- Soil - 3-5 boreholes or test pits for each potential source area, except very small sites where a minimum of 1 borehole or test pit is sufficient. Potential source areas include storage tanks and barrels, lines, pump islands, loading areas, previous underground installations and areas of discoloured or stained soil. At a typical community POL facility with 1 tank nest, 1 set of lines, 1 pump island, and 1 waste oil tank, this would equate to 4 source test locations.
- Groundwater - Sufficient test locations to determine the direction of groundwater flow on-site should be selected (minimum of 3 groundwater monitoring wells or piezometers, including at least 1 multilevel installation to assess vertical gradients). Shallow wells are to be screened across the water table to intercept floating product.
- All soil test holes should extend to the bottom of the contaminated soil zone or to an impermeable layer (e.g. bedrock), whichever is shallower.
- All test holes and wells should be monitored for the presence of free product.
- At least 1 'control' site should be established to determine accurate background concentrations of the suspected contaminant.

Each sample location should be marked or documented so it can be found again, if needed.

APPENDIX 6 – SAMPLE ANALYSIS

Soil samples may be screened in the field for vapours, staining or odour in order to reduce the number of samples to be analyzed by the laboratory. All field observations must be included in reports.

Chemical analyses are to be conducted on at least 2 soil samples per test hole location - one surface <1.5 m depth, one subsurface >1.5 m depth. Chemical analyses are to be conducted on at least one groundwater sample from each well sampled.

Chemical analyses for petroleum hydrocarbon impacted sites are to include PHC and BTEX (benzene, toluene, ethylbenzene, xylene)[1]. Analysis for additional site-specific parameters may be required, depending on past or present land use (e.g. PAHs, lead, PCBs).

Grain size analyses are to be conducted on at least 1 sample per hydrogeologic unit if soil grain size criteria are to be applied.

Quality Assurance/Quality Control (QA/QC) – For small batches of soil samples (less than 10 samples), at least one blind duplicate should be analyzed per batch of samples. For larger batches of soil samples (greater than 10 samples), 10% duplicates should be analyzed. For groundwater samples, a blind duplicate and field blank sample should be collected and analyzed with each batch of samples tested. The QA/QC results should be presented and interpreted in the closure report.

All sampling, sample handling and chemical analysis must be consistent with accepted practices. In particular, samples for volatile organics must be collected such that there is a minimum headspace in soil samples and no headspace in water samples. Samples should be kept cool, but not frozen, until they are delivered to the laboratory. Sample handling procedures should be verified with the receiving laboratory and chemical analysis should be consistent with the PHC Canada-Wide Standard reference method. See *Guidance Manual on Sampling, Analysis and Data Management for Contaminated Sites, Volume 1: Main Report (*CCME, 1993), and *Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil – Tier 1 Method (CCME, 2001)*.

Accredited Laboratory

Laboratory analysis of contaminated soil, water and other materials must be conducted by laboratories that have been formally recognized as competent to perform specified tests by the Canadian Association for Environmental Analytical Laboratories (CAEAL*)*. CAEAL is a non-profit organization dedicated to raising the level of competency, consistency, capability, and communication within environmental testing laboratories in Canada. Their member laboratories voluntarily participate in rigorous programs of proficiency testing and accreditation, demonstrating their commitment to generate high quality and consistent data (see Appendix 8).

[1] Soils with high natural organic carbon (such as peats) may give a "false positive" result when analyzed. If this is suspected, it may be beneficial to collect additional background soil samples for organic carbon analysis.

APPENDIX 7 - TRANSPORTATION OF CONTAMINATED SOIL

Contaminated soil must be transported in accordance with requirements of the appropriate transport authority. The road transportation of contaminated soil is administered by the Nunavut Department of Economic Development and Transportation under the territorial *Transportation of Dangerous Goods Act* and Regulations (TDGR). The transportation of contaminated soil by air and marine mode is administered by Transport Canada under the federal *Transportation of Dangerous Goods Act* and *International Maritime Dangerous Goods Code,* respectively.

The TDGR require that a waste manifest form accompany shipments of contaminated oil and other hazardous waste. The completed manifest form provides:

- Detailed information on the types and amounts of hazardous waste shipped;
- A record of the parties involved in the shipment;
- Information on the storage, treatment or disposal of the waste; and
- Confirmation that the waste reached the final destination.

No chemical test of the hydrocarbon is required as “petroleum distillate” is a specified dangerous good in List II, Schedule II of TDGR. The word “waste” must precede the shipping name.

Manifest requirements:

	Shipping name:	WASTE SOLIDS CONTAINING FLAMMABLE LIQUID, n.o.s.*, (gasoline or diesel, as appropriate)
	Classification:	4.1
	UN number:	UN3175
	Packing group:	II
or	Shipping name:	WASTE ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, n.o.s.*, (gasoline or diesel, as appropriate)
	Classification:	9
	UN number:	UN3077
	Packing group:	III

Further assistance in completing a waste manifest can be obtained by referring to the *User’s Guide for the Hazardous Waste Manifest* produced by Environment Canada or by contacting the Motor Vehicles Division of the Department of Economic Development and Transportation. Further information on hazardous waste management in Nunavut can be obtained by referring to the *Environmental Guideline for the General Management of Hazardous Waste (January 2002)* produced by the Department of Environment.

APPENDIX 8 - ADDITIONAL CONTACTS

Canadian Council of Ministers of the Environment (CCME)
CCME works to promote effective intergovernmental cooperation and coordinated approaches to interjurisdictional issues such as air pollution and toxic chemicals. Under the auspices of CCME, the federal, provincial and territorial ministers of environment collectively establish nationally consistent environmental standards, strategies and objectives so as to achieve a high level of environmental quality across the country. Comprehensive literature and technical documentation is available from:

Canadian Council of Ministers of the Environment
123 Main Street, Suite 360
Winnipeg, Manitoba R3C 1A3
Phone: (204) 948-2090; Fax: (204) 948-2125
Website: http://www.ccme.ca
E-mail: info@ccme.ca

Canadian Association for Environmental Analytical Laboratories (CAEAL)
CAEAL is a not-for-profit organization formed in 1989 dedicated to raising the level of competency, consistency, capability, and communication within environmental testing laboratories in Canada. Membership in CAEAL is open to individuals, institutions, user groups, consultants, industrial organizations, regulatory agencies, materials and laboratory equipment suppliers, and others interested in the work being carried out in environmental analytical laboratories. More information on CAEAL may be obtained from:

Canadian Association for Environmental Analytical Laboratories
300-265 Carling Avenue
Ottawa, Ontario K1S 2E1
Phone: (613) 233-5300; Fax: (613) 233-5501
Website: http://www.caeal.ca/

Canadian Standards Association (CSA)
CSA is a not-for-profit membership-based association serving business, industry, government and consumers in Canada and the global marketplace. As an organization, CSA works to develop standards that address a wide variety of needs, such as enhancing public health and safety, occupational health and safety, and the environment. More information on CSA may be obtained from:

Canadian Standards Association
5060 Spectrum Way
Mississauga, Ontario L4W 5N6
Phone: (416) 747-4000; Fax (416) 747-2473
Website: http://www.csa.ca

Appendix B

Site Photos

Appendix C

Operational Procedures for Site Personnel

LANDFARM OPERATION AND MAINTENANCE PROCEDURES FOR SITE PERSONNEL

The following describes specific procedures for the the operation and maintenance of the contaminated soil facility ("landfarm") at the Meadowbank site. Operation and monitoring of the facility will come under the responsibility of the Environmental Superintendent. Any questions about operation and maintenance procedures should be directed to the Environment Department.

1 TYPE OF CONTAMINATION

1.1 Acceptable Types of Contamination

The landfarm facility is designed to accept, treat and/or store petroleum hydrocarbon contaminated soils that have been generated through mine-related activities (i.e. spills) at the Meadowbank Gold Project and the Meadowbank exploration camp. The following products may be treated in the landfarm if used onsite and spilled on soil or snow:

- Gasoline
- Diesel fuel
- Aviation fuel (Jet A)
- Hydraulic oil
- Other light oils e.g. engine oil, lubricating oil

If the source of contamination is unknown, or the contaminated material is suspected to contain any non-PHC contaminants, additional analyses should be performed (see Section 1.2).

1.2 Unknown Contamination

In the event that the contaminant source is unknown, Environment Department should be notified so that soil can be analyzed for petroleum hydrocarbons and possibly additional contaminants prior to placement in the landfarm.

- Additional parameters could include:
  - Total heavy metals
  - Heavy oil and grease
  - Volatile organic compounds
- Concentrations of additional contaminants will be compared to the site background values (for metals) and/or criteria in the Government of Nunavut (GN) Guidelines for Contaminated Site Remediation.

- If non-PHC soil contamination is below background or agricultural/wildland GN guidelines (whichever is higher), the material will be accepted into the landfarm as usual (see Section 2).
- If non-PHC contamination is above background or GN agricultural/wildland criteria but below GN industrial use criteria, soil will be placed in a designated area in the landfarm for PHC remediation prior to disposal in the Portage Rock Storage Facility (PRSF).
- If non-PHC contamination is above GN industrial criteria, the material cannot be remediated in the landfarm. Spills of > 100 L of non-PHC material (e.g. solvents, glycol) will be placed in drums and stored in the site Hazmat area for shipment south to approved facilities during barge season. Spills of non-PHC material < 100 L will be placed in the TSF.

2 HANDLING CONTAMINATED SOIL AND SNOW

2.1 Spill Excavation

2.1.1 General Procedures

- All spills must be reported to the Environment Department in accordance with AEM's Spill Reporting Procedures. Spills that are acceptable as described in Section 1 will be excavated for treatment in the landfarm.
- Prior to excavation, absorbent pads will be used to contain the spill and minimize excavated soil volumes. Used absorbent pads will be disposed of in the onsite incinerator.
- During excavation, larger coarse material (>1") should be separated as much as possible. Coarse and fine material will be treated separately in the landfarm.
- Care should be exercised to ensure that the entire spill is excavated. The excavation should be thoroughly assessed for any visible remaining product or odour, and the extents of excavation approved by Environment Department.

2.1.2 Spills on Snow

- For spills < 100 L, PHC-contaminated snow will be placed in a designated area of the landfarm and treated as contact water after snowmelt.
- For spills > 100L, excavated snow will be stored in drums until it has melted. The melt water will be processed in the oil/water separator (carbon filter) to remove PHC residue. The treated water will be sampled per Part F, Item 6 of the Water License, and discharged to the Stormwater Management Pond if criteria are met. If criteria not met, water will be treated as hazardous material.

2.1.3 Records

- In addition to the regular spill report provided by the affected department, the following information should be recorded by Environment Department at the excavation of potentially landfarmable material:
    - Time and date of excavation
    - Estimated quantity of excavated material (soil or snow)
    - Destination of excavated material (storage or landfarm)

2.2 Addition of Soil to the Landfarm

- Environment Department should be contacted prior to any additions of soil or snow to the landfarm.
- During transport to the landfarm, care should be exercised to ensure that no contaminated material is lost. If this occurs, it should be cleaned up immediately, ensuring none is left behind.
- If not already removed, efforts should be made to separate larger coarse material (> 1”) from the finer material in the landfarm, using a screen sieve if necessary.
- Each load of contaminated soil will be placed in an area designated by Environment Department staff. The layout of the landfarm should be prepared by the Environment Department and provided to Site Services and the Mine Department as changes occur.
- Location will be based on:
    - Year
        - New windrows will be developed annually at a minimum so that new product is not added to partially remediated piles
    - Grain size
        - Material < 1” will be piled and shaped into windrows with maximum dimensions of ~15 m wide at base x 4 m high x 50 m long
        - Material > 1” will be spread out in a thin layer (< 30 cm) for volatilization
    - Presence of other contaminants
        - Material contaminated with concentrations of other contaminants above background/GN wildland criteria will be treated in a separate area in the landfarm
    - Nutrient amendment
        - Certain windrows are treated with sewage sludge as a nutrient amendment

2.3 Remedial Activities

Environment Department will determine the timing of all remedial activities, and will maintain detailed records.

2.3.1 Absorbent material

- Oil-absorbent pads will be used to help remove visible product from coarse material as necessary.
- Used absorbent materials will be incinerated.

2.3.2 Aeration

- Windrows will be mixed mechanically with earth-moving equipment two - four times per year, during the summer months.
- Prior to turning, site personnel will ensure that soil is not so dry as to generate significant dust, nor overly saturated.
    - If soil is dry, water from within the landfarm containment area will be used as a moisture source and sprayed on the piles. If no accumulated water is available, a freshwater supply will be used.
    - If the windrows are saturated, aeration will be conducted at a later date.

2.3.3 Nutrient Amendment – Pilot Project

- Two pilot piles in the landfarm facility were treated in 2012 with 400 gallons of sewage sludge as a nutrient source.
- Depending on the effectiveness of this treatment (to be determined by Fall 2013), future additions of sewage sludge will be determined by Environment Department, and procedures updated at that time.

2.4 Sampling

All sampling of the landfarm will be conducted by the Environment Department.

- Windrows will be sampled annually at the end of the summer season to determine if remediation objectives have been met.
- For each 10 m of windrow length, one composite sample will be collected, each consisting of three sub-samples from the surface and three sub-samples at 1 m depth. Sub-samples will be taken approximately 3.3 m apart, and will be taken from both sides of the windrow.
- Samples should be analyzed for BTEX and PHC Fractions 1 – 4.

2.5 Removal of Soil from the Landfarm

- All removal of soil from the landfarm will be directed by the Environment Department, who will maintain a record of all soil removal operations, including the date, quantity of soil, location in the landfarm and end use.

2.5.1 Coarse-grained Material

- Will be assessed near the end of the summer season by Environment Department technicians for PHC product and odour.
- When PHC odours are no longer detected, this material will be removed to the PRSF and disposed of as PAG material.

2.5.2 Fine-grained Material

- When sample analysis indicates that concentrations of PHC contaminants are below GN guidelines, a soil pile or the appropriate section of a pile will be deemed acceptable for removal from the facility.
- The soil to be removed will be delineated by Environment Department staff.
- If agricultural/wildland criteria are met, soil can be stockpiled outside the landfarm and used in site works or reclamation activities.
- If industrial criteria are met, soil will be placed in the PRSF as PAG.
- GN criteria for agriculture/wildland use are targeted, but if remediation to this level is not feasible based on time/space, industrial-use criteria will be used (discretion of Environment Department).

3 WATER MANAGEMENT

3.1 Winter

- Snow should be removed as much as possible before spring to minimize the quantity of melt water inside the berm.
- This activity is to be undertaken by Site Services.
- Care should be taken to ensure contaminated snow/soil is not removed by leaving a base layer of snow (> 10 cm) in place.
- Removed snow will be placed in the TSF.

3.2 Summer

The monitoring and removal of any water accumulated within or around the berm will be directed by the Environment Department.

- Monitoring for water accumulation within the berm, or seepage through the berm will be conducted on a weekly basis, after freshet, when water is likely to be present.
- In the event of water accumulation or seepage, the ponded water will either be:
    - Collected and pumped to the adjacent Tailings Storage Facility after analysis for BTEX, lead, oil and grease per Part F, Item 6 of the Water License OR

    - Sprayed on the windrows to increase moisture content, if required
- Water accumulating in the landfarm should not be discharged to the environment.

4 SUMMARY OF ACTIVITIES

The following table summarizes landfarm-related activities, possible analyses, and the records to be maintained. Environment Department will direct all activities.

Activity	Analysis	Frequency of Analysis	Record
Excavation of spill and transport of contaminated material	If unsure of full excavation - F1-F4, BTEX	As needed	Date and time of excavation; estimated quantity of excavated soil; storage/disposal location of excavated soil, if applicable; any evidence of remaining product
Contaminated soil additions to landfarm	If contaminant source unknown, F1-F4, BTEX, metals, oil and grease, VOCs (at discretion of Environment Department)	Prior to soil addition at facility	Date and time; quantity of soil; original location; landfarm location; spill/excavation record # or storage container label
Soil aeration	N/A	Two - four times during summer	Date and time; location; soil condition (moisture, odour, etc.)
Soil treatment with sewage sludge as nutrient supplement	Visual inspection to ensure proper incorporation	At least once during summer on selected windrows	Date and time; type of treatment (aeration or nutrient amendment); location in landfarm; any odour noticed during aeration
Sampling for progress of remediation	Hydrocarbon vapour in headspace (by PID); F1-F4, BTEX (laboratory)	Vapour – as needed; Laboratory - annually	Date and time; location; odour; laboratory report;
Soil removal from landfarm	Removal subject to meeting GN criteria	N/A	Date and time; location; quantity of soil removed; final location
Ponded contact water	BTEX, oil and grease, lead – as per Part F, Item 6 of Water License	Prior to any dewatering; if re-used in landfarm, no sampling necessary	Date and time, location, laboratory report, Annual Report
Seepage	Visual inspection	Weekly during summer	Location, extent, approximate depth, evidence of sheen
Identification of maintenance requirements	Visual inspection of facility	Twice annually during summer	Inspected areas; condition of berm and base; previously unidentified safety concerns

5 ASSESSMENT AND REPORTING

5.1 Feasibility

After two seasons of treatment in the landfarm (Fall 2013), degradation rates of PCH contaminants will be assessed to estimate the total remediation time required under these conditions.

- If remediation to GN guidelines is feasible within the life-of-mine timeframe, landfarm operations will continue, with aeration and possible nutrient amendments as described above.
- If rates of TPH degradation are not sufficient through this method, alternate options will be further investigated (see Landfarm Design and Management Plan – Section 5).

5.2 Reporting

- A report of landfarm activities will be prepared annually by Environment Department, indicating the volume of material added to the facility, amount of material removed and disposal or re-use location, all analysis results, volume and type of nutrient addition, visual inspection results and volume of contact water pumped.
- This information will be appended to AEM's NWB Annual Report.

5.3 Plan Review and Continual Improvement

- The Landfarm Design and Management Plan will be reviewed annually by the Meadowbank Environmental Superintendent in consultation with the Mine General Manager and be updated at least every two years of operation.

AGNICO EAGLE

MEADOWBANK GOLD PROJECT

Air Quality and Dustfall Monitoring Plan

In Accordance with NIRB Project Certificate No.004

Prepared by:
Agnico Eagle Mines Limited – Meadowbank Division

Version 2
November 2013

EXECUTIVE SUMMARY

General Information

The Air Quality and Dustfall Monitoring Plan (AQDMP) describe the design features and operational procedures for the monitoring of air quality and dustfall at the Meadowbank Gold Project site.

Annual Review

The AQDMP will be reviewed and updated regularly if necessary. Completion of the review of the AQDMP will be documented through signatures of the personnel responsible for reviewing, updating and approving the AQDMP.

Record of Changes

A record will document all significant changes that have been incorporated in the AQDMP subsequent to the latest review. The record will include the names of the persons who made and approved the change, as well as the date of the approval.

Distribution List

Agnico Eagle Mines Limited (AEM) will maintain a distribution list for the AQDMP providing information about all parties that receive the plan.

IMPLEMENTATION SCHEDULE

The proposed implementation schedule for this Plan is effective immediately (November 2013) subject to any modifications proposed by the NIRB as a result of the review and approval process.

DISTRIBUTION LIST

AEM - Environmental Superintendent

AEM – Environmental Coordinator (s)

DOCUMENT CONTROL

Version	Date (YMD)	Section	Page	Revision
1	10/2005			
Tech. Memo Addendum	16/05/2008	3.4		Update to air quality monitoring section of Version 1
2	10/2013	All		Revision

Version 2

Prepared By: Meadowbank Environment Department

Approved By:

Kevin Buck
Environmental Superintendent

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1 INTRODUCTION

1.1 OBJECTIVES

In accordance with NIRB Project Certificate No.004, the objective of this program is to monitor ambient air quality and dustfall at the Meadowbank mine site perimeter, with the goals of verifying compliance with applicable standards, and mitigating potential environmental effects. The parameters to be measured are suspended particulates (total, PM_{10}, $PM_{2.5}$), NO_2 and dustfall (settleable particulate matter).

1.2 MONITORING LOCATIONS

Monitoring locations were determined in consultation with Environment Canada in 2011. One station was moved in 2012 due to changes in the location of the Vault Road (see Section 1.2.4). UTM coordinates are provided in Table 1, and locations are shown in relation to mine site features in Figure 1.

Table 1 - UTM coordinates for the Meadowbank air quality and dustfall monitoring locations.

Monitoring locations	Measured preferences	Easting	Northing
DF-1	TSP, PM_{10}, $PM_{2.5}$, NO_2, dustfall	636850	7217663
DF-2	TSP, PM_{10}, $PM_{2.5}$, NO_2, dustfall	637895	7213049
DF-3	Dustfall	639599	7213198
DF-4	Dustfall	639233	7217074

1.2.1 DF-1

Station DF-1 is located next to the explosive storage area (emulsion plant), and approximately 500 m north of the all-weather access road. TSP, PM_{10}, $PM_{2.5}$, NO_2 and dustfall are monitored at this location.

1.2.2 DF-2

Station DF-2 is located at the northern corner of South Camp Island, near the TCG contractor area. TSP, PM_{10}, $PM_{2.5}$, NO_2 and dustfall are monitored at this location.

1.2.3 DF-3

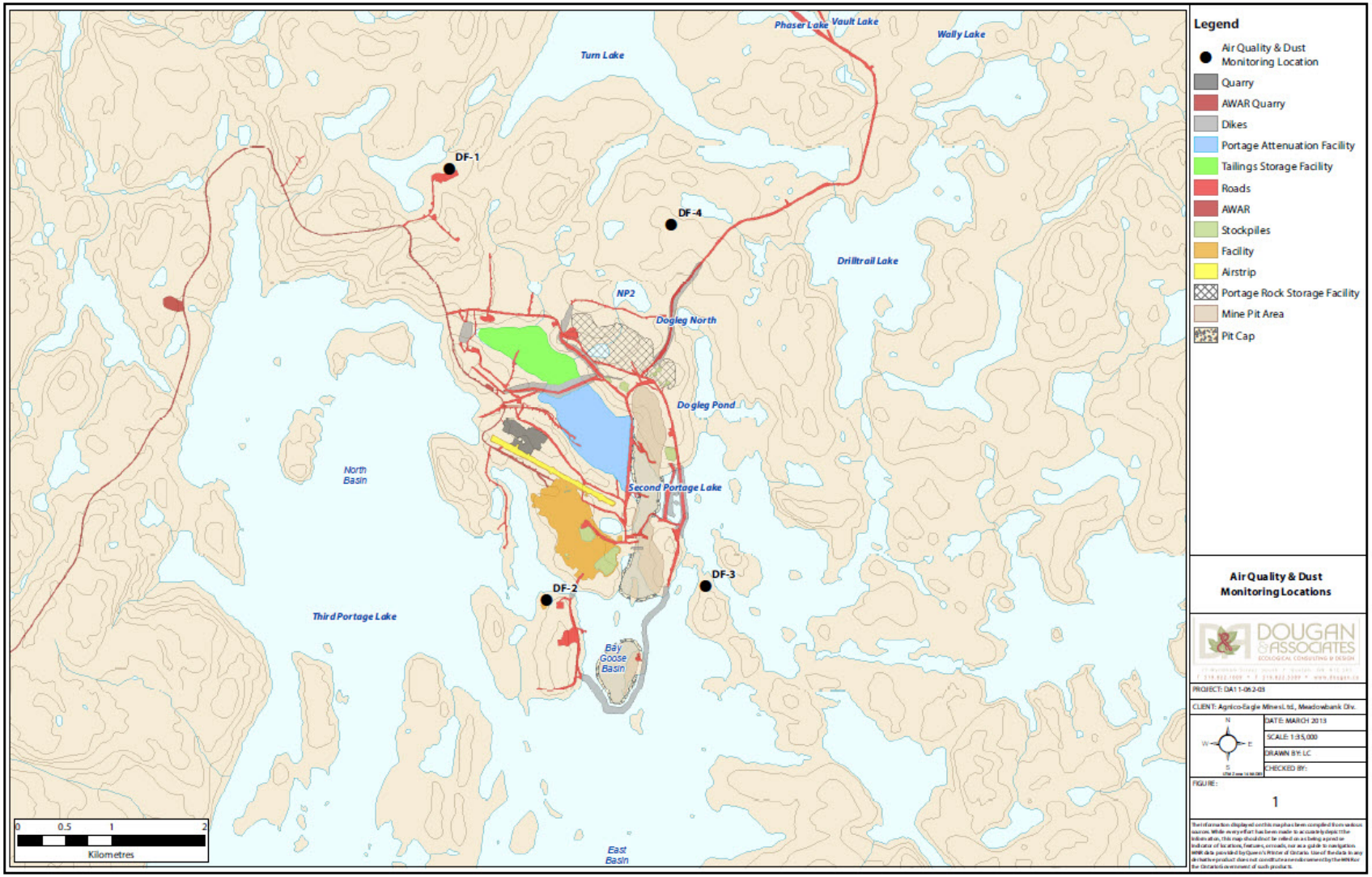
Station DF-3 is approximately 1,800 m east of the East Dike. Second Portage Lake is to the west and east. Dustfall only is monitored at this location.

1.2.4 DF-4

Station DF-4 is approximately 1,500 m southwest of the future location of Vault Pit. This monitoring station was installed before the construction of the Vault Road. Realignment of the road during construction placed the station within 10 feet of the road. Therefore, AEM re-positioned Station DF-4 approximately 480 m to the north-west on February 29, 2012 to be representative of the originally intended location relative to the road.

Dustfall only is monitored at this location.

Figure 1 - Meadowbank air quality and dustfall monitoring locations.



2 METHODS

2.1 TSP, PM_{10}, $PM_{2.5}$

Suspended particulate matter will be generated by wind erosion of local landscapes, movement of vehicles/equipment, airstrip activities, construction activities, the combustion of diesel fuel, and solid waste incineration.

The monitoring program for suspended particulates will utilize Partisol Model 2025 sequential air samplers (single and dichotomous units) installed at two locations to measure:

- Total suspended particulates (TSP) – particulate matter less than 100 µm;
- PM_{10} – particulate matter less than 10 µm; and
- $PM_{2.5}$ – particulate matter less than 2.5 µm.

Partisol samplers operate on the principle that a stream of ambient air at a controlled flow rate is drawn through a size-selective inlet and then through a pre-weighed filter for a pre-determined time period. The exposed filter is shipped to a laboratory where it is re-weighed. The concentrations can be determined using the measured volume of air and the weight difference between the pre-weighed and exposed filter. The U.S. EPA has described standard methods for collection of PM air samples in section 40 CFR part 53 and 58 of the U.S. Code of federal Regulations (U.S. CFR, 1997a, 1997b, 1997c,).

The monitoring of TSP, PM_{10}, and $PM_{2.5}$ concentrations will be carried out according to the National Air Pollution Surveillance (NAPS) schedule. This schedule follows a monitoring cycle where a single 24-hour sample is collected every sixth day. Sampling in accordance with the NAPS schedule will provide consistency between the Meadowbank particulate monitoring stations and stations at the other facilities across the country. In addition, by operating stations on a six-day cycle, different days are sampled each week, which allows for the monitoring of differing production intensities or other variations. Monitoring of TSP and fine particulate matter will continue throughout the operations and closure phases of the Project.

Particulate sampling will be conducted year-round using the Partisol instruments' automated sampling function. However, sampling during extreme winter conditions (-20 degrees Celsius [°C] and colder with the potential for blowing snow) which frequently occur during winter months, allows the possibility for snow to be drawn through the inlet, resulting in a void sample and possible damage to the electronic components of the sampler. A small amount of data loss is expected during the winter as ambient conditions exceed the normal operating range expected for the equipment being used. Climate-controlled shelters are used to minimize those issues.

The collection of TSP provides a measure of airborne dust or dirt, which may present environmental issues such as reduced visibility, while $PM_{2.5}$ and PM_{10} (fine and coarse particulates) are regulated based on health-related concerns. TSP and $PM_{2.5}$ are subject to GN ambient air quality standards

(GN, 2011). No standard is provided for PM_{10} in Nunavut, so these results will be compared to the BC air quality objective (BC, 2013) – see Section 3.

For comparison to Government of Nunavut Ambient Air Quality Standards (GN, 2011), concentrations of particulates must be calculated as:

$$C = M/V_{STD}$$

Where:

C = mass concentration of particulates ($\mu g/m^3$)

M = final mass of filter – initial mass of filter (μg)

V_{STD} = volume of air drawn in during the sampling period, normalized to 25°C and 101.3kPA (standard temperature and pressure; STP)

The Partisol instrument will be set to calculate and store the V_{STD} value for each filter.

2.2 DUSTFALL

Dustfall collection is a passive program that provides a measure of particulate deposition in the vicinity of the Project. The main dust generation processes at Meadowbank are wind erosion of site structures (e.g. the Rock Storage Facility), and fugitive sources from open pit mining, rock crushing and movement of vehicles/equipment/air traffic on site.

Dustfall is collected over monthly periods at four locations in open vessels containing a purified liquid matrix, supplied by an external accredited laboratory. Particles are deposited and retained in the liquid, which is then analyzed by the accredited laboratory for total and fixed (non-combustible) dustfall. Calculated dustfall rates are normalized to 30 days (mg/cm^2/30 days). Sampling is conducted over this period to allow for a sufficient sample size for analysis, and as a result it provides an indication of longer-term air quality trends.

The analysis of the fixed dustfall sampling results will include comparison with Alberta Environment's objectives since neither Nunavut nor the NWT have dustfall standards or guidelines (see Section 3).

2.3 NO_2

Concentrations of NO_2 by volume (ppb) are analyzed at two locations over monthly periods using a passive sampling device provided by an external accredited laboratory. No continuous monitoring is proposed for other gaseous pollutants because of low concentrations predicted in pre-construction dispersion modeling (Cumberland, 2005).

The passive NO_2 monitoring stations are co-located with dustfall stations to allow for the efficient collection of samples and the calculation of ambient secondary particulate (nitrate) concentrations (should this information be required at a later date).

The annual average NO_2 concentration by volume is calculated from the monthly data for comparison against the relevant standard.

2.4 WEATHER DATA

Weather data for the dustfall and air quality monitoring periods is collected using the mine site's permanent climate station. Daily averages for wind speed, wind direction and temperature are available from this station (see Meteorological Monitoring Plan).

2.5 GREENHOUSE GAS EMISSIONS

AEM is required by the Greenhouse Gas Emissions Reporting Program (GHGRP) to track greenhouse gas emissions based on annual fuel consumption, composition and the US EPA's AP-42 emission factors.

2.6 QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

AEM will ensure that monitoring is conducted in accordance with the sampling reference methodology. In addition to standardized quality assurance/quality control requirements, such as instrument calibration, leak checks, review of data, and proper labeling of all sampling containers, field audits of Partisol samplers will be performed in accordance, where possible, with the Partisol Sampler Operating Manual, "Section 6 – Operations". See Section 4 for a detailed description of instrument management. Filters and dustfall samplers will be supplied and analyzed by a CALA-accredited external laboratory.

3 DATA ANALYSIS

3.1 REGULATORY STANDARDS

Data collected from the air quality and dustfall monitoring program at Meadowbank are compared to the applicable Government of Nunavut Environmental Standards for Ambient Air Quality (October, 2011). Standards for the measured parameters are provided in Table 2.

Table 2 - Government of Nunavut Environmental Standards for Ambient Air Quality (October, 2011) for the parameters of concern at Meadowbank. All values are for data normalized to standard conditions of 25°C and 101.3 kPa.

Parameter	Time frame	Standard	
		µg/m^3	ppb
Fine Particulate Matter ($PM_{2.5}$)	24-h average	30	
Total Suspended Particulate (TSP)	24-h average	120	
	Annual geometric mean	60	
Nitrogen Dioxide (NO_2)	1-h average	400	213
	24-h average	200	106
	Annual arithmetic mean	60	32

No standard is yet available for coarse particulate matter (PM_{10}), so results will be compared to the BC Air Quality Objective (August, 2013) of 50 µg/m^3.

Likewise, no standards for dustfall are available for Nunavut. Results of the dustfall analysis will be compared to the Alberta Environment Department recreational area guideline of 0.53mg/cm^2/30d, to provide context.

3.2 ANNUAL TRENDS

In addition, annual and year-over-year trends will be assessed, and results will be discussed in the context of mine site activity.

3.3 REPORTING

AEM will provide an annual air quality and dustfall monitoring report that summarizes the collected data. In addition, AEM will report annual emission estimates to the NPRI and GHG emissions to the appropriate federal program.

Annual monitoring reports will include the following:

- Description of the monitoring programs;

- Description of mitigation efforts undertaken in the previous year;
- Monitoring locations;
- Instrumentation;
- Weather conditions during sample collection;
- Time and duration of monitoring, including dates;
- Partisol sampler inspection reports;
- Relevant standards/guidelines;
- Results of monitoring (raw and averaged as appropriate for comparison to standards);
- Emission tracking data for SO_2 and greenhouse gases based on annual fuel consumption, composition, and AP-42 emission factors;
- Comparison of results to relevant standards, analysis of annual and year-over-year trends, and comparison to estimates in EIA dispersion modeling;
- Discussion of results, including possible reasons for non-compliance with standards; and
- Mitigation measures for reducing non-compliance incidents in the future.

4 OPERATION AND MAINTENANCE

4.1 MANAGEMENT RESPONSIBILITY

AEM will be responsible for managing and operating the stations. Operation and monitoring of the stations will come under the responsibility of the Environment Superintendent. Designation of training requirements is the responsibility of Meadowbank Environment Department.

4.2 OPERATION

The Environment Department will be responsible to ensure that the Partisol samplers are operated in accordance with the equipment operating manual and that samples will be collected by appropriately trained personnel consistent with detailed written operating instructions from qualified personnel (i.e. air quality specialist familiar with the equipment). An SOP will be kept up to date and communicated to personnel. It will also ensure that proper QAQC practices are followed.

4.3 MAINTENANCE

As recommended by the manufacturer and to ensure results are in compliance with good practices, the following items will be part of the regular maintenance and care of the Partisol sequential air samplers. This will allow flow values and temperature compensation to be constant with time.

Maintenance Procedures	**Interval**
Exchanging particle trap filter	6 months
Testing batteries–exchange if necessary	6 months
Exchanging fuses	As needed
Cleaning Air Intake Filters	6 months
Inspect “V” Seals and O-rings	3 months
Rebuilding piston pump(s)	18 months

Audit Procedures	**Interval**
Ambient Air Temperature audit	4 weeks
Filter Temperature(s) audit	4 weeks
Ambient Pressure audit	4 weeks
External Leak Check	4 weeks
Flow controller audit	4 weeks

Calibration Procedures	**Interval**
Analog I/O calibration	Automatic
Ambient Air Temperature calibration	1 year
Filter Compartment Temperature calibration	1 year
Filter Temperature(s) calibration	1 year
Ambient Pressure calibration	1 year
Ambient Relative humidity calibration	1 year
External Leak Check	1 year
Flow controller calibration	1 year

5 PLAN REVIEW

The Air Quality and Dustfall Monitoring Plan will be reviewed regularly by the Meadowbank Environmental Superintendent and be updated if any changes to the equipment or the program occur.

6 REFERENCE

AEM (2008) Agnico-Eagle Mines Limited. Technical Memo- Air Traffic Management- Meadowbank Gold Project (June 10, 2008)

BC 2013. British Columbia Ambient Air Quality Objectives. Provincial Air Quality Objective Information Sheet. August 12, 2013.

Cumberland Resources Ltd. 2005. Meadowbank Gold Project Air Quality Impact Assessment Report.

Golder Associates Ltd. (Golder) 2005 Air Quality and Noise Management. Meadowbank Gold Project.

Golder Associates Ltd. (Golder) 2008. Technical Memorandum. Addendum Report: Air Quality Monitoring Meadowbank Gold Project. Prepared for Agnico-Eagle Mines Ltd. May 16, 2008.

GN (Government of Nunavut) 2011. Environmental Guideline for Ambient Air Quality. Department of Environment, Government of Nunavut. October, 2011.

AGNICO EAGLE

MEADOWBANK GOLD PROJECT

Meteorological Monitoring Plan

In Accordance with NIRB project certificate 004

Prepared by:
Agnico-Eagle Mines Limited – Meadowbank Division

Version 1
May 2013

EXECUTIVE SUMMARY

General Information

The Meteorological Monitoring Plan (MMP) describes the design features and operational procedures for the weather station installed at the Meadowbank Gold Project site for the collection of atmospheric data.

Annual Review

The MMP will be reviewed and updated at least annually if necessary. Completion of the annual review of the MMP will be documented through signatures of the personnel responsible for reviewing, updating and approving the MMP.

Record of Changes

A record will document all significant changes that have been incorporated in the MMP subsequent to the latest annual review. The record will include the names of the persons who made and approved the change, as well as the date of the approval.

Distribution List

Agnico-Eagle Mines Limited (AEM) will maintain a distribution list for the MMP providing information about all parties that receive the plan.

IMPLEMENTATION SCHEDULE

The proposed implementation schedule for this Plan is effective immediately (May 2013) subject to any modifications proposed by the NIRB as a result of the review and approval process.

DISTRIBUTION LIST

AEM - Environmental Superintendent

AEM – Environmental Coordinator

DOCUMENT CONTROL

Table 1 – Document Control

Version	Date (YMD)	Section	Page	Revision
1	13/05/3031	All		First draft

Version 1

Prepared By: Meadowbank Environment Department

Approved By: _____

Kevin Buck
Environmental Superintendent

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1 INTRODUCTION

1.1 PROJECT HISTORY

Agnico-Eagle Mines Limited (AEM) Meadowbank Division currently operates an open pit gold mine located on Inuit-owned land in the Kivalliq Region of Nunavut, approximately 70 km north of the hamlet of Baker Lake. The Meteorological Management Plan was developed by AEM in accordance with NIRB recommendation for the monitoring of atmospheric data for the project during construction and operations.

1.2 OBJECTIVES

The objective of a climatological/meteorological monitoring station is to provide data to support ongoing environmental assessment at the site. Air quality and hydrology assessment are the primary reasons for the collection of this data, however, there is potential for other environmental and engineering factors that may require the data generated by the station. It could also be used to contribute to a regional data bank and to assist in transportation logistic planning if needed.

This plan is a component of the Meadowbank Environmental Management System. The objectives of this plan are:

1. To provide reliable meteorological data for the Meadowbank site
2. To provide necessary information and data for preparation of air quality and noise monitoring reports
3. To provide statistical data for ongoing projects.

2 STATION DESIGN

2.1 BACKGROUND

A single meteorological station was installed for this project. Since no guidance exists in Nunavut regarding meteorological stations, it was designed and installed according to the Alberta Air Monitoring Directive.

2.2 LOCATION

The overall site plan for the Meadowbank Gold Project and the location of the meteorological station are shown in Figure 3-1. This central location was chosen to meet guidelines specifications.

2.3 DESIGN

The installed station consists of Campbell Scientific Canada monitoring equipment and includes the following:

- Wind monitor
- Temperature probe
- Temperature thermalinear probe
- Net radiometer sensor
- Measurement and control module
- Module housing
- Solar panel
- Rechargeable battery
- Station tower
- Software

The site is also equipped with a manual recording device to measure precipitation, including snow and rain. :

3 STATION OPERATION AND MANAGEMENT

The following presents the operational procedures for the weather station.

3.1 MANAGEMENT RESPONSIBILITY

AEM will be responsible for managing and operating the station. Operation and monitoring of the station will come under the responsibility of the Environment Superintendent. Designation of training requirements is the responsibility of Meadowbank Environment Department.

3.2 OPERATION

3.2.1 Monitoring methods

The monitoring sensors are mounted on a 10 meter tower and the station is operated independently using power from the main camp. It is also equipped with a rechargeable battery linked to a solar panel as back-up power supply. The station is connected to the AEM network via an Ethernet link.

Monitored parameters include the following:

- Wind speed at 10 m above ground
- Wind direction at 10 m above ground
- Temperature at 2 m above ground
- Relative humidity at 2 m above ground

Total daily precipitation is collected in a manual rain gauge installed on site.

3.2.2 Monitoring frequency

Meteorological monitoring is conducted year-round and is planned for both the operation and closure phases of the project. Data is collected continuously and is recorded hourly and daily in a datalogger. This data is downloaded into a separate file and analyzed bi-weekly by the Environmental department staff. Any discrepancies are noted and corrected as soon as possible.
Regular visual inspections are also included in the meteorological inspections template.

Precipitation is manually recorded daily and logged.

4 PLAN REVIEW AND CONTINUAL IMPROVEMENT

The Meteorological Monitoring Plan will be reviewed annually by the Meadowbank Environmental Superintendent in consultation with the Mine General Manager, and updated, if necessary.

REFERENCE

Alberta Environment, 2006. 2006 Amendments to the Air Monitoring Directive, 1989. Monitoring and reporting directives, Environmental monitoring and evaluation, April 1st 2006.

Golder (Golder Associates Ltd). 2008. Technical Memorandum: Meteorological monitoring plan – draft, Meadowbank Gold Project, Nunavut. Prepared for: Agnico-Eagle Mines Ltd. May 9th, 2007.

National Weather Service, web site, http://www.weather.gov/

National Oceanic and Atmospheric Association, web site, http://www.noaa.gov/

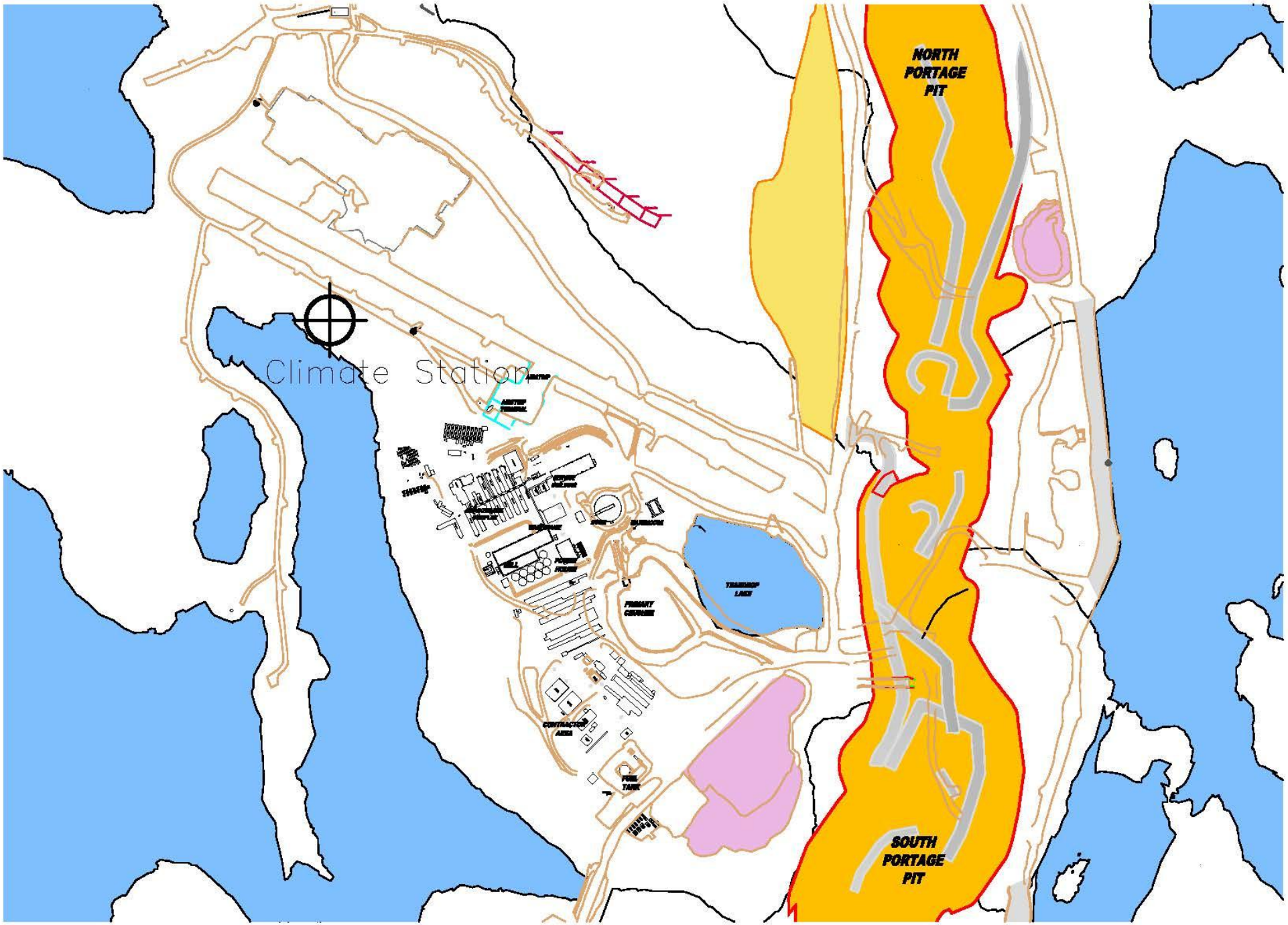
LIST OF ACRONYMS

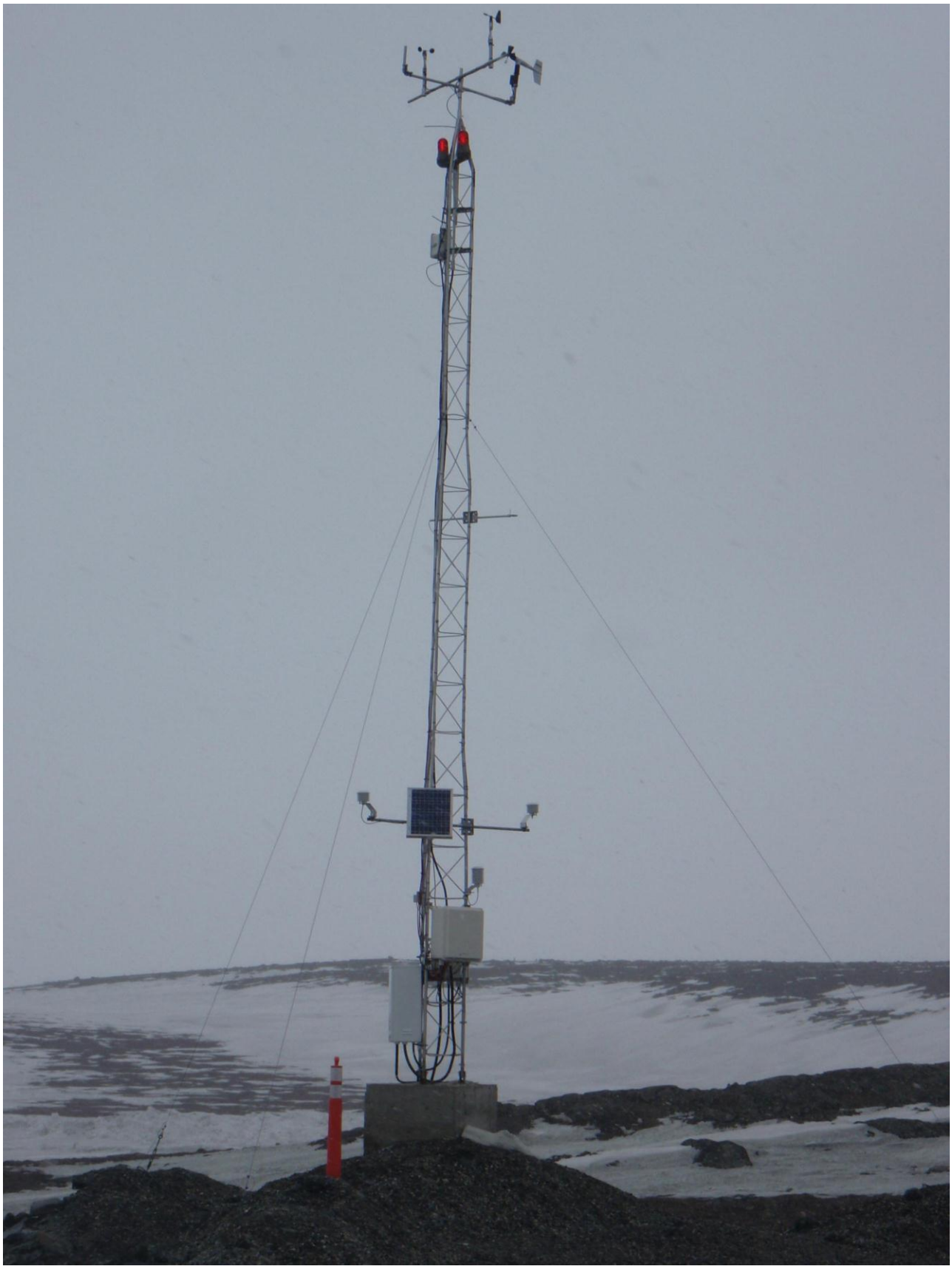
AEM	Agnico-Eagle Mines Ltd.
MMP	Meteorological Monitoring Plan
NIRB	Nunavut Impact Review Board

FIGURES

Figure 3.1 – Location of the meteorological station on the Meadowbank site

Figure 3.2 – Photo of station installation


NORTH
PORTAGE
PIT
Climate Station
SOUTH
PORTAGE
PIT



AGNICO EAGLE

MEADOWBANK GOLD PROJECT

Noise Monitoring and Abatement Plan

In Accordance with NIRB Project Certificate No. 004

Prepared by:
Agnico Eagle Mines Limited – Meadowbank Division

Version 2
January 2014

EXECUTIVE SUMMARY

GENERAL INFORMATION

This Noise Monitoring and Abatement Plan (NMAP) describe the operational procedures for noise abatement and monitoring at the Meadowbank Gold Project site, with respect to wildlife disturbance and potential offsite human receptors. This plan is an updated version of the Noise Management and Abatement Plan (Version 1) – September 2009. Noise management for the Meadowbank site was originally described in Cumberland (2005) – Air Quality and Noise Management.

ANNUAL REVIEW

The NMAP will be reviewed regularly and updated as necessary. Completion of the review of the NMAP will be documented through signatures of the personnel responsible for reviewing, updating and approving the NMAP.

RECORD OF CHANGES

A record will document all significant changes that have been incorporated in the NMAP subsequent to the latest review. The record will include the names of the persons who made and approved the change, as well as the date of the approval.

DISTRIBUTION LIST

Agnico Eagle Mines Limited (AEM) will maintain a distribution list for the NMAP, providing information about all parties that receive the plan.

IMPLEMENTATION SCHEDULE

The proposed implementation schedule for this Plan is effective immediately (January 2014) subject to any modifications proposed by the NIRB as a result of the review and approval process.

DISTRIBUTION LIST

AEM - Environmental Superintendent
AEM – Environmental Coordinator

DOCUMENT CONTROL

Version	Date	Section	Page	Revision
1	09/2009			
2	01/2014	All		See Record of Changes

Version 2

Prepared By: Meadowbank Environment Department

Approved By: _____

Kevin Buck

Environmental Superintendent

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Appendix B: Environmental Noise Monitoring Guide - Bruel and Kjaer 2250 Sound Level Meter

SECTION 1 • INTRODUCTION

The following document presents the Meadowbank Gold Project Noise Monitoring and Abatement Plan in support of Condition 62 of NIRB Project Certificate No.004. This plan outlines AEM's strategy for reducing noise disturbance on and near the Meadowbank mine site, with particular regard to wildlife and potential offsite human receptors.

Section 2 describes the site's target sound levels based on Environment Canada (2009) guidelines.

Section 3 describes the onsite noise monitoring program that will be conducted to track typical noise levels in the local study area and to assist in the continual improvement of noise mitigation whenever possible.

Section 4 describes the onsite noise abatement plan for anticipated common noise sources and intense noise occurrences.

SECTION 2 • TARGET SOUND LEVELS

2.1 WILDLIFE

As no specific noise guidelines were found for the Meadowbank project area, recommendations made by Environment Canada's "Environmental Code of Practice for Metal Mines" (2009) were adopted. This document states that:

> *"In residential areas adjacent to mine sites, the equilibrium sound pressure level (L_{eq}) from mining activities should not exceed 55 dBA during the day and 45 dBA at night. Ambient noise can also affect wildlife, so sites in remote locations should also work to meet these objectives for off-site ambient noise levels."*

Therefore, target sound levels at the perimeter of the Meadowbank site are:

Daytime (0700 – 2300 h) L_{eq} (1hr) = 55 dBA

Nighttime (2300 – 0700 h) L_{eq} (1hr) = 45 dBA

Results from noise monitoring stations located at the perimeter of the Meadowbank site are compared to these guidelines to assist in ongoing noise management (see Section 3).

To further ensure that mine site activities are not impacting wildlife more than predicted, AEM maintains a Terrestrial Ecosystem Management Plan (Cumberland, 2006), per Condition 54 of the NIRB Project Certificate.

2.2 OFFSITE HUMAN RECEPTORS

Although no offsite impacts to human receptors were identified in the FEIS due to the remote location of the mine site, a Permissible Sound Level (PSL) may be developed in the event of construction of a dwelling in an impacted location. Based on the Alberta Energy and Utilities Board (EUB)'s "Noise Control Directive User Guide" (1999, 2007) this value will be the existing noise level at the new dwelling, when constructed.

SECTION 3 • NOISE MONITORING

3.1 OBJECTIVE

The objective of noise monitoring at the Meadowbank site is to measure representative noise levels at the perimeter of the mine, and to assist in the implementation of noise mitigation measures, wherever feasible (see Section 4).

3.2 MONITORING LOCATIONS

Meadowbank's Environment Department will continue to monitor noise levels around the mine site at five locations previously determined in consultation with Golder Associates Ltd. UTM coordinates for the base noise monitoring stations are provided in Table 1, and are shown in relation to the mine site features in Figure 1. All sites were located at a distance from noise sources, to be representative of sound levels in locations where wildlife may be expected to occur, and where noise-related PPE is not required. These locations may be adjusted as mine site operations change, to target specific activities or receptors.

Table 1 - Base noise monitoring locations.

Location Name	Easting	Northing
R1	636896	7216829
R2	636795	7214435
R3	641104	7214427
R4	639990	7218810
R5	633781	7214493

3.2.1 R1

Location R1 is approximately 700 m south of the explosive storage area, and 400 m northeast of the all-weather access road. Third Portage Lake is nearby to the south, and surrounding terrain is rocky tundra with some vegetation. Since a spur road and storage area were constructed within 100 m of R1 in 2011, AEM proposes to move this station approximately 700 m northwest of the explosives storage area to better represent the originally intended orientation. Additionally, this location will provide a better indication of impacts to potential offsite receptors. The specific location will be confirmed during 2014 field season.

3.2.2 R2

Location R2 is approximately 600 m west of the airstrip. Third Portage Lake is to the west and southwest and surrounding terrain is vegetated tundra with rocky outcrops.

3.2.3 R3

Location R3 is approximately 1,800 m east of the East Dike. Second Portage Lake is to the west and east, and surrounding terrain is vegetated tundra with rocky outcrops.

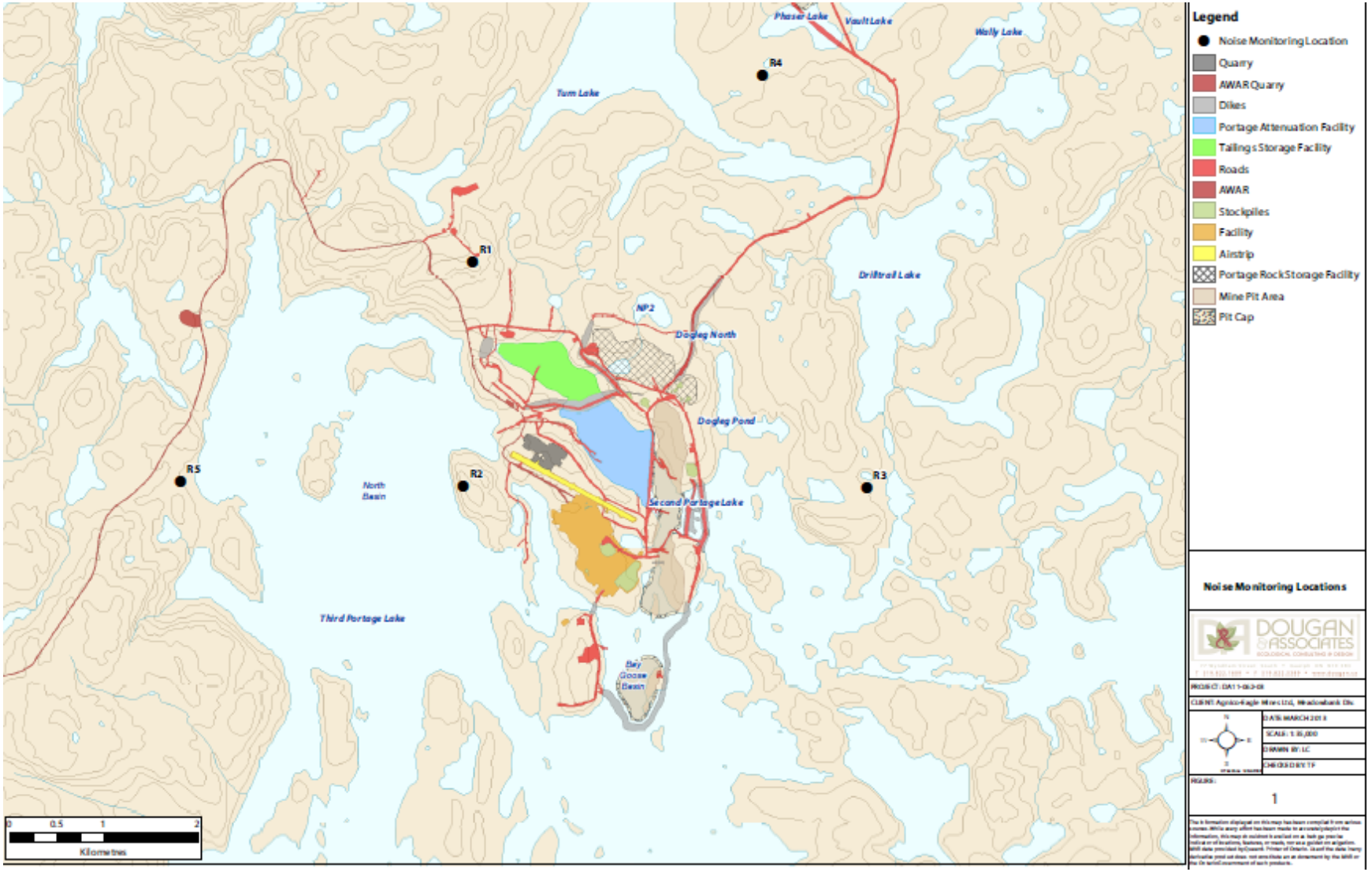
3.2.4 R4

Location R4 is approximately 1,500 m southwest of the future location of Vault Pit. Turn Lake is to the west, and surrounding terrain is vegetated tundra with rocky outcrops.

3.2.5 R5

Location R5 is in the exploration camp area, near the all-weather access road, and approximately 3,500 m west of the airstrip. Third Portage Lake is immediately to the east, and surrounding terrain away from the shoreline is vegetated tundra with rocky outcrops. This location is situated on a known caribou migration route.

Figure 1 - Meadowbank noise monitoring stations



3.3 MONITORING FREQUENCY

AEM field staff will aim to conduct two noise surveys per year at each of the locations described in Section 3.2. Each survey will be for a 3-4 day period to ensure significant data is collected. These surveys provide data on average noise levels during a typical day, as well as variability of noise levels within the day.

3.4 SOUND LEVEL METER

A Bruel and Kjaer Model 2250 integrating sound level meter will be used to conduct the noise surveys at the locations described in Section 3.2. The noise level logging rate will be set at one-minute intervals, and sound will be recorded in 10 minute intervals.

The parameters logged each minute will be:

- Integrated average sound level, in dBA – L_{eq}
- Absolute maximum sound level, in dBA – L_{max}
- Absolute minimum sound level, in dBA – L_{min}

3.5 WEATHER DATA

Weather data for the noise monitoring periods is collected using the mine site's permanent weather station (see Meteorological Monitoring Plan). Hourly data for wind, temperature and relative humidity is available from this station. This data is used to screen out sound levels collected under inappropriate conditions (see Section 3.7).

3.6 FIELD NOTES

A pocket weather meter (Kestrel 3000) will be used by field staff to record wind speed, direction and temperature at the beginning and end of each monitoring period. Other records include precipitation, cloud cover and observed noises during instrument set-up and take-down. See Appendix A for an example field monitoring sheet.

3.7 QUALITY CONTROL

Calibration of the sound level instrument will be performed before and after each monitoring period using a Bruel and Kjaer Type 4231 Calibrator, to ensure variance is within 0.5 dB. Calibration results are recorded in field notes. Estimated uncertainty of the calibrator is ± 0.12 dB at a 99% confidence level. Professional calibration of the instrument will be performed as described in Section 5.

3.8 DATA ANALYSIS

Since noise levels vary over time, the monitoring instrument used at Meadowbank measures near-continuously and reports a single-number value for each minute, representing the "equivalent sound level" (L_{eq}). This value is the average sound level occurring over the specified time period (i.e.one minute). Alternatively, it is the sound level that would produce the same total amount of acoustical energy in the specified time period as the measured sound levels did.

Data downloaded from the instrument will be filtered to remove measurements collected outside of acceptable weather conditions (wind speed > 4.17 m/s; relative humidity > 90%). All data points associated with the first and last 30 min of measurement will be filtered out to remove noise from technicians, and more than 30 min of data will contribute to hourly averages.

One-minute L_{eq} values produced by the instrument will be used to calculate hourly, day-time (7am-11pm), night-time (11pm-7am) and 24 hr L_{eq} values. These time periods are based on Health Canada recommendations, as described in Golder (2012). L_{eq} values for each time period are calculated as the geometric mean of filtered one-minute L_{eq} values.

3.9 REPORT

Results of the noise monitoring program will be compiled annually and reported to NIRB and Environment Canada. Reports will include, for each station:

- Visual display of one-minute L_{eq}, one-minute maximum and one-minute minimum values
- Hourly, daytime, nighttime and 24 hr L_{eq} values, including number of hours of valid data contributing to each
- Weather data for each monitoring period (temperature, wind speed and direction)
- Audible noises noted on field logs and in sound files, especially those corresponding with intense noise occurrences (see Section 4.3)
- Comparison of daytime and nighttime L_{eq} values to target sound levels, for applicable stations (those located at the site perimeter)
- A historical comparison of daytime, nighttime and 24-hr L_{eq} values
- Recommendations for additional monitoring or for implementation of additional abatement measures, if possible, when sources of intense noise occurrence are confirmed

SECTION 4 • NOISE ABATEMENT

4.1 GENERAL PRACTICES

The Meadowbank mine site infrastructure is laid out to concentrate all activities within a small footprint (see Figure 1). As a result, the common noise sources at Meadowbank are in close proximity to one another and for the most part are contained within separate buildings (i.e. facilities such as the crusher, SAG mill are indoors to reduce noise intensity). Personnel office spaces and accommodations are separate from these operational buildings. The Meadowbank site infrastructure is oriented to reduce intense noise occurrences that may impact wildlife or personnel. These attenuation measures taken during the design and construction of the infrastructure are an important component of noise abatement on the Meadowbank mine site.

In general, all departments will strive to ensure that equipment manufacturers have incorporated noise attenuation into their design as much as possible, will maintain equipment in good working condition, and will position stationary equipment away from potential receptors of concern or in enclosed areas.

4.2 DAILY NOISE OCCURRENCES

Common noise sources that are daily occurrences may include road traffic, air traffic, impact equipment, stationary equipment (such as generators, compressors or pumps), blasting, material handling (i.e. crushers, cranes), earth movers (i.e. truck loaders and dozers) and primary plant facilities (i.e. SAG mill, ball mill and power plant).

Table 2 describes the project-related noise sources that have been identified as well as proposed mitigation/management measures to be implemented whenever possible during operation of the facility.

Table 2 - Standard mitigation measures for daily noise occurrences.

Noise Source	Noise Mitigation Measures
Road traffic (mine site, AWPAR)	• Avoid trucking operation during night time, when possible • During maintenance, check that noise abatement devices are in good order (e.g., brakes, exhaust mufflers, engine hoods) • Enforce speed limits • Use shallow slopes for haul road • Educate truck drivers about the characteristics of diesel engines (i.e., that the flat torque characteristic allows ascending an incline in a higher gear, which is a less noisy operation) • Keep road surfaces in good repair to reduce tire noise • Avoid prolonged idling
Air traffic	• Avoid low altitude flights (not lower than 610 m in sensitive bird/wildlife areas), except on take-off and landing • Restrict air traffic to daytime hours except for emergencies
Impact equipment (pile drivers,	• Avoid operating numerous pneumatic tools at the same time,

Noise Source	Noise Mitigation Measures
jack hammers, drills, pneumatic tools)	and spread operation throughout working periods
Stationary equipment (compressors, generators, pumps)	• Keep equipment in good condition
Blasting	• Use delays, both surface and down hole • Preference for daytime blasting • Blasting in depressed pits (normal production practice)
Outdoor material handling equipment (crushers, concrete mixers, cranes)	• Place crushers in sheltered/enclosed locations if possible • Maintain equipment in good working condition • Turn equipment off when not in use if practicable
Earth moving equipment (trucks, loaders, dozers, scrapers)	• Aim to restrict equipment age so only newer, more efficient machinery will operate onsite • Operate equipment within specification and capacity (i.e., don't overload machines) • Use noise abatement accessories such as sound hood and mufflers
Primary plant facilities (gyratory primary crusher, SAG mill, ball mill, power plant)	• Provide building with walls absorbing noise • Maintain equipment on a regular basis, replace worn parts, lubricate as required • Provide diesel plant units with efficient intakes and exhaust silencers • Use conveyor system with low noise output, paying particular attention to rollers • Enclose conveyors where necessary
Utilities and services	• Ensure that a rotating biological contactor treatment system operates quietly • Dump solid waste behind barriers

4.3 INTENSE NOISE OCCURRENCES

4.3.1 Strategy

It has been found that people (and therefore, potentially, wildlife) are more tolerant of louder continuous background noise than a quieter baseline punctuated by high-level peaks. Therefore, the intense noise abatement strategy acknowledges the common continuous noise sources, and aims to reduce the occurrence of intense noise peaks. For the purposes of this Plan, intense noise occurrences are considered to be those that exceed the target sound levels described in Section 2. Examples of these may be low flying air traffic, exceedingly loud blasting or nearby impact equipment. Since noise monitoring stations may be located away from the site perimeter, the target sound levels are only used as a conservative benchmark to filter audio files for closer analysis and adaptive noise management.

4.3.2 Identification

Through the annual monitoring program, 24-h sound profiles for each monitoring station will be developed, and the daytime equivalent sound level (L_{eq}) identified (see Section 3.7). Recorded sound files will then be reviewed in conjunction with field notes to attempt to determine the sources of intense noises (> target sound levels).

4.3.3 Abatement

When sources of intense noises are confirmed, Environment Department staff will work with the responsible party to determine whether further abatement of the noise is possible. At a minimum, this will include ensuring the previously identified mitigation measures (Table 2) are being applied. If all abatement practices are in use and the source continues to contribute to intense noise occurrences in subsequent monitoring events, the implementation of additional appropriate measures will be investigated. This method of intense noise identification means that there will be a continual effort to reduce the sounds contributing to the loudest, most disruptive noise peaks onsite, even as site operations evolve and average noise levels change.

SECTION 5 • MANAGEMENT AND OPERATION

The following presents the plan's management responsibility, and operational procedures for the Bruel and Kjaer Model 2250 integrating sound level meter.

5.1 MANAGEMENT RESPONSIBILITY

Operation and monitoring of the noise stations will come under the responsibility of the Environment Superintendent. Designation of training requirements is the responsibility of the Meadowbank Environment Department.

5.2 EQUIPMENT OPERATION

The Environment Department will be responsible for the operation of equipment and collection of samples by appropriately trained personnel consistent with detailed written operating instructions (SOP – Appendix B) from qualified personnel. The SOP will be kept up-to-date and any changes will be communicated to relevant personnel.

5.3 EQUIPMENT MAINTENANCE

As recommended by the manufacturer and to make sure results are in compliance with good practices, the meter will be factory calibrated and certified per the schedule outlined below.

Calibration	Interval
Microphone	2 years
Meter	2 years
Calibrator	1 year

SECTION 6 • PLAN REVIEW

The Noise Monitoring and Abatement Plan will be reviewed regularly by the Meadowbank Environmental Superintendent and be updated if any changes to the equipment or the program occur.

SECTION 7 •REFERENCES

AEM (2009). Noise Management and Abatement Plan. Meadowbank Gold Project. Version 1. September, 2009

Alberta Energy and Utilities Board (1999, 2007). Directive 038 - Noise Control.

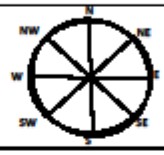
Environment Canada (2009). Environmental Code of Practice for Metal Mines. 1/MM/17 Mining Section, Mining and Processing Division, Public and Resources Sectors Directorate, Environmental Stewardship Branch.

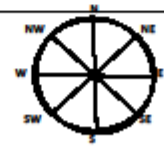
Health Canada (2005) Noise Impact Assessment Orientation Document for Projects Triggering CEAA. Prepared by the Healthy Environments and Consumer Safety Branch. Health Canada, May 2005.

Golder Associates (Golder), 2012. 2011 Noise Monitoring, Meadowbank Division, Nunavut. Prepared for Agnico-Eagle Mines Ltd. February, 2012.

Appendix A

Example of noise monitoring field sheet

MONITORING STARTS			
Operator:			
Location:			
Noise Meter Start Time:			
Date:			
Calibration complete ?:			
Sensitivity			
Derviation			
Time of Calibration:			
Battery Power Check:	Good		Poor
Photographs of Setup (Y/N)			
Photographs of Surrounding (Y/N)			
Check available disk memory (Y/N)			
Cloud cover:	cloudy	partly cloudy	sunny
Height of cloud (feet):	0-10,000	10,000-25,000	25,000 +
Air Temperature (C):			
Wind Speed (km/hr):			
Wind Direction: North wind (wind blows from North)			
Barometric Pressure (kPa):			
Relative Humidity (%)			
Precipitation:	none	drizzle	rain
GENERAL SITE DESCRIPTION			
GPS Location	Latitude	Longitude	Altitude
Type of Ground Surface:			
Acoustic Environment:			
Traffic			
Human activities			
Animal			
Other noise sources			

MONITORING ENDS			
Operator:			
Record Data File Name:			
Total Monitoring Period			
Noise Meter End Time:			
Date:			
Calibration complete ?:			
Sensitivity			
Derviation			
Time of Calibration:			
Check file size (GB)			
Battery Power Check:	Good		Poor
Cloud cover:	cloudy	partly cloudy	sunny
Height of cloud (feet):	0-10,000	10,000-25,000	25,000 +
Air Temperature (C):			
Wind Speed (km/hr):			
Wind Direction: North wind (wind blows from North)			
Barometric Pressure (kPa):			
Relative Humidity (%)			
Precipitation:	none	drizzle	rain
Depature Time:			

Appendix B

Environmental Noise Monitoring Guide - Bruel and Kjaer 2250 Sound Level Meter

GOLDER ASSOCIATES

ENVIRONMENTAL NOISE MONITORING GUIDE

Doc. No. 747 Ver.0

September 2008

08-1428-0007/4000/4100

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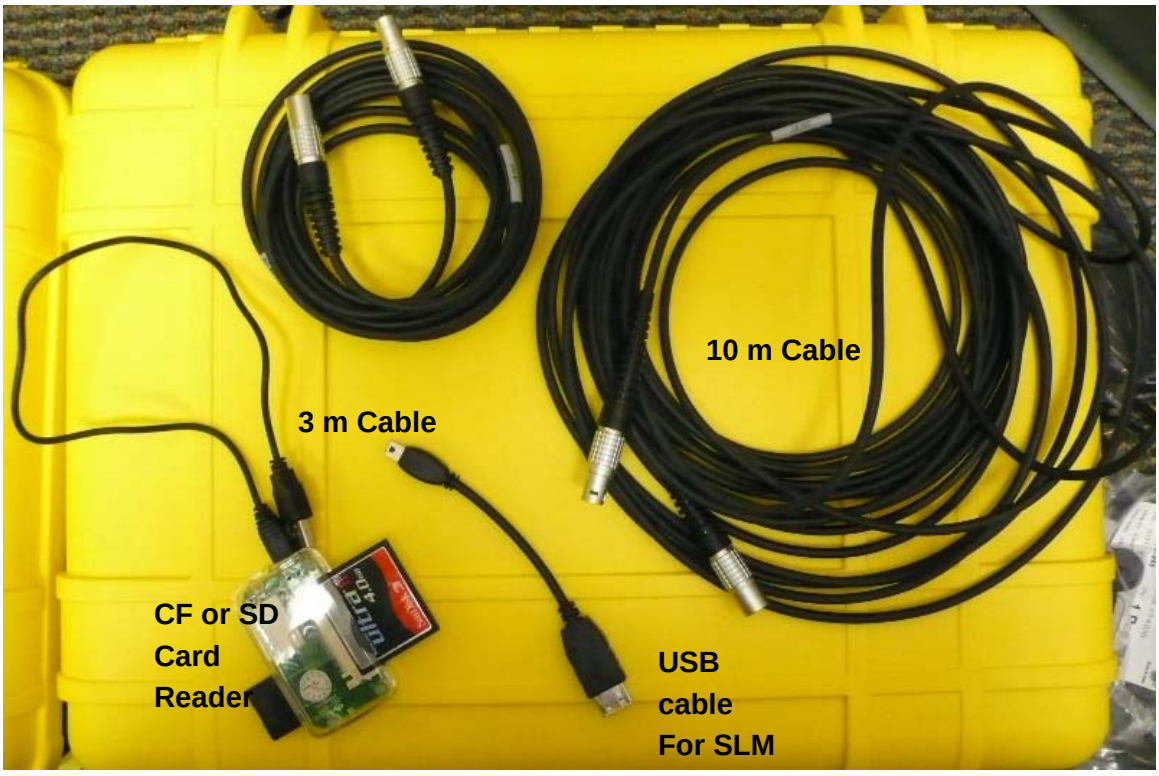
1.0 LONG-TERM MONITORING CONFIGURATION

The Bruel and Kjaer 2250 sound level meter (2250 SLM) can be configured for short or long term noise monitoring. The photo below shows the long-term monitoring setup including the weather protective case. In long-term monitoring, the following components are required:

- 2250 SLM;
- Microphone and Preamp Assembly;
- Outdoor Microphone Kit;
- Microphone Extension Cable;
- Tripod;
- External 12 Volt DC Power Supply;
- Power Supply Cable Connector;
- External Memory Card (CF-Card or SD-Card);
- Support Pegs; and
- Electrical Tape.

1.1 Storage Case Setup

The monitoring components and setup for the equipment storage case are shown below.



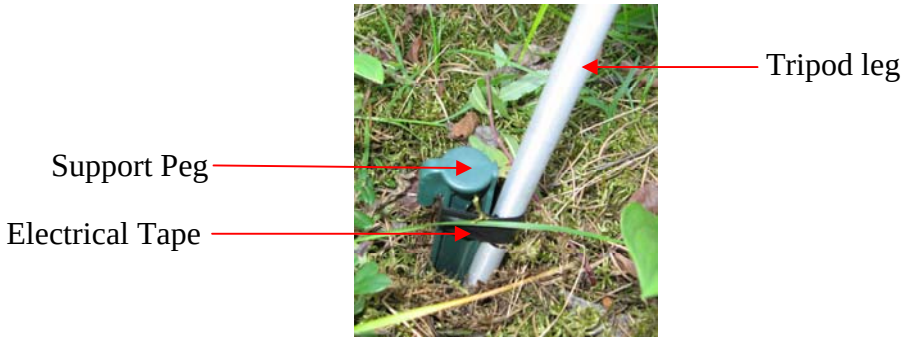
1.2 Outdoor Microphone Assembly

The procedure for assembling the outdoor microphone is summarized below:

1.3 Hardware Setup Procedure

1.3.1 Tripod

Extend the tripod to its maximum extension. Secure a support peg to end of each tripod leg, making sure that the pegs are parallel to the leg. Using electrical tape (note electrical tape is ideal as it is durable and can be easily removed) to secure the tripod legs to the support pegs such that little to no swaying or tipping is possible. Insert the support pegs into the ground far enough to provide ample support of the legs of the tripod.



1.3.2 Outdoor Microphone Kit

Remove the outdoor microphone kit windscreen and extension cable and attach it to the top of the extension pole. Run the microphone extension cable down one of the tripod legs securing it with electrical tape approximately every 2 feet along the leg as shown below.

1.3.3 Extension Cable Connection

Connect the microphone extension cable to the input of the B&K 2250 Analyzer making sure that the dot on the extension cable is lined up with the dot on the input of the Analyzer (see left figure below).

Note, when dismantling the meter it may be difficult to remove the microphone extension cable from the B&K 2250 Analyzer. If difficulties do arise, place a cloth over the sleeve and use pliers to gently grip and pull back the sleeve to release the connection as shown below.

Sleeve

Place cloth over sleeve.

Use pliers to gently pull back sleeve.

1.3.4 Long Term Power Supply (12V DC)

Connect the power supply cable from the 12V Panasonic battery to the external power supply located at the base of 2250 SLM. There are two indicators to confirm that 12V DC power supply is connected successfully to the 2250 SLM:

- The green LED which is located at the bottom of the B&K 2250 Analyzer should be on; and

Check 2250 Analyzer LED for power.

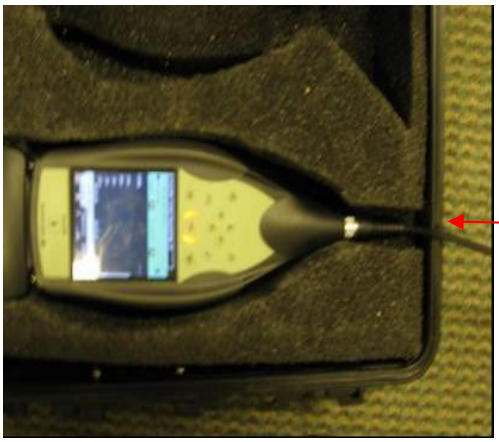
- The battery symbol on the B&K 2250 Analyzer screen display changes from a battery to a power plug symbol - as shown in the figure below.

External power symbol indicating that external power is connected.

A flashing green LED light indicates the internal battery of the Sound Level Meter is fully charged (100%).

1.3.5 Extension Cable Arrangement

There are two data cable available (3 m and 10 m). Use the 3 m when connect to the handheld microphone pre-amp and use the 10 m extension cable when using the outdoor microphone kit. The microphone extension cable must extend across the notched portion of the sound level meter case as shown below.



Extend microphone extension cord over notched portion of protective case.

After securing the cables of the sound level meter, the case should be placed underneath the three legs of the tripod as shown below. Coil the excess cable length and store it inside the case. Tape the microphone extension cord along the tripod to avoid tripping and noise contamination (wind).

Tape microphone extension cord along tripod.

1.4 SLM Setup Procedure

1.4.1 Data Storage Card - 4.0 GB Memory (CF/SD) Card

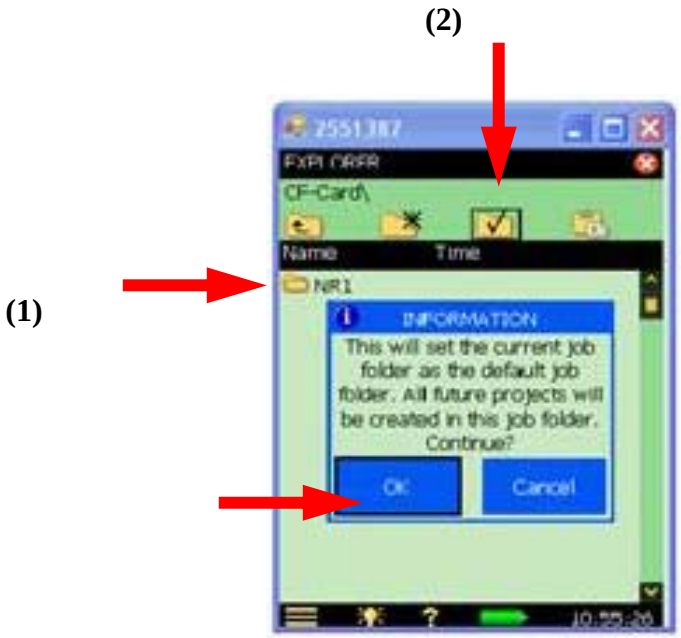
1. Insert an empty 4 Gigabyte memory card into the B&K 2250 Analyzer. Upon inserting the CF/SD card, the B&K 2250 Analyzer should acknowledge the card and display the prompt to accept the card. Click "Yes" to this.

2. Select the "Main Menu" which is shown by three bars to the lower right on the B&K 2250 Analyzer screen as shown above left. Then select the "Explorer" (see below) option so that a folder can be created on the CF/SD card.

3. The next step involves creating a folder on the CF/SD card in which to store the noise data. Creating a new folder is done by selecting the folder icon with a star as shown in the figure below left. A prompt will display that a new job folder will be created. Select "Ok".

4. Renaming the folder is the next step. Select the folder, right click mouse button, and then select the "Rename" option. Choose the name of the folder appropriately to help with identification of noise monitoring location during data analysis and processing later (*e.g.*, MEADOWBANK030308).

5. Once the folder has been renamed, the folder must be identified as the default for data storage. This is done by selecting the folder itself and selecting the "Open" option (1 below). Now select the folder icon with the check mark (2 below) on it to set the current job folder (NR1 in photo below) as the default job folder, *i.e.*, all measurements will be stored within this folder.



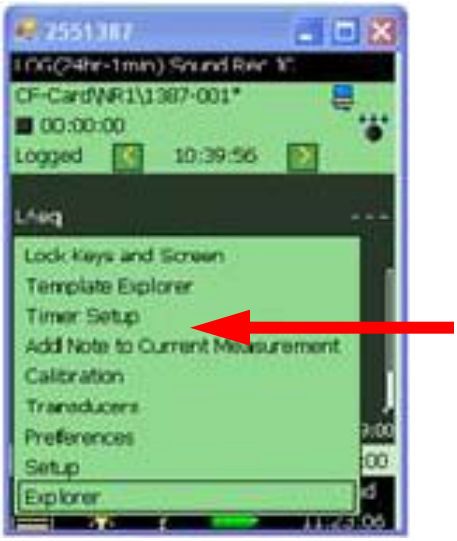
6. Observe the file path that is shown at the top of the display screen, it should display that the CF/SD card is at the top level and that the folder (NR1 in photo below) is one level below, *i.e.*, "CR-Card\NR1" as is shown in the below left screen.

7. Exit the “Explorer” screen by selecting the red “x” at the top left of the display screen.

1.4.2 Monitoring Template

The 2250 SLM is loaded with 10 standard monitoring templates. Each of the 10 standard templates performs a different type of measurement. The standard templates can be modified and saved as a Project Template to retain specific display settings and measurement setups. The template itself does not store any measurements. A Project Template named “MEADOWBANK 24hr LOGGING” has been designed to conduct the 24 hr noise monitoring. Use the following procedures to load the template.

1. Select the “Main Menu” and select the “Template Explorer” option as shown below. All the available templates will be shown on the screen.



2. Choose the “MEADOWBANK 24hr LOGGING” and then select “Open”.

3. The common measurement settings selected in this template are shown in the following table:

MEADOWBANK 24hr LOGGING SETTING

Input		
Input	Top Socket	
Trans. Used	4152_0 (########) Check serial # on mic	Outdoor kit
Sound Field Correction	Free-field	
Extended Low Frequency	Off	
Frequency Weightings		
Broadband (excl.Peak)	AZ	Z is linear
Broadband Peak	A	
Spectrum	Z	
Bandwidth (1/3-octave)		
Statistics		
Broadband Statistics based on	LAF	
Spectral Statistics based on	LXF	
Percentile 1	1 %	
Percentile 2	5 %	
Percentile 3	10 %	
Percentile 4	50 %	
Percentile 5	90 %	
Percentile 6	95 %	
Percentile 7	99 %	
Measurement Control		
Preset Logging Time	1.00:30:00	1 day and 30 minutes
Logging Period	00:01:00	1 minutes
Synchronize with Clock	Yes	Save at 1:00, 1:01, 1:02
Logged Broadband		
Full Statistics	Yes	
Broadband Parameters	Selected	
Parameter 1	LAeq	
Parameter 2	LApeak	
Parameter 3	LAFmax	
Parameter 4	LAFmin	
Parameter 5	LZeq	
Parameter 6	LAIeq	
Parameter 7	LCeq-LAeq	
Parameter 8	Overload	
Logged Spectrum		
Full Spectral Statistics	Yes	
Spectrum Parameters	Selected	
Spectrum	LZeq	

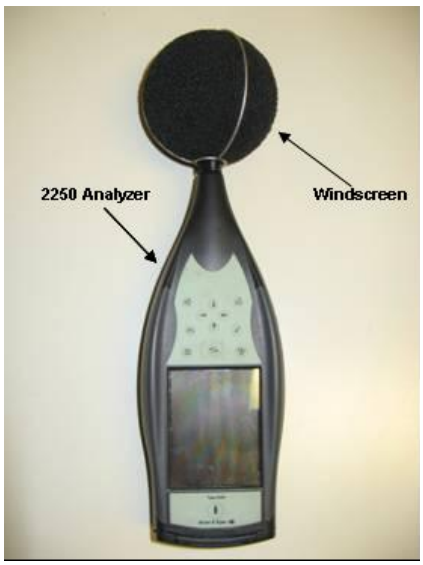
MEADOWBANK 24hr LOGGING SETTING continued

Level Trigger (OFF)		
Trigger	Off	
Start Slope	Rising	
Start Level	50 dB	
Start Duration	2 s	
Stop Level	40 dB	
Stop Duration	2 s	
Parameter	LAF (SPL)	
Sound Recording		
Recording Control	Automatic	
Recording Quality	Fair (6.6 kHz)	
Recorded Signal	Input Z-weighted	
Automatic Gain Control	On	
Duration Limits	Off	

2.0 SHORT TERM MONITORING CONFIGURATION

The following components are for short term monitoring:

- 2250 SLM;
- Microphone and Preamp assembly;
- Windscreen;
- External Compact Flash Memory Card (CF/SD-Card);
- Tripod; and
- Tripod mounting bracket.



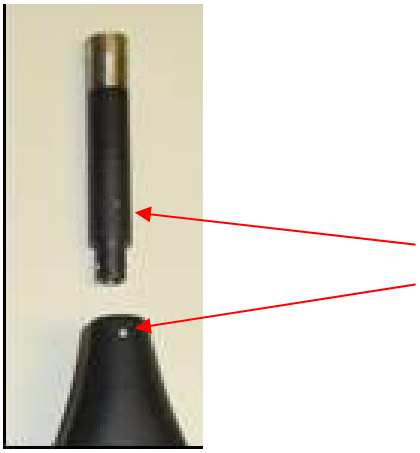
Since short term measurements rarely require an external power source. The B&K 2250 internal battery is typically used as the power source which can supply the meter for approximately 7 hours of operating time. The battery icon will display the estimate battery life remain in the internal battery. The photo on the left shows the hand-held configuration assembly.

2.1 B&K 2250 Hand-held Configuration

1. Connect the microphone to the pre-amplifier.

Option:
3 m extension cable can be inserted here for extension purposes.
(*e.g.*, ventilation fans on building wall)

2. Insert the microphone and pre-amplifier component into the B&K Analyzer making sure to line up the dot on the preamplifier with the dot on the B&K Analyzer.



3. Connect the windscreen to the microphone-preamplifier.

4. Mount the SLM on the tripod with the tripod adaptor.

2.2 Frequency Analyzer Template

Select the "Main Menu" and select the "Template Explorer" option as shown in Section 1.4.2 above. All the templates available will be shown on the screen. Choose the Project template named "MEADOWBANK SHORT-TERM FREQ ANALYZER", and then select "Open". This template is setup so that the B&K 2250 Analyzer records the frequency content in 1/3-octave measurements and broadband sound level measurements simultaneously. The measurement settings selected in this template are shown in the following table:

MEADOWBANK SHORT-TERM FREQUENCY ANALYZER SETTING

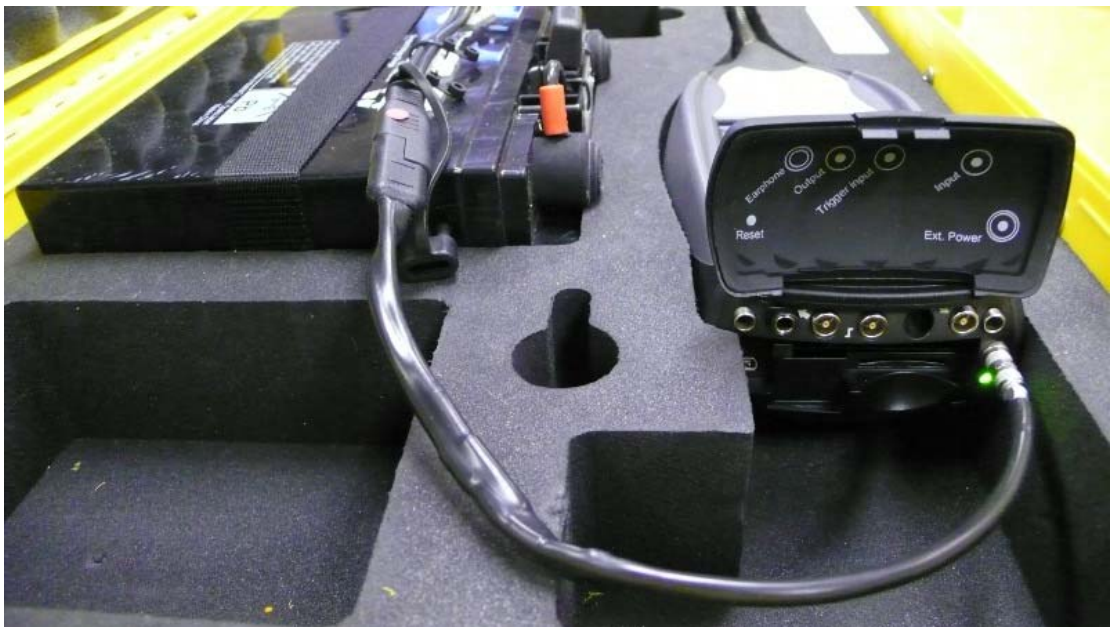
Input		
Input	Top Socket	
Trans. Used	4189 (#######) Check serial # on mic	mic with preamp
Sound Field Correction	Free field	
Windscreen Auto Detect	On	
Extended Low Frequency	Off	
Trigger Input	None	
Frequency Weightings		
Broadband (excl.Peak)	AZ	Z is linear
Broadband Peak	Z	
Spectrum	Z	
Bandwidth (1/3 Octave)		
Statistics		
Broadband Statistics based on	LAF	
Spectral Statistics based on	LXF	
Percentile 1	1 %	
Percentile 2	5 %	
Percentile 3	10 %	
Percentile 4	50 %	
Percentile 5	90 %	
Percentile 6	95 %	
Percentile 7	99 %	
Measurement Control		
Measurement Mode	Manual	
Sound Recording (Off)		

3.0 POWER SUPPLY

3.1 Panasonic 12 Volt External Battery Charging

A long term measurement duration can be anywhere between 7 to 36 hours. When an external batter supply is used, the 2250 m draws first from it until it is depleted. When the fully charged external battery is depleted (roughly 3 days) then the meter begins to draw from the internal power supply (roughly 7 hours). To recharge the 12 Volt Panasonic batteries used for long term measurements do the following:

- Connect the battery power supply cord to the battery charge cord;



- NOTE: The battery charger input rating is 120V, connecting it directly to a 220-230V AC supply will DESTROY IT!

- Connect the battery charger to the power outlet and observe the colour of the battery chargers LED.

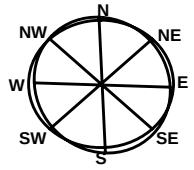
    - GREEN - battery is being charged, NOT READY
    - YELLOW - battery is being charged, READY FOR USE
    - RED - battery malfunction or bad connection

3.2 2250 SLM Internal Battery Charging

Connect AC/DC power supply adaptor to 2250 SLM power inlet as shown in the photo below. The 2250 internal battery will take up to 10 hours to charge. The battery will typically last 7 to 8 hours in warm temperature.

4.0 FIELD MEASUREMENT RECORDS

Important information such as field observation, measurement location, weather, acoustic environment must be recorded prior to any measurement period. The following field record sheets shows example for the record entries in Long Term and Short Term Measurements:

MONITORING STARTS		
Operator:		
Location:		
Noise Meter Start Time:		
Date:		
Calibration complete ?:		
Sensitivity		
Derviation		
Time of Calibration:		
Battery Power Check:	Good	Poor
Photographs of Setup (Y/N)		
Photographs of Surrounding (Y/N)		
Check available disk memory (Y/N)		
Cloud cover:	cloudy	partly cloudy
Height of cloud (feet):	0-10,000	10,000-25,000
Air Temperature (C):		
Wind Speed (km/hr):		
Wind Direction: North wind (wind blows from North)		
Barometric Pressure (kPa):		
Relative Humidity (%)		
Precipitation:	none	drizzle
GENERAL SITE DESCRIPTION		
GPS Location	Latitude	Longitude
Type of Ground Surface:		
Acoustic Environment:		
Traffic		
Human activities		
Animal		
Other noise sources		
MONITORING ENDS		
Operator:		
Record Data File Name:		
Total Monitoring Period		
Noise Meter End Time:		
Date:		
Calibration complete ?:		
Sensitivity		
Derviation		
Time of Calibration:		

5.0 CALIBRATION

5.1 Calibrator

The 2250 SLM requires regular calibration to confirm the meter meets the precision requirement. It is mandatory to perform a calibration before and after each measurement program. Calibration is carried out via the B&K 4231 Calibrator shown in following photos.

Without case

With case

5.2 Calibration Procedure

The following steps are to be taken for proper calibration:

1. Choose the Main Menu to access the “Calibration” option as shown below.

2. Insert the B&K 4231 Calibrator on to the microphone; pushing it until it becomes flush (bottoms out). Press the start button. The way in which the calibrator is installed for the hand-held and outdoor kit configuration is shown below. There are two ways of checking that the calibrator is working. The first is by simply turning it on prior to inserting it onto the microphone and listening. Alternatively, confirming that the LED light on the calibrator is lit.

Outdoor Calibration Configuration

Hand-held Calibration Configuration

3. On the display screen the "Start Calibration" should appear. Select this and let the calibration begin.

4. It is important to conduct the calibration in a quiet environment (*e.g.*, no car engine idling or conversation). High ambient noise will disrupt calibration.

5. Observe the dB level in the 2250 SLM display measuring the calibration signal. This level should be at or very close to 94 dB.

6. Just before the end of the calibration, the meter will display "New Sensitivity" information. This information should be documented on the "Noise Field Sheet" for later use (see Noise Field Sheet form in Section 4 above). Note that the value "Deviation from last" should be no more than ±0.1 dB. Repeat the calibration if the deviation exceeds the ±0.1 dB limit.

7. Select yes to "Accept calibration?" and then "Exit Calibration".

5.3 High Deviation Level

The following may be reasons for the deviation value being consistently outside the acceptable limit of ±0.1 dB during calibration:

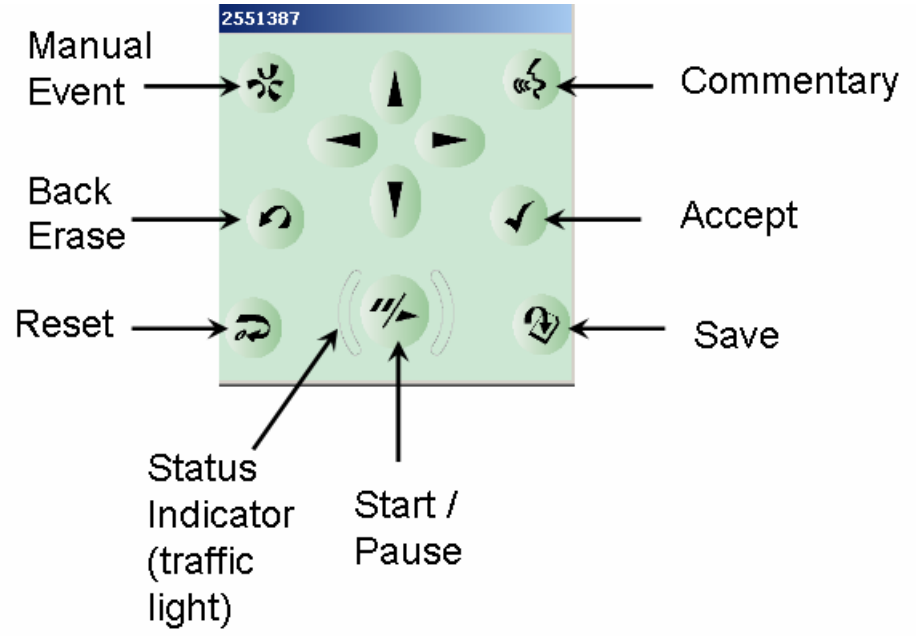
- High humidity levels;
- High ambient noise level surrounding the calibration environment; and/or
- Poor connection between the preamplifier and the B&K outdoor kit body. The preamplifier should be firmly screwed into B&K outdoor kit body; however, not so tight as to damage the fine threads of the preamplifier, or not to be able to unscrew the amplifier after use.

6.0 START NOISE MONITORING

After completing the setup and calibration, the following steps are to be carried out to begin noise measurements during long-term monitoring:

1. Press the “Reset Measurement” button.

2. Press the “Start” button.



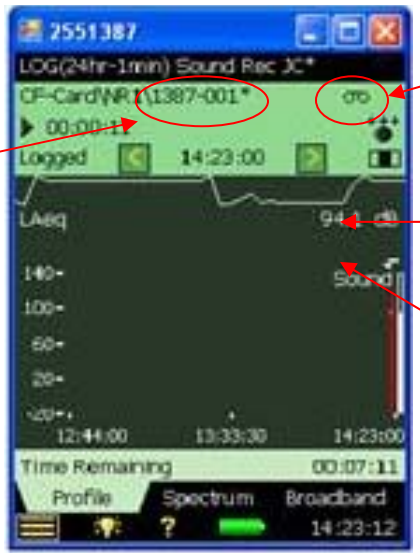
Because the measurement control setup is manual during short-term monitoring, you will have to repeat the following steps for each measurement:

- Reset
- Start
- Stop/Pause
- Save

The following information should be recorded on the Noise Field Sheet shown in Section 4:

- Save file number
- Location of measurement
- Overall level

Upon starting a measurement, one will see a time history forming which fluctuates with time as shown in the below figure.



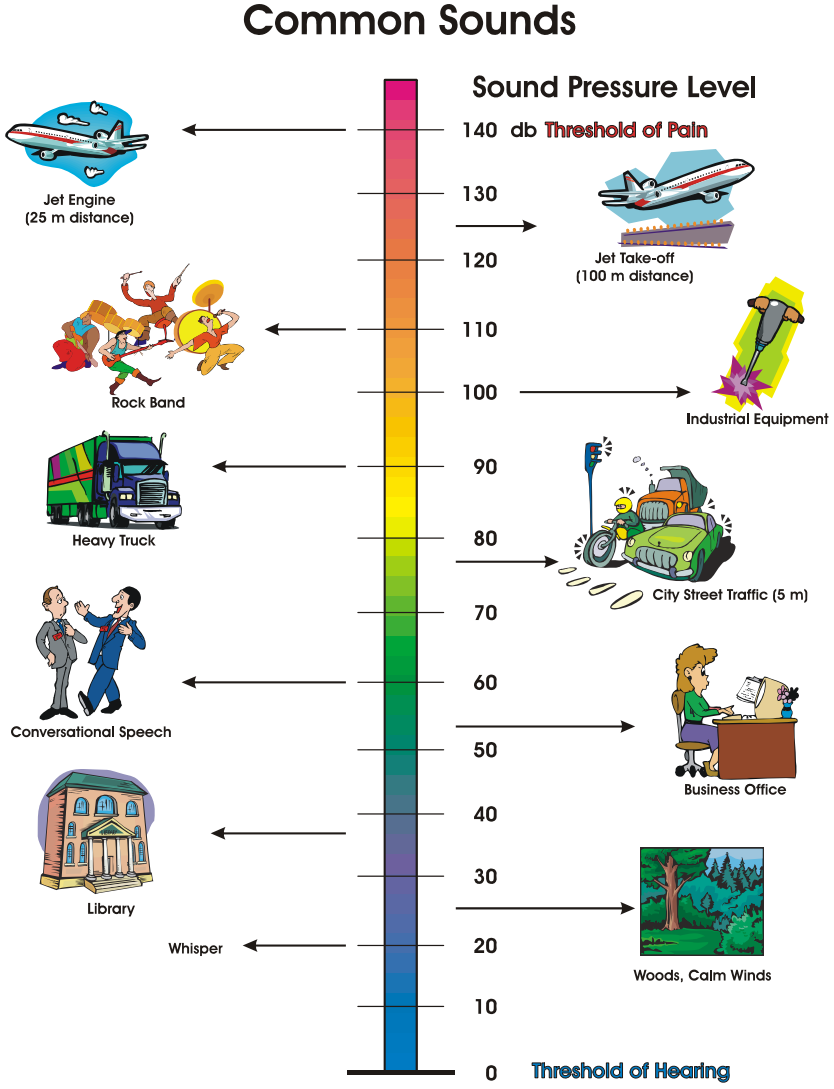
Sound recording

File name for data storage, asterisk * indicates file has not been saved

"Real Time" Time History Plot

Instantaneous Noise Level

It is recommended to remain silent for a minute after starting a measurement so as to let the meter "settle-down" and to determine whether the noise levels being recorded are representative for the study area. The following figure lists some typical noise level ranges for different environments. It should be used as a rough guide when on site taking noise measurements.


Common Sounds
Sound Pressure Level
140 db Threshold of Pain
130
120
110
100
90
80
70
60
50
40
30
20
10
0 Threshold of Hearing
Jet Engine
(25 m distance)
Jet Take-off
(100 m distance)
Rock Band
Industrial Equipment
Heavy Truck
City Street Traffic (5 m)
Conversational Speech
Business Office
Library
Whisper
Woods, Calm Winds

7.0 POST MEASUREMENT PROCEDURES

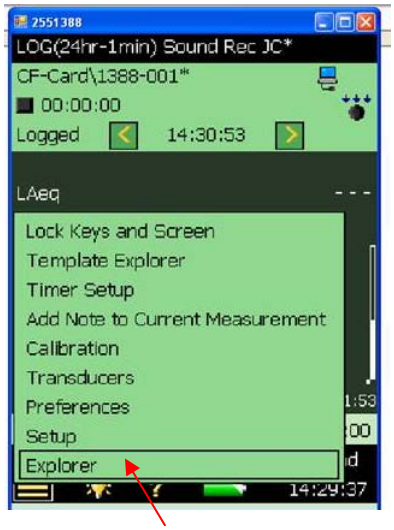
After completing a long-term noise measurement (*i.e.*, after 24 hours has passed), it is time to retrieve the equipment from the field to set it up at some other desired location.

7.1 Data Check

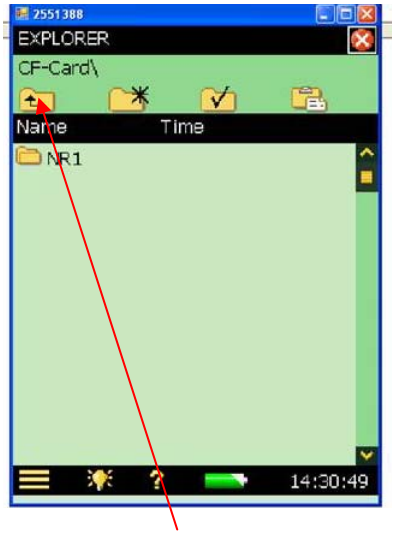
Prior to completely dismantling the equipment, the quantity of the data that has been recorded should be verified.

A series of checks can be performed to confirm that the noise data has been collected. Prior to removing the CF/SD card from the B&K 2250 Analyzer, the amount of data recorded on the CF/SD card should be checked on the 2250 Explorer display. As a general rule of thumb, a 24 hour noise measurement should represent approximately 2.4-2.7 Gigabytes of data (or thereabouts). This leaves about 1.6 Gigabytes of storage space remaining on the card.

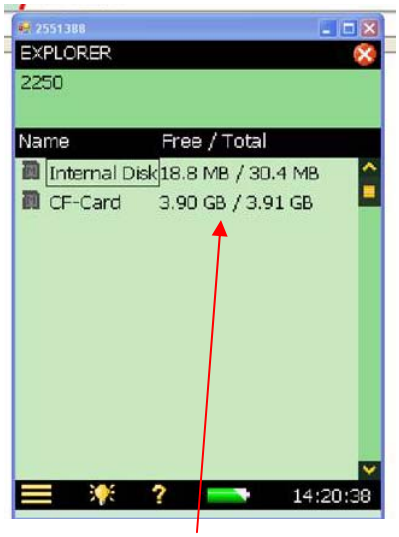
Select the Main Menu to access Explorer. Select the up one folder icon (folder with up arrow on it) to view both the "Internal Disk" and the "CF/SD card" as shown below.



Choose Explorer



Choose Up one level



View "Free/Total" of each storage device

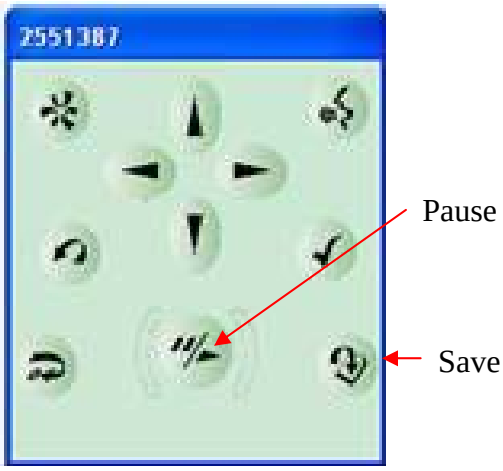
In the example above, it can be seen that there is 3.90 Gigabytes of free data storage space available on the CF/SD card. Note Explorer displays "Free" space on the storage medium and not used space. This means that 0.01 Gigabytes has been used; not enough for a 24 hour monitoring period. Again, approximately 1.6 Gigabytes of free data storage space should be available following a 24-hour monitoring period.

7.2 Save

The recorded data will be saved automatically into the specified file upon completion of the specified measurement period (24 hours). However, if the measurement period is terminated before the specified period, the data must be saved manually.

Only save the file if the specified measurement period has not been exceeded.

In such case, the SLM is still recording upon arrival. The data record file display on the top will show an asterisk '*' at the end of the filename (*e.g.*, CF-card\Project001*****). Press the Pause button and then the Save button.



7.3 Calibration

Before powering down the B&K 2250 Analyzer, the sound level meter needs to be recalibrated. Following procedure outlined in Section 5 for post measurement calibration.

8.0 DATA DOWNLOAD

The data download requires the following steps:

1. Connect CF/SD card to the card reader;

2. Activate the B&K BZ5503 software to copy data files from CF/SD card into archive files on a computer;

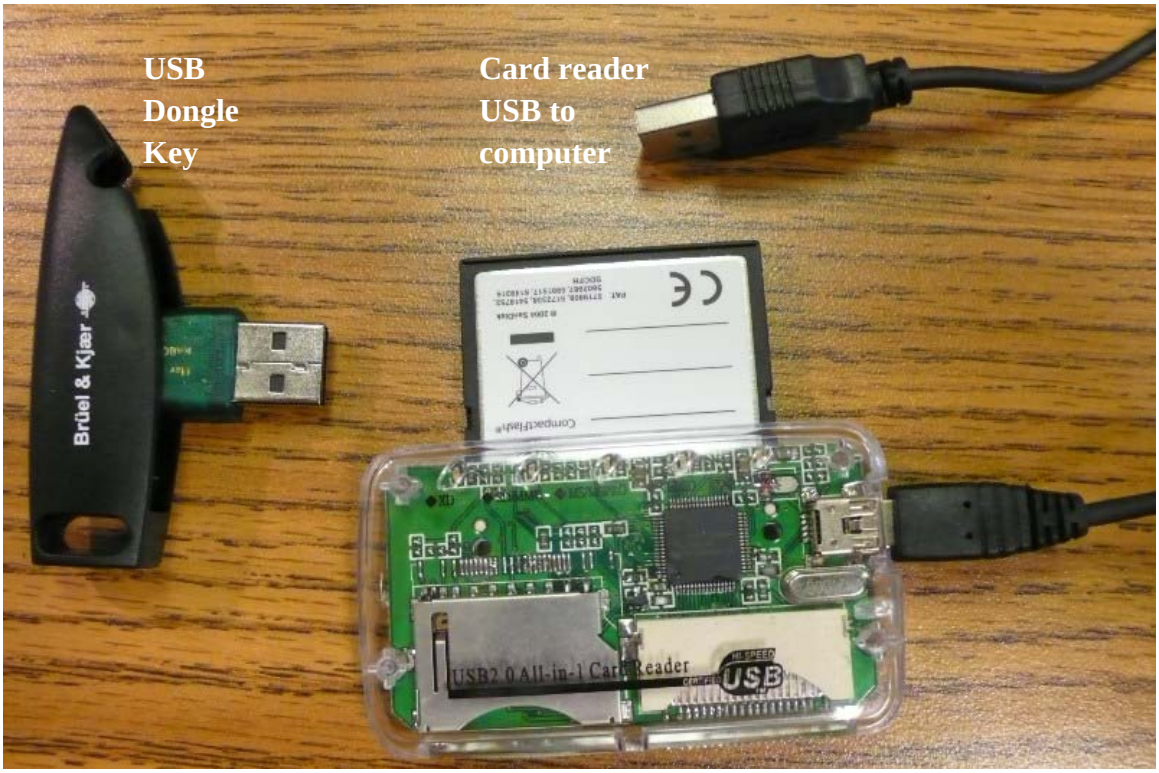
3. Export the archive file to a format for the Evaluator 7820-7821 Software; and

4. View recorded data in Evaluator 7820-7821 Software.

The following equipment is required to complete the data download:

- Computer with USB port;
- CF/SD card reader; and
- B&K USB dongle key for the use of the B&K Evaluator software.

Refer to the document “BZ – 5503 Data Download Procedure” provided with the noise monitoring equipment for further details.



8.1 CF/SD Card Reader and USB Dongle Key

After connecting the dongle key to the computer, start/run the B&K BZ 5503 software and connect the card reader using the computer USB connection as shown in the figures below:

Insert B&K Dongle

Remove CF/SD card from 2250 Analyzer and insert into card reader

Connect USB connection to USB port

8.2 Data Archive

The data from each 24-monitoring location should be archived and the entire archive directory should be burnt to a DVD. A typical 24 hour monitoring program will occupy one 4GB DVD.

9.0 EQUIPMENT TROUBLESHOOTING CASE STUDY

The following are examples of potential equipment malfunctions and possible reasons for those malfunctions.

9.1 Failed Power Connection

The following reasons can result in external power supply failure:

- Loose power supply connecting cable;
- Uncharged battery; and
- Bad fuse.

9.2 Invalid Data Collection

Invalid data collection is typically found when analyzing the time history of the sound file. The data ends up having either higher or lower sound levels (dBA) than would be representative of the area. Regular field visits during the monitoring period to check on the measurement levels will reduce the potential for invalid data being recorded. The following are common causes of invalid data:

- Power failure;
- Poor weather – heavy rainfall, high wind gust;
- Tampering with sound level meters;
- No calibration check; and
- Incorrect setup.

9.2.1 Poor Weather: Wind Speed and Precipitation

Poor weather conditions are probably the biggest reason for invalid data. Poor weather conditions include rain and high winds. Long-term noise measurements are rarely if ever done during winter months. Ideal noise monitoring conditions require that wind be no more than 20 km/hr (5.6 m/s) and that there be no precipitation during the measurement period. High wind has the effect of masking the true noise at a distance from different sources. Flutter noise is a type of noise due to velocity gusts impacting the microphone. In both cases the data collected during these non ideal conditions must be removed in order to have valid noise data set. The Energy Resources Conservation Board (ERCB) has established guidelines, namely, Directive 0038, for “Favourable summertime weather conditions” as shown in the below table:

Parameter	Preferred Condition
Ground Cover	No snow, water, or ice (frozen) ground cover.
Precipitation	No steady precipitation, monitoring invalid.

Wind Speed	Wind speed limits (noise data may be invalid if limits are exceeded):
	• Less than 500 m from noise source
	  • Upwind: 10 km/hr limit
	  • Crosswind: 15 km/hr limit
	  • Downwind: 15 km/hr limit
	• 500–1000 m from noise source
	  • Upwind: 5 km/hr limit
	  • Crosswind: 10 km/hr limit
	  • Downwind: 10 km/hr limit
	• Greater than 1000 m from noise source
	  • Upwind: less than 5 km/hr limit
	  • Crosswind: 10 km/hr limit
	  • Downwind: 10 km/hr limit
	24-hour noise sampling period: there should be at least 3 hours of wind blowing directly to the noise receptor in the nighttime sampling period (22:00 to 7:00) and 3 hours in the daytime sampling period (7:00 to 22:00).

When doing a long-term noise measurement, it is not always possible to determine whether rain has occurred over the entire 24 hours of the study. The possibility of rain should be investigated prior to the noise field trip. The following website is useful for determining weather conditions across Canada: www.theweathernetwork.com or http://www.weatheroffice.gc.ca/canada_e.html.

In addition, a couple of indicators may help determine whether rain has occurred including:

- Visible signs of water on the protective sound level meter case and the surrounding ground.

- Cross referencing the B&K Evaluator sound file with the weather data obtained from the site weather station. If rain can be heard upon listening to the sound file, and the humidity is close to 100 %, then there is good reason to believe that rain occurred during that time period.

9.2.2 B&K 2250 Analyzer Calibration Fault

Calibrating the sound level meter before and after each measurement is a necessary part of the noise monitoring process. Not carrying out this necessary step can result in invalid data. Calibrating the noise level meter essentially tests the B&K 2250 Analyzer's ability to sense correct noise levels. The B&K 4231 calibrator itself must have new or fully charged batteries so that it too outputs the correct test signal (94 dBA at 1000 Hz). As an example during one noise field study, the microphone on the B&K 2250 Analyzer was found to become wet from the rain. Upon performing a post measurement calibration, the B&K 2250 Analyzer was found to be observing larger than normal values. Typically, the B&K 2250 Analyzer outputs a reading in the range between 49-52 mV/Pa (millivolts per Pascal). With the moisture in the microphone, the values were found to be much higher than this. After the water evaporated, the calibration was again found to be in normal range.

10.0 EQUIPMENT MAINTENANCE

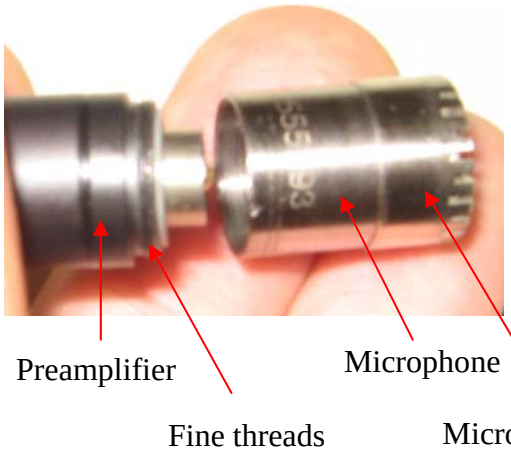
10.1 Microphone Maintenance

The following maintenance procedures are recommended keeping order to maintain the microphone in good working order:

- When not in use, keep the microphone in an environmentally controlled area with moderate to low humidity levels, as humidity will alter the sensitivity of the microphone. Condensation of water vapour within the microphone can cause significant negative effects, the worse of which is electrical continuity between the diaphragm and the back plate. Thus, it is necessary to prevent the microphone from coming into contact with any liquid whatsoever. Keep the microphone and preamplifier assembly in the designated case when not in use for long periods of time as shown in the figure below:

- When connecting the microphone to the preamplifier or the outdoor kit body, thread the microphone VERY CAREFULLY to avoid damaging the threads. Do not remove the microphone shield as the microphone drum can fall out and become damaged or lost (see photos below).

- The Microphone and SLM should be calibrated every two years.



10.2 B&K 2250 Analyzer Maintenance

The following maintenance procedures are recommended to keep the B&K 2250 Analyzer in good working order:

- Keep the Analyzer in the protective case when not in use.
- Be careful not to drop the meter as the touch display screen can be damaged.
- Avoid using solvents when cleaning the touch display screen. Instead use a damp cloth as recommended by B&K.
- To remove the microphone extension cable, make sure to pull back the spring loaded sleeve gently before pulling the connection from the meter. If difficultly arises in removing the connection, put a cloth over the sleeve and use pliers to gently grip the cloth while pulling back to release the connection.
- The B&K 2250 Analyzer should be sent to the B&K North America service department every two years for maintenance. This facility is located at:

  Bruel & Kjaer North America
  2815-A colonnades Court
  Norcross, GA 30071-1588
  Phone: 800-332-2040
  Fax: 770-447-4033
  www.bkhome.com

10.3 B&K 4231 Calibrator Maintenance

The following maintenance procedures are recommended to keep the B&K 4231 Calibrator in good working order:

- Keep the calibrator in its case at all times. There is no need for the leather case to be removed except for when the batteries need to be changed.

- The B&K 4231 Calibrator should be sent to the B&K North America service department every year for maintenance. This facility is located at the same address as that given above.

10.4 Outdoor Microphone Assembly Maintenance

- Keep the windscreen on the outdoor microphone body, as this protects the microphone.

- Clean the windscreen from any debris that may accumulate on it after field work, as any build up of debris will serve to impede sound from being transmitted to the microphone.

HSL/JC/TD/DRW/rs
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AGNICO EAGLE

MEADOWBANK GOLD MINE

FINAL - Vault Lake Fishout Work Plan

APRIL 2013

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DOCUMENT CONTROL

Version	Date	Section	Page	Revision
V1	May 2008	All	All	Azimuth. 2008. Fishout Program for the northwest arm of Second Portage Lake
V2	June 2010	All	All	AEM. 2010. Meadowbank Gold Project Fishout Program.
V3	January 2013	All	All	AEM. 2013.DRAFT Vault Lake Fishout Work Plan

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Reviewed by:

North/South Consultants Inc. &

Department of Fisheries and Oceans

ACRONYMS

AEM	Agnico-Eagle Mines Limited
CCME	Canadian Council of Ministers of the Environment
CEPA	*Canadian Environmental Protection Act*
CPUE	Catch per Unit Effort
CREMP	Core Receiving Environmental Monitoring Program
DFO	Department of Fisheries and Oceans
EC	Environment Canada
HADD	Habitat Alteration Disruption and Destruction
HEP	Habitat Evaluation Procedure
NNL	No Net Loss
NT/NWT	Northwest Territories
NWB	Nunavut Water Board

SECTION 1 • INTRODUCTION

1.1 Background

Since 2009, Agnico-Eagle Mines (AEM) has operated the Meadowbank Gold Mine, which is located 75 km north of the Hamlet of Baker Lake, Nunavut. The mine site is connected to the hamlet by a 110 km all-weather road, and an airstrip onsite allows direct access for personnel and freight. The Meadowbank mine consists of several gold-bearing deposits that are currently planned to be extracted using three open pits (Goose Pit, Portage Pit, Vault Pit), two of which are currently operational (Portage Pit and Goose Pit). Much of the pit development is located in close proximity to the mill, office and lodging infrastructure, with the exception of the Vault Pit which is approximately 10 km northeast of the main minesite (Figure 1-1).

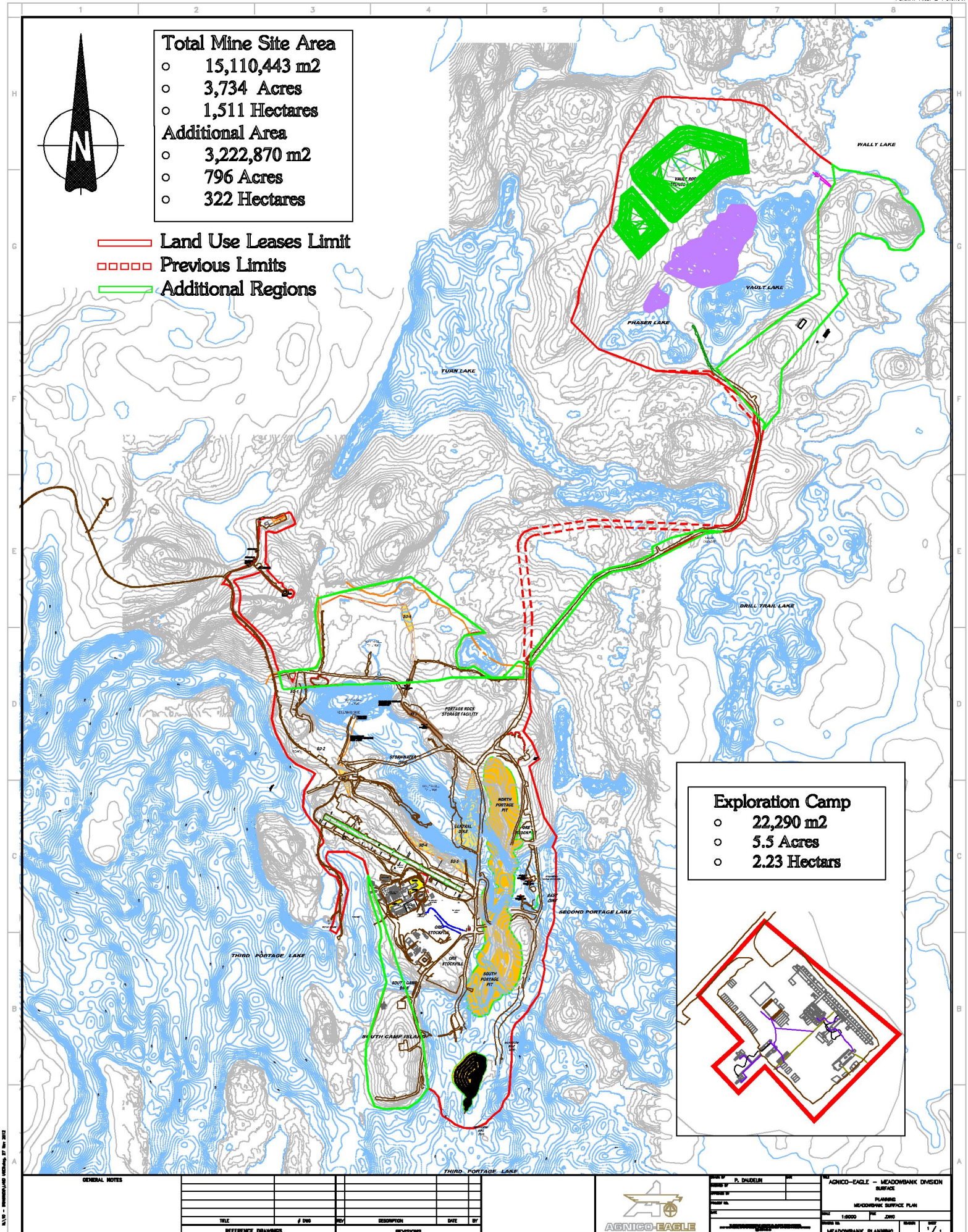
Under the current design plans and DFO authorizations, a portion of each of the pits occurs in lacustrine environment. As a result, construction has commenced on a series of dikes to separate the pit areas from the remainder of the adjacent lakes. Under DFO authorizations, four lakes (Second Portage Lake, Third Portage Lake, Vault Lake and Phaser Lake) are to undergo partial or complete dewatering following dike construction, to provide access to the pit areas. To date, dewatering has been completed in the northwest arm of Second Portage Lake, and the Bay-Goose Basin of Third Portage Lake. Following the submission of a revised Meadowbank No Net Loss Plan on October 15, 2012, AEM recently received the *DFO authorization NU-03-019.4*, dated April 2, 2013, for Vault Lake which permitted harmful alteration, disruption or destruction of fish habitat under Section 32 (2)(c) and 35(2)(b) and the isolation, dewatering and operations in Vault Lake which will begin in 2013. Phaser Lake is planned to be isolated and be dewatered without dike construction in the future.

As discussed during the EIS, approved in the NIRB project certificate and in follow-up consultations with stakeholders, three fishout programs were planned for the Meadowbank mine. The first fish-out program took place during the summer of 2008 in the northwest arm of Second Portage Lake (Azimuth, 2009); the second took place during the summer of 2010 in the Bay-Goose basin in the eastern portion of the Third Portage Lake (North-South, 2011); and the third is planned for the summer of 2013 in Vault Lake to allow for mining activities to occur in the western portion of the lake.

The fish-out programs conducted for the Meadowbank mine have been guided by the Tyson et al. (2011) *General fish-out protocol for lakes and impoundments in the Northwest Territories and Nunavut.* The fish-out programs have also incorporated inputs from the local community including: public presentations in Baker Lake on April 16, 2008, consultation during the preparation of the 2012 NNL Plan, and reviews of the 2008 and 2010 fishout programs. The fishout programs have incorporated experience from the preceding fishout programs that included fish collection methods and data analysis provided by DFO representatives. Furthermore, a meeting with the Baker Lake

Hunters and Trappers Organization (HTO) will be held prior to the fishout commencing to discuss the final fishout workplan.

The following document outlines the objectives, timeline, methods and procedures that are proposed for the 2013 Vault Lake fishout at the Meadowbank mine.



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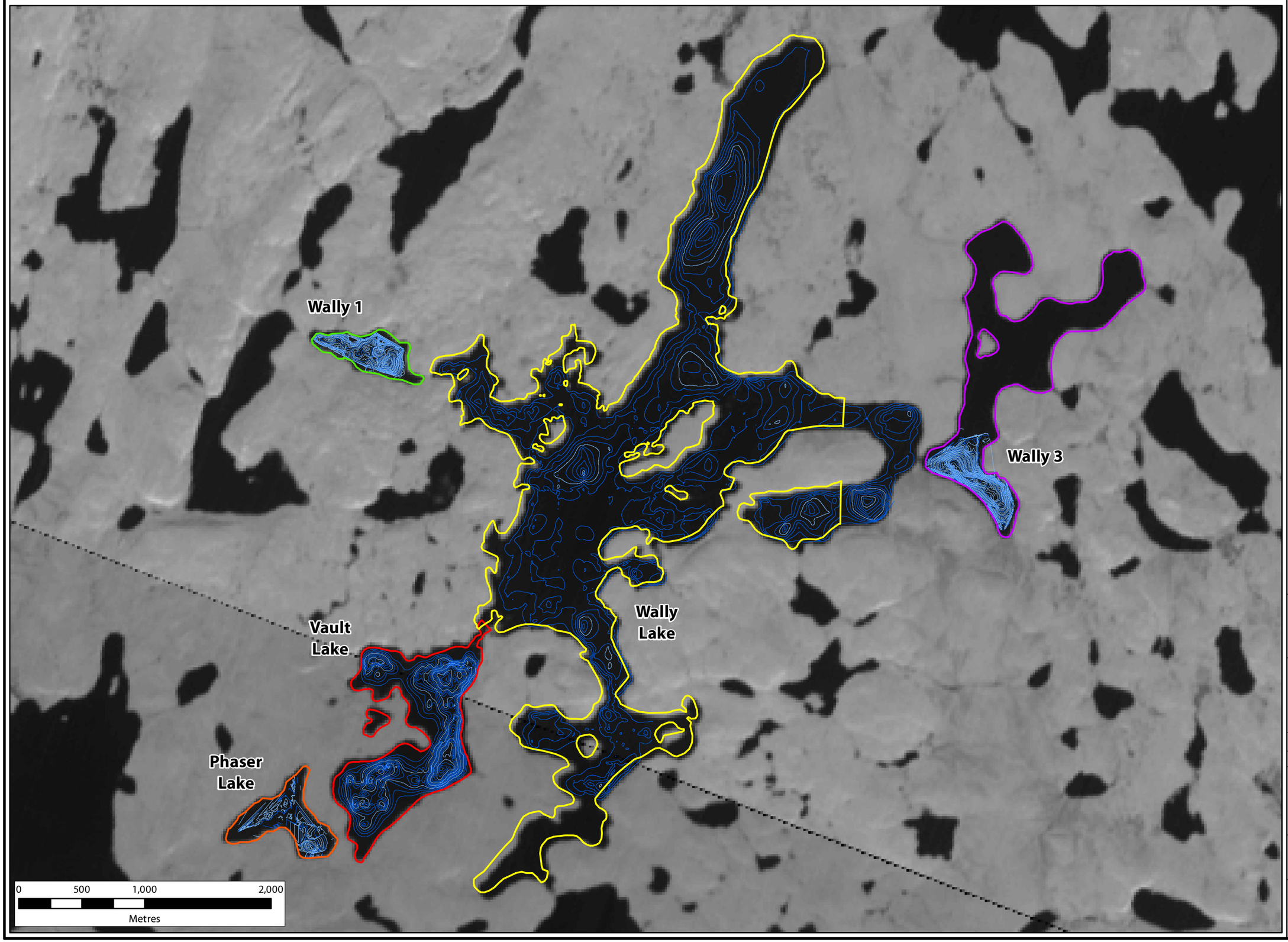

Legend

- Wally Lake
- Wally 1
- Wally 3
- Phaser Lake
- Vault Lake

Contour

- Major
- Minor

Lake Depth

Wally Lake
Maximum: 118masl
Minimum: 138masl

Wally 1
Maximum: 122masl
Minimum: 135.5masl

Wally 3
Maximum: 121masl
Minimum: 139masl

Phaser Lake
Maximum: 136masl
Minimum: 143masl

Vault Lake
Maximum: 9.5m depth
Minimum: 0m

Meadowbank, Nunavut
Bathymetry

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PROJECT: DA11-062-01

CLIENT: Agnico-Eagle Meadowbank Division

N W E S
UTM Zone 14 NAD83

DATE: JANUARY 2012

SCALE: 1:28,000

DRAWN BY: LW

CHECKED BY:

FIGURE:

1

The information displayed on this map has been compiled from various sources. While every effort has been made to accurately depict the information, this map should not be relied on as being a precise indicator of locations, features, or roads, nor as a guide to navigation. MNR data provided by Queen's Printer of Ontario. Use of the data in any derivative product does not constitute an endorsement by the MNR or the Ontario Government of such products.

1.2 Objectives and Scope

According to Tyson et al. (2011), the guiding principle of the Vault Lake fish-out program is to ensure that both ecological data and fish specimens are collected in a manner that does not cause "fish wasting". In consideration of these principles and in consultation with the DFO, the objective of the fishout will be to rescue as many fish in Vault Lake, recover and distributing fish to local communities and properly collect and record data that will meet the general requirements of Tyson et al. (2011). The fish-out program will have 3 core components: fish recovery and rescue from Vault lake (which will involve a fish transfer, primarily to Wally Lake), CPUE phase, final removal phase, collection of biological data, and distribution of fish to local communities.

1.3 Timeline

The schedule for implementing key elements of the fishout program in Vault Lake will follow a similar timeline as was completed and approved by DFO for the fishout of Bay-Goose Basin in 2010 (North South, 2011). The proposed schedule of the fishout program in Vault Lake is shown in Table 1-1. Vault dike construction has been completed. As a result, Vault Lake is isolated and water levels will need to be managed accordingly. As outlined in Table 1-1, dewatering will begin prior to freshet and is proposed to be completed in conjunction with the final phase of the fishout program to manage water levels near operations (See Figure 1-3). Commencement of the fishout program will be dependent on ice thaw which is anticipated for mid- July 2013. The Vault Lake CPUE and fish rescue phase will continue in July and August; the final removal phase will aim to begin at the end of August alongside partial - dewatering with a targeted completion date of the fishout by mid-September.

Table 1-1 Proposed Timeline for 2013 Vault Lake Fishout

Proposed Time	Activity	Description
February to April 2013	Vault Dike Construction	Dike construction occurring in shallow, less than 2m water depth. The entire area is frozen to depth. This will isolate Vault Lake from Wally Lake.
May - June 2013	Partial dewatering	Water volume control of freshet inflow and rain event volume control into Vault Lake.
Mid-July 2013	Fishout	Fishout begins with the CPUE and rescue phase- fish community data collection, transfer of fish to Wally Lake and distribution of fish to Baker Lake.
End of August 2013	Fishout	Complete CPUE and rescue phase and transition to final removal phase
End of August 2013	Partial dewatering	Dewatering resumes to create 4 small basins (A, BC and D - See Figure 1-2)
September 2013	Fishout	Final removal phase and fish rescue.
Mid- September 2013	Fishout	Complete fishout
October 2013	Partial Dewatering	Dewatering continues; not completely dewatered until DFO Section 32 is authorized

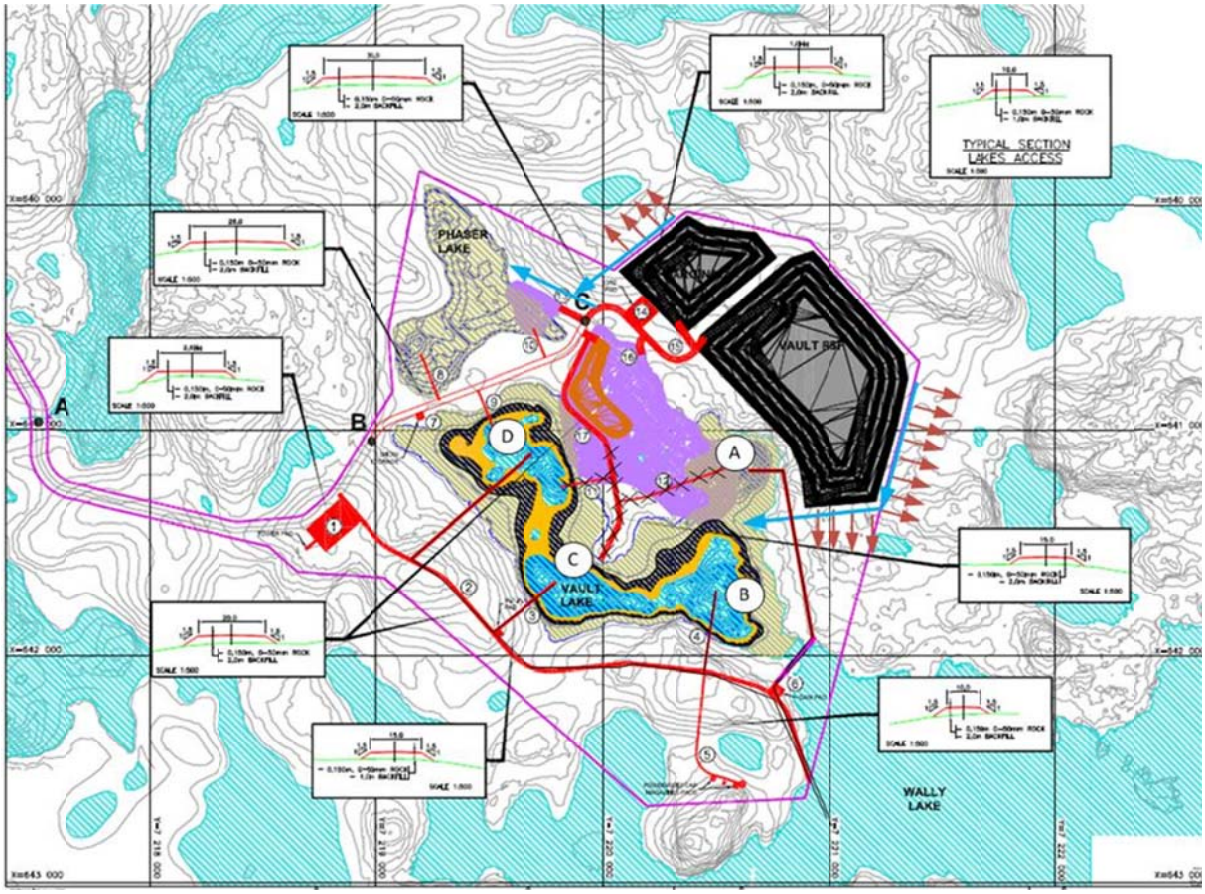

Figure 1-3 Dewatering sequencing and Vault Pit operations in Vault Lake Area

SECTION 2 • COMMUNITY CONSULTATION AND FISH DISTRIBUTION

Prior to the fishout of the northwest arm of Second Portage Lake, on April 16, 2008, a presentation was given to the community of Baker Lake by AEM and Azimuth Consulting Group Inc. (Azimuth) representatives. This presentation welcomed all community members and familiarized the community with the three proposed fishout programs, with a focus on the largest fishout of Second Portage Lake. It described in detail the meristics data that would be collected and a proposed method of fish distribution to the community. General questions regarding the program were raised by the community. In addition, one person expressed concerns regarding consuming fin-clipped fish. Informal discussions with other attendees suggested that this was not a general concern, so the program was not modified. No other concerns were raised.

Distribution of fish from the northwest arm of Second Portage Lake to the community of Baker Lake took place from mid-August to mid-October 2008. Meristics data from all fish were collected and categorized to size and species, and grouped into two categories: “people food” or “dog food”.

People Food: All lake trout and Arctic char greater than about 300 mm were processed on site (i.e., gutted and gilled) and shipped either fresh or frozen to Baker Lake. A small number of round whitefish, in excess of 250 mm, were shipped to town because some elders indicated they liked to eat whitefish. All fish destined for human consumption were placed within individual bags, heat sealed and identified whether fish were sacrificed (by pithing) or died in the nets. Some people preferred to eat fish that were sacrificed and not those that died in nets. Labelling individual bags allowed locals to choose what they preferred.

Dog Food: All small fish of all species and all burbot were frozen in small groups, bagged and frozen for use as dog food. Fish smaller than 100 mm were not processed; they were frozen whole for use as dog food.

The fish were transported in boxes to Baker Lake and placed inside of the community freezer and were made accessible to community members. Initially, during the first 2 – 3 weeks of fishing, fish were delivered fresh or frozen daily or every second day. As numbers of fish declined during the course of the fishing effort, shipments to town were reduced to every few days. Residents came down to the freezer and selected fish as desired. On occasion, boxes of ‘people food’ fish were taken to the local hospice and community center for special events which were coordinated by AEM’s community liaison officer. Overall, the fish distribution in 2008 from Second Portage Lake was successful. AEM received good feedback from the community on the program and all of the fish at the end of the season had been consumed by residents.

In consultation with the DFO and the HTO, in 2010, AEM transferred many of the fish from the Bay-Goose basin directly into Third Portage Lake. The fish that were used for data collection were distributed to the community of Baker Lake in a similar manner as previously described for the 2008

fishout. The results of the 2010 fishout (North-South, 2011) were shared with the HTO during a Meadowbank mine site visit on June 13, 2011, following the completion of the 2010 annual report.

Similarly, in the 2013 Vault Lake Fishout, AEM proposes to transfer as many fish as possible to the nearby waterbody and collect detailed meristics data on any incidental fish mortalities. On July 13, 2011 and on February 23, 2012 the HTO were consulted on Meadowbank no net loss planning and the fishout program of Vault Lake during a Meadowbank mine site visit. During discussion with the HTO, representatives did not have a problem with the previous fishouts and expressed an interest that the fish be packaged and distributed to the community as per 2008 and 2010 fishout programs; they understood that community members would be hired by AEM or their consultant to assist in the fishout and that fewer fish will likely be delivered to the community because the fishout will focus on a fish transfer. Prior to the 2013 Vault Fishout commencing, AEM will host a meeting with the HTO to review the work plan and approach and answer any questions or concerns at that time.

SECTION 3 • REGULATORY SETTING AND PERMITTING

AEM recently completed and submitted to DFO a revised No Net Loss Plan (October 15, 2012) that calculated the loss of fish habitat and compensation for the Vault Lake Area (AEM, 2012). AEM received a DFO authorization (NU-03-0191.4) on April 2, 2013 prior to the fishout commencing and dewatering that authorized the loss of fish habitat (HADDs) as a result of the Vault Pit undertakings and temporary loss of habitat due to dewatering.

Furthermore, in preparation for the Vault Lake fishout, AEM will work with the DFO to ensure the fishout work plan and proposed fishout methods meet the objectives and goals of the DFO guidance *General fish-out protocol for lakes and impoundments in the Northwest Territories and Nunavut* (Tyson et al, 2011) while meeting mine operations timelines for dewatering. On February 19th, AEM met with DFO representatives in Ottawa to review and discuss the approach described herein, prior to finalizing the Vault Lake fishout workplan. AEM will ensure the contracted fisheries consultant (North-South consultants) apply for a license from DFO to Fish for Scientific Purposes and apply for a letter of approval of the Animal Use Protocol. All staff handling fish will be trained in proper fish handling as directed by the animal care department.

SECTION 4 • PROJECT MANAGEMENT AND FISHOUT PERSONNEL

For the fish-out program, a project team will be created to develop and implement the work plan. The project team will include a DFO habitat biologist, a project manager, a project field biologist, field technicians and field assistants. Field assistants will be staffed primarily from local communities (i.e., Baker Lake). The DFO habitat biologist (Elizabeth Patreau) will be the principal contact for AEM during development of the work plan and providing advice to AEM as required throughout the fishout. The project manager (Ryan VanEngen) will represent AEM and will be responsible for managing the fishout program including developing the work plan, communicating with DFO and providing deliverables to the regulatory agencies. AEM has recently hired North-South Consultants that will be using experienced personnel, many of which have worked in the Arctic and/or participated in the fish-out of Second Portage Lake in 2008 and Bay-Goose Basin in 2010, on behalf of AEM. The project biologist from North- South Consultants will work together with the project manager and will be a qualified biologist that will be responsible for the technical requirements and implementation of the fish-out program including aiding in the development of the work plan, training field staff, supervising field activities and data collection, QA/QC, data analysis and preparing deliverables. The field technicians will conduct the fish-out and data collection under the supervision and guidance of the project biologist.

SECTION 5 • ISOLATION OF VAULT LAKE, TSS MONITORING AND TSS MITIGATION

5.1 Vault Dike

In 2008, turbidity curtains and a fish-cut-off-net were deployed in the northwest arm of Second Portage Lake, immediately northwest of the impoundment side of the East dike. Installation of the fish cut off net allowed the fishout to start approximately 3 weeks sooner than had the program waited until the construction of the dike walls was complete. In 2010, during the ice-cover period, a causeway was built to provide wind and water current protection during the construction of the Bay-Goose dike (phase 2). The causeway was constructed during the winter and once completed, prevented any fish movement between the Third Portage Lake and the Bay-Goose basin. In 2013, the Vault dike is scheduled to begin construction in the winter and was completed under frozen conditions by April. This has resulted in the complete isolation of Vault Lake from Wally Lake during the open water season. As a result, no fish cut-off- net will be installed and the requirement of an isolated lake prior to the fishout beginning will be met (Tyson et al. 2011).

5.2 TSS Monitoring and Mitigation

Vault dike construction will be occurring under frozen conditions during the months of February and March. The small channel where the dike was constructed between Vault Lake and Wally Lake, is a shallow channel that freezes to the bottom (<2m deep). As a result, no construction monitoring for Total Suspended Solids (TSS) is proposed for the Vault Dike. Monthly monitoring will take place during the Core Receiving Environmental Monitoring Program (CREMP) in April prior to freshet (Azimuth, 2012). Freshet monitoring will take place in June and post freshet monitoring will be undertaken in the open water months in the summer. In accordance with the NWB Type A License 2AM- MEA-0815, the dewatering will follow the *Water Quality Monitoring and Management Plan for Dike Construction and Dewatering* (AEM, 2010).

SECTION 6 • FISH COMMUNITY ASSESSMENT AND FISH RESCUE

In accordance with Tyson et al. (2011) (at that time it was a *Draft* DFO fishout protocol), a mark recapture study was completed in 2008 during the fishout of the northwest arm of Second Portage Lake. The purpose of the study was to estimate the total fish population for the impoundment area. This phase of the fish out program began on August 3, 2008, once the cut-off net was in place and all necessary permits were acquired. Initially, two types of fish capture methods for this phase were used:

- Trap nets - two trap nets were set perpendicular to shore targeting fairly shallow areas where smaller fish would be expected.
- Gill nets – only 38-mm index gill nets were used for this phase. Each boat crew were able to fish with 4 to 8 net panels, set only for a short time (1 to 4 hours).

All nets and traps were moved regularly (every day or two) to cover all available habitats, with an emphasis towards shallow water habitats. Partial fin clips and/or floy tags were used to mark lake trout (the most abundant species) and Arctic char. Biological assessments in this phase were limited to fish mortalities. Species; weight; fork length (total length for burbot) were recorded for every fish. Fish were also palpitated where possible to identify sexually active males or females. Details of each set were recorded using the field forms.

The mark-recapture phase continued to the maximum duration of 14 days. A 10% recapture rate was achieved by the end of this period using a total of 275 sets of 6 x 45.4 m length gill nets. Following the Chapman adjustment to Schnabel's method, the index of abundance was calculated; 1497 lake trout were estimated and 58 Arctic char. These estimates underestimated the true population size; at the end of the fish out a total of 2018 lake trout and 485 arctic char had been captured. The Catch-Per-Unit-Effort (CPUE) study (described in Section 6) proved to be a more accurate predictor of population size; the CPUE estimated a total of 2690-2710 fish (using the DeLury and Leslie regression models) while the true total number of fish captured at the end of the fish out was 3079.

At the end of the 2008 fishout of the northwest arm of Second Portage Lake, AEM made the following observations/conclusions:

- The mark recapture phase of the fish out program took a total of 17 days to complete (14 days of fishing and 3 days of waiting to begin the CPUE phase). Given the short ice-off period at the site, this took valuable time away from the goal of fishing out the impoundment area.
- The results from the mark recapture study were limited in usefulness. The CPUE phase gave a far more accurate estimation of initial abundance.

- The fish out program concluded on October 16, 2008. Due to high winds and icy conditions from mid- September until early October (when ice-over conditions started), weather conditions posed a serious safety risk for the fishout field personnel.

Consequently, in collaboration with DFO, AEM omitted this phase of the fishout program for the Bay Goose basin in 2010 and permitted the fishout crews to concentrate their efforts on the CPUE phase and final removal phase. As the CPUE phase of the program has the same purpose as the mark recapture phase, AEM concluded that the intent of the draft DFO fish out protocol was met.

Similar to the 2010 fishout and in accordance with Tyson et al. (2011), AEM proposes to omit the mark and recapture phase of the 2013 Vault Lake fishout.

6.1 CPUE phase

The objective for the Catch Per Unit Effort (CPUE) phase is to collect fish community CPUE data for the entire fish population in Vault lake. This involves collecting fish using a standard unit of effort for the duration of the phase. The equipment type, fishing methods, unit effort and fishing periods will remain the same as in the 2010 fishout for the duration of the CPUE phase.

The CPUE phase of the fishout program will begin as soon as possible after ice-out (with an anticipated start date of July 15, 2013, see Table 1-1). Fish will be captured using the same gear that was employed in 2008 and 2010. Six panel gill nets of stretched mesh sizes 126, 102, 76, 51, 38, and 25 mm will be used, with an increasing total number of nets/panels deployed as CPUE declines over time. Panels will be 1.8 m deep by 22.7 m. Nets will be moved every day or two to ensure full coverage of Vault Lake; duration of sets may vary as this phase of the program proceeds (i.e., similar to the 2008 and 2010 program, in the later season when catches are low and water is cold, set durations may be longer). Angling may also be used to minimize fish capture times and volunteers from the mine site may participate in the fishout.

As in 2008 and 2010, CPUE data will be analyzed daily using both the Leslie and DeLury methods. As updated and available, data and graphs will be sent to DFO every 2 days by email. Unit of effort for the Vault Fishout will remain comparable to previous fishouts, despite a greater effort to rescue and transfer fish (Tyson et al, 2011). All data from net sets will be recorded on field forms. Similar forms will be used as in the 2010 fishout program (see Appendix A). All captured fish will be identified to species, weighed and measured for fork length (total length in the case of burbot). Fish will also be gently palpitated to identify reproducing males or females prior to their release. A detailed biological assessment will be conducted on all fish that do not survive the transfer (ie. on incidental mortalities). More specifically, a detailed biological assessment will be conducted for a representative number of fish (we will aim to collect 30 from the dominant species lake trout and round whitefish (as they are often the least likely to successfully survive transfer), that may not survive the fish rescue and transfer). Similar to what was conducted in 2010, this assessment on incidental mortalities will include:

- Detailed internal and external examinations will be conducted on each of the fish to determine sex, reproductive status, parasite presence, and overall apparent health (e.g., DELT - deformities, erosions, lesions or tumours). A subset of these fish will be subject to more invasive measurements/sampling.
- Aging structures (otoliths and/or fins) will be taken (if possible) from all species across a range of expected size classes.
- Stomach contents will be collected from the same fish and either be analyzed in the field (e.g., whole fish can easily be counted) or preserved if more detailed analysis is needed. In the latter case, samples will be uniquely labelled (and associated with a uniquely identified fish), and placed in a 10% buffered formalin solution in whirl-pac bags. Stomach contents will be processed on site by the Project Biologist or sent to North/South in Winnipeg.
- Gonad weights and fecundity (female only) will also be measured for the same fish. Ovaries will be preserved in buffered formalin (or modified Gilson's solution) and analyzed for fecundity (on site or at North/South in Winnipeg), where a subsample of at least 100 eggs will be weighed to allow the estimation of the total number of eggs.
- Liver weights and metals samples will also be taken. Livers will be weighed in their entirety and frozen for shipment to the laboratory for analysis.
- Fish guts not retained for analytical sampling will be incinerated on site, as requested by DFO during the 2008 fishout.

AEM will begin discussing the completion of the CPUE phase with DFO when:

- there has been a consistent, statistically significant (e.g., $p<0.10$) decline over a 10-day or greater period (for at least one of the two CPUE population estimate methods); and/or
- overnight sets are catching very few fish regardless of the location of deployment.

When one or both of these criteria are met, in consultation with the DFO, the nets will be removed for 24 hours. Following the no-fishing period, nets will be re-deployed to confirm that the CPUE phase has met DFO expectations. The decision of determining when the CPUE phase is complete and the final removal will begin will be made in consultation with DFO.

6.2 Fish Transfer (Rescue) and CPUE phase

With DFO approval, during the CPUE phase fish that appear healthy and capable of recovery will be transferred primarily to Wally Lake. The decision to transfer individual fish will be a made in the field by fish technicians under the direction of the project biologist. Although considerable effort will be made to salvage and transfer as many fish as possible, the effectiveness of the salvage efforts will be evaluated in consultation with DFO. Based on 2010 fishout results, it is expected that the greatest number of fish will be salvaged during the first month during the CPUE phase, while catch rates remain high. However, fish are expected to be rescued through all phases as successful rescue and transfer of fish will be the main priority. All healthy fish that appear unaffected by capture and handling (i.e., especially VECs such as lake trout) will be transferred primarily into Wally Lake.

As in 2010, fish will be transferred in aerated cold water tubs in 2013. The water temperature and number of healthy fish transferred will be recorded. Ideally, both length and weight measurements, and a physical inspection will be taken for all fish. However, to reduce handling time, only length may be taken for the transferred fish. All fish >250mm in length will be floy tagged (to identify each individual) and transferred into Wally Lake. Fish <250mm, found to be healthy will be fin clipped or left unmarked and released. Detailed records will document mortalities due to capture, handling or transfer. Fish recovery rates were 50% for lake trout and arctic char at other northern projects (Ekati and Diavik) with very poor recovery rates for whitefish. However, based on the success in 2010 fish transfer, where approximately 80% of the fish were successfully transferred within the first 3 weeks of the fishout, AEM is anticipating a similar success rate for the Vault fish rescue.

Overall, the goal of the fishout rescue is to preserve the net productivity of the system. Given the relatively short duration of mining (less than 5 years) which will destroy a small portion of Vault lake, the large size of Wally Lake as compared to Vault Lake, and the near identical fish community assemblage (see Figure 6-1), a fish transfer is a viable option that is expected to assist in a more rapid recovery in Vault Lake after reflooding (reclamation is proposed to begin in 2018). Although there is some uncertainty, it is expected that Wally will provide a temporary holding area for transferred fish that will ultimately be relocated back into Vault Lake. Furthermore, the transfer into Wally Lake may increase recruitment and ultimately increase the energy of the system without disturbing the fish population dynamics.

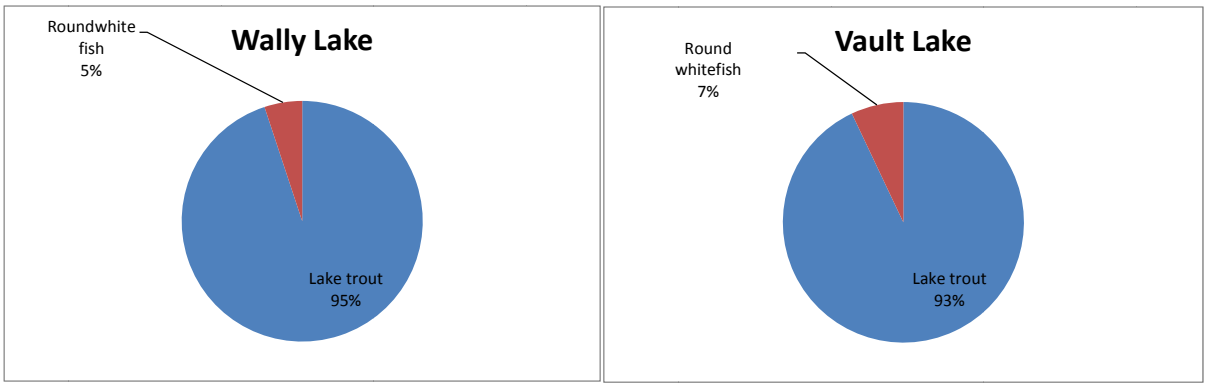

Figure 6-1: Fish biomass estimate in Vault and Wally Lake from surveys conducted in August 2012. Adapted from AEM (2012)

SECTION 7 • FINAL REMOVAL PHASE

In consultation with DFO, the final removal will take place immediately after the CPUE phase is completed. The objective of the final removal phase is to remove all of the remaining fish. This phase will begin at the same time as the partial dewatering of Vault Lake. Over the course of the final removal phase, the fish will be concentrated into smaller basins of water (see Table 1-1 and Figure 1-2). The final fish removal phase may include: using all available fish capture techniques and methods not used in the CPUE phase (including smaller nets, angling, bating nets to capture fish, etc.). Every effort will be made to remove all of the fish from the waterbody. The removal phase will be completed when final benchmarks are met that may include:

- no fish are caught for 48 hours, and then after a 24 hour break, no fish are caught for an additional 48 hours; and/or
- catch has declined to near zero and the total abundance and/or biomass has reached at least 95% of the estimated initial abundance from the CPUE data.

Similar to the 2008 and 2010 fishouts, gill nets will be used as the principal gear to capture the fish. However, the number of gangs will be increased, and AEM may consider using larger mesh sizes; in addition, some fine mesh "Swedish" gill nets (8mm, 10mm and/or 12.5mm nets) will be incorporated into the program. As in 2008 and 2010, effort will continue to be recorded approximately so that depletion estimators can be evaluated. All captured fish during the final removal will continue to be processed for biological information, but details regarding which net or mesh size caught each fish may not be recorded.

Partial dewatering is proposed in the Vault Lake during the final phase, as a result the decision to continue the final removal in the 2013 open water season will be based on the fishout data, drawdown timing, weather, and personnel safety.

SECTION 8 • AQUATIC BIOLOGY AND LIMNOLOGY DATA COLLECTION

Prior to disturbance caused by mine activity, data was collected for limnology, water chemistry, sediment chemistry, periphyton biomass, zooplankton and benthic invertebrate data in Vault Lake during baseline data collection in 2002 and 2003 (Cumberland, 2005). Fish community surveys were completed in 2003 and more recently in 2012 in Vault Lake and determined the presence of lake trout and round whitefish, with no burbot or Arctic char caught. These data provide a complete account of background limnology, aquatic biology and fish community assemblages in the Vault Lake prior to mining activities.

According to Tyson et al. (2011), more detailed and/or updated sampling may be desirable. Unfortunately due to limited access to Vault Lake prior to October 2012 (when the road was complete), updated aquatic data was not collected during the open water season. Furthermore, due to dewatering activity, which is proposed to begin prior to freshet to control the water level, no additional aquatic biology and limnology data will be collected as the limnology and lower trophic biology may have already been altered.

SECTION 9 • HABITAT MAPPING

Thorough physical habitat inventories were conducted prior to mine activity to evaluate habitat in Vault Lake as part of the original No Net Loss Plan (Cumberland, 2006). Due to some uncertainties in fish collection, follow-up fish community assessments were conducted in 2012 and an additional physical habitat inventory assessment was conducted to verify baseline conditions. The results of the habitat evaluation procedure were submitted as part of the updated NNL Plan which provide a thorough evaluation of fish habitat loss due to Vault Pit operations (AEM, 2012).

Habitat mapping of the northwest arm of Second Portage Lake was completed from July to August 2009, after dewatering removed a sufficient volume of water to expose the habitat. Low level photogrammetric aerial photographs were taken of the whole impoundment area; these photos will be used to confirm earlier estimates of habitat quality and will allow derivation of a relationship between habitat area and fish biomass. Similarly, in 2012, a physical habitat mapping comparison using aerial photography, high resolution ground surveying and GIS of a portion of the Bay-Goose basin was completed and was submitted as part of the 2012 annual reporting. These data allowed for an analysis of the habitat evaluation procedure (HEP) used for Bay-Goose basin predevelopment and compare the methods and results to after dewatering. Given the level of detail, GIS capabilities and statistical approaches available for these analyses, AEM will consult with the DFO to determine the necessity in collecting additional follow-up habitat mapping in Vault Lake. This decision will be made in consideration that the mining operations and dewatering platforms will be constructed upon receipt of a Section 32 Authorization, immediately following the fishout, which will increase the uncertainty in conducting habitat mapping post dewatering.

SECTION 10 • REPORTING

According to Tyson et al. (2011), DFO has developed data input forms to match the data collected during all fish-out activities. AEM will use these forms to enter the field data into an Excel database or to suit DFO requirements. Data entry will not be finalized until all results are available (example field sheets are presented in Appendix A); at that time it will be provided to the DFO.

Data analysis and reporting will include an interpretative report as well as raw data tables and summary statistics of data. Specifics will include, but not limited to, the following:

- Introduction and objectives,
- Review of methodology, including maps showing where gear was placed,
- Analysis of CPUE data according to the Leslie and DeLury methods, including best estimates of population sizes and consideration of uncertainty. Depending on findings, the analysis may also extend to biomass rather than only abundance (i.e., similar to the 2008 and 2010 analysis)
- Copies of field data sheets and photographs; and
- Discussion of results in comparison to the 2008 and 2010 fishouts.

SECTION 11 • REFERENCES

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Tyson, J.D., W.M. Tonn, S. Boss, and B.W. Hanna. 2011. General fish-out protocol for lakes and impoundments in the Northwest Territories and Nunavut. Can. Tech. Rep. Fish. Aquat. Sci. 2935: v + 34 p.

APPENDIX A • FIELD DATA COLLECTION FORMS

The attached forms were approved by DFO and used in the 2010 fishout. We propose to use the same field sheet for the 2013 Vault Fishout; the only change is the addition of a floy tag # column.

In addition, each boat crew will carry a map of the Vault Lake and indicate the location & direction of each net set.

Meadowbank Project. Fish-Out CPUE Phase Field Data Sheet

AEM 2010

A. Gear set data

Location / ID:			Number of panels by mesh size (for GNs):	Net Length (m):
	Start location	End of Net (in NAD 83)	25:___ 38:___ 51:___ 76:___ 102:___ 126:___	Net Height (m): All are 2m
Easting:			Set date:	Net depth at each end (m): /
Northing:			Set time:	Surface temp:
Recorder:			Lift date:	Wind direction / speed:
Field Staff:			Lift time:	General comments:

B. Fish sample data

These fields for every fish					Field fish data [3]			Fish Transfer				Lab Analysis: Biological Assessment									
Species Code	Sample ID or Number	Mesh Size[1]	Length [2]	Weight (g)	Sex	Repro Status	Maturity	Mortality	Cause of Death: (Net/ handling/ transfer)	Successfully transferred to TPL?		Aging Structure [4]	Stomach weight (or % full) & contents - indicate if preserved for taxonomy	Ovary weight (g)	Weight of 100 eggs	Liver Weight (g)	Liver metals sample?[5]	Tissue metals sample?[6]	Comments (including results of internal / external examinations including DELT)		
		(mm)	(mm)	(g)	M/F	Code	Code	Y/N		Y/N	Tag #	Code(s)					Y/N	Y/N			

Notes: 1. See mesh size options in section A. 2. Fork length for trout, char and whitefish; total for all others. 3. Fill out fields for sex, repro status and maturity based on "milking" for most fish. 4. otoliths and fins for LT and AC, otoliths only for burbot and whitefish, none for sculpins or sticklebacks. 5. Some stomachs to be processed in field; some to be sent to lab - see plan. 6/7. Liver sample should be coded as "fish sample ID" + "L". Tissue samples should be coded as "fish sample ID" + "T"

Assess Code	Assessment Type
FO-MR	Fish-out: Mark-Recapture phase
FO-CPUE	Fish-out: CPUE/Removal phase
FO-FREM	Fish-out: Final Removal phase
B-line	Base line sampling
AEMP	Aquatic Effects Monitoring Program

Gear Code	Gear Type
AN	Angling
GN	Gill net
MN	Minnow trap
TN	Trap net
OT	Other

Length Code	Length
F	Fork
T	Total

Sex Code	Sex
F	Female
M	Male
U	Unknown

Maturity Code	Maturity
IM	Immature
MA	Mature
SD	Seasonal development
UN	Unknown

Reprod Code	Reprod Status
GR	Green
RI	Ripe
RU	Running
SP	Spent
UD	Undeveloped
UN	Unknown

AgeStruct Code	Aging Structure
FR	Finray
OT	Otolith
SC	Scale
NO	None
CL	Cleithrum
OP	Operculum bone

Fate Code	Fate
NR	New, released marked
NM	New, mortality
RR	Recapture, released
RM	Recapture, mortality
E	Escaped unmarked

Tissue Code	Tissue Sample
ST	Stomach
MU	Muscle
LV	Liver
EG	Eggs
GO	Gonad
NO	None

Fin Code	Fin Clip
ADIP	Adipose
LPEC	Left Pectoral
RPEC	Right Pectoral
LPEL	Left Pelvic
RPEL	Right Pelvic
ANAL	Anal
UPCA	Upper Caudal
LOCA	Lower Caudal

Species codes:	
LKTR	lake trout
ARCH	arctic char
RNWH	round whitefish
BURB	burbot
NSST	ninespine stickleback
SLSC	slimy sculpin

M6	F1	immature male; immature female
M7	F2	preparing to spawn in current year
M8	F3	Ripe and running Male and Females
M9	F4	Spent males and females
M10	F5	M and F that have spawned in past; not in current ye
M11	F11	male or female previously spawned but unsure of condition in current year.

Note: These codes correspond to the Reprod Codes above

AGNICO EAGLE

MEADOWBANK GOLD PROJECT

Groundwater Monitoring Plan

In Accordance with Water License 2AM-MEA0815

Prepared by:
Agnico Eagle Mines Limited – Meadowbank Division

Version 4
January 2014

EXECUTIVE SUMMARY

This document presents the Meadowbank Mine Groundwater Monitoring Plan, a requirement of the Meadowbank Type A Water License No. 2AM-MEA0815.

The Meadowbank Mine currently has two operating groundwater monitoring wells, drilled in 2008. A number of wells drilled in 2003, 2006, 2008, and 2011 are now inoperable for various reasons. One well drilled in 2011 will be replaced in 2014, and sampling of pit wall seeps has been added to augment the program. Methods to obtain groundwater samples from production drill holes are currently under investigation.

Groundwater chemistry data is used to predict the quality of water accumulating in open pits, and to determine any effects of mining on groundwater quality, particularly with respect to tailings deposition.

Groundwater sampling will be carried out on an annual basis. Analytical parameters will comply as per Schedule 1, Table 1, Group 3 of the Meadowbank Water License. Quality Assurance/Quality Control procedures will be implemented during each sampling event.

A groundwater monitoring report will be submitted by Agnico Eagle Mines Limited to the Nunavut Water Board (NWB) by March 31 annually. This report will include all data from the previous year's results as well as a historical record, dates and methods of sampling, and an assessment of the data obtained with particular regards to salinity parameters and indicators of tailings reclaim water movement (total cyanide and dissolved copper).

IMPLEMENTATION SCHEDULE

This Plan will be implemented immediately (January 2014) subject to any modifications proposed by the NWB as a result of the review and approval process.

DISTRIBUTION LIST

AEM – Geology Superintendent

AEM – Engineering Superintendent

AEM – Geotechnical Engineer

AEM – Environment Superintendent

AEM – Environmental Coordinator

AEM – Environmental Technician

DOCUMENT CONTROL

Version	Date (YMD)	Section	Page	Revision
1	08/08/08			Comprehensive plan for Meadowbank Project
2	09/03/31	all		Comprehensive update of plan to include 2008 well installations
3	11/12/14			Update Executive Summary; insert Figure 1; update Table 1; addition of information on wells created in 2011; include well installation section;
4	14/01			Update Executive Summary; update Section 1.2 to reflect current wells; add Section 3.3 and 3.4 (seep and production drill hole sampling methods); update Section 5 (additional reporting on tailings-related parameters)

Version 4

Prepared By: Meadowbank Environment Department

Approved by: _____

Kevin Buck
Environmental Superintendent

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Appendix A - Standard Operating Procedure for Sampling of Groundwater Monitoring Wells
Appendix B - Standard Operation Procedure for Sampling of Production Drill Holes (interim)

1 INTRODUCTION

This document presents the Meadowbank Mine Groundwater Monitoring Plan, Version 4. This version maintains the principles and sampling methodology for monitoring wells presented in Version 3 (AEM, 2012), and presents alternative groundwater sampling options (pit wall seeps and production drill holes) as suggested in the 2012 Groundwater Monitoring Report (Golder, 2012). Monitoring well and alternative sampling locations, design characteristics, and the sampling methodology used to recover water samples for chemical analysis are included in this Plan.

1.1 PURPOSE OF GROUNDWATER MONITORING

Groundwater data is used to predict the chemistry of water accumulating in open pits (especially salinity as TDS, conductivity and chloride), and to determine any effects of mining on groundwater quality, particularly with respect to tailings deposition. To this end, groundwater monitoring wells have been installed to sample talik water (unfrozen ground beneath large lakes) in areas where through taliks exist. No groundwater monitoring wells will be installed at the Vault deposit, as the Vault pit will be developed in an area where the talik does not extend down through the permafrost.

Groundwater sampling has traditionally been conducted using installed monitoring wells, but difficulties in obtaining representative samples by this method prompted the investigation of alternative methods in 2013. Based on recommendations by Golder Associates (see 2012 Groundwater Monitoring Report), these include sampling of pit wall seeps and production drill holes. Traditional wells are also utilized in the monitoring program.

1.2 MONITORING WELLS

Four monitoring wells were installed at the Meadowbank site in 2003. Three of these wells (MW-03-02, MW03-03 and MW03-04) were damaged by frost action between 2004 and 2006. The fourth (MW03-01) was operable until 2010 when it was also damaged by frost action. The three defective wells were replaced in 2006 (MW06-05, MW06-06 and MW-06-07). The three wells were again damaged by frost action. MW06-05 and MW06-06 were replaced in 2008 with a more robust design (MW08-02 and MW08-03). The replacement of the third defective well (MW06-07), at the tailings storage facility, was deferred until verification of the effectiveness of the new well designs in 2009-2010. In 2011, two monitoring wells were installed. Well MW11-01 was installed on Goose Island adjacent to the Goose pit outline, to replace one of the 2003 wells (MW03-01). Well MW11-02 was installed at the tailings storage facility to replace MW06-07 and to monitor shallow groundwater quality below the basin where tailings are deposited. The well MW08-03 has been partially blocked by an ice bridge since 2010, but attempts to melt the ice have proven

somewhat successful and are ongoing. Well MW11-01 was decommissioned in 2012 after being damaged during site operations. Well MW11-02 became obstructed with development materials during the 2012 monitoring program and could not be sampled. Attempts were made in 2013 to remove the material, but these were unsuccessful. This well will be replaced in 2014.

The locations of each former and existing groundwater well are provided in Figure 1.

1.3 PIT WALL SEEPS

Seepage from pit walls commonly occurs in several locations in both the Portage and Goose pits. Groundwater samples can readily be obtained directly from the waterfall when sufficient flow occurs. In 2013, AEM obtained a sample from one seep in the Goose pit. Due to the changeable nature of seep positions, sampling locations are not set and GPS coordinates of any sampled seep will be included in each annual report.

1.4 PRODUCTION DRILL HOLES

When sufficient groundwater flow from production drill holes is encountered, sampling using this method is likely feasible. Although wells with sufficient flow rates only occur on occasion, AEM is of the opinion that this is a viable method, and will continue attempts to sample production drill holes. Since the sampled locations will change each year depending on where flowing groundwater is encountered, drill hole identification numbers and GPS coordinates will be included in each annual report. This source of groundwater has the potential to be viable in determining any mining affects to groundwater, especially in the Portage Pit as it is directly downstream of the inferred groundwater flow path.

Figure 1 - Map of former and existing monitoring wells on the Meadowbank Site

2 MONITORING WELL INSTALLATION

Installation details for existing monitoring wells are provided here. Details for decommissioned wells are presented in the Groundwater Monitoring Report for the year of installation.

2.1 2008 WELL INSTALLATION

2.1.1 MW08-02 & MW08-03

The two boreholes drilled for the replacement monitoring wells MW08-02, and MW08-03 were drilled using standard PQ and HQ size coring method. Heated water from the Second Portage Lake was used as drilling fluid during drilling. The boreholes were drilled to 200m depth along a 60 degree angle. Each borehole was cased to 20 m past the anticipated base of the permafrost using HWT flush-joint casing. The geological information used to was based on the core recovered from each borehole. The first 170 meters of the MW08-02 borehole were drilled without core recovery; the screened interval core was collected to confirm the target lithology. The full length of MW08-03 borehole was logged. Agnico Eagle geologists logged the core from both boreholes.

2.1.2 Instrumentation

The MW08-02 & MW08-03 wells were constructed with 1.5-inch diameter, schedule 40 stainless steel pipe and 18 m long 2 inch diameter stainless steel screen. The annulus between the casing and the monitoring well pipe was sealed at the base of the casing (169 m depth) with a pneumatic packer inflated with propylene glycol (a non-toxic and biodegradable liquid with low freezing point). This isolated the annular space between the borehole casing and the monitoring well pipe from the borehole interval below the permafrost. A small diameter double valve pump (DPV) driven by inert nitrogen gas was fixed to the outside of the riser pipe to allow removal of water from the well annulus above the packer to keep this area dry and minimize the potential for frost damage to the outside of the monitoring well pipe. A smaller diameter stainless steel pneumatic packer was installed inside of the monitoring well pipe immediately above the screen interval to prevent freezing of the inside of the monitoring well pipe throughout the permafrost. After sample collection, the inside packer is inflated and a portable DPV pump is used to evacuate water above this packer and keep the well pipe dry between the sampling events. A heating cable was attached to the outside of the monitoring well pipe through the entire anticipated interval of permafrost. The heating cables prevent water from freezing during sampling, and constitute a back-up system to melt the ice inside the monitoring well in case of a packer failure.

2.2 2011 WELL INSTALLATION

2.2.1 MW11-02

Although MW11-02 is planned to be replaced in 2014, installation details are included here because decommissioning has not yet occurred. The borehole was drilled using standard HQ size coring method. Heated lake water was used as drilling fluid during drilling. The borehole was drilled to 81 m depth at an angle of 80 degrees below ground surface. The borehole was cased through the overburden and into the first few metres of bedrock. All cores were recovered and logged by Agnico Eagle geologists.

2.2.2 Instrumentation

MW11-02 was constructed with 1.5 inch diameter, schedule 40 stainless steel pipe and 15.25 m of 2 inch diameter slotted stainless steel screen. The well was installed into an open borehole. The annulus between the stainless steel well and the borehole was filled with approximately 16 m of sand. A bentonite seal approximately 4 m thick was placed on top of the sand. The remainder of the annulus was loosely filled with gravel and a grout seal was placed at the top of the well. Although the ground is not frozen at this location in the talik, it is predicted to freeze in time. For this reason, a heating cable was attached to the outside of the stainless steel pipes above the bentonite seal. The heating cable will allow for thawing of the well in the event of permafrost in the area.

3 SAMPLING METHODS

Since monitoring results to date have not indicated any effects of mining activity on groundwater quality, the groundwater sampling program will be performed annually using traditional onsite monitoring wells, as well as pit wall seeps and production drill holes as available. One sample will be collected in duplicate and submitted blind (using different reference numbers) to the analytical laboratory.

Specific details of sampling methods for monitoring wells, pit wall seeps and production drill holes are provided here. The collection of samples from production drill holes will occur when flowing conditions are encountered in order to obtain additional samples to assist in the assessment of any potential impacts of mining activity.

3.1 GROUNDWATER WELL MW08-03

3.1.1 Well Preparation for Sampling

At the time of purging and sampling the heat trace cables will be activated to warm the well pipe. Once the new well has been warmed up the pneumatic valve inside the well pipe will be deflated to allow groundwater to flow into the well pipe.

3.1.2 Well Purging

The well is then purged to remove standing water inside the well and to induce the flow of fresh groundwater from the rock formation. Purging is done by lowering a portable double valve sampling pump (DVP) into the well pipe to approximately 10 to 20 meters above the top of the screened interval and activating the DVP. The pump is activated by pumping compressed air into a ¼" Low Density Polyethylene (LDPE) tubing attached to the DVP. The quality of the purged water is to be monitored for pH, electrical conductivity, temperature, water clarity and colour (visual observation) during this activity. A minimum of 3 well volumes (volume of water between the in-well packer and bottom of screened interval) are to be removed prior to sampling or until the monitored parameters stabilize (values remaining within 10% for three consecutive readings).

3.1.3 Groundwater Sampling

Groundwater is to be sampled immediately after purging, by lowering the intake of the DVP tubing to 3 to 5 meters above the screened interval. The same DVP pump and tubing used for purging is to be used for sampling but utilizing compressed nitrogen gas to evacuate water that entered the sampler unit. Nitrogen gas is stable (inert) and avoids alteration of

groundwater chemistry during sampling. Chemical parameters are to continue to be measured during sampling.

A groundwater sample is to be collected in clean, laboratory-supplied containers. Where required, preservatives will be added to the sample bottles prior to sample collection, to minimize chemical alteration during transport to the laboratory. Samples analyzed for dissolved metals are to be filtered through a 45 μm inline filter.

3.1.4 Well Close-Down Procedure

Once the water sample is obtained, the pneumatic valve will be re-inflated and the well water above the valve will be removed using the portable DVP pump. The DVP pump fixed to the outside of the well will also be activated to remove water accumulated in the annulus of the well during purging and sampling (if any). The heating cable will be de-activated and the cap will be replaced on the casing.

3.2 GROUNDWATER WELLS MW08-02 AND MW11-02

Although MW11-02 will no longer be sampled after it is replaced in 2014, the replacement well will be sampled in the same manner.

3.2.1 Well Preparation for Sampling

Because water is allowed to rise and freeze in place within the well pipe, the heat trace cable activation period will be considerably longer, in the order of 4-7 days, to thaw standing water (ice) present in the well pipe. The effective heating cables in the groundwater wells should allow the water present in the well pipe to thaw in a timelier manner.

3.2.2 Well Purging

Once ice is fully thawed purging is initiated in the same way as for the 2008 wells, by inserting the DVP and tubing at 10 to 20 meters above the screened interval and removing well water by pumping compressed air. Groundwater will be continually pumped from the well until electrical conductivity and pH readings stabilized. This process may require more than 3 well volumes. In consideration of the low hydraulic conductivity of the rock causing a very slow recovery of groundwater level (only a few litres of groundwater can be removed at a time), this process can take up to 4 days to complete.

3.2.3 Groundwater Sampling

Groundwater sampling will be carried out immediately after well purging, in the same manner as for the 2008 design wells (same equipment, elevation of tube intake for water sample, use of nitrogen gas, monitoring of water quality parameters during this process).

Groundwater samples are to be collected in clean, laboratory-supplied containers. Where required, preservatives will be added to the sample bottles prior to sample collection, to minimize chemical alteration during transport to the laboratory. Samples analyzed for dissolved metals are to be filtered through a 45 μm inline filter.

Samples are to be collected in duplicate and submitted as blind duplicates (using different reference numbers) to the analytical laboratory. Duplicate samples are to be analyzed for chloride and the suite of dissolved metals specified in Table 1 of Schedule 1 of the Meadowbank Water License.

3.2.4 Well Close-Down Procedure

Once the water sample is obtained, the heating cable will be de-activated and the cap will be replaced on the well.

3.3 PIT WALL SEEPS - ST-GW-#S

Samples from pit wall seeps will be collected directly from the pit wall waterfall.

A groundwater sample is to be collected in clean, laboratory-supplied containers. Where required, preservatives will be added to the sample bottles prior to sample collection, to minimize chemical alteration during transport to the laboratory. Samples analyzed for dissolved metals are to be filtered through a 45 μm inline filter.

A separate container should be used to collect water for immediate measurement of field parameters (pH, conductivity).

3.4 PRODUCTION DRILL HOLES – ST-GW-#P

The collection of samples from production drill holes will occur whenever flowing drill holes are encountered and the designed methods will be modified as required based on field testing. Standard methods are provided in Appendix B, and summarized here.

AEM's Senior Environmental Technician or Coordinator will request that the Blast Supervisor (Mine Dept.) notify Environment Department staff when a flowing production well is encountered during regular production (for blasting) drilling (it is not a regular occurrence). Sampling needs to be conducted prior to addition of any explosive material.

Before sampling, three well volumes will be purged from the flowing hole. Production wells are usually 0.17 m diameter and 8.5 m deep so approximately 579 L will be removed.

Analysis of field parameters will be used to assist in determining if sufficient purging has occurred. Values are to be stable (within 10%) for three consecutive readings (in accordance with procedures for monitoring wells).

The sample is to be collected in clean, laboratory-supplied containers. Where required, preservatives will be added to the sample bottles prior to sample collection, to minimize chemical alteration during transport to the laboratory. Samples analyzed for dissolved metals are to be filtered through a 45 μm inline filter.

For each sampling location, GPS coordinates and the drill hole number/blast pattern number will be recorded.

4 SAMPLE ANALYSIS

4.1 ANALYSIS

These samples will have field parameters taken (pH and Conductivity) and will also be sent to an accredited laboratory for analysis. Analytical parameters will include the following, per Schedule 1, Table 1, Group 3 of the Meadowbank Water License: pH, alkalinity, turbidity, hardness, ammonia nitrogen, nitrate, nitrite, chloride, fluoride, sulphate, total dissolved solids (TDS), total and free cyanide (for wells located in the flow path of the tailings containment area) and the following dissolved metals: aluminum, arsenic, barium, cadmium, copper, iron lead, manganese, mercury, molybdenum, nickel, selenium, silver, thallium and zinc.

4.2 QUALITY ASSURANCE / QUALITY CONTROL

4.2.1 Handling

The following procedures will be followed to provide data quality control:

- Measurement of field parameters at selected intervals until stable readings (within 10% of each other);
- Minimization of the exposure of the sampled water to the atmosphere;
- Use of compressed, inert gas (nitrogen) to evacuate water for sample collection;
- In-situ measurement of sensitive chemical parameters (pH, conductivity, dissolved oxygen, alkalinity, where applicable); and
- Abiding by sample preservation methods (refrigeration and use of preservatives where needed); and specified holding times.

4.2.2 Duplicates

A duplicate sample will be collected for one monitoring well per sampling event, and submitted as a blind duplicate to the analytical laboratory. Where both results are higher than five times the method detection limit (MDL), the relative percent difference (RPD) will be calculated as:

RPD = absolute difference in concentration/average concentration x 100

USEPA (1994) indicates that an RPD of 20% or less is acceptable. Where one or both results are less than five times the MDL, a margin of +/- MDL is acceptable.

5 REPORTING

An annual groundwater monitoring report will be submitted by Agnico Eagle Mines Limited to the Nunavut Water Board (NWB) by March 31 of the following year. This report will include the following information:

- Installation logs for any new monitoring wells;
- Location in UTM coordinates of all groundwater sample locations;
- Description of the working condition of the existing wells;
- Date of groundwater sampling;
- Details of sampling methods;
- Analytical results including: field data, laboratory analytical data and QA/QC information;
- Comparative assessment of data obtained to date to input values used in the Water Quality Model for the site (relevant salinity parameters); and
- Comparative assessment of parameters indicative of mine impacts to groundwater, with particular regard to tailings (total cyanide and dissolved copper).

APPENDIX A

Standard Operating Procedure for Sampling of Groundwater Monitoring Wells

WORK INSTRUCTION

Purpose:

This procedure is used to ensure that groundwater (GW) sampling is conducted in a safe and orderly manner. All samples need to be taken in the same manner to provide continuity of samples regardless of who is taking the samples. The Environment Department is required to conduct a GW sampling program to determine if there are any mining impacts to the local GW regime. This is in accordance with both our NWB and NIRB permits. In 2013 AEM environment staff will conduct the GW sampling program at Meadowbank.

Groundwater Sampling SOP:

GW sampling consists of measuring field parameters and collecting GW samples within the designated bottles.

Material needed:

Waterra 1 inch
Waterra ¼ inch
2 Genset (Atlas Copco, QAS 30) (GEN 30 and 34)
1 compressor (environment compressor)
3 Nitrogen tanks (JDE number 134720)
Nitrogen regulator
Solinst pump
Clean pails
Cond./pH/Temperature probe (PCStestr 35 or multi-parameter probe)
Water level probe
Control box
Red hose for NO2
Black hose with moisture trap for NO2
Adaptor, Fitting, Ring, Tools
Sampling bottle and syringe

Procedures to be done in 2013 for existing GW Wells

MW-11-02

In accordance with the 2012 Golder Groundwater Technical Memorandum Env Dept staff needs to retrieve a melted waterra that has plugged this well at a depth of 28 meters. This will require the use of at least a 30 meter RW drill rod with a fitting containing external thread. Orbit Gallant will conduct this drilling to remove the blockage (Ask Orbit to drill with size A casing).

Also there is a short on the heat trace cable in this well so the electrician must be informed prior to plug the heat trace to avoid overheating.

MW-08-03

This well has been determined to have an ice blockage, below the existing heat trace, at a depth of 150 meters. To melt the ice, Carlon tubing HDPE is required (about 200 meters).Orbit Garant will thaw the blockage below the heat trace cable with hot water. Once the ice melts we can push the tubing down to continue the purge and characterization of the water prior to obtain a sample. Temperature of the heated water shouldn't exceed 60 °C

MW-08-02

Nothing special. This well was sampled last year using regular unthawing and purging techniques.

Thaw and Purge Procedures

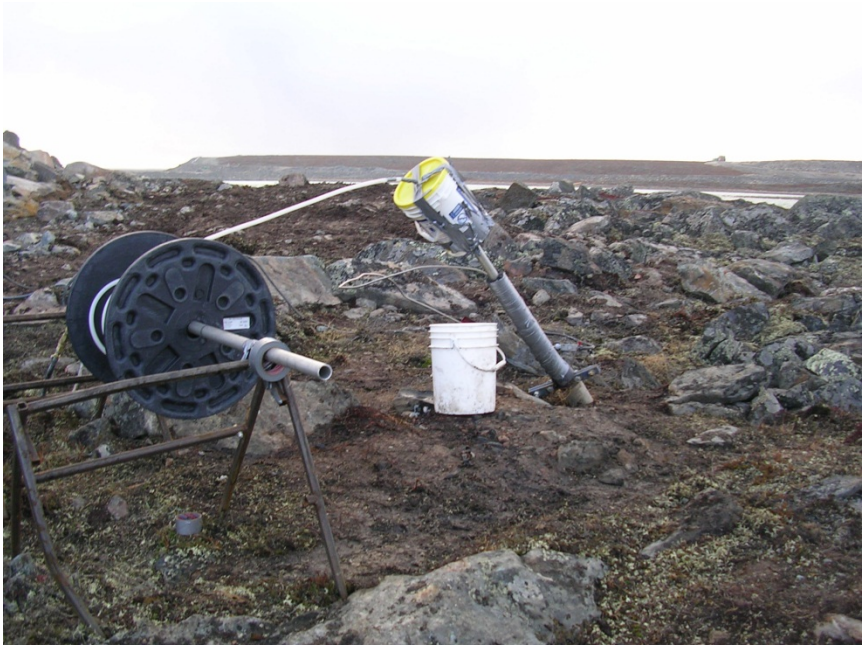
A) Melt the ice in the monitoring well

1- Measure the depth of the ice in the well – use existing well logs to document all activity. This is important for report preparation.
2- Ask for an electrician to plug the heat trace to the generator (Atlas Copco, QAS 30)

3- Monitor the ice and water depth every twelve hours or so.
4- Once the ice level has been melted to a depth of over 150 meters, we can start to purge.

B) Purge the water in the well

1- Place a pail upside down on top of the well to avoid having water flow all over and place an additional pail on the ground underneath to collect the purged water (see photo below).

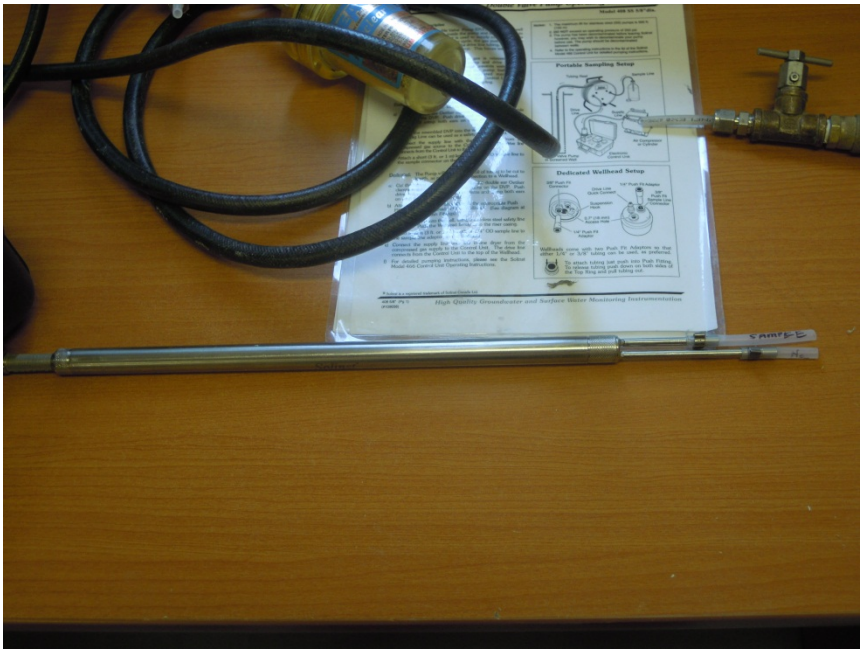


2- Place the 1 inch Waterra into the well to about 30 meters below the water level.
3- Place the rings (the smaller one first and then larger one after) onto the tubing and screw the fitting on the Waterra.
4- Connect the fitting to the red hose and then connect the red hose to the compressor.
5- Plug the compressor into the generator (make sure that the valves are close).

6- Once the compressor reaches 125 psi, open the valve and wait for the water to flow out (can take between 30 seconds to 2 minutes).
7- Once there is no water flowing, close the valve, measure the pH, conductivity, temperature, amount of water purge (by number of pails), level of the water and then, lower the waterra, wait for 10 minutes and start over. This will equal one volume purged.
8- At the end of the day, take the waterra of the well and take the water level.
9- Once you purge 3 times the amount of water in the well and parameters are stabilized (all results within +/-10%), you can sample the well

C) Sample the water in the well

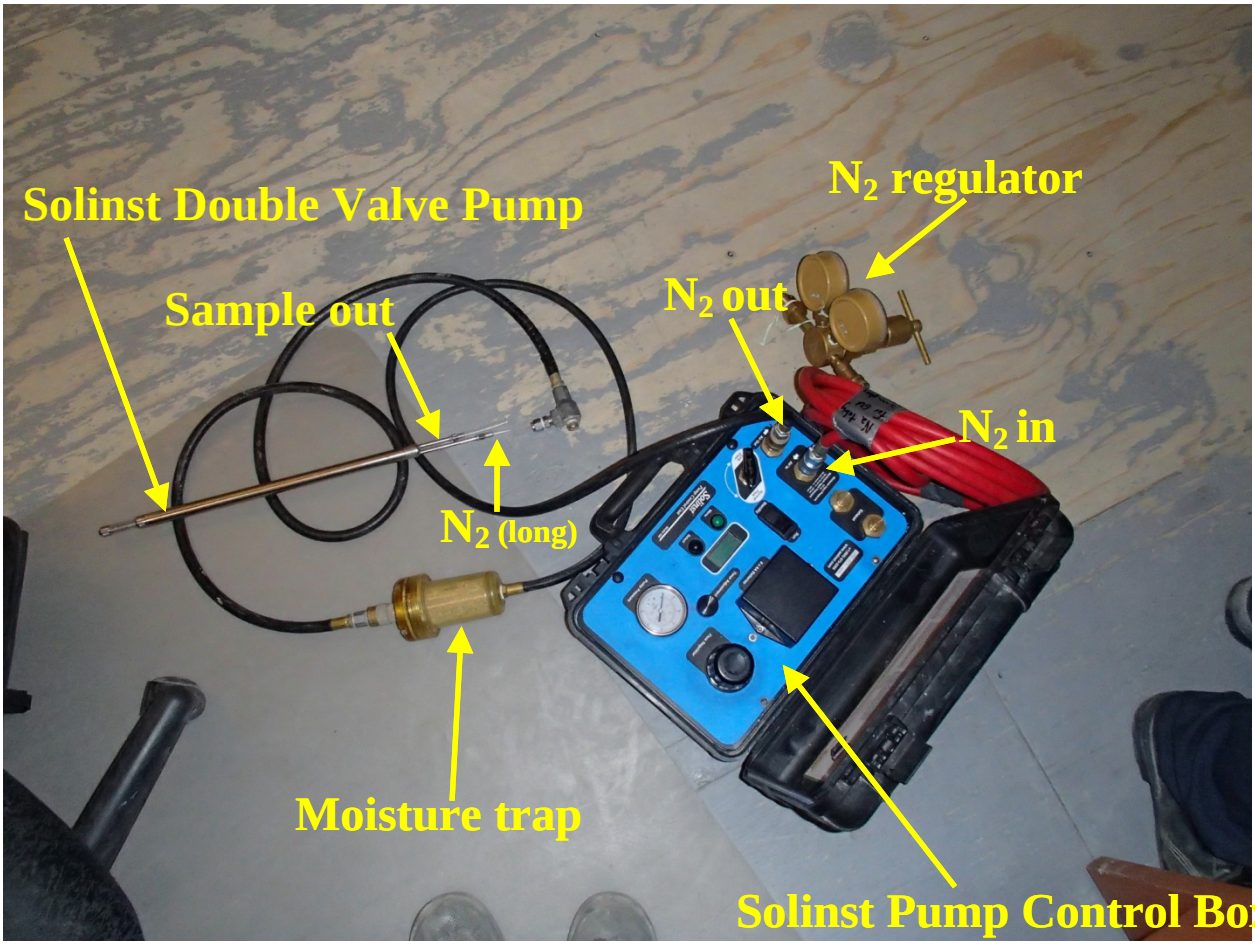
1- Place the ¼ inch double waterra line on the Solinst double valve pump.
2- Tighten the waterra with the rings



3- One Waterra line will be bring the sample water and one will send Nitrogen to the pump. Make sure to identify which line is the one for Nitrogen and which one is the line for water (longest metal tale on the pump is for nitrogen) (see photos).
4- On the nitrogen waterra line, place 2 rings and a bolt and place it on the 90˚adapter and the black hose with the moisture trap.

5- Connect the black hose to the Nitrogen control box (AIR OUT)
6- Plug the red hose to the control box (AIR IN).
7- Plug the other end of the red hose to the ``T`` regulator with the gauge.

8- Connect the regulator to the nitrogen tank and slowly open the Nitrogen tank to a pressure of140 PSI.
9- On the control box press RUN than put the menu on AUTO mode.
10- With the SELECT button adjust the pressure so that when it's pumping the pressure is at 140 PSI and when it's venting, it goes back to 0 PSI.
11- This should take about 5 minutes before there is a water flow.
12- Let it run for 10 to 15 minutes, measure parameters with the PCSTestr 35 or the multi-parameter probe and sample the water. Record all field parameters results.
13- For filtering, place the pumped GW in a clean container, rinse 3 times and use a syringe to sample.


Solinst Double Valve Pump
N_2 regulator
Sample out
N_2 out
N_2 in
N_2 (long)
Moisture trap
Solinst Pump Control Box

Control box

8 AA batteries
250 ECU 5655
+1 (905) 873-2255
www.solinst.com
Exhaust
N_2 in, connected to N_2 regulator
Minimum Input Pressure
Maximum Input Pressure
Air In
Run
Standby
8 x AA Batteries
Timer Adjustment
Flow Regulator
Pressure fluctuates between 0 and 140 psi between drive and purge cycles
Drive – 12s
Normal Flow
Normal flow
Menu
Select
Pump Pressure
Solinst
N_2 out, connected to ¼ tubing attached to Solinst Double Valve Pump (long stainless steel tube)
Control box

Valve and Ring

Take a triplicate for every sample, send 2 to the lab and keep a backup sample.

Follow the SOP for the shipping request..\Shipping\Shipping Samples SOP.doc

Author:		
Environmental Technician	Martin Theriault	
Print Title	Print Name	Signature

Approval:		
Environmental Coordinator	Jeffrey Pratt	
Print Title	Print Name	Signature

APPENDIX B

Standard Operating Procedure for Sampling of Production Drill Holes (Interim)

Procedure for Groundwater Sampling from Flowing Production Drill Holes/Wells

Purpose:

This procedure is to ensure that groundwater (GW) sampling from flowing production drill holes/wells is conducted in a safe and orderly manner. Production holes are drilled to place explosives for blasting. All samples need to be taken in the same manner to provide continuity of samples regardless of who is taking the samples. Using the Environment Department PCSTestr 35 conductivity and salinity readings are to be taken from flowing production wells, when notification is received, and compared to results from previous GW sampling events conducted by Golder (see chart below). If these parameters are determined to be similar we can conclude that the water is representative of area GW.A sample can then be taken. The drilling of production wells involves the use of freshwater and this water will be purged when a flowing well is encountered. It is important to ensure that this water is purged prior to taking a sample (which is why the meter is used – to take continuous samples until it is determined that the water is GW).

Groundwater sampling from production holes SOP:

GW sampling from production holes consists of measuring field parameters (conductivity, TDS and salinity) with the PCSTestr 35 and comparing the results with past results (Golder) from the GW wells. If the results are similar in chemistry to previous results then a sample is collected using the designated sample bottles prior to the addition and use of explosives in the hole. The location, time, depth of hole and procedural notes are documentation that will be required from each sampling event.

Material needed for the job:

Calibrated Multi-parameter PCSTestr 35
Watch
Clean Pail
Sampling gloves
Sampling bottles
GPS
Camera

Procedures to be done in 2013

1- Senior Environmental Technician or Coordinator will request that the Blast supervisor (Mine Dept) notify Env staff when a flowing production well is drilled (it is not a regular occurrence). We need to make sure no explosive material is added to the hole before sampling. Env Dept should have equipment ready and proceed to site upon notification if possible.

2- Before sampling, make sure that 3 well volumes have been purged from the flowing hole. Production wells are usually 0.17 meter diameter and 8.5 meters deep so approximately 579L

needs to have been discharged. It will not always be possible to determine the purged volume due to the time it takes to travel to the location. In field sampling will assist in determining if the GW is representative of the area GW.

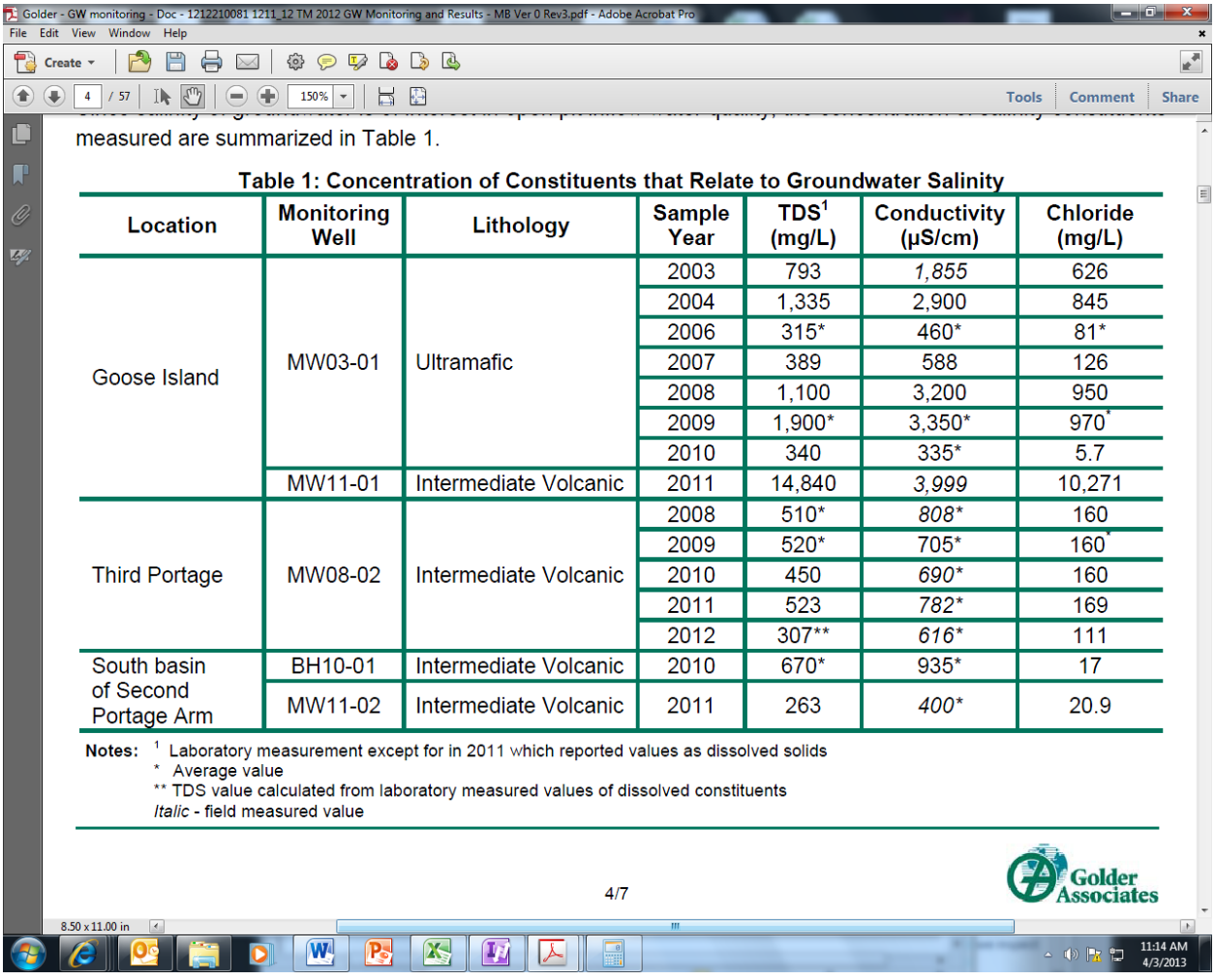
3- Calculate the amount of time needed before sampling according to the flow.

4- Take at least 3 readings during the purging with the multi-parameter probe (conductivity, TDS and salinity) and compare your results with Golder's results (see table below). Parameters need to be stable (within 10% of each other).

5- If results are similar, once the purge is completed, put on the nitrile gloves and sample the hole with the appropriate bottles. For filtering, let the water flow into a clean container, rinse 3 times and use a syringe to sample.

6- Take the GPS coordinates and the identification of the hole (blast pattern) of the sampling location and also take some pictures of the overflowing hole.

Golder's results for TDS, Conductivity and Salinity


Golder - GW monitoring - Doc - 1212210081 1211_12 TM 2012 GW Monitoring and Results - MB Ver 0 Rev3.pdf - Adobe Acrobat Pro

measured are summarized in Table 1.

Table 1: Concentration of Constituents that Relate to Groundwater Salinity

Location	Monitoring Well	Lithology	Sample Year	TDS[1] (mg/L)	Conductivity (µS/cm)	Chloride (mg/L)
Goose Island	MW03-01	Ultramafic	2003	793	*1,855*	626
			2004	1,335	2,900	845
			2006	315*	460*	81*
			2007	389	588	126
			2008	1,100	3,200	950
			2009	1,900*	3,350*	970*
			2010	340	335*	5.7
	MW11-01	Intermediate Volcanic	2011	14,840	*3,999*	10,271
Third Portage	MW08-02	Intermediate Volcanic	2008	510*	*808**	160
			2009	520*	705*	160*
			2010	450	*690**	160
			2011	523	*782**	169
			2012	307**	*616**	111
South basin of Second Portage Arm	BH10-01	Intermediate Volcanic	2010	670*	935*	17
	MW11-02	Intermediate Volcanic	2011	263	*400**	20.9

Notes: [1] Laboratory measurement except for in 2011 which reported values as dissolved solids
* Average value
** TDS value calculated from laboratory measured values of dissolved constituents
Italic - field measured value

4/7

Follow the SOP for the shipping request..\Shipping\Shipping Samples SOP.doc

Author:		
Environmental Technician	Martin Theriault	
Print Title	Print Name	Signature

AGNICO EAGLE

MEADOWBANK GOLD PROJECT

Habitat Compensation Monitoring Plan

In Accordance with Fisheries Authorization NU- 03.0190, NU-03-0191.3 and NU-03-0191.4

Prepared by:
Agnico-Eagle Mines Limited – Meadowbank Division

Version 2
June 2013

EXECUTIVE SUMMARY

General Information

This Habitat Compensation Monitoring Plan (HCMP) defines the sampling methods and criteria for success of the fish habitat compensation features described in Meadowbank's No Net Loss Plan (October 2012). In consultation with DFO, this HCMP is designed to meet DFO authorizations: All Weather Road NU 03.0190 (Condition 5 –monitoring), Meadowbank Mine Site Authorization NU 03.0191.3 (Condition 3 and 6 – monitoring and reporting) and Meadowbank Mine Vault Area Authorization NU 03.0191.4 (Condition 3 and 6 – monitoring and reporting).

Record of Changes

A record will document all significant changes that have been incorporated in the HCMP subsequent to the latest annual review. The record will include the names of the persons who made and approved the change, as well as the date of the approval.

Distribution List

Agnico-Eagle Mines Limited will maintain a distribution list for the HCMP, providing information about all parties that receive the plan including mine personnel, departments, and outside agencies.

IMPLEMENTATION SCHEDULE

As required by the original Meadowbank Fisheries Authorizations (NU-03-0191 and NU-03-0190), and in the updated Fisheries Authorizations (2013; NU-03-0191.3 and NU-03-0191.4), the implementation schedule for this plan is effective immediately (June 2013) subject to any modifications proposed by DFO as a result of the review and approval process.

DISTRIBUTION LIST

AEM - Environmental Superintendent

AEM – Environmental Coordinator

AEM – General Mine Manager

AEM – Site Services Superintendent

AEM – Field Services Supervisor

AEM – Engineering Superintendent

DFO Arctic Region Representative

DOCUMENT CONTROL

Document Control

Version	Date (YMD)	Section	Page	Revision
1	05/08			Initial document (Azimuth Consulting Group Inc.)
	26/03/09			Further detail by technical memorandum (Azimuth Consulting Group Inc.)
2	06/13	All	All	Document re-written to reflect updated NNLP (AEM, 2012b)
3	03/14	Added Section 4.3	15, 22-29	In consultation with DFO, AEM changed timing and frequency of monitoring back to the original DFO authorization timing.

Version 2

Prepared By: Meadowbank Environment Department

Approved By: _____

Kevin Buck
Environmental Superintendent

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SECTION 1 • INTRODUCTION

1.1 BACKGROUND

Agnico Eagle Mines Limited (AEM) Meadowbank Division currently operates an open pit gold mine located on Inuit-owned land in the Kivalliq Region of Nunavut. The mine site is approximately 70 km north of the hamlet of Baker Lake. Mining rights for this site were obtained by AEM from Cumberland Resources Ltd. in 2007.

Since mining activities at this site result in the harmful alteration, disruption and destruction of fish habitat, a DFO Fisheries Authorization application was required. In 2006, Cumberland Resources Ltd. developed a No Net Loss Plan (NNLP) in support of this application. This plan quantified losses to fish habitat that were expected to occur, and described the habitat gains that would be achieved through compensation measures.

The first DFO Fisheries Authorization (NU-03-0190) issued was for the All Weather Access Road, in 2007. Shortly thereafter, a Habitat Compensation Monitoring Plan was developed by Azimuth Consulting Group Inc. on behalf of AEM in order to describe a specific program for monitoring the effectiveness of the fish habitat compensation features identified in the NNLP.

In May 2008, the Habitat Compensation Monitoring Plan for the mine site was developed by Azimuth Consulting Group Inc. on behalf of AEM, and at the request of DFO. A DFO Fisheries Authorization (NU-03-0191) was then issued for the Portage lakes area (main mine site) on July 30, 2008.

As a result of discrepancies between the original NNLP and the issued mine site Authorization, as well as changes to construction feasibility and mine site designs, Meadowbank's NNLP was updated in October, 2012. An updated Fisheries Authorization for the Portage lakes area was provided in March, 2013 (NU-03-0191.3), and a new Authorization for the Vault Lake area was provided in May, 2013 (NU-03-0191.4).

Since changes in compensation features are included in the updated NNLP, the HCMP is required to be updated, as described in NU-03-0191.3, Condition 6.3, which states:

"The stability and successful utilization of all fish habitat compensation features shall be assessed according to the methodology and schedule detailed in the Habitat Compensation Monitoring Plan, version 4, dated May 2008 and the No Net Loss Implementation Cost Estimate & Construction Schedule – Meadowbank Gold Mine Project, Revision 1, dated July 08, 2008 to be updated by June 1, 2013."

and NU-03-0191.4, Condition 6.1 which states:

"The Proponent shall conduct monitoring of the compensation habitat according to the Habitat Compensation Monitoring Plan, version 4, dated May 2008 and the No Net Loss Implementation Cost Estimate & Construction Schedule – Meadowbank Gold Mine Project, Revision 1, dated July 08, 2008", and will be updated in June 2013.

1.2 OBJECTIVES

The development of onsite, like-for-like fish habitat is the method of compensation preferred by DFO. In general, habitat gains at Meadowbank are achieved through constructed features such as dike faces and roads that act as reefs, access enhancements for isolated fish populations, and land-to-lake conversions. Based on the conditions in the Authorizations described above, assessment of the structure and successful utilization of these features by fish are the primary goals of the monitoring program.

This work will be carried out as a targeted monitoring plan under the Meadowbank Aquatic Effects Monitoring Program (AEMP).

The objectives of this plan are:

1. To provide an overview of habitat compensation features at Meadowbank
2. To summarize the habitat compensation monitoring conducted to date
3. To describe the physical and ecological monitoring methods for each feature
4. To describe the quality assurance and control measures to be included in the monitoring program
5. To define the criteria for success
6. To present the monitoring frequency and reporting schedule

SECTION 2 • HABITAT COMPENSATION FEATURES

In the 2006 NNLP, habitat gains for the Meadowbank site were largely to be obtained from re-flooding of dewatered basins and excavated pits. The construction of boulder gardens, reef and shoal features within the dewatered basins were proposed to increase habitat value. In addition, large (19 ha) finger dikes and habitat mounts were planned for in-water construction in Second and Third Portage Lakes (outside the dikes) to provide supplementary habitat gains pre-closure.

Re-flooding of the dewatered areas remains the primary compensation measure to be implemented at Meadowbank (AEM, 2012b). However, based on the experience of AEM with in-water dike construction, the supplementary compensation projects proposed previously were found to be technically challenging to construct without possible short-term impacts on the aquatic system. The updated habitat compensation plan therefore includes

similar features, with modifications for improved constructability and reduced potential for impact to the receiving environment. A current schedule of completion for the habitat compensation features is provided in Table 1.

2.1 RE-FLOODING OF DEWATERED BASINS AND PITS

As previously stated the major compensation measure proposed for the Meadowbank site is the re-flooding of dewatered basins and associated pits following mining activities. In order to provide the greatest gain:loss ratio possible, considerations for improving fish habitat have been incorporated into the basin and pit designs (e.g. boulder gardens, backfilling of deep pits).

2.1.1 Portage Lakes Area (DFO Authorization NU 03-0191.3)

Post-closure, the Bay-Goose dike will be breached and the impounded area will be gradually re-flooded to re-gain the temporarily lost habitat. The portion of Second Portage Lake between the East Dike and the Central Dike will become part of Third Portage Lake, due to the land-to-lake conversion resulting from the Portage Pit construction. The East Dike will not be breached in order to maintain the current 1 m difference in elevation between Second Portage and Third Portage Lakes.

Prior to re-flooding, a number of habitat improvement measures will be implemented to increase the productive capacity of this area (Figure 1). Construction of a boulder garden feature along the west side of the soft-sediment Bay-Goose Basin will increase habitat suitability in this area. This feature will consist of at least 2.97 ha of heterogeneous, coarse substrate habitat in the <4 m depth zone, just west of the Goose Island Pit. Further, construction of mine-related features (pit caps, roads and dikes) from coarse rock material throughout the basin will create shoals and reefs after re-flooding. In addition, approximately 30% of the area of Portage Pit will be backfilled to a depth of 4-10 m during the construction phase, reducing the amount of ultra-deep water areas, and increasing habitat suitability in this area.

2.1.2 Vault Lake Area (DFO Authorization NU 03-0191.4)

After mining, Vault Pit will connect Vault Lake (and if mined Phaser Lake) to Wally Lake, and the Vault Dike will be breached to allow both lakes to gradually re-fill. Post-closure alterations to Vault and Phaser Lakes[1] will result from construction of pits, pit caps, roads and dikes. Both lakes will be expanded as a result of land-to-lake conversion in the Vault Pit (as shown in Figure 2). Backfilling of a portion of the pit (3.94 ha) in Phaser Lake to 2-4 m depth will reduce the amount of ultra-deep areas. However, the un-filled portion of the pit will provide improved overwintering habitat, which is limited in these relatively shallow lakes.

[1] Although Phaser Lake is not authorized nor part of the most recent Life of Mine, consideration was made in AEM (2012b) to include a conceptual Vault Pit extension that includes a likely HADD of Phaser Lake. As a result, compensation monitoring of the Vault area (including Phaser Lake habitat losses) are considered

Further habitat improvements in these lakes will be made through development of shoals due to permanent roadway construction, areas of mixed substrate from temporary haul roads, and the improvement of the connecting channels between Vault and Wally Lakes, and Vault and Phaser Lakes, to allow fish movement. In particular, the connection to Wally Lake will provide access for arctic char (after further connection to W3 – see Section 2.4), which currently are not present in Vault and Phaser Lakes. Improvement of the connection to Wally Lake will involve deepening the channel inside the Vault Dike to a depth of at least 3 m, while the lake is dewatered, to allow fish passage year-round after removal of the dike.

2.1.3 Dogleg System (DFO Authorization NU 03-0191.3)

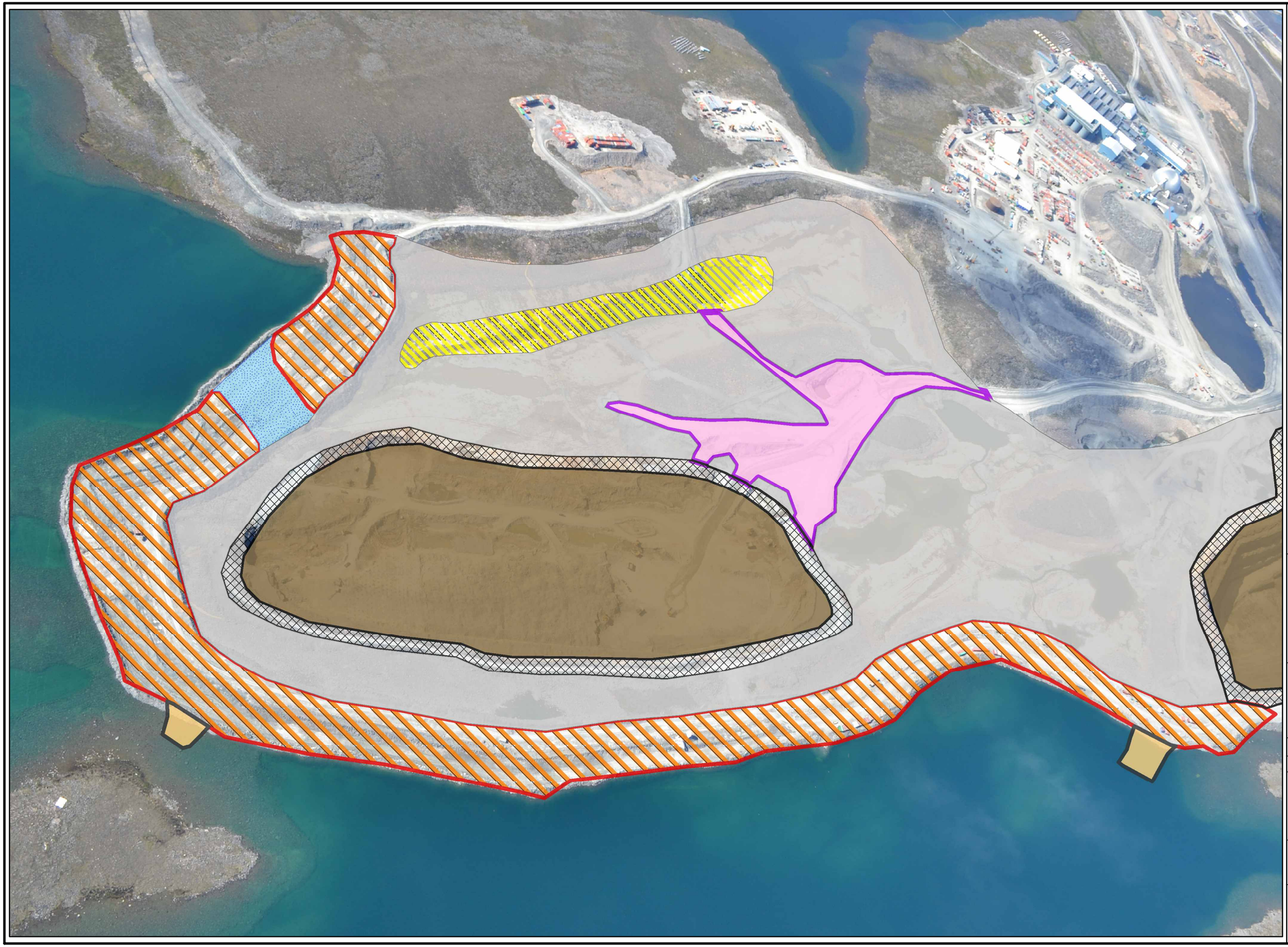
Dogleg Pond and the "North Portage" ponds, Dogleg North Pond and NP-2, are isolated ponds located near the waste rock area, just north of Second Portage Lake. They are shallow ponds, with a maximum depth of 11 m in Dogleg Pond. Dogleg North Pond reaches about 3.8 m in depth, and NP-2 has a small area of about 5 m depth. The project described below was not specifically developed as compensation, but has integrated habitat compensation with water management to result in a small net gain of fish habitat.

NP-2 formerly drained into the TSF area of Second Portage Lake, while Dogleg and Dogleg North drain towards the main body of Second Portage Lake. Since drainage of NP-2 became blocked by the waste rock pile on the northern edge of the TSF, a connecting channel was excavated to direct flow from NP-2 to Dogleg North, effectively increasing the drainage area of Dogleg and Dogleg North Pond. The accompanying increase in wetted area is estimated at 5% for Dogleg Pond, 15% for Dogleg North Pond, and 5% for NP-2.

Through construction of the diversion channel, connectivity between the ponds has been improved, and previously inaccessible habitat in Dogleg North Pond will be available for use by lake trout and round whitefish currently inhabiting Dogleg Pond and NP-2. Eventually these ponds may be seasonally accessible from Second Portage Lake. This connection would theoretically provide access for arctic char to the Dogleg system, but because it is deemed unlikely due to the shallow, ephemeral nature of the connections, access for char is conservatively excluded from habitat gain calculations.

2.2 FINGER DIKES (TAILINGS STORAGE FACILITY- MMER)

In keeping with the original NNLP, a number of finger dikes are proposed to be built, extending from the Bay-Goose Dike into Third Portage Lake. While the original NNLP proposed 19 ha of finger dikes, AEM has found that the method described for construction to pose safety concerns, as well as potential concerns with elevated TSS during settling of material. Therefore, the new finger dikes will be 1 ha in total at their base. Potential locations for each finger dike are shown in Figure 1. Specific locations will be chosen prior to construction. These changes will not alter the monitoring techniques described in Section 4 and 5.



Legend

Post-Closure Features

- Capped roadways
- Dike to remain
- Finger dike
- Breach in dike
- Free dump boulder garden
- Mixed substrate basin
- Pit
- Pit capping

Bay Goose Basin
Conceptual Drawings

POST-CLOSURE FEATURES

DOUGAN & ASSOCIATES
ECOLOGICAL CONSULTING & DESIGN
77 Wyndham Street South • Guelph ON N1E 5R3
T 519.822.1609 • F 519.822.5389 • www.dougan.ca

PROJECT: DA11-062-02

CLIENT: Agnico-Eagle Mines Ltd., Meadowbank Div.

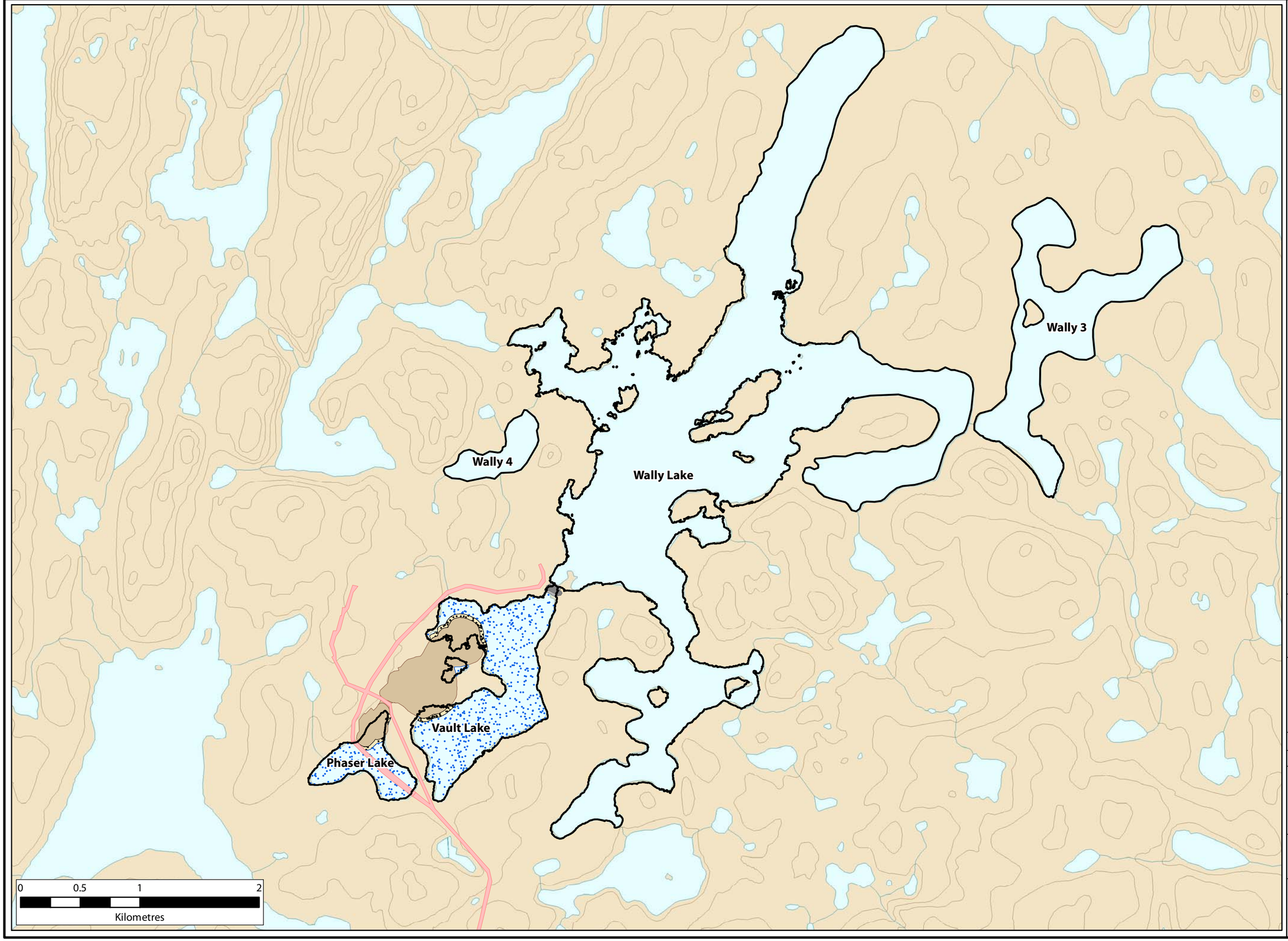
	DATE: OCTOBER 2012
	SCALE: NTS
	DRAWN BY: MAY
	CHECKED BY: RV

W S N
m
UTM Zone 14 NAD83

FIGURE:

1

The information displayed on this map has been compiled from various sources. While every effort has been made to accurately depict the information, this map should not be relied on as being a precise indicator of locations, features, or roads, nor as a guide to navigation. MNR data provided by Queen's Printer of Ontario. Use of the data in any derivative product does not constitute an endorsement by the MNR or the Ontario Government of such products.



Legend

- Study Lakes
- Dike
- Dike Base
- Roads
- Pit
- Pit Cap
- Lake Basin

Features
Vault Lake Area

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77 Wyndham Street South • Guelph ON N1E 5R1
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PROJECT: DA11-062-02

CLIENT: Agnico-Eagle Mines Ltd., Meadowbank Div.

N
W E
S
UTM Zone 14 NAD83

DATE: OCTOBER 2012

SCALE: 1:29,531

DRAWN BY: LC

CHECKED BY:

FIGURE:

2

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2.3 WALLY LAKE ACCESS (DFO AUTHORIZATION NU 03-0191.4)

Wally Lake is a 532 ha lake connected to Vault Lake (see Figure 2) via a seasonally passable channel. Fish movement between these lakes is currently almost nil and this channel will be diked prior to de-watering of Vault Lake. Information in baseline studies indicates that the only large bodied fish in Wally, Vault and Phaser Lakes are lake trout and round whitefish. In 2012, follow-up studies were completed which confirmed these results.

Wally 3 (W3) is a smaller lake (approximately 100 ha), which seasonally is hydraulically connected to Wally Lake via an impassable channel. No fish were found to use this corridor in baseline studies. Follow-up studies conducted in 2011 used fine mesh index gill nets to quantitatively determine the species composition, size and catch-per-unit-effort in the southern basin. Lake trout, round whitefish and arctic char were found to inhabit this relatively small but deep lake.

Topographical surveys conducted in this area indicated that water levels in Wally Lake and W3 are similar (within cm), and therefore slight deepening of the connecting channel through selective substrate removal and excavation during winter would provide access to Wally Lake for the isolated arctic char population in W3.

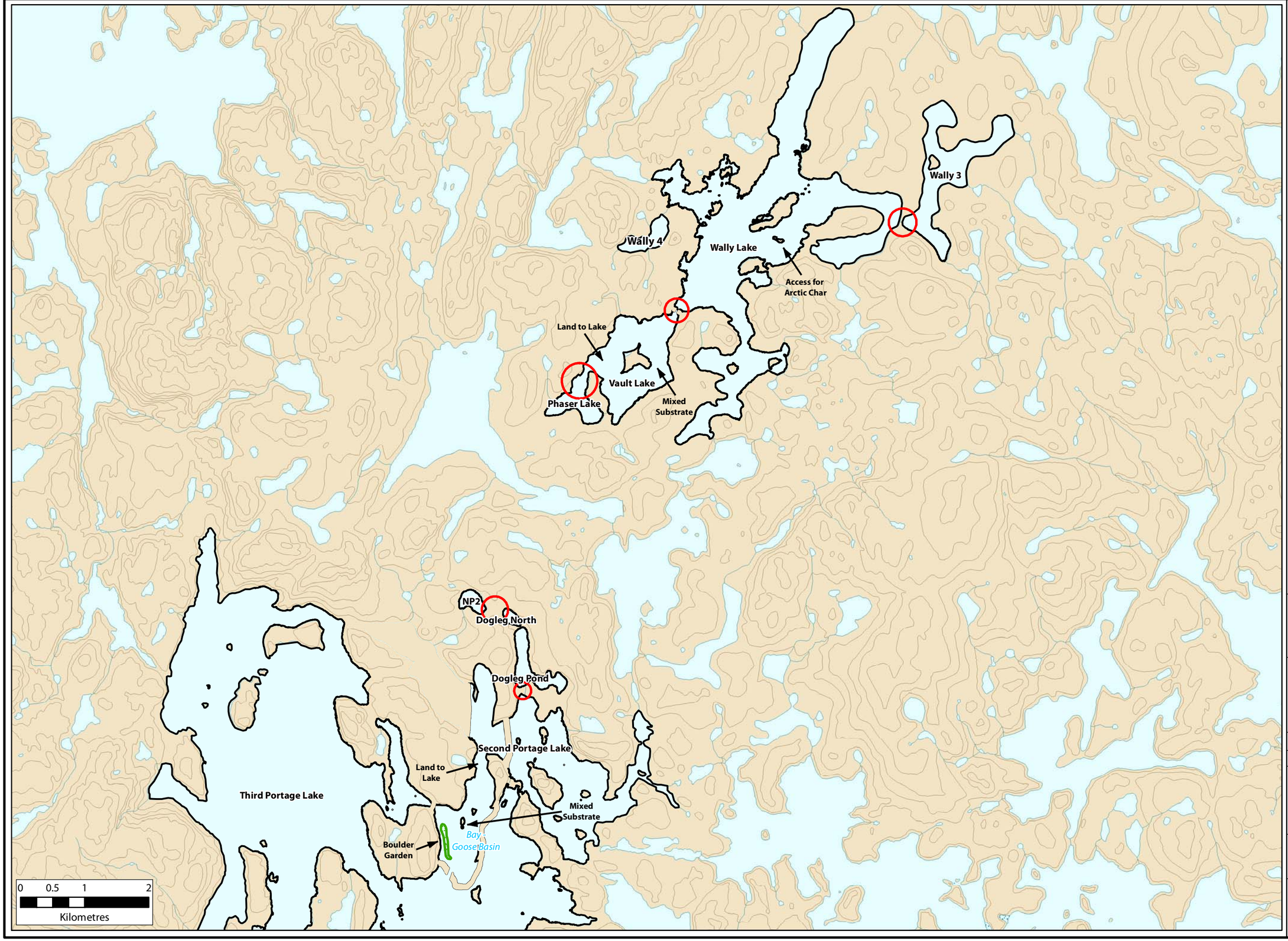
In addition, improvement of the channel between Wally Lake and Vault Lake, post-closure, would further allow movement of char into Vault and Phaser Lakes (as Phaser Lake will be connected to Vault Lake through the Vault Pit). In order to make this channel passable year-round and provide access to newly created deep habitat in the Vault Pit, a passage will be excavated while Vault Lake is dewatered.

As discussed in the NNLP, it is suspected that the lack of char in Wally, Vault and Phaser Lakes is due to historical isolation and the lack of deep-water habitat, which is preferred by this species. Pit development in the Vault Lake area will provide a significant quantity (approximately 45 ha) of this deep-water habitat, which is limited in the Vault Lake Area, but is prevalent in all nearby char-bearing lakes.

2.4 AWAR FISHERIES COMPENSATION

As part of the habitat compensation plan for construction of the roadway between Baker Lake and the mine site, a spawning pad was constructed in 2009 near bridge crossing R02 (Figure 3). This habitat compensation project was constructed according to design specifications that met biological criteria aimed at enhancing arctic grayling productivity in this stream system. The construction focused on creating high value spawning and nursing habitat to compensate for the loss of the low and medium value habitat affected by bridge abutment construction at the four crossings. An overview of the Meadowbank area post-closure, incorporating all compensation features, is shown in aerial photo below.

Figure 3- Aerial Photo of R02 Habitat Compensation Feature- Taken in September 2009



Legend

- Study Lakes (Post-Closure)
- Improved Access

Meadowbank Minesite
Post-Closure

DOUGAN & ASSOCIATES
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PROJECT: DA11-062-02

CLIENT: Agnico-Eagle Mines Ltd., Meadowbank Div.

N W E S
UTM Zone 14 NAD83

DATE: OCTOBER 2012

SCALE: 1:55,000

DRAWN BY: LC

CHECKED BY:

FIGURE:

4

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SECTION 3 • HISTORICAL MONITORING

Until now, monitoring has proceeded according to the 2008 HCMP (Azimuth, 2008). Based on construction to date, this includes monitoring of the East and Bay-Goose Dikes. Since construction of the East Dike in 2008, two rounds of monitoring have been reported (Azimuth 2010a, AEM 2012a). One round of monitoring has been reported since completion of the Bay-Goose Dike in 2010 (AEM 2012a). These monitoring reports focus on the ecological components of the HCMP. Although monitoring the structural integrity of the compensation features is a component of the 2008 HCMP, results of this analysis are detailed in the as-built reports, sent to NWB on December 17, 2009 (East Dike), May 14, 2013 (Bay-Goose Dike) and June 12, 2009 (AWAR).

3.1 INTERSTITIAL WATER QUALITY

Water samples were collected from between the rocks of the dike face using a tube sampler and electronic pump, and were analyzed for conventional parameters (hardness, conductivity, pH, and total dissolved and suspended solids), anions (alkalinity, chloride and sulfate), nutrients (ammonia, nitrate, nitrite, total Kjeldahl nitrogen, orthophosphate and total phosphate), organic parameters (chlorophyll-a, dissolved and total organic carbon) and total and dissolved metals at an accredited facility. While TSS was elevated in 2009, this was likely due to sediment re-entrainment during sampling. The dissolved aluminum guideline was exceeded in one sample in 2009 due to marginally low pH, but this trend did not recur with additional sampling. Total phosphorus concentrations exceeded CCME guidelines in both years, but since orthophosphate was at or below detection, no potential ecological concerns were identified.

3.2 PERIPHYTON COMMUNITY

Density, biomass and composition of the periphyton community were measured in the shallow zone by collecting a sample from the rock face with a specialized scrubber. Underwater video imagery was used to qualitatively examine periphyton growth in the deep zone. Periphyton was found to colonize rocks in shallow areas in the first year after construction of both dikes, and increasing likeness to reference stations (in both density and composition) was evident year over year.

3.3 FISH USE

In 2009, a variety of methods were tested to monitor fish use of the dike face, including hydroacoustic surveys, minnow traps, gill nets and visual observation. Only gill nets were found to be effective, and this method alone was used in 2011. Fish use of the dike faces

was documented at rates no lower than reference stations, even in the first year after construction.

3.4 AWAR MONTORING

Length and weight measurements and maturity identifications of adult fish captured in hoopnets have been recorded at AWAR crossings since 2005 (prior to construction). Nets are set to capture both upstream and downstream movements, and are set as soon as ice conditions allowed. Flow speed and water temperature measurements are also conducted at each crossing. Additionally, larval drift catches have been collected at crossing R02 since 2005, where the compensation feature was constructed in 2009.

Generally, condition factors of adult fish, population size distributions and timing of upstream and downstream movements did not change pre- and post-construction of the AWAR crossings. Flow speeds at all crossings were within published arctic grayling sustained or prolonged speeds, indicating the bridge structures likely are not physically affecting ability of grayling to move upstream. It is suspected that the primary upstream migration occurs below ice cover or immediately at ice-off, since arctic grayling larval drift has been consistently caught within 1-3 days of study initiation.

An examination of the history of arctic grayling populations at R02 indicates that the constructed spawning pad may be allowing an increase in successful spawning runs, with increasing larval drift collected at all drift trap locations beginning in 2009. The increasing proportion of immature arctic grayling since that time also suggests that more fish are being recruited into the population than pre-construction.

SECTION 4 • MONITORING COMPONENTS AND METHODS

Habitat gains at Meadowbank are derived through both physical improvements to existing habitat (e.g. creation of reefs), and the facilitation of access to new habitat (e.g. previously fishless or underutilized areas). As per the original fisheries authorization, regardless of the type of compensation, both physical and ecological components are included in the monitoring plan, to record whether each feature is constructed and is functioning as intended.

This updated monitoring program maintains the major elements of the 2008 version (structure, water quality, periphyton and fish use), while modifying timelines and methods based on past experience, new compensation features (AEM, 2012b), current life-of-mine designs and to meet the conditions of the updated Fisheries Authorizations.

4.1 PHYSICAL COMPONENTS

Since the habitat evaluation procedure focuses on quantifying losses and gains to habitat, based on physical characteristics (area, depth and type of substrate), physical structure is arguably the most important component to monitor in cases where habitat compensation is derived from constructed features (such as reefs or boulder gardens).

All compensation structures will be assessed post-construction to determine whether they meet the assumptions of the 2012 NNLP. These include area, depth and substrate characteristics. For each feature, a comparison will be made to the specifications described for these characteristics in the NNLP, to determine whether expected habitat gains are achieved in the as-built state. This analysis is separate to as-built reports, which are required under NU-03-0191.4, Condition 6.3, but may make use of information provided in those reports. Analysis reported under the HCMP report will, however, include the photographic evidence (pre-, during and post-construction) of compensation features, as described under NU-03-0191.3, Condition 6.4 and NU-03-0191.4, Condition 6.2. Photographic evidence for the AWAR compensation feature has previously been included in annual AWAR monitoring reports (e.g. AEM, 2010).

In addition to the analysis of depth, area and substrate in the dry basins, structural integrity will be qualitatively assessed after re-flooding for features in the de-watered basins, to record any movement occurring during this process.

Methods of evaluation will depend on the specific compensation feature, as detailed in Tables 3 - 7. In general, methods will include:

On-the-ground photos – photos will be taken of the compensation feature pre-, during and post-construction and included in HCMP reports.

Air photos – will be taken of dry basins just prior to re-flooding, to compare areal extents of compensation features with NNLP predictions. Differences will be estimated visually or by GIS.

Visual observation – conducted to ground-truth substrate types for confirmation in air photos.

Field survey – conducted in the dry to determine depth-below-surface of compensation features.

Bathymetric survey – conducted to determine the final depth contours of compensation features that are constructed in-water.

Underwater video – conducted post-flooding to qualitatively examine structural integrity of constructed features.

Results will be recorded for each compensation feature and compared to the 2012 NNLP estimate in an annual HCMP report, as in the example in Table 2.

The proposed schedule of monitoring is described for each feature in Tables 3 - 7. Analysis of the physical components will occur in the dry for features constructed in de-watered basins, in order to facilitate ground-truthing of substrate and total area. This analysis will occur just prior to re-flooding, such that features are in their final condition. As-built reports will first be consulted to determine if the required information is available. For features constructed in-water (finger dikes, access enhancements), analysis of the physical components will be conducted in the years after construction.

4.2 ECOLOGICAL COMPONENTS

Since successful utilization of the compensation features is also a component of the monitoring requirements under Meadowbank's Fisheries Authorizations, ecological monitoring elements are included for both constructed features and access enhancements.

The major constituents and basic sampling methods for the main components of the monitoring program are maintained from the 2008 HCMP, with some modifications based on field experience. Ecological monitoring components include interstitial water quality, open basin water quality, periphyton community biomass and fish use.

4.2.1 Interstitial Water Quality

Modeling during the EIA process indicated that metals leaching from quarried rock would not significantly impact the aquatic environment. Nevertheless, interstitial water quality of constructed habitat compensation features will be assessed through the HCMP to verify these predictions.

In order to collect a representative sample from the bioactive zone between the rocks, an electric diaphragm pump with food-grade silicon tubing will be used, as in previous years. Samples will be taken at depths between 1 and 4 m, and analyzed in an accredited laboratory for total suspended solids, and total and dissolved metals. Results will be compared to background concentrations and CCME guidelines where available.

4.2.2 Open Basin Water Quality

Modeling during the EIA process indicated that water quality in re-flooded pits and basins would support healthy fish populations. Because the re-flooded areas form part of Meadowbank's habitat compensation, water quality will be monitored as part of the HCMP and in conjunction with the Core Receiving Environmental Monitoring Program (CREMP) in order to determine when breaching of the dike to allow fish access is appropriate. Sampling will be based on procedures and parameters analyzed in the CREMP (Azimuth, 2010b). Analyses will generally be repeated once per sampling event in each pit basin (Goose

Island, Portage and Vault pits), with specific locations determined by experienced field technicians. Analyses will include vertical depth profiles of temperature, DO and conductivity to a representative depth. Secchi depth and surface pH will also be determined at each sampling location. Water samples will be collected from approximately 3 m depth by pumping lake water using weighted flexible (food-grade silicone) tubing, and a diaphragm pump connected to a 12 volt battery. A depth of 3 m is chosen for consistency across all basins and seasons (i.e., sampling at 3 m is still possible in the winter under ice). The lakes are never thermally stratified and are well mixed; given the uncertainty in the end pit water quality, varying depths of samples will be taken. An inline filter is connected to the end of the outflow tube when filling bottles for dissolved metals and dissolved organic carbon analyses.

Water samples will be analyzed by an accredited facility for conventional parameters (hardness, conductivity, pH, turbidity, and total dissolved and suspended solids), anions (alkalinity, bromide, chloride, fluoride, silicate and sulfate), nutrients (ammonia, nitrate, nitrite, total Kjeldahl nitrogen, orthophosphate and total phosphate), organic parameters (chlorophyll-α, dissolved and total organic carbon) and total and dissolved metals. Results will be compared to background concentrations, CREMP trigger or threshold levels and CCME guidelines where available.

4.2.3 Periphyton Community

The periphyton community consists of a collection of microorganisms, including algae, that grow attached to or in very close proximity to submerged substrate. Colonization of the community occurs over time, with rates depending on nutrient and light availability. Periphyton is an important food source for benthic invertebrates, so colonization will be monitored to ensure that quarried rock substrate provides habitat that is as suitable at this level of the food chain as natural substrate.

A specialized scrubber will be used to collect periphyton samples from a prescribed area of rock face, in order to calculate biomass ($\mu g/cm^2$). Results will be compared to baseline data, and historical monitoring programs.

4.2.4 Fish Use

4.2.4.1 Mine Site Monitoring

The ultimate goal of NNL planning is to provide suitable habitat for fish populations. Although fish use of a specific feature may be difficult to determine quantitatively, the presence of fish around habitat features would indicate no behavioural tendency to avoid these areas. Fish presence in the vicinity of constructed dikes, in re-flooded basins and in connecting channels of access enhancement projects will therefore be verified.

Since the use of gill nets has historically been found to result in elevated incidences of mortality, angling and underwater motion camera techniques will be used to establish fish presence around the constructed compensation features and in open basins. Catch per unit effort and physical characteristics (species, length, weight, maturity) will be recorded. If

these techniques are not successful, a DFO representative will be contacted and the use of gill nets may need to be included. Hoopnets, which consist of either a 4 ft (1.22 m) or 3 ft (0.9 m) diameter front hoop will be deployed in the W3 connecting channel to determine whether Arctic char are moving into Wally Lake, and at dike breaches to assess fish movement into the re-flooded basins. Hoopnets have interior hoops and traps that prevent fish from escaping but provide enough space in the cod end for fish to survive. Wings are attached to the front hoop to direct fish into the hoopnet.

4.2.4.2 AWR R02 Compensation Monitoring

Monitoring fish use of the compensation structure at R02 will continue as previously. This monitoring program consists of sampling adult fish populations using hoopnets, and assessing reproductive activity using larval drift traps.

As described above, hoopnets consisting of either a 4 ft (1.22 m) or 3 ft (0.9 m) diameter front hoop will be used to target arctic grayling. The captured fish are gently removed by field technicians from the nets using dip nets, placed in large tubs filled on location with stream water for biological processing and then placed in a recovery tub. The fish are released up or downstream of the hoopnets (depending on the fish's migration direction) following handling. Biological processing includes measurement of fork length, weight and maturity.

Hoopnets are placed adjacent to the habitat compensation area, in a riffle/ side channel area upstream of the bridge and downstream of the compensation area, and immediately upstream of the culverts. Nets are set with the goal of capturing the maximum number of fish moving beyond the R02 bridge crossing, but also to assist in determining effectiveness of the R02 habitat compensation area.

Larval drift traps were placed in representative, high to moderate flow sections of the stream, both upstream and downstream of the habitat compensation feature. These traps consist of a square sided cone with a ridged frame that funnels into a 0.5 mm nitex mesh bag. Attached at the back of the nitex bag was a Nalgene®-type container where the drift is collected. The frame is submerged at least halfway under water and secured by poles on each side. Drift traps will be checked at least every other day. Larval drift will be identified in the field and preserved in vials of diluted formalin.

4.3 FREQUENCY

Previously, monitoring for interstitial water quality, periphyton growth and fish use was proposed for years 1, 3, 5 and 10 post-construction of each feature (Azimuth, 2008). Under the current plan, the frequency of these monitoring events is proposed for every other year following construction, until 2021, with additional sampling in 2025 (all areas) and 2030 (Vault area and central dike only). The sampling schedule and general locations are

described in Tables 3 - 7. Specific sampling locations will be determined in the field by a qualified environment technician or biologist.

SECTION 5 • QA/QC AND CRITERIA FOR SUCCESS

5.1 LABORATORY QA/QC

Water Quality – Data Quality Objectives (DQOs) are numerically definable measures of analytical precision and completeness. Analytical precision is a measurement of the variability associated with duplicate analyses of the same sample in the laboratory. Completeness for this study is defined as the percentage of valid analytical results. Duplicate results will be assessed using the relative percent difference (RPD) between measurements.

The laboratory DQOs for this project are:

Analytical Precision = 25% RPD or less for concentrations that exceed 10x the method detection limit (MDL).

Completeness = 95% valid data obtained.

Periphyton Community – Laboratory analyses for periphyton samples will be conducted by experienced scientists following a standardized procedure (i.e., quality assurance), internal quality control samples (e.g., duplicate counts) will be included to document analytical variability.

5.2 FIELD QA/QC

Water Sampling – Field QA/QC standards during water sampling will be maintained for every sample. The standard QA/QC procedures include thoroughly flushing the flexible tubing and pump to prevent cross-contamination between stations and thoroughly rinsing the sample containers with site water prior to sample collection. Trip blanks and field duplicates will be collected (approximately 1 per 10 samples). Field duplicates assess sample variability and sample homogeneity; a RPD of 50% or less for concentrations that exceed 10x the MDL is considered acceptable.

Periphyton Community – Standard procedures will be used to collect biota samples. All sampling gear will be thoroughly rinsed between sampling stations to ensure that there was no inadvertent introduction of biota from one station to another. A field duplicate will be collected for phytoplankton at one sampling station per sampling event to assess sampling variability and sample homogeneity. Due to large natural variability and the qualitative

nature of this component, no specific RPD acceptability criterion is recommended for density and biomass.

Fish Use – These study components will be conducted in accordance to the general practices listed previously. All relevant spatial and depth information will be recorded. Fish biological data will be recorded as will reference spatial information. Field notebooks or field sheets will be used to compile notes and observations relevant to the studies. Fishing will be carried out by experienced technicians or biologists who are very familiar with this kind of work. Video/photo survey data will be conducted carefully to provide representative images of target communities. All relevant spatial and depth information will be recorded and identified by the time stamp (or photo number) and tape number (or memory card number).

5.3 CRITERIA FOR SUCCESS

The intent of NNL planning is to replace HADD-related habitat losses and to maintain the productive capacity of the system. Consistent with the original habitat compensation monitoring plans, since lakes in the Meadowbank area are ultra-oligotrophic and productivity is nutrient-limited rather than habitat-limited, criteria for success will be focused primarily on capability to support fish, rather than on actual use.

The following success criteria will be used to evaluate this capability.

5.3.1 Physical Structure

In order to provide the required habitat gains, constructed features should meet the specifications described for area, depth and substrate in the NNLP. Where specifications are not met, the total habitat units afforded by the feature in its as-built state should be calculated. If there is a deficiency in habitat units site-wide, DFO will be consulted.

5.3.2 Interstitial Water Quality

Water chemistry results will be compared to reference locations, CCME water quality guidelines. Since analysis of large in-water features (dikes) to date has not indicated any significant adverse effects on water quality, success criteria are expected to be met in the future. However, if necessary, follow-up sampling will be conducted as soon as practical (next ice-free season). If water quality criteria do not meet background or CCME guidelines after two monitoring events, risk-based toxicity reference values will be compared, and additional testing, such as laboratory toxicity tests will be considered. Because onsite experience indicates that adverse effects are unlikely, any additional testing would be determined in consultation with DFO in the unlikely situation that it is required.

5.3.3 Open Basin

Long-term water quality predictions made during the initial planning phase of the project (Cumberland, 2005) indicated that although some water quality parameters in the Vault and

Portage Pit lakes may exceed CCME criteria in year 10 post-closure, they would be within the same order of magnitude, which was recognized as the sensitivity limit of the modelling exercise. In particular, CCME exceedances were predicted for cadmium, zinc and arsenic in the Bay-Goose/Portage area, and for aluminum, arsenic, cadmium, copper, fluoride, mercury, and unionized ammonia (NH_3) in the Vault area. In addition, a temporary chemocline was predicted to occur 100 m below water surface in the Portage pit. Since pit backfilling is now prescribed for that area, this may not be a factor.

Since the pits are to be flooded with water from adjacent lakes, chemistry is expected to be similar. During HCMP monitoring of the re-flooded basins, water chemistry results will be compared to reference locations, CREMP trigger/ threshold levels, and CCME guidelines where available. The dike will be breached to allow mixing with adjacent lakes and fish entry once water quality meets these criteria during three sequential sampling events.

5.3.4 Periphyton Community

Since lakes in the Meadowbank region are ultra-oligotrophic and ice-covered for the majority of the year, periphyton development is expected to be slow and no specific criteria are provided for this monitoring component. However, based on experience to date, the periphyton community is expected to be visible on new substrate within the first year after deposition.

5.3.5 Fish Use

5.3.5.1 Mine site monitoring

The premise of NNL planning is that habitat compensation will increase the productive capacity of water bodies. Since it is recognized that factors other than habitat quantity or quality may limit fish population growth, no specific criteria for success are prescribed for this metric. Observations of the East and Bay-Goose Dikes have indicated fish presence around these features is no lower than in reference areas, so this trend is expected to continue.

5.3.5.2 AWR R02 Compensation Monitoring

As above, no specific criteria are established for determining success of the spawning pads constructed at R02 based on fish use metrics (hoopnet catch, larval drift). Based on results to date, however, the number of successful spawning events has increased in this reach relative to pre-construction.

SECTION 6 • REPORTING AND PLAN REVIEW

As required according to Table 3, Habitat Compensation Monitoring Plan reporting will be included in the annual AEMP report for the monitoring events occurring in the previous year.

The HCMP will be reviewed as required by the Meadowbank Environment Superintendent in consultation with the Mine General Manager, and updated as necessary based on changes to mine site designs. All changes will be provided to DFO for approval.

SECTION 7 • REFERENCES

Azimuth, 2008. Habitat Compensation Monitoring Plan, Meadowbank Gold Project. Prepared by Azimuth Consulting Group Inc. for Agnico-Eagle Mines Ltd. May, 2008.

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AEM. 2012a. Aquatic Effects Monitoring Program – Habitat Compensation Monitoring 2011, Meadowbank Gold Project. Report prepared by Azimuth Consulting Group Inc. for Agnico-Eagle Mines Ltd.

AEM, 2012b. No Net Loss Plan. Agnico-Eagle Mines – Meadowbank Division. October 15, 2012.

Cumberland, 2005. Meadowbank Gold Project - Water Quality Predictions. October, 2005.

TABLES

Table 1. Estimated timeline for the construction of fish habitat structures (adapted from Table 4-10 in AEM, 2012b).

Lake	Feature Name	Date of Completion
Second and Third Portage Lakes	In-basin habitat improvements	Ongoing until re-flooding
	Re-flooded basins and pits	2014- closure
	Finger dikes	2015- closure
Vault and Phaser Lakes*	In-basin habitat improvements	2014 until re-flooding
	Re-flooded basins and pits	Closure and reclamation (2018 – 2023)
	Access for arctic char	Closure and reclamation (2018 – 2023)
Dogleg System	NP-2 channel	2013
	NP-2 (increase in area)	2013- closure
	Dogleg North Pond (increase in area and access)	2013- closure
	Dogleg Pond (increase in area)	2015- closure
Wally Lake	Access for arctic char	2016- closure

Table 2. Example comparison of NNLP designs and as-built physical properties of habitat compensation features.

Feature	Assessment Metric*	Method	Design	As-Built
Boulder garden	Area	Air photo	2.97 ha	3.5 ha
	Substrate	Visual observation	Coarse	Coarse
	Depth	Field survey	> 4 m	> 4 m
	Stability	Underwater video	-	Minor movement

*Area, depth, substrate type or stability

Table 3. Summary of monitoring methods, analytical parameters, sampling frequency and number of samples for dike faces and finger dikes (under MMER Schedule II TSF and DFO NU-03-0191.3). *Dike as-built designs were incorporated into the 2012 NNLP. Flooding is estimated to be completed in 2023

Compensation Feature	Component	Reason	Method	Parameters	Completed Sampling	Number of Samples	Sampling Schedule
East Dike	Interstitial water	Possible metals leaching	Tube sampler	TSS Total and dissolved metals	2009 2011	2 locations (exterior) and 2 locations (interior, post-flooding)	2015, 2017, 2019, 2021 (Odd-numbered years until 2021) 2025
	Periphyton	Base of food chain	Periphyton sampler	Biomass	2009 2011	2 locations (exterior) and 2 locations (interior,	As above

Compensation Feature	Component	Reason	Method	Parameters	Completed Sampling	Number of Samples	Sampling Schedule
						post-flooding)	
	Fish use	Confirm use by fish	Angling Underwater motion camera	CPUE, physical characteristics	2009 2011	2 locations (exterior) and 2 locations (interior, post dike breach)	As above
	Structure	Design intent met	As-built designs	Area, substrate, depth zone	2012*	-	-
		Stability	Underwater camera	Qualitative observations	2009 2011	Vertical transects at 5 locations	-
Bay Goose Dike	Interstitial water	Possible metals leaching	Tube sampler	TSS Total and dissolved metals	2011	3 locations (exterior) and 3 locations (interior, post flooding)	Odd-numbered years until 2021; 2025
	Periphyton	Base of food chain	Periphyton sampler	Biomass	2011	3 locations (exterior) and 3 locations (interior, post flooding)	As above
	Fish use	Confirm use by fishing	Angling Underwater motion	CPUE Physical characteristics	2011	3 locations (exterior) and	As above

Compensation Feature	Component	Reason	Method	Parameters	Completed Sampling	Number of Samples	Sampling Schedule
			camera			3 locations (interior, post flooding)	
	Structure	Design intent met	As-built designs	Area, substrate, depth zone	2012*	-	-
		Stability	Underwater camera	Qualitative observations	2011	Vertical transects at 10 locations	-
Finger Dikes	Interstitial water	Possible metals leaching	Tube sampler	TSS Total and dissolved metals	-	2 locations	Odd-numbered years until 2021 2025
	Structure	Design intent met	Photos Field survey	Area, substrate, depth zone	-	-	Upon construction
		Stability	Underwater camera	Qualitative observations	-	One vertical transect of each dike	Upon construction
Central Dike	Interstitial water	Possible metals leaching	Tube sampler	TSS Total and dissolved metals	-	2 locations	After flooding, odd-numbered years until 2021 2025 2030
	Structure	Design intent	As-built	Area, substrate,	-	-	Prior to

Compensation Feature	Component	Reason	Method	Parameters	Completed Sampling	Number of Samples	Sampling Schedule
		met	designs	depth zone			flooding
		Stability	Underwater camera	Qualitative observations	-	Vertical transects at 5 locations	2025 (post flooding)

Table 4. Summary of monitoring methods, analytical parameters, sampling frequency and number of samples for compensation features constructed in the Portage basin (Under MMER Schedule II and DFO NU-03-0191.3). Year of re-flooding completion est. 2023 (F). Year of dike breach est. 2025.

Compensation Feature	Component	Reason	Method	Parameters	Number of Samples	Sampling Schedule
Basin	Structure	Design intent met	Air photos Field survey	Area, substrate, depth zone	-	Prior to flooding
	Open basin water quality*	Possible metals leaching, anoxia	Tube sampler Grab samples Depth profiles	Conventional parameters; Anions; Nutrients; Organic parameters; Total and dissolved metals	1 per pit area	3 x yr from F until dike breach Afterwards, as per CREMP
	Fish use	Confirm use (re-flooded basin and at dike breach)	Angling Underwater motion camera Hoopnets	CPUE Physical characteristics	TBD by field staff	2025 2030
Roads	Structure	Design intent met	Air photos Field survey	Area, substrate, depth zone	-	Prior to flooding
		Stability	Underwater camera	Qualitative observations	Representative transects TBD by field staff	2025 (post flooding)
Pits	Structure	Design intent met	Air photos	Area, substrate, depth zone	-	Prior to flooding

Compensation Feature	Component	Reason	Method	Parameters	Number of Samples	Sampling Schedule
			Field survey			
Boulder garden	Structure	Design intent met	Air photos Field survey	Area, substrate, depth zone	-	Prior to flooding
		Stability	Underwater camera	Qualitative observations	Representative transects TBD by field staff	2025 (post flooding)

*Monitoring and sampling protocols will be developed and conducted in-line with CREMP sampling

Table 5. Summary of monitoring methods, analytical parameters, sampling frequency and number of samples for compensation features constructed in the Vault and Phaser basins (Under DFO NU-03-0191.4). Year of re-flooding completion est. 2023 (F). Year of dike breach est. 2025.

Compensation Feature	Component	Reason	Method	Parameters	Number of Samples	Sampling Schedule
Basin	Structure	Design intent met	Air photos Field survey	Area, substrate, depth zone	-	Prior to flooding
	Open basin water quality*	Possible metals leaching, anoxia	Tube sampler Grab samples Depth profiles	Conventional parameters; Anions;Nutrients; Organic parameters;Total and dissolved metals	1 per basin	3x yr from F until dike breach Afterwards, per CREMP
	Fish use	Confirm use (re-flooded basin and at dike breach)	Angling Underwater motion camera Hoopnets	CPUE Physical characteristics	TBD by field staff	2025 2030
Roads	Structure	Design intent met	Air photos Field survey	Area, substrate, depth zone	-	Prior to flooding
		Stability	Underwater camera	Qualitative observations	Representative transect TBD by field staff	2025 (post flooding)
Pits	Structure	Design intent met	Air photos Field survey	Area, substrate, depth zone	-	Prior to flooding

*Monitoring and sampling protocols will be developed and conducted in-line with CREMP sampling

Table 6. Summary of monitoring methods, analytical parameters, sampling frequency and number of samples for access enhancement compensation features (Under DFO NU-03-0191.3 and DFO NU-03-0191.4).

Feature	Component	Reason	Method	Parameters	Number of Samples	Sampling Schedule
Dogleg Ponds	Structure	Design intent met (monitor water levels, especially access to Dogleg North)	Bathymetric survey	Area of ponds, depth of access channels	All three ponds and connecting channels	2015, 2017, 2019, 2021 (Odd-numbered years); 2025
	Fish use	Confirm use by fish	Angling Underwater motion camera	CPUE Physical characteristics	TBD by field staff	Odd-numbered years until 2021; 2025
W3 Access	Structure	Design intent met (W3 passage constructed as intended)	Bathymetric survey	Width, depth of excavation	-	Upon completion
	Fish use	Confirm movement of Arctic char into Wally Lake	Hoopnets at channel	CPUE Physical characteristics	TBD by field staff	Odd-numbered years after completion 2025 2030

Table 7. Summary of monitoring methods, analytical parameters, sampling frequency and number of samples for All Weather Private Access Road R02 (bridge 1) habitat compensation features.

Feature	Component	Reason	Method	Parameters	Completed Sampling	Sampling Schedule
Spawning pads	Structure	Design intent met	As-built report	Area, substrate	2009	-
		Stability	Visual observation	Qualitative observations	2010 2011 2013	Every-other year (Odd-numbered years) until 1 year after the road is decommissioned (last monitoring estimated in 2031)
	Fish use	Confirm use by Arctic grayling	Hoopnets set downstream and upstream Larvae traps	CPUE Physical characteristics	2009 2010 2011 2013	As above

MEADOWBANK GOLD PROJECT

Emergency Response Plan

Prepared by:
Agnico-Eagle Mines Limited – Meadowbank Division

Version 6
August 2013

EXECUTIVE SUMMARY

The Emergency Response Plan (ERP) is activated when an operations-related emergency, accident or malfunction occurs, or if such an incident is foreseeable. The ERP outlines potential emergency scenarios, initial actions for emergencies and the internal and external resources available including personnel, emergency response equipment and communication systems.

The ERP will be reviewed and updated as required, but on a minimum basis of at least once per year.

IMPLEMENTATION SCHEDULE

This Plan will be immediately implemented**.**

DISTRIBUTION LIST

AEM – General Mine Manager / Designate

AEM – General Superintendent Operations

AEM – General Superintendent Maintenance

AEM - General Superintendent General Services

AEM – Health and Safety Superintendent / Designate

AEM – Human Resources Superintendent / Designate

AEM – Engineering Superintendent / Designate

AEM – Geology Superintendent / Designate

AEM – Environment Superintendent / Designate

AEM – Mill Superintendent / Designate

AEM – Site Services Superintendent / Designate

AEM – Mine Superintendent / Designate

AEM – Maintenance Superintendent / designate

AEM – Emergency Response Counselors

AEM – OHSC Co-chairs

AEM - Security

DOCUMENT CONTROL

Version	Date (YMD)	Section	Page	Revision
1	08/10/31	Appendix A		Revision to include East Dike design modifications
2	09/11/16	All Sections		Confirmation of specific details and procedures Account for as-built designs and emergency preparedness for dike failure scenarios
3	12/01/31	All Sections		Review of all the documents
4	12/07/27	All Sections		Review of all documents
5	13/05/21	All Sections		Review of all documents – logo change – Duty cards
6	13/08/09	All Sections		Added appendixes at back
7	13/09/05	All Sections		Updated information on Dykes, Storm Water

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Health and Safety Superintendent

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Environment Superintendent

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General Manager

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SECTION 1 • INTRODUCTION

1.1 PURPOSE AND SCOPE OF THE EMERGENCY RESPONSE PLAN

The purpose of this Emergency Response Plan (ERP) is to provide a consolidated source of information for employees, contractors, and site visitors to respond quickly and efficiently to any foreseeable emergency that would likely occur at the Meadowbank project site. This ERP forms a component of the Environmental Management System (EMS) for the Project. As such, it is a working document that will be reviewed and updated on a regular basis as mine development, construction and operations proceed.

This ERP addresses gold mining, processing, transportation and related activities at the Meadowbank site as well as possible emergency scenarios that may occur off-site along the All Weather Private Access Road or at the Baker Lake Marshalling Facility. Guiding the development of this document has been the principle that an effective ERP must provide:

- A clear chain of command for safety and health activities;
- Well-defined corporate expectations regarding safety and health;
- Comprehensive hazard prevention and control methods; and
- Record-keeping requirements to track program progress.

AEM will ensure that all employees, contractors and site visitors fully understand and comply with all legislated safety standards, and the policies and procedures outlined in the ERP.

This ERP will be reviewed annually, or more frequently as required, to ensure compliance with applicable legislation, to evaluate its effectiveness and to continually improve the procedures. All employees, contractors and site visitors are encouraged to offer suggestions for ways to eliminate potential hazards and improve work procedures.

1.2 AEM'S POLICY STATEMENT

AEM is committed to protecting the health and safety of all its workers and the environment, and to adhering to all legislated safety standards. The necessary resources will be available to respond quickly and efficiently to all emergencies to prevent injury to, or degradation of, the health of individuals or the environment. In implementing this emergency response policy, AEM will set preparedness targets and report its progress on a regular basis.

To this end:

All relevant safety and emergency response laws and regulations will be incorporated into the ERP as minimum standards.

Senior management is responsible for making funds and other resources available, including hiring and training qualified personnel, to ensure the successful implementation of the ERP in the event of an emergency.

All supervisors are responsible for ensuring that their employees are aware of, and trained in, the proper emergency response procedures and that procedures and contact information are posted in all work areas. Supervisors are also responsible for ensuring that all employees follow safe work methods and all related regulations to prevent emergencies from occurring, and that they are provided with the proper tools to do so, including Personal Protective Equipment (PPE).

An emergency response team and coordination centre is establishes at the Meadowbank site.

The ERP will be tested on a periodic basis to ensure its effectiveness.

1.3 POLICY WITH RESPECT TO CONTRACTORS AND VISITORS

Every person working at or visiting the Meadowbank site receives an orientation upon arrival and as such is apprised of, and required to follow the ERP policies and procedures set forth in this manual. For a list of responsibilities, see Section 2.

Major contractors, such as those for mining and hauling, are required to have their own HS services. This is verified by AEM management prior to engagement of the contractor.

1.4 ENVIRONMENTAL POLICY

AEM is committed to achieving a high standard of environmental care in conducting its mineral exploration activities. AEM's Environmental Policy includes:

- Compliance with all applicable legislation including laws, regulations, and standards. Where laws do not exist, appropriate standards will be applied to minimize environmental impacts resulting from exploration activities.
- Open communication with government, the community, and employees on environmental issues.
- Development and adherence to management systems that adequately identify, monitor, and control environmental risks associated with AEM's exploration activities.
- Assurance that the employees are aware of their responsibilities and comply with AEM's Environmental Policy and field guide.

It is the policy of AEM to protect the environment, public health and safety, and natural resources by conducting operations in an environmentally sound manner while pursuing continuous improvement of our environmental performance.

SECTION 2 • ORGANIZATIONAL AND RESPONSIBILITIES

This section details the roles and responsibilities of all parties involved in emergency response planning and implementation at the Meadowbank mine site.

2.1 GENERAL MANAGER

The General Manager is responsible for implementing and maintaining the ERP. In addition, the General Manager's responsibilities are to:

- Act as a spokesperson on behalf of AEM with the public, media, and government agencies, as required;
- Prepare and submit any formal reports (within the required time frame) to regulators and AEM management detailing the occurrence of an emergency; this includes submitting an incident reporting form;
- Ensure that the Health & Safety and Environment Superintendents have the means (financial and otherwise) to ensure that all required resources are made available, or provided from off-site if required;
- Work with the H&S, Human Resources and Environment Superintendent to evaluate what training is required by all staff, ensure that all staff are given appropriate training, and ensure that all staff are retrained as needed;
- Ensure that the Human Resources Superintendent has the means (financial and otherwise) to ensure that all employees' training requirements are current;
- Ensure that inspections of emergency response training practices and emergency response equipment are carried out;
- Ensure that emergency response exercises are conducted annually,
- Ensure that the results of the regular inspections are used to improve emergency response practices, and improve relevant plans accordingly;
- Complete an annual detailed review of the ERP with the management team and the Join Health and Safety Committee with particular emphasis on the objectives and methods of the plan, and the job descriptions of all positions named within;
- Ensure that updates to new emergency communications information (new phone numbers, changes in reporting structure, etc.) are distributed as soon as the new information becomes available;
- Keep a formal record of distribution and amendments to the ERP; and

2.2 EMERGENCY CONTROL TEAM – ***ON SITE MANAGEMENT TEAM***

Appendix: MBK-HSS-3001-F-A Emergency Response Plan - Organizational Flowchart

No single department can handle an emergency situation alone. Everyone must work together to manage the emergency and coordinate the effective use of all available resources.

Therefore at the time of any emergency, all the management team and/or their designate must report to the 3rd floor Emergency Response Control room #1 or to the Emergency Response Control Room #2, at the Training room or to the Emergency Response Control Room #3 at the Meadowbank gatehouse.

The Emergency Control Team structure lends support, fosters efficiency and provides additional knowledge during an emergency response situation.

The Official In-Charge, (General Mine Manager or Designate) maintains the overall coordination and direction of the Emergency and ensures the continued safety of all employees and the public.

However, the Superintendent or designate of the Area affected by the emergency, will assist with the development of the overall emergency response plan.

The remainder of the Emergency Control Team will be given specific tasks to perform that will assist with the management and coordination of the emergency response plan.

Roles & Responsibilities of the Emergency Control Group (See Duty Cards)

2.2.1 Official In-Charge

The Official In-Charge (General Manager or designate) will take charge for overseeing and approving the overall emergency strategy.

Immediate duties of the Official In-Charge include:

- Consult with the Incident Commander the status of emergency.
- Appoint an Emergency Log Recorder to maintain a written record of the time and events, including all discussions, instructions and decisions made by the Emergency Control Team;
- Appoint a Muster Station Coordinator, who will ensure that proper head counts are conducted at three (3) designated Muster Stations.
- Issues specific tasks to the members of the Management as they arrive at the Control Room, as per this guideline;
- Brief the Emergency Control Team;
- Ensure that the safety of personnel is maintained, throughout the operation.

- Ensure procedures are in place for prompt dispatch of requested personnel, materials and equipment to the emergency area.

- Arrange for all reports to be presented at specific intervals to the Emergency Control Team

- Finalize the recommendations of the Incident Commander for rescue and recovery operations.

- The Official In-Charge is the only person authorized to release information to Government Agencies, Corporate Office or the Local Communities. He may delegate this activity to other members of the Emergency Control Team.

    - Verify all information you release;
    - Keep a record of all inquiries (media and non-media);
    - Do not speculate on causes;
    - Do not speculate on resumption of normal operations or when the problem will be solved;
    - Advise that further updates will be forth coming.

- Notify the corporate management, if the following appear probable:
    - fatalities;
    - injuries that could probably become items of local, regional or national media interest;
    - there is a public health or environmental risk;
    - an incident involving chemicals where there is a large volume or the potential for over reaction (e.g., cyanide);
    - a spill of effluent or contaminated water or chemical substance to an area that lies outside the area of drainage control of the mine site (i.e., an external spill);
    - mine operations may be stopped for more than two (2) days;
    - Government authorities will become involved.

- Ensure all response teams, regulatory agencies and any other agency on emergency alert notice are advised when the emergency has ended.

- Ensure all documentation (i.e., notes, log sheets, written instructions, etc.) is gathered for the creation of the final report.

- Participate in debriefing.

2.2.2 **General Superintendents:**

- General Services, Operations and Maintenance will report to the Emergency Control Room and support the General manager/Designate in whatever capacity required.

- They will also ensure that the Superintendent/Designate in each of their respective Department's is aware of the emergency.

- They will assist with the investigation and write up of the final report

2.2.3 **Incident Commander**: – **Usually a Trained Staff Member (ERT Coordinators or Supt. / GF.)**

The responsibilities of the Incident Commander include;

- Ensure Security has been notified of emergency;
- Ensure the evacuation procedures have been activated, if required;
- Ensure that there are sufficient ERT members available to respond to the emergency;
- Ensure that the ERT has back-up support, a standby Team;
- Ensure that ERT Team has refreshments and nourishment (if the emergency requires several hours to resolve);
- Assess the size and severity of the emergency and the likely consequences. Establish response priorities;
- Maintain communication with the ERT Captain.
- Advise the Official In-Charge of the ERT Team's activities, regarding the rescue and recovery operations.
- Appoint sufficient personnel, equipment and outside services are available. Utilize the members of the Emergency Control Team to organize these resources.
- Advise Official In-Charge when the emergency situation is under control and give the "All Clear".
- Participate in emergency investigation.
- Coordinate an orderly return to normal operating conditions.
- Arrange for a debriefing session, and utilize the services of all involved in resolving the emergency.
- Assist to write the final report.

2.2.4 **Emergency Log Recorder / Muster Station Coordinator: - "***keep a systematic record of the emergency events" and get an accurate "Head Count during Emergencies***"**

- These persons can be the Geology/ Engineering Supt/Designate/ General Supt. (whoever is available to perform these duties)

- The log is intended to be a systematic record of the events from the start of the emergency through all phases to termination, and will be used in the preparation of the final report. It is important that the log be legible and that all information is recorded.

Emergency Log Recorder: **"***Keep a systematic record of the emergency events, phone calls and directives,."*

- Date and time the incident was reported, who reported the event;
- Record all subsequent developments as they occur;
- Record all phone calls all discussions and decisions made;
- Record any other information that needs to be captured for the final report;
- Keep all the sheets of paper used to record information numbered, for the final report;
- All the pages will be initialed by the recorder and official in-charge;
- The official document will stay with the Health & Safety Department upon completion of the emergency.

Muster Station Coordinator: "Provide *a Head Count during Emergencies".*

- As soon as Management begins to assemble in the Emergency Control Room , the Person In Charge (the manager/designate) needs to assign a member of the Management Team to be responsible for ensuring that the Muster Stations are contacted.

- The Muster Station Coordinator is required to contact the three Muster Stations by telephone, to ensure that there is a Supervisor is in charge of that specific muster station and give him/her 20 minutes to achieve the head count.

- The Muster Station Coordinator will need to record the time the muster station was called, who is in-charge of the muster station, and any other instructions that have been given.

- The Muster Station Coordinator needs to open the Flo on his/her laptop in order to cross reference the names, once they receive the lists from the Muster Stations.(additional persons may need to be assigned to assist with the cross reference, in order to complete the head count in a timely manner).

2.2.5 Emergency Response Team (ERT Team) Duties:

- The ERT Team Members must report to the Fire Hall, when paged for a “code One” emergency;
- ERT Team Members will be given instructions on the emergency by the Incident Commander;
- ERT Team Members will follow instructions from the Incident Commander and will not put the Team at risk;
- The ERT Team Captain will maintain radio contact with the Incident Commander throughout the emergency:

2.2.6 Mine Superintendent/Designate Duties;

- Ensure that all employees working, are accounted for;
- Ensure that the ERT Members of his crew have responded to the “code One” emergency;
- If the “Emergency” is in the Pit, them assist the Official-in-Charge with the action plan to deal with the emergency:
- Assist as required by supplying equipment and/or manpower;
- Assist with restoring of the Operations back to normal operating standards:

2.2.7 Mill Superintendent/Designate Duties;

- Ensure all employees working, at this time, are accounted for;
- Ensure that the ERT Members on his crew, have responded to the “ Code One” emergency;
- If the “ Emergency” is in the Mill facilities, assist the Official-in-Charge with the action plan to deal with the emergency:
- Assist as required by supplying equipment and/or manpower;
- Assist with restoring of the Operations back to normal operating standards:

2.2.8 Environmental Superintendent/Designate Duties:

- The following are the responsibilities of the Environmental Superintendent/Designate;
- Provide technical advice on probable environmental effects resulting from a spill and how to minimize them;
- Provide advice to the Official-in-Charge for appropriate spill response procedures;

- Ensure that Environmental Staff are available to direct the spill response action plan;
- Assist with restoring of the Operations back to normal operating standards:

2.2.9 Health and Safety Superintendent/Designate Duties:

The Health and Safety Superintendent/Designate will be responsible for:

- Ensure that an Incident Commander is in place to oversee the ERT Teams;
- Ensure that all Management respond to the emergency and meet in the emergency control room;
- He will oversee all activities that require Security or Nursing. He will arrange for Medevac transport, if required;
- Will assist with getting a “head count” for the Official in-charge;
- Assist with obtaining outside help if required:

2.2.10 Site Services Superintendent/Designate Duties:

The following are the responsibilities of the Site Services Superintendent/Designate;

- Ensure that all his employees are accounted for
- Ensure that all ERT Member on his Crew, respond to the “ code One” emergency;
- If the “ Emergency” is involves the Site facilities, assist the Official-in-Charge with the action plan to deal with the emergency:
- Assist as required by supplying equipment and/or manpower;
- Assist with restoring of the Operations back to normal operating standards:

2.2.11 Maintenance Superintendent/Designate:

The following are the responsibilities of the Maintenance Superintendent/Designate:

- Ensure that all of his employees are accounted for;
- Ensure that all ERT Members of his crew respond to the “Code One” emergency;
- If the “Emergency” is in the Maintenance Shops, then assist the Official-in-Charge with the action plan to deal with the emergency;
- Assist as required by supplying equipment and/or manpower;
- Assist with restoring of the Operations back to normal operating standards:

2.2.12 Human Resources Superintendent/Designate Duties:

The following are the responsibilities of the Human Resources (HR) Superintendent/Designate;

- Ensure that all HR employees are accounted for;
- Provide assistance to the Official-in-Charge if there are employees issues, such as injuries, transportation requirements, etc.:

2.2.13 Health Care Professional (Nurse/Medic):

The on-site health professionals are responsible for the following:

- Providing on-site first aid and other medical support;
- Establish a triage location if there are multiple casualties;
- Arrange for medevac transportation, if required;
- Ensuring that the first aid room is maintained at all times, by using First Responders as support:

2.2.14 Security Department:

The on-Site Security Supervisor is responsible for the following:

- Ensuring that the Security officer has activated the appropriate level of emergency notification;
- Ensure that access points to the emergency are properly guarded.
- Notify the Baker Lake Gatehouse if the emergency involves the All-weather private Road (AWPR).
- Assist with other duties as requested by the Emergency Control Group.

2.2.15 Duty Cards for each Department/Roles and Responsibilities

Each individual' roles and responsibilities are defined on the following pages:

Name: _____

Date: _____

Time assumed Role: _____

Manager On Duty - Duty Card	Completed	Time
1. Notified of an emergency – Make decision to have the whole Management Paged – control group		
2. Brief Management Team on the emergency		
3. Appoint a Scribe – Engineering department		
4. Decide if communications are to be cut – Notify IT		
5. Ensure that the emergency remains confidential – limit what is said to employees		
6. Conduct a head count – (Muster Stations) Assign duty to Geology Department		
7. Ensure unaffected Departments are put on Standby – E.g.: mine dept. – may need equipment		
8. Ensure all Service Departments are put on Standby – as required by ERT – Camp / Mine / Site Services / Maintenance / Manpower / Equipment / Tools / Equipment		
9. Ensure Power House is on standby		
10. Ensure that Protocol is on standby – flights to and from site for our workers / Mutual Aid teams		
11. Ensure Warehouse is on standby: Note: list of materials taken will be kept and accounted for after the emergency is over		
12. Do we need radios, ERP, Site Drawings out for incident command team		
13. Security / Close Roads		

Once Emergency is over:		
1. Initiate the “Emergency Stand Down” when required		
2. Follow up with HR Designate on any victim or surviving members concerns		
3. Hold a de-briefing with Personnel prior to them exiting the site		
4. Gather any information for Corporate HQ and Regulatory Agencies (Mines Inspector)		
5. Prepare and facilitate a Debriefing Session		
6. **General Manager will liaise with media with ALL information going out from site.**		
*** Write notes on reverse side and return this Card to Scribe after the Incident Debriefing for compilation purposes**		
No information will be relayed to Corporate or Media without the expressed confirmation of the Manager on Duty.		

Name: _____

Date: _____

Time assumed role: _____

Health & Safety Department or Designate Duty Card	**Completed**	**Time**
Print Name:		
1. Report to Command Centre		
2. Offer support to all Incident Command Group Management Team Members		
3. Account for all persons in Health and Safety Dept.		
4. Liaison between Emergency Response Teams and Incident Command Group Management Team Members		
5. Review remaining Emergency Response Capabilities: manning, equipment, resources		
Questions to ask: a) Do we need to stop operations? (Ex: SCBA use – if SCBA's are required for emergency, and we have other confined space work occurring, do we cancel? b) Do we need to reduce or have rescuers stand down during an emergency to ensure that we have adequate numbers available for continuation of normal operations? c) (Ex: mine rescue team called out to an emergency, 12 people show up, only 6 is required for emergency, and then 6 can stand down and go back to work and be available if another emergency occurs at same time. d) If people and equipment are available to meet		

Regulation requirements, then normal operations can continue. If not – consider putting alternate plans in place.		
6. Respond to any field requests		
7. Maintain notes of all decisions made with times as required.		
8. Organize and manage any site security requirements		
9. Liaison with any other emergency resource provider		
10. Provide information updates to the Incident Command Group		
11. Maintain Health and Safety Standards at the Mine Site during any incident		
12. Assist with any trauma management situations and Post Incident Debriefing sessions as required		
13. Participate in the incident debriefing session		
14. Liaison with the Department Head where incident occurred and help with incident investigation process		
15. Advise on corrective action initiatives		
16. Communicate with Mines Inspector – Serious Injury / Dangerous Occurrence – only after approval of Manager on duty		
***Write notes on reverse side and return this Card to scribe after the Incident Debriefing**		

Name: _____

Date: _____

Time assumed role: _____

Department Head where incident occurred Duty Card	**Completed**	
Print Name:		
1. Report to Command Centre		
2. Gather all available information and share with Incident Command Group Team Members		
3. Account for all persons under area of responsibility – (Need to determine who is missing and where they may be)		
4. Confirm effective Communications with Responders and Relative Supervisors		
5. Confirm Incident losses and status of the incident		
6. Designate an Assistant if required		
7. Assess current resources and determine if additional resources are required		
8. Manage Personnel duty hours, needs, food and other		
9. Visit the incident scene if required – and Safe to do so		
10. Assemble any information required for a report		
11. Attend the Incident Debriefing		
***Write notes on reverse side and return this Card to Scribe after the Incident Debriefing**		

Name: _____

Date: _____

Time assumed role: _____

Logistics or Designate Duty Card	**Completed**	**Time**
Print Name:		
1. Report to Command Centre		
2. Account for all persons under area of responsibility		
3. Ensure that flights are arranged for outgoing and incoming purposes when required		
4. Ensure IT is available upon request – (cut communications) fix radios etc.		
5. Arrange transportation of all personnel as required		
6. Arrange for provision of food, water, temporary shelter, radios, PPE, etc. when required		
7. Assemble any information required for a report		
8. Participate in the Incident Debriefing		
***Write notes on reverse side and return this Card to scribe after the Incident Debriefing**		

Name: _____

Date: _____

Time assumed role: _____

Warehouse or Designate Duty Card	**Completed**	**Time**
Print Name:		
1. Report to Command Centre		
2. Account for all persons under area of responsibility		
3. Assemble lists for inventory of possible equipment or supply needs		
4. Source any supplies and equipment that is requested by the Manager on Duty		
5. Source any requests for external services or supplies		
6. Designate an Assistant if Required		
7. Schedule Support Staff Personnel if required		
8. Ensure that someone is available at all times during the entire emergency to supply equipment materials as necessary		
9. Assemble any information required for a report		
10. Participate in the Incident Debriefing		
***Write notes on reverse side and return this Card to scribe after the Incident Debriefing**		

Name: _____

Date: _____

Time assumed role: _____

Human Resources/Designate Duty Card	**Completed**	**Time**
Print Name:		
1. Report to Command Centre		
2. Account for all persons under area of responsibility		
3. Set up a format for any media communications		
4. Confirm information accuracy if required		
5. Designate an Assistant if required		
6. Ensure proper notification systems are followed (RCMP are responsible for initial notification of family in fatal events)		
7. Coordinate any follow up visits to family of victims		
8. Confirm that Employee Assistance Program, Critical Incident Stress or Victim Services is available to injured or survivors or Post Traumatic Stress sufferings of any personnel		
9. Assemble any information required for a report		
10. Help Manager on Duty prepare communication to advise workforce		
11. Participate in the Incident Debriefing		
12. **All communication to media will be done through the Manager on Duty**		
***Write notes on reverse side and return this Card to scribe after the Incident Debriefing**		

Name: _____

Date: _____

Time assumed role: _____

Emergency Response Team Captain Duty Card	**Completed**	**Time**
Print Name:		
1. Respond to the scene or requested area with all available and applicable equipment		
2. Confirm communication with the Incident Commander at Base Station		
3. Contact Department Head of affected area for any request or directions through Incident Commander		
4. Direct emergency activities with your Team		
5. Maintain Safe Working Standards with you team		
6. Offer periodic Status Reports to Incident Commander at Base Station		
7. Secure the incident scene – as per Regs. 16.03/16.04		
8. Liaison with any other external emergency personnel		
9. Ensure area clearances with Helicopter Pilots – if required		
10. Respond accordingly within you and your team's capabilities		
11. Request any additional resources through your Incident Commander at Base Station		
12. Assemble any information required for a report		

13. Attend the Incident Debriefing		
14. Take Cell Phone with them when going off site – phone number is 867-793-1330		
***Write notes on reverse side and return this Card to scribe during the Incident Debriefing**		

Note: Captain must have a report that will be submitted at completion of emergency which includes all of the above.

Name: _____

Date: _____

Time assumed role: _____

Environmental Department Duty Card	**Completed**	**Time**
Print Name:		
1. Report to Command Centre		
2. Account for all persons in area of responsibility		
3. Be available as a resource to Incident Command Group		
4. Maintain a log of events, calls, requests, external personnel and contact lists if requested		
5. Liaison with all field operations on the incident when involving spills/chemicals		
6. Liaise with Government Regulators as necessary for reporting spills/chemicals etc. upon approval of Manager on Duty.		
7. Designate an Assistant if required to help out in the field		
8. Direct external Emergency Spill Response Personnel to proper location(s) if required		
9. Assemble any information required for a report		
10. Attend the Incident Debriefing		
***Write notes on reverse side and return this Card to scribe during the Incident Debriefing**		

Name: _____

Date: _____

Time assumed role: _____

Maintenance Department Duty Card	**Completed**	**Time**
Print Name:		
1. Report to Command Centre		
2. Account for all persons in area of responsibility		
3. Be available as a resource to Incident Command Group		
4. Maintain a log of events, calls, requests, external personnel and contact lists		
5. Liaison with all field operations on the incident when involving equipment, machinery		
6. Have personnel available to deal with broken down machinery etc.		
7. Designate an Assistant if required to help out in the field		
8. Make equipment and manpower available if required by Emergency Response Team		
9. Assemble any information required for a report		
10. Attend the Incident Debriefing		
***Write notes on reverse side and return this Card to scribe during the Incident Debriefing**		

Name: _____

Date: _____

Time assumed role: _____

Mine Department Duty Card	**Completed**	**Time**
Print Name:		
1. Report to Command Centre		
2. Account for all persons in area of responsibility		
3. Be available as a resource to Incident Command Group		
4. Maintain a log of events, calls, requests, external personnel and contact lists		
5. Liaison with all field operations on the incident when involving incidents in the pit		
6. Ensure that contractors in area of responsibility are notified and accounted for		
7. Designate an Assistant if required to help out in the field		
8. Make equipment and manpower available as necessary to help Emergency Response Teams		
9. Assemble any information required for a report		
10. Attend the Incident Debriefing		
***Write notes on reverse side and return this Card to scribe during the Incident Debriefing**		

Name: _____

Date: _____

Time assumed role: _____

Engineering Department Duty Card	**Completed**	**Time**
Print Name:		
1. Report to Command Centre		
2. Account for all persons in area of responsibility		
3. Be available as a resource to Incident Command Group		
4. Maintain a log of events, calls, requests, external personnel and contact lists (SCRIBE) for the incident		
5. Liaison with all field operations on the incident when involving incidents where engineering is required		
6. Designate an Assistant if required to help out in the field		
7. Make equipment and manpower available as necessary to help Emergency Response Teams		
8. Assemble any information required for a report		
9. Attend the Incident Debriefing		
***Write notes on reverse side and return this Card to scribe during the Incident Debriefing**		

Name: _____

Date: _____

Time assumed role: _____

Geology Department Duty Card	**Completed**	**Time**
Print Name:		
1. Report to Command Centre		
2. Account for all persons in area of responsibility		
3. Be available as a resource to Incident Command Group		
4. Conduct a proper head count of all persons assembled in the Muster Stations (Procedure can be found in Emergency Response Plan)		
5. Maintain a log of events, calls, requests, external personnel and contact lists		
6. Designate an Assistant if required to help out in the field		
7. Make equipment and manpower available as necessary to help Emergency Response Teams		
8. Assemble any information required for a report		
9. Attend the Incident Debriefing		
***Write notes on reverse side and return this Card to scribe during the Incident Debriefing**		

Name: _____

Date: _____

Time assumed role: _____

Site Services Department Duty Card	**Completed**	**Time**
Print Name:		
1. Report to Command Centre		
2. Account for all persons in area of responsibility		
3. Be available as a resource to Incident Command Group		
4. Ensure that manpower, equipment is available for the proper function and maintenance of fire sprinkler systems		
5. Ensure that manpower, equipment is available to maintain an open road (AWPR) to Baker Lake		
6. Ensure that manpower is available as airport marshal and for moving material arriving in aircraft, fuel, etc.		
7. Ensure that manpower, equipment is available for transportation of men/gear to help Emergency Response Teams		
8. Maintain a log of events, calls, requests, external personnel and contact lists		
9. Designate an Assistant if required to help out in the field		
10. Make equipment and manpower available as necessary to help Emergency Response Teams		
11. Assemble any information required for a report		
12. Attend the Incident Debriefing		

***Write notes on reverse side and return this Card to scribe during the Incident Debriefing**		

Name: _____

Date: _____

Time assumed role: _____

Electrical Department Duty Card	**Completed**	**Time**
Print Name:		
1. Report to Command Centre		
2. Account for all persons in area of responsibility		
3. Be available as a resource to Incident Command Group		
4. Ensure that personnel and equipment is available to maintain the required power supply		
5. Maintain a log of events, calls, requests, external personnel and contact lists		
6. Designate an Assistant if required to help out in the field		
7. Make equipment and manpower available as necessary to help Emergency Response Teams		
8. Assemble any information required for a report		
9. Attend the Incident Debriefing		
***Write notes on reverse side and return this Card to scribe during the Incident Debriefing**		

Name: _____

Date: _____

Time assumed role: _____

Mill Department Duty Card	**Completed**	**Time**
Print Name:		
1. Report to Command Centre		
2. Account for all persons in area of responsibility		
3. Be available as a resource to Incident Command Group		
4. Conduct a proper head count of all persons assembled in the Arctic Corridor Muster Station		
5. Maintain a log of events, calls, requests, external personnel and contact lists		
6. Designate an Assistant if required to help out in the field		
7. Make equipment and manpower available as necessary to help Emergency Response Teams		
8. Assemble any information required for a report		
9. Attend the Incident Debriefing		
***Write notes on reverse side and return this Card to scribe during the Incident Debriefing**		

Name: _____

Date: _____

Time assumed role: _____

Camp / Housekeeping Department Duty Card	**Completed**	**Time**
Print Name:		
1. Report to Command Centre through HR		
2. Account for all persons in area of responsibility		
3. Be available as a resource to Incident Command Group		
4. Ensure an adequate supply of food when requested		
5. Ensure that an adequate supply of blankets, washers/dryers are available when requested		
6. Maintain a log of events, calls, requests, external personnel and contact lists		
7. Designate an Assistant if required to help out in the field		
8. Make equipment and manpower available as necessary to help Emergency Response Teams		
9. Assemble any information required for a report		
10. Ensure that HR has all available information		
***Write notes on reverse side and return this Card to scribe during the Incident Debriefing**		

Name: _____

Date: _____

Time Assumed Role: _____

To be filled out by Incident Commander:

Incident Commander Duty Card	Completed	Time
Print Name:		
1. Initiate an emergency response as required		
2. Ensure communications with Emergency Response Team Captain and be there to request assistance or resources		
3. Ensure incident scene is secured as required		
4. Liaise between Emergency Response Team and Incident Command Group		
5. Ensure that all gear, equipment, supplies required by Emergency Response Team is made available to them		
6. Have the gear, equipment, supplies brought to Emergency Response Teams when required		
7. Assemble any information required for a report		
8. Request any additional resources at any time required		
9. Attend the Incident Debriefing if requested		
***Write notes on reverse side and return this Card to ICS during the Incident Debriefing**		

Name: _____

Date: _____

Time assumed role: _____

Scribe Duty Card	**Completed**	**Time**
Print Name:		
1. Report to Command Centre		
2. Scribe all accounts of activity in chronological order		
3. Scribe information as requested by the Incident Command Group – Manager on Duty		
4. Provide a detailed report at end of incident		
5. Assemble any information required for a report		
***Write notes on reverse side and return this Card to ICS during the Incident Debriefing**		

2.3 OCCUPATIONAL HEALTH AND SAFETY COMMITTEE:

The Occupational Health and Safety Committee is responsible for:

- Review the emergency response plan on an annual basis.
- Assist with any investigation resulting from the emergency.

2.4 ALL EMPLOYEES:

All employees are responsible for:

- Reporting to the nearest Muster Station when an fire alarm is sounded;;
- Employees reporting to the Muster Station need to assemble at the placard that has their department name.
- Employee's must be quiet and await the "head count**".**
- Reporting any emergency by either using the radio on the dedicated emergency channel (#1) or using the telephone to call 6911, to describe the type, the location, and nature the emergency, including possible injuries, trapped personnel, and the presence of any chemical or explosive hazards.

2.5 SUPERVISOR:

The Supervisor is responsible for:

- Ensuring the "Code One" call in, is accurate and that all the pertinent information is available for the official-in-Charge. (providing details regarding the type, the location, and the nature of the emergency, including possible hazardous materials involved and health and safety concerns);
- Ensure all workers on his shift are accounted for:

2.6 OTHER PERSONNEL:

Depending on the nature of the emergency (medical, electrical, mechanical, fire, etc.) other site personnel, including the Site Electrician, Site Mechanic, and others, may be called upon to play key roles.

2.7 EMERGENCY RESPONSE CONTACT INFORMATION – INTERNAL & EXTERNAL

AEM internal emergency response personnel, their duties, and phone numbers has been compiled in Table 2.1, Important external contacts such as regulatory agencies, health organizations and transportation companies providing evacuation support are listed in Table 2.2.

Table 2.1: Internal Emergency Response Contact Information Chart

NOTE: 867-793-4610 may be replaced by 819-759-3555		
DEPARTMENT	**NAMES**	**CONTACT**
GENERAL MANAGER	Jean Beliveau	P: 867-793-4610 ext: 6901
Pager 404		C: 819-277-4080
		C: 416-315-6745
INCIDENT COMMANDER		
Pager 402	Andre Rouleau	P: 867-793-4610 ext: 6809
		C: 819-355-2191
Pager 405	Philippe Beaudoin	P: 867-793-4610 ext: 6809
		C:450-847-4214
MAINTENANCE GENERAL SUPER.	Richard Grenier	P: 867-793-4610 ext: 6914
Pager 451		C: 819-354-9531
GENERAL SERVICES SUPER.	Alain Hamel	P: 867-793-4610 ext: 6771
Pager 406		C: 819-856-5411
OPERATIONS GENERAL SUPER.	Alexandre Proulx	P: 867-793-4610 ext: 6915
Pager 421		C: 819-860-6389
HEALTH & SAFETY SUPERINTENDENT	Norman Ladouceur	P: 867-793-4610 ext: 6720
Pager 407		C:819-860-6258
ASSISTANT H & S SUPER.	Yves Levesque	P: 867-793-4610 ext: 6720
Pager 407		C:819-856-9051

INFORMATION TECHNOLOGY	**Phillip Quessy**	**P: 867-793-4610 ext: 6730**
Pager 282		**C: 819-856-8536**
	Bruno Poirier	**P: 867-793-4610 ext: 6824**
		C: 514-232-8358
	Jerome Lamarre	**P: 867-793-4610 ext: 6785**
		C: 450-917-0649
	Steve Petit	**P: 867-793-4610 ext: 6785**
		C: 514-718-1179
SECURITY	**Denis Roy**	**P: 867-793-4610 ext: 6748**
Pager 468		**C: 819-847-4460**
	Charles Blouin	**P: 867-793-4610 ext: 6748**
		C: 819-564-0357
		Gatehouse: 6817
ENGINEERING	**Julie Belanger**	**P: 867-793-4610 ext: 6721**
LOG RECORDER (scribe)		**C: 819-856-1667**
Pager 486	**Stephane Frechette**	**P: 867-793-4610 ext: 6881**
		C: 819-856-3152
	Erika Voyer or	**P: 867-793-4610 ext: 6837**
	Thomas Lepine	
GEOLOGY	**Bernard Waitzenegger**	**P: 867-793-4610 ext: 6711**
MUSTER STATION – (tally)		**C: 819-856-7829**
Pager 481	**Lisa Ragsdale**	**P: 867-793-4610 ext: 6790**
	Robert Badiu	**P: 867-793-4610 ext: 6790**
	Jean-Francois Desmeules	**P: 867-793-4610 ext: 6856**

MINE DEPARTMENT	**Martin Beausejour**	**P: 867-793-4610 ext: 6832**
Pager 495		**C: 819-355-2913**
	Brock Johnston	**P: 867-793-4610 ext: 6832**
		C: 480-652-9775
	Joey Audet	**P: 867-793-4610 ext: 6735**
		C: 819-856-1276
	Charlie O'Hara	**P: 867-793-4610 ext: 6735**
		C: none
ENVIRONMENT DEPARTMENT	**Kevin Buck**	**P: 867-793-4610 ext: 6838**
Pager 492		**C: 819-856-1956**
	Jeffrey Pratt	**P: 867-793-4610 ext: 6728**
		C: 819-856-1475
	Martin Theriault	**P: 867-793-4610 ext: 6747**
		C: 450-904-1390
	Robin Allard	**P: 867-793-4610 ext: 6747**
		C: 819-604-1417
PROCESS PLANT DEPARTMENT	**Michel Fortin**	**P: 867-793-4610 ext: 6814**
Pager 418		**C: 819-355-0460**
	Guillaume Gemme	**P: 867-793-4610 ext: 6831**
		C: 819-856-3073
	Luc Tremblay	**P: 867-793-4610 ext: 6831**
		C: None
	Nathalie Ledoux	**P: 867-793-4610 ext: 6755**
		C: None
	Guillaume Blanchette	**P: 867-793-4610 ext: 6862**

		C: None
	Pathies Nawej Mteb	**P: 867-793-4610 ext: 6862**
		C: None
HEALTH & SAFETY DEPARTMENT	**Ken Ludwig**	**P: 867-793-4610 ext: 6756**
		C: 705-929-5156
	Charlie Tautuajuk	**P: 867-793-4610 ext: 6756**
		C: 867-446-0964
SITE SERVICES DEPARTMENT	**Eric Trudel**	**P: 867-793-4610 ext: 6953**
Pager 483		**C: 819-355-9111**
	Roger Sauve	**P: 867-793-4610 ext: 6822**
		C: None
	Rene Baril	**P: 867-793-4610 ext: 6822**
		C: None
HUMAN RESOURCES DEPARTMENT	**Krystel Mayrand**	**P: 867-793-4610 ext: 6723**
Pager 434		**C: 819-856-9556**
	Louise Garon	**P: 867-793-4610 ext: 6890**
		C: None
	Audree Belisle	**P: 867-793-4610 ext: 6890**
		C: None
LOGISTICS & WAREHOUSE	**Monique Cossette**	**P: 867-793-3555 ext: 6903**
Pager 478		**C: 819-444-6023**
	Andre Racicot	**P: 867-793-3555 ext: 6813**
		C: 867-793-1332

	Yves Samuel	**P: 867-793-4610 ext: 6812**
		C: None
	Sebastien Byles	**P: 867-793-4610 ext: 6812**
MAINTENANCE DEPARTMENT	**Lonny Syvret**	**P: 867-793-4610 ext: 6722**
Pager 451		**C: 819-354-6819**
	Sylvain Portelance	**P: 867-793-4610 ext: 6825**
		C: None
	Stephane Boucher	**P: 867-793-4610 ext: 6825**
		C: 519-525-7505
	Pierre Laberge	**P: 867-793-4610 ext: 6825**
		C: None

Table 2.2: External Emergency Phone Numbers

Organization / Authority	Telephone Number	Fax Number
NT-NU 24-HOUR SPILL REPORT LINE	867.920.8130	867.873.6924
Nunavut Water Board	867.360.6338	867.360.6369
Environment Canada, Environmental Protection Branch	867.669.4700	867.873.8185
Environment Canada: 24-hour emergency pager monitored by Emergency and Enforcement	867.920.5131	
Manager Pollution Control & Air Quality Environmental Protection, Government of Nunavut	867.975.7748	867.975.5981
General Inquiry Department of Environment, Government of Nunavut	867.975.7700	
Indian and Northern Affairs Canada (INAC) – Water Resources Manager, Nunavut Regional Office	867.975.4550	867.975.4585
Indian and Northern Affairs Canada (INAC) – Manager, Land Administration, Nunavut Regional Office	867.975.4280	867.975.4286
Kivalliq Inuit Association – Reporting Line	867.645.2810 or 867.645.2800	

Department of Fisheries and Oceans (DFO) – Nunavut Regional Office	867.979.8000	867.979.8039
Workers Safety and Compensation Commission Mine Inspector: Martin Van Rooy	800.661.0792 867.979.8527	
Keewatin Health Services – Baker Lake	867.793.2816 867.793.2813	
Keewatin Air Ambulance (Medevac) 24h/7 – Rankin Inlet dispatch	867.645.4455	
Baffin Regional Hospital (Iqaluit)	867.979.7300	
Baker Lake RCMP Baker Lake RCMP – emergency number Cambridge Bay RCMP	867.793.0123 867.793.1111 867.983.2111	
Baker Lake Hamlet Office	867.793.2874	
Baker Lake Fire Emergency	867.793.2900	
Baker Lake Fire Marshall's Office	867.873.7944	
Baker Lake Radio Station	867.793.2962	
Baker Lake Airport	867.793.2564	
Department of Environment Health	867.983.7328	
Poison Control Centre	867.920.4111	
Search and rescue – Artic Armed Forces Rescue Coordination Centre Trenton	800.267.7270 613.965.3870	
NAVCAN (Flight Information Center North Bay)	866.541.4109	
CANUTEC (Spill Support Information)	613.996.6666	
Charter Aircraft (for Evacuation)		
Keewatin Air Ambulance (Medevac) 24h/7 – Rankin Inlet dispatch	867.645.4455	
Calm Air	204.677.0513 204.677.0519	
Nolinor	450.476.0018 888.505.7025	
First Air	867.669.6694 867.444.2002	
Helicopter Transport Services	613.839.5868	
Nunavut Emergency Management – Rankin Inlet	1-867-645-6803	
Nunavut Emergency Management – Iqaluit	1-800-693-1666 1-867-979-6262	

2.8 EMERGENCY COORDINATION CENTRE

Emergency operations will be directed out of the Emergency Control Centre (ECC). The ECC is located in the 3rd Floor of the Service Building Conference Room, or in the Training room on the main floor, or in the Security Guard Building by Air Strip from where the following will take place:

- Key decisions will be made and operations will be managed;

- Technical information to direct emergency activities will be provided;
- A communications centre will be established for emergency operations and to communicate with other organizations;
- Resource procurement will be provided and resource use will be directed;
- Any damage will be assessed and long-range objectives and plans will be developed; and
- Information on the emergency will be stored and disseminated to all necessary internal and external parties.

The following information is available at the centre:

- Shutdown procedures for operations;
- Locations of hazardous material storage areas;
- Locations of emergency and safety equipment;
- Locations of first aid stations and muster areas;
- Maps of communities and environmental maps;
- Information on location of other communications equipment, including portable sets;
- Information on emergency power;
- Contacts for other utilities;
- Operating manuals;
- Materials Safety Data Sheets (MSDS);
- List of personnel with alternate skills for use in emergencies;
- Type and location of alarm systems;
- Accident report forms;
- Accident status board and log book;
- Notification lists, staff lists, contact lists, with regular and emergency telephone/pages numbers, etc.

The ICC will be located at a safe and secure place near the site of the emergency. All responses and mitigation efforts developed at the ECC will be implemented through the ICC.

In the event of an emergency, security personnel may be required to establish and maintain a security perimeter to prevent or minimize injury to personnel, to preserve evidence for investigation, or to prevent unauthorized access to the scene.

2.9 TRAINING

The HR Superintendent is responsible for documenting, tracking, and updating all training activities. Record of training requirements and training attendance will be kept, tracked and updated for all employees by the HR Superintendent to ensure that retraining occurs as required.

For mine operations, AEM will ensure a sufficient number of trained ERT team members are on site at all times. All members of the ERT will be trained and familiar with emergency and spill response procedures. Emergency training will be conducted annually to ensure that a sufficient number of team members are available and that their training is up-to-date. The following will be included in the training:

- A review of the SCP and responsibilities of the team members;
- The nature, status, and location of fuel and chemical storage facilities;
- The location of on-site and off-site spill response equipment, and how to use it;
- Emergency contact lists;
- Desktop exercises of “worst case” scenarios; and
- The likely causes and possible effects of spills.

Emergency Response Equipment

The Emergency Measures Counsellor will ensure that site drawings and equipment lists are posted conspicuously in key locations throughout the site so that important information is always readily available. This will include the following:

- Location and isolation points of energy sources;
- Location of emergency equipment (e.g., fire water pumps, fire extinguishers, monitors, self-contained breathing apparatus);
- Emergency procedures outlines, such as specialist firefighting, chemical neutralization;
- Location of equipment for combating pollution (e.g., booms, skimmers, pumps, absorbents, dispersants);
- Availability of internal and external emergency medical support (e.g., hospitals, clinics, ambulances, medical supplies, personnel with medical or first aid training);

- Location of toxicity testing facilities (e.g., gas and water);
- Location of wind direction / speed indicators;
- Directions on how to contact the local or regional weather forecasting service;
- Location of personal protective equipment and directions on its proper use; and
- Location of first aid stations and muster areas.

The Incident Commander, EMC, and Health and Safety Superintendent will know where, throughout the project site, all of this information is posted and where emergency equipment is stored. These individuals will also be trained in the proper use of emergency equipment.

External emergency response equipment includes the mobile emergency response equipment described in the SCP.

SECTION 3 • COMMUNICATION SYSTEMS

The primary basis for communication will be the phone system; back-up communication will be available via satellite phone. For on-site communication, hand-held radios will be mandatory for all employees working or travelling in remote areas from the main camp. Cell phones can be used as an additional means of communication. Back-up power sources and replacement batteries for communications equipment will be available to provide continuous, uninterrupted operation either at fixed facilities or at emergency sites.

Key site personnel will be accessible at all times by either portable radios, radios in vehicles, or office radios. The Health Care Professional will carry a hand-held radio and will be available at all times. Security personnel will monitor the emergency channel twenty-four hours per day. Senior management personnel will rotate as “On-Call Managers” for after-hour emergencies. An accommodations list that highlights key personnel will be posted and updated as required.

Lists of employees trained in first aid, mine rescue, and Emergency Response will also be posted. Employees and contractors who will be on site for extended periods will be trained initially and then retrained annually. This training will include the locations and use of emergency equipment, terminology used, and who needs to be contacted immediately in the event of an emergency.

SECTION 4 • EMERGENCY MEASURES

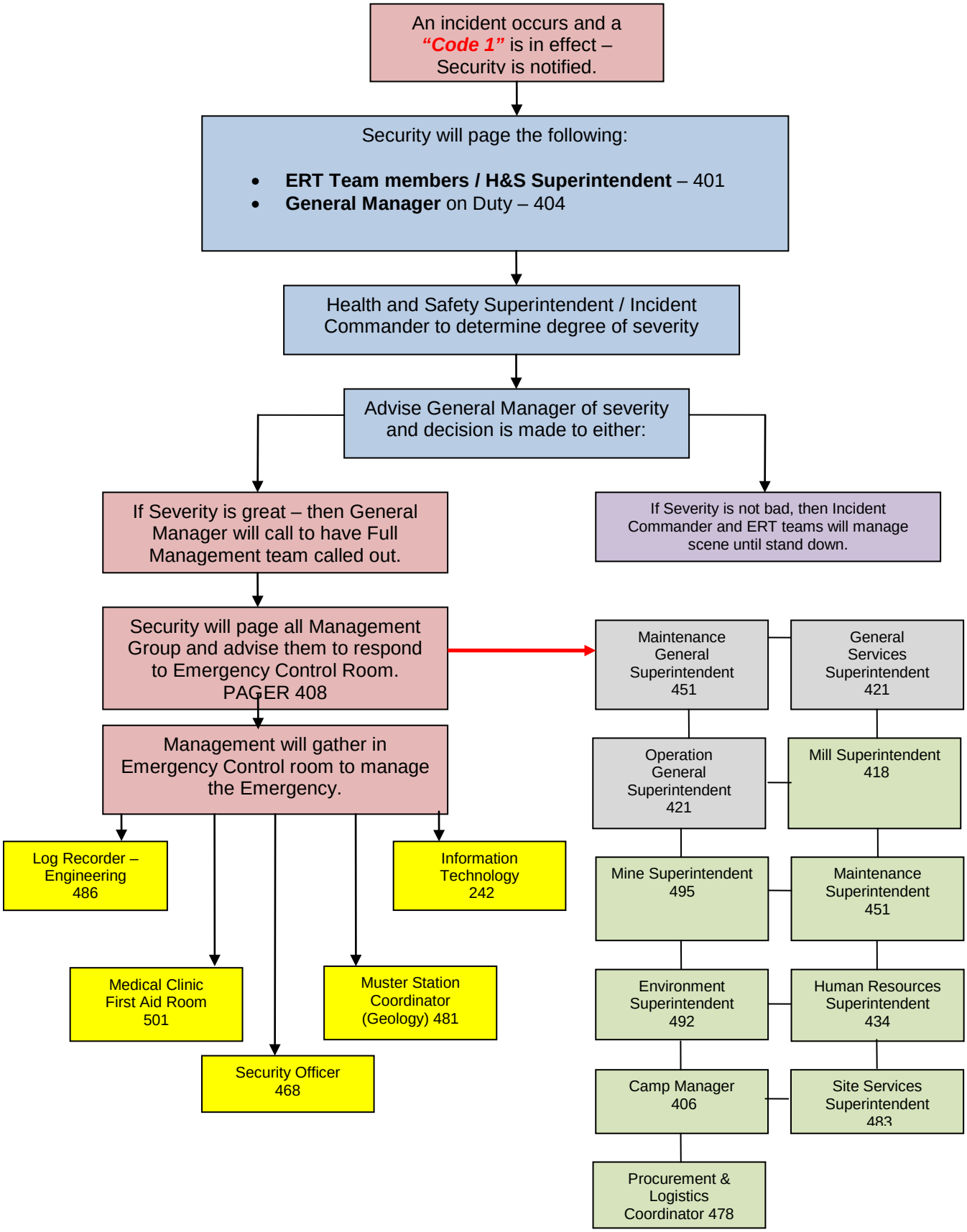
Appendix MBK-HSS-3001-F-B Emergency Measures Response Flowchart

In the event of an emergency, the employee will have to follow our emergency procedure:

- Emergency is initiated - by calling **6911** on desk type phones, or calling on Two-way radio on **"Working Channel" – Code 1 – Code 1 – Code 1.**
- All communication stops except for those involved with the Emergency – I.e.: First Aid Room attendants, Medics, ERT as required.
- All work stops in First Aid Room / Clinic – and in affected area – depending on seriousness of Emergency – the whole site.
- First Aid Room Attendant / Medic will answer the phone and/or radio.

  Note: if the First Aid Room Attendant / Medic do not answer, then Security Guard will answer and/or a Supervisor on radio will answer so that Emergency Response can be initiated.
- **Responder –** will ask where the medic is required?
- **Caller –** will give a brief description of the Emergency – name, location and what is wrong and/or required.
- **Responder –** will confirm location and details of incident and activate the **ERT** team. Security will be notified by responder and a page will be sent out to all **ERT** team members on site. (All **ERT** team members on site now carry pagers).
- The person at the casualty(s) will administer First Aid if trained to do so.
- Incident Commander Center will be immobilized as to ensure that communications, transportation, and effective deployment of **ERT** resources are conducted. It is mandatory that the Official In-Charge be notified immediately.
  - Transportation will be arranged to meet at the **ERT** hall by the two large doors for medical gear and **ERT** team members.

The **ERT** team (minimum of 6 team members) will assemble as quickly as possible. (Expectation – when the page goes off – all **ERT** team members will make their way expediently to the **ERT** hall.


An incident occurs and a "Code 1" is in effect – Security is notified.
Security will page the following:
ERT Team members / H&S Superintendent – 401
General Manager on Duty – 404
Health and Safety Superintendent / Incident Commander to determine degree of severity
Advise General Manager of severity and decision is made to either:
If Severity is great – then General Manager will call to have Full Management team called out.
If Severity is not bad, then Incident Commander and ERT teams will manage scene until stand down.
Security will page all Management Group and advise them to respond to Emergency Control Room. PAGER 408
Management will gather in Emergency Control room to manage the Emergency.
Log Recorder – Engineering 486
Information Technology 242
Medical Clinic First Aid Room 501
Muster Station Coordinator (Geology) 481
Security Officer 468
Maintenance General Superintendent 451
General Services Superintendent 421
Operation General Superintendent 421
Mill Superintendent 418
Mine Superintendent 495
Maintenance Superintendent 451
Environment Superintendent 492
Human Resources Superintendent 434
Camp Manager 406
Site Services Superintendent 483
Procurement & Logistics Coordinator 478

FIRE

The Camp Complex and Process Plant is equipped with a fire detection and audible fire warning system. All site operating personnel receive basic training in the use of fire extinguishers. This training is tracked by the HR Superintendent.

For any situation involving fires, the first action will be to extinguish the fire if it is safe to do so and then report the incident. If the person cannot safely put out the fire, it must be reported as quickly as possible. In the event of a fire alarm, all employees not directly involved with fighting the fire will report to the designated muster location (section 5.2). Employees will remain in this area until assigned other duties by the ERT or until given clearance that the emergency is over.

In the event that a fire causes damage to mining equipment, site buildings, or chemical containers, particulates and/or gases could be released into the air, and hazardous materials and/or other chemicals (e.g., fuels, oils, battery acid, lime, etc.) could be spilled. In the short-term, this could result in air quality degradation, and potentially affect the local vegetation in the case of a spill or burn scar. Should such scenarios occur, the following actions will be taken, as required and WHEN IT IS SAFE TO DO SO:

- Air quality monitoring for airborne emissions;
- Collection and incineration of all putrescible (food items);
- Removal of debris and contaminated soil for disposal on-site or off-site at a licensed disposal facility;

Further details on the cleanup of chemical spills are provided in the Spill Contingency Plan.

The incident commander will;

- Locate the source of fire.
- Dispatch the evacuation at the safest muster point.
- Assign a captain and his team.
- Ensure the security of all the ERT's members or any other service persons (medics, security guard, electricians, etc…).
- If the intervention of the mine inspector is necessary for a special investigation, he will ask to the security department to ensure the integrity of the scene.
- Call the end of the emergency measures and invites everyone evacuated to reintegrates their original locations.

General Manager or designate can decide to use any available machinery to separate all or part of a building to protect people or minimize losses.

Incident Reports are to be filed detailing the causes of the fires and responses undertaken. This information will be used by the EMC in subsequent fire prevention activities

4.1 MUSTER POINT

In the event that an evacuation is necessary, it is important that all affected personnel leave the emergency area and congregate at a pre-determined area or *Muster point* so that a head count can be taken to determine if there are any missing persons. Employees must remain at the muster point until the supervisor of the emergency area gives permission to return to work.

Upon hearing a fire alarm, smoke alarm, or evacuation alarm you shall ….

- ***Do Not Panic*** – Always ensure that you are prepared for the weather conditions – Dress appropriately – (Winter clothing during winter months).
- ***DO NOT*** delay and ***DO NOT*** stay and finish work before taking the proper steps to evacuate.
- Always **close** windows/doors as you leave your office etc.
- ***Always*** head to the ***closest*** **EXIT** door and follow **EXIT** signs to the closest outside door.
- Once outside head to the ***closest*** **"*Muster Station*".**
- Once in **"*Muster Station*"** – Stay put until relieved or instructed otherwise by your Supervisor.
- Your Supervisor and/or Senior Management person in your dept. will ***conduct a tally*** **(head count)** of everyone in his/her department. Ensure that you get your name on the **tally form**.
- Note: on nightshift, the highest level of Management may be a front line Supervisor.
- ***DO NOT*** **enter** a building when the alarm is sounding. Head straight to a "**Muster Station**".
- ***Never*** go through a building to get to a "**Muster Station**". Once you are outside, the first door you open should be the one to the "**Muster Station**".
- ***Never*** disregard an evacuation alarm. We understand that the system goes off without incident on occasion, but to disregard an ***alarm is to endanger your life and the lives of others.***
- ***Stay in*** "**Muster Station**" until you are instructed to "**Stand Down**" by the Incident Commander.
- ***Do Not*** leave "**Muster Station**" to go outside for a smoke. It is important for your Supervisor to know where you are at all times – especially during an "**Emergency**".
- The only person authorized to initiate a "**Stand Down**" is the incident commander or the General Manager or designate.
- **Failure to follow** proper Evacuation Procedures will result in Discipline.
- The following areas are considered "**Muster Stations**" (see Figure)

4.2 MEDICAL EVACUATION PLAN

In the event of serious injury, it may be necessary to remove the individual from the source of the danger and to administer emergency first aid. The Health Professional will be notified immediately in order to take charge of the situation and ensure the safe removal of the injured person to the first aid room if possible.

- The **ERT** team will respond with (Nurse / Medic) and assist as necessary with equipment, treatment etc.
- The (Nurse / Medic) and as many **ERT** team members as required will respond to the incident site. When the (Nurse / Medic) arrives at the scene, they will notify the First Aid Treatment Room.
- First Aid will be administered to casualty(s); the casualty(s) will be secured and transported to the First Aid Room. Vehicles transporting casualty(s) will have priority over any other vehicle on site.
- Once the “Mechanisms of Injury” and the patient’s condition have been assessed, a decision will be made by the (Nurse / Medic) whether a Medevac is required and decide on ground or air transportation. There are guidelines to follow to make this determination.

- As per guidelines for transportation, the "Mechanism of Injury" and/or patient condition, the (Nurse / Medic) will contact one of the following Medical facilities:

Winnipeg Health and Science Centre

Trauma team **204-774-6511** **or** **204-787-3901**

Main ER doctor in charge **204-774-6511**

Baker Lake Health Centre **867-793-2816**

Churchill Hospital **204-675-8881**

Rankin Inlet Health Care Centre - 867-645-2816

In addition: **Dr. Lee (AEM – MBK) Medical Director - will be notified.**

If a **MEDEVAC** is required, the Health Care Provider, will call one of the following airlines::

- Baker Lake Medical Clinic (**867)-793-2816**
- Rankin Inlet Medical Clinic (**867)-645-2816**

The following **INFORMATION** will be relayed to **Medical Facility** that you have reached and to **MEDEVAC** dispatcher:

- Give Patient's Name, Age, Mechanism of Injury, Nature of Injuries, and Medical Condition. Give all tests, treatment which you have done as well as ALL of the medication that has been administered to patient including the patient's past medical history and medications that he/she is taking.
- The TRANSFER sheet should be included and if possible FAX: to the Health Care Facility who will be receiving the **MEDEVAC and patient.**

If a **MEDEVAC** is required and decision is made to go with one:

- The patient will STAY in First Aid Room until his/her **Condition is stabilized.**
- Unnecessary delays will be avoided in transportation of Patient to Receiving Health Care Provider.
- When **MEDEVAC** personnel arrive on site – they will help establish the patient for air transportation.
- (Nurse / Medic) will take instructions from Medical Director and act according to his/her instructions.
- All decision/interventions will be documented with time lines.

Depending on the **MEDEVAC** Company that has been chosen, the (Nurse / Medic) may have to escort the patient to the receiving Health Care Facility.

The Official In-Charge will notify the (Nurse / Medic) when the **MEDEVAC** has arrived and landed. The (Nurse / Medic) with the help of the **ERT** team will transfer the patient into the ambulance, to the aircraft.

If the **MEDEVAC** comes to site with a **Medical crew:**

- The **MEDEVAC** team will call ahead to notify their ETA.
- The Manager on Duty or designate will ensure that a vehicle is sent to the airstrip at the ETA.
- The **Medical crew** with their equipment will be brought to the First Aid Room.
- Once the **MEDEVAC** equipment is in place, the **ERT** team will assist the **MEDEVAC Medical crew,** and (Nurse / Medic) with the transfer of the patient to the ambulance, and into the aircraft.

After the aircraft has left AEM – MBK site, the (Nurse / Medic) will notify the receiving Medical facility with the ETA to their closest airport. The **MEDEVAC** pilot will advise receiving airport air traffic controller that an ambulance is required for transportation to receiving Medical facility.

All Operations type work will be suspended until (Nurse / Medic) are back in First Aid Room. The incident scene, materials, machinery, medical equipment etc. will remain undisturbed until the investigating team has conducted the investigation. This type of incident is considered a “Reportable Incident” therefore the Mines Inspector shall be notified (without delay). The Official In-Charge will be responsible for ensure that this occurs. Under no circumstances shall any person move, or otherwise interfere with any wreckage or equipment at the scene of a “reportable incident” until an inspector has conducted an investigation of the incident and has given permission to do so.

The Official In-Charge will make all necessary calls to the outside for notification purposes: I.e.: Corporate Office notification, Mines Inspector, RCMP, etc.

If the incident is of a fatality, it is CLEAR that the Coroner or in his/her absence, the RCMP are in total control of the incident scene. The scene is to remain undisturbed until orders have been issued by either of these two authorities.

The scene will then be released to the local authorities such as the Mines Inspector for their portion of the investigation.

Upon arrival of the aircraft to the airport of the Receiving Medical Facility (other than Baker Lake), the receiving team will be notified and a designated person will call the Incident Command (control center) and update them on their arrival and the next steps to be taken. I.e.: transportation to Receiving Medical Facility.

The Receiving Medical Facility will communicate with AEM – MBK Division (Nurse / Medic) on frequent basis to update site on patient’s condition and treatment. Such as surgery required,

As soon as steps have been implemented to properly attend to the injuries, the Incident Commander will notify the appropriate authorities of the accident by telephone, providing as much information as possible. A complete accident description and investigation form is required to be submitted as soon as possible. The accident description and investigation form will be completed and submitted by the General Mine Manager. Unless some action is required to remove an immediate hazard, the site of

any serious accident will be cordoned off and remain unchanged until clearance is received from the appropriate authorities.

4.3 AIRPLANE CRASH DISASTER

Emergency Response begins as soon as an air crash is identified or reported.

- When the Meadowbank Air Traffic Controller or Meadowbank Security is notified that an approaching aircraft is having difficulty, they will immediately notify the General Manager or Designate.
- In the event of reported air crash off-site the Meadowbank Air Traffic Controller or Meadowbank Security will notify the General Manager or Designate.
- Emergency Response procedure will be initiated if required for response by ERT
- The ERT Team on scene will make a preliminary assessment and notify the Nursing Clinic.
- The Nurse or Medic, with the ERT Team, shall establish triage, treatment, transportation, communication, and staging.
- The ERT Incident Commander will direct all emergency response actions, and assess the need for additional resources keeping the Command Post updated as to all actions
- The RCMP will establish access and traffic control and assist the Coroner in body recovery and identification, if necessary.
- The Incident Commander will instruct emergency response personnel to not move debris associated with the wreckage, ie. cargo, plane remnants, passenger belongings, unless there is imminent danger of items being destroyed, or unless they inhibit access to passenger rescue.
- The Coroner/RCMP is responsible for the identification, movement and/or removal of the fatality. Unauthorized personnel are not to move the dead without express approval of the Coroner/RCMP, except when there is a question of whether the person is deceased or if the body is in danger of being destroyed. In all cases involving the movement of a body, personnel moving the body shall make careful note of the location and condition of the body for the Coroner/RCMP.
- Upon notification of an air disaster, NAV Canada will be responsible for air traffic in proximity to the scene, with immediate regulatory control of airspace around the area.

They will keep the airspace clear of intrusive air traffic, to the limits of the regulations.

Recovery:

- Recovery immediately follows emergency response. It involves direction from the General Manager or Designate.

- Maintaining access control to the scene.
- Providing emergency social services (critical stress debriefing), for employees and rescue workers.
- Investigating the accident.
- Clean-up of the crash site.

4.4 PIPELINE BREAKAGE

Pipelines will be used to transport tailings solids, reclaim water, freshwater, and domestic sewage on site. Pipeline breakage could lead to localized, short-term smothering of vegetation, the release of poor-quality water, and potentially exposure of mine personnel to infectious or toxic substances. In the event of a pipeline breakage, the following actions will be taken as required and when it is safe to do so:

- Shut off the feed to the pipeline;
- Physically contain the spill through the construction of dikes, berms, sumps and collection ditches;
- Pump collected water to the tailings reclaim pond or sewage treatment plant;
- Collect and remove solids for disposal in the tailings facility, incineration, or off-site disposal at a licensed disposal facility; and
- Monitor for residual contaminants on land and in surface water.

A general response procedure for the handling of spilled domestic sewage (infectious substances) is provided in the Spill Contingency Plan.

4.5 TOXIC GAS RELEASES

In the event of a toxic gas release, the following actions will be taken:

- Immediately evacuate the area/building and notify the incident commander;
- If possible and safety permits, turn off the source of the gas and ventilate (i.e., open windows/doors to outdoors) the area;
- Isolate the area and restrict access to ERT personnel only; and
- Implement air quality monitoring

For the mill, refer to the specific procedure *Toxic gas alarm emergency evacuation procedure*. A general response procedure for the release of compressed gases is provided in the SCP.

4.6 DIKE FAILURE

A detailed Emergency Preparedness Plan (EPP) was developed to address the consequences of failure of any of the dikes on site. The procedure was developed by the Geotechnical Engineering team with the assistance of the dike designer (Golder Associates provided the first version of the dike OMS and EPP, which was then elaborated upon by AEM) and the review of the EMC and the Satety Superintendent. The EPP for the dewatering dikes and Tailings Storage Facility are available in the Operation, Maintenance and Surveillance Manual (OMS manual) for the Tailing Storage Facilities and the Dewatering Dikes. Background information and potential failure scenarios of the dewatering dikes and Tailings Storage Facility are provided in Appendix A.

4.7 EMULSION PLANT

A detailed Emergency Response Plan (ERP) was prepared by Dyno Nobel and addresses incidents and potential incidents involving the manufacturing, handling and storage of explosives and related products in Dyno Nobel Canada Inc.' magazines, emulsion plants and worksites at Meadowbank. The ERP for Dyno Nobel emulsion plant is provided in Appendix B.

4.8 BAKER LAKE MARSHALLING FACILITY

The Baker Lake Marshaling facilities is located 2 Km., east of the Hamlet of Baker Lake and is used for the interim storage of supplies, including hazardous materials, prior to being transported to the mine site. The fuel farm at the Facility is used for bulk storage of:

60,000,000 liters of fuel

900,000 liters of Jet ''A'' fuel.

By the summer of 2013, 10 more tanks will be installed, in order to increase the Jet ''A'' fuel storing capability to a total of 1,900,000 liters.

Spill emergencies occurring at the Marshaling Facility will be handled according to the Spill Contingency Plan.

In case of any other major disaster, the primary Emergency procedures will fall under the Hamlet of Baker Lake authorities' responsibility.

By-Law no 212 (Emergency Response Plan) has already been adopted by local authorities. This By-Law for Baker Lake Hamlet's ERP plan is provided in Appendix C.

Maps and drawings of the Baker Lake fuel farm installations are also provided under Appendix C.1. and C.2.

Also, it is understood that major disaster occurring to Agnico Eagle Mines installations in Baker will be managed by RCMP's Baker Lake detachment, under Hamlet's governance as required under their contingency plans as revised on 2013-01-17

4.9 EMERGENCIES DEALING WITH REAGENTS

At Meadowbank mine site, we carry the following reagents:

- Cyanide (Sodium Cyanide)
- Copper Sulphite
- Lime (Calcium Oxide) (Quick Lime)
- Sodium Metabisulphite
- Caustic Soda (Sodium Hydroxide)
- Sulphur (Prill form)
- Nitric Acid
- Calcium Chloride (Dust Suppression)
- Flocculants
- Lead Nitrate
- Milsperse (Antiscalant)

Emergency Procedures for dealing with these reagents are found in Appendix B of this Emergency Response Plan.

SECTION 5 • REFERENCES

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SECTION 6 • LIST OF ACRONYMS

AEM	Agnico-Eagle Mines Limited – Meadowbank Division
AWPAR	All Weather Private Access Road
CDA	Canadian Dam Association
DFO	Fisheries and Oceans Canada
ECC	Emergency Coordination Centre
EIA	Environmental Impact Assessment
EMS	Environmental Management System
EPP	Emergency Preparedness Plan
ERG	Emergency Response Guidebook
ERP	Emergency Response Plan
ERT	Emergency Response Team
FoS	Factors-of-Safety
GN	Government of Nunavut
HAZCOM	Hazard Communication
HMMP	Hazardous Materials Management Plan
HR	Human Resources
HSC	Occupational Health & Safety Committee
IATA	International Air Transport Association
ICC	Incident Command Centre
INAC	Indian and Northern Affairs Canada
KIA	Kivalliq Inuit Association
MMER	Metal Mining Effluent Regulations

MSDS	Materials Safety Data Sheets
MSHA	Mine Safety and Health Administration
NWB	Nunavut Water Board
OHSA	Occupational Health and Safety Administration
OHSP	Occupational Health & Safety Plan
PPE	Personal Protective Equipment
SCP	Spill Contingency Plan
TDG	Transportation of Dangerous Goods
TSF	Tailings Storage Facility
WCB	Worker's Compensation Board
WHMIS	Workplace Hazardous Materials Information System

APPENDIX A

Dike Failure Scenarios

A.1 Dewatering Dikes

A.2 Central Dike

A.3 Saddle Dams

A.4 Storm water Dike

Appendix A.1

Dewatering Dikes

Dewatering Dike System

The Dewatering Dike System includes the East Dike, Bay Goose Dike, South Camp Dike and Vault Dike as shown on the general mine site plan provided at the beginning of this document. The dike construction for East Dike and Bay Goose Dike involved the dumping of rockfill into water to create the shells of the dikes, excavation through rockfill and lakebed soils to bedrock, placement of granular filter and core materials, dynamic compaction, construction of the cut off wall using slurry supported trench techniques and grouting of the bedrock and contact between the cut off wall and bedrock using cementitious grout. South Camp Dike and Vault Dike both include a bituminuous liner and a key trench cut-off to make the structure impermeable. East Dike and Bay Goose Dike have crest widths in excess of 50 m and are not used by haul trucks during normal mine operation. South Camp Dike and Vault Dike have crest widths in excess of 25 m and may be used as haul roads during normal mine operation.

East Dike and Bay Goose Dike are considered high consequence structures, based on Canadian Dam Association (CDA, 2007) Dam Safety Guidelines. South Camp Dike is considered to be a significant consequence structure, based on Canadian Dam Association (CDA, 2007) Dam Safety Guidelines. Vault Dike is considered to be a low consequence structure, based on Canadian Dam Association (CDA, 2007) Dam Safety Guidelines. The dikes are relatively low, wide structures that exceed the minimum design criteria factors-of-safety (FoS) for stability for pre-drawdown conditions, operation conditions with maximum head difference across the dikes, pseudo-static earthquake conditions, and post closure conditions. Consequently, the probability of dike failure is considered to be low provided that the dikes are constructed according to the design. Mitigation against failure of the dikes includes a quality control and quality assurance program during construction, and an ongoing program of dike surveillance and monitoring during operations, as specified in the design.

For information on the consequences and monitoring/action for the various embankment failure modes possible at the Dewatering Dikes see Table A.1 below.

East Dike

The East Dike was constructed in 2008, with foundation grouting continuing into early 2009. The East Dike has a crest length of 800 m, including abutments, and was constructed in water with a maximum water depth to bedrock at the cut off of 7.2 m. The crest of the East Dike is at elevation 137.1 m and the average lake level along the dike is 133.1 m. The main components of the East Dike include a rockfill shell, a granular core with downstream filter zone, a soil-bentonite cut-off wall through the densified granular core zone to the underlying foundations, and a grout curtain from the base of the cut-off wall into the underlying bedrock.

During operations, the East Dike separates the eastern portion of Second Portage Lake from the Portage Pit and the Tailings Storage Facility behind the Central Dike. Following closure, the East Dike will remain as a permanent structure that will separate Third Portage Lake (El. 134.1 m) from Second Portage Lake (El. 133.1 m) and maintain the existing water elevation difference of 1 metre.

The East Dike is approximately 800 m in length through an average water depth of approximately 2.3 metres, and a maximum water depth to bedrock of about 7.2 m. Crest width is approximately 55 metres. Minimum setback from the Portage Pit (distance between dike toe and pit crest) is greater than 170 metres.

Bay Goose Dike

The Bay Goose Dike together with the South Camp Dike isolates the Bay-Goose Pit from Third Portage Lake. The Bay Goose Dike acts as a permanent structure to allow mining of the Goose Pit and the southern portion of Portage Pit. The main components of the Bay Goose Dike include a rockfill shell, a granular core with downstream filter zone, a soil-bentonite and cement-soil-bentonite cut-off wall through the densified granular core zone to the underlying foundations, a jet grouted wall between the base of the cut-off wall and bedrock where the cutoff wall was not constructed on bedrock, and a grout curtain from the base of the cut-off wall or jet grouted wall into the underlying bedrock.

The Bay Goose Dike is approximately 2,200 m in length, and was constructed in water depths less than 9 metres at the cut off. Crest width varies between approximately 85 and 100 m. Minimum design setback from the Portage and Goose Pit is 70 metres.

South Camp Dike

The South Camp Dike covers a narrow channel within Third Portage Lake and in conjunction with the Bay Goose Dike isolates the Bay Goose Pit from Third Portage Lake.

The South Camp Dike is located south of the plant site area and is used to connect the mainland to South Camp Island. It covers a narrow channel, approximately 60 m in width, where water depths were between 0.5 and 1 m.

The South Camp Dike was primarily constructed between April and June of 2009, prior to ice breakup. During the winter of 2009-2010 additional thermal capping material and rockfill for the haul road was added to the dike. The South Camp Dike has a broad rockfill shell with a bituminous geomembrane liner installed on the upstream side of the shell. The liner was founded on native frozen (permafrost) till material, in a trench approximately 3 to 5 m below the lakebed surface. Compacted granular material mixed with bentonite was placed above the toe of the liner. The haul road is located on the downstream side of the dike. The South Camp Dike is approximately 85 m in length through water depths between 0.5 and 1m. Crest width is approximately 25 metres.

Vault Dike

The construction of the Vault Dike at Meadowbank was conducted from February 2013 to March 2013. Vault Dike is located across a shallow creek which connects Wally Lake and Vault Lake, at the Vault Pit area approximately 8 km north of the main Meadowbank site. Vault Dike is essential to allow the dewatering of Vault Lake and to isolate Vault Pit from Wally Lake during mining activities.

Vault Dike is designed and constructed as a zoned rockfill dam with filter zones, an impervious upstream liner consisting of a bituminous membrane, and an upstream key trench made of aggregate mixed with bentonite. The filter zones minimize seepage and internal erosion and facilitate seepage collection. Vault Dike includes a key trench at the base of the upstream side filled with a 0-25 mm fill amended with bentonite surrounding the liner. Coarse and fine filter material was placed on the upstream slope as geomembrane bedding. The bulk part of the dike consists of coarse rockfill material. The embankment crest is at El. 142.4 m and the upstream toe is at approximately El. 139.4 m. The downstream toe is at approximately El. 139.6 m and the bottom of the key trench ranges from El. 135.6m to El. 142.3m, with an average height of El. 137.0m. The upstream and downstream fill

slopes of the dam are 1.5H: 1V. The Vault Dike is approximately 275 m in length through a maximum water depth of 1 m. The crest width is approximately 25 metres.

Table A.1: Meadowbank Dewatering Dikes Summary of Consequences and Proposed Monitoring/Action for Rare Events Based on Water Retaining Embankment Failure Modes Identified in ICOLD Study (1995)

Failure Mode	Scenario	Consequence	Monitoring/Action
Overtopping	(1) Lake level rise because of restricted outflow from Third Portage, Second Portage Lake or Wally Lake (excessive inflow is a far less likely scenario).	Water spilling over the crest. The crest is wide and comprises coarse rockfill. Significant damage to the dike is not credible, based on performance of other rockfill structures subjected to overtopping or flow through events. Mining operations might need to be suspended, but there will be considerable warning time given the design freeboard and the storage volume within the lakes.	Lake levels should be part of safety information provided to mine management. Outflow channels should be inspected weekly during thaw, open water season, and during ice break-up. If overtopping is likely, a temporary spillway could be constructed and armoured to control and localize flow at shallow dike sections.
	(2) Dam crest settles more than 2m over a distance of (say) 50m or so. This scenario requires extensive loss of support in the foundation since the rockfill of the dikes is essentially not settlement prone itself. For foundation settlement of this magnitude to occur, a piping event must develop and which in itself might be a failure mode. Or, there would have to be an unexpected layer of compressible soil in the foundation.	Same as (1).	The situation envisaged in this scenario should develop slowly with crest settlement evident at least several weeks before a run-away event develops. Easily observed cracks should be evident. Monitoring of crest settlement is appropriate, and is included in the design. Rockfill and till available from the mining operation can be placed to raise the dike crest.
Internal Erosion	(1) Dike Section: Cut off wall, cut off key trench or bituminuous liner is defective, allowing high water flow across the wall. This defect occurs at a deep water location where the core backfill and filters are segregated and permeable; the combination allows erosion of the cut off wall and increasing seepage.	The cut off wall will develop a progressively increasing void ratio, thereby increasing the rate of water flow through the dike. This is not a catastrophic failure mode as the rockfill shoulders of the dike will be stable, and at its worst, would lead to temporary suspension of mining.	Monitor seepage from downstream face for rate of seepage, and for presence of sediment in seepage. Will become evident as localized intensive seepage at dike toe and can be repaired. May also see settlement in the cut off wall. Will be most likely in deep water sections. Gradients across the cut off wall in shallow water are not high enough to cause piping.
	(2) Dike Section: Cut off wall loses bentonite because of improper construction.	Same consequences as erosion because of defect, as above.	Bentonite makes up 2% of the cut off wall fill. Loss of this material will increase the permeability of the cut off wall and increase the rate of seepage.

Failure Mode	Scenario	Consequence	Monitoring/Action
	(3) Foundation: Till is possibly non-uniform with more transmissive zones and not self-filtering. It is possible that one of these zones may align with defective construction of the core backfill and defective construction of the cut off wall allowing high flows. Seepage along the transmissive zone beneath the downstream rockfill section could erode the foundation tills at the downstream toe or flow into the downstream rockfill because of the lack of filtering.	Limited seepage at the toe or into the rockfill would accelerate into a large inflow, and could lead to the undermining of the dike if no action was taken. This is a credible catastrophic failure mode if increased seepage is not detected in time.	No particular instrumentation is needed as this failure mode will show itself as localized and increasing seepage. It could be detected by walk-over inspection by an experienced engineer or technician. Remedial action could comprise a reverse filter and rockfill buttress depending on location of the flow and configuration of the foundation, freezing, or grouting if identified in time. Quality control of cut off is important, and most important for deep water sections. In the worst case, the pit may be deliberately flooded in a controlled manner, the cut off repaired, and the pit dewatered.
Seepage within Embankment	Seepage on its own is not a credible failure scenario. The downstream rockfill shell has extremely high flow through capacity. The rockfill zone is both large and pervious, so that seepage will daylight on the downstream face and lead to instability. Any seepage related failures must include internal erosion, see above.	No credible consequences. May require upgrade of the seepage collection system. May need to suspend mining activities while reducing seepage.	Seepage monitoring program.
Seepage within Foundation	Defective construction of cut off leading to transfer of unexpectedly high fraction of the reservoir head into the downstream part of the dike foundation, or leading to a piping event as above.	This failure mechanism has caused embankment failures elsewhere because of straightforward pore pressure induced instability. However, it is unclear that it could cause failure of the Dewatering Dikes because of their large width compared to the retained water head. The most likely consequence is downstream toe slumping requiring a localized stabilizing berm before the crest roadway could be reinstated.	If this mechanism arises it should show itself during initial dewatering or very shortly thereafter.

Failure Mode	Scenario	Consequence	Monitoring/Action
Internal Conduit Rupture	There are no water off take works or other structures extending through the dikes.	Not applicable.	Not applicable.
Slope Instability	(1) Normal Operation: The rockfill shoulders of the dikes are wide and have high shear strength, making it a conservative design. Slope failure requires failure in the foundation and which would then extend into the overlying dike. Sliding failure is considered unlikely given the low horizontal forces generated by water and ice forces relative to the normal frictional force due to the weight of the dikes and the friction angles of foundation materials	A foundation failure would cause a rotational slip or sliding failure until equilibrium was reached. This mechanism would limit access along the dike until repaired. Failure through the rockfill shoulders will not necessarily compromise the water retaining function of the dikes. Failures which reach the core may cause failure.	This mechanism should develop during construction or dewatering, due to increase in load and associated pore water pressure increase. Initial stages of failure should be observable as tension cracks in the dike crest. Walk-over inspection of the dikes by a trained inspector is an appropriate monitoring strategy. Survey of crest, face, and toe is also appropriate. Stabilizing berms can be placed inside the dikes or through water along the upstream shoulder.
	(2) Earthquake Induced: Occurrence of an extreme earthquake, much in excess of the current understanding of seismicity of the area.	The extreme earthquake loading for this site is a low magnitude. Settlement of the dikes could occur in the event of a large earthquake. Dynamic compaction of the core during construction may have subjected the rockfill shells to accelerations equivalent to the expected earthquake loading. This would not be a failure situation. The crest is also erosion resistant for any earthquake induced wave action in the impounded water.	Dike inspection following earthquakes felt on site.

Failure Mode	Scenario	Consequence	Monitoring/Action
Failure of Cut off Wall or Bituminuous Liner Due to Movement of the Dikes	Differential horizontal movement of dikes due to water or ice loading, or pit wall failure. Creates a breach in the cut off wall, cut off key trench or bituminuous liner. Ice and water forces are not credible due to the ratio of frictional forces generated by the weight of the dike versus ice loads and water pressure. Pit wall failure involving the dike unlikely based on assessments of pit wall stability and setback distance between the pit and the dikes.	Large inflows through the breach. Pit would flood requiring suspension of mining activities. Potential for loss of life for workers inside dikes.	No enhanced monitoring. Prism monitoring program sufficient. If the pit floods, then repairs to cut off or bituminuous liner would be done prior to dewatering.
Unexpected Settlements	Unexpected foundation soils consolidate during dike construction. A significant quantity of clay that was not recognized during foundation excavation would be required to generate settlement required for a water release event. Settlement of the core will be limited by dynamic compaction.	2 m of core settlement would be required to allow water flow through the rockfill and over the settled core. This flow would not cause failure of the rockfill shells. It would also be readily repaired by placing more end-dumped till into the settled zone.	No enhanced monitoring required, as settlement would be apparent from prism monitoring data and visual inspection. Excessive settlements may be remediated by excavating rockfill above the core and placing more till. Soil conditions will be observed during construction, and design revised to accommodate actual conditions.

A.1.1 Failure Scenario during Operations

The 'worst-case' scenario for failure of the dewatering dikes during operations would involve a movement of the dikes that compromises the integrity of the cut off wall, cut off key trench or bituminous liner. However, the rockfill has a very high flow-through capacity and a high strength and will not move unless the foundation is involved. The water will flow through the upstream rockfill first, then through the core and cut off wall, cut off key trench or bituminous liner, and finally through the downstream rockfill berm. Flow through cracks opening in the foundation may erode the foundation soils and the core. The upstream rockfill will choke the flow to some degree, and flow will decrease once the downstream toe of the dike is inundated and the head difference across the dike begins to reduce.

Although this describes a 'worst-case' scenario, a catastrophic failure of the pit dewatering dike system is not considered a credible failure mode. Elements of the dike design, including the width of the dike section, and the inclusion of filters, in addition to the cut off wall, cut off key trench and bituminous liner make catastrophic failure of the dike highly unlikely. However, for the purposes of this document, the effects of such a failure are described below.

Potential Effect

In the case of East Dike, the worst-case scenario would be associated with the short portion of the dike through the deepest water along the alignment at the centre of the dike. In this area the water depth is as much as 7 m to bedrock at the cut off wall within the dike. This inflow could potentially result in loss of workers caught in flowing water. Breach of the East Dike would be unlikely to trap workers in the pit when access ramps are on the west side, opposite the inflows. Breach of the East Dike would result in cessation of mining, either temporarily or permanently.

Upon completion of the East Dike and dewatering of the northwest arm of Second Portage Lake, there was approximately 17 million m^3 (Mm^3) of water remaining in Second Portage Lake. If the segment of dike at the deepest portion were suddenly removed, flow from Second Portage Lake into the pit would continue until the elevation of the lake drops by several metres, at which time the current lake bottom would be exposed and would act as a barrier to flow towards the pit. This scenario is the worst in the final year of pit operation when pit volume is the largest. The volume of water associated with this drawdown would be on the order of about 10 Mm^3. Some erosion of the till between the pit crest and dike toe would be expected, so the depth of water loss from the lake may be larger, but this would take some time to fully develop.

Inflow to the pit could expose large amounts of shoreline and shoal habitat around the lake. Water flowing into the pit could entrain suspended solids and dissolved constituents from the dike material and pit walls. If necessary, the water could be retained within the pit and diked area and would be amenable to treatment (e.g., particle settling, in-situ amendment) before discharge, should it be required.

The ecological effects of the exposure of shoreline and shoal habitat on fish and fish habitat would be to temporarily eliminate spawning areas and result in reduced water quality from exposure of sediment to wave and wind induced erosion. The effect of this would last approximately one year as inflow from Third Portage Lake to Second Portage Lake averages 10 Mm^3 annually (AMEC, 2003). Presuming that the dike breach is repaired, water levels in Second Portage Lake would rise over the

spring and summer to return to pre-breach elevations and would re-fill the lake in the event of a 'worst-case' scenario.

In the case of Bay Goose Dike, the worst-case scenario dike breach that could allow the greatest amount of water inflow would be associated with the southeast segment of the dike through the deepest water along the alignment. In this area, water depth is as much as 20 m deep at the cut off, and the pit could be as deep as 130 m. This inflow could potentially result in loss of workers caught in flowing water. Breach of the Bay Goose Dike would be unlikely to trap workers in the pit when access ramps are on the northwest side, opposite the inflows. Breach of the Bay Goose Dike would result in cessation of mining of the Goose Pit, either temporarily or permanently.

In the unlikely event that such a failure of the Bay Goose Dike were to occur, the rate and volume of water entering the downstream pit would depend on the magnitude of the breach and the length of time to repair the breach. Third Portage Lake has an estimated volume of 446 Mm^3 (Golder, 2006). The final volume of Portage Pit (30.0 Mm^3) is roughly 6.7% of the volume of the lake, while Goose Pit (14.8 Mm^3) is approximately 3.3% of the volume. In the case of a catastrophic breach of the Bay Goose Dike, the estimated Third Portage Lake water level drawdown would be approximately 1.0 m and 0.5 m, respectively assuming that the failure occurs when the pits are completely excavated and a complete filling of the pits. These estimated worst-case scenario changes in water level are comparable to the mean average annual difference between high and low water (0.3 m) on Third Portage Lake.

There would be a small impact to fish and fish habitat in Third Portage Lake in the event of a 0.5 m to 1.0 m drop in water level. Areas used for spawning may be slightly nearer to the ice cover and a small amount of habitat might be vulnerable to freezing. Water quality within the pit would be temporarily impaired from an increase in suspended and dissolved solids, although water quality would return to near background during the first winter as sediment would settle under the ice cover.

In the case of South Camp dike, the worst-case scenario dike breach that could allow the greatest amount of water inflow would be associated with the centre segment of the dike through the deepest water along the alignment. In this area, the water depth is only a maximum of 1 m. This inflow could put the workers at risk at the site on a temporary basis and a potential loss of life between 0 and 10 due to workers caught in flowing water. Breach of South Camp Dike could eventually result in cessation of mining, either temporarily or permanently.

If the segment of dike at the deepest portion were suddenly removed, flow from Third Portage Lake into the pit would continue until the elevation of the lake drew down slightly as South Camp Dike retains a maximum depth of 1 m of water. The impact of a potential failure would likely be limited.

Inflow to the pit could expose a limited amount of shoreline and shoal habitat around the lake. Water flowing into the pit could entrain suspended solids and dissolved constituents from the dike material and pit walls. If necessary, the water could be retained within the pit and diked area and would be amenable to treatment (e.g., particle settling, in-situ amendment) before discharge, should it be required.

The ecological effects of the dike failure will probably have no significant fish or wildlife habitat, affected or deteriorated. Presuming that the dike breach is repaired, water levels in Third Portage Lake would rise over the spring and summer to return to pre-breach elevations and would re-fill the lake in the event of a 'worst-case' scenario.

In the case of Vault dike, the worst-case scenario dike breach that could allow the greatest amount of water inflow would be associated with the centre segment of the dike through the deepest water along the alignment. In this area, the water depth is only a maximum of 1 m. This inflow could put the workers at risk at the site on a temporary basis and a potential loss of life between 0 and 10 due to workers caught in flowing water. Breach of the Vault Dike could eventually result in cessation of mining, either temporarily or permanently.

If the segment of dike at the deepest portion were suddenly removed, flow from Wally Lake into the pit would continue until the elevation of the lake drew down slightly as Vault Dike retains a maximum depth of 1 m of water. The impact of a potential failure would be limited.

Inflow to the pit could expose a limited amount of shoreline and shoal habitat around the lake. Water flowing into the pit could entrain suspended solids and dissolved constituents from the dike material and pit walls. If necessary, the water could be retained within the pit and diked area and would be amenable to treatment (e.g., particle settling, in-situ amendment) before discharge, should it be required.

The ecological effects of the dike failure will probably have no significant fish or wildlife habitat, affected or deteriorated. Presuming that the dike breach is repaired, water levels in Wally Lake would rise over the spring and summer to return to pre-breach elevations and would re-fill the lake in the event of a 'worst-case' scenario.

Mitigation, Management, and Monitoring

A major cut off breach scenario due to pit wall movement, while possible, has a low probability of occurrence in East Dike or Bay Goose Dike. If foundation movement was sufficient to compromise the cut off wall, then the core backfill would act as a semi-permeable element and limit flow. Water would first need to flow through the rockfill shell, the core backfill, the damaged cut off wall, and then through more of the core, filters, and the downstream rockfill. Provided that the downstream filter elements against the rockfill shell are properly constructed, then migration of the core and cut off wall into the rockfill will not occur. Some additional seepage may occur due to failure of the cut off wall; however this would be noted during regular monitoring. Mitigation could be by jet grouting, freezing, or installation of sheet piling through the cut off wall.

The use of appropriately graded filters in the design of dikes and dams is standard engineering practice, and is the key to preventing internal erosion. The dike design includes the use of a two zone filter on the upstream face of the pit side rockfill. During the construction of the dikes a quality control and quality assurance program was undertaken.

Routine visual inspection of the dikes is to be conducted on a regular basis to document any changes in the dikes.

During the operation of the dikes, a series of monitoring instrumentation will be installed, including:

- Thermistors to monitor the thermal regime in the dike and foundations;
- Slope inclinometers and prisms to monitor deformations within the dikes; and
- Piezometers to measure pressure and to infer flow through the dikes.

Piezometers downstream of the cut off wall would be monitored for pressure changes as the pits are deepened. Increasing pressure would indicate that less head loss is occurring across the seepage cut off, which might indicate that a crack has formed, permeability is increasing, or the pit is experiencing inflows from some other potential flow pathway. The instrumentation will be monitored to identify any potentially problematic areas relating to dike instability. Mitigation measures for seepage and piping could include:

- Additional pressure grouting of bedrock materials;
- De-pressurization wells;
- Construction of a slurry cut off wall within the core just upstream of the suspected seepage area;
- Jet grouting of the core and foundation in the suspected seepage or crack area;
- Construction of a cutter soil mixing (CSM) wall in the suspected crack area;
- Freezing;
- Installation of toe drains; and
- Construction of interceptor ditches within the down-stream overburden materials.
- Allow pit to flood, install new cut off or bituminous liner under no-flow conditions, then dewater and resume mining.

Specific monitoring and mitigation strategies have been be developed as part of an Operations Plan (OMS Manual) for the dewatering dikes.

A.1.2 Failure Scenario during Closure

At end of mine life, once the water quality of the pit lake has been determined to be suitable for release, a portion of the south end of the Bay-Goose Dike will be removed resulting in a hydraulic connection between the Goose/Portage Pit Lake and Third Portage Lake. The East Dike will be the only dike that will remain in service. The elevation of the pit lake will be equal to Third Portage Lake. The elevation difference between the pit lake and Second Portage Lake will be approximately 1 m. Consequently, there will be a low hydraulic gradient from the pit lake towards Second Portage Lake. During the closure and post-closure period, the natural central and east channel outlets that connect Third Portage to Second Portage Lake will continue to carry the entire flow between the two lakes.

Potential Effect

A breach of the East Dike would create an additional outlet and cause water to leave the Portage/Goose pit area and spill into Second Portage Lake at a greater rate, partly at the expense of flow from the central and east channel outlets. This would cause a rise in water level in Second Portage Lake and a reduction in level in Third Portage Lake. The additional water would flow through the channel connecting Second Portage Lake to Tehek Lake until the water elevations in Second and Third Portage lakes equilibrated.

In the event of such a scenario, water would flow from Third Portage Lake, northward through the pit lake area, and then east through a potential East Dike breach and into Second Portage Lake. There is a naturally large outlet capacity via the connecting channel from Second Portage to Tehek Lake. Water residence time in Second Portage Lake during and after mine development is less than one year. Thus, in the event of an East Dike breach, any additional water added to Second Portage Lake would leave the system relatively quickly. Given the flow-through nature of the lake there would be little net change in Second Portage Lake volume or lake elevation as water would easily be absorbed into the much larger Tehek Lake.

Drawdown of Third Portage Lake would be limited, given the large size of the lake (33 km^2) and the constriction points within the system that would slow drawdown. Specifically, the magnitude of drawdown in the event of a breach would depend on the magnitude and depth of the breach, time of year (winter ice cover would prevent loss of water), response time, flow rate (i.e., the loss of water depends on the location of the breach and friction through the system), and the outlet capacity of Second Portage Lake. For example, total annual average discharge from Third Portage to Second Portage Lake is approximately 10 Mm^3 with a mean annual difference in water level between spring and fall of 0.3 m. Given the large size of Third Portage Lake, a breach resulting in the loss of 10 Mm^3 of water, which is equivalent to an entire open water season of runoff through all discharge channels would result in a drawdown of only about 0.3 m. Maximum drawdown would be one metre.

Reductions in water level would therefore be small and have only minor impacts to fish habitat in Third Portage Lake. Adverse impacts to water quality would not be expected given that water quality within Goose/Portage pits is expected to be very high.

Mitigation, Management and Monitoring

Internal erosion of the cut off wall could result in an increase of the rate of water flow through the East Dike. However, this is extremely unlikely due to the low hydraulic gradient across the East Dike (~ 1 m of head difference) and the filter effect of the core backfill. Such a scenario is more likely to occur during the operational phase of the East Dike when the hydraulic gradient across the dike section is much higher, though in the opposite direction. If such a scenario were to occur, it would not be considered a catastrophic failure mode due to the stability of the rockfill shoulders comprising the outside structural elements of the dike.

A breach in the East Dike during closure could be managed by the placement of material to reduce the flow of water and reduce potential erosion of the till core. The hydraulic gradient across the dike at closure is low. The dike could be repaired and hydrologic conditions restored without any danger to the overall stability of the dike, provided annual monitoring is carried out following closure.

Appendix A.2

Central Dike

Central Dike

The Central Dike system is comprised of a Central Dike, a series of perimeter dikes, and the natural basin of the northwest arm of Second Portage Lake, as shown on the general mine site plan provided at the beginning of this document. The Central Dike cross-section consists of:

- A rockfill embankment, constructed from run-of-mine waste rock, placed in lifts and compacted, with the upstream face designed at 3H:1V and 2H:1V and the downstream face designed at a 1.5H:1V slope;
- An upstream two zone granular filter and inverted granular filter along the foundation;
- A bituminous liner with appropriate cover on the upstream face and part of the foundation;

A central or upstream key trench; The Central Dike is a high consequence structure, based on Dam Safety Guidelines (CDA, 2007). Slope stability analyses show that the dike will meet or exceed design FoS for stability under static and pseudostatic earthquake load conditions. Consequently, the probability of failure of the Central Dike is considered to be very low.

For information on the consequences and monitoring/action for the various embankment failure modes possible at the Central Dike see Table A.2 below.

Table A.2: Meadowbank Tailings Storage Facility Summary of Consequences and Proposed Monitoring / Action for Rare Event Based On Water Retaining Embankment Failure Modes Identified in ICOLD Study (1995)

Failure Mode	Scenario	Consequence	Monitoring/Action
Overtopping	(1) Pond Level rises because of restricted outflow (excessive inflow is a far less likely scenario). Water will spill at the low point on the dike system, which will depend on the construction schedule.	Water spills over the crest but, as this crest is both wide and comprises coarse compacted rock fill, minimal damage to the dike is credible. There will be considerable warning time prior to overtopping given the design freeboard and the storage volume.	Adjust decant and/or deposition rate. Add spillway in Central Dike, Saddle Dam, or natural ground.
	(2) Dam crest settles more than available freeboard over a distance of (say) 50m or so. This scenario requires unexpected foundation condition, such as glacial lake clay deposit. Settlement would occur upon placement of rock fill during dike raise construction. Freeboard is greatest immediately after a raise and this scenario is therefore unlikely to occur.	Water and tailings spill over crest and if settlement was rapid might erode the crest. Travel of tailings will be dependent on volume of water available, and level of thaw. Tailings would only go to the pit, and not reach the lake.	The situation envisaged is unlikely. This scenario would develop slowly during construction of the dike. Crest settlement would be evident at least several weeks before an overtopping event occurred. Easily observed cracks should be evident during summer period, but could be hidden during the winter. Systematic crest settlement monitoring is appropriate, and included in the design. Production and addition of tailings to the Tailings Storage Facility could be stopped to maintain freeboard. A spillway could also be constructed. The tailings deposition plan maintains a long beach between the dike and the pond, which provides additional freeboard to overtopping of the dike by pond water.

Internal Erosion	(1) Dike Section: Upstream bituminous liner contains defects arising from undetected damage during installation. May lead to loss of water, but filter retains tailing.	Loss of water into the rock fill. This is not a catastrophic failure mode, because the rock fill of the dike will be stable, and at its worst, would lead to temporary suspension of mining. Plus the bituminous liner does not propagate a tear like a plastic liner, so undetected damage is typically small and does not grow. Also, the foundation slopes down towards the tailings, so seepage impounds in the rock fill and will tend to reduce further seepage	Not necessary to monitor directly. Will become evident as possible seepage at dike toe. QA/QC program during construction is the main defence against this scenario.
	(2) Dike Section: Upstream bituminous liner contains defects arising from undetected damage during installation. This defect occurs at the same location as a filter defect.	Loss of tailings and water into the rock fill. This is not a catastrophic failure mode, because the rock fill of the dike will be stable, and at its worst, would lead to temporary suspension of mining. Accumulation of ponded water within the rock fill would decrease the head difference driving flow, thereby limiting the potential for a catastrophic failure.	Not necessary to monitor directly. Will become evident as possible intensive seepage at dike toe, and potentially as tailings fines within seepage downstream of the toe. QA/QC program during construction is the main defence against this scenario.
Seepage within Embankment	Seepage on its own is not a credible failure scenario. The rock fill is pervious so seepage will daylight on the downstream face. Flow through the rock fill will not lead to instability. Any seepage related failures must include internal erosion, see above.	No credible consequences.	No scenario specific monitoring required.
Seepage within Foundation	If the till foundation had a zone of more pervious soil (e.g. gravel seams) and the more pervious zone was preferentially exposed to water pressure, then normal seepage would transmit an unexpectedly high fraction of the reservoir head into the downstream part of the dike foundation. This scenario requires construction defects in filters, liner, and cut off trench fill.	This failure mechanism has caused other embankment failures elsewhere because of straightforward pore pressure induced instability. However, it is unclear that it could cause failure of the Central Dike because of its large width compared to the retained water head. The most likely consequence is downstream toe slumping requiring a localized stabilizing berm.	If this mechanism arises it should show itself gradually as the tailings and water level increase in the basin by buildup of pore water pressures in the foundation. This would be detected during routine monitoring of piezometers installed in the foundation. Pressure relief wells could be installed in the foundation during operations. The tailings deposition plan maintains a long beach between the pond and the dike. This will reduce seepage gradients beneath the dike. In addition, the tailings act as an upstream blanket on the bottom of the TSF to limit seepage into the foundation.

Internal Conduit Rupture	There are no water off take works or other structures extending through the dikes.	Not applicable.	Not applicable.
Slope Instability	(1) Normal Operation: The rockfill has high frictional strength and the design widths make it conservative. Slope failure requires failure in the foundation, which would then extend into the overlying dike.	A foundation failure would cause a rotational slip or sliding failure until equilibrium was reached. This mechanism would limit access along the dike until repaired. Failure through the rock fill will not necessarily compromise the tailings or water retaining function of the dike.	Initial stages of failure should be observable as tension cracks in dike crest and movement at dike toe. Walk-over inspection of dikes by a trained inspector is an appropriate monitoring strategy. Survey of crest, face and toe is also appropriate. If movements associated with increases in foundation pore pressures are discovered, then construction could be stopped or staged to allow pore pressure dissipation. Placement of rockfill as a downstream toe berm could help prevent failure.
	(2) Earthquake Induced: Occurrence of an extreme earthquake, a very rare event.	The extreme earthquake loading for site is a low magnitude event. A large earthquake would not be expected to cause a catastrophic failure, rather the dike would settle. The Central Dike rock fill is placed in the dry and compacted, and will therefore have limited settlement. This would not be a failure situation. The crest is also erosion resistant for earthquake induced wave action in the impounded water.	No monitoring is necessary. Dike should be inspected following any earthquakes felt on site.
Liner Failure Due To Foundation Movement	Differential horizontal movement of the dike due to pit wall failure. Creates a breach in the liner and filter. Pit wall failure is unlikely based on assessments of pit wall stability and the setback between the pit and the toe of the dike. Also, the liner and rock fill can withstand significant deformation, making this an unlikely scenario.	Tailings and water escape into the dike rock fill, but pond there because the foundation slopes towards the dike, rather than the pit. It is noted that the tailings pond is operated approximately 500 metres away. Rapid escape of water will therefore be limited.	No enhanced monitoring. Prism monitoring program and visual inspection sufficient. Movement would be evident in setback area between dike and pit. Tailings at face of dike may be excavated to allow repair of liner, or placement of filter material. Other options include freezing tailings at face of dike.
Unexpected Settlements	The foundation till is expected to consolidate during construction and operations. There is no credible mechanism for a large degree of unexpected settlement following construction required to eliminate freeboard and release tailings/water.	A large settlement could lead to water flowing through the rock fill, but this would not cause failure of the rock fill. It could also be readily repaired by placing more end-dumped rock fill, and extending the liner, in a manner similar to the periodic raise.	No enhanced monitoring required, as excessive settlement would be apparent from prism monitoring data, and visual inspection.

A.2.1 Failure Scenario during Operations

In the case of failure of the Central Dike during operations, the 'worst-case' scenario would involve a flow of unfrozen water and tailings in association with a catastrophic failure of the dike in the later stages of mining when personnel and machinery are working in the open pit directly down-stream of the Tailings Storage Facility (TSF).

Potential Effect

The failure of the Central Dike could result in the sudden release of dike material and tailings from the TSF into that portion of the Portage Pit immediately adjacent to the dike. This could potentially result in loss of life. This would result in cessation of mining activities, either temporarily or permanently.

There would be no effect on the receiving environment water quality, fish or fish habitat because tailings would be contained within the pit and the dewatering dikes and the area would not yet be flooded.

Mitigation, Management and Monitoring

The calculated FoS for this failure mode, under static and pseudo-static conditions, are above design criteria in the Dam Safety Guidelines (CDA, 2007). Consequently, the probability of such a failure developing is low. Based on the tailings deposition plan, it is expected that the tailings pond will typically be 500 m or more from the face of the Central Dike. Furthermore, thermal modeling indicates the tailings and Central Dike will be frozen or partially frozen, and that the facility will tend to the frozen state in the long term. Therefore, a catastrophic failure of the Central Dike without some form of prior dam distress providing a warning of deteriorating conditions is not considered a credible catastrophic failure mode.

Mitigation against such a failure mode occurring will be to construct the Central Dike to design so that it is physically stable under all loading conditions. A comprehensive quality control and quality assurance program will be undertaken during dike construction to confirm foundation conditions, material type and quality, and to adjust designs as necessary to accommodate actual or unexpected conditions found at site.

- A management plan was developed for the operation of the tailings facility, and includes appropriate operational controls and monitoring activities. During operations, instrumentation will be installed to monitor not only the physical performance of the Central Dike itself, but also the performance of the TSF. The instrumentation installed and to be installed includes thermistors to monitor the thermal regime in the dike and foundations, and deposited tailings.

- Piezometers to measure pressure and to infer flow through the dike and foundation materials

- Prisms to monitor deformations within the dike.

If necessary, the stability of the foundation materials and of the dike during operations can be enhanced through the construction of a stabilizing toe berm or through freezing.

A.2.2 Failure Scenario during Closure

In the case of failure of the Central Dike during or following closure, the 'worst-case' scenario would involve a catastrophic failure of the dike and the release of tailings into the lake.

Potential Effect

Failure of the Central Dike during or following closure is not expected to result in loss of life, as mining operations will have finished.

Under this scenario, a catastrophic failure of the Central Dike could result in the sudden and unexpected release of dike material and tailings into the Portage Pit lake area. This could potentially produce a wave of sediment laden water that could over-top the East Dike.

Such a scenario would destroy fish habitat along the dike face and smother benthic habitat outwards from the failure area. Suspended solids and dissolved metals would increase in the water column and would cause displacement of fish and possible toxicity of some bottom sediments, depending on how much tailings material was lost. The new face would be subject to chronic erosion of fine tailings material until such time as a new, stable dike face could be established. Failure of the dike would not cause a change in water level. Impacts would be localized because the Central Dike is situated in the upper part of a blind arm of the lake with an extremely limited drainage area and low turnover. Consequently, transport of suspended sediment away from the area would be restricted and the area of impact would be relatively small.

Mitigation, Management, and Monitoring

The calculated FoS for the Central Dike design are greater than design criteria for post closure for static and pseudo-static (earthquake) conditions. Consequently, the likelihood of a failure occurring is low. Furthermore, thermal modeling indicates the tailings and Central Dike will progressively freeze, and that the facility will tend to the frozen state in the long term. Freezing will increase dike and tailings stability and decrease tailings mobility, and therefore this is not considered a credible catastrophic failure mode.

Mitigation against such a failure mode occurring will be to construct the Central Dike to the design so that it is physically stable under static and pseudo-static loading conditions, and to monitor during the mine life to assess the overall performance of the dike and the TSF. Data gathered during the operational period of the TSF can be used to re-evaluate the performance of the Central Dike structure in the context of longer term stability post closure.

Appendix A.3

Saddle Dams

Saddle Dams

Five Saddle dams will be constructed around the limits of the tailings basin. Two Saddle Dams were built between 2009 and 2011, the three other Saddle Dams will be built later during the mine operation. The saddle dam locations are shown on the general mine site plan provided at the beginning of this document. The saddle dams will be constructed by dumping a rockfill berm with a crest width of 30 m to allow haul truck traffic. The Saddle Dams will be re-sloped, with a minimum 6 m crest width. The downstream face will be angle of repose, or 1.32H:1V (Horizontal:Vertical), and the upstream face will be 3H:1V. The Saddle Dams will have an upstream two-zone granular filter and a liner. There is a potential for release of attenuation water, reclaim water, or tailings to Third Portage Lake in the event of an overtopping or catastrophic failure.

For information on the consequences and monitoring/action for the various embankment failure modes possible at the Saddle Dams see Table A.2 for the Central Dike.

A.3.1 Failure Scenario during Operation

Depending upon the phase of operations, breach or complete failure of a Saddle Dam could result in the uncontrolled release of Attenuation Pond water, Reclaim Pond water or tailings to Third Portage Lake. There is also the possibility of the Saddle Dams being overtopped through the formation of a wave resulting from a slope failure within the Portage Waste Rock Storage Facility and the sudden release of waste rock into the TSF.

A tailings beach will be formed on the toe of each Saddle Dam. As a result, the Reclaim Pond will be pushed away from the Saddle Dams. As the tailings and Saddle Dams are expected to freeze, and freezing will reduce the chance of tailings reaching Third Portage Lake, failure of the Saddle Dams with release of tailings to Third Portage Lake is not considered to be credible.

An overtopping or breach failure of the section of the Saddle Dams located just south of the intersection with the Stormwater Dike could potentially result in flow of Reclaim Pond water and/or tailings toward Third Portage Lake.

<u>Potential Effect</u>

Should an overtopping event or breach occur in a Saddle Dam, water flowing toward Third Portage Lake would consist of Reclaim Pond water which is predicted to exceed Metal Mining Effluent Regulations (MMER) guidelines for a number of constituents.

As a worst case of failure resulting in a dam breach, the total predicted Reclaim Pond volume of 0.75 Mm^3 could be released towards Third Portage Lake. The Saddle Dams would not be expected to fail due to overtopping. This failure mode is not expected to release a considerable volume of water to Third Portage Lake. Given the size of Third Portage Lake, the impacts to water quality and on fish from a release of Reclaim Pond water would likely be localized.

A worst case scenario would also involve the flow of non-frozen tailings into Third Portage Lake. The distance between the toe of the Saddle Dams and Third Portage Lake is on the order of 150 m to 300 m. Such a scenario would destroy fish habitat and smother benthic habitat outwards from the failure area. Suspended solids and dissolved metals would increase in the water column and would cause displacement of fish and possible toxicity of some bottom sediments, depending on how much tailings material was lost.

Mitigation, Management, and Monitoring

The dams are designed according to Dam Safety Guidelines (CDA, 2007), and were and will be constructed under controlled conditions. A comprehensive quality control and quality assurance program was and will be undertaken during construction to confirm foundation conditions, material type and quality, and to adjust designs as necessary to reflect actual conditions found at site. The dams are predicted to eventually freeze, which will enhance stability. Therefore, failure of Saddle Dams by overtopping, full breaching or foundation and slope failure is not considered to be credible.

With respect to slope stability failure, the Saddle Dams are constructed of rockfill, which has high shear strength. Slope stability failures must therefore occur through foundation soils. The calculated FoS for slope stability failure modes through foundation soils are above the design criteria in the Dam Safety Guidelines (CDA, 2007) for static and pseudo-static conditions. Consequently, the probability of such a failure developing is low.

The tailings are expected to freeze, and freezing will reduce the chance of tailings reaching Third Portage Lake. The distance from Saddle Dam 1 to Third Portage Lake is about 300 m at its closest point. Leaks of supernatant water and or tailings from the South Saddle Dam would be most likely to occur during operations. Leaks would be visible, and could be mitigated during operations.

A.3.2 Failure Scenario during Closure

At closure Reclaim Pond water will be pumped to an Attenuation Pond, the basin behind the Saddle Dams will be drained and filled with run-of-mine, acid-buffering ultramafic waste rock (NPAG). The rock is expected to freeze over time. Failure of the Saddle Dams following closure is not considered to be credible. Further, the lack of water will reduce mobility of tailings if failure occurs.

Potential Effect

No effects to water quality, fish or fish habitat is expected.

Mitigation, Management, and Monitoring

As described previously, the dams were and will be designed to meet Dam Safety Guidelines (CDA, 2007). The dams were and will be constructed under controlled conditions. During the construction of the dams a comprehensive quality control and quality assurance program was and will be undertaken to confirm foundation conditions, material type and quality, and to adjust designs as necessary to reflect actual or unexpected conditions found at site. Monitoring during operations will

ensure the Saddle Dams perform as intended. The dams will eventually freeze, which will enhance stability. Therefore, post-closure failure of the Saddle Dams by full breaching or foundation and slope failure is not considered to be credible.

Appendix A.4

Stormwater Dike

Stormwater Dike

The Stormwater Dike is located at the northwest end of Second Portage Lake, within the TSF as shown on the general mine site plan provided at the beginning of this document. The location of the Stormwater Dike was selected to optimize the storage capacity of the main tailings basin, and of the Portage Attenuation Pond. The dike separates the tailings basin from the Attenuation Pond until approximately 2014 at which point the tailing deposition will start in the South tailing Cell. At the end of mine life, any remaining water will be treated within the TSF and released once discharge criteria are met.

The Stormwater Dike was constructed using rock fill, with a upstream slope of 3H: 1V and a downstream slope at angle of repose for rock fill. The minimum crest width is 6 m. Final crest is at elevation 150.0 m. The dike has a filter zone placed on the south face, underlying an impermeable element of bituminous geo-membrane. The maximum height of the dike is about 13 m. At the maximum cross section, the width of the base of the dike is approximately 95 m.

For information on the consequences and monitoring/action for the various embankment failure modes possible at Storm water Dike see Table A.2.

A.4.1 Failure Scenario during Operation

If slope failure of the Stormwater Dike were to occur when tailings are at their maximum elevation in the main tailings basin, and if the tailings are not frozen, this could potentially result in the sudden flow of tailings into the Attenuation Pond area. This in turn could potentially result in the development of a wave which overtops the Saddle Dam at the northwest end, releasing tailings and reclaim water to Third Portage Lake.

Potential Effect

A breach or failure of the Stormwater Dike may cause a wave-induced overtopping of the Saddle Dam at the northwest end. The Saddle Dam would not be expected to fail due to a single overtopping wave event.

This failure mode is not expected to release water to Third Portage Lake. The distance between the toe of the Saddle Dam and Third Portage Lake is on the order of 150 m, so tailings would likely settle out. The potential impacts on Third Portage Lake water quality, fish and fish habitat would likely be minor, localized and short-lived.

Mitigation, Management, and Monitoring

The Stormwater Dike was designed to meet Dam Safety Guidelines (CDA, 1999). The upstream side slopes were designed to allow machine traffic, and are therefore highly conservative with respect to slope stability. The dike was constructed in the dry under controlled conditions. During the construction of the dike a comprehensive quality control and quality assurance program was undertaken to confirm foundation conditions, material type and quality, and to adjust designs as necessary to reflect actual conditions found at site. The dike will eventually freeze, which will enhance stability. Therefore, failure of the dike due to overtopping is not considered to be credible.

A.4.2 Failure Scenario during Closure

The Stormwater Dike will be covered by tailing on both upstream and downstream side, to equal out the different elevations. At closure Reclaim Pond water will be pumped to an Attenuation Pond, the basin behind the Saddle Dams and Stormwater Dike will be drained and filled with run-of-mine, acid-buffering ultramafic waste rock (NPAG). The rock is expected to freeze over time. Failure of the Stormwater Dike following closure is not considered to be credible. Further, the lack of water will reduce mobility of tailings if failure occurs.

Potential Effect

No effects to water quality, fish or fish habitat is expected.

Mitigation, Management, and Monitoring

The Stormwater Dike was designed to meet Dam Safety Guidelines (CDA, 1999). The dike was constructed under controlled conditions. During the construction of the dike a comprehensive quality control and quality assurance program was undertaken to confirm foundation conditions, material type and quality, and to adjust designs as necessary to reflect actual or unexpected conditions found at site. Monitoring during operations ensure the Stormwater Dike performs as intended. The dike will eventually freeze, which will enhance stability. Therefore, post-closure failure of the Stormwater Dike by full breaching or foundation and slope failure is not considered to be credible.

APPENDIX B

Emergencies involving Reagents.

Emergencies involving reagents might be addressed by first responders, by using **EMERGENCY RESPONSE GUIDEBOOK**

ERG2012.pdf

In an emergency, CANUTEC may be called collect at
613-996-6666 (24 hours)
***666 cellular (Press star 666, Canada only)**

B.1: Cyanide (Sodium Cyanide)

UN #: 1689 (Guide 157)

Common Names:

- Sodium salt of hydrocyanic acid

Agent Characteristics

- **APPEARANCE**: White crystalline or granular powder.
- **DESCRIPTION**: Sodium cyanide releases hydrogen cyanide gas, a highly toxic chemical asphyxiant that interferes with the body's ability to use oxygen. Exposure to sodium cyanide can be rapidly fatal. It has whole-body (systemic) effects, particularly affecting those organ systems most sensitive to low oxygen levels: the central nervous system (brain), the cardiovascular system (heart and blood vessels), and the pulmonary system (lungs). Sodium cyanide is used commercially for fumigation, electroplating, extracting gold and silver from ores, and chemical manufacturing. Hydrogen cyanide gas released by sodium cyanide has a distinctive bitter almond odor (others describe a musty "old sneakers smell"), but a large proportion of people cannot detect it; the odor does not provide adequate warning of hazardous concentrations. Sodium cyanide is odorless when dry. Sodium cyanide is shipped as pellets or briquettes. It absorbs water from air (is hygroscopic or deliquescent).
- **METHODS OF DISSEMINATION**:
  - Indoor Air: Sodium cyanide can be released into indoor air as fine droplets, liquid spray (aerosol), or fine particles.
  - Water: Sodium cyanide can be used to contaminate water.
  - Food: Sodium cyanide can be used to contaminate food.

- Outdoor Air: Sodium cyanide can be released into outdoor air as fine droplets, liquid spray (aerosol), or fine particles.
- Agricultural: If sodium cyanide is released as fine droplets, liquid spray (aerosol), or fine particles, it has the potential to contaminate agricultural products.

- **ROUTES OF EXPOSURE**: Sodium cyanide can affect the body through ingestion, inhalation, skin contact, or eye contact.

Personal Protective Equipment

- **GENERAL INFORMATION**: First Responders should use a NIOSH-certified Chemical, Biological, Radiological, Nuclear (CBRN) Self Contained Breathing Apparatus (SCBA) with a Level A protective suit when entering an area with an unknown contaminant or when entering an area where the concentration of the contaminant is unknown. Level A protection should be used until monitoring results confirm the contaminant and the concentration of the contaminant.
  NOTE: Safe use of protective clothing and equipment requires specific skills developed through training and experience.

- **LEVEL A: (RED ZONE)**: Select when the greatest level of skin, respiratory, and eye protection is required. This is the maximum protection for workers in danger of exposure to unknown chemical hazards or levels above the IDLH.
  - A NIOSH-certified CBRN full-face-piece SCBA operated in a pressure-demand mode or a pressure-demand supplied air hose respirator with an auxiliary escape bottle.
  - A Totally-Encapsulating Chemical Protective (TECP) suit that provides protection against CBRN agents.
  - Chemical-resistant gloves (outer).
  - Chemical-resistant gloves (inner).
  - Chemical-resistant boots with a steel toe and shank.
  - Coveralls, long underwear, and a hard hat worn under the TECP suit are optional items.

- **LEVEL B: (RED ZONE)**: Select when the highest level of respiratory protection is necessary but a lesser level of skin protection is required. This is the minimum protection for workers in danger of exposure to unknown chemical hazards or levels above the IDLH. It differs from Level A in that it incorporates a non-encapsulating, splash-protective, chemical-resistant splash suit that provides Level A protection against liquids but is not airtight.
  - A NIOSH-certified CBRN full-face-piece SCBA operated in a pressure-demand mode or a pressure-demand supplied air hose respirator with an auxiliary escape bottle.
  - A hooded chemical-resistant suit that provides protection against CBRN agents.
  - Chemical-resistant gloves (outer).
  - Chemical-resistant gloves (inner).
  - Chemical-resistant boots with a steel toe and shank.
  - Coveralls, long underwear, a hard hat worn under the chemical-resistant suit, and chemical-resistant disposable boot-covers worn over the chemical-resistant suit are optional items.

- **LEVEL C: (YELLOW ZONE)**: Select when the contaminant and concentration of the contaminant are known and the respiratory protection criteria factors for using Air Purifying Respirators (APR) or Powered Air Purifying Respirators (PAPR) are met. This level is appropriate when decontaminating patient/victims.
  - A NIOSH-certified CBRN tight-fitting APR with a canister-type gas mask or CBRN PAPR for air levels greater than Acute Exposure Guideline (AEGL) L-2.
  - A NIOSH-certified CBRN PAPR with a loose-fitting face-piece, hood, or helmet and a filter or a combination organic vapor, acid gas, and particulate cartridge/filter combination or a continuous flow respirator for air levels greater than AEGL-1.
  - A hooded chemical-resistant suit that provides protection against CBRN agents.
  - Chemical-resistant gloves (outer).
  - Chemical-resistant gloves (inner).
  - Chemical-resistant boots with a steel toe and shank.
  - Escape mask, face shield, coveralls, long underwear, a hard hat worn under the chemical-resistant suit, and chemical-resistant disposable boot-covers worn over the chemical-resistant suit are optional items.

- **LEVEL D: (GREEN ZONE)**: Select when the contaminant and concentration of the contaminant are known and the concentration is below the appropriate occupational exposure limit or less than AEGL-1 for the stated duration times.
  - Limited to coveralls or other work clothes, boots, and gloves.

Emergency Response

- **CHEMICAL DANGERS**:
  - Sodium cyanide is water-reactive.
  - Sodium cyanide decomposes on contact with acids, acid salts, water, moisture, and carbon dioxide, producing highly toxic, flammable hydrogen cyanide gas.
  - Sodium cyanide solution in water is a strong base; it reacts violently with acid and is corrosive.
  - Sodium cyanide is incompatible with strong oxidants.
  - Carbon dioxide from the air is sufficiently acidic to liberate toxic hydrogen cyanide gas on contact with sodium cyanide.

- **EXPLOSION HAZARDS**:
  - Sodium cyanide reacts violently with strong oxidants such as nitrates, chlorates, nitric acid, and peroxides, causing an explosion hazard.
  - Upper and lower explosive (flammable) limits in air are not available for sodium cyanide.
  - Containers may explode when heated or if they are contaminated with water.

- **FIRE FIGHTING INFORMATION**:
  - Sodium cyanide is non-combustible.

- The agent itself does not burn.
- Sodium cyanide releases highly flammable and toxic hydrogen cyanide gas on contact with acids or water.
- Fire will produce irritating, corrosive, and/or toxic gases.
- Note: Most foam will react with the agent and release corrosive/toxic gases.
- For small fires, do not use carbon dioxide; **use dry chemical**, dry sand, or alcohol-resistant foam.
- For large fires, use water spray, fog, or alcohol-resistant foam. Move containers from the fire area if it is possible to do so without risk to personnel. Use water spray or fog; do not use straight streams. Dike fire control water for later disposal; do not scatter the material.
- For fire involving tanks or car/trailer loads, fight the fire from maximum distance or use unmanned hose holders or monitor nozzles. Do not get water inside containers. Cool containers with flooding quantities of water until well after the fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tanks. Always stay away from tanks engulfed in fire.
- Run-off from fire control or dilution water may be corrosive and/or toxic, and it may cause pollution.
- If the situation allows, control and properly dispose of run-off (effluent).

- **INITIAL ISOLATION AND PROTECTIVE ACTION DISTANCES**:
  - If a tank, rail car, or tank truck is involved in a fire, isolate it for 0.5 mi (800 m) in all directions; also consider initial evacuation for 0.5 mi (800 m) in all directions.
  - Small spills (when spilled in water)
    - First isolate in all directions: 200 ft (60 m).
    - Then protect persons downwind during the day: 0.1 mi (0.2 km).
    - Then protect persons downwind during the night: 0.4 mi (0.7 km).
  - Large spills (when spilled in water)
    - First isolate in all directions: 1300 ft (390 m).
    - Then protect persons downwind during the day: 0.8 mi (1.3 km).
    - Then protect persons downwind during the night: 3.0 mi (4.9 km).

- **PHYSICAL DANGERS**:
  - Vapors may collect and stay in confined areas (e.g., sewers, basements, and tanks).
  - Hazardous concentrations may develop quickly in enclosed, poorly-ventilated, or low-lying areas. Keep out of these areas. Stay upwind.
  - Hydrogen cyanide gas produced from sodium cyanide mixes well with air; explosive mixtures are easily formed.

- **NFPA 704 Signal**:

- **Health:** 3
- **Flammability:** 0
- **Reactivity:** 0
- **Special:**

Signs/Symptoms

- **TIME COURSE**: Effects occur rapidly following exposure to sodium cyanide. Inhalation exposure to hydrogen cyanide gas released from sodium cyanide produces symptoms within seconds to minutes; death may occur within minutes.

- **EFFECTS OF SHORT-TERM (LESS THAN 8-HOURS) EXPOSURE**: Early symptoms of cyanide poisoning include lightheadedness, giddiness, rapid breathing, nausea, vomiting (emesis), feeling of neck constriction and suffocation, confusion, restlessness, and anxiety. Accumulation of fluid in the lungs (pulmonary edema) may complicate severe intoxications. Rapid breathing is soon followed by respiratory depression/respiratory arrest (cessation of breathing). Severe cyanide poisonings progress to stupor, coma, muscle spasms (in which head, neck, and spine are arched backwards), convulsions (seizures), fixed and dilated pupils, and death. The CNS is the most sensitive target organ of cyanide poisoning. Cardiovascular effects require higher cyanide doses than those necessary for CNS effects. In serious poisonings, the skin is cold, clammy, and diaphoretic. Blue discoloration of the skin may be a late finding. Severe signs of oxygen deprivation in the absence of blue discoloration of the skin suggest cyanide poisoning.

- **EYE EXPOSURE**:
  - Redness, pain, and severe deep burns.
  - Contact with the eyes can contribute to whole-body (systemic) toxicity. See Inhalation Exposure.

- **INGESTION EXPOSURE**:
  - Nausea, vomiting (emesis), abdominal pain, and irritation or corrosion of the lining of the esophagus and stomach.
  - Whole-body (systemic) toxicity can occur. See Inhalation Exposure.

- **INHALATION EXPOSURE**:

- Mild to moderate: Central Nervous System (CNS) effects: headache, confusion, anxiety, dizziness, weakness (malaise), and loss of consciousness. Cardiovascular effects: palpitations. Respiratory effects: respiratory tract irritation, difficulty breathing or shortness of breath (dyspnea), and transient increase in rate and depth of breathing (hyperpnea). Gastro Intestinal effects: nausea and vomiting (emesis).
- Severe: CNS effects: coma, seizures, and dilated pupils (mydriasis). Cardiovascular effects: shock, abnormal or disordered heart rhythms (dysrhythmias), critically low blood pressure, and cardiac arrest. Respiratory effects: abnormally rapid, followed by abnormally slow respirations; accumulation of fluid in the lungs (pulmonary edema); and respiratory arrest. Eye effects: dilated pupils, inflammation of the surface of the eye, and temporary blindness.

- **SKIN EXPOSURE**:
  - Irritation, tissue damage (ulceration), burning sensation, and pain
  - Absorption through the skin can contribute to whole-body (systemic) toxicity. See Inhalation Exposure.

Decontamination

- **INTRODUCTION**: The purpose of decontamination is to make an individual and/or their equipment safe by physically removing toxic substances quickly and effectively. Care should be taken during decontamination, because absorbed agent can be released from clothing and skin as a gas. Your Incident Commander will provide you with decontaminants specific for the agent released or the agent believed to have been released.

- **DECONTAMINATION CORRIDOR**: The following are recommendations to protect the first responders from the release area:
  - Position the decontamination corridor upwind and uphill of the hot zone. The warm zone should include two decontamination corridors. One decontamination corridor is used to enter the warm zone and the other for exiting the warm zone into the cold zone. The decontamination zone for exiting should be upwind and uphill from the zone used to enter.
  - Decontamination area workers should wear appropriate PPE. See the PPE section of this card for detailed information.
  - A solution of detergent and water (which should have a pH value of at least 8 but should not exceed a pH value of 10.5) should be available for use in decontamination procedures. Soft brushes should be available to remove contamination from the PPE. Labeled, durable 6-mil polyethylene bags should be available for disposal of contaminated PPE.

- **INDIVIDUAL DECONTAMINATION**: The following methods can be used to decontaminate an individual:
  - Decontamination of First Responder:

- Begin washing PPE of the first responder using soap and water solution and a soft brush. Always move in a downward motion (from head to toe). Make sure to get into all areas, especially folds in the clothing. Wash and rinse (using cold or warm water) until the contaminant is thoroughly removed.
- Remove PPE by rolling downward (from head to toe) and avoid pulling PPE off over the head. Remove the SCBA after other PPE has been removed.
- Place all PPE in labeled durable 6-mil polyethylene bags.

o Decontamination of Patient/Victim:

- Remove the patient/victim from the contaminated area and into the decontamination corridor.
- Remove all clothing (at least down to their undergarments) and place the clothing in a labeled durable 6-mil polyethylene bag.
- Thoroughly wash and rinse (using cold or warm water) the contaminated skin of the patient/victim using a soap and water solution. Be careful not to break the patient/victim's skin during the decontamination process, and cover all open wounds.
- Cover the patient/victim to prevent shock and loss of body heat.
- Move the patient/victim to an area where emergency medical treatment can be provided.

First Aid

➢ **GENERAL INFORMATION**: Careful observation, supplemental oxygen, and supportive care may be sufficient therapy for the patient/victim who does not exhibit physical findings of cyanide toxicity. For the patient/victim exhibiting physical findings of cyanide toxicity, initial treatment consists of administration of antidotes under a physician's direction, respiratory and circulatory support (oxygen and IV fluids), correction of chemical imbalances in the blood, and seizure control. Speed is critical. Avoid mouth-to-mouth resuscitation regardless of route of exposure. Avoid contact with vomitus, which may off-gas hydrogen cyanide.

➢ **ANTIDOTE**: Amyl nitrite, sodium nitrite, and sodium thiosulfate are antidotes for cyanide toxicity; however, amyl nitrite and sodium nitrite should not be administered to patient/victims suffering from smoke inhalation. In these cases, only administer sodium thiosulfate. The described administration of nitrites is based on a patient having normal hemoglobin levels. Below normal hemoglobin levels require titration of nitrites.

➢ **For mild to moderate physical findings** such as nausea, vomiting, palpitations, confusion, anxiety, dizziness (vertigo), and/or abnormally fast or deep respiration (hyperventilation):

o **Child (less than 55 lbs. (25 kg)** - Observe the patient/victim and administer 0.75 mL per pound of a 25% solution (1.65 mL per kilogram of a 25% solution) of sodium thiosulfate intravenously over a period of 10 minutes. (Note: All persons working at Meadowbank are adults – 18 years of age and older). This has been put in as a result of delivery of Cyanide in Baker Lake) close to this community.

- **Adult** Observe the patient/victim and administer 12.5 g of a 25% solution (50 mL of a 25% solution) of sodium thiosulfate intravenously over a period of 10 minutes.

- **For severe physical findings** such as coma; cessation of breathing (apnea); seizures; slowness of the heart rate, usually to fewer than 60 beats per minute (bradycardia); abnormally low blood pressure (hypotension); bluish skin coloring due to abnormally low levels of oxygen in the blood (cyanosis); irregular heart beat (dysrhythmias); and/or accumulation of fluid in the lungs (pulmonary edema):
  - **Child (less than 55 lbs. (25 kg)** Until sodium nitrite becomes available, break one ampule of amyl nitrite into a cloth. Out of every minute, hold the cloth containing amyl nitrite in front of the patient's mouth for 30 seconds, and then remove it for 30 seconds, until sodium nitrite can be administered. A new ampule of amyl nitrite should be broken into a cloth every 3 minutes. Discontinue use of amyl nitrite when sodium nitrite becomes available. Administration of an entire dose (10 mL of a 3% solution) of sodium nitrite to a child can produce overwhelming lethal methemoglobinemia. Therefore, children should receive 0.15 mL per pound of body weight of sodium nitrite (0.33 mL per kg body weight of 3% sodium nitrite) over a period of 5 to 20 minutes.
  - Next, administer 0.75 mL per pound body weight of 25% sodium thiosulfate (1.65 mL per kilogram body weight of 25% sodium thiosulfate) intravenously over a period of 10 minutes. If physical findings persist for 30 minutes after antidote administration, sodium nitrite and sodium thiosulfate may be re-administered at half their original respective doses. However, methemoglobin levels should be monitored and not allowed to exceed 40%.
  - **If a child weighs more than 55 lbs. (25 kg)**, administer antidote as described for the adult (see below).
  - **Adult** Until sodium nitrite becomes available, break one ampule of amyl nitrite into a cloth. Out of every minute, hold the cloth containing amyl nitrite in front of the patient's mouth for 30 seconds, and then remove it for 30 seconds, until sodium nitrite can be administered. A new ampule of amyl nitrite should be broken into a cloth every 3 minutes. Discontinue use of amyl nitrite when sodium nitrite becomes available. Administer 300 mg of a 3% solution (10 mL of a 3% solution) of sodium nitrite intravenously over a period of 5 to 20 minutes.
  - Next, administer 12.5 g (50 mL of a 25% solution) of sodium thiosulfate intravenously over a period of 10 minutes. If physical findings persist for 30 minutes after antidote administration, sodium nitrite and sodium thiosulfate may be re-administered at half their original respective doses. However, methemoglobin levels should be monitored and not allowed to exceed 40%.

- **EYE**:
  - Immediately remove the patient/victim from the source of exposure.
  - Immediately wash eyes with large amounts of tepid water for at least 15 minutes.
  - Monitor the patient/victim for signs of whole-body (systemic) effects.
  - If signs of whole-body (systemic) poisoning appear, see the Inhalation section for treatment recommendations.
  - Seek medical attention immediately.
- **INGESTION**:

- Immediately remove the patient/victim from the source of exposure.
- Establish secure large-bore IV access.
- Ensure that the patient/victim has an unobstructed airway.
- Do not induce vomiting (emesis).
- Immediately administer 100% oxygen.
- Prepare a cyanide antidote kit, for use under a physician's direction, for symptomatic patient/victims. See the Antidote section for antidote administration procedures.
- Treat seizures with benzodiazepines.
- Seek medical attention immediately.

➢ **INHALATION**:

- Immediately remove the patient/victim from the source of exposure.
- Evaluate respiratory function and pulse.
- Ensure that the patient/victim has an unobstructed airway.
- Immediately administer 100% oxygen.
- Assist ventilation as required.
- If breathing has ceased (apnea), provide artificial respiration.
- Establish secure large-bore intravenous (IV) access.
- Prepare a cyanide antidote kit, for use under a physician's direction, for symptomatic patient/victims. See the Antidote section for antidote administration procedures.
- Monitor for respiratory distress.
- Seek medical attention immediately.

➢ **SKIN**:

- Immediately remove the patient/victim from the source of exposure.
- See the Decontamination section for patient/victim decontamination procedures.
- Monitor the patient/victim for signs of whole-body (systemic) effects.
- If signs of whole-body (systemic) poisoning appear, see the Inhalation section for treatment recommendations.
- Seek medical attention immediately.

Long-Term Implications

➢ **MEDICAL TREATMENT**: Evidence for the benefit of gastric decontamination in cases of cyanide ingestion is limited at best and should come after all other known life-saving measures have been instituted. Gastric lavage (stomach pumping) is recommended only if it can be done shortly after ingestion (generally within 1 hour), in an emergency department, and after the airway has been secured. Activated charcoal may be administered as slurry (240 mL water/30 g charcoal). Usual dose: 25 to 100 g in adults/adolescents, 25 to 50 g in children (1 to 12 years), and 1 g/kg in infants less than 1 year old. Patient/victims who have ingested hydrogen cyanide solutions or patient/victims who have direct skin or eye contact should be observed in the Emergency Department for at least 4 to 6 hours for the development of delayed symptoms. Patient/victims with significant inhalation exposure

should be monitored for the accumulation of fluid in the lungs (pulmonary edema), which may occur up to 24 to 72 hours following exposure.

- **DELAYED EFFECTS OF EXPOSURE**: Usually death occurs rapidly or there is prompt recovery. Survivors of severe cyanide exposures may suffer brain damage due to a direct effect of the poison (toxin) on nerve cells, or to a lack of oxygen, or possibly due to insufficient blood circulation. Examples of long-term neurological effects caused by cyanide poisoning include personality changes, memory loss, and disturbances in movement (both voluntary and involuntary movement disorders); some damage may be permanent.

- **EFFECTS OF CHRONIC OR REPEATED EXPOSURE**: Hydrogen cyanide has not been classified for cancer-causing (carcinogenic) effects, and no carcinogenic effects have been reported for hydrogen cyanide. No reproductive or developmental effects of hydrogen cyanide have been reported. Chronically exposed workers may complain of headache, eye irritation, easy fatigue, chest discomfort, palpitations, loss of appetite (anorexia), and nosebleeds (epistaxis). Workers such as electroplaters and picklers, who are exposed daily to cyanide solutions, may develop a "cyanide" rash, characterized by itching and by macular, papular, and vesicular eruptions. Exposure to small amounts of cyanide compounds over long periods of time is reported to cause loss of appetite, headache, weakness, nausea, dizziness, and symptoms of irritation of the upper respiratory tract and eyes.

On-Site Fatalities – Scene is not be disturbed until it has been release as per MSHR section 16.01 “serious injury” – 16.02, 16.03, 16.04.

- **INCIDENT SITE**:
  - Incident site must be kept barricaded off and guarded and undisturbed until appropriate personnel (RCMP), (Coroner), (Mines Inspector) have conducted their investigations and have released the scene.
  - Consult with the Incident Commander regarding the agent dispersed, dissemination method, level of PPE required, location, geographic complications (if any), and the number of person(s) involved.
  - Ensure that all person(s) involved have the proper level of PPE protection, training and knowledge to deal with the situation.

- **RECOVERY AND ON-SITE MORGUE**:
  - Wear PPE until all bodies(s) are deemed free of contamination.
  - Establish a preliminary (holding) morgue.
  - Gather all necessary information and document all findings.
  - See the Decontamination section for decontamination procedures.
  - Decontaminate affected bodies before they are removed from the incident site.

Occupational Exposure Limits

- **ACGIH TLV**:

- Hydrogen Cyanide – Ceiling 4.7 ppm (Skin)
- Cyanide Salts - Ceiling: 5 mg/m^3 (skin)

➢ **NIOSH IDLH**: 25 mg/m^3 (as CN [cyanide ion])

➢ **BC MINE RESCUE MANUAL**:

- Hydrogen Cyanide – 10 ppm for 8 hours
- Hydrogen Cyanide – 5 ppm for 12 hours

Acute Exposure Guidelines

Hydrogen cyanide 74-90-8 (Final)					
ppm					
	10 min	30 min	60 min	4 hr	8 hr
AEGL 1	2.5	2.5	2.0	1.3	1.0
AEGL 2	17	10	7.1	3.5	2.5
AEGL 3	27	21	15	8.6	6.6

Decontamination (Environment and Equipment)

➢ **ENVIRONMENT/SPILLAGE DISPOSAL**: The following methods can be used to decontaminate the environment/spillage disposal:

- Do not touch or walk through the spilled agent if at all possible. However, if you must, personnel should wear the appropriate PPE during environmental decontamination. See the PPE section of this card for detailed information.
- Keep combustibles (e.g., wood, paper, and oil) away from the spilled agent. Use water spray to reduce vapors or divert vapor cloud drift. Avoid allowing water runoff to contact the spilled agent.
- Do not direct water at the spill or the source of the leak.
- Stop the leak if it is possible to do so without risk to personnel, and turn leaking containers so that gas rather than liquid escapes.
- Prevent entry into waterways, sewers, basements, or confined areas.
- Isolate the area until gas has dispersed.
- Ventilate the area.

➢ **EQUIPMENT**: Agents can seep into the crevices of equipment making it dangerous to handle. The following methods can be used to decontaminate equipment:

- Not established/determined

Agent Properties

- **Chemical Formula:**
  NaCN

- **Aqueous solubility:**
  Soluble

- **Boiling Point:**
  2725°F (1496°C)
- **Density:**
  1.60 g/mL at 77°F (25°C)

- **Flammability:**
  Noncombustible

- **Flashpoint:**
  Not established/determined

- **Ionization potential:**
  Not established/determined

- **Melting Point:**
  1045°F (563°C)

- **Molecular Mass:**
  49.01
- **Soluble In:**
  Ammonia, alcohol (slightly soluble)

- **Specific Gravity:**
  1.60

- **Vapor Pressure:**
  Approximately 0 mm Hg at 68°F (20°C)

Hazardous Materials Warning Labels/Placards

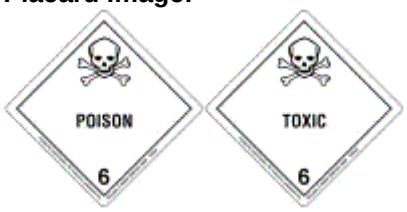
- **Shipping Name:**
  Sodium cyanide, solid or solution

- **Identification Number:**
  1689 (Guide 157)

- **Hazardous Class or Division:**
  6.1

- **Label:**
  Poison (Toxic)

- **Placard Image:**



Who to Contact in an Emergency

In the event of an emergency, call 6911/ Code 1 X 3 on two-way radio Channel #1 – Mine site.
Baker Lake Health Clinic – 867-793-2816 (Day)
Baker Lake Health Clinic – 867-793-1350 (After Hours)
Poison Control – 867-920-4111
In the event of an emergency, call ***Chemtrec*** immediately at **1-800-424-9300**.

APPENDIX C

MBK-HSS-3002 Emergency Response Plan for DYNO Nobel Emulsion Plant

APPENDIX D

MBK-HSS-3003 Oil Pollution Emergency Response Plan

APPENDIX E

***MBK-HSS-3004* Nolinor ERP Plan (Note: accessible only on Intelex under Plans – Emergency Response (access limited)**

APPENDIX F

MBK-HSS-3005 F-A Baker Lake Facilities O M Manual- Drawings Appendix

APPENDIX G

MBK-HSS-3005 Baker Lake Facilities O M Manual

APPENDIX H

***MBK-HSS-3006* Baker Lake Bulk Fuel Storage Facility Environmental Performance Monitoring Plan Ver. 2**

APPENDIX I

MBK-HSS-3007 Meadowbank Transportation Management Plan AWPAR

APPENDIX J

MBK-HSS-3008 Vault Emergency Response Plan

APPENDIX K

MBK-HSS-3009 Emergency Response Guideline Handbook – ERG 2012

MEADOWBANK GOLD PROJECT

Hazardous Materials Management
Meadowbank Mine Site
Baker Lake Facilities

In Accordance with Water License 2AM-MEA0815

Prepared by:
Agnico Eagle Mines Limited – Meadowbank Division

Version 3
October 2013

EXECUTIVE SUMMARY

General Information

The Hazardous Materials Management Plan (HMMP) will be executed within the scope of normal operations. The Meadowbank Gold Project is in the Operations Phase, and as such, requires that the transportation, storage, handling and use of hydrocarbon products, ammonium nitrate and associated explosive materials, and all other chemicals be conducted in a safe and efficient manner.

Annual Review

The HMMP will be reviewed annually and updated as required. Completion of the annual review of the HMMP will be documented through signatures of the personnel responsible for reviewing, updating and approving the HMMP.

Record of Changes

A record will document all significant changes that have been incorporated in the HMMP subsequent to the latest annual review.

Distribution List

Agnico Eagle Mines Limited (AEM) will maintain a distribution list for the HMMP providing information about all parties that receive the plan including mine personnel, departments, and outside agencies.

IMPLEMENTATION SCHEDULE

As required by Water License 2AM-MEA0815, Part B, Item 16, the proposed implementation schedule for this plan is effective immediately (March 2012) subject to any modification proposed by the NWB as a result of the review and approval process.

DISTRIBUTION LIST

AEM - Environmental Superintendent

AEM – Environmental Coordinator

AEM – General Mine Manager

AEM – Health and Safety Superintendent

AEM – Mill Superintendent

AEM – Maintenance Superintendent

AEM – Mine Superintendent

AEM – Site Services Superintendent

AEM – General Services Superintendent

AEM – Procurement and Logistics Coordinator

DOCUMENT CONTROL

Version	Date (YMD)	Section	Page	Revision
1	2007/08			Comprehensive plan for Meadowbank Mine Site and Baker Lake Facilities
2	2012/3/12			Comprehensive review and update.
3	2013/10			Add Baker Lake Jet-A Information and comprehensive review and update

Version 3:

Prepared By: _____

Jeffrey Pratt
Environmental Coordinator

Approved By: _____

Kevin Buck
Environmental Superintendent

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1. INTRODUCTION

1.1 PURPOSE & SCOPE OF THE PLAN

The purpose of this plan is to provide a consolidated source of information on the safe and environmentally sound transportation, storage, and handling of the major hazardous products that are used at the Meadowbank Gold Project. A hazardous material is one that, as a result of its physical, chemical, or other properties, poses a hazard to human health or the environment when it is improperly handled, used, stored, disposed of, or otherwise managed. In combination with AEM's Emergency Response Plan (ERP) and Spill Contingency Plan (SCP), this Hazardous Materials Management Plan (HMMP) provides instruction on the prevention, detection, containment, response, and mitigation of accidents that could result from handling hazardous materials.

The plan is based on the following principles of best practice management for hazardous materials:

- Identify and prepare materials and waste inventories;
- Characterize potential environmental hazards posed by those materials;
- Allocate clear responsibility for managing hazardous materials;
- Describe methods for transport, storage, handling, and use;
- Identify means of long-term storage and disposal;
- Prepare contingency and emergency response plans;
- Ensure training for management, workers, and contractors whose responsibilities include handling hazardous materials; and
- Maintain and review records of hazardous material consumption and incidents in order to anticipate and avoid impacts on personal health and the environment.

All hazardous materials to be used at the Meadowbank operation will be manufactured, delivered, stored, and handled in compliance with all applicable federal and territorial regulations. AEM is committed to preventing, to the greatest extent possible, both inadvertent release of these substances to the environment and accidents resulting from mishandling or mishap. AEM has instituted programs for employee training, facility inspection, periodic drills to test systems, and procedural review to address deficiencies, accountability, and continuous improvement objectives.

AEM actively works towards minimizing the generation of hazardous wastes by investigating alternatives to the use of hazardous materials, by recycling products and containers wherever feasible, and by treating wastes using state-of-the-art technologies before any release to the environment.

As with all other aspects of health and safety policy at the Meadowbank mine, all employees will be expected to comply with all applicable precautions and handling procedures with regard to hazardous materials. Employees are also expected to report any concerns to their supervisors, the Occupational Health & Safety Committee (OH&SC), or senior site management. All staff is

encouraged to bring forward suggestions for improvements that can be incorporated into procedure revisions as appropriate.

1.2 APPLICABLE LEGISLATION

Both federal and territorial legislation regulate the management of hazardous materials in Nunavut. Copies of relevant legal documents are kept on file at the mine site. AEM will regularly update the HMMP with respect to applicable legislation, and ensure that current legislation documents are available at the mine site.

Management and safety personnel provide an overview of the applicable regulations to all employees as part of their initiation and ongoing training. The acts, regulations, and guidelines pertinent to the hazardous products that are used at the Meadowbank Gold Project are listed in Appendix A.

The *Transportation of Dangerous Goods Act* classifies hazardous materials into nine (9) main classes according to an internationally recognized system, as follows:

- Class 1 – Explosives;
- Class 2 – Gases;
- Class 3 – Flammable liquids;
- Class 4 – Flammable solids;
- Class 5 – Oxidizing substances and organic products;
- Class 6 – Poisonous (toxic) and infectious substances;
- Class 7 – Nuclear substances, within the meaning of the Nuclear Safety and Control Act, which are radioactive;
- Class 8 – Corrosives; and
- Class 9 – Miscellaneous products or substances.

Fuel products hazard classes and potential impacts are located in Table 1.

2. OVERVIEW OF HAZARDOUS MATERIALS

2.1 HAZARDOUS MATERIALS AND FUEL STORAGE LOCATIONS

The primary storage locations for hazardous materials, hazardous wastes and fuel are shown on Figures 1 to 5. Figure 1 and 2 are respectively a general layout of the Meadowbank mine site and Vault. Figure 3 identifies hazardous material storage areas at the mine site. Figure 4 shows the Diesel Fuel Tank Farm and Figure 5 show the Jet-A Fuel Tank Farm at the Baker Lake Marshalling Area. Comprehensive lists of all hazardous materials and the estimated quantities that are and will be stored at the mine site are provided in Appendix B.

Petroleum products, explosives, sodium cyanide and miscellaneous hazardous materials are stored in facilities that contain no open drains, utilize concrete berms, and incorporate lined areas or secure sea-cans. Storage tanks on site are regularly inspected and maintained.

The permanent storage facilities are clearly identified as storage facilities for hazardous materials with proper labelling. These are ventilated in order to prevent the build-up of toxic fumes or dust, which could harm both the personnel present and the environment. The facilities are secured and only authorized personnel have access to the area.

2.2 TYPES OF HAZARDOUS MATERIALS

The Meadowbank Gold Project requires the use of the following types of classified hazardous materials:

- Petroleum products and lubricants – diesel fuel, Jet-A, oils, greases, anti-freeze, and solvents used for equipment operation and maintenance;
- Process plant consumables – sodium cyanide, caustic soda(sodium hyroxide), sulphur prills, carbon sodium metabisulphite, nitric acid , calcine lime, flocculants, calcium chloride, borax, silica, lead nitrate, and anti-scalants used in mineral extraction;
- Water treatment chemicals - silica sand and flocculants polymers;
- Explosives – emulsion, caps, and high explosives used for blasting in the mine; and
- Laboratory chemicals and wastes – various by-products classified as hazardous waste and chemicals such as nitric acid used in the assay laboratory.

Sections 5 and 7 contain general information and safe handling procedures for the first four categories above. Laboratory wastes are generally very limited in quantity and will be handled only

by specialist laboratory technicians. These wastes will be pumped to the grinding circuit in the process plant for recycling and eventually become part of the tailings disposal stream. As such, they are not addressed separately in this document.

2.3 GENERAL HAZARDOUS MATERIAL STORAGE GUIDELINES

AEM is committed to the safe and appropriate storage of fuels, hazardous materials and hazardous wastes. The following sections outline AEM's general guidelines for storing fuels, hazardous materials and hazardous wastes.

2.3.1 General Guidelines for Storage Drums/Containers

Hazardous materials/waste shall be stored in super sacs/drums/sea containers according to the following guidelines:

- In the original containers, where possible, or in containers compatible with the material being stored to prevent corrosion or chemical interaction that could lead to leaks or fires;
- Storage containers shall be in good condition, sealable and not damaged or leaking;
- Drums containing hazardous materials/wastes expected to be in storage for more than six months shall be placed on pallets or on a well-drained storage area to prevent rusting;
- Each container shall be clearly labelled to identify the substance being stored according to the requirements of the *Workplace Hazardous Materials Information System* (WHMIS) and MSDS available;
- Containers shall be kept closed except when adding or removing product;
- Containers with product shall be kept in the upright position, empty drums can be placed horizontally;
- Containers shall be arranged to prevent damage from falling or dislodging; and
- Containers shall be arranged to allow for easy access and inspections.

2.3.2 General Guidelines for Storage Areas

To assist in the safe and secure storage of fuels, hazardous materials and hazardous wastes, the following general guidelines for storage areas/facilities are followed:

- Design of storage areas are in compliance with the *National Fire Code*, where appropriate;
- Compliance with the Canadian Council of Ministers of the Environment (CCME) publication, *"Environmental Code of Good Practice for Above Ground Storage Tank Systems Containing Petroleum Products"*. This CCME code deals with inventory control, inspections, corrosion protection, records and monitoring. Environment Canada's *Storage Tank Systems for*

Petroleum Products and Allied Petroleum Products Regulations outline registration and documentation requirements for storage tanks;

- Storage areas are adequately signed indicating that hazardous materials/wastes are stored therein;
- Storage locations are clearly defined and marked to prevent damage of storage drums and containers in the event they are covered by snow;
- Incompatible materials are segregated by chemical compatibility within the storage area to prevent contact between materials in the event of a release;
- Storage areas are located at least 30 metres from surface water and on a low-permeability area;
- Storage areas are readily accessible for firefighting and other emergency procedures;
- Storage areas are adequately ventilated to prevent the build-up of noxious or toxic vapours;
- Where necessary secondary containment is installed to allow for the containment of at least 110% of the largest container or tank volume within the contained area;
- Storage areas are constructed, or provided with barriers, to protect containers from physical damage;
- Adequate spill and emergency response equipment has been installed at large volume storage areas – ie bulk fuel tank facilities (i.e. spill control, fire protection, etc.). A list of spill control equipment is provided in the Spill Contingency Plan.

3. HAZARDOUS MATERIALS LIFE CYCLE MANAGEMENT

3.1 LIFE CYCLE MANAGEMENT

"Life cycle management" implies the assessment of a particular product over its entire life — from the time where a material need is identified to the time the product is fully consumed or disposed of as waste. It covers product supply, transportation, storage, handling, recycling, and waste disposal. AEM is committed to ensuring proper life cycle management of all products used at the Meadowbank site, including hazardous materials. AEM and its contractors will deal only with reputable, certified suppliers, transporters, and expediters.

3.1.1 Delivery

All hazardous materials are delivered to site by commercial carriers in accordance with the requirements of the *Canadian Transportation of Dangerous Goods Act* (TDGA). Carriers are licensed and inspected as required by the Department of Transportation. All required permits, licences, and certificates of compliance are the responsibility of the carrier. All shipments are properly identified and labelled. Shipping papers must be accessible and include information describing the substance, immediate health hazards, fire and explosion risks, immediate precautions, firefighting information, procedures for handling leaks or spills, first aid measures, and emergency response telephone numbers.

Each transportation company is required to develop a spill prevention, control, and countermeasures plan to address the materials they are importing. In the event of a release during transport, the commercial transportation company is responsible for first response and cleanup. AEM intends to periodically verify the qualifications of transport companies, their personnel and the existence of their spill prevention, control and countermeasures plan.

3.1.2 On-Site Handling

Once dangerous goods are received at the workplace, additional regulations apply. The federal *Workplace Hazardous Materials Information System* (WHMIS) calls for the proper labelling of products, the availability of product information in the form of MSDS, and employee education on how to identify and handle hazardous products. AEM has established procedures for obtaining MSDS with new product deliveries; maintaining MSDS current (i.e. no older than three years), and maintaining a system of hardcopy or electronic MSDS that are readily accessible by all employees. A chemical tracking system is also established and all news hazardous material used on site are reviewed by Health and Safety and Environmental Department before the first use.

All hazardous materials are stored in secured areas to prevent access by unauthorized personnel or any tampering. All tanks used for the storage of diesel and aviation fuel have been installed in secondary containment areas sized to hold at least 110% of the volume of the largest tank or in double walled storage tanks. Tanks and vessels in the process plant are installed on concrete

surfaces sloping to interior sumps that will route spilled solutions to lined collection areas. Additional guidelines for the storage of hazardous materials are provided in Section 2.3.2.

In support of pollution prevention, AEM has established procedures for the regular inspection of storage containers and facilities. If deficient conditions are identified, appropriate corrective actions are taken and documented. Additional details for inspection of storage areas are provided in Section 9.

Emergency response procedures for spilled chemical substances are provided in the Spill Contingency Plan (SCP) (see also the Emergency Response Plan (ERP). These procedures outline the response to accidental spills or releases of hazardous materials to minimize health risks and environmental effects. Included are procedures for evacuating personnel, maintaining safety, cleanup and neutralization activities, emergency contacts, internal and external notifications to regulatory authorities, and incident documentation.

3.1.3 Wastes

On becoming wastes, materials are stored and/or disposed of in accordance with specific government regulations and guidelines. AEM stores most waste materials on site in secure facilities until they can be transported to other provincial jurisdictions for recycling or disposal.

Process plant tailings pass through a treatment plant for cyanide destruction using the standard Inco SO_2/air process or through chemical destruction with Sodium Metabisulphite before being disposed of in the tailings pond. The cyanide content of the tailings material is reduced to 15 ppm (parts per million). Cyanide further degrades naturally with exposure to air and sunlight (UV) in the Tailings Storage Facility. The current regulatory requirement for cyanide content in liquids released to the environment is 1 mg/L for a single grab sample or no greater than 0.5 mg/L average for the month (Nunavut Water Board Water License).

The Nunavut Department of Environment and Environment Protection Service (EPS) monitor the movement of hazardous waste from the generator to final disposal, through use of a tracking document known as a Waste Manifest. Accordingly, a Waste Manifest accompanies movements of hazardous wastes for the Meadowbank Project. AEM is registered with the EPS as a waste generator, and employs only registered waste carriers to transport waste to registered/approved waste receivers. A copy of the completed manifest will be maintained for a period of two years after the hazardous waste is received by the authorized waste disposal facility.

3.1.4 Empty Product Containers

Many empty chemical containers are not safe to dispose of directly and require handling precautions identical to those for full containers. Chemical users must be familiar with safe waste handling and storage procedures supplied by manufacturers in MSDS. The containers are backhauled to the Baker Lake Marshalling Area for disposal at an approved facility. These containers are stored and hauled south via sealift.

4. SODIUM CYANIDE

4.1 INTRODUCTION

Large quantities of sodium cyanide are used at the Meadowbank Gold Project to optimize gold recovery from the ore. Due to transportation restrictions, normally a full year's supply of sodium cyanide will be transported and stored on site. This product will be transported, stored, handled, transferred and used in compliance with appropriate legislation and applicable Best Management Practices. AEM is a signatory to the International Cyanide Management Code.

4.1.1 Physical Properties

Cyanide is one of only a few chemical reagents that will dissolve in water. Gold mining operations use very dilute solutions of sodium cyanide, typically in the range of 0.01% to 0.05% cyanide (100 to 500 ppm). Unlike many synthetic chemicals, cyanide oxidizes and decomposes when exposed to air or other oxidants (UV sunlight rays), and does not persist in the environment. As such, it does not give rise to chronic health or environmental problems when present in low concentrations.

4.1.2 Cyanide Production

Cyanide production and handling are highly regulated. Both the manufacturer and AEM employ stringent risk management systems to prevent injury or damage from the use of cyanide.

Sodium cyanide for the Meadowbank project is in briquette form, and packaged in water-resistant super sac and 4mm bags inside an intermediate bulk container (IBC). The IBC holds 1,000 kg of cyanide, and have the following approximate dimensions: 44" x 44" x 44". For shipment, there are normally 20 IBCs in a sea can container.

4.1.3 Cyanide Transport

Cyanide producers audit purchasers and transportation systems. They design special packaging for the transport of cyanide and inventory all shipments against delivery records to ensure proper surveillance at all times. All shipments are accompanied by MSDS that provide the chemistry and toxicity of sodium cyanide, instructions in case of accidents, and emergency telephone numbers for assistance.

Truck, rail, and barge transporters screen their employees, carefully inventory shipments and, establish and maintain systems for loading and unloading cyanide products. Product handling and transportation are in accordance with protocols set by the industries and in compliance with national and international regulations.

For the Meadowbank Project, the IBCs are properly stacked in sea containers and transported by ship from Becancour, QC to Baker Lake, NU. At Baker Lake, the containers are transferred from

barge to truck for transport to the Meadowbank mine site. At no point during transport the sea container or IBCs will be opened. From the point of cyanide packaging and onwards, the bags will only be opened on site, when and at the location (mill) where the use of cyanide is required.

This method of cyanide transport provides three levels of containment. The cyanide is contained within plastic bags. In the event one of the bags ruptures, the cyanide is contained within the IBC. In the event the IBC container breaks, the cyanide is contained within the sea container, which provides a tertiary precautionary measure for minimizing the impact of the spilled material.

4.1.4 On-Site Storage & Handling

The cyanide is stored on site in a dark, cool, dry, location. Cyanide is stored within sealed sea cans until the time in which cyanide is needed for process. The cyanide storage area is located close to the processing plant. Only authorized personnel have access to the cyanide storage.

When cyanide is required, only the quantity required for immediate use will be removed from storage. The cyanide bag will be lifted by its straps (the straps are provided by the manufacturer as part of packaging; see Appendix C for an illustration) using a forklift, and then using an overhead crane to lower onto a specially designed knife slitter that cuts the bag. The contents of the bag will drop into a mixing tank. At no time does the cyanide need to be physically handled by Meadowbank personnel.

The IBC materials are properly decontaminated and disposed of according to all applicable regulations to prevent environmental impact. Before disposal, the bags are visually inspected to ensure they are empty, and triple rinsed and drained to dissolve any residual cyanide left in the bag. Rinse water from the flushing process is recovered and reused in the cyanide mix tank and used in the gold recovery plant.

All personnel potentially exposed to cyanide, including contractors and visitors, receive appropriate training (see Section 10).

4.1.5 Spills

In the event a spill occurs, the cyanide will be promptly cleaned up to minimize its exposure to humans and the environment. A dry spill will be swept up and disposed of in a drum or other suitable container. In the event of a wet spill, the spill procedures will be carried out to prevent environmental contamination and the appropriate authorities will be contacted. For more information on spills handling and containment, see the SCP and ERP.

After cleaning up as much cyanide as possible, the area will be decontaminated using a small amount of caustic solution (i.e., 1 oz. /5 gal hypochlorite solution). This will help keep the pH in the 10 to 11 range and suppress the formation of lethal HCN gas.

4.1.6 International Cyanide Management Code

AEM is a signatory to the International Cyanide Management Code (the Code) for the manufacture, transport and use of cyanide in the production of gold. The Code is administered by a non-profit

institute consisting of participants from the gold mining industry, governments, non-governmental organizations, labour, cyanide producers, and other interested parties.

The Code represents a voluntary commitment on the part of all signatories to identify and follow basic principles and guidelines for safe cyanide use at gold mining operations. This is the first such generic international code in the history of the mining industry. Under the Code, gold mines are required to manage their cyanide from source to site, thus assuming “cradle to grave” responsibility for all cyanide used at their operation.

5. PETROLEUM PRODUCTS

5.1 PRODUCT DESCRIPTION

The operation uses large amounts of fuel and lubricants (petroleum products). These products are transported, stored, handled, transferred and used in compliance with the appropriate legislation and Best Management Practices.

5.2 DELIVERY TO SITE

With the exception of diesel and aviation fuel, most petroleum fuel and lubricant products are delivered to site and stored in the original packing container from the manufacturer. These types of containers include a variety of sealed drums, pails, 1 ton super sac, bulk cubes, cans, and tubes.

Due to transportation restrictions, i.e. climate, a full year's supply of fuel and lubricants is transported and stored on-site, in order to meet the demand of the upcoming year. During the summer months, diesel and aviation fuel are shipped from Becancour, QC to Baker Lake, NU where it is transferred into storage tanks. From the Baker Lake storage tanks, fuel is transported daily on the AWPR to the Meadowbank site via contracted tanker trucks.

Diesel fuel coming from the Baker Lake Tank Farm is stored at the Meadowbank site into a single 5.6 million liter tank within secondary containment and the aviation fuel into two (2) – 50,000L double walled tanks at the airstrip. From there, the diesel is redistributed into different storage tanks by an on-site tanker. Table 2 provides the varieties and volumes of petroleum products stored on site and the storage locations. The Baker Lake fuel farm consists of six (6), ten (10) million liter tanks for diesel fuel and twenty (20), 100,000L double walled tanks, within secondary containment, for aviation fuel. The diesel fuel tanks are single-walled and constructed of welded steel. The aviation fuel tanks are double-walled and constructed of steel. Both Baker Lake Fuel Farm and storage locations have been designed and constructed to meet the CCME guidelines for *Aboveground Storage Tank Systems Containing Petroleum and Allied Petroleum Products*. The fuel unloading facility in each area includes a sloped lined pad to prevent contamination of the receiving environment. A continuous 60 mm high-density, polyethylene liner sheet is installed under the tanks and the internal sides of the berm. The containment area is sized to hold 110% of the volume of the largest tank.

All fuel transfer and storage facilities have been designed in accordance with the Canadian Council of Ministers for the Environment (CCME, 1994) *Environmental Code of Practice for Above Ground Storage Tank Systems Containing Petroleum Products*, and the *National Fire Code*.

Appropriate measures are in place to minimize impacts to surface water, groundwater and soils from potential vehicle accidents when transporting petroleum products to the site. Details of petroleum

product safe handling procedures and proper PPE can be found in Tables 3 and 4. Details of spill response measures are presented in the SCP. The following general precautions will be taken:

- A maximum speed on the All-Weather Private Access Road for loaded and empty vehicles has been established based on the road design. This speed limit is 50 km/hr;
- All trucks will carry a spill kit;
- Trucks are equipped with a reliable radio and/or satellite phone; and
- AEM commits to being prepared to respond to spills resulting from vehicle accidents in a timely and efficient manner.

5.3 FUEL TRUCK TRANSFER PROCEDURES

A contract supplier fills the storage tanks in the main tank farms. General procedures to be followed are listed below. Similar procedures would be followed for fuelling remote station tanks.

Before fuel transfer, verify that:

- All fuel transfer hoses are connected properly and couplings are tight;
- Transfer hoses are not obviously damaged;
- Fuel transfer personnel are familiar with procedures;
- Personnel are located at both the fuel delivery truck and fuel transfer tank(s) and can manually shut off the flow of fuel;
- If a high liquid level shutoff device is installed at the delivery tank, verify that the shutoff is operating correctly each time it is used; and
- Fuel transfer will then proceed per the established procedures of the contract supplier.

Any accidents or spills must be reported immediately to the Environmental Coordinator. Notification and response procedures are detailed in the SCP.

5.4 CONTAMINATED SOILS AND SPILLS

All contaminated spill pads, and booms resulting from the storage and handling of fuels and lubricants will be salvaged at the time such impacts are identified, and put into Quatrex bags, labelled and shipped off-site to an approved disposal facility or incinerated (small quantities) on site. All the petroleum hydrocarbon contaminated soil is placed into the site landfarm for treatment. Refer to the *Landfarm Design and Management Plan* for more details.

5.5 USED PETROLEUM PRODUCTS

Used oil that is no longer suitable for its intended use is classified as a liquid waste. The discharge of used oil into the environment, including but not limited to landfills, sewers and water bodies, is prohibited.

Used oil is used as auxiliary fuel at the secondary chamber at the incinerator or in designated on site waste oil heaters. This used oil burner at the incinerator has the capacity to handle approximately 200,000 liters of used oil per year. You can refer to the *Incinerator Waste Management Plan* for more information. All used oil products that are not burned in the incinerator or on site waste oil heaters are collected in tanks or drums marked "Waste Oil" and disposed of at an approved facility in the south. Empty petroleum containers are stored on site in a designated area and returned to the supplier on backhauls or disposed at approved facilities in the south. Oil filters are punctured and/or crushed and drained of their contents for 24 hours prior to disposal.

A random sample of used oil incinerated is analysed each month to ensure that it does not contain unacceptable levels of impurities, including cadmium, chromium, lead, total organic halogens (such as chlorine compounds), polychlorinated biphenyls (PCB) and ash content. Samples will be sent to an accredited laboratory (Multi-lab) for analysis. Concentrations of parameters listed above will be compared to the criteria set out in Schedule A of the *Used Oil and Waste Fuel Management Regulations*. Alternate arrangements will be made for the off-site disposal, treatment or recycling of used oil that does not meet this criteria.

The following information is recorded in association with the incineration of used oil:

- Volume of used oil generated at the facility;
- Volume of used oil incinerated;
- Name and address of the person in charge, management or control of the used oil, and the place where the used oil was produced;
- Analysis of any representative sample of used oil;
- Summary of maintenance performed on the incinerator or processing equipment;
- Volume and nature of the products produced from the used oil; and
- Destination of the used oil products shipped from the facility.

Table 1 - Fuel Products – Hazardous Classes & Potential Impacts

Material	TDGA Class[a]	Potential Environmental Impact
Diesel	3	Water & soil contamination
Motor oil	Not regulated	Water & soil contamination
Aviation fuel	3	Water & soil contamination
Hydraulic fluid	Not regulated	Low risk to water & soil with proper handling
Varsol	3	Water & Soil contamination
Automotive grease	Not regulated	Low risk to water & soil with proper handling
Ethylene glycol	Not regulated	Toxic by ingestion, could potentially be consumed by wildlife.

Table 2- Fuel Products – Storage Locations

Product	Total Quantity On-Site	Storage Location	Container	Presently used
Diesel	6.1 ML (potentially 66.1 ML including Baker Lake)	Fuel farm	1 x 5.6 ML tank in bermed area	Yes
		Powerhouse	2 x 25,000 L tank	Yes
		Exploration camp	1 x 10,000 L tank	Not in use but contain diesel
			1 x 75,000 L tank	Not in use but contain diesel
		Emulsion Plan	1 x 25,000 L tank	Yes
		Camp Emergency Genset	2 x 55,000 L tank	Yes
		Incinerator	1 x 2,200 L tank	Yes
		Fueling station	1 x 50,000 L tank	No
		Vault	4 x 50,000 L tank	Yes
			1 x 25,000 L tank	Yes
			1 x 10,000 L tank	Yes
		AWPR	1 x 10,000 L tank at KM 73	Yes
			1 x 10,000 L tank at KM 23	Yes
		Baker Lake	6 x 10 ML tank in bermed area	Yes
Gasoline	60,000 L	Fueling Station	1 x 50,000 L tank	Yes
			1 x 10,000 L tank	Yes

Waste oil	50,000 L	Incinerator	1 x 50,000 L tank	Yes
Motor oils	*refer to Appendix B	Mechanical shop	Cubes or Barrels	Yes
		Powerhouse	Cubes or Barrels	Yes
		Exploration camp	Cubes or Barrels	No
Aviation fuel	100,000 L (potentially 2.1ML including Baker Lake)	Airstrip	2 x 50,000 L tank	Yes
		Exploration Camp	1 x 75,000 L tank	Not in use but contain aviation fuel
		Baker Lake	20 x 100,000 L tank in bermed area	Yes
Hydraulic fluid	*refer to Appendix B	Mechanical shop	Cubes or Barrels	Yes
		Powerhouse	Cubes or Barrels	Yes
		Plant	Cubes or Barrels	Yes
Ethylene glycol	*refer to Appendix B	Mechanical shop	Cubes	Yes

Note: L = litre; ML = Mega-litre ($1X10^6$ litres).

Table 3 - Fuel Products – Safe Handling Procedures

Product	Handling Procedures
Diesel	Do not get in eyes, on skin, or on clothing. Avoid breathing vapours, mist, fume, or dust. Do not swallow. May be aspirated into lungs. Wear PPE and/or garments if exposure conditions warrant. Wash thoroughly after handling. Launder contaminated clothing before reuse. Use with adequate ventilation. Keep away from heat, sparks, and flames. Store in a well-ventilated area. Store in a closed container. Bond and ground during transfer.
Motor oil	Wear protective clothing and impervious gloves when working with used motor oils. To be handled generally consistent with other petroleum hydrocarbons.
Aviation fuel	See diesel procedures above.
Hydraulic fluid	Keep container closed until ready for use.
Ethylene glycol	Ensure adequate ventilation. Wear protective gloves and chemical safety goggles. Keep in tightly closed container, stored in a cool, dry, ventilated area. Separate from acids and oxidizing materials. Empty containers of this product retain product residues and may be hazardous.

Table 4 - Fuel Products – Personal Protective Equipment

Product	Personal Protective Equipment		
	Eyes	**Skin**	**Respiration**
Diesel	Chemical goggles	Neoprene or nitrile gloves; protective garments	None usually required
Motor oil	Chemical goggles	Neoprene or nitrile gloves; protective garments	None usually required
Aviation fuel	Chemical goggles	Neoprene or nitrile gloves; protective garments	None usually required; ensure adequate ventilation
Hydraulic fluid	Chemical goggles	None usually required	None usually required
Ethylene glycol	Chemical goggles	Neoprene or nitrile gloves; protective garments	None usually required; ensure adequate ventilation

6. EXPLOSIVES

6.1 PRODUCT DESCRIPTION

Explosives are required for blasting waste rock and ore in the mine. Transportation, storage, use, and handling of blasting materials are strictly regulated by the Federal *Explosives Act* and *Transportation of Dangerous Goods Act* (Class 1 – Explosives), as well as the following territorial Acts:

- Explosives Use Act and Regulations; and
- Mine Health and Safety Act and Regulations.

6.2 EXPLOSIVES STORAGE

Manufacturing, handling, and storage of explosives are carried out by QAAQTUQ – Dyno Nobel Canada Inc.

The estimated annual explosives requirement for the Meadowbank mine vary between 6,000 to 11,000 tonnes per year. However, only a small amount of explosive materials are shipped to site in the form of blasting caps. These are handled by AEM. The bulk of the explosives used at site are Emulsion (XL-1000), which is a mixture of nitrites and emulsifier. Emulsion is mixed in an on-site plant (Emulsion Plant shown on Figure 1) by Dyno Nobel.

Sea cans of emulsion and nitrite prill are stored on the Emulsion Plant site. They are stored within sea cans in quantities of approximately 20,000 kg's per sea can. These items are stored in separate locations so as to prevent the mixing of the two products. These products are also stored away from any other products, >40m away from the emulsion plant, and >25m from the fuel tanks.

The high explosive detonators and blasting caps are stored in an enclosed magazine. It is estimated that twelve magazines will be required on site, each being approximately 4 m x 14 m (i.e., not much bigger than a sea can). AEM looks after the handling of these explosive detonators.

The explosive mixing plant, product storage, and magazines are safely located away from vulnerable facilities, as stipulated by the federal and territorial *Explosives Use Act* and Regulations. The mixing plant is also used for the washing and minor repair of trucks and equipment used to handle the explosives.

6.3 USE OF EXPLOSIVES

The primary blasthole drills are diesel-powered rigs capable of drilling 152.4 mm diameter holes. Drilling requirements were calculated for ore and waste. A pre-shear and buffer blasting followed by mechanical wall cleanup is used for the final wall. Blasting operations are affected by several factors, including wall control and weather. A number of modified operating procedures will be implemented during the winter season. These may include minimizing the sleep time for loaded holes; ensuring that cuttings are mounded around the hole collars after loading to prevent snow drifting into the holes, and utilizing blasthole covers.

The responsibility for blasting is split between appropriately trained mine personnel and the explosives supplier, Dyno Nobel. Dyno Nobel is responsible for supplying and delivering blasting agents to the site, manufacturing the blasting product on site, delivering blasting agents to the blastholes and filling the holes. AEM Blasters are responsible for charging the holes, placing the detonators and boosters, and tying-in the patterns. The AN and emulsion components are loaded on barges and transported to the Baker Lake Marshalling Area for temporary storage, if necessary, prior to transport to site. Dyno Nobel provide mixing and delivery trucks. AEM provides diesel fuel and accommodations.

Blasting will be approximately daily and will average, in size, the daily production requirement of 50-90,000 tonnes per blast. Blasting will likely be by electric initiation and will feature current technology with down-the-hole delays to minimize the energy per delay to single hole loads. This will minimize backbreak, fly rock, vibration levels and will optimize fragmentation and minimize digging problems.

Blasting is carried out by certified blasters following blasting regulations and safe practices. All pit activities are under the supervision of certified mine supervisors, knowledgeable in mine operating regulations and best practices.

The manufacture and distribution of explosives is carried out by suppliers under Federal license to conduct such work. They provide and operate the explosives manufacturing plant under such license and authority.

Details on explosives inventory and inspections are provided in Section 9.2. Information on Explosives Handlers is available in Section 10.3.

6.4 DISPOSAL

Disposal of regular waste will follow the *AEM Waste Management Plan*.

Wash water that is created at the Emulsion plant is sucked out via vacuum truck and taken to the tailings storage facility for disposal.

Any unusable Emulsion waste is taken to the mines blast pattern for disposal down the bore holes.

7. PROCESS PLANT & WATER TREATMENT REAGENTS & CONSUMABLES

7.1 PRODUCT DESCRIPTION

The Process Plant (mill) uses a number of chemicals and reagents to treat the ore, recover entrained gold and to destroy cyanide. The Water Treatment Plant also uses a number of chemicals and reagents to treat water for TSS removal. Water Treatment chemicals would be used over a 3 to 4 month period during frost-free months only for the discharge of the attenuation pond water to Third Portage Lake and to Wally Lake. The range in annual quantities used would reflect the different dosages that may be used during different mining stages (early operations, late operations, closure treatment of tailings water and polishing of pit lake water quality on a contingency basis). Material categories, site handling and storage requirements, and PPE recommended by manufacturers are summarized in Tables 5 to 8.

Table 5 - Process Plant & Water Treatment Reagents – Use, Consumption & Storage

Reagent	Use	Approximate Consumption		Phase	Normal Delivery Format	On-Site Storage
		Daily	Annual			
Acetylene	Welding	1-2	600	gas	gas cylinders	secured upright
Activated carbon (granular)	Gold recovery	340 kg	140 t	solid	500 kg bags	Pallet
Anti-scalant	Water treatment	25 kg	10 t	liquid	650 kg tote tank	Pallet drums
Borax	Refinery	60 kg	22 t	solid	40 kg bags	Pallet
Silica	Refinery	30 kg	11 t	solid	22.7 kg bags	Pallet
Calcium oxide (Quicklime) (CaO)	pH control	7,814 kg	3150 t	solid	1 t supersacs	Pallet
Calcium peroxide (alternative to hydrogen peroxide)	Potential use: Water treatment	minimal*	minimal*	solid	45 kg drum	Pallet drums
Copper sulphate ($CuSO_4$)	Cyanide destruction	1450 kg	585 t	solid	1 t supersacs	Pallet
Flocculant (Magnafloc 338 or Magnafloc 10)	Settling aid	300 kg	120 t	solid	25 kg bags	Pallet
Hydrochloric acid (HCl)	Refining/stripping	200 kg	75 t	liquid	20 gal drums	Pallet drums
Hydrofluoric acid	Laboratory	5 gallons	1 825 gallons	liquid	20 gal drums	Pallet drums
Hydrogen peroxide (alternative to calcium hydroxide)	Potential use: Water treatment	minimal*	minimal*	liquid	1 m^3 HDPE tote	Pallet
Lead acid batteries	Vehicles	-	24	liquid	-	Pallet
Nitric acid	Stripping	50 kg	18 t	liquid	34 kg bottle	Pallet

Paints	Maintenance	-	100 gallons	liquid	gallon	Pallet
Sodium cyanide (NaCN)	Leaching	3825 kg	1 540 t	solid	1 t box bags	Pallet
Sodium hydroxide (caustic soda) (NaOH)	Refining/stripping	20 kg	8 t	solid	25 kg bags	Pallet
	Refining/stripping	786 kg	320 t	solid	1000 kg	Pallet
Sodium metabisulphite ($Na_2S_2O_5$)	Cyanide destruction	7710 kg	3100 t	solid	1 t supersacs	Pallet
Sodium nitrate	Refinery	40 kg	15 t	solid	50 kg bags	Pallet
Sulphur	Cyanide destruction	745 kg	300 t	solid	1 t bags	Pallet

Note: kg = kilogram; t = ton; gal = gallon; m^3 = cubic metre.

Table 6 - Process Plant & Water Treatment Reagents – Hazard Classes & Potential Environmental Impacts

Material	Class	Potential Impact
Acetylene	2.1	Generally not hazardous for water.
Activated carbon	4.2	No information available.
Anti-scalant	Not regulated	Negligible with proper handling
Borax	Not regulated	Presents no health hazards.
Calcium oxide	Not regulated	No information available.
Calcium peroxide	5.1	Releases oxygen into environment when dissolved in water.
Copper sulphate	9	Harmful to aquatic life.
Flocculant	Not regulated	Acute fish, invertebrate, algae and bacteria toxicity.
Hydrochloric acid	8	Extremely toxic to aquatic life by lowering the pH below 5.5. When released into the soil, this material may leach into groundwater.
Hydrofluoric acid	8.6.1	No information available.
Hydrogen peroxide	5.1	Aquatic Toxicity 96-hour LC50.
Lead acid batteries	8	No information available.
Nitric acid	8	No information available.
Paints	Not regulated	No information available.
Silica	Not regulated	Generally not hazardous for water.
Sodium cyanide	6.1	Expected to be very toxic to aquatic life and to terrestrial life.
Sodium hydroxide	8	No information available.
Sodium metabisulphite	Not regulated	No information available.

Sodium nitrate	5.1	Possibly hazardous short-term degradation products are not likely. However, long term degradation products may arise. The products of degradation are less toxic than the product itself.
Sulphur	9	No info available (insoluble in water).

Table 7 - Process Plant & Water Treatment Reagents – Safe Handling Procedures

Product	Handling Procedure
Acetylene	Do not mix with air or oxygen above atmospheric pressure. Store away from oxidizing agents. Open and handle cylinder with care. Keep ignition sources away - Do not smoke. Protect from heat. Protect against electrostatic charges. Pressurized container: protect from sunlight, store in a cool location and do not expose to temperatures exceeding 50°C. Do not pierce or burn, even after use. Prevent impact and friction. Store in accordance with local fire code and/or building code or any pertaining regulations.
Activated carbon	Wash thoroughly after handling. Use with adequate ventilation. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Avoid ingestion and inhalation. Activated Carbon, especially when wet, can deplete oxygen from air in enclosed spaces, and dangerously low levels of oxygen may result. Store in a tightly closed container. Keep from contact with oxidizing materials. Store in a cool, dry, well-ventilated area away from incompatible substances.
Anti-scalant	Used in extremely small quantities. Can cause mild to moderate irritation of eyes, skin, and upper respiratory tract. Wash thoroughly after handling. Use sensible industrial hygiene and housekeeping products. Not flammable. Keep containers tightly closed
Borax	No special steps required.
Calcium oxide	Store in closed containers in a controlled drainage area under cover. Use in a well-ventilated area. Empty containers retain product residues and may be hazardous.
Calcium peroxide	Wash thoroughly after handling. Avoid all situations that could lead to harmful exposure. Store in a cool, dry, well-ventilated place. Keep container tightly closed and away from

Product	Handling Procedure
	incompatible materials and sources of heat.
Copper sulphate	Avoid contact with skin and eyes. DO NOT breathe dust. Always wash hands thoroughly after contact. Store and use only in dry, well-ventilated areas. Keep container tightly closed.
Flocculant	Dust generated in handling of this product can be explosive if sufficient quantities are mixed in air, in which case ignition sources should be avoided. Employ grounding, venting and explosion relief provisions in accord with accepted engineering practices in process operations capable of generating dust/or static electricity. Handle in accordance with good industrial practice, handle with care and avoid unnecessary personal contact. Avoid contact with eyes and prolonged or repeated skin contact. Avoid continuous or repetitive breathing of dust. Use only with adequate ventilation. Remove contaminated clothing; launder or dry-clean before reuse. Wash thoroughly with soap and water after using. For industrial use only. Slip hazard when wet. Material is slippery when wet. Store in the original container, securely closed, in a cool and dry location. Avoid extremes of temperature and ignition sources.
Hydrochloric acid	Do not get in eyes, on skin, or on clothing. Wear protective clothing. Avoid breathing vapours or fumes. Store in cool, dry, ventilated area with acid-resistant floors. Keep container closed, out of direct sunlight, and away from heat, water, and incompatible materials. When diluting, add acid slowly to water and in small amounts. Never use hot water and never add water to acid. When opening metal drum, use non-sparking tools because hydrogen gas may be present. Do not wash out container and use for other purposes. Empty containers retain product residues and may be hazardous.
Hydrofluoric acid	Wash thoroughly after handling. Remove contaminated clothing and wash before re-use. Use with adequate ventilation. Do not get on skin, in eyes or on clothing. Do not ingest or inhale. Store in a cool, dry, well-ventilated area away from incompatible substances. Do not store in metal or glass containers. Do not store in direct sunlight. Keep tightly closed. Empty container may contain hazardous residue. Do not add any other material to the container. Do not wash down the drain. Do not allow smoking or food consumption while handling. Store in approved containers only. Do not add water to acids.
Hydrogen peroxide	Use extreme care when attempting any reactions because of fire and explosion potential (immediate or delayed). Conduct all initial experiments on a small scale and protect personnel with adequate shielding as the reactions are unpredictable, and may be delayed, and may be affected by impurities, contaminants, temperature, etc. Do not get in eyes. Avoid contact with skin and clothing. Wash thoroughly after handling. Avoid contact with flammable or combustible materials. Avoid contamination from any

Product	Handling Procedure
	source including metals, dust, and organic materials. In the event of an accident where large volumes of hydrogen peroxide might come into contact with external fires or with incompatible chemicals, a one-half mile area from the incident should be evacuated. Store in a properly vented container or in approved bulk storage facilities. Do not block vent. Do not store on wooden pallets. Do not store where contact with incompatible materials could occur, even with a spill (see "Hazardous Reactivity" on MSDS). Have water source available for diluting. Do not add any other product to container. Never return used or unused peroxide to container, instead dilute with plenty of water and discard. Rinse empty containers thoroughly with clean water before discarding. (See "Waste Disposal" on MSDS).
Lead Acid Batteries	Store batteries in a well-ventilated cool area. Handle carefully to avoid damaging or turning batteries over.
Nitric acid	Class 8 products are not to be loaded with class 1, 4.3, 5, 6, 7 or foodstuffs or foodstuff empties. Store in a well-ventilated area and out of direct sunlight. Keep containers closed at all times. Store away from oxidisable, caustic and combustible materials. Vapours heavier than air; prevent concentration in sumps and hollows. DO NOT enter confined spaces where vapour may have collected. Strong oxidising agent; can lead to fire or explosion with organic and/or combustible materials.
Paints	No special steps required.
Silica	Prevent formation of dust. This product is not flammable. When pouring into a container of flammable liquid, ground both containers electrically to prevent static electric spark. Keep containers tightly sealed.
Sodium cyanide	Highly toxic, corrosive to eyes, skin, and respiratory tract. Can be fatal if swallowed, inhaled, or absorbed through skin. Keep cyanide antidote kit available in any cyanide work area. Wear personal protective clothing at all times. Keep in tightly closed container in cool, dry, ventilated area. Protect against physical damage to containers. Do not store under sprinkler systems. Do not wash out container and use for other purposes. Empty containers retain product residues and may be hazardous.
Sodium hydroxide (caustic soda)	Can cause severe injury to eyes, skin, and respiratory tract. Use PPE at all times and DO NOT contact product directly. Wash thoroughly after handling. Store in dry, well-ventilated area. Keep in original container, tightly closed. Empty containers retain product residues and may be hazardous.
Sodium	May cause irritation to eyes, skin, and respiratory tract with prolonged exposure.

Product	Handling Procedure
metabisulphite	Sulphite-sensitive individuals may experience severe allergic reaction to dust. Releases sulphur dioxide gas when mixed with water. Wear PPE and wash thoroughly after handling. Store in dry, well-ventilated area away from heat, acids, and oxidizers. Keep container tightly closed. Use vacuum to clean up dust.
Sodium nitrate	Keep away from heat. Keep away from sources of ignition. Keep away from combustible materials. Empty containers pose a fire risk; evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as reducing agents, combustible materials, acids. Keep container dry. Keep in a cool place. Keep container tightly closed. Keep in a cool and well-ventilated area. Highly toxic or infectious materials should be stored in a separate locked safety storage cabinet or room.
Sulphur	Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Minimize dust generation and accumulation. May form flammable dust-air mixtures. Avoid contact with skin, eyes and clothing. Empty containers contain product residue, (liquid and/or vapour), and can be dangerous. Keep containers tightly closed. Avoid contact with heat, sparks, and flame. Use with adequate ventilation. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat spark, or open flames. Store away from heat, sparks, and flame. Keep away from sources of ignition. Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances (oxidizing agents).

Table 8 - Process Plant & Water Treatment Reagents – Personal Protective Equipment

Product	Personal Eyes	Protective Skin	Equipment Respiration
Acetylene	Tightly sealed goggles	Protective gloves	Use atmosphere-supplying respirators (e.g. supplied-air: demand, pressure-demand, or continuous-flow or self-contained breathing apparatus:

Product	Personal Eyes	Protective Skin	Equipment Respiration
			demand or pressure-demand or combination supplied-air with auxiliary self-contained air supply atmosphere-supplying respirator in case of insufficient ventilation).
Activated carbon	None required	None required	None required
Anti-scalant	For splash protection use chemical goggles or full face shield	Rubber or neoprene gloves; impervious apron or coveralls and boots	Not normally needed
Borax	Avoid eye contact	None required	None required
Calcium oxide	For splash protection use chemical goggles or full face shield.	Rubber, neoprene, or nitrile gloves; impervious apron or coveralls and boots.	NIOSH/MSHA approved respirator, if required.
Calcium peroxide	Chemical goggles, full-face shield, or a full-face respirator is to be worn at all times when product is handled. Contact lenses should not be worn; they may contribute to severe eye injury.	Impervious gloves of chemically resistant material (rubber or neoprene) should be worn at all times. Wash contaminated gloves and dry thoroughly before reuse. Body suits, aprons, and/or coveralls of chemical resistant material should be worn at all times. Wash contaminated clothing and dry thoroughly before reuse. Impervious boots of chemically resistant material should be worn.	NIOSH-approved respirator for dust should be worn if needed.
Copper sulphate	Chemical goggles or full face shield.	Rubber or neoprene gloves; impervious apron or coveralls and boots.	Dust mask; NIOSH/MSHA approved respirator, if required.

Product	Personal Eyes	Protective Skin	Equipment Respiration
Flocculant	For splash protection use chemical goggles or full face shield	Rubber or neoprene gloves; impervious apron or coveralls and boots	Dust mask
Hydrochloric acid	For splash protection use chemical goggles or full face shield	Rubber or neoprene gloves; impervious apron or coveralls and boots	NIOSH/MSHA approved respirator
Hydrofluoric acid	Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133. Wear face shield.	Wear appropriate protective neoprene gloves to prevent skin exposure. Wear acid-resistant jacket, trousers and boots sufficient to protect skin.	Wear appropriate OSHA/MSHA approved chemical cartridge respirator regulations found in 29CFR 1910.134. If more than TLV, do not breathe vapour. Wear self-contained breathing apparatus. Always use an NIOSH-approved respirator when necessary.
Hydrogen peroxide	Wear coverall chemical splash goggles. In addition, where the possibility exists for eye or faces contact due to splashing or spraying of material, wear chemical splash goggles/full-length face shield combination.	Where there is potential for skin contact, have available and wear as appropriate: impervious gloves, apron, pants, jacket, hood, and boots; or totally encapsulating chemical suit with breathing air supply. Permeation data supplied by vendors indicate that impervious materials such as natural rubber, natural rubber plus neoprene, nitrile, or polyvinylchloride afford adequate protection. Do not wear leather gloves or leather shoes (uppers or soles) because they can ignite following contact with peroxide. Cotton clothing can also	Where there is potential for airborne exposure in excess of applicable limits, wear NIOSH approved respiratory protection.

Product	Personal Eyes	Protective Skin	Equipment Respiration
		ignite. This effect may be within minutes, or delayed. Clothing fires and skin damage occur less quickly with 50% or lower hydrogen peroxide than with 70% material, but adequate personal protection is essential for all industrial concentrations. Protective skin creams offer no protection from hydrogen peroxide and should not be used.	
Lead Acid Batteries	Safety glasses must be worn when moving, connecting, disconnecting or maintaining batteries, or cleaning up acid spills; as well as, when brushing battery posts or handling solids from inside a battery.	When moving, connecting, disconnecting or maintaining batteries, or cleaning up acid spills acid resistant gloves and full coverage acid resistant clothing must be worn. When brushing battery posts or handling solids from inside a battery gloves and apron must be worn.	When brushing battery posts or handling solids from inside a battery, dust masks must be worn.
Nitric acid	Chemical safety goggles. A face shield may also be necessary.	Impervious gloves, coveralls, boots, and/or other resistant protective clothing. An impervious full-body encapsulating suit and respiratory protection may be required in some operations.	NIOSH/MSHA approved respirator, if required
Paints	None required.	None required.	None required.
Silica	Safety goggles	Wear impervious gloves, shoes and protective clothing to prevent skin	NIOSH/MSHA approved respirator, if required

Product	Personal Eyes	Protective Skin	Equipment Respiration
		contact.	
Sodium cyanide	For dust and splash protection use chemical goggles or full face shield	Rubber or neoprene gloves; impervious lab coat, apron, or coveralls and boots	NIOSH/MSHA approved respirator, if required
Sodium hydroxide (caustic soda)	Tight-fitting goggles if dust is generated. For splash protection use chemical goggles or full face shield	Gauntlet type rubber or neoprene gloves; impervious apron or coveralls and boots	NIOSH/MSHA approved respirator
Sodium metabisulphite	Chemical safety goggles	Cotton gloves adequate for handling dry product. For solutions, use rubber or neoprene gloves; impervious apron or overalls and boots	NIOSH/MSHA approved respirator
Sodium nitrate	Contact lenses should not be worn; they may contribute to severe eye injury.	Impervious gloves of chemically resistant material (rubber or PVC), body suits, aprons, and/or coveralls of chemical resistant material and impervious boots of chemically resistant material should be worn at all times	For dusty or misty conditions, wear NIOSH-approved dust or mist respirator. In case of spill or leak resulting in unknown concentration, use NIOSH approved supplied air respirator.
Sulphur	Chemical safety goggles	Wear impervious gloves, shoes and protective clothing to prevent skin contact.	NIOSH/MSHA approved respirator, if required

8. MISCELLANEOUS HAZARDOUS/TOXIC MATERIALS

8.1 PRODUCT DESCRIPTION

Acids such as nitric acid, as well as emulsifiers and ammonium nitrate are used at the mine site. Gases such as propane, oxygen, acetylene; solvents; water/effluent treatment chemicals and various additives are also utilized.

The release or spillage of any of these substances would possibly result in environmental impacts and pose a potentially hazardous situation for those personnel exposed to some of these materials. It is essential that materials deemed to be potentially hazardous be dealt with in a cautious manner, in strict adherence to recommended regulations outlined in the legislation, whether the substance is provided in large or smaller quantities as this will prevent serious repercussions should an accidental release of material happen.

8.2 STORAGE FACILITIES OF HAZARDOUS/TOXIC CHEMICALS

All explosive related chemicals will be stored as discussed in Section 6 of this Plan.

All other chemicals and gases will be stored in appropriate locations.

These storage facilities ensure that chemicals that could interact and cause a serious incident will be kept segregated.

9. INVENTORY, INSPECTION & RECORDS

A contract expediting company, Arctic Fuels, arranges all deliveries from the Baker Lake Marshalling Area to the Meadowbank site. This includes the hazardous materials discussed in this plan. The General Mine Manager has ultimate responsibility for supervising the receipt, inspection, and recording of all material inventories at site. The division managers reconcile total amounts received against amounts ordered.

9.1 PETROLEUM PRODUCTS

9.1.1 Inventory Management

Diesel fuel use is metered automatically when it is pumped from the bulk tanks. The metered volumes are summarized weekly and reconciled against tank levels determined manually with a dipstick from the top of the tanks. Diesel fuel consumption for the power generators is recorded weekly.

Aviation fuel is dispensed as required under the supervision of aircraft personnel. Consumption and on-site volumes are reconciled monthly. Lubricants and other petroleum products are inventoried monthly.

9.1.2 Inspection

The Environmental Department performs regularly scheduled inspections of all fuel and lubricant storage areas. The inspection schedule and procedures to be followed are summarized in Table 9. All inspections are logged with the date and time of inspection, facility inspected, and name of the person making the inspection. See Appendix D for the inspection report of any hazardous material storage area.

The condition of hazardous materials storage areas, containers, tanks, connectors and associated plumbing will be checked on a regular basis. Observations on their condition will be logged, dated and kept near the corresponding storage area. Drums/containers will be inspected for the presence and legibility of symbols, words or other marks identifying the contents, signs of deterioration or damage such as corrosion, rust, leaks at seams or signs that the drum/container is under pressure such as bulging and swelling, spillage or discoloration on the top or sides of the drum/container. If leaks or deterioration is encountered it will be noted and addressed in a timely manner.

The hazardous materials area's secondary containment will be inspected and the condition of the secondary containment will be noted. Arrangements will be made for repairs if necessary.

Table 9 - Inspection of Petroleum Storage Sites

Fuel Tanks	*Schedule* – Daily by Site Services Supervisor, Weekly by Environmental Technician, Quarterly by Environmental Coordinator. *Procedure* – Repair leaks and report promptly. Inspections will be reported annually and filed with the General Mine Manager or Site Services Superintendent and Environmental Superintendent.
Electrical Generating Plant (diesel)	*Schedule* – Daily by powerhouse operator, weekly by Environmental Technician as part of internal environmental inspections. *Procedure* – Inspections will be reported annually and filed as above.
Other Fuelling Stations	*Schedule* – Daily by Site Services Supervisor, Weekly by Environmental Technician as part of regular inspections. *Procedure* – Inspections will be reported annually and filed as above.
Spill Kits	*Schedule* – Monthly by Environmental Technician, Quarterly by Environmental Coordinator. *Procedure* – Inspections will be reported annually and filed as above.
Other Hazardous Material Storage	*Schedule* – Daily by Site Services Supervisor, Mill Supervisor, Weekly by Environmental Technician when materials are on site. *Procedure* – Inspections will be reported annually and filed as above.

Any accidental damage to containment structures will be inspected immediately and appropriate repairs undertaken. The extent of damage will be reported in writing to the General Mine Manager and Environmental Superintendent. The report will note any remedial repairs that may be made, the date of any repairs, and the need for any follow-up inspection.

9.1.3 Records

Records pertaining to storage, use, and loss of fuels and lubricants are required by CCME and the Fire Marshal (under the *National Fire Code).* The following records are prepared by the Procurement and Logistics and Site Services departments:

- Reconciliation of bulk inventory from resupply logs;
- Weekly use summaries;
- Weekly reconciliation for each storage tank;
- Overfill alarm tests;
- Pressure tests (if applicable);

- Inspections and maintenance checks of the storage tank, piping, and delivery systems;
- Any alteration to the systems;
- Reports of leaks or losses;
- Reports of spill responses; and
- Records of training.

9.2 EXPLOSIVES

9.2.1 Inventory Management

See Figure 1 for location of the Explosives Mixing Plant or Emulsion Plant. The emulsion manufactured on-site is stored in a tank located at the Emulsion Plant. AEM's explosive contractor, Dyno Nobel Inc., performs daily and weekly inspections on the Emulsion Plant to ensure that Inventory used is documented. AEM conducts daily inspections of the seacan's storing the boosters, delays and detonator cords and provides an inventory to the Mine Manager.

9.2.2 Inspection

Access to and use of explosives will be under the exclusive control of AEM. AEM will be responsible for inspection of all explosives equipment and facilities, including the ammonium nitrate storage areas and the magazines for high explosive detonators and blasting caps. The explosives manufacturing plant is inspected by Dyno Nobel Inc. and reports this to AEM Management.

9.2.3 Records

The *Federal Explosives Act* requires that the following records be kept with regard to explosives products:

- Quantity and strength of each explosive manufactured; and
- Quantity of each explosive issued to the mine site from the factory, including the dates of shipments and quantity of each explosive on site.

AEM staff will provide weekly reports to the General Mine Manager that will include:

- Staffing;
- Safety concerns or incidents;
- Total explosives consumption;
- Amount of ammonium nitrate remaining on site; and
- Inventory of other explosives and accessories to be audited for fiscal month-end balances.

9.3 MISCELLANEOUS HAZARDOUS/TOXIC MATERIALS

9.3.1 Inventory Management

Adequate quantities of all hazardous chemicals are reconciled against orders on receipt. The appropriate department responsible for the miscellaneous chemicals is responsible for reconciling the resupply inventory.

9.3.2 Inspection

During operations, the appropriate department responsible for storage and handling of the miscellaneous chemicals are to regularly inspect all areas where such hazardous materials are used and stored. Any problems will be noted and reported to the Department Manager. The Department Manager is responsible for weekly or monthly inspections of miscellaneous hazardous materials and storage areas.

9.3.3 Records

The quantity of hazardous materials received, used, and in possession of personnel are recorded by appropriate Departments. The departments are to comply with the environmental regulations.

10. TRAINING

10.1 GENERAL

All staff and contractors at the Meadowbank Gold project will receive the following training:

- WHMIS;
- Emergency and spill response (see also the SCP and ERP);
- Operations overview; and
- Mine Standard Operating Procedures.

Mine employees will receive additional training in mine safety as specified by the *Mine Health and Safety Act* and regulations. AEM will ensure compliance with the training requirements specified in the Act and regulations.

Plant employees will receive additional training specific to their area of work and duties, including safe operating practices, safe handling and storage of chemicals, and use of PPE. Other training includes cyanide and chemical awareness, specific chemical training for specific tasks, and a mill induction training. This training will be the responsibility of AEM.

A record of training received will be maintained for each employee and also from contractors.

In Appendix E you will find a procedure poster that is placed at the applicable hazardous material storage location. This poster will also be used during toolbox meetings with all departments to ensure that hazardous material is being segregated and placed in the appropriate containers for storage.

10.2 PETROLEUM PRODUCTS HANDLERS

Personnel who handle petroleum products will be expected to be conversant with relevant MSDS information. As well, these personnel will be given training in the following:

- Transportation of dangerous goods (TDG);
- AEM's fuel handling procedures (outlined in Section 5);
- Spill response and cleanup procedures for petroleum (see the SCP); and
- Emergency response, especially firefighting procedures (see the ERP).

10.3 EXPLOSIVES HANDLERS

Only trained and certified persons will work with explosives. The explosives personnel will undertake formal training and on-the-job training to ensure compliance with legislation. The Mine Inspector will check the adequacy of training. Training requirements will include (but not necessarily be limited to):

- Specific fire procedures as per the *Federal Explosives Act*;
- First aid;
- Transportation of dangerous goods (TDG); and
- WCB Blasting Certificate.

10.4 PLANT EMPLOYEES

Plant operators may receive TDG training, if appropriate. All plant employees will be trained in spill and emergency response procedures. Emergency response procedures for spilled chemical substances are provided in the SCP.

10.5 THIRD PARTY CONTRACTORS

It is expected that third party contractors receive adequate and comprehensive training to conduct their work tasks from their employer. AEM intends to review the general qualifications of third party contractors prior to having them work at the site. In addition, the contractor companies may also be requested to confirm the qualifications of specific individuals that they may have working at the site.

Third party contractors working on the site are required to participate in, and complete a site specific health and safety training session. The training session is envisioned to be valid for a period of 3 years, after which time the contractor may be required to complete the training again, or attend a refresher. The training session will outline site specific hazardous and response procedures that they should be aware of in the course of conducting their work on site. The training session will cover hazardous materials management.

11. PLAN EVALUATION, AUDIT & IMPROVEMENT

As part of AEM's commitment to attain certification under the International Cyanide Management Code, it will sponsor regular (every three years) audits by Institute-approved, third-party professionals to verify its compliance with the Code's principles and standards of practice with regard to cyanide handling

12. FIGURE

Figure 1: Meadowbank Mine Site General Layout

Figure 2: Vault General Layout

Figure 3: Meadowbank Mine Site: Hazardous Material Storage Locations

Figure 4: Baker Lake Marshalling Area Layout: Diesel Fuel Storage Facility

Figure 5: Baker Lake Marshalling Area Layout: Jet-A Fuel Storage Facility

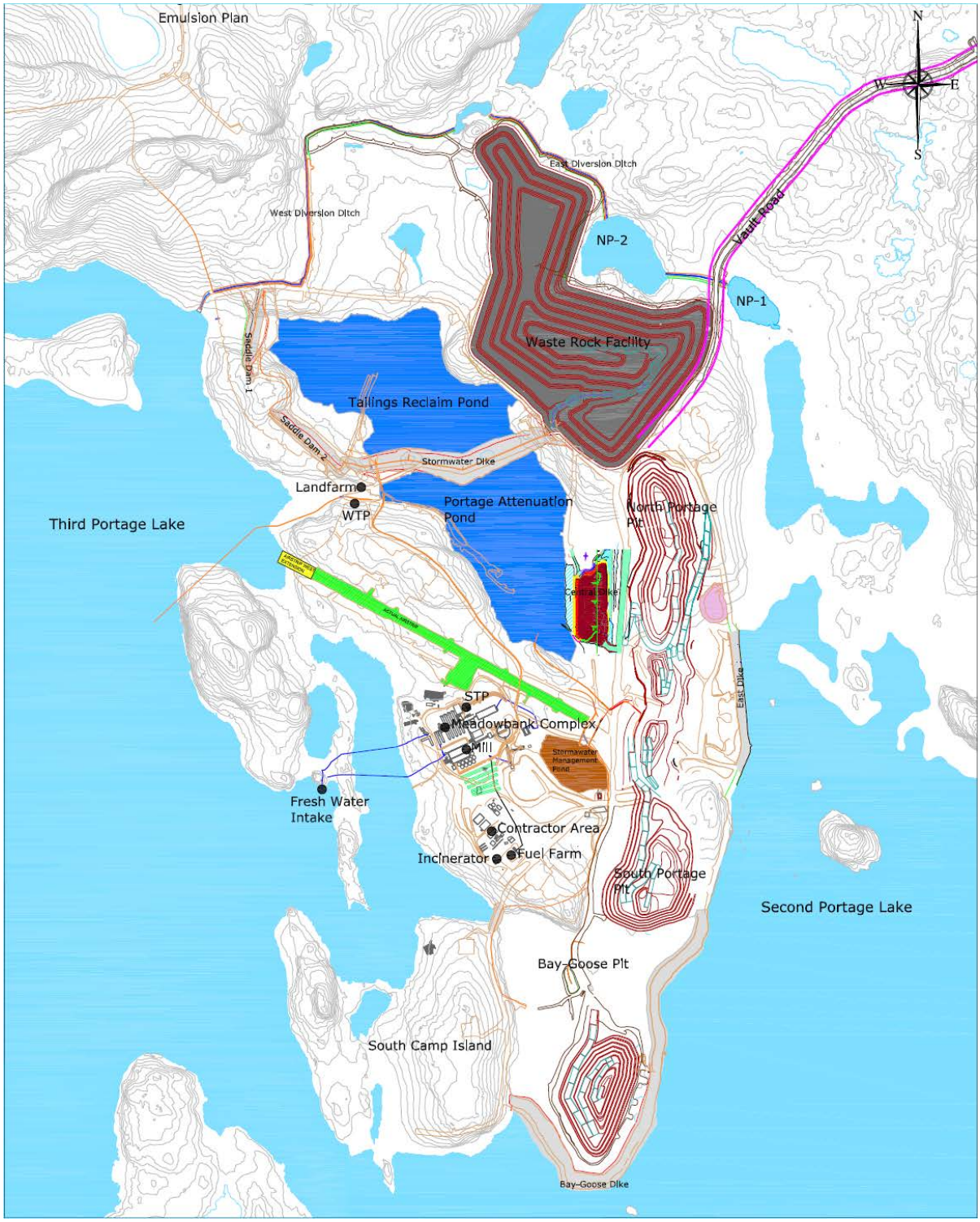

Figure 1 - Meadowbank Mine Site General Layout

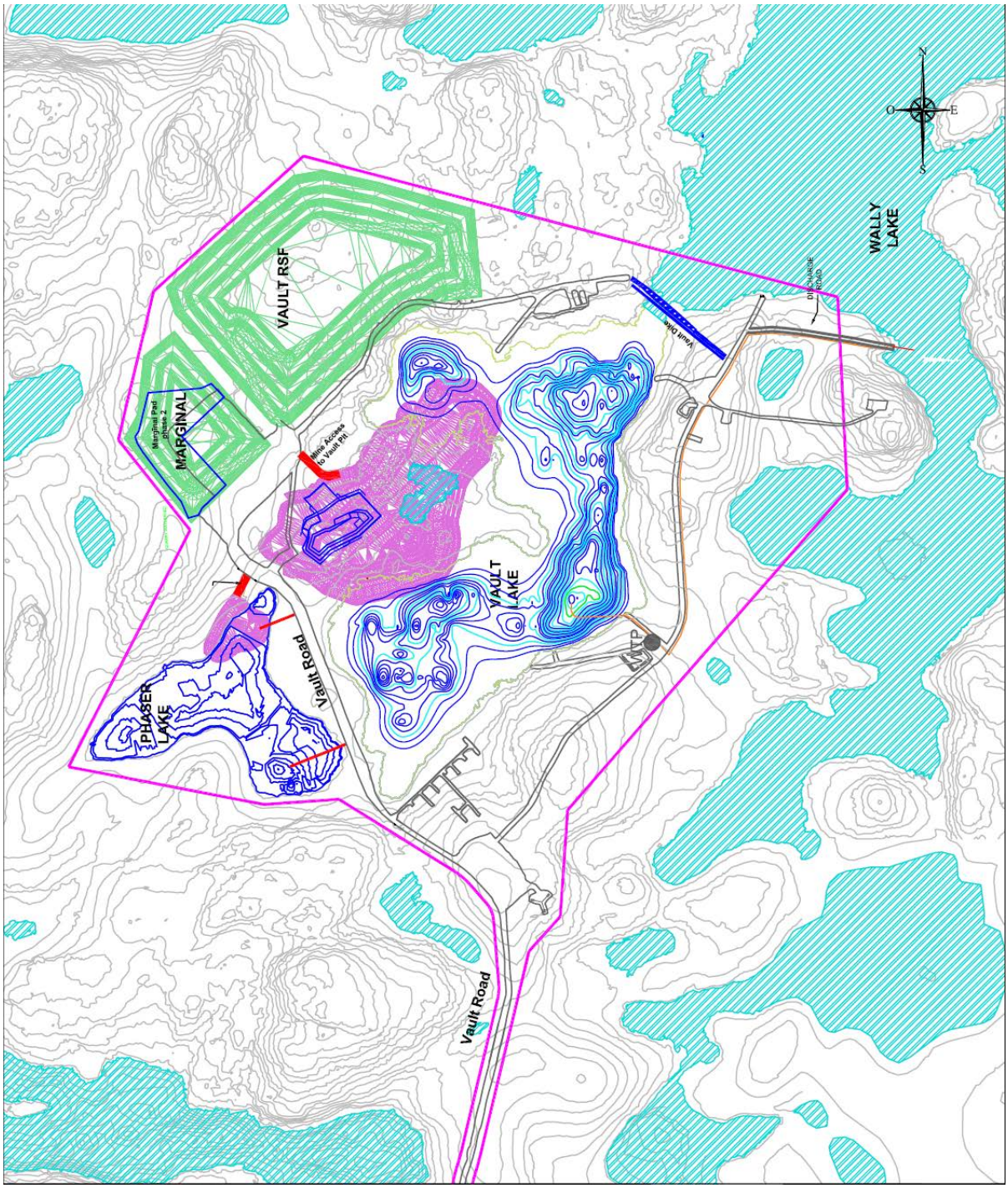

Figure 2 - Vault General Layout

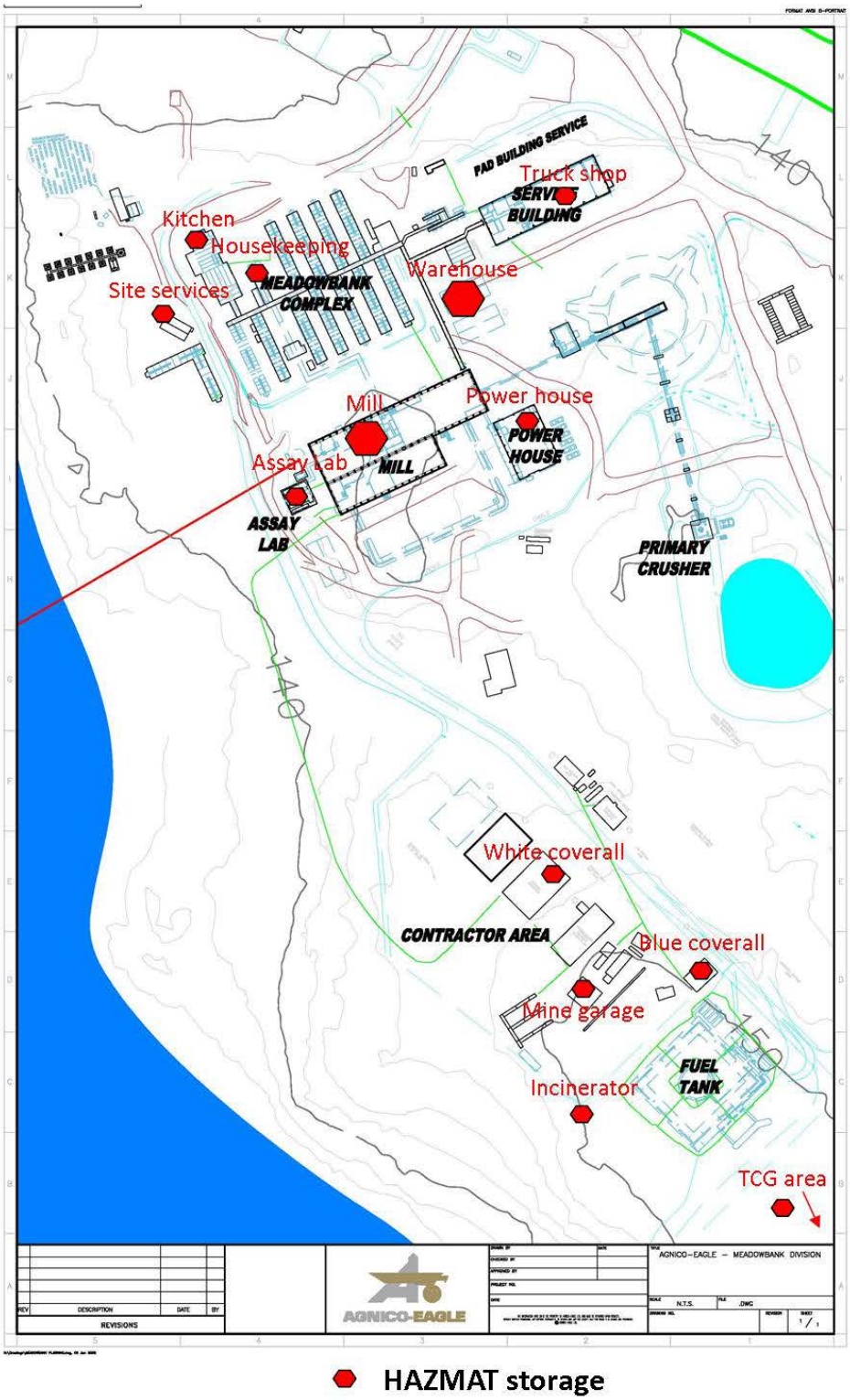

Figure 3 - Meadowbank Mine Site: Hazardous Material Storage Locations

Figure 4 - Baker Lake Marshalling Area Layout: Diesel Fuel Storage Facility

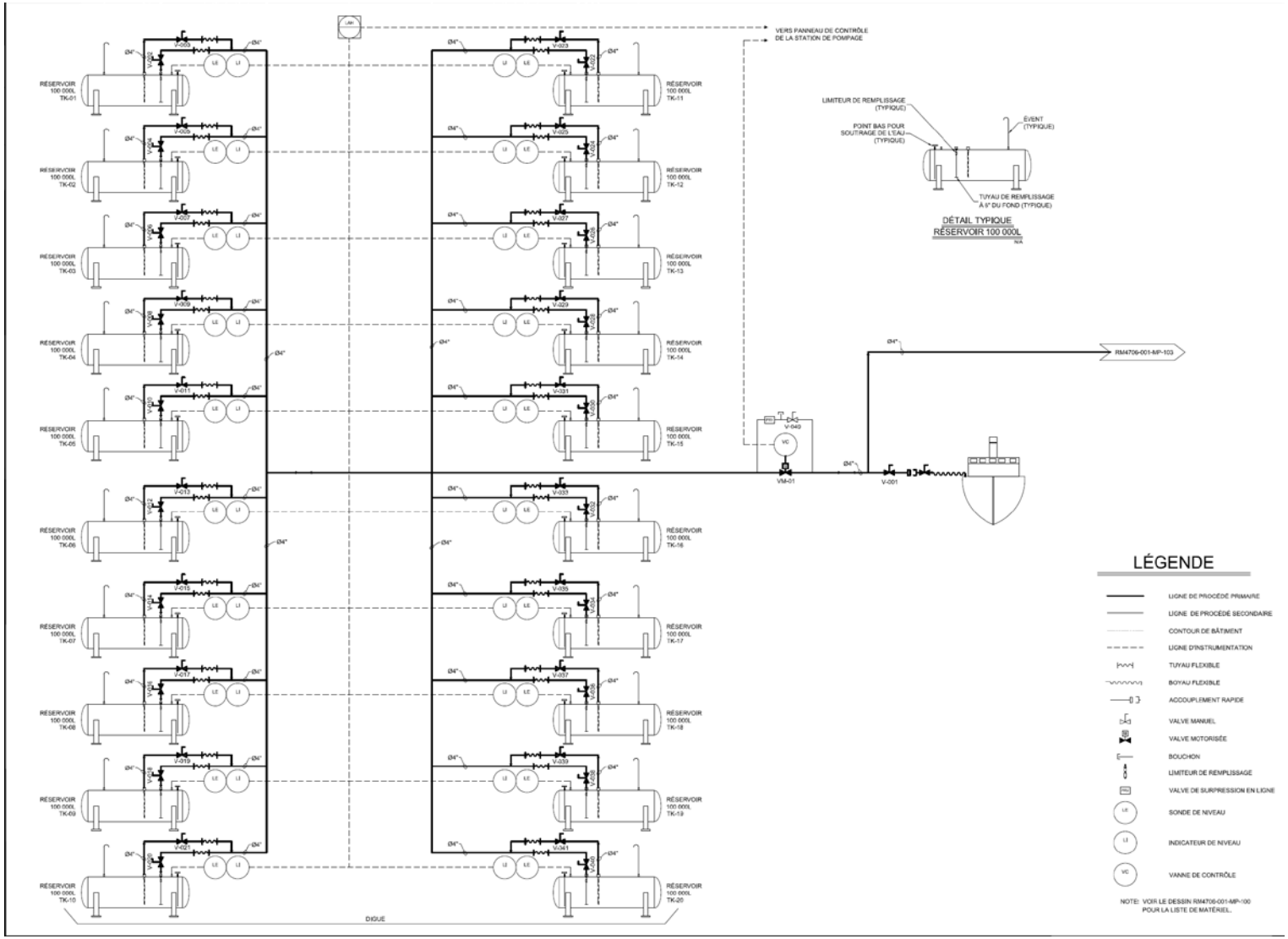

Figure 5 – Baker Lake Marshalling Area Layout: Jet-A Fuel Storage Facility

13. LIST OF ACRONYMS

AEM	Agnico-Eagle Mines Ltd.
AN	Ammonium Nitrate
ANSI	American National Standards Institute
ANFO	Ammonium Nitrate Fuel Oil
CCME	Canadian Council of Ministers of the Environment
EPS	Environmental Protection Service
ERD	Explosives Regulatory Division, Natural Resources Canada
ERP	Emergency Response Plan
ERT	Emergency Response Team
FS	Fuel Storage Area
HAZCOM	Hazard Communication
HCN	Hydrogen Cyanide
HM	Hazardous Materials Storage Area
HMMP	Hazardous Materials Management Plan
HR	Human Resources
HSC	Occupational Health & Safety Committee
HW	Hazardous Waste Storage Area
IBC	Intermediate Bulk Container
ISO	International Organization for Standardization
MSDS	Materials Safety Data Sheets
MSHA	Mine Safety and Health Administration
NIOSH	National Institute for Occupational Safety and Health
OHSA	Occupational Health and Safety Administration

OHSP	Occupational Health & Safety Plan
PCB	Polychlorinated Biphenyls
PPE	Personal Protective Equipment
SCP	Spill Contingency Plan
TDG	Transportation of Dangerous Goods
TDGA	Transportation of Dangerous Goods Act
WCB	Workers' Compensation Board
WHMIS	Workplace Hazardous Materials Information System

Appendix A

List of Applicable Legislation

The following is a list of federal and territorial legislation and guidelines that regulate the management of hazardous materials in Nunavut, and which are considered potentially applicable to the Meadowbank Gold Mine. As part of Meadowbank Mining Corp's overall environmental management system for the mine site, this list is updated at least annually to ensure it represents current and relevant information.

Federal Legislation

- **CANADIAN ENVIRONMENTAL PROTECTION ACT, 1999 S.C. 1999, c. 33**

  Code of Practice for the Reduction of Chlorofluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

  Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

  Environmental Code of Practice on Halons Code of Practice EPS 1/RA/3E.

  Environmental Emergency Regulations SOR/2003-307.

  Environmental Guidelines for Controlling Emissions of Volatile Organic Compounds from Aboveground Storage Tanks, CCME-EPC-87-E, as amended.

  Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations SOR/2005-149.

  Federal Halocarbon Regulations, 2003 SOR/2003-289.

  Interprovincial Movement of Hazardous Waste Regulations SOR/2002-301.

  Ozone-Depleting Substances Regulations, 1998 SOR/99-7.

- **EXPLOSIVES ACT R.S.C 1985, c. E-17**

  Ammonium Nitrate and Fuel Oil Order C.R.C. 1978, c. 598.

  Explosives Regulations C.R.C. 1978, c. 599.

- **TRANSPORTATION OF DANGEROUS GOODS ACT, 1992 S.C. 1992, c. 34**

  Transportation of Dangerous Goods Regulations SOR/2001-286.

  Transportation of Dangerous Goods Regulations - Schedules SOR/2001-286.

Federal Codes and Other Guidance Documents

- National Fire Code.
- Indian and Northern Affairs Canada. 2005. DEW Line Cleanup Barrel Protocol.
- Canadian Council of Ministers for the Environment (CCME) - Environmental Code of Practice for Above-Ground and Underground Storage Tanks Systems containing Petroleum Products and Allied Petroleum Products (2003).
- CCME - Canadian Wide Standards for Petroleum Hydrocarbons in Soil.
- CCME - Canadian Environmental Quality Guidelines.
- Environment Canada (Tilden & Westerman). 1990. Guidelines for the Preparation of Hazardous Material Spill Contingency Plans.
- Department of Fisheries and Oceans. 1998. Guidelines for the Use of Explosives in or Near Canadian Fisheries Water.

Territorial Legislation

- **ENVIRONMENTAL PROTECTION ACT R.S.N.W.T. 1988, c. E-7**

  A Guide to the Spill Contingency Planning and Reporting Regulations January 2002.

  Environmental Guideline for Contaminated Site Remediation November 2003.

  Environmental Guideline for Waste Lead and Lead Paint.

  Guideline for Ozone Depleting Substances.

  Guideline for the General Management of Hazardous Waste in the NWT.

  Guideline for the Management of Waste Antifreeze.

  Guideline for the Management of Waste Batteries.

  Guideline for the Management of Waste Paint.

  Guideline for the Management of Waste Solvents.

  Guideline for Dust Suppression, February 1998.

  Spill Contingency Planning and Reporting Regulations R-068-93.

  Used Oil and Waste Fuel Management Regulations R-064-2003.

  Plain Language Guide to the Used Oil and Waste Fuel Management Regulations.

- **TRANSPORTATION OF DANGEROUS GOODS ACT, 1990 S.N.W.T. 1990, c. 36**

  Transportation of Dangerous Goods Regulations R-049-2002.

- **EXPLOSIVES USE ACT R.S.N.W.T. 1988, c. E-10**

  Explosives Regulations R.R.N.W.T. 1990, c. E-27.

Appendix B

Hazardous Materials Stored on the Meadowbank Site

Name	Description	Quantity
2,6 DIMETHYL 4 HEPTANONE 80 %	4LT	60
ABS GLUE CAN WITH BRUSH	500ML	3
ABS TO PVC TRANSITION GLUE	W/ BRUSH 500ML	11
ACETONE	4LT	4
ACETONE CLEANER		22
ACETYLENE	SIZE A390 CYLINDERS	506
ACETYLENE CGA510	SIZE MC CYLINDERS	20
ACETYLENE LABORATORY GRADE	SIZE K	42
ACTISAND 7E-3003	SILICE SAND 22.68KG	144
ACTIVATED CARBON	8 X 16 - 60% ACTIVE IN 500KG	504
ACTIVATED CARBON (GAC) FILTER	2 1/2" X 10" PHOSPHATE	12
ADDITIVE		16
ADHESIVE SILICONE	WITH RTV SUPERFLEX	40
ADHESIVE SILICONE	HIGH-TEMP RTV RED	93
ADHESIVE/SEALANT 277	BOT/250ML F/ LARGE BOLTS	41
ALIQUAT 336 AVERAGE MW 442	1LT	4
ALIQUOT 336	250ML	4
ALL SEASON SELECT OIL.	1L	16
ALL STEEL WELDING ELECTRODE	M4 5/32" 2.5KG/BX	2
ANHYDRE BORAX 12 MESH	25KG DEHYBOR	167
ANHYDRONE		7
ANIONIC FLOCCULANT 920 MC	750KG/BAG	181
ANIONIC FLOCCULANT 934 SH	750KG/BAG	151
ANTI SEIZE LOCTITE SILVER GR	CONTENANT 1LB	26
ANTI-STATIC/FOG BOTTLE CLEANER	MAGIC 225ML	36
ARC AIR TORCH	EXTREME K4000	4
ARC AIR TORCH 1000A	W/10' CABLE CSK4000W	9
ARCAIR SLICE ROD	1/4" X 22" LONG 100/PACK	2
ARCAIR SLICE ROD	3/8" X 18" LONG 50/PACK	2
ARCTIC GREEN LOW TEMP WET CHEM	FOR HVY EQUIP FIRE SUPPRESSION	15
ARDEE 100 ROCK DRILL OIL	20LT	201
ARDEE 32 ROCK DRILL OIL	20LT	1301
ARDEE 32 ROCK DRILL OIL	205LT DRUM	7
ARENA SILICA	MALLA 2030 INDUSTRIAL 25KG/BAG	0
ARGON	SIZE T CYLINDERS	118
ARSENIC EDL		2
ARSENIC STANDARD	1000PPM 500ML	4
ASSIST 1AL1 LIQUID ALKALI	18.9LT	107
ATF D3M	1040LT	1
AU LUMINA HCL		1
BACKING COMPOUND	MAGANESE	50
BATTERY	12V CM785	4
BATTERY	12 VOLTS	0
BATTERY	KAWASAKI MULE	12
BATTERY	12V 8DW ELECTROL F/ DM45 DRILL	2
BATTERY	CR2	6
BATTERY 12V	FOR HVY EQUIP FIRE SUPPRES	6
BATTERY ACID NEUTRALIZER		22
BATTERY ENERGIZER	6V	3
BATTERY ENERGIZER INDUSTRIAL	ALKALINE AAA 4/PK	2185
BATTERY ENERGIZER INDUSTRIAL	AA 4/PK	2554
BATTERY ENERGIZER INDUSTRIAL	C	39
BATTERY ENERGIZER INDUSTRIAL	ALKALINE D	572
BATTERY ENERGIZER INDUSTRIAL	9V	453

BATTERY INTERNATIONAL	LUBE AND SERVICE TRK	12
BATTERY LI-ION CP200	2250MA CAPACITY	13
BATTERY MOTORCRAFT	12V 850A	31
BLUESHIELD WIRE LA-S6.35	20KG ROLL	10
BODY PRIMER	F/ URATHANE WINDOW&WINDSHIELD	1
BONE ASH	20 MESH	27
BRAKE CLEANER	KLEEN-FLO 20LT	82
BRAKE CLEANER	12/CS	766
BRAKE FLUID DOT-3	1LT	32
BRP MINERAL OIL	946ML 2 STROKE	265
BUFFER SOLUTION PH 10	4L	3
BUFFER SOLUTION PH 4	4L	3
BUFFER SOLUTION PH12	R1300 (4 LITRES)	0
BUFFER SOLUTION PH7	4/CASE	2
BUG SPRAY DEEP WOOD OFF	100ML PUMP BTL	278
BURNING RODS LENCO	10' 6" 5/8ID 11/16OD	100
BUTANE FUEL	70ML	14
C25 ARGOSHIELD	SIZE T CYLINDERS	99
CALCIUM CHLORIDE LIQUID	29.6% 1000L/DM	1587
CALCIUM CHLORIDE LIQUID	29.6% 1200L/DM	303
CARBON DIOXIDE	SIZE T CYLINDERS	0
CAT DEO MONOGRADE 40 OIL	1200 LITERS/TOTE	93
CAT DEO MONOGRADE 40 OIL	205 LITERS DRUM	6
CATIONIC POLYMER	25KG HYDREX 3613	25
CAUSTIC SODA ANHYDRE	1000KG MICROPEARL	321
CAUSTIC SODA MICROPEARL	25KG/BG	1137
CAUSTIC ULTRATAK GREASE	CARTRIDGES	4
CELLULOSE		30
CHASSIS LUBRIFIANT	2KG CASTROL	2
CHIP CMS HYDROCYANIC ACID	2 - 50 PPM	10
CHOKE AND CARB CLEANER	KLEEN-FLO	37
CLEANER BATTERY MAINTENANCE	AERO 312GM	78
CLEANER CARBURATOR/CHOKE		9
COAGULANT ALUMINIUM HYDROXYDE	1000KG HYDREX 352 PASS-10S	123
COLORED FLEECE RAGS	20LB	314
COMPRESSOR OIL SYNTHETIC	COMPRO XL-S 32 205LT	23
COMPRO SYNTHETIC	205LT/DM	14
COOLANT CVC-7-A	1040LT TOTE YELLOW	1
COOLANT SAMPLE KIT		114
COOLANT TREATMENT		2
COPPER OXIDE		16
COPPER SULPHATE	PENTAHYDRATE MINE GRADE	447
COUPLER QUICK		34
CPVC GLUE	W/ BRUSH 500ML	7
CULTURE TUBE DISPOSABLE	BOROSILICATE16MMX150MM 1000/BX	196
CVC-7-A YELLOW COOLANT	3.78LT	50
DEB DEBBA PROTECTIVE CREAM	# 233 8 X 800ML	31
DEB NATURELL HAIR/BODY	# 266 4 X 4LT	166
DEB NATURELL SUNFLOWER	# 256	145
DEFLECT PRO SUN SCREEN	140ML	1174
DE-ICER LOCK POCKET SIZE	35ML	47
DIELECTRIC GREASE		7
DIESEL ADDITIVE	9.8L	145
DIESEL MELT	ANTI-GELLING TREATMENT	34
DIFERENCIEL LOCK ADDITIVE SEAL		6

DISSOLVED OXYGEN SERVICE KIT	HACH PORTABLE OXYGEN METER	6
DIXON LUBRICATOR	3/4"	3
DOW CORNING GREASE # 111 TUBE	HVY EQUIP FIRE SUPPRES	7
DPD FREE CHLORINE HACH	10ML SAMPLE REAGENT 100/PK	7
DRILL CARE MOTOR OIL	QT FOR DM45 DRILL	7
DRILL STEEL GREASE	KOPPER KOTE 10LT	76
DURADRIVE MV SYNTHETIC ATF	20LT PAIL	10
DURATRAN SYNTHETIC	205 LITERS DRUM	5
DURON E 15W40	1040LT IBC	80
DURON E SYN 0W40	1040LT IBC	27
DURON E SYNTHETIC 5W-40	4L	32
DURON SYNTHETIC 15W40	205LT	1
DURON XL 0W30	1040LT IBC	88
DUST BAN	20KG	95
DUST CONTROL NALCO	8882.61 1183KG TOTE	92
DYNALENE EG 60 A-RED	ETHYLENE GLYCOL (1078KG/TOTE)	15
ECOTRACTION	1 TON BULK TOTE IBC	15
EDGE DETERGENT	18.9LT	108
ELECTRODE	600-800-900	60
ELECTRODE CLEANING SOLUTION	HANNA INSTR.TESTER 230ML BTL	12
ENDURATEX EP150	205L/DM	86
ENDURATEX EP220	205LT/DRUM	30
ENDURATEX EP220	1040LB IBC	10
ENDURATEX EP320	205LT/DM	4
ENDURATEX EP460	205LT/DM	7
ENDURATEX EP68	205LT/DM	29
ENDURATEX SYN EP150	205LT/DM	3
ENDURATEX SYN EP220	205LT/DM	34
ENDURATEX SYN EP320	205L/DM	10
ENDURATEX XL SYN BLEND 68/220	205LT	7
ESAB WELDING WIRE	0.045 (15 Kg/ROLL)	50
ESAB WELDING WIRE	0.062 (15 Kg/ROLL)	82
ESSO XDO 60	1100L/TOTE	0
EXTENDED LIFE COOLANT -52	1040LT	123
EXTERIOR SEALANT MULCO	300ML BLUE SCOTIA	47
EXTERIOR SEALANT MULCO	300ML CLEAR	48
FLOCULANT	25KG/BG 85016	1
FUNNEL	DYNALINE	9
GASKET ELIMINATOR 515	50ML SMALL TUBE	16
GASKET MAKER HI-TEMP	80ML RED	5
GASKET SEALANT IN TUBE		94
GEAR CHAIN & CABLE LUBRICANT	LOCTITE 12 OZ. AEROSOL	26
GEARGUARD	180KG/DRUM	4
GENERAL PURPOSE THINNER	GALLON	59
GLUE STICK	20G	23
GLUE STICK ENIUM	40G	7
GLYCEROL (VERLUBE)	4LT/CONTAINER	1
GOLD SOLUTION STD	1000PPM	5
GREASE EP.	NLGI CHEVRON 6134 300GR	12
GREASE EP-1	IN TUBE ULTRA DUTY	58
GREASE FOR COUPLING	PEERLESS XCG FLEX GREASE	90
GREASE TUBE	TRAMAC	0
GREASE TUBE KIT	GRACO FIREBALL 425 50:1	8
HAND CLEANER GRIME EATER	3.5LT	7
HARD FACING ELECTRODE	3/16" 20KG/CS	0

HELISTAR CS GAS		30
HELIUM	SIZE T CYLINDERS	28
HIGH PRESSURE NITROGEN	SIZE T CYLINDERS	25
HIGH TEMPERATURE CONTROLLER		1
HIGH VACUUM GREASE		4
HYD ARCTIC OIL	FOR DM45	2
HYDRAULIC COOLER	THERMAL TRANSFER	1
HYDREX AW 46	HYDRAULIC OIL 20LT/PAIL	6
HYDREX EXTREME HYDRAULIC OIL	205LT	10
HYDREX MV ARCTIC 15	205LT	24
HYDREX MV22	20LT/PAIL	40
HYDREX MV36	20LT/PAIL	40
HYDREX MV60	20LT/PAIL	32
HYDREX XV ALL SEASON	1040LT IBC	0
HYDROCHLORIC ACID	240KG 20BE 32%	396
HYDROCHLORIC ACID REAGENT GRAD	2.5LT 4/CS	52
ICE FREE AIR TOOL OIL	1LT WHEEL & ACCESSORIES	0
INO FOAM SOAP	6 X 1LT	160
INT/EXT BLUE PAINT	AGNICO DEVOE	17
IRON ACCELERATOR		89
J-512 FINAL STEP/SANITIZER	4 X 1.89LB BY CS	15
JAVELISANT DIBAC	20LT	12
JERRYCAN GAS	20LT	30
KEEN-FLO	BRAKE & PARTS CLEANER 4LT	20
KIDDY APC WET CHEMICAL AGENT	MODEL # WHDR-125	2
KIDDY APC WET CHEMICAL AGENT	MODEL # : WHDR-600	2
KVS	20G/PKG	2
LAUNCH 6GL2 LIQUID SOUR	18.9LT	28
LEAD BULLION MOLD	1000 OZ	20
LEAD NITRATE	25KG 99% MIN	2730
LEAD NITRATE	1000 KG	138
LEPAGE BLUE CONTACT CEMENT	3.8L	0
LITHARGE GOLD FREE	25KG	2
LOCTITE 290	50ML GREEN	4
LOCTITE 510 GASKET ELIMINATOR	50ML	12
LOCTITE SUPER GLUE	SUPER GLUE 495	69
LOCTITE THREADLOCKER 242 BLUE	REMOVABLE BOT 250ML	7
LOW COOLANT SEN		2
LUBRICANT	5 GALLON	2
LUBRICANT OIL WD 40	AEROSOL	2
LUBRICANT OIL WD40	4LT	24
LUBRICANT SUPER PENETRATING	PL-100 350G 12/CS	20
LYSOL TOILET CLEANER	710ML	1
MAGIC BOND EPOXY STICK		6
MAGLITE RECHARGEABLE BATTERY		10
MERCON SP TRANSMISSION OIL	1 LITER CONTENANT	2070
METABISULFITE	97% W	1046
METABISULFITE	97% W 907.19KG	389
METABISULFITE	97% W 1200KG/BAG	51
METABISULFITE	97% W 1360KG/BAG	80
MILL PERSE 813	SCALE CONTROL 200LT	0
MILL PERSE 813	SCALE CONTROL 1000LT TOTE	34
MOBILE SHC 10/24	20LT COMPRESSOR OIL	4
MOBILITH	GREASE SHC100	10
MOBILTAC 325NC	205L/DM	1

MOBILTAC 375 NC	17.2KG PAILS	24
NEW FLUX	491KG BATCH (26 PAILS/18.8846)	34074.85
NICKEL ANTI-SEIZE	1LB. CAN	13
NITRIC ACID 67%	193LT/DM	467
NITRIC ACID REAGENT GRADE	2.5LT 4/CS	23
NITRO CARTRIDGE	FOR HVY EQUIP FIRE SUPPRESSION	14
NITROGEN PILOT CYLINDER KIT	FOR HVY EQUIP FIRE SUPPRESSION	4
NITROGEN PP4.8	SIZE T CYLINDERS	25
NU-ACTION-3	4LT	76
NU-BIO SCRUB	4LT	55
NU-KLEENSMELL	4LT	20
NU-TRAP	20LT	14
OIL ADDITIVE	301-A	20
OIL COOLER	COOLER	4
OIL COOLER		0
OIL COOLER		2
OIL F/ CHAIN LIGHT	WINTER -40°C RESISTANT	20
OIL MOTOR DRILL CARE	20 LITER	2
OIL RALUBE 40	1040 LITER TOTE IBC	40
OXYGEN	SIZE K CYLINDERS	286
OXYGEN CGA540	SIZE D CYLINDERS	10
OXYGEN LABORATORY GRADE	HYDROCARBON FREE SIZE K	67
PAINT	1GAL BRIGHT YELLOW	25
PAINT AERVOE INVERTED	ORANGE GLO 12CN/BX	158
PAINT AERVOE INVERTED	GREEN GLO 12 CAN/BX	78
PAINT BRUSH	2 1/2"	196
PAINT BRUSH ANGLE	2 1/2"	100
PAINT DEVOE	1GAL SAFETY BLUE H19	54
PAINT DEVOE	1GAL SAFETY YELLOW EPOXY	13
PAINT DEVOE RUST-OLEUM	1GAL SILVER GRAY	47
PAINT EXTERIOR LATEX	1GAL SAFETY BLUE	22
PAINT GREY	ATLAS-COPCO	15
PAINT PIZZAZZ ENAMEL ALKYD	1GAL SATURN YELLOW	2
PAINT RUST-OLEUM	14OZ FLUO GREEN	64
PAINT RUST-OLEUM	14OZ FLUO ORANGE	241
PAINT YELLOW	ATLAS-COPCO	12
PC ATF D3M	205LT/DM	5
PEERLESS LLG GREASE	TUBE	140
PEKOE THE VRAC	(1000/BX)	99
PERMATEX ORING&RUBBER ADHESIVE		11
PETROSOL 3139	205LT	1
PH 4.01 SOLUTION	HANNA INSTRUMENT PH TESTER	5
PH 7.01 SOLUTION	HANNA INSTRUMENT PH TESTER	6
PINE-SOL	443ML	0
POTASSIUM NITRATE	FA209A	0
PRECISION SYNTHETIC EMB	TUBE	90
PRECISION SYNTHETIC GREASE	TUBE	270
PRECISION XL EMB GREASE	TUBE	179
PRECISION XL EP2 GREASE	TUBE	782
PRECISION XL EP2 GREASE DRUM		15
PREMIX FLUX 66PB026SODA4.5	ORANGE 19KG/PAIL	0
PRIMARY OIL BURNER		1
PRODURO OIL FD-1 60	1100/TOTES	8
PRODURO TO -4+ SYNTH	ALL SEASON 205L	25
PRODURO TO-4 30 S	205LT/DRUM	9

PRODURO TO-4 SYN ALL SEASON	1040LT IBC	43
PRODURO TO-4 XL SYN LO-TEMP	1040LT	20
PROLEACH KG		10
PROLITE MOP STICK 54	#AG-1674	17
PROPANE FUEL TANK	16.9OZ	133
PVC GLUE W/ BRUSH	711 WELD*ON 946ML	16
PVC PRIMER WITH BRUSH	P70 500ML	2
QUICK LIME	1700KG 0-2 5MM 1152	2768
REAGENT TUBE	280 X 32MM F/ CHS500	2
REAGENT TUBE		1
REAGENT TUBE		1
RUBBER CLEANER RUB-O-MATIC	1 LITER	119
SAND FOR SANDBLAST JETMAG	GRIT 30-60 25KG OLIVINE	316
SILICA SAND	SILICA SAND 22.7KG	177
SILICON FOOD GRADE GREASE	4 OZ FOR AMP SERIES PUMPS	0
SILICONE LUBRICANT		11
SILVER ELECTRODE	M2.4 3/32" .5KG/TUBE	1
SILVER FOIL	1 ONCE 99.999% PURE	52
SILVER NITRATE	500GRAM	3
SODA ASH NA2CO3	25KG MR118	11
SODIUM CYANIDE	PELLETS 1000KG	1677
SODIUM HYDROXIDE	SCRUBBER FILL	8
SODIUM HYPOCHLORITE	20/LITERS	52
SODIUM NITRATE	22.27KG 98% INDUSTRIAL GRADE	226
SOLVENT VARSOL	PLASTIC BOTTLE 3.78LT	68
SPRAY SPATTER BLOCK	W/TRIGGER 500ML	10
STOKOLAN HAND CREAM		35
SULPHUR PRILLS	99.5% 1000KG	4497
SUPER 3000 MORTAR		4
SUPER 77 SPRAY ADHESIVE		0
SUPER 90 ABC DRY CHEMICAL	PAIL FOR HVY EQUIP FIRE SUPPRE	30
SUPER DUTY MOTOR OIL	4LT	18
SUPER FLUID KLAR PILOT		199
SWIVEL CASTERS WHEEL	8"	8
SYNDURO SHB150	205LT/DM	59
SYNDURO SHB32	20LT/BUCKET	262
SYNDURO SHB32 SYNT.	COMPRESSOR OIL 205L/DRUM	14
SYNDURO SHB460		2
SYNTETHIC SHB 68	205LT-45GAL	7
SYNTEX FAN MOP HEAD	20OZ 550G	70
SYNTHETIC 75W140	1040LT/TOTE	2
THREAD SEALANT	W/ PTFE	17
THREAD SEALANT W/TEFLON	PERMATEX 118ML	56
THREADLOCKER	36ML GREEN	4
THREADLOCKER 272 HIGH-TEMP	LOCTITE 250ML	2
TRANSFORMER OIL	VOLTESSO 205LT	1
TRAXON E SYN 80W140	1040LT/DRUM	3
TRAXON E SYN CD50	205LT/DRUM	8
TRAXON ENGRENAGE	20LT 85W140	1
TRAXON XL 75W90	205LT/DRUM	2
TRAXON XL SYNTH BLEND 75W90	60L	5
TUNGSTEN ACCELERATOR		15
TURBOFLO R&068	20LT PAIL	1
TURBOFLO R&O 100 OIL	20L PAIL	8
TWO CYCLE ENGINE OIL		12

ULTIMA EP150	205LT	2
ULTRA CLEAR PREMIUM OIL LAMP		3
URATHANE BRUSH	F/ URETHANE WINDOW&WINDSHIELD	33
URETHANE DUR-X-LINE MATERIEL	780001277 WRM-80T 1KG KIT	15
URETHANE DUR-X-LINE MATERIEL	780001276 WRM-80T 4KG KIT	5
URETHANE SEALANT IN TUBE		275
VALVE LUBRICANT AND SEALANT	400GR	40
VARSOL	PARTS CLEANER 45GAL/DM	8
VICTAULIC LUBRICANT	ONE QUART	0
VULTREX G-124 GREASE	TUBE	59
VULTREX GEARSHIELD NC	205 LITERS	120
VULTREX OGL SYNTHETIC	ALL SEASONS 54KG KEG	1
VULTREX OGL SYNTHETIC GREASE	ALL SEASON 680, 54KG	70
WELDING ELECTRODE BRONZE	3.2MM 1/8 SODEL 661 5KG/BX	5
WELDING ELECTRODE MG	1/8" 5KG/BX	2
WELDING ELECTRODE MG	3/32" 2.5KG/BX	2
WELDING ELECTRODE TRACTALOY	M2.4 3/32" 5KG/BX	2
WELDING FACE SHIELD		15
WELDING ROD	STUD-XTRACT SOUDOTEC 5KG/BX	2
WELDING ROD	0.156" NON FERROUS	12
WELDING ROD	3/32" 10.20KG/BOX 624P-3	5
WELDING ROD	1/8" 12.90KG/BX 624P-309	14
WELDING ROD	5/32" 12.90KG/BX 624P-309	7
WELDING ROD	3/32" 10KG/BX LA-11018	6
WELDING ROD	1/8" 20KG/BX LA-11018-M	5
WELDING ROD	5/32" 20KG/BOX LA-11018-M	5
WELDING ROD	3/32" 10KG/BX LA6010	14
WELDING ROD	1/8" 20KG/BX LA6010	14
WELDING ROD	3/32" 10KG/BX LA7018	8
WELDING ROD	1/8" 20KG/BX LA7018	25
WELDING ROD	5/32" 20KG/BX LA7018	24
WELDING ROD 1/4	6 X 450MM 19.5KG/CS	1
WELDING ROD 5/32	4 X 450MM 18.6KG/CS	1
WELDING ROD ALU LITE	3/32 2.5KG/BX	10
WELDING ROD ALU LITE	1/8 2.5 KG/BX	10
WELDING ROD CARBON ARC DCCC	1/8" X 12" 100/BX	15
WELDING ROD CARBON ARC DCCC	3/16" X 12" 50/BX	41
WELDING ROD CARBON ARC DCCC	1/4" X 12" 50/BX	22
WELDING ROD CARBON ARC DCCC	5/16" X 12" 50/BX	71
WELDING ROD CARBON ARC DCCC	3/8" X 12" 50/BX	98
WELDING ROD CARBON ARC DCCC	1/2" X 14" 50/BX	28
WELDING ROD FLAT DCCC	3/8" X 5/32" X 12" 50/BX	20
WELDING ROD FLAT DCCC	5/8" X 3/16" X 12" 50/BX	18
WELDING ROD HARD 58	1/8" 5KG/BX	6
WELDING ROD HARD 58	5/32" 5KG/BX	14
WELDING ROD STEEL ALLOY	1/8" (3.2mm) 5 KG/BOX	5
WELDING ROD TRI-CAST	3/32 5KG/BX	9
WELDING ROD TRI-CAST	1/8 5KG/BX	10
WELDING ROD XTREME	1/16 0.5KG/BX	11
WELDING ROD XTREME	3/32" 5KG/BX	7
WELDING ROD XTREME	1/8" 5KG/BX	7
WELDING WIRE LA 111 T1-K3M	1/16 FLUX CORE 15KG SPOOL	68
WELDING WIRE LA T-91	.045 CARBON STEEL 15KG SPOOL	155
WELDING WIRE LA T-91	1/16 CARBON STEEL 15KG SPOOL	215
WELDING WIRE OUTERSHIELD	0.045 33LBS	52

WELDING WIRE OUTERSHIELD	0.062 33LBS-	0
WET WASHING SIEVE 200 MESH		2
WHITE GREASE	KLEEN FLOW 225G/TUBE	51
WINDEX	765ML	437
WINDOW PRIMER	F/ URETHANE WINDOW&WINDSHIELD	6
WINDSHIELD GLUE TREMSHIELD		44
WINDSHIELD WASHER CONCENTRATE	SOLUTION 1000LT TOTE	54
WINDSOCK (ORANGE/WHITE)	AVIOATION STANDARD 36" x 12'	6
WIRE OPEN ARC	110-O 1/16 33LB WB	15
XL3 MOLY ARCTIC GREASE	54KG/KEG	636
ZEP LIQUID BOTTLE WASHER	X-2887 20LT/PAIL	4

Appendix C

Cyanide

C.1: Cyanide – Properties, Uses, Storage & Handling (Dupont)

C.2: Material Safety Data Sheets – Sodium Cyanide

C.1 Cyanide – Properties, Uses, Storage & Handling (Dupont)

Sodium Cyanide

PROPERTIES, USES, STORAGE, AND HANDLING

DUPONT CHEMICAL SOLUTIONS ENTERPRISE

DUPONT

The miracles of science™

Notice:

Sodium cyanide may be fatal if swallowed, inhaled, or with prolonged skin contact. Contact with acids, water, or weak alkalies liberates poisonous gas. Causes eye burns and may irritate skin. See "Personal Safety and First Aid." See DuPont's Sodium Cyanide Material Safety Data Sheet (MSDS) for more detailed safety and health information.

For Emergency Assistance, Call DuPont at

(901) 357-1546

(This is a transportation emergency Cyanide Hotline to our Memphis, TN plant.
Do not use for routine technical or commercial information.)

For Transportation Emergencies,

Call DuPont at (901) 357-1546, Then Call

CHEMTREC at (800) 424-9300

(See "Transportation Emergencies")

For commercial or technical information, call your DuPont marketing representative or a sales office listed on the back cover.

Sodium Cyanide: UN 1689

DO NOT USE AS A PESTICIDE.

See DuPont's MSDS for detailed instructions for treatment of cyanide poisoning.

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Product Information

Introduction

DuPont sodium cyanide (NaCN) is a white crystalline solid, available in a briquette or granular form. The briquettes are uniform in size, average 18 g (about ⅔ oz) in weight, and have overall dimensions of approximately 3.5 × 3.5 × 1.3 cm (1⅜ × 1⅜ × ½ in). They are resistant to breakage and dusting, easy to scoop up, and readily soluble in water. The granules are irregularly shaped particles, typically sized to generate a minimum of dust, and pass 90–100% through a ⅜-in screen and 3% maximum through a USS Sieve No. 50. Cyanobrik® and Cyanogran® are DuPont trade names (see **Figures 1** and **2**).

The Chemical Abstract Service Registry Number for NaCN is 143-33-9.

Table 1. Physical Properties of Sodium Cyanide

Formula Weight	49.007
Melting Point, °C (°F)	564 (1047)
Boiling Point, °C (°F)	1496 (2725)
Specific Gravity, Solid, 25°C (77°F)	1.60
Apparent Bulk Density, Solid, kg/m³ (lb/ft³)	880–960 (55–60)
Specific Gravity, Liquid, 850°C (1560°F)	1.19
Heat of Formation, ΔH° *f*	
25°C, cal/g	–438
25°C, kJ/kg	–1833
77°F, Btu/lb	–788
Specific Heat, 26–73°C (78–163°F)	
Btu/lb·°F or cal/g·°C	0.335
kJ/kg·K	1.402
Heat of Fusion, mp, Btu/lb	77
cal/g	43
kJ/kg	179
Heat of Vaporization, bp, Btu/lb	1309
cal/g	727
kJ/kg	3041
Vapor Pressure, mmHg	
800°C (1470°F)	0.76
1200°C (2190°F)	89.8
1360°C (2480°F)	314.0
Solubility in Water, g NaCN/100 g water	
(see **Figure 3**), –20°C (–4°F)	35.4
20°C (68°F)	58.3

Table 2. Specifications and Typical Analysis

	Cyanobrik®/Cyanogran® and Bulk Solution Specifications	Typical Analysis*
Product Code 1220 (Cyanobrik®)		
Product Code 1222 (Cyanogran®)		
Sodium Cyanide, %	98.0 minimum	99
Sodium Hydroxide, %	0.5 maximum 0.06 minimum	0.3**
Product Code 1254 (Mining Grade)		
Sodium Cyanide, %	96.0 minimum	98
Sodium Hydroxide, %	0.5 maximum 0.06 minimum	0.3**
Product Code 1249 (30% Solution)		
Sodium Cyanide, %	28 minimum	30
Sodium Hydroxide, %	0.5 minimum	1

* Typical analyses based on historical production performance. DuPont does not make any express or implied warranty that future production will demonstrate or continue to possess these analyses.

** **CAUTION:** Sodium hydroxide (NaOH) content can be below 0.1% versus 0.3%, typical. NaOH should be added as outlined on page 3 to suppress hydrogen cyanide formation when making a water solution.

Figure 1. Cyanobrik®

Figure 2. Cyanogran®

Uses and Applications

The mining, metal, and chemical industries are the principal consumers of sodium cyanide. Typical uses include:

Ore Extraction and Ore Flotation

The cyanide process for extracting gold and silver from low-grade ores uses aqueous solutions of sodium cyanide with oxygen (air) to convert the noble metal (M) to soluble $NaM(CN)_2$, from which M can be recovered either by precipitation with zinc dust or aluminum powder, carbon absorption, or electrowinning.

In the flotation of galena (lead sulfide) to separate it from mixed ores containing sphalerite (zinc sulfide) and pyrite (iron sulfide), sodium cyanide acts as a depressor; that is, it reduces the tendency of gangue materials to travel along on the froth and so impair the separation. Sodium cyanide finds similar use in the separation of pentlandite from pyrrhotite and molybdenite from copper concentrates by flotation. It is also used to purify the molybdenite by extraction of copper impurities.

Electroplating

Cyanide brass, cadmium, copper, gold, silver, and zinc baths deposit decorative and/or functional metal coatings on a variety of substrates. The good throwing power of the electrolyte causes relatively uniform deposition of the metal on intricately shaped parts. Small amounts of special additives in the baths give bright metal deposits, even on recessed surfaces of the work. Cyanide electroplating baths are versatile and capable of high production rates, whether plating large or small parts.

Case Hardening Steel

Molten salt baths containing 10–30% sodium cyanide find extensive use for case hardening steels at temperatures below 870°C (1600°F). The molten bath process is fast, easy to operate, and yields mixed carbon-nitrogen cases that have excellent wear resistance and uniformity. The addition of activators or accelerators to the bath results in deeper cases than those obtained with plain cyanide baths, but nitrogen pickup is usually less.

The life of keen-edged tools improves when the high-speed steel is cyanide-nitrided in molten cyanide baths at about 565°C (1050°F).

Metal Cleaning

Aqueous solutions of sodium cyanide are effective metal cleaners, especially for smut removal after acid pickling.

Chemical Manufacture

Sodium cyanide is used to make other chemicals that lead to such diverse products as pharmaceuticals, vitamins, animal food supplements, dyes and pigments, insecticides, sequestrants, polymers, and catalysts (see "Chemical Reactions" section).

In any synthesis or formulation involving sodium cyanide, no cyanide compound should survive in the final product as an impurity. This is especially important with regard to consumer products.

Chemical Reactions

The most hazardous reaction of sodium cyanide is with acids to form lethal hydrogen cyanide (HCN) gas, which is invisible and has a very weak odor. Smaller amounts of HCN gas can develop from contact with water and weak alkalies. When working with sodium cyanide, special provisions are needed to address HCN and cyanide toxicity.

Sodium cyanide deliquesces in moist air. Crystals of the dihydrate, $NaCN{\cdot}2H_2O$, form when saturated solutions of sodium cyanide cool at temperatures below 35°C (95°F) (see **Figure 3**). Sodium cyanide dissolves in methanol (6.05 g/100 mL saturated solution at 15°C [59°F]). It also dissolves in liquid ammonia (3.7 g/100 mL NH_3 at –33°C [–27°F]).

Sodium Cyanide Reactions in Water

Sodium cyanide dissolved in water forms an equilibrium between ionized sodium cyanide and highly volatile HCN. In sodium cyanide solutions, HCN concentrations must be kept low and/or contained to avoid toxic fumes. HCN formation varies with pH, cyanide concentration, and temperature. HCN in the air around a sodium cyanide solution will also be influenced by the amount of solution surface area and ventilation. At pH 8 or less, essentially all of the cyanide will be in the HCN form in dilute solutions (see **Figure 5**). To suppress HCN formation in typical concentrated sodium cyanide make-up solutions, a pH of 12 minimum (preferably 12.5–13) should normally be used. In operating tanks, HCN in the vapor space above a 23% solution at room temperature typically will be about 250 ppm (without pH adjustment). With the pH raised to 12–12.5, HCN levels drop to around 125 ppm and below 50 ppm, around pH 13. Higher temperatures and solution concentrations increase HCN fumes. The following recommendation is made to minimize HCN formation with a modest pH increase.

When making a concentrated (e.g., 10–30%) cyanide solution, the proper procedure is to add about 0.5% sodium hydroxide (caustic) (about 50 lb [22.7 kg] sodium hydroxide/1000 gal [3785 L] water) before adding the cyanide. More sodium hydroxide will not be chemically harmful to the cyanide and will further reduce HCN levels; however, increased alkalinity increases eye hazards from splashes. For most operations, pH 12.5–13.0 is a good compromise to reduce HCN without excessively high alkalinity. If process chemistry prevents adding caustic, adequate precautions in design and operation must be taken to protect against HCN fumes, HCN polymerization, and cyanide hydrolysis.

pH is a log scale measurement, which means it takes about ten times as much sodium hydroxide to raise the pH each subsequent unit than the previous. For example, if it took 1 lb (0.45 kg) of sodium hydroxide to go from pH 9 to 10, it would take 10 lb (4.5 kg) to raise the pH from 10 to 11 and 100 lb (45.4 kg) from 11 to 12, etc. Therefore, even pH 11 water will need

Figure 3. Solubility of Sodium Cyanide in Water

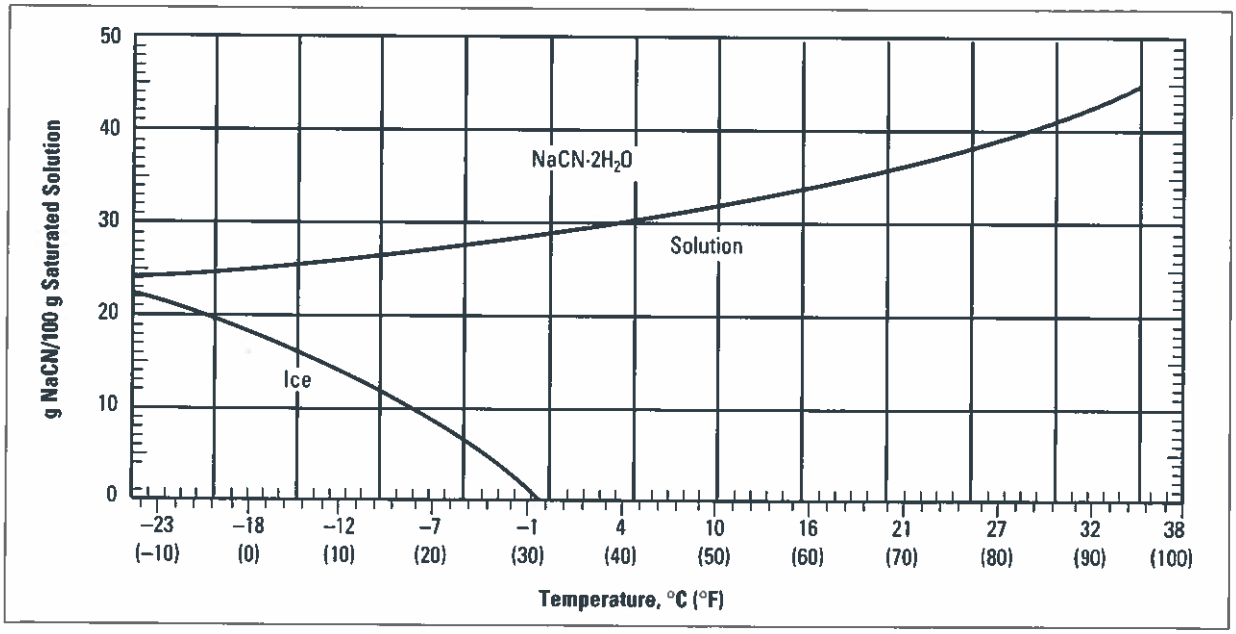


Figure 4. Densities of NaCN Solutions

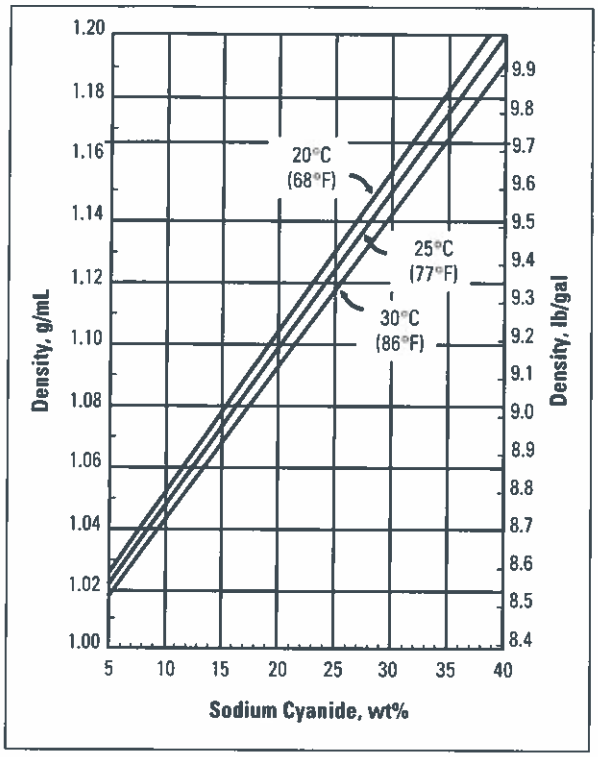
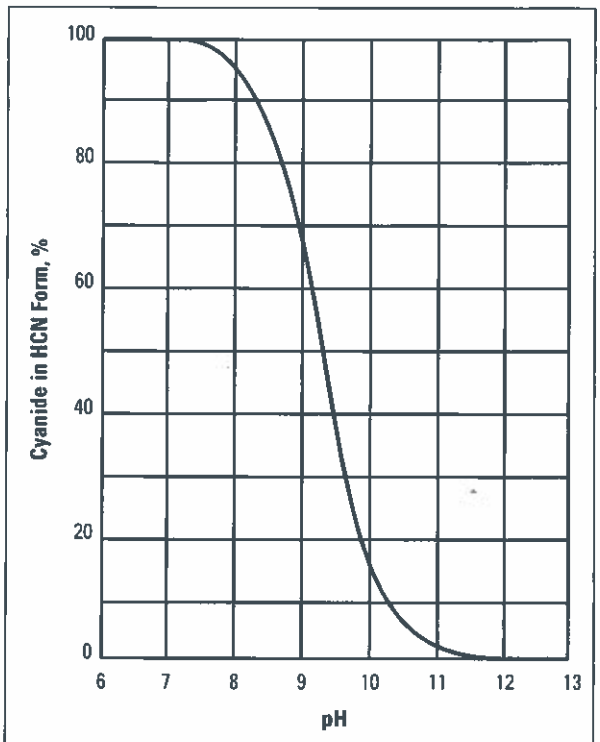


Figure 5. Effect of pH on Cyanide Ionization



Data based on work by D. Milne, 1950, for dilute sodium cyanide solutions at ambient temperature. Toxic HCN fumes increase as temperature and solution concentrations increase, requiring higher pH for safe operation.

nearly as much sodium hydroxide added to it as would the same amount of water with pH 6 to 11. Water at pH 10 or 11 does not eliminate the need to add sodium hydroxide to reduce HCN.

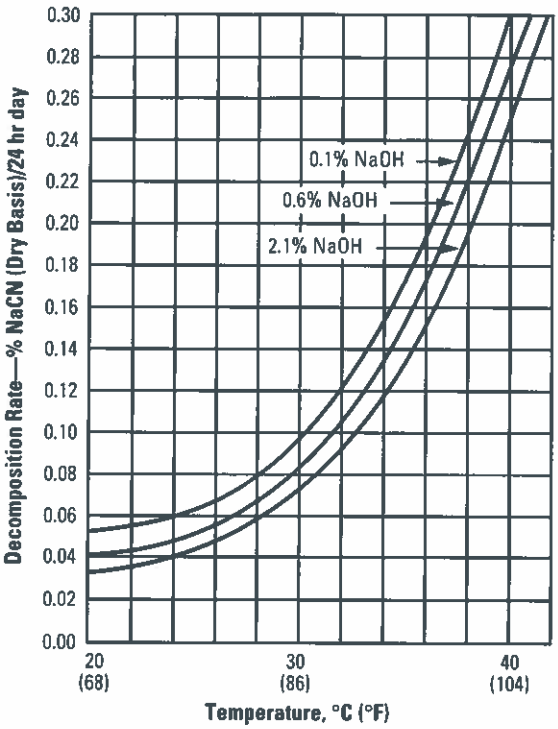
NOTE: Lime (calcium hydroxide) is not as effective as sodium hydroxide because of limited solubility, but it can be substituted to raise the pH to around 12.

Hydrogen cyanide molecules will polymerize to form the extremely inert HCN polymer. It is not unusual for HCN polymerization to occur in sodium cyanide solutions made without additional alkali, particularly if stored at elevated temperatures. In dilute solutions, HCN polymer will generate colors ranging from pale yellow to dark reddish brown. In stronger solutions, a dark brown precipitate resembling iron rust can form, which will interfere with heat transfer, plug pumps, orifices, etc., and may cause significant cyanide loss. HCN polymer will discolor chemical products. Again, high pH values give low HCN concentrations, which reduces the tendency for polymer formation.

Cyanide also reacts with water to form ammonia and formate ions. In the acid pH range, hydrolysis products are formic acid and ammonium salts. Alkaline solutions produce formate salts and volatile ammonia. With strong solutions, the volume of ammonia evolved can cause dangerous pressure buildup. One gallon of 30% sodium cyanide solution can produce more than 25 ft^3. For this reason, extra vent capacity is recommended for large, heated storage tanks.

Ordinarily, the reaction between cyanide and water proceeds slowly. However, the reaction rate increases exponentially with an increase in temperature. The critical range is around 60–70°C (140–158°F). At temperatures below this range, the reaction can be controlled by cooling and, where practical, by dilution. At higher temperatures, however, the reaction can be uncontrollable in large tanks for highly concentrated solutions and may proceed until substantially all the cyanide has been consumed, unless temperature control and adequate cooling and venting capacity exist (see **Figure 6**).

Figure 6. Decomposition Rate of NaCN Solutions



NOTE: The % NaOH shown above is the concentration in the final solution. The NaCN (as shipped–containing 0.1% NaOH), when diluted to a 30% solution, will have only 0.03% NaOH in the final solution, unless additional NaOH is added. (Decomposition rates based on DuPont experimental data using 35% NaCN solution.)

Heated sodium cyanide solution storage tanks should be equipped with facilities to measure and control solution temperature (see "Equipment" section). Heating may be needed to assist in dissolving the NaCN and to prevent freezing (see **Figures 3** and **7**). Cooling could be critically important, if the hydrolysis reaction begins to generate heat faster than it can be dissipated to the surroundings.

All the reactions discussed above consume a portion of the stored cyanide, and all are inhibited by maintaining low solution temperature and high pH.

If special precautions are taken, acidification of sodium cyanide to produce HCN gas for a chemical reaction is an acceptable procedure, but only when handled in special equipment by technically qualified people after detailed planning. HCN operations require much more stringent plans, procedures, and standards for safe operation.

CAUTION

Even in laboratory quantities, the accumulation and storage of liquid or gaseous HCN should not be considered until its properties and the required safety precautions for handling it have been studied carefully. In addition to toxicity considerations, violent exothermic polymerization reactions can occur with liquid HCN, even in the absence of air or oxygen.

Other Reactions

Oxidants, such as alkaline hypochlorite solutions, hydrogen peroxide solutions, and permanganate solutions can oxidize cyanide to sodium cyanate. These oxidation reactions find wide use in the control of cyanides in effluents. They must be done in dilute solutions at proper pH to avoid formation of highly toxic gases (see "Cyanide Destruction" section).

Strong oxidants, such as nitrites and chlorates, react violently when added to molten sodium cyanide (or vice versa).

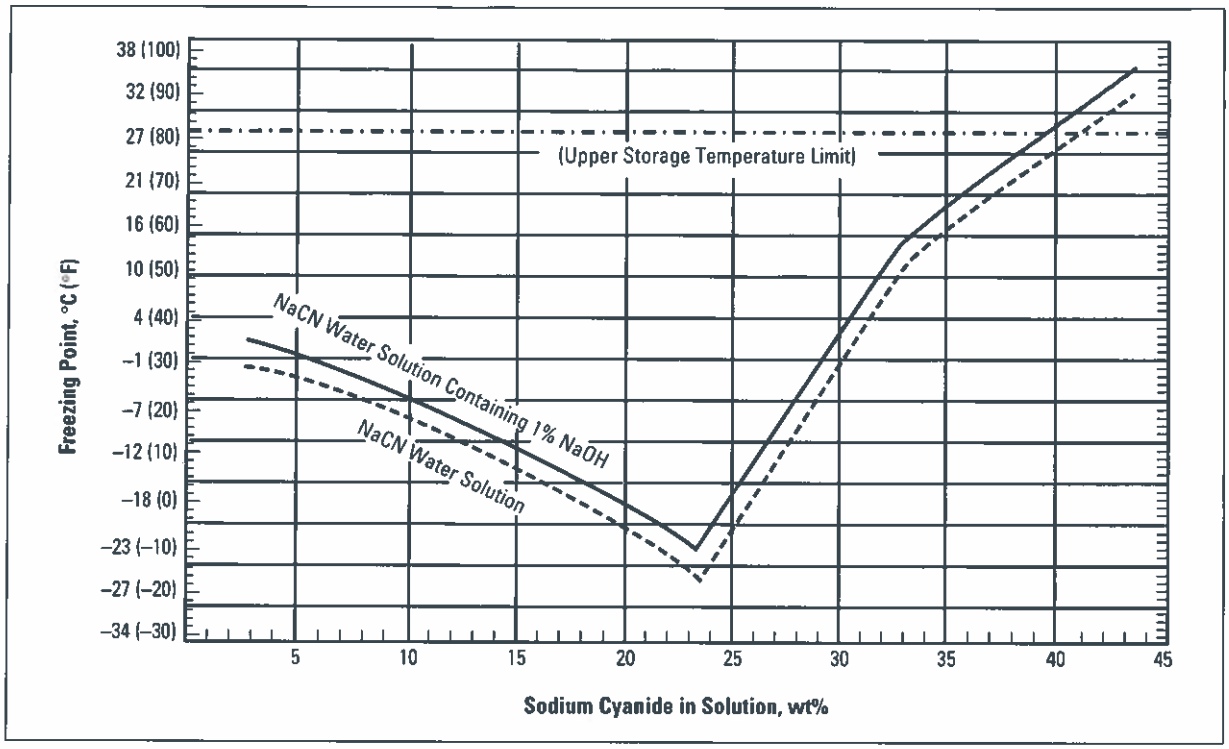
With the exception of lead and platinum, most metals (when finely divided) dissolve in aqueous sodium cyanide in the presence of oxygen.

Alkaline solutions of sodium cyanide dissolve water-insoluble cuprous and zinc cyanide with formation of sodium tricyanocuprate and tetracyanozincate, respectively.

Reacting an alkyl halide, sulfate, or toluene-sulfonate (p-$CH_3C_6H_4SO_2OR$) with sodium cyanide in aqueous alcohol, dimethylformamide (DMF), or similar aprotic solvent, leads to an alkyl cyanide (nitrile). Fusing a sodium aryl sulfonate with sodium cyanide yields the aryl nitrile; for example, sodium benzene-sulfonate (sodium phenyl sulfonate) gives benzonitrile (phenyl cyanide).

Hydrogen cyanide, generated by reacting an acid with sodium cyanide, is capable of adding to isolated double bonds and to the carbonyl group of an aldehyde or ketone. In the case of acetophenone, for example, the corresponding cyanohydrin forms, which hydrolyzes to atrolactic acid (a-phenylacetic acid, $C_6H_5[CH_3]C[OH]COOH$). Similarly, when preparing an alpha-amino acid from an aldehyde or ketone by Strecker synthesis, the hydrogen cyanide and ammonia needed can come from ammonium cyanide formed in the reaction of sodium cyanide with ammonium chloride.

Figure 7. Freezing Points of Sodium Cyanide Solutions



One method of synthesizing the sodium salt of ethylen ediaminetetraacetic acid (tetrasodium EDTA, a chelating agent) combines ethylenediamine with formaldehyde and sodium cyanide in hot (80°C [175°F]) alkaline solution.

Personal Safety and First Aid

Health and Safety Hazards

See DuPont's MSDS for detailed instructions for treatment of cyanide poisoning.

Because of the toxicity of sodium cyanide, all persons working with it should be completely familiar with and observe the established safety practices.

Sodium cyanide is a fast-acting poison that can cause death quickly at low levels of exposure. Its toxic effect results from the inhibition of specific processes in body cells by restricting oxygen use in cellular respiration, particularly cells in the brain and heart. Poisoning can result from breathing cyanide gas, dust, or solution; absorption through the skin, particularly the eyes and other membranes and feet; and from ingestion. Contact with the skin may cause irritation and poisoning, particularly with prolonged contact, or if open wounds, skin abrasions, or mucous membranes are involved. Sodium cyanide is alkaline and causes eye burns. Because of the possibility of skin absorption of hydrogen cyanide fumes, air monitoring for HCN is required, even for someone wearing an air mask.

Cyanide is not a cumulative poison, and it is not a carcinogen. It is believed that there are no chronic effects of cyanide poisoning, unless repeated, prolonged exposures, well above the established limits, were to occur. With prompt treatment, recovery from overexposure is normally quick and complete.

CAUTION

Sodium cyanide in contact with acids liberates highly toxic and flammable hydrocyanic acid gas. Also, toxic amounts of HCN can be liberated from water solutions of sodium cyanide or from contact with weak alkalies, if ventilation is inadequate (see "Sodium Cyanide Reactions in Water").

Safety Precautions

The basic safety precautions are:

- Do not breathe sodium cyanide dust, solution mist, or HCN gas. Wear an approved toxic dust and mist respirator when there is danger of inhaling cyanide dust or mist. Additional protection is required for HCN gas. The respirator should be one approved by the Mine Safety and Health Administration (MSHA) or by the National Institute for Occupational Safety and Health (NIOSH).
- Avoid skin contact with cyanides, particularly contact with open wounds or skin abrasions. Wash skin promptly and thoroughly if contact occurs. Wear protective gloves when handling solid cyanides. Wear rubber gloves when handling cyanide solutions (butyl rubber has very low permeability; neoprene is more rugged with low HCN permeability and is best for many jobs involving sodium cyanide).
- Do not get in eyes. Wear approved chemical splash goggles when handling cyanide solutions and when there is danger of splashing.
- Have available and wear other protective clothing as needed for job safety. Develop clothing change procedures to ensure cyanide is not scattered around the site or inadvertently carried home.
- Immediately sweep up any spilled cyanide and place in a suitable container. Wash area and/or treat contaminated area with dilute hypochlorite solution to destroy the cyanide. Comply with federal, state, or local regulations. If approved, drain to neutral chemical waste sewer.
- Take every precaution to keep acids from contacting sodium cyanide. Do not store with acids or weak alkalies.
- Do not eat, drink, or smoke in areas where cyanide is present. Do not handle or store food or beverages in cyanide areas.
- Store sodium cyanide in a ventilated, locked area. Containers should be kept closed and their contents dry. Do not store under sprinklers; sodium cyanide will not burn, but sprinkler activation could cause an environmental problem. Local fire regulations may require sprinklers. Always check and follow local regulations. If sprinkling is required, the area must be diked to contain the runoff.
- Have antidote, emergency plans, and training in place before using cyanide. See DuPont's Sodium Cyanide MSDS for detailed instructions.

Sodium Cyanide Exposure Limits

The U.S. Department of Labor (OSHA) has ruled that an employee's exposure to sodium cyanide in any 8-hr work shift of a 40-hr week shall not exceed a time-weighted average (TWA) of 5 mg of cyanide per cubic meter of air.[2,3] It also cautions that because cyanide may penetrate the skin, control of vapor or dust inhalation alone may not be sufficient to prevent absorption of an excessive dose.

HCN Exposure Limits

The current OSHA workplace exposure limit for HCN is 11 mg/m^3 (10 ppm), ***8-hr average***. A 1989 revision of the HCN limit (along with several hundred other chemicals) to 5 mg/m^3 (4.7 ppm), ***15-min average***, was vacated by court order, and the pre-1989 limit has been reinstated. OSHA (and others) also cautions that because hydrogen cyanide may penetrate the skin, control of vapor inhalation alone may not be sufficient to prevent absorption of an excessive dose.[2,3] During all of this, the U.S. Mine Safety and Health Administration (MSHA) limit stayed at 10 ppm for HCN. The American Conference of Governmental Industrial Hygienists (ACGIH) recommends a 4.7 ppm limit instantaneous ceiling value with a similar skin notation.[4] DuPont's experience supports the current OSHA and MSHA regulatory levels. However, as a matter of practice, DuPont does not have people working for prolonged periods under conditions approaching our upper limits, because we can design/operate to avoid prolonged exposure.

In summary, HCN air quality requirements will vary from jurisdiction to jurisdiction, and it is incumbent on each user to be aware of and comply with the rules regulating exposure to HCN in their regulatory jurisdiction. The specific OSHA and MSHA exposure limit for HCN is currently 11 mg/m^3 (10 ppm) for an 8-hr TWA. The ACGIH Threshold Limit Value (TLV) is 5 mg/m^3 (4.7 ppm), 15-min TWA. This is also a ceiling value. The DuPont Acceptable Exposure Limit (AEL) is 4.7 ppm, 15-min TWA with current regulatory ceiling limitations. All of these exposure limits carry a "skin" notation indicating that HCN may penetrate the skin; therefore, control of vapor inhalation alone may not be sufficient to prevent cyanide poisoning. Also, exposure limits are subject to change, and users should stay current with regulatory changes.

Symptoms of Cyanide Poisoning

Personnel should be constantly alert for symptoms of cyanide poisoning in themselves and others. The following poison symptoms can result from other causes, but should be investigated promptly when they occur around cyanide:

Reddening of the eyes*	Nausea*
Irritation of the throat	Headache*
Palpitation	Weakness of arms and legs
Difficulty in breathing	Giddiness
Salivation	Collapse
Numbness	Convulsions

Effects of Exposure to HCN Vapor

The following toxicity data show the "Reported Human Response to Various Concentrations of HCN Vapor"[5]:

2–5 ppm	Odor threshold
10 ppm	OSHA and MSHA exposure limit, 8-hr TWA[2]
20–40 ppm	Slight symptoms after several hours
45–54 ppm	Tolerated for ½ to 1 hr without significant immediate or delayed effects
100–200 ppm	Fatal within ½ to 1 hr
300 ppm	Rapidly fatal (if no treatment)

These numbers should be considered reasonable estimates only, because data are not exact and effects vary for different people. Also, *heavy breathing from physical work will increase cyanide intake and reduce the time for symptoms to show.* The "rapidly fatal" exposure level of 300 ppm assumes no first aid or medical treatment; either is very effective if used quickly.

* Reddening of the eyes (and skin) is one of the earliest symptoms, with nausea and/or headache common in low level exposure. These three are the most readily identifiable symptoms of low level cyanide overexposure.

Prompt administration of the recovery techniques has proven very effective, but emphasis must be placed on quick action. Seconds count, and treatment should be provided within about 200 sec (3–4 min). In case of overexposure to cyanide, quick action is required to sound the alarm, remove the patient from the contaminated area, and provide treatment. With prompt treatment as prescribed, recovery is normally quick and complete with no serious aftereffects. Treatment after 3–4 min can still be effective, but chances of recovery are reduced without prompt treatment. Unlike many poisons, cyanide is not cumulative. While cyanide poisoning can be rapidly fatal, no case should be considered hopeless. Treatment should be continued until a physician certifies death.

First Aid and Medical Treatment

See DuPont's MSDS for detailed instructions for treatment of cyanide poisoning.

Ordering Cyanide Poisoning Antidote Kits and Amyl Nitrite

To obtain cyanide poisoning antidote kits and/or amyl nitrite ampules:

1. Obtain a prescription from your local physician (required because amyl nitrite is a prescription product).
2. Purchase the cyanide antidote kit from your pharmacy. The pharmacy can obtain the kit from Akorn Pharmaceuticals at (800) 932-5676.
3. Amyl nitrite can also be purchased from your local pharmacy or from Save-A-Life Systems in Ft. Wayne, IN at (800) 933-5885.

Shipping

Containers

DuPont produces sodium cyanide in briquette and granular forms.

A variety of containers are used as follows:

Nonreturnable Drums

Net weight 50-kg (110.2-lb) steel drums stacked 9–27 to a pallet.

Net weight 100-kg (220.4-lb) steel drums stacked eight to a pallet (see **Figure 8**).

Note: Drums can be stored three pallets high in a warehouse.

Figure 8. Palletized 100-kg (220-lb) Drums Being Loaded into a Truck

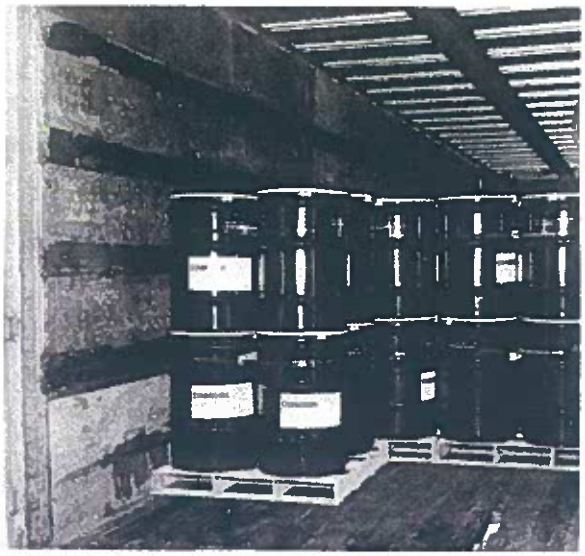


Figure 9. A Tuff-Pak Box Full of Bags

Tuff-Pak

- 48 20-kg (44-lb) pinch-bottom, multiwall composite bags that are hermetically sealed and water-resistant. The bags are packaged in a wooden box on a self-contained pallet. Net weight 960 kg (2116 lb). Individual bags are not to be sold separately (see **Figure 9**).

Figure 10. Partially Loaded Container of IBCs

Nonreturnable Intermediate Bulk Container (IBC)

- Water-resistant package holding 1000 kg (2205 lb). Box dimensions are 44¾ × 44¾ × 44⅜ in high (see **Figure 10**). For shipment, there are normally 20 IBCs in a container.

Returnable FLO-BIN® Containers (Briquettes Only)

- 1361- and 1497-kg (3000- and 3300-lb) net returnable FLO-BIN® containers, 12–14 bins per truck (see **Figures 11** and **14**).

Bulk Trucks

- 30% solution tank trailers (18,000 lb, 100% basis—8180 kg) are available from the Carlin, NV terminal. They can be unloaded using the customer's pump or by plant or truck air (see **Figure 13**).
- Excel I tank trucks (6804–9526 kg [15,000–21,000 lb]). These trucks are equipped with circulation pumps that will permit water addition, dissolving by circulation, and then pumping off into the customer's tank (see **Figure 15**).
- Excel II tank trucks (15,876–18,144 kg [35,000–40,000 lb]) are unloaded by circulating premeasured water from a storage tank by a driver/technician (see **Figures 12** and **16**).

Figure 11. Bins corded two abreast on a flatbed trailer. The bins are strapped to the trailer to prevent movement during transportation.

Transportation

Sodium cyanide must not be shipped by U.S. mail. The U.S. Department of Transportation (DOT)[3,6] hazard classification is Class 6.1 (Toxic) with an ID number of UN1689. A DOT toxic label is required. Transportation equipment must also be placarded with toxic placards in accordance with DOT requirements.

Sodium cyanide drums, Tuff-Paks, and IBCs should be shipped in vehicles that have secondary containment, such as vans. Pickup trucks, etc., should not be used. In case of an accident, secondary containment will minimize the impact of spilled material. Also, the driver must be in a separate compartment isolated from the cyanide.

Sodium cyanide must not be shipped with any acids (dry or liquid), food (human or animal), or ingredients for products used for human or animal consumption, including food, pharmaceuticals, food supplements, etc. Shipment with flammables and strong oxidizers should be avoided, as these mixed shipments can cause fire fighting complications, including cyanide runoff, in case of an accident and subsequent fire.

Storage and Handling

Storage and use areas should be designed so that accidental spillage can be contained and disposed of safely.

Storage Security

When sodium cyanide is stored, security should be maintained so only authorized people have access to it. Locked rooms or locked fenced areas can be used. Only the quantity required for immediate use should be removed from storage.

Figure 12. Excel II Truck

Drums

Drums of sodium cyanide should be stored inside and segregated from acids, weak alkalies, and strong oxidizing materials such as nitrates. It is also recommended that sodium cyanide be stored away from flammables and combustibles to minimize the chance of cyanide-water runoff as a result of fire fighting. Where local regulations permit, sodium cyanide drums should not be stored under sprinklers, because sodium cyanide will not burn in ordinary fires and cyanide runoff must be avoided. Storage with food or intermediates for human or animal products must be avoided. Observe all the precautions given under "Safety Precautions."

Figure 13. NaCN Solution Truck

If possible, open cyanide containers in the areas in which the cyanide is to be used. Remove the cover from the container, and remove the cyanide with a metal scoop or dump the cyanide from the container as required. Replace the cover on the container if the drum still contains cyanide. Store appropriately. Immediately pick up any spillage.

Drum Disposal

Sodium cyanide drums are nonreturnable, and it is against U.S. DOT regulations to reship or recoup the drum, except when approved for disposal of waste materials. Empty drums should be visually inspected for cyanide removal, flushed with large volumes of water, and then drained. This flush and drain cycle should be repeated three times to comply with federal regulations. Rinse water should be collected, treated, and disposed of according to local regulations (see "Cyanide Destruction" section). After cleaning, drum labels should be removed or obliterated to confirm cleaning, and the drum destroyed to prevent reuse. After the above, recycling as scrap metal is appropriate.

FLO-BIN®

A typical FLO-BIN® unloading and storage system is shown in **Figure 14**. A special design manual is available from DuPont. Contact DuPont's sales representative to discuss package and delivery options to meet specific needs.

Sodium cyanide is shipped in returnable FLO-BIN® containers (600 lb tare weight) to customers by truck or rail. In trailers, bins are shipped two abreast. Road weight limitations restrict the truck load to 12–14 bins. The advantages of FLO-BIN® deliveries are:

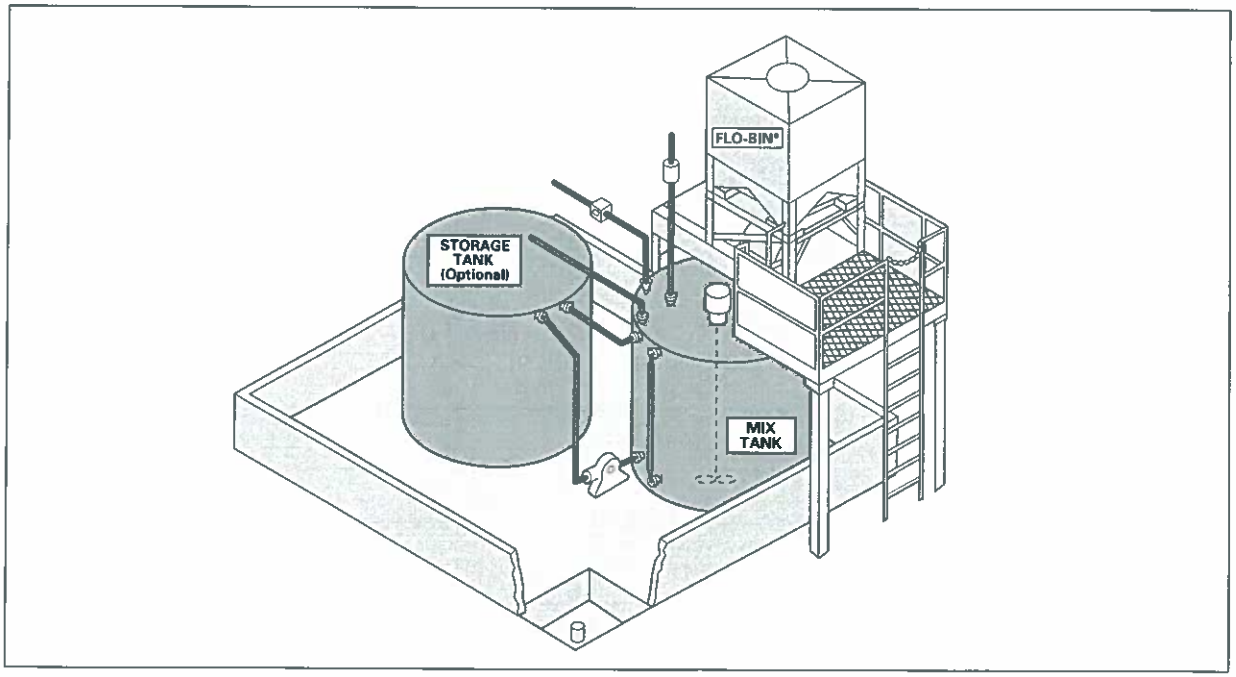
Economics—Customers using about 100,000 kg (200,000 lb) or more per year of sodium cya-nide can effect direct cost savings versus other smaller packages.

FLO-BIN® Customer Shipping Responsibility

When returning bins, the customer becomes the shipper and bears the responsibility for seeing that all safety precautions are carried out. DOT regulation 49 CFR 173.29 requires that a returnable container offered for transportation must meet the same standards as when the container previously held a greater quantity of a hazardous material. Returning bins do not have to be cleaned internally. Internal water washing is discouraged, because cyanide solution rundown is likely to create spillage, unless the bins are dried. External cleaning and inspection of each bin is required to ensure no cyanide is left on the outside and that the camlocks are locked closed with locking pins or wires.

When returning bins, secure bins with equipment provided. DO NOT reverse the poison placards (four) on car or truck. DO NOT remove or deface product label on bin.

Figure 14. Typical FLO-BIN® Unloading System



Intermediate Bulk Container (IBC)

IBCs are the ideal package for most large consumers of NaCN who are not near a manufacturing facility. IBCs are readily handled with forklift trucks. DuPont recommends stacking IBCs two high for storage. The DuPont IBC holds 1000 kg (2205 lb) of NaCN. When diluted to 23% (the minimum freezing point of a NaCN/water solution) with pH at 12 or above, the IBC will make about 3900 L (1030 gal).

The IBC is emptied by lifting the bag by the straps using a forklift or hoist and then positioning and lowering the bag onto the specially designed knife slitter that cuts the bag, allowing the contents to drop into the dissolving tank.

IBC Decontamination and Disposal

Decontamination and disposal of used IBC materials must be properly handled to prevent environmental contamination and meet regulations. The bags should be empty—this should be confirmed visually or by weight before they are sent to a disposal facility. Then, a flush and drain cycle, repeated three times, will dissolve any residual cyanide left in the bag. Care must be taken to ensure the bag material does not overlap and prevent water contact—interfering with the dissolving process. Rinse water should be collected and recycled or treated and disposed of according to local regulations. As part of the cleaning process, labels should be removed or obliterated. If burning is the method of disposal, keep in mind that all of the NaCN will probably not be destroyed during the burning process, and the ashes must be properly contained.

30% NaCN Solution

The DuPont terminal in Carlin, NV ships 30% NaCN solution as far away as 300 miles. The specially designed trailers hold 6300 gal—equivalent to 18,000 lb of dry NaCN. DuPont 30% NaCN solution is often the most convenient way to receive NaCN. The drivers are specially trained to make these deliveries and have a safety record envied in the trucking industry. DuPont offers technical assistance and support to assist with the design or modification of an existing system.

Excel Trucks

Excel trucks combine transportation and unloading safety by permitting shipment of solid sodium cyanide and unloading by dissolving the cyanide in place and then pumping the solution into appropriate storage. Excel I (see **Figure 15**) is ideal for customers with annual usage of ½ to 1 million lb, where 30% solution may not be desirable, but Excel I is only available in limited geographical areas. Excel II delivery systems (see **Figure 16**) are ideal for many large sodium cyanide users and usually require an annual NaCN usage of about 1 million lb per year to justify the larger investment compared to handling FLO-BIN® containers. Cost factors such as location (transportation), expected operating life, available space, inventory requirements, etc., should be evaluated with DuPont to determine the best system for each specific situation. Design manuals are available for Excel systems.

When dissolving the sodium cyanide in Excel systems, position the tank truck so that the hose connection can be made between the truck pipe headers and the storage tank and pump piping.

For Excel II, meter into the storage tank the amount of water and sodium hydroxide (NaOH) needed to make the desired concentration of sodium cyanide solution (about 363 kg [800 lb] NaOH for 18,144 kg [40,000 lb] NaCN). The water temperature needed for dissolving the NaCN depends on the solution concentration needed, the circulation rate, and weather conditions. The water can be preheated up to about 38°C (100°F) to speed the dissolving, but heated water is frequently not needed, unless cold weather and cold water are involved (see "Chemical Reactions" section).

Cyanide decomposition rates increase with higher temperatures, with sodium formate and ammonia being formed. Because the decomposition reaction is exothermic, provision must be made for temperature monitoring and emergency cooling, if heating is used (see "Temperature Indicators, Insulation, Heating, and Cooling").

Excel II Unloading Procedures

Position valves. Start the pump. Check the system for leaks. Circulate the water continuously from the storage tank through the tank truck from the bottom to top to flood the truck and overflow back to the storage tank. Listen to the rattling briquettes by placing your ear near the bottom of the tank trailer. Dissolving should be complete about 30 min after the rattling stops, but system experience will provide the best guide. Then, pump the sodium cyanide solution from the tank truck into the storage tank. The dissolving time varies with circulation rate, water temperature, and final concentration, but dissolving can be complete in about 1½ hr under best conditions. Typically, 3–4 hr are needed in winter, without heat, for a 20–25% concentration.

Figure 15. Typical Excel I Unloading System

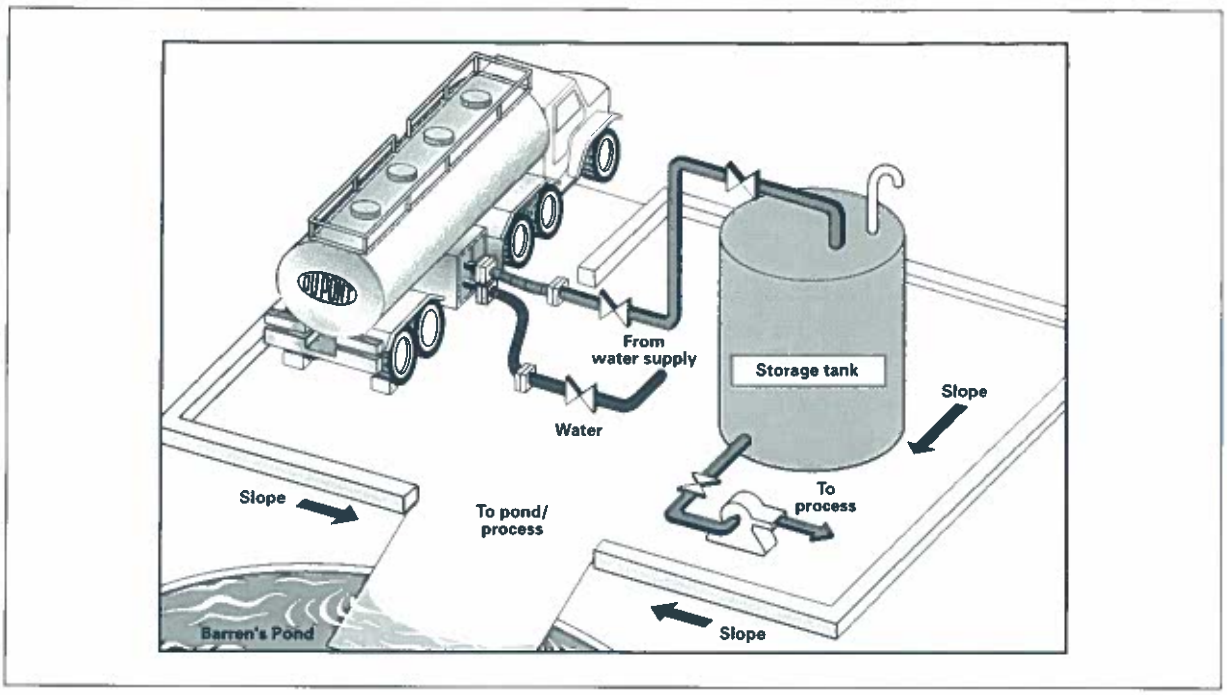
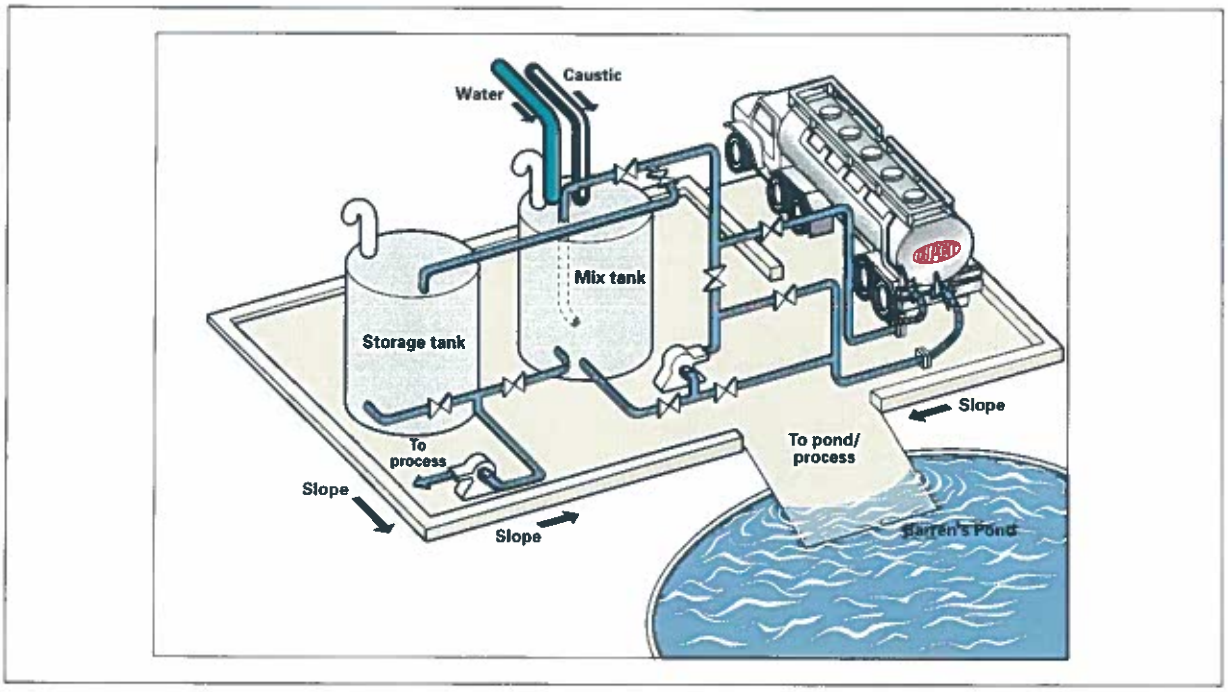


Figure 16. Typical Excel II Unloading/Storage System



Equipment

Materials of Construction

Carbon steel equipment is usually satisfactory for sodium cyanide solutions where velocities are not over 1.2–1.5 m/sec (4–5 ft/sec). At higher velocity, 304 or 316 stainless steel is sometimes recommended, because an erosion-corrosion effect occurs on steel. Carbon steel with a corrosion allowance may be acceptable instead of stainless to reduce cost, particularly if flow is frequently shut off so no erosion-corrosion is occurring. Even at very low velocities, welded, not threaded, piping should be used for all pipe materials to avoid leaks. To avoid leaks, no threaded connections should be used for piping instruments, drains, or any other connection. For pumps and instruments, 316 stainless is recommended. Valve operating conditions will determine whether carbon steel versus stainless can be used. Gaskets of Teflon® or nitrile-butadiene rubber (NBR), with Kevlar® filler, are recommended for sodium cyanide solutions.

Solution Storage Tank

Sodium cyanide solution is stored in a tank typically fabricated from ¼-in carbon steel plate. For bulk installations, top nozzles are recommended for a 15.2- to 20.3-cm (6- to 8-in) pipe vent, a 10-cm (4-in) fill and circulating line, level indicator, high-level alarm, provision for water, and caustic additions and manway. A top 4-in nozzle with a physical break in the water line will prevent backflow. Bottom openings must also be provided for a 15-cm (6-in) pump suction line, temperature control-alarm, and (optional) heating/cooling coils. The size of the storage tank depends upon the sodium cyanide shipment size and concentration of solution required. For example, 18,150 kg (40,000 lb) of sodium cyanide makes 71,000 L (18,750 gal) of 23% solution. A vertical tank 4.9 m (16 ft) in diameter by 5.0 m (16½ ft) high has a nominal 95,000-L (25,000-gal) capacity, which is sufficient to allow some outage and/or solution inventory (see **Figure 17**). The tank may be lined with neoprene to prevent buildup of iron content, if this is critical to the process. All pipe nozzles should be schedule 40 pipe minimum.

To provide mixing, a properly aligned dip tube/mixer with a siphon vent must be installed.

If the storage tank is located inside a building, all tank openings must be sealed and the tank vent routed outside the building to a safe location. This will prevent the discharge of hydrogen cyanide inside the building when the tank is being filled (see "Caustic Addition" on page 15).

Pump

For Excel II, a 316 stainless steel pump with a 10.2-cm (4-in) suction and a 7.6-cm (3-in) discharge is needed. It should be capable of delivering 2271–2650 L (600–700 gal) per minute at 18.3–21.3 m (60–70 ft) head. Small pumps will not provide sufficient agitation for tank car cyanide dissolving. Totally enclosed, fan-cooled, 25-HP motors are recommended.

Water Meter and Supply

A 7.6-cm (3-in) water meter with a preset totalizer and an automatic cutoff is recommended in the storage tank water addition line. There should be a physical disconnection in the water supply line to prevent cyanide from backing up into the water system.

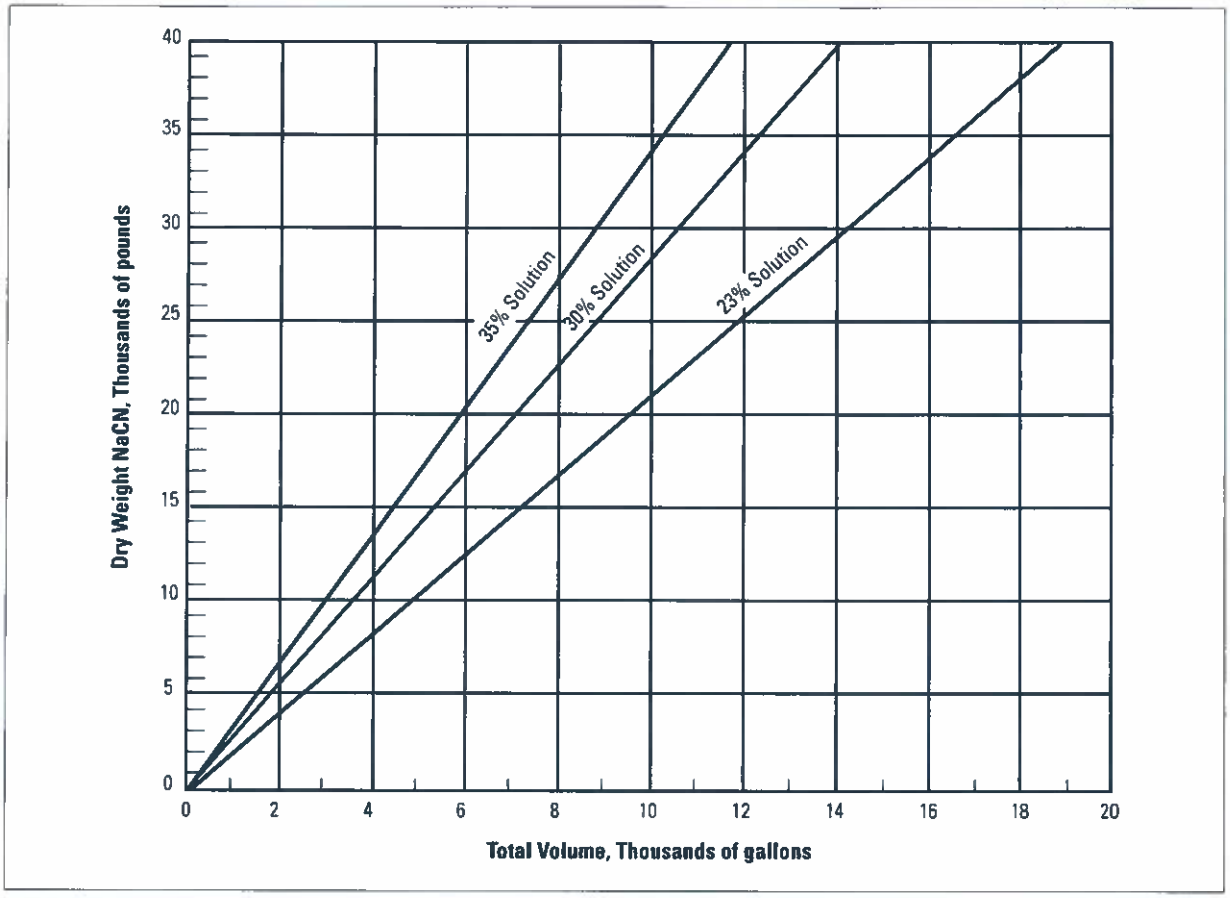
Pipe and Hoses

Welded, not threaded, carbon steel (or 304 or 316 stainless steel) pipe with minimum flanges can be used (see "Materials of Construction" for piping and gaskets). Excel II circulation piping of 10.2-cm (4-in) is recommended (except for the line from the tank to the pump inlet, which should be 6 in, to minimize NPSH losses) with all valves, pumps, etc., located inside the dike and minimum flanges outside the dike. Tank car and truck hoses should be overdesigned to ensure against failure. Hose pressure rating should be 225 psi minimum with burst pressure (including end connections) at least twice the rated pressure. Contact DuPont for hose design and vendor recommendations. Circulation piping system, including hoses, should be inspected before each use to protect against failure and a major spill. Hoses should be long enough to permit hookup, regardless of the direction the vehicle comes into the facility. Sodium cyanide solution trailer connections are located at the rear (bumper level) and middle (on top) of the trailer; Excel II trailer connections are located at the rear (bumper level); and Excel I connections are in the box located in the middle of the trailer (ground level). All connections are quick connects, except for the top solution connection, which may be either bolted or quick connect.

Drainage Control

The storage tank should be diked and have a sealed concrete bottom. No dike drain should be installed, because it might leak or be left open. The unloading area should be curbed and drainage control provided that will prevent spilled cyanide solution from draining into public water courses (see "Pipe and Hoses"). Specific spill control requirements depend on surroundings and local regulations. Impounded sodium cyanide can be reclaimed or chemically destroyed.

Figure 17. Solution Volume Curves—Gallons of Solution from Dry Weight at 35°C (95°F)



Filter

To obtain a clear solution, a filter can be used. It should be located so that it filters the solution between the tank car and the storage tank and, also, between the storage tank and process. Filters are not needed if a clear solution is not required.

Level Indicator and Alarm

A sonic liquid level indicator is preferred over a float-type instrument, as it is more reliable, easier to read, and can be installed at a convenient location. It is recommended that a high-level alarm system, equipped to shut off the pump, be installed to prevent overflowing the storage tank.

Temperature Indicators, Insulation, Heating, and Cooling

Sodium cyanide solution should be stored above the crystallization point (see **Figure 3**), but normally below 38°C (100°F), when possible, to reduce decomposition (see **Figure 6**). A temperature control system may be needed for high concentrations. Tank insulation can be fiberglass with a sheet aluminum cover, if climate and solution concentration warrant. Low pressure steam can be used to reduce localized overheating. The same coils can be used for circulating cold water when necessary. Alternately, live steam can be injected, if small concentration changes from condensation are acceptable.

CAUTION

Read the "Chemical Reactions" section carefully and note the dangers at high temperatures.

Caustic Addition

To minimize highly toxic HCN formation and prevent color formation from HCN polymerization in the stored sodium cyanide solution, sufficient caustic (sodium hydroxide) is added to give a pH 12, preferably 12.5–13. Caustic addition to provide a 0.3–0.5% solution (about 50 lb NaOH per 1000 gal water) is usually sufficient. A 50% caustic solution can be used during the summer, but 25% solution is recommended for winter to avoid freezing. Use of 22.7-kg (50-lb) bags of bead caustic may be convenient. Additions can be made directly to the tank. Caustic should be added before sodium cyanide is added. Where process chemistry prevents caustic addition, HCN formation will increase, which must be controlled by ventilation and/or other means.

Transportation Emergencies

How to Get Help

DuPont wants to be called about any transportation incident involving DuPont cyanide, regardless of whether a spill occurred. In the event of a transportation incident or other problem involving DuPont cyanide that requires immediate help, call the DuPont Cyanide Hotline at our Memphis, Tennessee plant:

Call Collect, Day or Night

(901) 357-1546

NOTE: Do not use this number for non-emergencies. Contact the sales office listed on the back cover for routine commercial or technical information.

Calling the DuPont Cyanide Hotline is the fastest way DuPont can provide guidance to assist in handling an emergency. DuPont will evaluate whether a team of specialists should be sent to the scene.

In the United States and Canada, CHEMTREC can also be called at:

(800) 424-9300

In the rest of the world, call CHEMTREC at:

001-703-527-3887

CHEMTREC uses Language Services for non-English speakers.

The DuPont or CHEMTREC information specialist on duty will ask the name and location of the caller, the name of the shipper, the product, the shipping point and destination as well as what happened, nature of any injuries, weather conditions, proximity to populated areas, etc. If you call CHEMTREC, the information specialist will then contact the manufacturer (DuPont) for further assistance.

In Canada, CANUTEC can also be called in Ottawa, Ontario, at:

(613) 996-6666

Action at the Scene

The following is intended to provide guidance to first responders to a DuPont sodium cyanide transportation emergency incident.

1. For any transportation incident involving DuPont sodium cyanide, call DuPont for assistance as soon as possible, regardless of whether there is a spill.
2. Avoid overreaction that can occur because "cyanide" is involved. Remember, in most cases, you are dealing with a dry, solid, nonvolatile material that is normally easy to clean up, unless the cyanide has contacted acid or some other incompatible chemical or is spilled into a water system. If sodium cyanide solution is spilled, the amount of HCN gas evolved will probably be greater than if dry sodium cyanide was spilled, but because of the amount of caustic contained in sodium cyanide solution, the amount of HCN will probably still be well below lethal limits (see "Effects of Exposure to HCN Vapor" on page 8)—unless the HCN vapors are somehow contained or the solution is in contact with an acid. Gasoline, diesel, or other motor oils do not generally cause large amounts of cyanide gas.
   a. The need for evacuation is highly unlikely. Unless acid and cyanide are mixed, hydrogen cyanide gas formation is limited.
   b. While rain or any water contact with sodium cyanide can produce hydrogen cyanide gas, the amount of gas is small and would not require evacuation. While dangerous levels of gas can develop in enclosed spaces, wet sodium cyanide in the open can be shoveled up by standing upwind during cleanup.
3. Shovel the cyanide into drums, plastic bags, or any suitable container.
4. If sodium cyanide solution is spilled, contain the spill as soon and as much as possible. Keep sodium cyanide out of lakes, streams, or any other water. Block off sewer system, drainage, or any other water access. Even small concentrations of cyanide can be fatal to aquatic life. As soon as is practical, place the spilled material into a container suitable for movement to a proper disposal area.
5. As with all chemical spills, approach the scene from upwind to determine what chemicals are involved. With sodium cyanide spillage, check for battery acid spillage.
6. Keep people (nonresponders) away.
7. Halt or divert traffic to prevent spreading the cyanide.
8. If raining, cover any spilled sodium cyanide with a tarp, plastic, or anything available to minimize water contact and subsequent cyanide-water runoff. Divert any water streams around the cyanide.
9. To repeat, call the DuPont Cyanide Hotline at:

(901) 357-1546

Cyanide Destruction

The entire process in which by-products are generated should be reviewed for possible recycle of sodium cyanide, instead of disposal. If recycle is not feasible, ion exchange and reverse osmosis may be useful for concentrating cyanides, but destruction is usually easier and more economical.

The most effective and widely used chemical methods to destroy cyanide are oxidizing it to cyanate (CNO^-) with hypochlorite or hydrogen peroxide. Both methods are effective for oxidizing free and weak acid-dissociable cyanide.

For concentrated cyanide solutions, long-term high-temperature heating will destroy much of the cyanide with associated ammonia release.

Chlorination

CAUTION

Concentrated hypochlorite should not be mixed with concentrated cyanide solutions or solid cyanide, because highly toxic cyanogen chloride gas will be released. Very dilute solutions, in the correct pH range, should be used.

Chlorination of dilute sodium cyanide solutions can be accomplished by treatment with diluted solutions of sodium hypochlorite, calcium hypochlorite, or by generating hypochlorite from NaOH and Cl_2 gas. The choice of hypochlorite is an economic and safety decision. Solution concentrations of 1% sodium cyanide and 1% hypochlorite can be reacted if mixed slowly (over, say, 10 min) and with proper pH control.

Hypochlorite reacts with cyanide ions (CN^-) to produce highly toxic cyanogen chloride, which, at pH 10–11, hydrolyzes promptly to form cyanate ions (CNO^-). Because cyanogen chloride is a poisonous gas with little water solubility, the treatment process must be designed and operated to prevent cyanogen chloride fumes. Fumes are best controlled by limiting the cyanide concentration to a few thousand parts per million and controlling pH. Below pH 10, cyanogen chloride release increases; above pH 11, cyanide destruction slows, particularly above pH 11.5.

Further chlorination to destroy cyanate, sometimes referred to as "complete" chlorination, can be accomplished with additional chlorine. After reaction at pH 10.5 for 10 min or more, the pH must be reduced to 7.5–9, preferably 8–8.5, and maintained at that pH until the reaction is complete. Completion of both reactions typically requires at least 2 hr and can use eight or more parts of Cl_2 per part of CN^- (versus about three parts of Cl_2 for oxidation to CNO^-), while producing CO_2 and N_2 as reaction products. Chlorination is effective for cyanide destruction and can be automated for continuous systems. However, other waste stream components are often chlorinated, which increases chlorine consumption and may produce undesirable by-products in the effluent.

pH 10–11

Normally fastest reaction rate. Reduced HCN release and pH drop during treatment favor starting around pH 11. Higher pH will slow reaction, particularly above 11.5.

CAUTION

Adequate ventilation and HCN monitoring are important and more so as cyanide concentrations increase and pH decreases, particularly below pH 11.

pH Below 10

Causes slower reaction and release of HCN and/or cyanogen chloride gas (highly toxic, like HCN, and a powerful lachrymator, causing tearing of the eyes). Also, there is greatly increased concern about HCN release.

Acid pH

CAUTION

In addition to toxic gas release, acidic conditions can result in nitrogen trichloride formation that can separate as an insoluble oil-like material and explode violently, even in small amounts.

Hydrogen Peroxide Oxidation

CAUTION

Concentrated hydrogen peroxide should not be mixed with concentrated cyanide solutions or solid sodium cyanide, because highly toxic HCN or ammonia gas could be released. Also, high heat and oxygen gas release may cause foaming or eruption and splash workers. Dilution minimizes these problems.

Depending on the composition of the waste, additions of copper or formaldehyde may be required to destroy cyanide. The waste liquor is adjusted to pH 11 (10.5–11.5), formaldehyde or copper ions (typically with copper sulfate) added if needed, and hydrogen peroxide mixed with the solution. The solution must be agitated mechanically or with air. The reaction rate is dependent on temperature. Dilute wastes can be warmed to 38–54°C (100–130°F), but temperature elevation is usually less economical than adding 10–20% excess peroxide to shorten reaction time (which is normally about ½–1 hr at ambient temperature). Dilution and/or controlled addition rate may be needed when treating more concentrated wastes.

Chlorination is faster than peroxide oxidation and is frequently more adaptable to continuous destruction systems. Where speed is not critical, such as in batch tanks, hydrogen peroxide has several advantages including:

- Cyanogen chloride and chlorinated by-products are not produced.
- More concentrated cyanide wastes can be treated safely.
- The hazards of handling chlorine are avoided.
- Chlorine/chloride in water discharges are prohibited in some locations and can be avoided with peroxide.
- Sulfur compounds will react with hypochlorite, but not peroxide, and can increase hypochlorite costs substantially.
- Peroxide may destroy other objectionable organics.

By-products from peroxide treatment are cyanate, ammonia, and glycolic acid amide. Cyanate does not revert to cyanide in surface waters or sewage treatment systems, according to a U.S. Public Health Service study. Both the cyanate and glycolic acid amide are biodegradable. The cyanate can be readily hydrolyzed in acid solutions to ammonia.

Hydrolysis

Hydrolysis is sometimes a practical treatment for strong sodium cyanide solutions. Simply heating a 10% sodium cyanide solution for about 36 hr to 95–100°C (about 210°F) should reduce the cyanide content well below 1%, where chemical oxidation can be used more effectively. Provisions should be made to accommodate the ammonia that will be generated (see "Sodium Cyanide Reactions in Water").

Metal Complexes

Strongly bonded metal cyanides, especially iron cyanides (ferrocyanide and ferricyanide), are apt to be found in cyanide waste streams. These will not be detected by simple analytical procedures, such as titration with silver nitrate, which are normally used for measuring "free" or "weak acid-dissociable" cyanides. However, they will be included in the "total cyanide" analyses using acid distillation procedures. These complexes are not effectively destroyed by the commonly used waste treatment processes. If regulations require removal of these generally stable complexes of low toxicity, other treatment methods such as precipitation to produce a solid waste may be required.

Handling Spills

Sodium cyanide spills should be cleaned up promptly to minimize exposure of people and the environment. Shovel and sweep dry spilled material into a drum or suitable container. Keep dry spilled material dry. If solutions are spilled, immediately contain them to prevent contaminating nearby water. Contact DuPont for additional actions at a spill scene. If raining, covering the spill will reduce sodium cyanide dissolving and runoff. Decontamination of an area, after cleaning up as much cyanide as possible, can be accomplished with hypochlorite solution. A small amount of caustic (1 oz/5 gal hypochlorite solution) will help keep the pH in the 10–11 range.

References and Notes

1. Elial, E. L., and Freeman, J. P., "Organic Syntheses," Wiley, New York, Coll. Vol. 4, 58–62.
2. OSHA, 29 CFR 1910.1000, Air Contaminants.
3. Due to changing governmental regulations, such as those of the Department of Transportation, Department of Labor, U.S. Environmental Protection Agency, and the Food and Drug Administration, references to governmental requirements may be superseded. Consult and follow the current governmental regulations, such as Hazard Classification, Labeling, Worker Exposure Limitations, and Waste Disposal procedures, for up-to-date requirements for sodium cyanide.
4. "HYDROGEN CYANIDE and CYANIDE SALTS" published in 2001 by American Conference of Governmental Industrial Hygienists (ACGIH) 1330 Kemper Meadow Drive, Cincinnati, OH 45240; telephone (513) 742-2020. The ACGIH recommends a 4.7 ppm ceiling for HCN. Both OSHA and ACGIH advise avoiding skin contact.
5. "Occupational Exposure to Hydrogen Cyanide and Cyanide Salts," NIOSH Criteria Document, U.S. Department of Health, Education, and Welfare, 1976.
6. DOT, 49 CFR 712.101, Hazardous Material Table.

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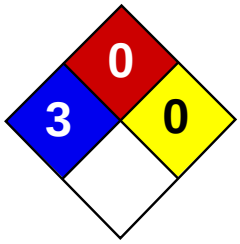
C.2 Material Safety Data Sheets – Sodium Cyanide



Material Safety Data Sheet
Sodium Cyanide MSDS

Section 1: Chemical Product and Company Identification

Product Name: Sodium Cyanide

Catalog Codes: SLS2314, SLS3736

CAS#: 143-33-9

RTECS: VZ7525000

TSCA: TSCA 8(b) inventory: Sodium Cyanide

CI#: Not available.

Synonym:

Chemical Name: Sodium Cyanide

Chemical Formula: NaCN

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Sodium Cyanide	143-33-9	100

Toxicological Data on Ingredients: Sodium Cyanide: ORAL (LD50): Acute: 6.44 mg/kg [Rat]. DERMAL (LD50): Acute: 10.4 mg/kg [Rabbit].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Hazardous in case of skin contact (permeator). Corrosive to eyes and skin. The amount of tissue damage depends on length of contact. Eye contact can result in corneal damage or blindness. Skin contact can produce inflammation and blistering. Inhalation of dust will produce irritation to gastro-intestinal or respiratory tract, characterized by burning, sneezing and coughing. Severe over-exposure can produce lung damage, choking, unconsciousness or death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to skin, eyes, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure of the eyes to a low level of dust can produce eye irritation. Repeated skin exposure can produce local skin destruction, or dermatitis. Repeated inhalation of dust can produce varying degree of respiratory irritation or lung damage. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Slightly flammable to flammable in presence of acids, of moisture.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards:
Dangerous on contact with acids, acid fumes, water or stream. It will produce toxic and flammable vapors of CN-H and sodium oxide. Contact with acids and acid salts causes immediate formation of toxic and flammable hydrogen cyanide gas. When heated to decomposition it emits toxic fumes hydgrogen cyanide and oxides of nitrogen

Special Remarks on Explosion Hazards: Fusion mixtures of metal cyanides with metal chlorates, perchlorated or nitrates causes a violent explosion

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:
Corrosive solid. Poisonous solid. Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep container dry. Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, acids, moisture.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area. Do not store above 24°C (75.2°F).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:
Splash goggles. Synthetic apron. Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor and dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
STEL: 5 (mg/m3) from ACGIH (TLV) [United States] SKIN CEIL: 4.7 from NIOSH CEIL: 5 (mg/m3) from NIOSHConsult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Granular solid. Flakes solid.)

Odor:
Faint almond-like odor. Odorless when perfectly dry. Emits odor of hydrogen cyanide when damp.

Taste: Not available.

Molecular Weight: 49.01 g/mole

Color: White.

pH (1% soln/water): Not available.

Boiling Point: 1496°C (2724.8°F)

Melting Point: 563°C (1045.4°F)

Critical Temperature: Not available.

Specific Gravity: 1.595 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Vapor Density of Hydrogen Cyanide gas: 0.941

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water.

Solubility:
Soluble in cold water. Slightly soluble in Ethanol

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Excess heat, moisture, incompatibles.

Incompatibility with various substances: Reactive with oxidizing agents, acids, moisture.

Corrosivity:
Corrosive in presence of aluminum. Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Violent reaction with fluorine gas, magnesium, nitrates, nitric acid. Dangerous on contact with acids, acid fumes, water or stream. It wil produce toxic and flammable vapors of CN-H and sodium oxide. Cyanide may react with CO2 in ordinary air to form toxic hydrogen cyanide gas. Strong oxidizers such as acids, acid salts, chlorates, and nitrates. Contact with acids and acid salts causes immediate formation of toxic and flammable hydrogen cyanide gas.

Special Remarks on Corrosivity: Corrosive to aluminum

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
Acute oral toxicity (LD50): 6.44 mg/kg [Rat]. Acute dermal toxicity (LD50): 10.4 mg/kg [Rabbit].

Chronic Effects on Humans: May cause damage to the following organs: skin, eyes, central nervous system (CNS).

Other Toxic Effects on Humans:
Very hazardous in case of skin contact (irritant), of ingestion, of inhalation. Hazardous in case of skin contact (permeator).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: May cause adverse reproductive effects (maternal and paternal fertility) based on animal data.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health effects: Skin: May cause itching and irritation. May be fatal if absorbed through injured skin with symtpoms similar to those noted for inhalation and ingestion. Eyes: May cause eye irritation and eye damage. Inhalation: May cause respiratory tract irritation. May be fatal if inhaled. The substance inhibits cellular respiration causing metabolic asphyxiation. May cause headache, weakness, dizziness, labored breathing, nausea, vomiting. May be followed by cardiovascular effects, unconciousness, convulsions, coma, and death Ingestion: May be fatal if swallowed. May cause

gastrointestinal tract irritation with nausea, vomiting. May affect behavior and nervous systems(seizures, convulsions, change in motor activity, headache, dizziness, confusion, weakness stupor, aniexity, agitation, tremors), cardiovascular system, respiration (hyperventilation, pulmonary edema, breathing difficulty, respiratory failure), cardiovascular system (palpitations, rapid heart beat, hypertension, hypotension). Massive doses by produce sudden loss of conciousness and prompt death from respiratory arrest. Smaller but still lethal doses on the breath or vomitus. Chronic Potential Health Effects: Central Nervous system effects (headaches, vertigo, insomnia, memory loss, tremors, fatigue), fatigue, metabolic effects (poor appetite), cardiovascular effects (chest discomfort, palpitations), nerve damage to the eyes, or dermatitis, respiratory tract irritation, eye irritation, or death can occur. may prolong the illness for 1 or more hours. A bitter almond odor may be noted

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Sodium cyanide UNNA: 1689 PG: I

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut carcinogen reporting list.: Sodium Cyanide Illinois chemical safety act: Sodium Cyanide New York release reporting list: Sodium Cyanide Rhode Island RTK hazardous substances: Sodium Cyanide Pennsylvania RTK: Sodium Cyanide Minnesota: Sodium Cyanide Massachusetts RTK: Sodium Cyanide Massachusetts spill list: Sodium Cyanide New Jersey: Sodium Cyanide New Jersey spill list: Sodium Cyanide Louisiana RTK reporting list: Sodium Cyanide Louisiana spill reporting: Sodium Cyanide California Director's List of Hazardous Substances: Sodium Cyanide TSCA 8(b) inventory: Sodium Cyanide TSCA 4(a) final test rules: Sodium Cyanide TSCA 8(a) PAIR: Sodium Cyanide TSCA 8(d) H and S data reporting: Sodium Cyanide TSCA 12(b) one time export: Sodium Cyanide SARA 302/304/311/312 extremely hazardous substances: Sodium Cyanide CERCLA: Hazardous substances.: Sodium Cyanide: 10 lbs. (4.536 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-6: Reactive and very flammable material. CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC). CLASS E: Corrosive solid.

DSCL (EEC):
R27/28- Very toxic in contact with skin and if swallowed. R41- Risk of serious damage to eyes. S1/2- Keep locked up and out of the reach of children. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S28- After contact with skin, wash immediately with plenty of water S36/37- Wear suitable protective clothing and gloves. S39- Wear eye/face protection. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). S46- If swallowed, seek medical advice immediately and show this container or label.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 1

Reactivity: 0

Personal Protection: j

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Synthetic apron. Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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Appendix D

Hazardous Material Storage Area Inspection Report

HAZMAT Storage Area: Environmental Inspection report

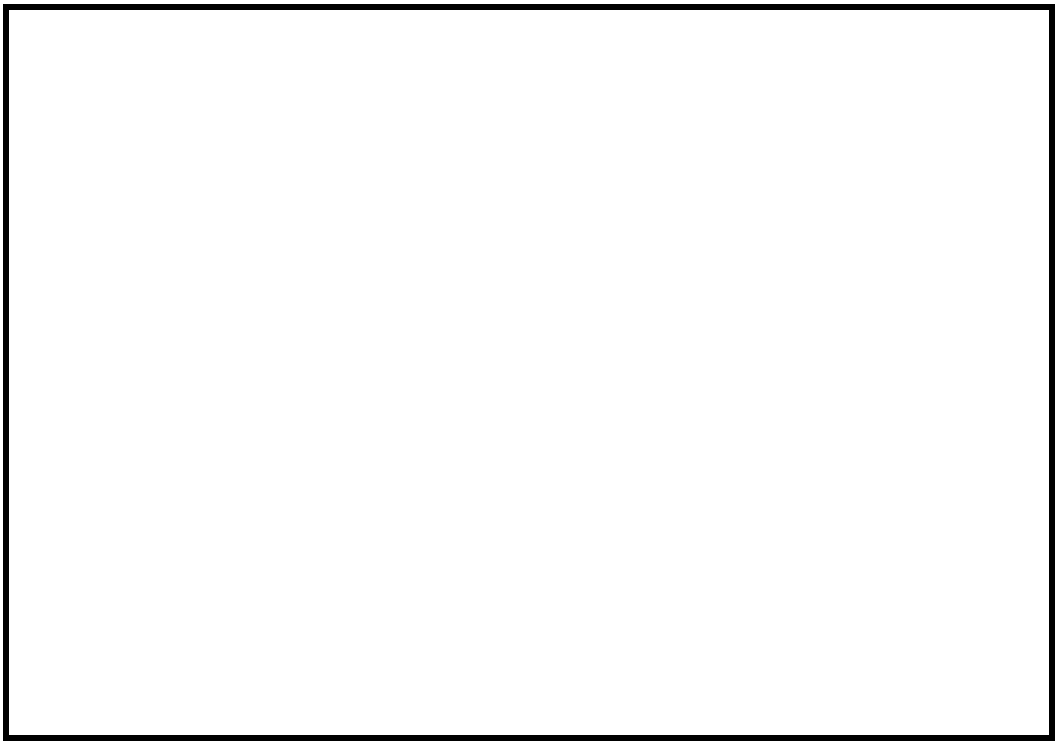
Date: _____ **Inspected By: _____**

Location: _____ **Responsible department: _____**

Subject	Conform	Non-conform	N/A	Picture(s) #
Are storage containers clearly labelled to identify Hazmat substance?				
Are storage containers in good condition? Is there any visible damage or leaks? Can the doors be sealed shut?				
Is HAZMAT in containers properly segregated?				
Is HAZMAT arrangement to prevent from falling or dislodging?				
Where necessary – Is HAZMAT placed on pallets i.e. Drums?				
Where necessary – Are containers with product stored in an upright position?				
Where necessary – Are Quatrex bags closed properly?				
Do you see any potential environmental hazards posed by these HAZMAT containers/materials?				

Comments:_____
_____
_____
_____
_____

Recommendations:_____
_____
_____
_____
_____



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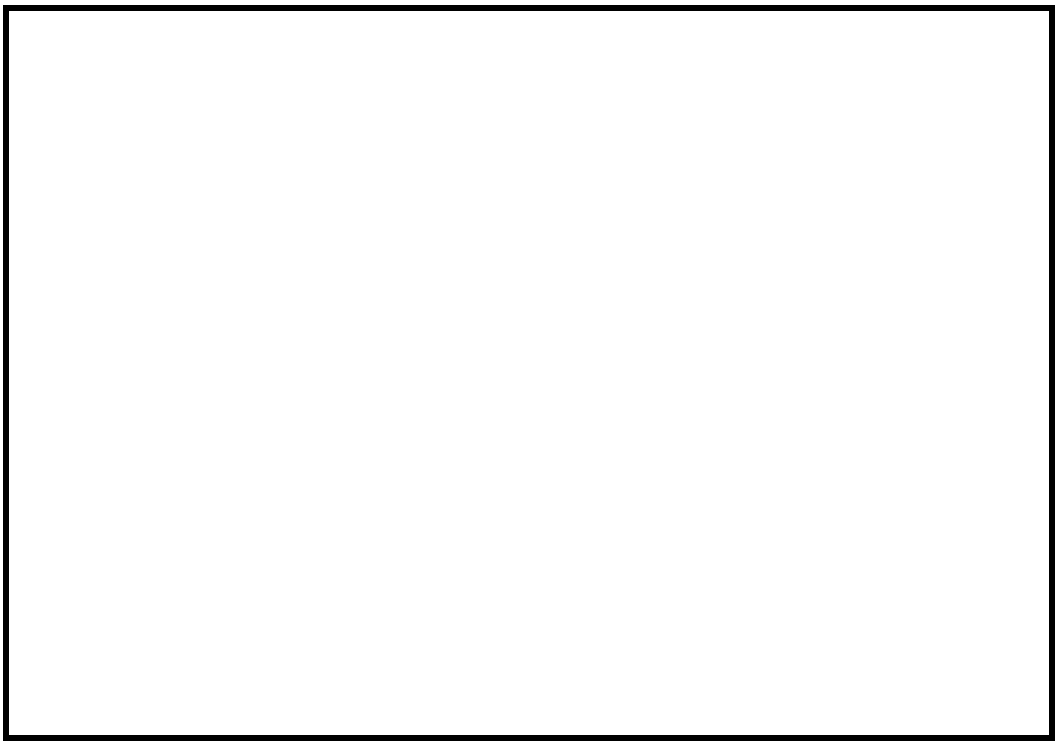

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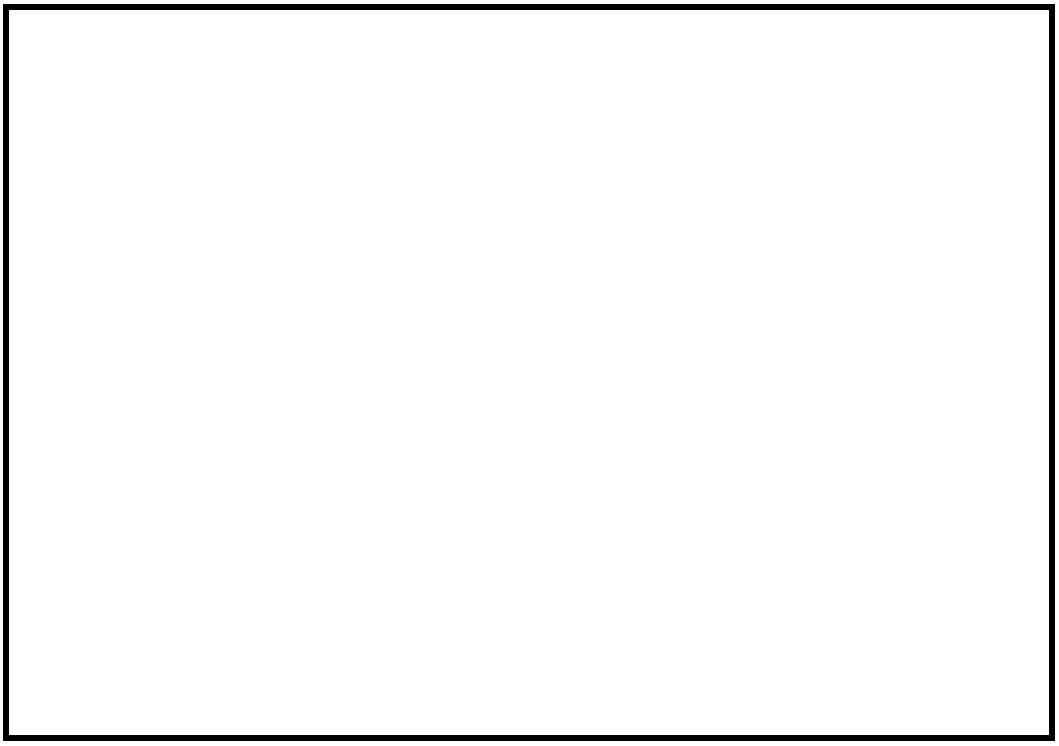

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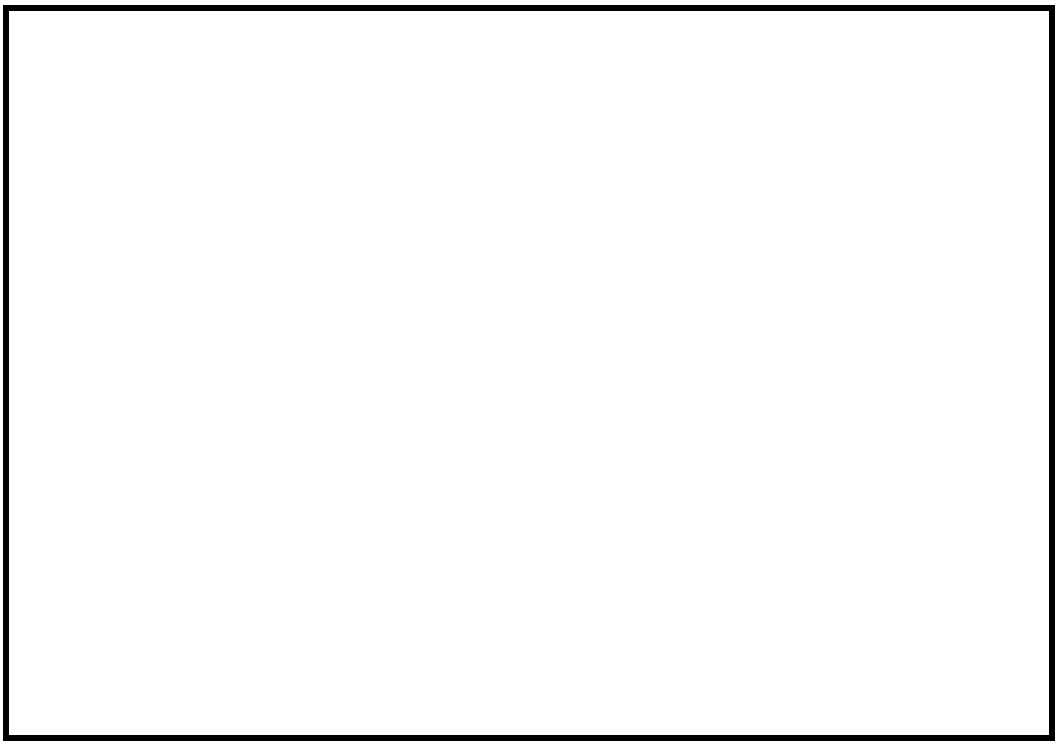

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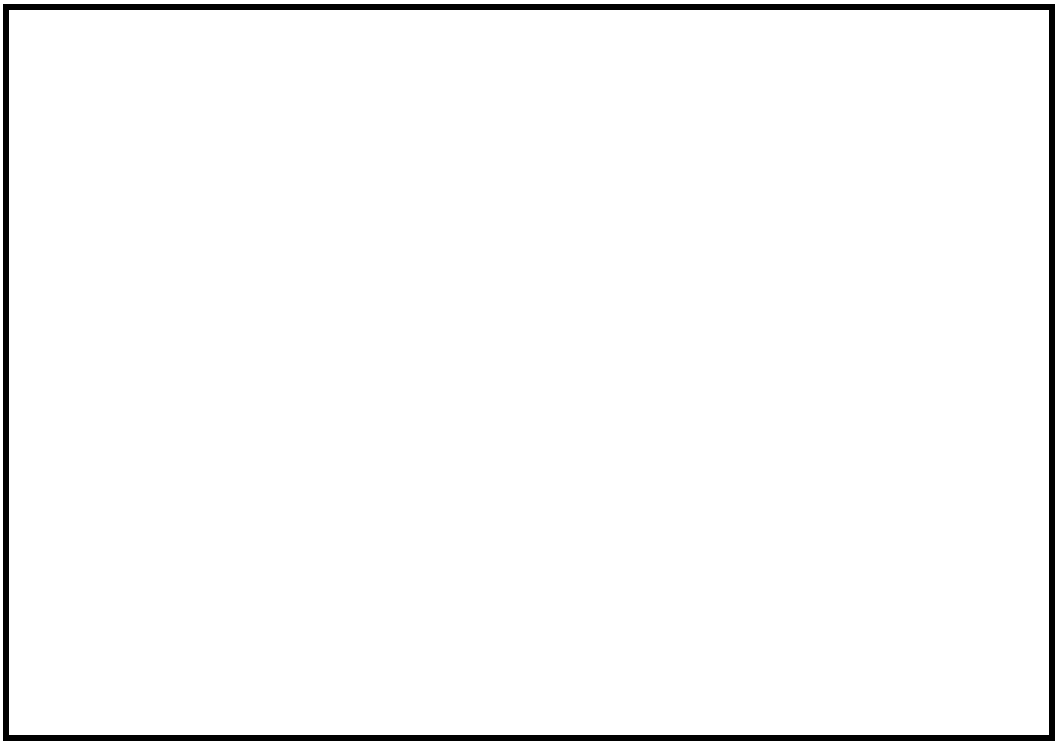

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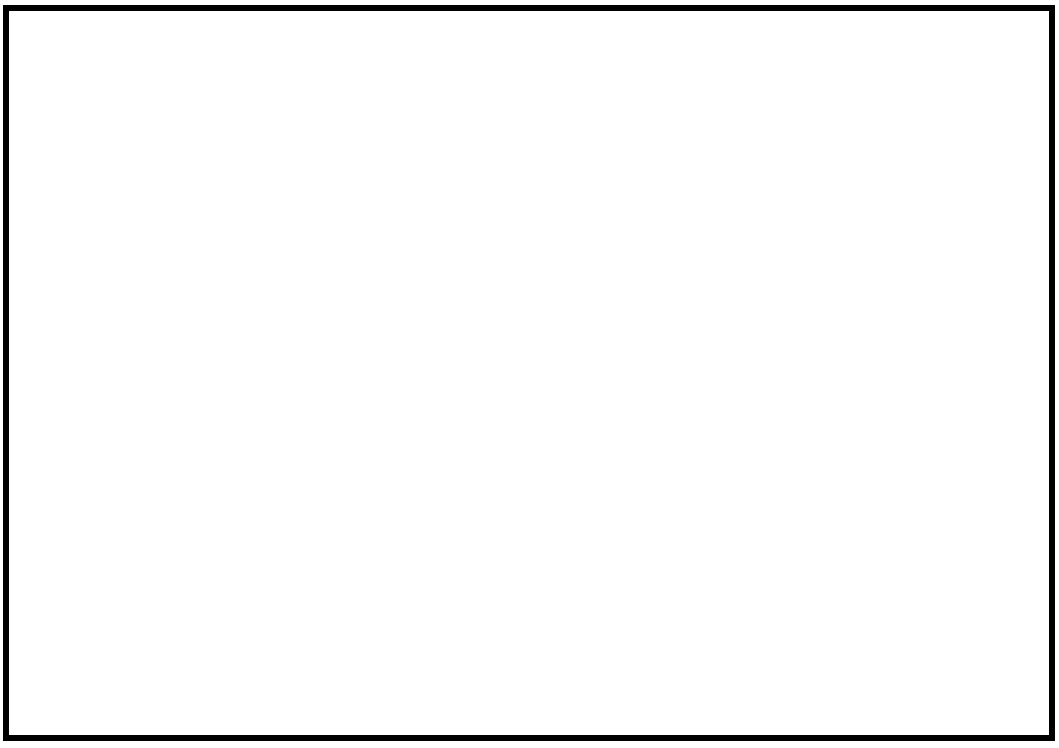


Picture 6: Description

Appendix E

Procedure Poster Hazardous Material Storage

Agnico-Eagle Mines: Meadowbank Division Environment Department

AGNICO EAGLE
MEADOWBANK

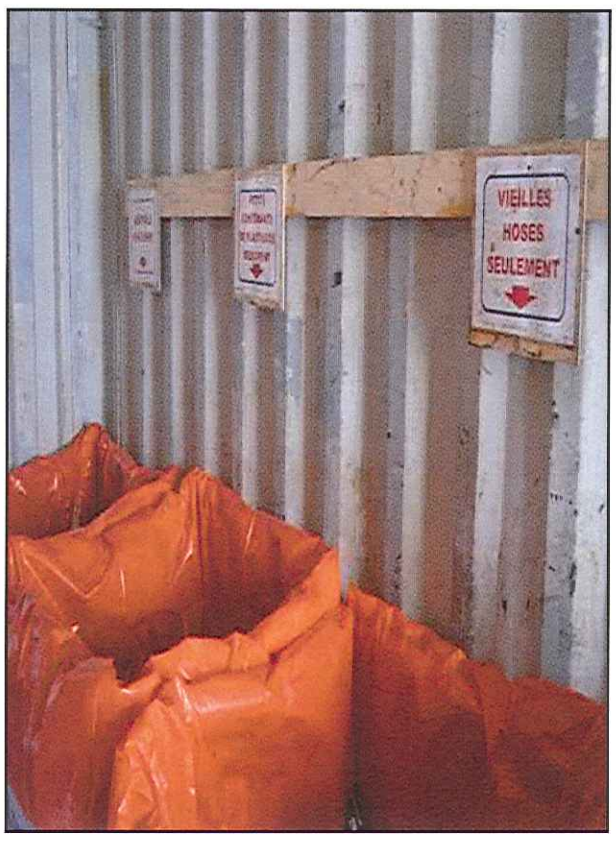
HAZARDOUS Materials/Waste Management and Storage Procedures

- AEM is committed to the safe and appropriate storage of fuels, hazardous materials, and hazardous wastes.
- AEM Environmental Department will be conducting routine inspections on each departments HAZMAT area to ensure proper procedures and storage are being met. This not only meets the requirements of our license, but is also a cost-savings initiative.
- When Hazardous Materials are not properly segregated, additional handling costs are added to the total cost of shipping our Hazardous Material down south.
- AEM's general guidelines for storing fuels, hazardous materials and hazardous wastes are listed below.

Hazardous Materials/Waste includes:

Waste Oil, Grease, Filters & Hoses, Spray Cans, Rags with Oil, Grease or Chemical Product, Paints, Batteries, Fluorescent Lights

HAZARDOUS MATERIALS/WASTE MUST BE SEPARATED (See Example Below)



The Hazardous Materials/Waste Storage Area is located near the Fuel Farm and Incinerator

When your HAZMAT is ready to transport to the Hazardous Materials/Waste Storage area, we ask that you follow these steps:

- HAZARDOUS MATERIALS MUST BE SEGREGATED AND STORED IN PROPER DRUMS, QUATREX, OR CONTAINER TO ALLOW ACCESS FOR INSPECTION AND EMERGENCY RESPONSE IN THE EVENT OF A SPILL OR RELEASE
- ALL OF THE CONTAINERS IN THE HAZMAT STORAGE AREA ARE CLEARLY LABELED. IDENTIFY THE STORAGE CONTAINER THAT MATCHES THE HAZMAT THAT YOUR TRANSPORTING (FOR EXAMPLE—SEE BELOW)

AEROSOL CANS **INTO** **AEROSOL CONTAINER**

- WHEN PLACING HAZMAT PRODUCT INTO THE STORAGE AREA CONTAINERS, GENERAL HOUSE KEEPING RULES APPLY. CONTAINERS WITH PRODUCT SHALL BE KEPT IN AN UPRIGHT POSITION AND MATERIAL SHALL BE ARRANGED TO PREVENT DAMAGE FROM FALLING OR DISLODGING

Hazardous Materials/Waste Management requires the commitment and participation of all site personal. If you have questions or are unsure of where to dispose of your Hazardous Material/Waste please call:

Site Services at extension 6902, Environment Department at extension 6747

THANK YOU FOR YOUR CO-OPERATION

AGNICO EAGLE

OIL HANDLING FACILITY

OIL POLLUTION EMERGENCY PLAN

For
Meadowbank Mine Fuel Farm in Baker Lake

January 2014
Version 3

EXECUTIVE SUMMARY

This document presents the Oil Pollution Emergency Plan for Agnico Eagle Mines Limited (AEM) Meadowbank Mine Site, All Weather Private Access Road (AWPAR) and Baker Lake Facilities, which is a requirement of the Meadowbank Gold Project Type A Water License No. 2AM-MEA0815 issued on June 09, 2008. Oil Pollution Emergency Plan (OPEP) designates lines of authority, responsibility, establishes proper reporting and details plans of action in the event of a spill. This plan applies to the operational phase of the mine and is applicable to all AEM employees and any contractors associated with the project located at latitude 65°01'52"N longitude 96°04'22"W approximately 70 km north of Baker Lake in Nunavut including the Baker Lake Marshaling Facilities and the Fuel Farm located at latitude 64°18'36"N and longitude 95°58'04"W and the AWPAR.

ACRONYMS

AEM	Agnico Eagle Mines Limited
ECC	Emergency Control Center
ERT	Emergency Response Team
ERP	Emergency Response Plan
Fuel	P50 Arctic Grade diesel fuel and/or Jet-A aviation fuel
IMO	International Maritime Organization
MARPOL	*The International Convention for the Prevention of Pollution from Ships,* 1973, and the *Protocols* of 1978 and 1997, as amended from time to time
OHF	Oil Handling Facility
OPEP	Oil Pollution Emergency Plan
SCP	Spill Contingency Plan
SOPEP	Ship Oil Pollution Emergency Plan
SMP	Spill Management Plan
TEU	Twenty-foot equivalent unit

DISTRIBUTION LIST

AEM - Environmental Superintendent

AEM – General Mine Manager

AEM – Health and Safety Superintendent

AEM – Site Services Superintendent

AEM – General Services Superintendent

AEM – ERT Emergency Measures Councilor

Baker Lake – Baker Lake Hamlet Office

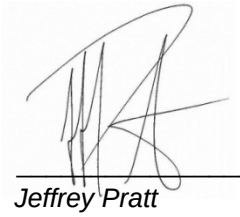
Baker Lake – Fire Department

Coastal Shipping Limited – General Manager

DOCUMENT CONTROL

Version	Date (YMD)	Section	Page	Revision
0	12/09/02	All	All	Comprehensive plan for AEM's Baker Lake Fuel Farm Facilities
1	12-09-17		10, 12, 13	P10: Tide and Currents reference change; P12: Rephrasing of the last paragraph title; P13: in INITIAL SPILL RESPONSE PRIORITIES table into Section 2 RESPOND SAFELY, rewording to show only diesel fuel actions.
2	13-03-30	6 & App. D	10	Oil Handling Facility Declaration; 2013 Jet-A to start being stored at OHF
			12	Adequate lighting required during fuel transfer
		9	20 21	Item list on inside door of each Sea can. Internal Contacts Updated
		10 & App. C	23	Update to AEM site spill training & Location of training records
		13	29	Major Failure At Helicopter Island
		14 & App. E	30	In-situ Burning
		16	32	New for 2013
3	January 2014	ALL		Comprehensive Review

Version 3:

Prepared By: 

Jeffrey Pratt
Environmental Coordinator

Approved By:

Kevin Buck
Environmental Superintendent

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1. OIL HANDLING FACILITY DECLARATION

Pursuant to paragraph 168(1) of the Canada Shipping Act 2001, AEM has signed an Oil Handling Facility Declaration. This Declaration can be found posted at the Oil Handling Facility (OHF).

OIL HANDLING FACILITY DECLARATION

Pursuant to paragraph 168(1) of the Canada Shipping Act 2001, I, Kevin Buck, (Name of the operator of the oil handling facility) declare that to comply with the Oil Handling Facility Regulation, Respecting the circumstances in which operators of oil handling facilities shall report discharges or anticipated discharges of pollutants, the manner of making the reports and the persons to whom the reports shall be made; all the information contained in the submission is true and complete to the best of my ability and accurately reflect our interpretation of the regulations.

The persons listed below are authorized to implement the oil pollution emergency plan.

Kevin Buck, Agnico Eagle Mines Ltd. -- P.O. Box 540; Baker Lake, Nunavut X0C 0A0 (819) 759-3555 ext 6838; kevin.buck@agnicoeagle.com

(Write: Name, Address, Telephone number and fax or e-mail address on the upper line)

Jeffrey Pratt, Agnico Eagle Mines Ltd. -- P.O. Box 540; Baker Lake, Nunavut X0C 0A0 (819) 759-3555 ext 6728; jeffrey.pratt@agnicoeagle.com

(Write: Name, Address, Telephone number and fax or e-mail address on the upper line)

Norman Ladouceur, Agnico Eagle Mines Ltd. -- P.O. Box 540; Baker Lake, Nunavut X0C 0A0 (819) 759-3555 ext 6720; norman.ladouceur@agnicoeagle.com

(Signed by the operator of the oil handling facility or its representative)

March 30, 2013
(Date)

AGNICO EAGLE

2. GENERAL INTRODUCTION

The Oil Pollution Emergency Plan (OPEP) is to set in motion the necessary actions to stop or minimize the loss of diesel resulting from a mishap at Agnico Eagle Mines Limited's Baker Lake Fuel Tank Oil Handling Facility located in Baker Lake, Nunavut. Additionally, it provides direction to AEM personnel and/or contractors at the laydown and tank farm areas, and to AEM's Emergency Response Team (ERT) for emergency spill response situations; describes oil pollution scenarios, defines the roles and responsibilities of management and responders; and outlines the measures taken to prevent spills. The purpose of the OPEP is to minimize potential health and safety hazards, environmental damage and cleanup costs

2.1 Fundamental Principles

In response to any incident that may occur at the Meadowbank mine site or associated facilities, such as the OHF, the fundamental principles of any response is as follows and will **always** be in this order:

1. Health and Safety of works, responders, and public;
2. Environmental Issues;
3. Protection of property; and
4. Rehabilitation of the work area.

2.2 Legislative Requirements

This plan was prepared in accordance with federal legislation outlined in Table 1, which lists legislative instruments applicable to AEM's Baker Lake Fuel Oil Handling Facility. All requirements found in the Canada *Shipping Act*, *2001*, ss. 168 are laid out in the Concordance Table located in Appendix A.

The OPEP complies with the requirements for procedures, equipment and resources as set out in the *Canada Shipping Act* (s.s. 660.2(4)) specific to a fuel handling facility - the bulk incoming transfer of fuel from ship-to-shore and spill scenarios directly relating to this operation.

Table 1 - Applicable Acts, Regulation and Guidelines

Federal Legislation		
Acts	**Regulations**[1]	**Guidelines**
Canada Shipping Act	Response Organizations and Oil Handling Facilities Regulations 1995	Oil Handling Facilities Standards – TP12402
	Pollutant Discharge Reporting Regulations, 1995	Environmental Prevention and Response National Preparedness Plan 2008 – TP13585
		Guidelines for Reporting Incidents Involving Dangerous Goods, Harmful Substances and /or Marine Pollutants – TP9834E 2009
		Arctic Waters Oil Transfer Guidelines, 1997 - TP10783E
	Environmental Response Arrangements Regulations	Response Organizations Standards – TP 12401E 1995

	An Oil Prevention Emergency Plan is required under the Act [168(3)b]	Guidelines for Reporting Incidents Involving Dangerous Goods, Harmful Substances and/or Marine Pollutants - TP- 9834E 2009
	Ballast Water Control and Management Regulations	
Oceans Act	Marine Liability Regulations	
Navigable Waters Protection Act	Transportation of Dangerous Goods Regulations	
Transportation of Dangerous Goods Act	Arctic Waters Pollution Prevention Regulations (C.R.C., c. 354)	
Arctic Waters Pollution Prevention Act	Arctic Shipping Pollution Prevention Regulations	
Canadian Environmental Protection Act	Environmental Emergency Regulations	
	Petroleum Products and Allied Petroleum Products Storage Tank System Regulations (2008)	

[1] *Only Canada Shipping Act's regulations centered on the environment and that apply to Oil Handling Facility (OHF) and the Oil Pollution Emergencies Plan are listed. Legislative instruments not directly applicable to the OHF are not listed.*

2.3 Related Documents

Management and monitoring plans for Meadowbank mine that provided input to the Oil Pollution Emergency Plan include the following:

1. Spill Contingency Plan;
2. Emergency Response Plan; and
3. Shipboard Oil Pollution Emergency Plan[1].

The cornerstones of contingency planning for AEM are the Spill Contingency Plan and the Oil Pollution Emergency Plan. These, coupled with the Emergency Response Plan, describe the processes to be followed in responding to a spill. The OPEP on its own provides the necessary information in the event of a mishap where diesel fuel is lost during the transfer of fuel from a tanker vessel to the Fuel Tank Facility.

The OPEP complements the Spill Contingency Plan and it should not be construed as superseding it. The Spill Contingency Plan addresses a wider scope of operations stretching 110 kilometres from the Meadowbank mine site in the north to their infrastructure in the south. It is inclusive of more than just diesel fuel, covering other hazardous materials such as Jet A, hydraulic fluids, and chemicals.

The Emergency Response Plan focuses on responding to all emergencies in a timely and adequate manner. Large spills are an emergency in which the AEM Emergency Response Team will respond. It commits AEM to being prepared for and providing adequate resources, qualified personnel and equipment to handle a wide variety of emergency situations.

[1] *The Shipboard Oil Pollution Emergency Plan (SOPEP) contains all information and operational instructions as required by the "Guidelines for the development of the Shipboard Marine Pollution Emergency Plan" as developed by the International Marine Organization. Woodward's, the shipping company, is responsible for this Plan.*

2.4 Meadowbank Mine Oil Pollution Emergency Plan

This Plan is a working document that will be reviewed and, if necessary, updated on an annual basis. It will be reviewed by the Environmental Superintendent, Environmental Coordinator, Baker Lake Supervisor, Health and Safety Superintendent, Emergency Response Coordinator, and sent to the Baker Lake Hamlet Counsel and Fire Department for review and comments. In addition during the review process the afore mentioned personnel will also review The Central & Arctic Regional Response Plan (2008), or the most up to date response plan created by the Canadian Coast Guard for the region in which the Meadowbank Project resides within. The Central & Arctic Regional Response Plan (2008) can be found in Appendix B.

This plan specifically centres on the activities in ship-to-shore transfer of fuel from a small tanker delivering fuel to AEM's Baker Lake Fuel Tank Facility constructed in Baker Lake. On site personnel at the Facility are expected to respond to minor spill incidents[2] that can be contained and cleaned up without assistance, while the ERT will respond to larger spills.

The Shipboard Oil Pollution Emergency Plan (SOPEP) is the responsibility of the shipping company; it covers the ship-to-ship transfer of fuel near Helicopter Island as shown on Figure 6 (a copy of the contractor's plan is available in Appendix C). The containment and clean-up of inadvertent spills resulting from the tankers in transporting the fuel is the responsibility of the shipping company. In the unlikely event where a large fuel spill becomes unmanageable, the shipping company could call on external resources such as the Canadian Coast Guard for assistance. In these situations, AEM would provide whatever assistance it can to the shipping company[3].

Fuel is being delivered to AEM's Baker Lake Fuel Farm by Coastal Shipping Limited, a Division of the Woodward Group of Companies. Fuel is stored within the existing tank farm owned and operated by AEM. The outline of the SOPEP prepared by Coastal Shipping Limited can be found in Appendix C.

[2] A minor incident can be controlled and cleaned up readily by the polluter and has little effect on natural resources, the environment, or public property. Source Environment Canada 2002.

[3] The Emergency Response Team will not be equipped or trained to respond to spills offshore in the Marine environment. They will however be able to respond to spills in the near shore area.

3. PLANNING STANDARDS

3.1 Facility Category

Oil handling facilities are categorized according to their maximum oil transfer rate in cubic metres per hour, in respect of the oil product loaded or unloaded to or from a ship, as follows (Table 2):

Table 2 - Category of OHF

Category of Oil Handling Facility	Maximum Oil Transfer Rate (cubic metres/hour)
Level 1	150
Level 2	750
Level 3	2 000
Level 4	More than 2 000

AEM's proposed that oil handling facility at Baker Lake is a level 2 based on a diesel fuel transfer rate of 400 m^3/hr.

3.2 General Planning Guidelines

3.2.1 Response Time Standards

AEM and contractor personnel at Baker Lake Fuel Farm are trained to respond to minor spills if it is safe to do so. This would be done without activating the Spill Contingency Plan (SCP), the OPEP or the Emergency Response Plan (ERP).

If the spill does exceed the volume of a Level II spill >5m^3 (>5000L) or if the spill occurs on water excess of 200L; it would then be proven necessary to activate the OPEP and ERP. The Emergency Response Team (ERT) located at Meadowbank mine site can realistically be on site within 120 minutes (or less) ready to commence containment and clean up activity.

3.2.2 On-Water Recovery

AEM has a boat in a sea can at the Baker Lake barge area that is ready to be deployed in the case of an emergency situation.

3.2.3 Dedicated Facility Spill Response Equipment

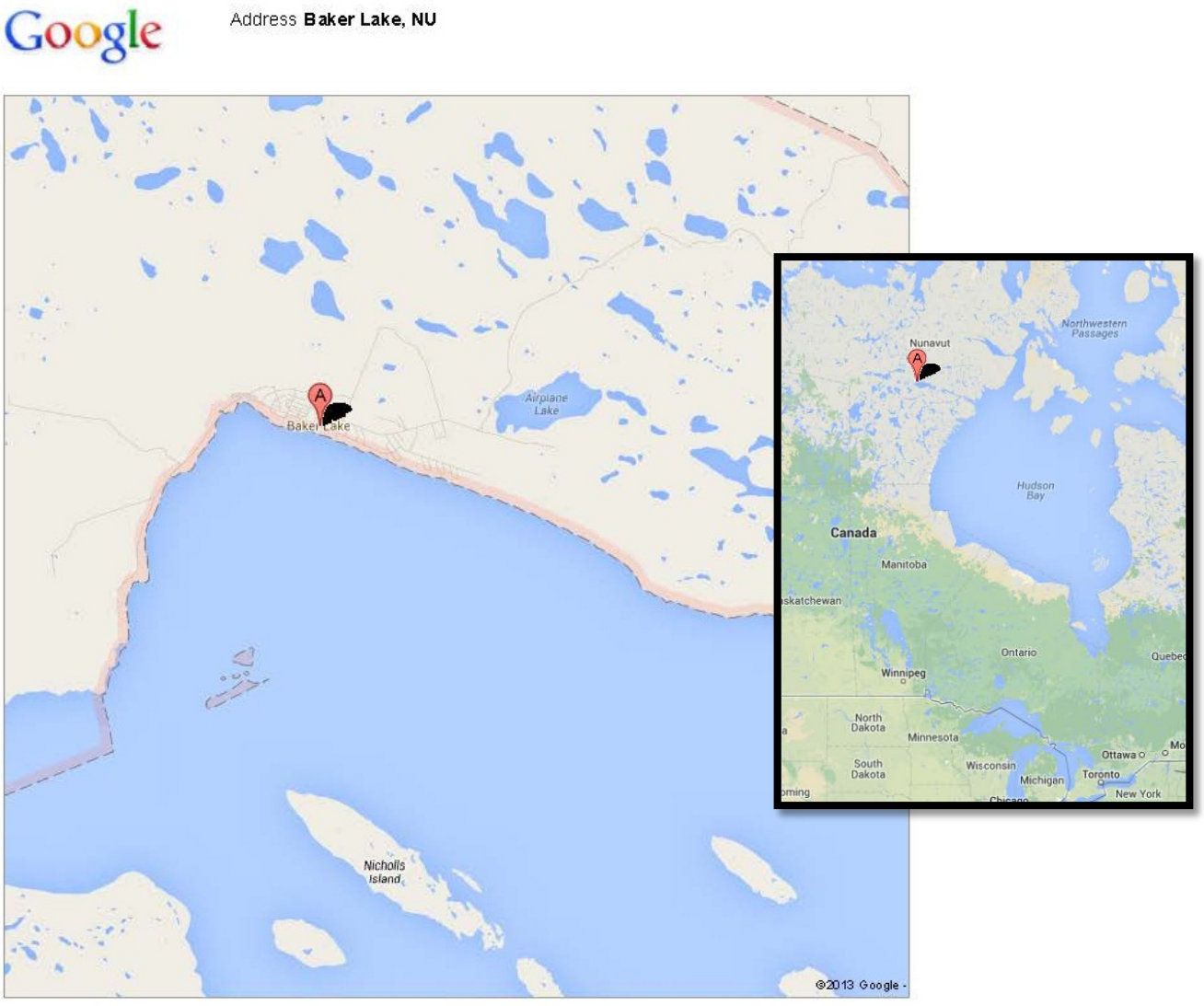
AEM has located a sea can with spill response equipment near the Baker Lake shore within AEM's Marshaling area and includes booms that can rapidly be deployed to limit the spread of any spill on water. The list of equipment can be found in Table 4.

4. BAKER LAKE MARSHALING AREA AND FUEL STORAGE FACILITY

4.1 General Overview and Site Description

AEM's Oil Handling Facility (OHF) is located in the area of Baker Lake at latitude 64°18 22.778" N and longitude 95°57'33.990" W. The location shown on Figure 1 provides more detail. The Fuel Tank Facility consists of six - 10 million litre diesel fuel[4] (10,000 m^3) storage tanks all holding P50 grade diesel (Figure 2), and 20 tanks holding 2,000,000 litres of Jet-A fuel (Figure 3). The Facility is located adjacent to AEM's Marshalling area, approximately 250 metres from the shore of Baker Lake at high tide. Power is provided by a generator for the fuel pump module located next to the tank farm.

Figure 1 - Location of the Community of Baker Lake



[4] *1000 litres = 1 m^3 of fuel. Cubic metres are used throughout this document.*

4.2 Fuel Storage Facilities Infrastructure

4.2.1 P-50 Fuel Tanks

The diesel fuel tanks are contained within an impermeable lined and bermed area. The steel fuel tanks have been field-erected and built to API-650 standards with each bermed area holding two tanks. This area is capable of containing 110% of the volume of one 10,000 m^3 storage tank. Each impermeable lined and bermed cell has the following:

- A granular base for the tank complete with an impermeable 60 mil HDPE liner system and granular dikes;
- Two – 10,000 m^3 tanks complete with the required appurtenances such as stairs, base manholes, water draw offs, re-supply nozzle, suction nozzle, tank lighting, tank level monitoring, roof manhole, manual gauge hatch, tank temperature and P/V vent;
- Piping for unloading and loading;
- Site lighting via fixtures mounted from the dispensing building; and

The Tank Farm Facility is designed to meet the following standards:

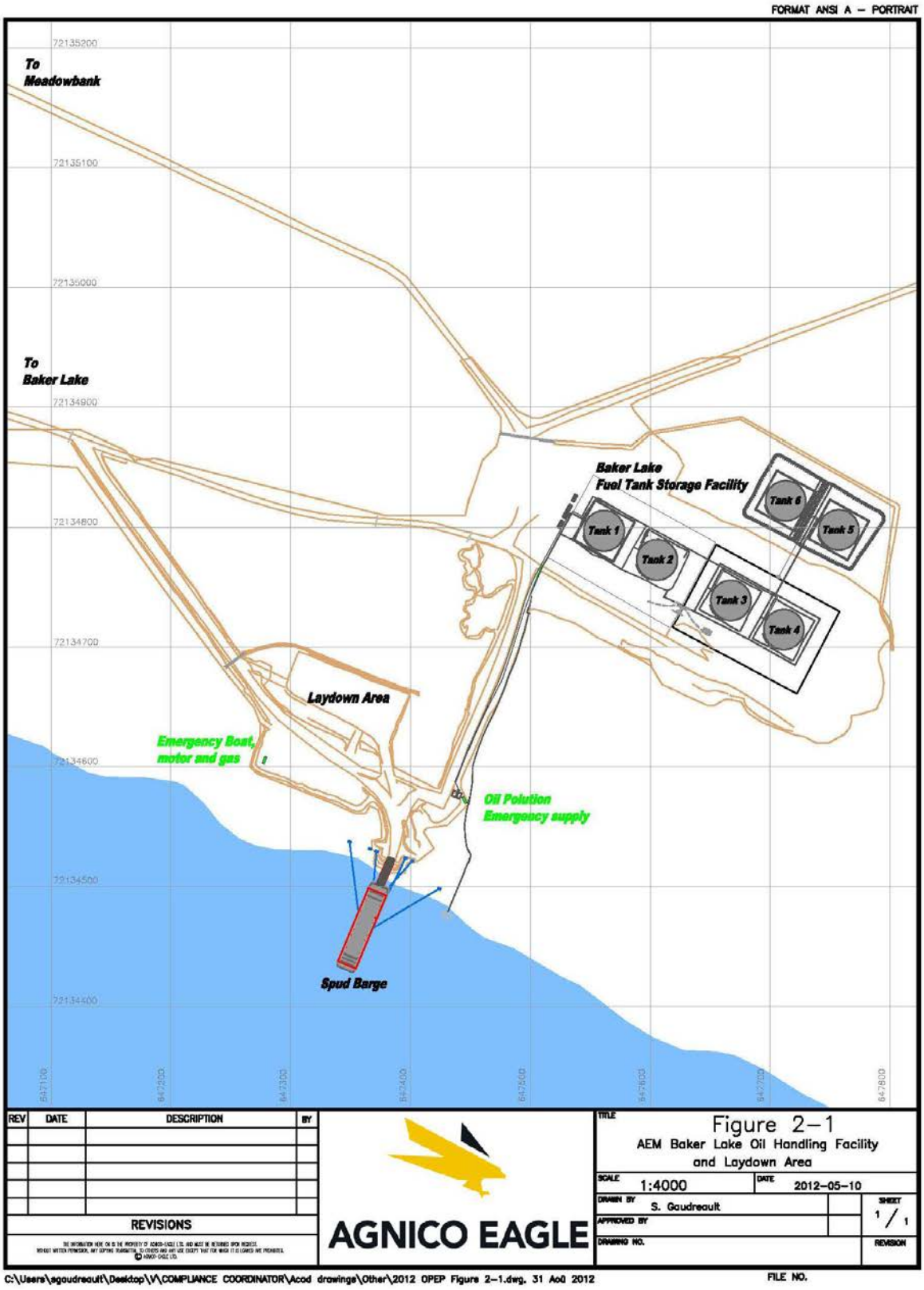
- National Fire Code 2010;
- *Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations* – 2008; and
- Canadian Council of Ministers of the Environment, "*Environmental Code of Practice of Aboveground and Underground Storage Tank Systems Containing Petroleum Products and Allied Petroleum Products – 2003* (PN1326)"

The Oil Handling Facility (OHF) is constructed and operated in accordance with Transport Canada Arctic Waters Oil Transfer Guidelines (TP 10783E) and Oil Handling Facility Guidelines (TP 12402E). A fuel dispensing pad area complete with a dispensing unit is located in a lined facility with a provision to capture any and all spills at the fueling area and direct them to a containment area provided at the tank farm.

All diesel fuel is transported to the mine site by tanker trucks on a year round basis. Tanker trucks are loaded on the fuel dispensing pad at rates of approximately 50 m^3/hr. The facility has incorporated the following:

- Temperature compensated metering system to manage fuel flows;
- Safety valve to prevent loss of fuel from the fuel facility
- Fire extinguishers;
- Building heating, ventilation systems and lighting systems; and
- Control systems for the pumps.

Figure 2 - AEM's Baker Lake Oil Handling Facility and Laydown Area – Ship to Shore Transfer Area

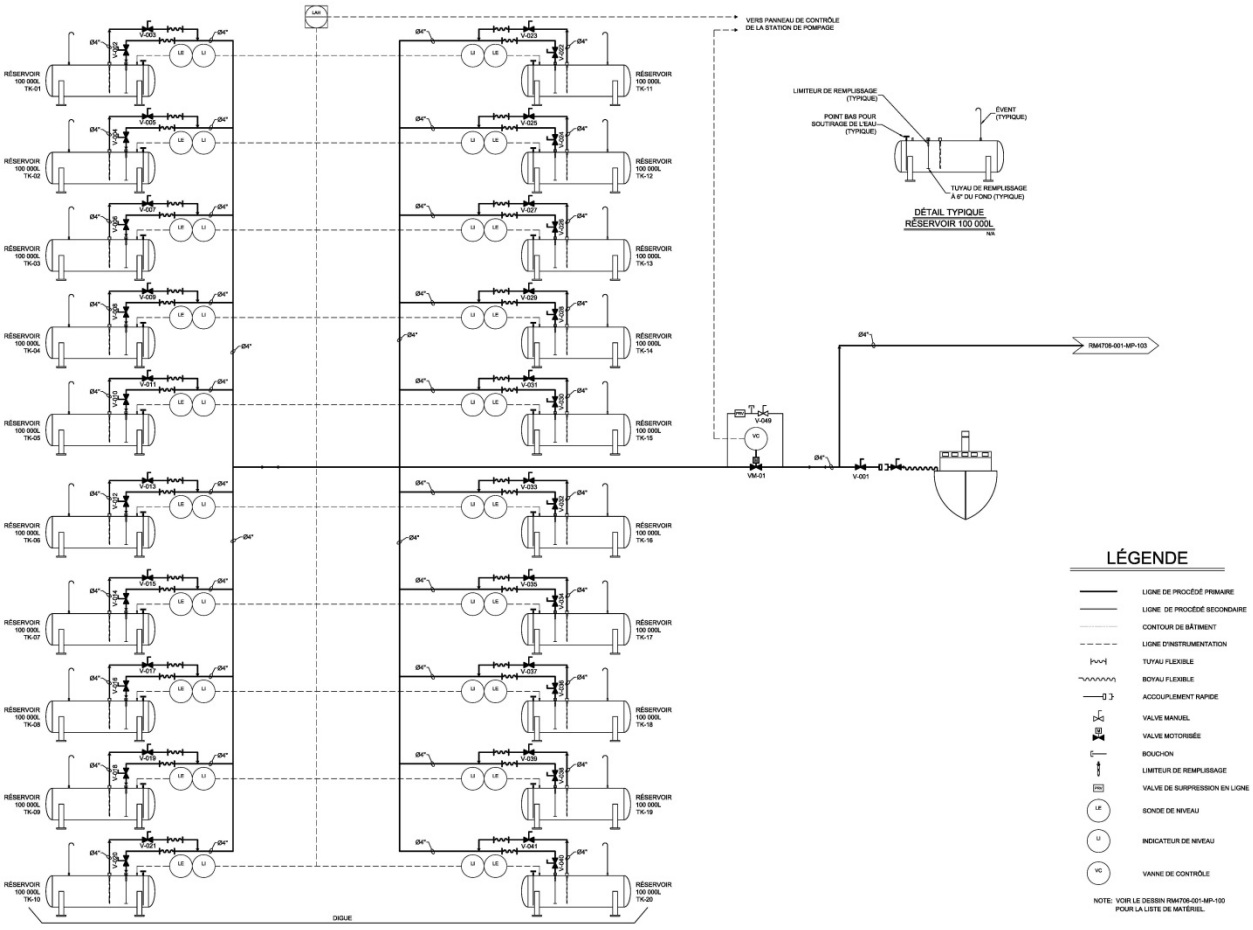


4.2.2 Jet-A Fuel

The Jet-A fuel tanks are contained within an impermeable lined and bermed area. The steel fuel tanks have been field-erected and built to API-650 standards with the bermed area holding twenty tanks. This area is capable of containing >110% of the volume of one 10,000 m^3 storage tank. Each impermeable lined and bermed cell has the following:

- A granular base for the tank complete with an impermeable 60 mil HDPE liner system and granular dikes;
- Twenty – 10,000 m^3 tanks complete with the required appurtenances such as stairs, base manholes, water draw offs, re-supply nozzle, suction nozzle, tank lighting, tank level monitoring, roof manhole, manual gauge hatch, tank temperature and P/V vent;
- Piping for unloading and loading; and

Figure 3 - Jet-A Tank Configuration



The Tank Farm Facility is designed to meet the following standards:

- National Fire Code 2010;

- *Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations* – 2008; and
- Canadian Council of Ministers of the Environment, "*Environmental Code of Practice of Aboveground and Underground Storage Tank Systems Containing Petroleum Products and Allied Petroleum Products – 2003* (PN1326)"

All Jet-A fuel is transported to the mine site by tanker trucks on a year round basis. Tanker trucks are loaded on the fuel dispensing pad at rates of approximately 50 m^3/hr. The facility has incorporated the following:

- Temperature compensated metering system to manage fuel flows;
- Safety valve to prevent loss of fuel from the fuel facility
- Fire extinguishers;
- Building heating, ventilation systems and lighting systems; and
- Control systems for the pumps.

All stamped engineer drawings for the Jet-A fuel storage construction can be found in Appendix F.

4.3 Baker Lake Shoreline and Marine Characteristics

4.3.1 Topography

The bulk fuel storage area is located east of the Hamlet of Baker Lake, approximately 350 m north of Baker Lake. The OHF sits on a low terrace parallel with the shoreline of the lake. There is a gradual slope (5 to 10% grade) toward Baker Lake with an approximate elevation change of 35 m from the OHF to the Baker Lake shoreline. The Baker Lake shoreline is gently sloping, well-drained and is lined with marine gravels, sands and boulders.

4.3.2 Geology

The regional surficial geology is characterized by sandy till, bedrock outcrops, felsenmeer (ice-shattered bedrock) and shallow lakes (Golder, 2007). The most common soil type in this region is glacial till. Marine beach deposits are found along the north shore of Baker Lake.

The soil near the bulk fuel storage facility is comprised of silts, sands, gravels, cobble and boulders and frost-susceptible glacial till overlying weathered bedrock (Golder, 2007). The soil thickness is typically less than 1.4 m with permafrost or bedrock encountered at less than 2 m. Approximately 60% of the surface area surrounding the bulk fuel storage facility is comprised of bedrock outcrop.

4.3.3 Flora and Fauna

There are no trees and few shrubs in the area surrounding the bulk fuel storage facility. The site is covered by low-lying vegetation; predominated by grassy hummocks, dwarf willow, sedge, green moss and lichen.

Arctic ground squirrels, ptarmigan and songbirds are inhabitants in the area surrounding the bulk fuel storage facility. Lake cisco, lake trout, arctic char, lake whitefish, round whitefish, slimy sculpin and stickleback are predominant species found in Baker Lake.

4.3.4 Subsurface Conditions

Test pits excavated in 2005 near the Bulk Fuel Storage Facility and between the tanks and the shoreline indicate a saturated top layer (0.2 m) of organic material (primarily green moss) (Golder, 2005; 2007). A layer of grey to black medium sand is present up to 0.7 m thickness throughout the area, below which a saturated, grey brown, sand and silt layer is found.

Bedrock is exposed at shallow depths throughout the site in locations where topsoil or till soils are present (Golder, 2005). Bedrock is encountered at a maximum depth of 1.4 m. As predicted by the soil conditions, seepage flows in test pits indicate high site drainage (*Baker Lake Bulk Fuel Storage Facility Environmental Performance Monitoring Plan Version 2; December 2011*).

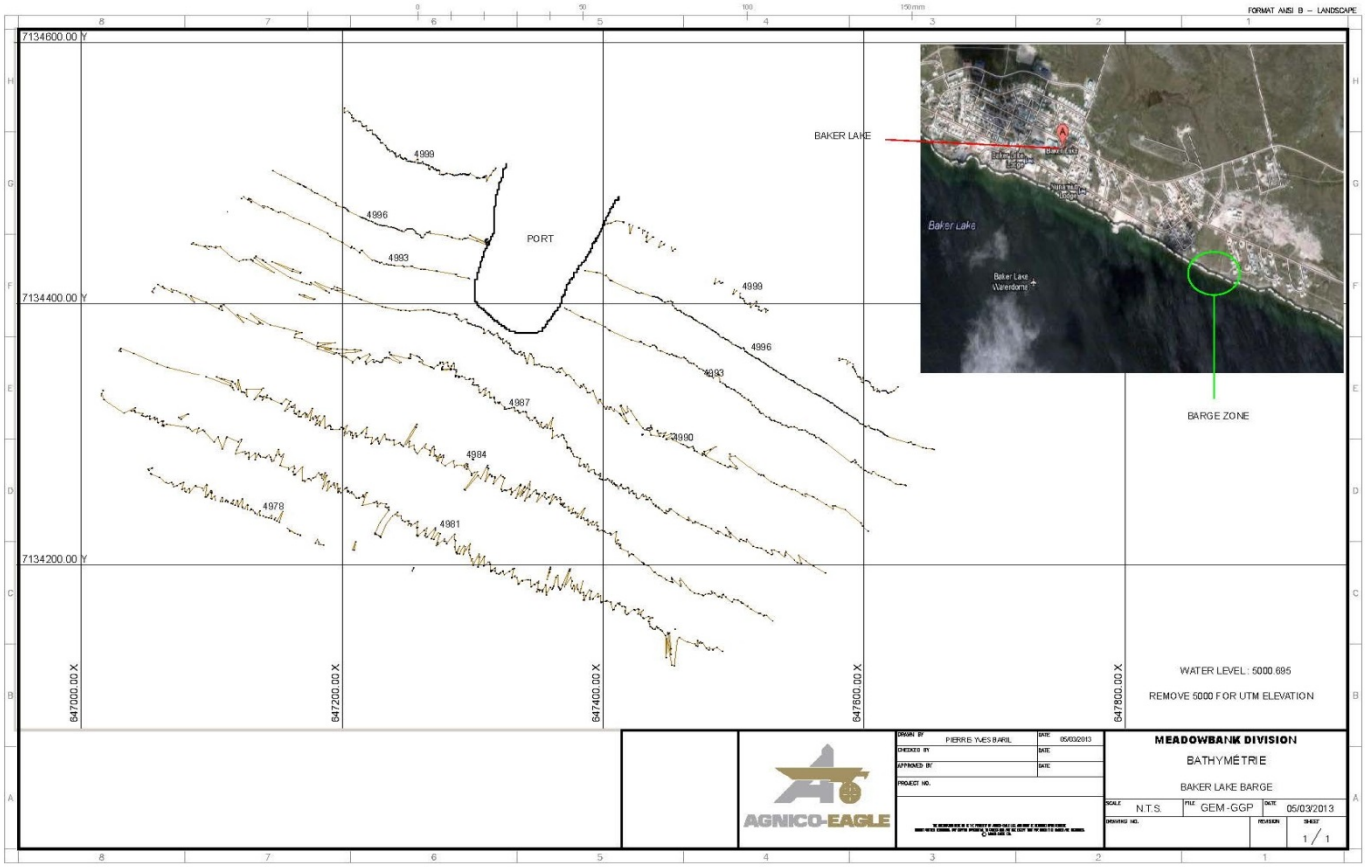
4.3.5 Water Quality

Baker Lake water quality closely resembles distilled water as many conventional water chemistry parameters are at or below detection limits (BAER, 2005). The water column is generally well mixed and the water chemistry homogenous. During the open water season there is limited vertical stratification in temperature and dissolved oxygen, with observed higher salinity in the bottom strata.

4.3.6 Bathymetric Data

As required by Water License 2AM-MEA0815 Schedule B, Item 4: *A bathymetric survey(s) conducted prior to each year of shipping at the Baker Lake Marshaling Facility*. Figure 4 is a copy of the 2012 bathymetric survey.

Figure 4 - 2012 Bathymetric Survey



4.3.7 Tides and Currents that Prevail at the Facility

There is a general southward current in Hudson Bay at Chesterfield Inlet of about 19 km/day (CCG 2008). Tides are 4.6 metres with strong cross-currents at Chesterfield Inlet; usually flowing south-west at about 1.85 km/hr.

4.3.8 Meteorological Conditions Prevailing at the Facility

Monthly meteorological data has been collected from 1971 to 2000 from the Baker Lake "A" climate station, which is a Meteorological Service of Canada climate station. Snow and rain are combined to give monthly average precipitation. The prevailing winds for the area are generally from the north to north-west and average 20.4 km/hr.

In Table 3 below the meteorological records for the entire year is presented, even though AEM will only receive fuel during the open water season – July to October. It is foreseen, that there will not be any shipping requiring ice breaking nor will any ships or barges holding fuel be left to freeze in over the winter.

Table 3 - Summary of Baker Lake Meteorological Data

Month	Baker Lake A Climate Station (1971 to 2000)				
	Monthly Means Air Temperature (°C)	Precipitation (mm)	Mean Monthly Relative Humidity [%]	Average Wind Speed (km/h)	Most Frequent Direction (8 point compass)
January	-32.3	7.5	65.3	23.7	NW
February	-31.5	7.2	64.5	22.9	NW
March	-27.2	10.5	65.3	21.6	NW
April	-17.4	13.6	72.9	20.5	NW
May	-5.8	15.6	82.0	19.4	NW
June	4.9	24.1	74.8	16.5	E
July	11.4	41.8	69.5	16.6	N
August	9.5	47.0	75.5	17.7	NW
September	2.6	44.1	80.9	19.4	NW
October	-7.5	32.1	83.0	21.8	NW
November	-20.1	17.0	72.5	22.3	NW
December	-28.4	10.2	66.7	22.7	NW
Annual Average/Total	-11.8	270.4	72.8	20.4	NW

5. SITE ACTIVITIES

5.1 Nature of the Oil Product

The main fuel stored at the AEM's Baker Lake Fuel Farm will be P50 diesel and Jet-A. All other fuels such as gasoline and possibly other grades of diesel will be purchased in drums and brought to the mine site for storage into the Meadowbank Fuel Storage Facility, or purchased and brought to site from a contractor in Baker Lake.

Coastal Shipping Limited, a division of the Woodward's Group of Companies, is contracted by AEM to supply and deliver diesel fuel and Jet-A to AEM's facilities in Baker Lake. The tanker picking up the fuel will be double hulled, Motor Tank type ship, will have segregated ballast compartments and would be able to carry up to 20,000 m^3 of diesel or Jet-A fuel. Ballast will not be required during the inward voyage to Baker Lake. However, ballast will be picked up while on anchor outside the access passage after offloading the diesel and Jet-A fuel for its outward journey. A total of three (3) tanker loads of fuel will be required to fill the six diesel tanks in the tank farm, cumulatively holding 60,000 m^3.

5.2 Route

The diesel and Jet-A fuel pick-up point is most likely being an east coast refinery (east coast of North America). Figure 5 depicts the marine transport of fuel to Baker Lake and is comprised of four main segments:

- From an east coast refinery along the coast of Labrador to the Hudson Strait;
- Through Hudson Strait to Hudson Bay;
- Across Hudson Bay to Chesterfield inlet; and
- From Chesterfield inlet to Helicopter Island, to an anchoring point outside the access passage to Baker Lake (see Figure 6).

Figure 5 - Fuel Barge Route

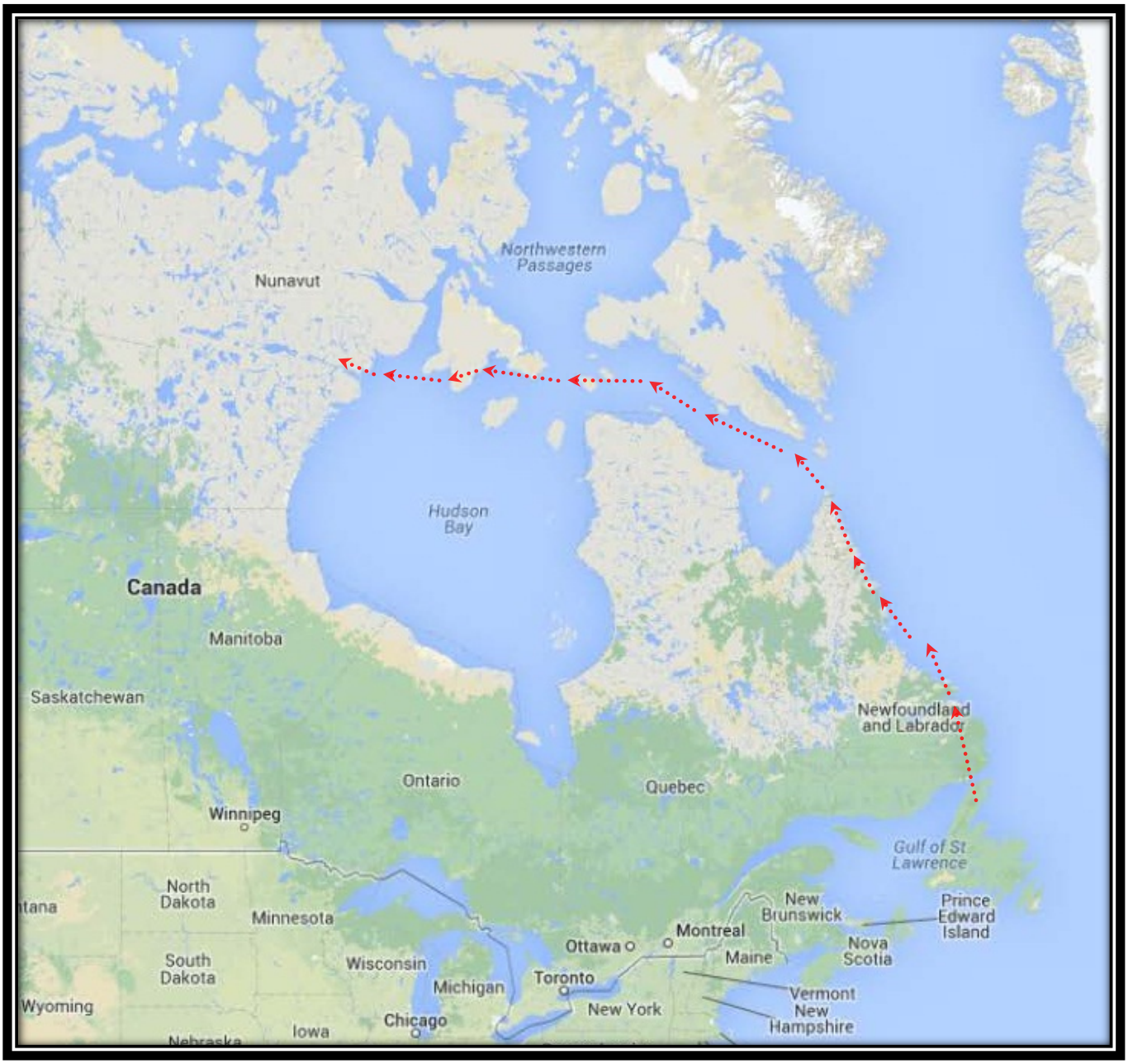
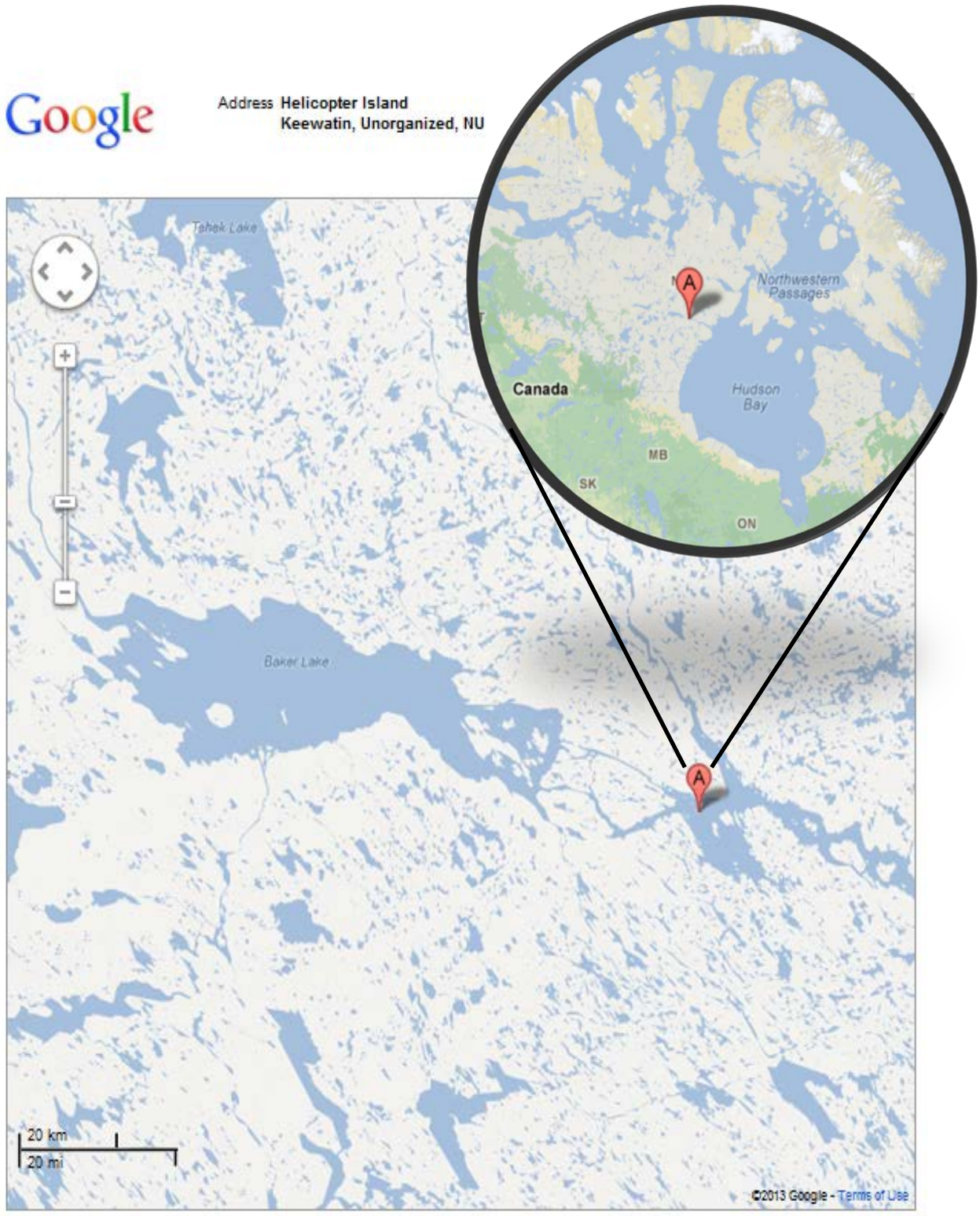


Figure 6 - Location of Helicopter Island



5.3 Bulk Transfer

It is expected that the large tankers delivering diesel fuel and Jet-A will anchor in the same general location as the dry cargo vessels shown on Figure 6. Ship-to-ship transfer of fuel will occur at this location from the larger tanker to a smaller tanker that can navigate the access passage. The carrying capacity of the small tanker will be either 7,300 m^3 or 10,500 m^3. The Ship to be used at any one time will be subject to its availability at the time when the large fuel tanker is set to deliver fuel to AEM's Baker Lake Fuel Farm Facility. The small tanker will anchor directly to AEM's spud barge. From there, transfer hoses are connected to a shore based pipeline for transfer of fuel to the tank farm.

Ballast will not be required for the inward voyage of the small tanker as it arrives at Baker Lake loaded with diesel fuel and Jet-A. After transferring the diesel fuel or Jet-A fuel to the tank farm, the small tanker will take on ballast in its segregated ballast compartments before sailing out to Helicopter Island to pick up another load of fuel from the large tanker anchored outside the access passage. Ballast will be dispelled as ship-to-ship transfer of diesel or Jet-A occurs and the small tanker is loaded. This sequence of events will be repeated until the large tanker is empty or the tank farm is full.

Due consideration will be given to prevailing and expected wind, weather and tide conditions when undertaking ship-to-ship and ship-to-shore fuel transfers. The large tanker anchored near Helicopter Island and the small tanker anchored near Baker Lake will be clear of land and traffic routes, and in open water of a depth exceeding the draught of the vessel(s). For ship-to-ship transfers, the ships will be secured alongside or anchored.

The small tanker will discharge at a rate of 400 m^3/hr with a 10,000 m^3 tank taking approximately a day to fill. Communications between the shore and the small tanker will be maintained throughout to ensure the safe transfer of the fuels and to avoid the overfilling of the tanks. The ship-to-shore transfer to be used will be similar to that used at communities throughout Nunavut.

5.4 Measures to Minimize a Diesel and Jet-A Pollution Incident

The small tanker will be anchored offshore in water of sufficient depth to allow for draught and tidal changes during transfer.

The transfer of the fuels will use sound, well-rehearsed practices, include an adequate number of trained and alert personnel, have sufficient materials, and use well maintained, thoroughly tested equipment. A team of trained personnel on the tanker will be in charge of the tanker fuel transfer equipment while an onshore team will be in charge of the land based transfer equipment. Fire-fighting, spill response equipment and supplies will be located on the tanker and onshore near to the transfer point as required by Transport Canada. This will include readily available absorbent material at the flexible hose connections on deck and onshore to quickly address minor spills at predictable minor spill locations. Additionally, AEM has placed a sea can with spill response supplies (including boat) and equipment at AEM's Baker Lake Fuel Farm area where it can quickly be accessed in the event of a spill.

Four-inch (10 cm) steel piping able to accommodate a flow rate of approximately 400 m^3/hr will lead down to the shore from the proposed diesel and Jet-A fuel tank farm. Transfer hoses from ship-to-shore will be connected to the fuel-receiving manifold located onshore using a dry-break coupling(s). All connection points will be protected with save-alls. Other measures to be taken to minimize and prevent spills include:

- During the transfer, constant monitoring will be undertaken for detection of incipient spills and leaks between the tanker and the tank farm;
- Transfer operations will be suspended should any leak be detected;
- The onshore area and ship deck will be well lit as fuel transfers could continue around the clock;
- Minimization of land drainage containing spilled diesel or Jet-A to limit the amount reaching the marine environment; and
- The regular update of the OHF Plan.

During the ship-to-shore transfer, AEM will have personnel on location at all times to monitor the fuel transfer and maintain contact with the tanker's crew. Should problems arise, the ship can be called to shut down the transfer and onshore piping will be closed down. In the event of a spill that escapes the containment boom, diversion booming will be deployed to minimize migration of a spill throughout Baker Lake. Adequate lighting will be put in place during all transfers, to allow for proper inspections of transfer locations around the clock.

Spills within the tank farm will be contained by the bermed, lined areas. Each bermed and lined area has sufficient storage to hold 110% of the largest tank. All fuel transfers from the tank farm to tanker trucks and small vehicles will occur on a pad that can contain any spilled product with the overflow being directed into the bermed area. Spilled fuels will not have the opportunity to migrate to the marine environment from this area.

6. MEADOWBANK RESPONSE TO EMERGENCIES

6.1 Levels of Emergency

For the purpose of this OPEP, and not to be confused with any levels mentioned in the ERP or SCP, the levels of emergency are stated below:

6.1.1 Level I (LOW)

A LOW emergency would be a spill that does not exceed 1 m^3 or 1000L and does not come into contact with water. A low level emergency can be addressed by the responsible party who created the spill. The Meadowbank environment department must be made aware of this and consulted for clean-up measures.

6.1.2 Level II (MEDIUM)

A MEDIUM emergency would be a spill to land in excess of 1 m^3 up to but not exceeding 5 m^3 (1000L;5000L). It would also be considered a level two spill if the product contacted water but did not exceed 200L. A medium level emergency would be involve activating the Emergency Response Team and would require management of the scene and clean up by the Incident commander, as it pertains to spill response. See AEM Spill Contingency Plan.

6.1.3 Level III (HIGH)

A HIGH emergency would be a spill to land in excess of 5 m^3, or a spill to water in excess of 200L. A high level emergency would trigger the OPEP and ERP to be put into place.

6.1.4 Level IV (EXTREME)

An EXTREME emergency would be a level four spill which is in excess of 50m3. A spill of this magnitude would be responded to in the same manner as a Level III emergency. An EXTREME level emergency would trigger the OPEP and ERP to be put into place.

6.2 Emergency Control Centre

For operations related to the Meadowbank Mine Site, as stated in the Emergency Response Plan Ver. 7, item 2.8: Emergency operations will be directed out of the Emergency Control Centre (ECC). The ECC is located in the 3rd floor of the service building conference room, or in the training room on the main floor, or in the security guard building by airstrip from where the following will take place:

- Key decisions will be made and operations will be managed;
- Technical information to direct emergency activities will be provided;
- A communications centre will be established for emergency operations and to communicate with other organizations;
- Resource procurement will be provided and resource use will be directed;
- Any damage will be assessed and long-range objectives and plans will be developed; and
- Information on the emergency will be stored and disseminated to all necessary internal and external parties.

The following information is available at the centre:

- Shutdown procedures for operations;
- Locations of hazardous material storage areas;
- Locations of emergency and safety equipment;
- Locations of first aid stations and muster areas;
- Maps of communities and environmental maps;
- Information on location of other communications equipment, including portable sets;
- Information on emergency power;
- Contacts for other utilities;
- Operating manuals;
- Materials Safety Data Sheets (MSDS);
- List of personnel with alternate skills for use in emergencies;
- Type and location of alarm systems;
- Accident report forms;
- Accident status board and log book; and
- Notification lists, staff lists, contact lists, with regular and emergency telephone/pages numbers, etc.

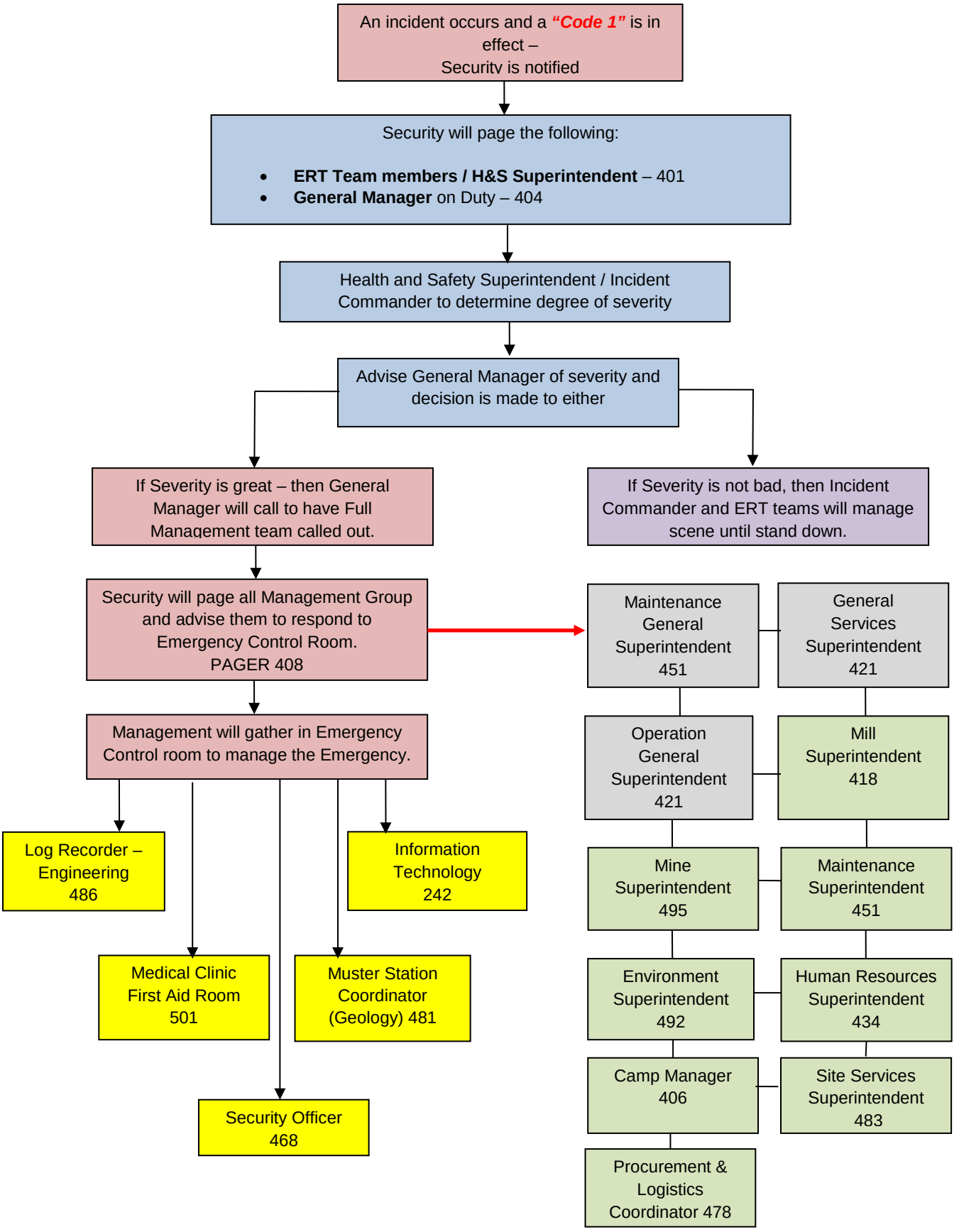
The Incident Command Center (ICC) will be located at a safe and secure place near the site of the emergency. All responses and mitigation efforts developed at the ECC will be implemented through the ICC.

In the event of an emergency, security personnel may be required to establish and maintain a security perimeter to prevent or minimize injury to personnel, to preserve evidence for investigation, or to prevent unauthorized access to the scene.

6.3 Response Management Structure

Figure 7 depicts the Response Management System.

Figure 7 - Response Management System



6.4 Emergency Response Team

AEM has an Emergency Response Team (ERT) at the Meadowbank Gold Mine trained and responsible for controlling the level 2 or greater spills as well as spills from tanker truck overturns along the municipal bypass road and AWPR, AEM's Baker Lake laydown and tank farm, and for assisting with medical and other emergencies that may occur at the camp. Team members will attend regular training.

6.5 Equipment and PPE

6.5.1 Emergency Response Equipment

The Emergency Measures Counsellor (EMC) will ensure that site drawings and equipment lists are posted conspicuously in key locations throughout the site so that important information is always readily available. This will include the following:

- Location and isolation points of energy sources;
- Location of emergency equipment (e.g., fire water pumps, fire extinguishers, monitors, self-contained breathing apparatus);
- Emergency procedures outlines, such as specialist firefighting, chemical neutralization;
- Location of equipment for combating pollution (e.g., booms, skimmers, pumps, absorbents, dispersants);
- Availability of internal and external emergency medical support (e.g., hospitals, clinics, ambulances, medical supplies, personnel with medical or first aid training);
- Location of toxicity testing facilities (e.g., gas and water);
- Location of wind direction / speed indicators;
- Directions on how to contact the local or regional weather forecasting service;
- Location of personal protective equipment and directions on its proper use; and
- Location of first aid stations and muster areas.

The Incident Commander, EMC, and Health and Safety Superintendent will know where, throughout the project site, all of this information is posted and where emergency equipment is stored. These individuals will also be trained in the proper use of emergency equipment.

External emergency response equipment includes the mobile emergency response equipment described in the SCP.

6.5.2 General Equipment

This section addresses the emergency response machinery, equipment, tools and other resources that will be made available on-site for spill counter measures.

6.5.2.1 Mobile Equipment

Mobile Equipment available to AEM, that will be used for spill contingency include:

- Graders
- Cranes
- Winch Trucks
- Pickup Trucks

- Snowmobiles
- Vacuum Truck
- Loaders
- Backhoe
- Bulldozer
- Forklift
- Water Trucks
- Excavators
- Generator Sets
- Fire Truck
- Aluminum Boats
- Fuel Trucks
- Bobcat
- Haul Trucks
- Snow Cat

If required, additional equipment on site will be made available to assist with spill recovery.

6.5.2.2 Containment System

Temporary containment systems are also available on site and include:

- Booms
- Drums
- Tanks
- Tailings Pond
- Spill absorbent material packages/pads
- Silt fencing
- Maritime Barrier

6.5.2.3 Emergency Transportation

Emergency transportation that will be used under an emergency situation are:

- Aircraft (fixed wing or helicopter)
- 4-wheel drive vehicles
- Snowmobiles
- Boats

6.5.3 Spill Response Kits and Containers

6.5.3.1 Kits

Spill response kits are strategically located where required. Each department and work area is responsible for providing sufficient spill response kits in their respective work areas. The kits are kept in marked and accessible locations. The locations include all fuel storage areas, chemical storage areas and so on.

All of the mobile equipment on site (including heavy equipment) contains an emergency spill kit.

6.5.3.2 Emergency Trailer

AEM also have an Environmental Emergency Trailer which is easily accessible and mobile. The trailer is located on site east of the Environmental Office. This trailer contains the following items:

- Pump Elastec
- Pump accessories

- Vaccum ends
- 45 gallons top
- Tubing 2 inches diameter
- Tubing 3 or 4 inches diameter
- Diesel Fuel jerry can (place on a miniberm)
- Spill kit accessory (red box)
- Drums opener
- Wescot (to open empty drum screw)
- Empty drums
- 2 drums berm
- 4 drums berm 4x8
- Tarp 20x30
- Tarp 30x50
- Oil white spill pads
- Universal boom 5x10
- Universal boom 8x10
- ABS pipe: 10' (4")
- ABS pipe: 10' (6")
- Cell U-Sorb
- Sphagsorb
- 3 Size of Wedge wood
- Plug pattie
- Quattrex bags
- Hand shovel
- Ice braker chisel
- Sledge hammer
- Rod bar (4')

6.5.3.3 AWPR Sea cans

Along the AWPR there are 9 environmental emergency sea cans. These sea cans are strategically placed along the road at water crossings. Each environmental emergency sea can contains the following material:

- Empty drums (Sealed)
- Mini berm 36"x36" x4'
- 4 drum spill berm 4x8
- Tarp 20'x30'
- Tarp 30'x50'
- Oil white spill pads
- Universal boom 5"x10' (Chemical)
- Universal boom 8"x10' (Chemical)
- Oil only booms 5"x10' (Hydro-carbons)
- Maritime barrier (Baffle)
- ABS pipe: 10' (4")
- Cell U-Sorb
- Amerisorb peat moss

- Oil gator absorbant
- Plug pattie
- Quattrex bags
- Fork lift crate (pallets)
- Long handle round point shovel
- Chisel point crow bar 16 lbs 57"
- Ice braker chisel
- Sledge hammer 12 lbs 36"
- Rod bar (4')

6.5.3.4 OHF Response Equipment

All equipment previously mention is available for use during an emergency situation but would take time to get to the spill site, time would vary depending on distance from the spill. All these equipment and resources can be deployed on scene within 6 hours for the recover and clean-up of the spill. The following equipment (Table 4) is available right at the OHF at any given time in a sea can designated for environmental emergency and can be deployed on scene within one hour after the discovery of the oil pollution incident to contain and control the spill:

Table 4 - Material available in the Spill Response Sea Can at AEM's OHF

Quantity	Equipment/tool name
3	Empty drums (sealed)
2	Mini Berm 36"x 36"
2	4 Drums Berm 4'x 8'
4	Tarp 20'x 30'
4	Tarp 30'x 50'
10	Oil Spill Absorbent Pads
5	Universal Absorbent Boom 5"x 10' (For Hydro-soluble Chemical)
5	Universal Absorbent Boom 8"x 10' (For Hydro-soluble Chemical)
5	Petroleum base Absorbent Boom 5"x 10' (for Petroleum product)
3	Maritime Barrier (Baffle)
5	ABS pipe: 10' long x 4" diameter
2	Cell-U-Sorb (Absorbent)
2	Amerisorb Peat moss (Absorbent)
2	Oil Gator Absorbent
1	Plug Patties
4	Quatrex bags
2	Fork Lift Crate
4	Hand Shovel
1	Cro Bar Chisel
1	Ice Breaker Chisel
1	Sledge hammer
15	Rod bar 4'
1	½ drum containment
1	16ft Boat with motor and gasoline jerry can (sea can #321225)

6.5.3.5 Canadian Coast Guard Sea Cans

There are 4 seacans located in the hamlet of Baker Lake that belong to the Canadian Coast Guard. The response equipment in these seacans could also be utilized at the discretion of the Canadian Coast Guard by contacting the number found in Table 9.

6.5.3.6 PPE

Personal Protective Equipment is stored in bulk quantities at the Meadowbank Warehouse. Quantities of each can be found on site using the JD Edwards system.

The following PPE (Table 5) will be found in the Emergency Trailer and also on sea can at the OHF:

Table 5 - PPE available at OHF

Quantity	Equipment/tool name
3	Rain gear -- Pants and Top (L & 2-XL)
3	Rubber boots (size 8,10,12)
6	Rubber gloves
3	Goggles
3	Tyvex suits (L & 2 XL)
3	Safety glasses
3	Leather gloves

6.6 Communication

The primary basis for communication will be the phone system; back-up communication will be available via satellite phone. For on-site communication, hand-held radios will be mandatory for all employees working or travelling in remote areas from the main camp. Cell phones can be used as an additional means of communication. Back-up power sources and replacement batteries for communications equipment will be available to provide continuous, uninterrupted operation either at fixed facilities or at emergency sites.

Key site personnel will be accessible at all times by either portable radios, radios in vehicles, or office radios. The Health Care Professional will carry a hand-held radio and will be available at all times. Security personnel will monitor the emergency channel twenty-four hours per day. Senior management personnel will rotate as “On-Call Managers” for after-hour emergencies. An accommodations list that highlights key personnel will be posted and updated as required.

Lists of employees trained in first aid, mine rescue, and emergency response will also be posted. Employees and contractors who will be on site for extended periods will be trained initially and then retrained annually. This training will include the locations and use of emergency equipment, terminology used, and who needs to be contacted immediately in the event of an emergency.

In the event of a major emergency all external communications for the mine site and associated areas will be cut and all external contact will take place solely through the ECC.

6.6.1 Communication with the Public

Communication with public bodies during the state of emergency will be the responsibility of the General Mine Manager or by the Communications & Public Affairs Corporate Director.

In the case that the communities of Baker Lake should need to be evacuated on short notice, the Emergency Response Team will immediately assist in the evacuation of the community. The General Mine Manager will immediately contact the Mayor of the Hamlet to inform regarding the situation. In addition, if safe to do so, a radio notification should be immediately broadcast on the Baker Lake Radio station.

6.6.2 Hand Held Radio Communication

The channels used for hand held radio communication on the Meadowbank mine site and associated facilities are as follows in Table 6:

Table 6 - AEM Radio channels

Mine	Surface
1. Vault Eng / Geo	1. Spare RPTR
2. Vault Maintenance	2. Mill Simplex
3. Portage Eng / Geo	3. Mill Repeater
4. Portage Maintenance	4. Exploration
5. Goose Eng /Geo	5. Simplex 5
6. Goose Maintenance	6. Baker Lake
7. AEM Surface	7. Project
8. FGL	8. Auto-Patch
9. Mill / Crusher	9. AEM Surface
10. MB Dykes	10. MB Dykes
11. Goose Operation	11. Goose Operation
12. Goose Drill / Blast	12. Portage Operation
13. Portage Operation	13. Vault Operation
14. Portage Drill / Blast	14. RD MB
15. Vault Operation	15. RD KM37
16. Vault Drill / Blast	16. RD Baker

The colors in each zone represents that they are 'linked' together. For instance, on the Mine Zone, the Goose Operation, Portage Operation and Vault Operation are plugged in a way that 3 persons talking on those 3 channels separately will hear each other as if they were on the same channel.

6.6.3 Coastal Shipping

In Appendix B you will find the 2013 contact information for Coastal Shipping during the barge season. This will be updated by Coastal Shipping and Provided to AEM on an annual basis.

6.6.4 Contacts

Internal contact information is contained in Table 7 for all AEM personnel involved in spill recovery. Table 8 contains contact information for contractor contacts which can be called for assistance with spill recovery. Table 9 is a list of government officials and external contacts to notify and provide subsequent reporting.

Table 7 - AEM Contact

Title	Name	Telephone No.
Vice President, Environment and Sustainable Development	Louise Grondin	(416) 847-8656 Cell: (819) 724-2020
Corporate Director, Communications & Public Affairs	Dale Coffin	(416) 847-8669 Cell: (647) 274.4154
Manager of Regulatory Affairs Nunavut	Stephane Robert	(819) 759-3700 ext. 5188 Cell: (819) 763-0229
General Mine Manager	Jean Beliveau	(867) 793-4610 ext. 6843 Cell: (416) 315-6745
Assistant General Mine Manager	Alexandre Proulx	(867) 793-4610 ext. 6915 Cell: (819) 860-6389
H&S Superintendent or H&S Ass. Superintendent	Normand Ladouceur or Yves Levesque	(867) 793-4610 ext. 6720
Emergency Response Counselors	André Rouleau/Philip Beaudoin	(867) 793-4610 ext.6809
Environmental Superintendent	Kevin Buck	(867) 793-4610 ext. 6838
Environmental Coordinator or Environmental Department	Jeffrey Pratt or Environmental Technicians	(867) 793-4610 ext. 6728 Or (867) 793-4610 ext. 6747
Incident Commander	Jeffrey Pratt/Kevin Buck	(867) 793-4610 ext. 6728 (867) 793-4610 ext. 6838
On site Medics	On-site Nurses	(867) 793-4610 ext. 6734
Site Security	On-site Security	(867) 793-4610 ext. 6748

Table 8 - Contractor Contacts

Title	Telephone No.
Nolinor Aviation Services	Protocol Agent (867) 793-4610 ext. 6808
First Air	(867) 446-1744
Calm Air	(867) 793-2873
Dyno Nobel Explosives Ltd.	(867) 793-4610 ext. 6804
Woodward Group of Companies (Shipping)	(709) 896-2421 or (709) 896-6569
Baker Lake Contracting & Supplies	(867) 793-2831
Peter's Expediting	(867) 793-2703
NWT ltd. (Arctic Fuel)	(867) 793-2311

Table 9 - External Contacts

Organization/Authority	Telephone Number	Fax Number
NT-NU 24-Hour Spill Report Line	(867) 920-8130 spills@gov.nt.ca	(867) 873-6924
Workers Safety and Compensation Commission	(867) 979-8637	(867) 979-8501
Kivalliq Inuit Association	(867) 645-5725	(867) 645-2348
Nunavut Water Board	(867) 360-6338	(867) 360-6369
AANDC Inspector	(867) 975-4548	(867) 979-6445
Environment Canada, Enforcement Branch	(867) 975-4644	(867) 975-4594
Department of Fisheries and Ocean (DFO) – Nunavut Regional Office	(867) 979-8000	(867) 979-8039
Manager, Environmental Protection, Government of Nunavut	(867) 975-7748	(867) 975-5981
Kivalliq Health Services – Baker Lake	(867) 793-2816	(867) 793-2813
Baker Lake Hamlet Office	(867) 793-2874	
Baker Lake Fire Emergency	(867) 793-2900	
RCMP Regular Hour RCMP 24 Hour Emergency Number	(867) 793-0123 (867) 793-1111	
Canadian Coast Guard (in the event of a spill to the marine environment)	(800) 265-0237	(519) 337-2498

7. ROLES AND RESPONSIBILITIES

7.1.1 First Responder

The person who has caused a spill or is the first to observe the spill is the first responder.

The responsibilities of the First Responder are as follows:

- In case of a tanker truck overturn, initiate a Code 1. Remain on radio to provide guidance to the ERT;
- In case of spill to land, ice or water, contact the supervisor to report the incident;
- Identify and contain the spill, IF SAFE TO DO SO; and
- Participate in spill response as a member of the clean-up crew.

7.1.2 Supervisor

The responsibilities of the Supervisor are as follows:

- Initial assessment of the severity of the incident;
- Contact the Incident Commander; if Level I contact Environment Department;
- Gather facts about the spill; and
- Participate in spill response as a member of the clean-up crew.

7.2 Roles & Responsibilities of the Emergency Control Group

Below are the roles and responsibilities of the Emergency control group. Duty cards for these positions can be found in Appendix G. These duty cards are to be used in the ECC to organize what each person's roles and responsibilities are that they must carry out.

7.2.1 Official In-Charge

The Official In-Charge (General Manager or designate) will take charge for overseeing and approving the overall emergency strategy.

Immediate duties of the Official In-Charge include:

- Consult with the Incident Commander the status of emergency;
- Appoint an Emergency Log Recorder to maintain a written record of the time and events, including all discussions, instructions and decisions made by the Emergency Control Team;
- Appoint a Muster Station Coordinator, who will ensure that proper head counts are conducted at three (3) designated Muster Stations;
- Issues specific tasks to the members of the Management as they arrive at the Control Room, as per this guideline;

- Brief the Emergency Control Team;

- Ensure that the safety of personnel is maintained, throughout the operation;

- Ensure procedures are in place for prompt dispatch of requested personnel, materials and equipment to the emergency area;

- Arrange for all reports to be presented at specific intervals to the Emergency Control Team;

- Finalize the recommendations of the Incident Commander for rescue and recovery operations;

- The Official In-Charge is the only person authorized to release information to Government Agencies, Corporate Office or the Local Communities. He may delegate this activity to other members of the Emergency Control Team;

    - Verify all information you release;
    - Keep a record of all inquiries (media and non-media);
    - Do not speculate on causes;
    - Do not speculate on resumption of normal operations or when the problem will be solved; and
    - Advise that further updates will be forth coming.

- Notify the corporate management, if the following appear probable:

    - Fatalities;
    - Injuries that could probably become items of local, regional or national media interest;
    - There is a public health or environmental risk;
    - An incident involving chemicals where there is a large volume or the potential for over reaction (e.g., cyanide);
    - A spill of effluent or contaminated water or chemical substance to an area that lies outside the area of drainage control of the mine site (i.e., an external spill);
    - Mine operations may be stopped for more than two (2) days; and
    - Government authorities will become involved.

- Ensure all response teams, regulatory agencies and any other agency on emergency alert notice are advised when the emergency has ended;

- Ensure all documentation (i.e., notes, log sheets, written instructions, etc.) is gathered for the creation of the final report; and

- Participate in debriefing.

7.2.2 General Superintendents

- General Services, Operations and Maintenance will report to the Emergency Control Room and support the General manager/Designate in whatever capacity required;

- They will also ensure that the Superintendent/Designate in each of their respective Department's is aware of the emergency; and

- They will assist with the investigation and write up of the final report.

7.2.3 Incident Commander: A Trained Staff Member (ERT Coordinators or Supt.)

The responsibilities of the Incident Commander include:

- Ensure Security has been notified of emergency;

- Ensure the evacuation procedures have been activated, if required;

- Ensure that there are sufficient ERT members available to respond to the emergency;

- Ensure that the ERT has back-up support, a standby Team;

- Ensure that ERT Team has refreshments and nourishment (if the emergency requires several hours to resolve);

- Assess the size and severity of the emergency and the likely consequences. Establish response priorities; as well coordinate prevention of fire or explosion

- Maintain communication with the ERT Captain;

- Advise the Official In-Charge of the ERT Team's activities, regarding the rescue and recovery operations;

- Appoint sufficient personnel, equipment and outside services are available. Utilize the members of the Emergency Control Team to organize these resources;

- Advise Official In-Charge when the emergency situation is under control and give the "All Clear";

- Participate in emergency investigation;

- Coordinate an orderly return to normal operating conditions;

- Arrange for a debriefing session, and utilize the services of all involved in resolving the emergency; and

- Assist to write the final report.

7.2.4 Emergency Log Recorder / Muster Station Coordinator

"Keep a systematic record of the emergency events" and get an accurate "Head Count during Emergencies".

- These persons can be the Geology/ Engineering Supt/Designate/ General Supt. (whoever is available to perform these duties); and

- The log is intended to be a systematic record of the events from the start of the emergency through all phases to termination, and will be used in the preparation of the final report. It is important that the log be legible and that all information is recorded.

7.2.4.1 Emergency Log Recorder

"Keep a systematic record of the emergency events, phone calls and directives".

- Date and time the incident was reported, who reported the event;

- Record all subsequent developments as they occur;

- Record all phone calls all discussions and decisions made;

- Record any other information that needs to be captured for the final report;

- Keep all the sheets of paper used to record information numbered, for the final report;

- All the pages will be initialed by the recorder and official in-charge; and

- The official document will stay with the Health & Safety Department upon completion of the emergency.

7.2.4.2 Muster Station Coordinator

"Provide a Head Count during Emergencies"

- As soon as Management begins to assemble in the Emergency Control Room , the Person In Charge (the manager/designate) needs to assign a member of the Management Team to be responsible for ensuring that the Muster Stations are contacted;

- The Muster Station Coordinator is required to contact the three Muster Stations by telephone, to ensure that there is a Supervisor is in charge of that specific muster station and give him/her 20 minutes to achieve the head count;

- The Muster Station Coordinator will need to record the time the muster station was called, who is in-charge of the muster station, and any other instructions that have been given; and

- The Muster Station Coordinator needs to open the Flo on his/her laptop in order to cross reference the names, once they receive the lists from the Muster Stations (additional persons may need to be assigned to assist with the cross reference, in order to complete the head count in a timely manner).

7.2.5 Emergency Response Team (ERT Team) Duties:

- The ERT Team Members must report to the Fire Hall, when paged for a "Code One" emergency;

- ERT Team Members will be given instructions on the emergency by the Incident Commander;
- ERT Team Members will follow instructions from the Incident Commander and will not put the Team at risk; and
- The ERT Team Captain will maintain radio contact with the Incident Commander throughout the emergency.

7.2.6 Mine Superintendent/Designate Duties;

- Ensure that all employees working, are accounted for;
- Ensure that the ERT Members of his crew have responded to the “Code One” emergency;
- If the “Emergency” is in the Pit, them assist the Official-in-Charge with the action plan to deal with the emergency;
- Assist as required by supplying equipment and/or manpower; and
- Assist with restoring of the Operations back to normal operating standards.

7.2.7 Mill Superintendent/Designate Duties;

- Ensure all employees working, at this time, are accounted for;
- Ensure that the ERT Members on his crew, have responded to the “ Code One” emergency;
- If the “ Emergency” is in the Mill facilities, assist the Official-in-Charge with the action plan to deal with the emergency;
- Assist as required by supplying equipment and/or manpower; and
- Assist with restoring of the Operations back to normal operating standards.

7.2.8 Environmental Superintendent/Designate Duties:

The following are the responsibilities of the Environmental Superintendent/Designate;

- Provide technical advice on probable environmental effects resulting from a spill and how to minimize them;
- Provide advice to the Official-in-Charge for appropriate spill response procedures;
- Ensure that Environmental Staff are available to direct the spill response action plan; and
- Assist with restoring of the Operations back to normal operating standards.

7.2.9 Health and Safety Superintendent/Designate Duties:

The Health and Safety Superintendent/Designate will be responsible for:

- Ensure that an Incident Commander is in place to oversee the ERT Teams;
- Ensure that all Management respond to the emergency and meet in the emergency control room;
- Oversee all activities that require Security or Nursing and arrange for Medevac transport, if required;
- Assist with getting a “head count” for the Official in-charge; and
- Assist with obtaining outside help if required.

7.2.10 Site Services Superintendent/Designate Duties:

The following are the responsibilities of the Site Services Superintendent/Designate;

- Ensure that all his employees are accounted for;
- Ensure that all ERT Member on his Crew, respond to the “ Code One” emergency;
- If the “ Emergency” is involves the site facilities, assist the Official-in-Charge with the action plan to deal with the emergency;
- Assist as required by supplying equipment and/or manpower; and
- Assist with restoring of the Operations back to normal operating standards.

7.2.11 Maintenance Superintendent/Designate:

The following are the responsibilities of the Maintenance Superintendent/Designate:

- Ensure that all of his employees are accounted for;
- Ensure that all ERT Members of his crew respond to the “Code One” emergency;
- If the “Emergency” is in the Maintenance Shops, then assist the Official-in-Charge with the action plan to deal with the emergency;
- Assist as required by supplying equipment and/or manpower; and
- Assist with restoring of the Operations back to normal operating standards.

7.2.12 Human Resources Superintendent/Designate Duties:

The following are the responsibilities of the Human Resources (HR) Superintendent/Designate;

- Ensure that all HR employees are accounted for; and

- Provide assistance to the Official-in-Charge if there are employees issues, such as injuries, transportation requirements, etc.

7.2.13 Health Care Professional (Nurse/Medic):

The on-site health professionals are responsible for the following:

- Providing on-site first aid and other medical support;
- Establish a triage location if there are multiple casualties;
- Arrange for medevac transportation, if required; and
- Ensuring that the first aid room is maintained at all times, by using First Responders as support.

7.2.14 Security Department:

The on-site Security Supervisor is responsible for the following:

- Ensuring that the Security officer has activated the appropriate level of emergency notification;
- Ensure that access points to the emergency are properly guarded;
- Notify the Baker Lake Gatehouse if the emergency involves the all-weather private road (AWPR); and
- Assist with other duties as requested by the Emergency Control Group.

7.3 Debriefing

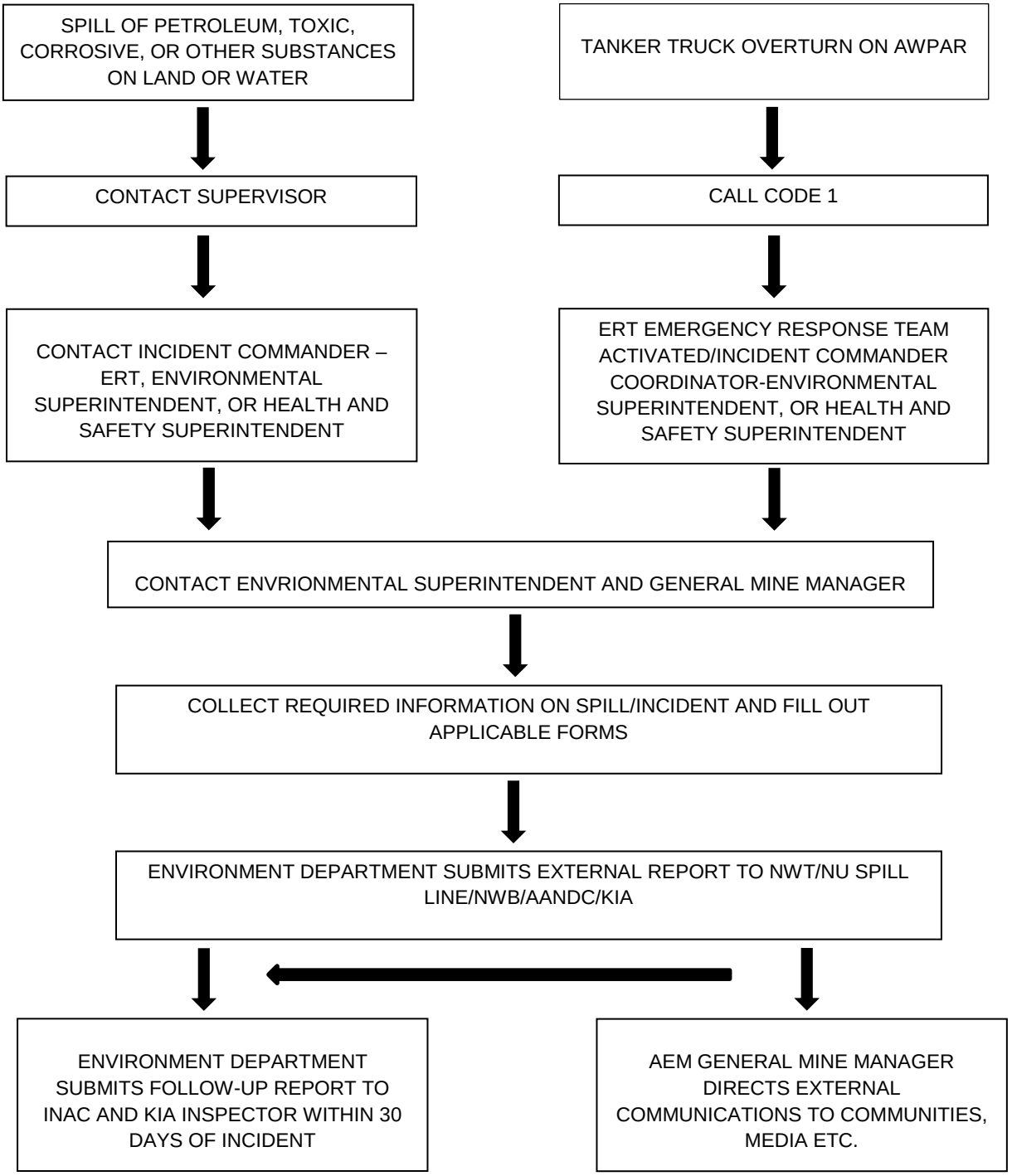
After an incident has taken place and the location is brought back to normal operating standards a debriefing session will occur between ECG, Field Supervisors for the incident, ERT Captain(s), and the supervisor of the department involved with the spill.

The point of this debriefing session to determine the *who, what, where, when, why, and how* the incident occurred. It will also be the time to reflect on the steps that were taken to carry out the response and to determine what was done right and what corrective measures need to be put in place to better the response if needed in the future.

8. GENERAL SPILL PROCEDURES

AEM's Fuel Handling Facility is located 110 kilometres by road from the Meadowbank Mine site. A single AEM Emergency Response Team will be available to respond to all spill incidents, the proposed spill response sequence is schematically shown in Figure 8.

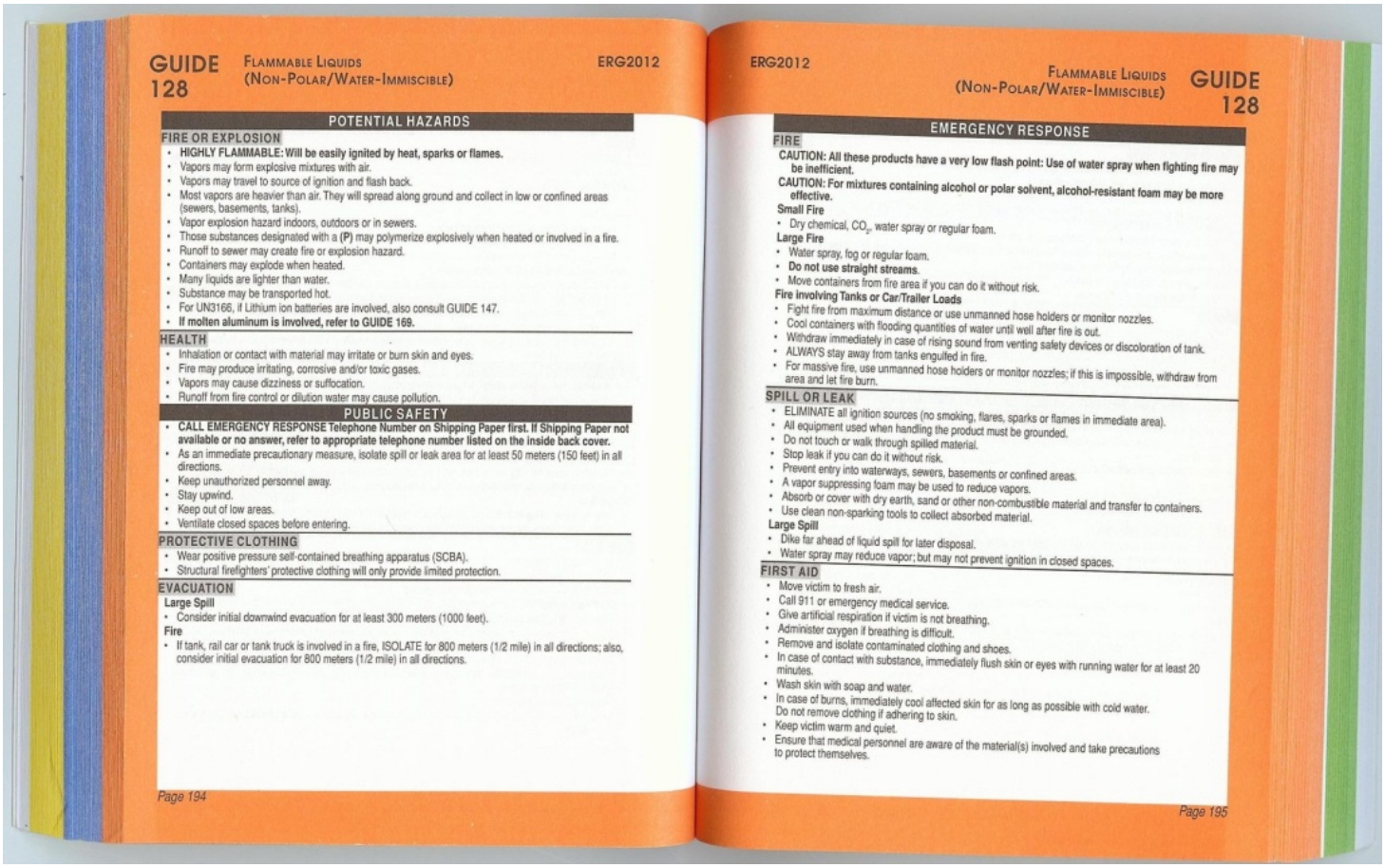
Figure 8 - Spill/Incident Reporting Procedure Sequence



Spill response procedures found in the Spill Contingency Plan and in the Oil Handling Facility Plan are one and the same. In this OPEP, the procedures have nonetheless been abridged to only address spills of diesel fuel and Jet-A at AEM's Baker Lake Fuel Farm Facility.

Prior to any response taking place the 2012 Emergency Response Guidebook should be consulted. Both items are under Guide #128. Diesel fuel is ID# 1202 and Jet-A fuel is listed under Kerosene with ID# 1223. Figure 9 is a scan of the Guide #128 information for emergency response.

Figure 9 – Emergency Response Guidebook: Guide #128



GUIDE 128 FLAMMABLE LIQUIDS (NON-POLAR/WATER-IMMISCIBLE) ERG2012

POTENTIAL HAZARDS

FIRE OR EXPLOSION
- **HIGHLY FLAMMABLE: Will be easily ignited by heat, sparks or flames.**
- Vapors may form explosive mixtures with air.
- Vapors may travel to source of ignition and flash back.
- Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks).
- Vapor explosion hazard indoors, outdoors or in sewers.
- Those substances designated with a **(P)** may polymerize explosively when heated or involved in a fire.
- Runoff to sewer may create fire or explosion hazard.
- Containers may explode when heated.
- Many liquids are lighter than water.
- Substance may be transported hot.
- For UN3166, if Lithium ion batteries are involved, also consult GUIDE 147.
- **If molten aluminum is involved, refer to GUIDE 169.**

HEALTH
- Inhalation or contact with material may irritate or burn skin and eyes.
- Fire may produce irritating, corrosive and/or toxic gases.
- Vapors may cause dizziness or suffocation.
- Runoff from fire control or dilution water may cause pollution.

PUBLIC SAFETY
- **CALL EMERGENCY RESPONSE Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.**
- As an immediate precautionary measure, isolate spill or leak area for at least 50 meters (150 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.
- Keep out of low areas.
- Ventilate closed spaces before entering.

PROTECTIVE CLOTHING
- Wear positive pressure self-contained breathing apparatus (SCBA).
- Structural firefighters' protective clothing will only provide limited protection.

EVACUATION

Large Spill
- Consider initial downwind evacuation for at least 300 meters (1000 feet).

Fire
- If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions.

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ERG2012 FLAMMABLE LIQUIDS (NON-POLAR/WATER-IMMISCIBLE) GUIDE 128

EMERGENCY RESPONSE

FIRE

CAUTION: All these products have a very low flash point: Use of water spray when fighting fire may be inefficient.

CAUTION: For mixtures containing alcohol or polar solvent, alcohol-resistant foam may be more effective.

Small Fire
- Dry chemical, CO_2, water spray or regular foam.

Large Fire
- Water spray, fog or regular foam.
- **Do not use straight streams.**
- Move containers from fire area if you can do it without risk.

Fire involving Tanks or Car/Trailer Loads
- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Cool containers with flooding quantities of water until well after fire is out.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- ALWAYS stay away from tanks engulfed in fire.
- For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

SPILL OR LEAK
- ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area).
- All equipment used when handling the product must be grounded.
- Do not touch or walk through spilled material.
- Stop leak if you can do it without risk.
- Prevent entry into waterways, sewers, basements or confined areas.
- A vapor suppressing foam may be used to reduce vapors.
- Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers.
- Use clean non-sparking tools to collect absorbed material.

Large Spill
- Dike far ahead of liquid spill for later disposal.
- Water spray may reduce vapor; but may not prevent ignition in closed spaces.

FIRST AID
- Move victim to fresh air.
- Call 911 or emergency medical service.
- Give artificial respiration if victim is not breathing.
- Administer oxygen if breathing is difficult.
- Remove and isolate contaminated clothing and shoes.
- In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
- Wash skin with soap and water.
- In case of burns, immediately cool affected skin for as long as possible with cold water. Do not remove clothing if adhering to skin.
- Keep victim warm and quiet.
- Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.

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INITIAL SPILL RESPONSE PRIORITIES

SAFETY FIRST

1. RESPOND QUICKLY

a. Identify the spilled material.
b. Ensure safety of yourself and others.
c. Shut off ignition sources - NO SMOKING.
d. Stop any loading or unloading operation
e. Attend to injured.
f. Assess the severity of the spill.
g. Call for assistance.
h. **On-site Manager mobilizes Emergency Response Team**.
i. Keep unnecessary people out of the area.
j. Wear impervious clothing, goggles, and gloves.
k. Approach spill from upwind IF **SAFE TO DO SO**.
l. Stop product flow if possible.
m. Contain and recover spill as soon as possible.
n. Notify the regulatory authorities.

2. RESPOND SAFELY

a. Do not contain diesel fuel if vapors might ignite.
b. Allow fuel vapors to evaporate before intervention.

A proficient and timely response to a spill will be dependent on the following:

- Compiling and exercising contingency and emergency plans regularly and thoroughly, to familiarize all personnel involved with the essential needs and hazards of such operations;

- Immediately activate the OPEP in response to a spill;

- Safeguard life and property;

- Take immediate actions to lessen the environmental impact of the spill; and

- Ensure prompt and accurate reporting of diesel and Jet-A spills to enable responsible authorities to mobilize resources and take appropriate measures, if required, to lessen the impact of such an event.

The first person (first responder) to notice, or come in contact with, any spill situation either initiates a Code 1 (in the case tanker truck overturns on the municipal road or AWPR) or reports to his/her immediate supervisor (in the case of spills on land, ice or water). The dispatch or supervisor is responsible to report the incident to the designated Incident Commander for a =>Level II or to the environment department for a Level I. A Code 1 is initiated in the instance a tanker truck over turns, and the Incident Commander will respond in conjunction with the ERT. Major responsibilities such as initial coordination, spill clean-up and mobilizing the Emergency Response Team (ERT) are part of the Incident Commander's duties.

8.1 Coordination with Canadian Coast Guard and Government Agencies

8.1.1 Coordination with Canadian Coast Guard

In the event of a marine spill greater than a level II, the Canadian Coast guard will be contacted to report the situation. At this time it will be determine if Agnico Eagle Mines will require the assistance of the Coast Guard to respond to the spill.
On an Annual basis prior to the shipment of fuels to the OHF commencing, AEM will contact the CCG and make them, aware that the shipping season will be starting so they are aware theat fuels will eb travelling on the route suggested in Figure 5. The contact number for the Canadian Coast guard can be found in Table 9.

8.1.2 Other Government Agencies

In the event of a level II or higher incident, AEM will contact all government agencies associated with the Meadowbank Gold Project as is the norm for any reportable spill. These groups include: Government of Nunavut (GN) via 24 hour spill reporting line, Aboriginal Affairs and Northern Development Canada (AANDC), Nunavut Water Board (NWB),and Kivaliq Inuit Association (KIA).

8.2 Reporting Requirements

8.2.1 Government of Nunavut Reporting Requirements

To ensure compliance with Section 36(3) of the *Fisheries Act*, all spills of fuel or hazardous materials, regardless of quantity, into a water body or onto ice will be reported immediately to the NT-NU 24-HOUR SPILL REPORT LINE (phone: (867) 920-8130, fax: (867) 873-6924, spills@gov.nt.ca). Spills to the marine environment will also be reported to the Canadian Coast Guard (phone: (800) 265-0237, fax: (519) 337-2498). Marine spills will be reported in accordance with Transport Canada Guideline TP-9834E, *Guidelines for Reporting Incidents Involving Dangerous Goods, Harmful Substances and /or Marine Pollutants*; a copy of this can be located in APPENDIX D. Others to receive the spill report include the Kivalliq Inuit Association, Hamlet of Rankin Inlet, and Fisheries and Oceans Canada, Canadian Coast Guard[5], and Aboriginal Affairs and Northern Development Canada. Incidents that require media communications will be the responsibility of AEM General Mine Manager or Public Affairs Corporate Director.

8.3 Treatment and Disposal

All diesel or Jet-A fuel recovered through the spill response and any contaminated material will be taken to the Meadowbank mine site for recovery and, if applicable, incineration. It could also be packaged for disposal/recycling by a certified hazardous waste management company in southern Canada.

[5] Only spills in the marine environment will be reported to the Transport Canada and Canadian Coast Guard.

9. SPILL SCENERIOS AND RESPONSE STRATEGIES

AEM will strive to prevent any accidental spills and take all reasonable steps to minimize the risk of spill incidents and their impact on the environment. Response personnel will have safety and spill response training. Use of personal protective equipment around water will be part of this training; this will include personal floating devices.

The minimum size of an oil pollution incident, in respect of each single oil product loaded or unloaded to or from a ship, for which a response needs to be described in the oil pollution emergency plan for a Level 2 facility is 5 cubic metres.

Jet fuel, Jet-A, Jet-A1, or kerosene is a type of aviation fuel designed for use in aircraft powered by gas-turbine engines. It is colourless to straw-coloured in appearance.

P50 Diesel is a bright oily substance that has a low viscosity. It spreads rapidly on the water, has a low solubility in salt water (60 mg/L), and a high evaporation rate as described in the text box below.

At Baker Lake, the wind is largely from the NW to N.

Predicted Evaporation Rate of Spilled Diesel

Weight percent Evaporation = (5.8 + 0.045T) in(t)
Where T = water temperature
t = time in minutes

After a time span of 60 minutes at a surface temperature of 5°C, up to 25 % weight of the spilled diesel would have evaporated.

After 240 minutes, or 4 hours, the weight percent of the diesel that would have evaporated would be 33%.

Source: *Environment Canada, Emergencies Science and Technology Division*

As a result of the properties of diesel and the environmental conditions that predominate at Baker Lake, the spill response will need to aim to stop the spilled product from spreading across Baker Lake. This could include activating the Shipboard Oil Pollution Emergency Plan. The tanker would have response equipment on board and a fully trained crew in spill response. This, coupled with a shore based response under the OPEP, would ensure sufficient resources are available to control and recover as much diesel fuel as feasible. The following scenarios were developed with this in mind.

There are a number of safeguards in operating the ship-to-shore pipeline; these include:

- Save-all trays to capture any minor spills at the ends of the floating pipeline;
- Dry-break couplings at both ends of the floating pipeline;
- A pressure test will be performed before the diesel transfer to confirm the system is free of leaks; and

- Both the crew on the tanker and AEM's shore based personnel will be fully trained in spill response and spill recovery.

Six scenarios are considered, these being:

1. A leak at the ship based end of the floating pipeline resulting in the maximum loss of 100 to 600 litres of diesel fuel;

2. A leak at the shore based end of the floating pipeline resulting in the maximum loss of 20 to 600 litres of diesel fuel;

3. A major failure in the floating pipeline with 5,000 litres of fuel lost to the marine environment due to a rupture;

4. A major failure outside the tank farm resulting in the loss of 5,000 litres of diesel fuel[6];

5. At the municipal and AWAR road a tanker truck holding 40,000 litres turns over with its contents migrating towards the marine environment: and

6. A major failure at Helicopter Island.

In most instances AEM personnel and/or contractors will be able to respond to the spill but if necessary, backup can be requested by calling for the assistance of the AEM Emergency Response Team that is stationed at the Meadowbank site located 110 kilometres away. The ERT can be at Baker Lake within 120 minutes to take charge of the spill response. AEM will make every effort to have its equipment and resources deployed within 6 hours of an incident

Scenario 1: Loss of diesel or Jet-A fuel onboard the tanker – Level I
Quantity spilled: 1 - 1000 litres

Appropriate Actions

1. Stop the ship-to-shore transfer of diesel.
2. Try to contain the spilled diesel on the deck and keep it from flowing overboard into the marine environment.
3. Containment boom is manned to prevent the escape of diesel outside the boom.
4. If necessary, place a diversion boom outside the containment boom to stop the diesel from getting onto the beach.
5. Spread absorbent material on the spill to capture it.
6. For larger amounts of spilled materials on water, use a skimmer to collect the spilled diesel and afterwards use absorbents to capture for residual amounts.

Resources

a. Crew on the tanker trained in spill response.
b. Crew from the large tanker anchored outside the access passage.
c. AEM's shore based personnel trained in spill response and recovery.
d. Emergency Response Team to take control of the spill response and recovery.
e. Spill response equipment and supplies maintained on board the tanker and also in the sea can located on shore of AEM's Fuel Farm and Marshalling area.
f. Save-alls placed under the pipeline manifolds to collect minor spills.
g. Shore-based boat to position booms.
h. Skimmer to recover spilled diesel on sea water.

[6] Loss of diesel within the bermed and lined areas of the tank farm will be contained and recovered without any impact on the environment.

7. Monitor any diesel that could not be recovered and collect water samples near the spill site and in the access passage for analysis. Repeat as necessary.
8. If diesel reaches the beach, excavate the contaminated beach material and take it to the Landfarm area at the Meadowbank site.
9. Notify local and regulatory authorities.

i. Heavy equipment such as excavators, back hoes, vacuum trucks, and dump trucks.

Scenario 2: Loss of diesel or Jet-A fuel onshore – Level I
Quantity spilled 1 – 1000 litres

Appropriate Actions

1. **For quantities over 200L Stop the ship-to-shore transfer of diesel.
2. Close all valves to the tank farm.
3. Place a berm of any material between the spill and the high tide mark to stop the migration of the diesel to the marine environment, or dig a trench and line it with plastic sheeting between the spill and the high tide mark to capture the spilled diesel and use a vacuum truck to recover it.
4. If the spill reaches the water, place a sorbent boom along the shoreline to collect and contain the spill next to the beach and to stop its spread.
5. For smaller quantities of diesel, spread absorbent materials on the spill to capture it.
6. For larger amounts of spilled materials, use a skimmer to collect the spilled diesel contained within the booms and afterwards use absorbents to capture residual amounts.
7. Monitor any free floating diesel that could not be recovered and collect water samples near the spill site and in the access passage for analysis. Repeat as necessary.
8. Excavate contaminated soil and move it to the Landfarm area at the Meadowbank site
9. Notify local and regulatory authorities.

Resources

a. Crew on the tanker trained in spill response.
b. Crew from the large tanker anchored outside the access passage.
c. AEM's shore based personnel trained in spill response and recovery.
d. Spill response equipment and supplies maintained on board the tanker and in AEM sea can located at AEM's Marshalling area and the Coast Guard sea can of spill response equipment and supplies located in Baker Lake.
e. Save-all placed under the pipeline connection to collect minor spills.
f. Shore-based boat to position booms and spread absorbent materials.
g. Emergency Response Team to take control of the spill response.
h. Skimmer to recover spilled diesel on sea water.
i. Heavy equipment such as excavators, back hoes, vacuum trucks, and dump trucks.

Scenario 3: Loss to the marine environment from a pipeline rupture - Level II
Quantity spilled 1,000 - 5,000 litres

Appropriate Actions

1. Stop the ship-to-shore transfer of diesel.
2. Containment boom is manned to prevent the escape of diesel.
3. Place a sorbent boom within the containment

Resources

a. Crew on the small tanker trained in marine spill response.
b. Crew from the large tanker anchored outside the access passage.

boom to collect and prevent the diesel from getting onto the beach.
4. Deploy skimmer to recover as much diesel as possible and spread absorbent material afterwards to capture any residual diesel remaining.
5. Monitor any free floating diesel that could not be recovered and collect water samples near the spill site and in the access passage for analysis. Repeat as necessary.
6. If diesel reaches the beach, excavate the contaminated beach material and move it to the Landfarm area at the Meadowbank site.
7. Notify local and regulatory authorities.

c. AEM's shore based personnel trained in near shore spill response and recovery.
d. Emergency Response Team trained for near shore spill response.
e. Call the Canadian Coast Guard for assistance.
f. Spill response equipment and supplies maintained on board the tanker, in AEM sea can locate at AEM's Marshalling area and the Coast Guard sea can of spill response equipment and supplies located in Baker Lake.
f. Skimmer to recover spilled diesel.
g. Additional booms to place outside the containment boom.
h. Shore-based boat to position booms and spread absorbent material.
i Heavy equipment such as excavators, back hoes, vacuum trucks, and dump trucks for waste materials.

Scenario 4: A Level II spill outside the tank farm area
Quantity spilled 1,000 - 5,000 litres

Appropriate Actions
1. Stop the ship-to-shore transfer of diesel.
2. Close all valves to the tank farm.
3. Place a berm of any material between the spill and the high tide mark to stop the migration of the diesel to the marine environment or dig a trench and line it with plastic sheeting between the spill and the high tide mark to capture the spilled diesel and use a vacuum truck to recover it.
4. If the spill reaches the water, place a sorbent boom along the shoreline to collect and contain the spill next to the beach.
5. For smaller quantities of diesel in the water, spread absorbent materials on the spill to capture it.
6. For larger amounts of spilled materials, use a skimmer to collect the spilled diesel contained within the booms and afterwards use absorbents to capture residual amounts.
7. Monitor any free floating diesel that could not be recovered and collect water samples near the spill site and in the access passage for analysis. Repeat as necessary.
8. Excavate contained soil and move it to the Landfarm area at the Meadowbank site.
9. Notify local and regulatory authorities.

Resources
a. Crew on the tanker trained in spill response.
b. AEM's shore based personnel trained in spill response and recovery.
c. AEM's Emergency Response Team.
d. Spill response equipment and supplies maintained on board the tanker and also in the AEM sea can locate at AEM's Marshalling area.
e. Save-all placed under the pipeline connection to collect minor spills.
f. Shore boat to position booms and spread absorbent materials.
g. Activate the Emergency Response Team to take control of the spill response.
h. Skimmer to recover spilled diesel on sea water.
i. Heavy equipment such as excavators, back hoes, vacuum trucks, and dump trucks.

Scenario 5: Tanker truck rolls over along the road next to a bridge
Quantity spilled > 5,000 litres

Appropriate Actions

1. Call a code 1 to mobilize the Emergency Response Team trained in responding to tanker mishaps along roads.
2. If the tanker is not empty, seal the leak if possible but **ONLY IF IT SAFE TO DO SO**.
3. AEM Marshalling personnel to take initial actions **IF IT SAFE TO DO SO**.
4. Place a berm of any material between the spill and the shore line to stop the migration of the diesel to the marine environment or dig a trench or sumps between the spill and the high tide mark, line them with plastic sheeting to capture the spilled diesel and use a vacuum truck to recover it.
5. If the spill reaches marine water, place a boom along the shoreline to contain the spill next to the beach to stop its spread.
6. For smaller quantities of diesel in the water, spread absorbent materials on the spill to capture it.
7. For larger amounts of spilled materials, use a skimmer to collect the spilled diesel contained within the booms and afterwards use absorbents to capture residual amounts.
8. Monitor any free floating diesel that could not be recovered and collect water samples near the spill site and in the access passage for analysis. Repeat as necessary.
9. Excavate contained soil and move it to the Landfarm area at the Meadowbank site.
10. Notify local and regulatory authorities.

Resources

a. AEM's shore based personnel trained in spill response to take initial actions.
b. AEM's Emergency Response Team to take control of the spill site.
c. Spill response equipment and supplies stored in AEM's sea can at Itivia.
d. Shore based boat to position booms and spread absorbent materials.
e. Skimmer to recover spilled diesel on sea water.
f. Heavy equipment such as excavators, back hoes, vacuum trucks, and dump trucks.

Scenario 6 - A major failure at Helicopter Island Level III.

In the event of a major spill during a ship-to-ship transfer or due to unforeseen circumstances, Coastal Shipping Limited will be the sole proprietor for the spill. Canadian Coast Guard will be contacted for assistance. Due to the lack of resources in which Agnico Eagle Mines (AEM) possess to counter act such a large scale marine spill, AEM's assistance would be limited to providing support to preserve the shore line environment. AEM would put its resources to the best use possible during such an event, and assist as much as possible with the resources at hand.

9.1 In-situ Burning

In-situ burning is a spill response technique used when responding to an oil or fuel spill. In-situ burning involves the controlled burning of oil or fuel that has spilled from a tanker, vessel, or a facility, at the location of the spill. When conducted properly, in situ burning significantly reduces the amount of oil or fuel on the water and minimizes adverse effects to the environment.

Appendix H is a document from the National Oceanic and Atmospheric Administration on in-situ burning of spills. This document explains in detail In-situ burning and how it works.

AEM would only consider In-situ burning in the event of an extremely large spill, if approval was granted by governing agencies.

10. PREVENTIVE MEASURES

AEM recognises that spill prevention is more desirable than any modern efficient cleanup measures after the fact. Preventive measures have been adopted in relation to any transport, transfer, use and storage of diesel and Jet-A fuel. The tankers carry a Ship Oil Pollution Emergency Plan (SOPEP) as per the MARPOL 73/78 requirement under Annex I. All ships with 400 GT and above must carry an oil prevention plan as per the norms and guidelines laid down by the International Maritime Organization (IMO).

A SOPEP contains the following things:

- The action plan contains duty of each crew member at the time of spill, including emergency muster and actions;
- General information about the ship and the owner of the ship etc.;
- Steps and procedure to contain the discharge of oil into the sea using SOPEP equipment;
- On-board Reporting procedure and requirement in case of oil spill;
- List of authorities to contact and reporting requirements in case of oil spill. Authorities like port state control, oil clean up team etc. are to be notified;
- Drawing of various fuel lines, along with other oil lines on board vessel with positioning of vents, save-all trays, etc.;
- General arrangement of ship, which includes location of all the oil tanks with capacity, content, etc.; and
- The location of the SOPEP locker and contents of the locker with a list of inventory. (Marine Insight 2012)

The Spill Contingency Plan, Emergency Response Plan and the Oil Pollution Emergency Plan identify potential causes of emergencies and provides for the development and implementation of strategies to minimize the likelihood of the same.

As described in the Spill Contingency Plan, exercises are part of training for the Emergency Response Team. This will include comprehensive spill response exercise to practice the use of spill response equipment, including the use of booms and skimmers.

The OPEP will be updated annually based on the results of spill exercises, changes to the infrastructure at AEM's Fuel Handling Facilities, changes to procedures and other variables. The updated OPEP will be distributed to the AEM Emergency Response Team, Transport Canada, the Kivalliq Inuit Association, the Municipality of Baker Lake and other agencies as appropriate.

10.1 Training

The environmental department and ERT team received training from a response organization and as a result will be able to respond to or assist with incidents that may occur at the OHF.

10.1.1 On-site Personnel

A designated Emergency Response Team (ERT) consisting of on-site personnel is established at AEM's Meadowbank Mine Site. AEM will ensure that the ERT is trained and staffed in sufficient number so that the ERT is present at all times. All members of the team will be trained and familiar with emergency and spill response resources, including their location and access, the Spill Contingency Plan, the Oil Pollution

Emergency Plan and appropriate emergency spill response methodologies. The ERT will have up to 60 members, each of whom will train approximately 8 hours per month.

The training will include the following:

- Worker health and safety during emergency interventions;
- A review of the spill response plan and responsibilities of the ERT members;
- The nature, status, and location of fuel and chemical storage facilities;
- The on-site and off-site spill response equipment and how to use it;
- Emergency contact lists;
- Communication methods and signals;
- Desktop exercises of “worst case” scenarios;
- Emergency evacuation;
- Fires or explosions;
- Emergency equipment and use;
- Personal protective equipment and clothing;
- Marine shoreline recovery operations; and
- The likely causes and possible effects of spills.

Every employee at the Meadowbank project will receive spill and waste management induction during their initial site orientation, so they are able to respond to small spills and raise the alarm if a larger response is required. ERT members will receive more extensive spill response training and learn how to respond while wearing personal protective clothing, use of specific spill response gear, proper deployment of absorbents and maritime boom.

The Environmental Department will regularly provide tool-box sessions to give information on spill response and reporting procedures.

You can find records of different trainings that AEM personnel have attended in Appendix E. Basic spill response training will be completed in 2014 by all AEM employees and contractors working on the Meadowbank project.

11. NEW FOR 2014

In 2014 AEM will perform a mock spill scenario at the Oil Handling Facility. This will be performed prior to the first shipment of fuel being dispensed to the OHF.

12. REFERENCES

Canadian Coast Guard, 1995. *Oil Handling Facilities Standards*, TP12402E.

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CCME, 2003. *Environmental Code of Practice of Aboveground and Underground Storage Tank Systems Containing Petroleum Products and Allied Petroleum Products* (PN1326).

Environment Canada, 2002. *Arctic Regional Environmental Emergencies Team (REET) Contingency Plan.*

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http://response.restoration.noaa.gov/oil-and-chemical-spills/oil-spills/resources/in-situ-burning.html

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Transport Canada, TP-12402, 1995. *Oil Handling Facilities Standards.*

Transport Canada, TP-10783, 1997. *Arctic Waters Oil Transfer Guidelines.*

Transport Canada Guideline, TP-10783E, 1997. *Arctic Waters Oil Transfer Guidelines,* Prairie and Northern Region, Marine (AMNS - OTT).

Transport Canada, TP-13585, 2008. *Environmental Prevention and Response National Preparedness Plan.*

Transport Canada Guideline TP- 9834E, 2009. *Guidelines for Reporting Incidents Involving Dangerous Goods, Harmful Substances and /or Marine Pollutants*.

APPENDIX A - CONCORDANCE TABLE

Agnico Eagle Mines LTD Oil Pollution Prevention/ Oil Pollution Emergency Plan

Concordance Table:

Oil Pollution Prevention Plans and Oil Pollution Emergency Plans must contain the following information:

SOURCE:
Canada Shipping Act, *2001*, ss. 167-168
Response Organizations and Oil Handling Facilities Regulations, SOR/95-405, s. 13
Oil Handling Facilities Standards (the "*Standards*")

	REQUIREMENT	**Page/Heading Reference**
12(2)(a)	The policies that the operator of the oil handling facility will follow in the event of an oil pollution incident;	OPEP – Section 7 Page 29 ERP – Section 4.8 Page 58
12.(2)(b)	in respect of **each group of oil products that are loaded or unloaded** at the oil handling facility, an oil pollution scenario that contains:	OPEP – Section 9 Pages 40-45
12(2)(b)(i)	a description of the response in respect of the spill size determined in accordance with section 2 of the *Standards* (see below) AND **Category of Oil Handling Facility Minimum Spill Size** Level 1 - 1 m^3	OPEP – Section 9 Pages 40-45
12(2)(b)(ii)	the assumptions on which each scenario is based, taking into account the factors set out in section 3 of the *Standards* (see below); An oil handling facility, in developing oil pollution scenarios, shall take into account the following factors: (i) the nature of the oil product in respect of which the scenario is developed; (ii) the types of ships that are loaded or unloaded at the facility; (iii) the tides and currents that prevail at the facility; (iv) the meteorological conditions that prevail at the facility; (v) the surrounding areas of environmental sensitivities that would likely be affected by an oil spill; (vi) the measures that will be implemented to minimize an oil pollution incident; and (vii) the time within which an effective	OPEP – i) Section 9 Pages 40-45 ii) Section 5.1 Page 13 iii) Section 4.3.7 Page 12 iv) Section 4.3.8 Page 12 v) Section 4.3 Pages 9-12 vi) Section 9 Pages 40-45 vii) Section 9 Pages 41

	response to an oil pollution incident can be carried out.	
12.(2)(c)	a description of the activities that will be carried out in the event of an oil pollution incident, taking into account the priorities set out in section 4 of the *Standards* (see below), the time of those activities and the names of the persons responsible for carrying them out; The following priorities shall be taken into account for the purpose of establishing the order of measures to be taken during a response to an oil pollution incident: (a) the safety of the facility's personnel; (b) the safety of the facility; (c) the safety of the communities living adjacent to the facility; (d) the prevention of fire and explosion; (e) the minimization of the oil pollution incident; (f) the notification and reporting of the oil pollution incident; (g) the environmental impact of the oil pollution incident; and (h) the requirements for cleaning up the oil pollution incident.	OPEP – Section 7 pages 29-35 a) Section 7.2.9 Page 34 b) Section 7.2.1 Pages 29&30 c) Section 7.2.1 Pages 29&30 d) Section 7.2.8 Page 31 e) Section 7.2.8 Page 33 f) Section 7.2.1 Pages 29&30 g) Section 7.2.8 Page 33 h) Section 7.2.8 Page 33
12.(2)(d)	the types and quantity of equipment for use on scene during a response to an oil pollution incident at the oil handling facility in respect of the spill size that is determined in accordance with section 2 of the *Standards* (see description at 2(a) above);	OPEP – Section 6.5 Pages 31-25
12.(2)(e)	the name of each person or body from which the equipment and resources will be obtained, in the event of an oil pollution incident, and the manner in which the equipment and resources will be deployed;	OPEP – Section 6.5 Pages 31-25
12.(2)(f)	the name or position of the persons who are authorized and responsible for ensuring that the response to an oil pollution incident at the oil handling facility is immediate, effective and sustained;	OPEP – Section 1 Page 1
12.(2)(g)	the name of each person included in the personnel who has received basic oil pollution incident response training or any other training in relation to an oil pollution incident;	OPEP – APPENDIX E
12.(2)(h)	a description of the training that the operator of the oil handling facility provides to its personnel in	OPEP – Section 10.1 Page 46

	preparation for the responsibilities that they might be requested to undertake in response to an oil pollution incident;	
12.(2)(i)	a description of the training that the operator of the oil handling facility plans to provide to its employees and to volunteers whom it might use to respond at short notice to an oil pollution incident;	OPEP – Section 10.1 Pages 46-47
12.(2)(j)	an oil pollution incident exercise program established to evaluate the effectiveness of all aspects of the procedures, equipment and resources that are identified in the oil pollution emergency plan, including exercises to be coordinated with response organizations;	OPEP – Section 11 Page 48
12.(2)(k)	a description of the measures that the operator of the oil handling facility will take, in accordance with federal and provincial regulations relating to health and safety, to protect the health and safety of personnel who are involved, at the request of the operator, in responding to an oil pollution incident;	OPEP – Figure 9 – Page 37 Section 2.1 Page 1 Section 8 Pages 36-38
12.(2)(l)	a description of procedures for the updating of the oil pollution emergency plan.	OPEP – Section – 2.4 Page 3
12.(2)(m)	A description of the manner in which the operator of the oil handling facility plans to respond to an oil pollution incident that involves a quantity of oil that is greater than the spill size referred to in paragraph (*d*) and that is scheduled to be transhipped, to a maximum of 10,000 t.	OPEP – Roles and Responsibilities Section 7 Pages 29-35 Procedures Section 8 Pages 36-39
12.(3)	An oil handling facility's oil pollution emergency plan shall take into account any contingency plan for the area that is issued by the Canadian Coast Guard.	OPEP – Section 2.4 page 3 APPENDIX B

PROCEDURES TO BE FOLLOWED IN THE EVENT OF A SPILL

In the event of a spill, the following requirements must be met:
SOURCE:
Canada Shipping Act, 2001, ss. 167-168
Response Organizations and Oil Handling Facilities Regulations, SOR/95-405, s. 13
Oil Handling Facilities Standards (the "*Standards*")

	REQUIREMENT	**OPEP Page/Heading Reference**
13.(1)(a)	the loading and unloading operation is to be shut down immediately and is not to be restarted in a manner that would interfere with the immediate, effective and sustained response to the oil pollution incident;	Section 8 page 38
13.(1)(b)	the response to the oil pollution incident is to be managed in coordination with the Canadian Coast Guard and federal, provincial and other bodies responsible for, or involved in, the protection of the environment	Section 8 Page 38
13.(1)(c)	in relation to the quantity of oil involved in the oil pollution incident, up to the minimum spill size determined in accordance with section 2 of the *Oil Handling Facilities Standards*, the response to that incident in accordance with paragraphs 13(2)(*b*) and (*c*);	Section 9 Page 41
13.(1)(d)	the operator takes the measures required during the response to the oil pollution incident in accordance with the plans for spill quantities and priorities for response set out in the *Standards*	Section 8 Page 38
13.(1)(e)	At least one of the persons referred to in the OPEP is to be accessible to the Canadian Coast Guard during the entire loading or unloading operation	OPEP – Section 1 Page 1
13.(1)(f)	the operator of the oil handling facility is prepared to respond to an oil pollution incident in relation to the total quantity of oil that is scheduled to be transshipped, to a maximum of 10,000 tonnes	OPEP – Roles and Responsibilities Section 7 Pages 29-35 Procedures Section 8 Pages 36-39
13.	(2) The equipment and resources that an oil handling facility shall have for use, in respect of an oil pollution incident at the oil handling facility arising out of the loading or unloading of oil to or from a ship, include the following:	
13.(2)(a)	the equipment referred to in paragraph 12(2)(*d*) that is required to contain and control the oil or, where the oil cannot be contained, to control the quantity of oil involved in the incident, up to the minimum spill size determined in accordance with section 2 of the *Oil Handling Facilities Standards*, is to be on site during any loading or unloading operation;	Section 6.5 Page's 21-25
13.(2)(b)	the equipment and resources required to contain and control the oil are to be deployed on scene within one hour after the discovery of the oil pollution incident, unless deployment within one hour would be unsafe, ineffective or impracticable	Section 9 page 41
13.(2)(c)	the equipment and resources required to recover and clean up the oil involved in the incident are to be deployed on scene within six hours after the discovery of the oil pollution incident	Section 9 page 41

Oil Handling Facilities Standards 1995 TP 12402 E

<table>
<tr><th></th><th><u>REQUIREMENT</u></th><th><u>OPEP Page/Heading Reference</u></th></tr>
<tr><td></td><td>Levels of Facilities

1. For the purpose of section 2, oil handling facilities are categorized according to their maximum oil transfer rate in cubic metres per hour, in respect of each single oil product loaded or unloaded to or from a ship, as follows:

<table>
<tr><th>Category of Oil Handling Facility</th><th>Maximum Oil Transfer Rate</th></tr>
<tr><td>Level 1</td><td>150 m^3/h</td></tr>
<tr><td>Level 2</td><td>750 m^3/h</td></tr>
<tr><td>Level 3</td><td>2 000 m^3/h</td></tr>
<tr><td>Level 4</td><td>More than 2 000 m^3/h</td></tr>
</table></td><td>Table 2 – Page 4</td></tr>
<tr><td></td><td>Spill Sizes

2. The following is the minimum size of an oil pollution incident in respect of each single oil product loaded or unloaded to or from a ship, for which a response needs to be described in the oil pollution emergency plan:

<table>
<tr><th>Category of Oil Handling Facility</th><th>Minimum Spill Size</th></tr>
<tr><td>Level 1</td><td>1 m^3</td></tr>
<tr><td>Level 2</td><td>5 m^3</td></tr>
<tr><td>Level 3</td><td>15 m^3</td></tr>
<tr><td>Level 4</td><td>50 m^3</td></tr>
</table></td><td>Section 9 Pages 40-45</td></tr>
<tr><td></td><td>3. An oil handling facility, in developing oil pollution scenarios, shall take into account the following factors:</td><td></td></tr>
<tr><td></td><td>(a) the nature of the oil product in respect of which the scenario is developed;</td><td>Section 5.1 Page 13</td></tr>
<tr><td></td><td>(b) the types of ships that are loaded or unloaded at the facility;</td><td>Section 5.1 Page 13</td></tr>
<tr><td></td><td>(c) the tides and currents that prevail at the facility;</td><td>Section 4.3.7 Page 12</td></tr>
<tr><td></td><td>(d) the meteorological conditions that prevail at the facility;</td><td>Section 4.3.8 Page 12</td></tr>
<tr><td></td><td>(e) the surrounding areas of environmental sensitivities that would likely be affected by an oil spill;</td><td>Section 4.3 Pages 9-12</td></tr>
<tr><td></td><td>(f) the measures that will be implemented to minimize an oil pollution incident; and</td><td>Section 9 Pages 40-45</td></tr>
<tr><td></td><td>(g) the time within which an effective response to an oil pollution incident can be carried out.</td><td>Section 9 Page 41</td></tr>
</table>

	4. The following priorities shall be taken into account for the purpose of establishing the order of measures to be taken during a response to an oil pollution incident:	OPEP – Section 7 pages 29-35
	(a) the safety of the facility's personnel;	a) Section 7.2.9 Page 34
	(b) the safety of the facility;	b) Section 7.2.1 Pages 29&30
	(c) the safety of the communities living adjacent to the facility;	c) Section 7.2.1 Pages 29&30
	(d) the prevention of fire and explosion;	d) Section 7.2.8 Page 31
	(e) the minimization of the oil pollution incident;	e) Section 7.2.8 Page 33
	(f) the notification and reporting of the oil pollution incident;	f) Section 7.2.1 Pages 29&30
	(g) the environmental impact of the oil pollution incident; and	g) Section 7.2.8 Page 33
	(h) the requirements for cleaning up the oil pollution incident.	h) Section 7.2.8 Page 33

APPENDIX B - THE CENTRAL & ARCTIC REGIONAL RESPOSNE PLAN (2008)

Canadian Coast Guard
Central & Arctic Region

Regional Response Plan

December 2008

LETTER OF PROMULGATION

The *Central & Arctic Regional Response Plan (2008)* replaces the *Central & Arctic Region Contingency Chapter (2006)* and the *Arctic Response Strategy (1999)*. This plan is a component of the *Canadian Coast Guard National Response Plan* which is the responsibility of the Director of Safety and Environmental Response Systems, Ottawa. It establishes the framework and the procedures by which Central & Arctic Region will prepare for, assess, respond to and document actions taken in response to pollution incidents in this Region.

The saving of life is of paramount consideration and the Plan is subordinate to the operational requirements of marine search and rescue.

The Plan has been reviewed by the internal partners identified in Section 3.3 in context to the services they may provide and by the external partners identified in Sections 3.4 and 3.5 to confirm their mandated response authorities.

Responsibility for the *Regional Response Plan* lies with the Assistant Commissioner Coast Guard Central & Arctic Region. The Central & Arctic Region Environmental Response branch is the custodian of the plan. The responsibility for specific sections is identified in Section 7 - Plan Maintenance and Custodians. Comments, recommendations and communications relating to the various sections are clearly identified in this section.

REVISION RECORD

CENTRAL & ARCTIC REGIONAL RESPONSE PLAN			
Section	Replace	Transmittal No.	Description of Changes
Entire Plan	All	December 1, 2005	Complete revision of Central & Arctic Regional Response Plan
Entire plan	All	April 1, 2006	Complete revision of Central & Arctic Regional Response Plan
7.1 Maintenance Process	Page 7-1	May 8, 2007	Update address to 520 Exmouth Street
8.3 CCG ER Phone List	Page 8-1	June 4, 2007	Update address to 520 Exmouth Street
Entire Plan	All	December 2008	Complete revision of Central & Arctic Regional Response Plan

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Section 1 - INTRODUCTION

1.1. Authority

This plan is based upon the policy and guiding principles set forth in the *National Response Plan* of the *Canadian Coast Guard National Response Strategy*.

1.2. Purpose

The *Central and Arctic Regional Response Plan* is designed as a guide to Canadian Coast Guard staff and relevant stakeholders involved in marine spill responses. It outlines the Regional application of the various roles of On-Scene Commander (OSC) (active response), Federal Monitoring Officer (FMO) (ensuring the Responsible Party fulfills their obligations), and as a Resource Agency (in assistance to other Lead Agencies).

It contains the specific information and activities that are pertinent to all spill response activities within Central & Arctic Region (C&A Region).

1.3. Area of Responsibility

For the purposes of marine pollution response Central & Arctic Region is defined geographically as:

- The contiguous waters of the Canadian Arctic (North of 60^{o} Latitude) to the limits of the International Boundary, including the North Slope Area of the Yukon Territories, and internal waters of the Northwest Territories and the Territory of Nunavut; and

- The waterways contained within the provinces of Alberta, Saskatchewan, Manitoba, Ontario, and a western portion of Quebec commencing at the east wall of the Beauharnois Lock in the St. Lawrence River.

(see Figure 1-1 Fisheries and Oceans Central & Arctic Region)

Significant waterways include the Canadian Great Lakes and interconnecting waterways to the international Boundary with the United States, Hudson and James Bays, Lake Winnipeg, Lake Athabasca and interconnecting waterways, Great Slave Lake, Mackenzie River and the Northwest Passage in the Canadian Arctic.

There are also a number of specific geographic locations which, although not excluded from Canadian Coast Guard's mandate, require coordination between the managing authorities and this plan. These areas include the waters associated with

the various Port Authorities (Hamilton, Thunder Bay, Toronto and Windsor) and the St. Lawrence Seaway Authority (Welland Canal, St. Lawrence Locks) as defined by the *Canada Marine Act, 1998*.

Figure 1-1: Fisheries and Oceans Central & Arctic Region

1.4. Safety Policy

Safety is the first and foremost consideration in any pollution response in Central & Arctic Region. This commitment is expressed throughout this and other documents as well as in the programs relied on by the Environmental Response (ER) branch to prepare for such spills (i.e. training and exercising programs). General safety procedures and considerations to be followed by all members of the Regional Response Team are identified in Section 5.7 of this plan.

1.5. Links to the National Response Plan

The Guiding Principles and Mandate (including legislative, interdepartmental, intergovernmental and international agreements) as well as designation of Lead and Resource Agency roles are contained in the *National Response Plan Section 1 – Introduction.* The mechanism for activating the Environmental Response National Response Team is also defined in the *National Response Plan*.

1.6. Regional Response Plan Structure

The Regional Response Plan is structured to reflect the three fundamental phases of Environmental Response activities. These are:

1) Preparedness - through the regional application of Contingency Planning (resulting in specific response strategies), Training (state of personnel readiness), Exercising (state of system readiness) and Inventory Maintenance and Management (state of mechanical/equipment readiness).

2) Response Operations - identifying the mechanisms for:
   - *Initiating* (through a dedicated Duty Officer and Assessment process),
   - *Sustaining* (Operational functions as Lead or Resource Agency),
   - *Controlling* (using the Response Management System), and
   - *Finalizing* the response activity (decommissioning and reporting).

3) Claims, Recovery and After-action activities - for the documentation and recovery of spent resources from the polluter, their agents, national or international funding conventions.

Surrounding these fundamentals are the specifics of the Environmental Response Program in Central and Arctic Region that are too cumbersome to be included in the main text of this Response Plan. They include: Regional Agreements and Memoranda of Understanding, Regional Organization and the specific Annexes which support the program. Finally, the Response Plan includes the preliminary and supplementary matter such as Letter of Promulgation, Record of Revision and the Identification of Custodians and the Plan Maintenance process.

1.7. Linkages to other Response Plans in the Region

When a pollutant is spilled into the water, the Canada Shipping Act is not the only legislation that applies. Recognizing that being designated Lead Agency for pollution response to mystery spills and spills from vessels does not preclude other agencies from completing their mandate CCG acknowledges that the Internal and External Partners listed in Sections 3.4 and 3.5 have plans that are active within Central & Arctic Region.

1.8. Linkages to International Joint Plans

International Joint Plans and agreements affecting Central & Arctic Region include:

- Canada-United States Joint Marine Pollution Contingency Plan
- Canada-Denmark Agreement for Co-operation Relating to the Marine Environment, Annex B (Joint Marine Contingency Plan concerning Incidents resulting from Shipping Activities)
- Great Lakes Water Quality Agreement, Annex 9
- International Boundary Waters Treaty Act

The Canadian Coast Guard Environmental Response Branch also provides technical support for the Emergency Prevention, Preparedness and Response (EPPR) Working Group of the Arctic Council. The EPPR Working Group exchanges information on best practices for preventing spills, preparing to respond to spills should they occur, and practical response measures for use in the event of a spill.

The Arctic Council is an intergovernmental forum of the eight circumpolar countries (Canada, Denmark, Finland, Iceland, Norway, Sweden, the Russian Federation and the United States of America) that provides a mechanism to address the common concerns and challenges faced by the Arctic governments and the people of the Arctic.

Some work has been initiated with the Russian Federation for the development of a Joint Pollution Response Plan. To date no agreements have been signed.

Section 2 - AGREEMENTS AND MEMORANDA OF UNDERSTANDING

2.1 Overview

The Canadian Coast Guard (CCG), both Central & Arctic and National Headquarters, maintain numerous memoranda and letters of understanding and agreement between other government departments which outline shared responsibilities in pollution response. A brief description of the major agreements is listed below.

- Letter of Agreement between Canadian Coast Guard, Environmental Response Branch and Canadian Coast Guard, Operational Services and Canadian Coast Guard, Technical Services regarding the use of Environmental Response First Response Units (FRUs) by non-environmental response staff. This agreement concerns the use of FRUs at the various CCG facility sites (bases, sub-bases and search and rescue stations).

- Northwest Territories/Nunavut Spills Working Agreement. This agreement formalizes procedures whereby spill investigation and monitoring in the Northwest Territories (NT) and Nunavut (NU) can be coordinated.

- Fisheries & Oceans (DFO) and Environment Canada (EC) Letter of Agreement respecting transfer of responsibility as lead agency for mystery spills from Environment Canada (EC) to the Canadian Coast Guard/Fisheries & Oceans Canada (July 1996)

- Transport Canada (TC) and Fisheries & Oceans (DFO) Memorandum of Understanding respecting Marine Transportation Safety & Environmental Protection (May 1996). This MOU outlines the responsibilities transferred from TC to DFO in accordance with the *Public Service Rearrangement and Transfer of Duties Act*. Those pertinent to this plan include:
    a) The responsibility for ensuring the provision of pollution clean up services
    b) The authority to take actions to mitigate or prevent pollution from ships

- Letter of Understanding between the Canadian Coast Guard and the Hamilton Port Authority to outline the roles that the CCG and the HPA will

play in the event of a pollution incident which falls within the mandate of the Canadian Coast Guard.

- Letter of Understanding between the Canadian Coast Guard and the Thunder Bay Port Authority to outline the roles that the CCG and the TBPA will play in the event of a pollution incident which falls within the mandate of the Canadian Coast Guard.

- Letter of Understanding between the Canadian Coast Guard and the Toronto Port Authority to outline the roles that the CCG and the TPA will play in the event of a pollution incident which falls within the mandate of the Canadian Coast Guard.

- Letter of Understanding between the Canadian Coast Guard and the Windsor Port Authority to outline the roles that the CCG and the WPA will play in the event of a pollution incident which falls within the mandate of the Canadian Coast Guard.

Some memoranda of understanding and letters of agreement have been rendered defunct by virtue of the dissolution or reorganization of the entities that signed the original document. It is the Region's intent to assess the need for an MOU and in those cases where renewal is needed, to draft a new MOU and submit to the partner organization the request for re-entry into that agreement. For further information on these memoranda, please contact the Environmental Response Planning Section.

Section 3 - ORGANIZATION

3.1 General Application

This section describes the primary working relationships between Fisheries and Oceans (DFO), Canadian Coast Guard, Environmental Response branch (CCG/ER) and the various internal and external partners, clients and external resources.

Internal partners include: Other DFO sectors, directorates and branches, and other federal departments which provide direct assistance or have specific mandates which directly affect response activities.

External partners include those entities that share the burden of pollution response for their specific area of responsibility. These agencies include the provincial and territorial government ministries with the generic mandate of pollution response.

Clients include those entities that are specifically identified by the *Canada Shipping Act (CSA)* and have direct involvement in the response regime; they include Oil Handling Facilities (OHF), Legislated Ships and Non-legislated Ships.

External resources are those resources outside of the government that the Canadian Coast Guard may engage while conducting spill response activities. These include the Response Organizations (RO) certified by Transport Canada and other independent contractors which may perform more specific functions.

3.2 Fisheries and Oceans, Canadian Coast Guard - Environmental Response Branch (CCG/ER)

The Assistant Commissioner, Canadian Coast Guard through the Maritime Services Directorate and the Superintendent of Environmental Response (ER) directs the Regional Environmental Response Team. This team represents one facet of the overall crisis management structure within Central and Arctic Region and performs the function of the Lead Response Agency for pollution incidents as defined in the *National Response Plan – Section 1* of the *Canadian Coast Guard National Response Strategy.* The branch consists of approximately seventeen (17) full time employees (FTEs).

Internally, the Environmental Response Branch is made up of five (5) distinct but integrated functions:

1) *Direction and Administration* - providing the overall guidance, management and liaison with Headquarters. The Superintendent holds the responsibility for escalating a response and/or dedicating resources.
2) *Planning* - providing the design and management of plans and procedures to facilitate the preparedness posture of the Region (responsible for developing and maintaining intradepartmental, interdepartmental, client and regime stakeholder relationships).

3) *Operations and Inventory Maintenance & Management* - provide the management and maintenance of equipment to ensure the operational response readiness of the Region.
4) *Training* - provides the coordination and delivery of educational materials, to internal as well as external partners and clients, in support of the overall preparedness posture of the Region.
5) *Exercising* - provides the management and coordination of internal and external partners and clients to validate, practice and reinforce all aspects of the Response readiness of the Region.

In addition to these core functions, each staff member is required to actively participate in the operational aspects of the response regime based upon their skill and ability levels. This includes assuming various roles within the Response Management Structure acting as Duty Officer (DO) and supporting the overall emergency preparedness structure within the Region (not necessarily related exclusively to oil spills or pollution).

In the context of this Plan, the Environmental Response Branch is tasked to:

- Fulfill the Canadian Coast Guard's obligations as Lead Agency in an OSC or FMO posture in responding to marine pollution incidents from ships in waters of Canadian interest as well as from unknown sources.
- Act as a Resource Agency in support of a response led by another agency when requested.
- Staff a Duty Officer position on a 24/7 basis which, together with other agency representatives, will assess or direct the assessment of spill reports.
- Ensure that an appropriate response to pollution incidents is initiated on a timely basis.
- Provide initial response capabilities throughout the region.
- Monitor response and clean-up priorities when polluter has accepted responsibility.
- Ensure international commitments in spill preparedness and response are fulfilled.
- Provide a pollution response capability for lightering, salvage and offshore recovery operations.
- Provide Regional and HQ briefings on status of emergency operations.
- Evaluate, acquire and maintain specialized marine emergency countermeasures equipment and develop deployment techniques.
- Develop, distribute and maintain the *Central and Arctic Regional Response Plan* of the *Canadian Coast Guard National Response Strategy* (including area annexes) on behalf of Fisheries and Oceans.
- Review and comment on other government as well as industry pollution response plans upon request.
- Provide pollution response related training to Canadian Coast Guard and civilian personnel.

- Conduct spill response exercises according to the Canadian Coast Guard National Exercise Program (NEP) standards.
- Provide detailed explanations of response operations and policies to representatives of the media, interest groups, industry, police and Provincial and Municipal governments.
- Provide a centre of expertise for pollution concerns.
- Develop and foster a good working relationship with other authorities, shipping and oil/chemical handling communities.
- Working with Environmental Response Headquarters and the Chemical Industry to develop, implement and maintain a corresponding and complimentary regional capability for spills of hazardous and noxious substances other than oil.

3.3 Internal Partners – Fisheries and Oceans

Other branches and directorates within Fisheries and Oceans which directly and in a continuous active way support preparedness and response activities include:

Marine Traffic and Communications Branch (MTCS) – CCG/Marine Programs Directorate

Marine Traffic and Communications Services operates a marine VHF/MF/HF communications system (depending on location) primarily for the provision of marine safety information, distress coordination and marine traffic regulation. MCTS will support Environmental Response (ER) activities by:

- Establishment of Movement Restriction Areas (MRA's) or exclusion zones as directed by the Federal Monitoring Officer (FMO) or On Scene Commander (OSC).
- Providing communications/radio equipment operators in support of off-site ER operations.
- Dissemination of marine information and issuing marine Notices to Shipping (NOTSHIPS).
- Providing vessel tombstone information including, but not limited to, vessel name, call sign, nationality, tonnage, dangerous cargo type and quantity.

Regional Operations Centre (ROC) and Fleet Resources – CCG/Operational Services Directorate

Regional Operations Centre

The ROC provides notification to the Environmental Response Duty Officer (ERDO) when notified of a spill or an occurrence which may result in a spill. Upon receiving information regarding a spill, the ROC confirms the report using reliable resources and agencies. When the incident has been confirmed the Operation Centre begins the alerting and notification procedure. A schedule of ERDOs, approved by the Superintendent Environmental Response Canadian Coast Guard, will be maintained by the ER Regional Emergency Operations Officer (REOO) and forwarded to ROC for distribution.

The Regional Operations Centre will support the Environmental Response Branch during a marine pollution incident by:

- Maintaining up to update contact lists for Canadian Coast Guard and other government agencies for use as incidents progress.
- Coordinating the allocation of CCG resources as required by the FMO or the OSC to respond to a marine pollution incident.
- Provide communications support (when necessary).

Fleet Resources

Fleet Resources may be called upon to provide a host of support and/or lead services depending upon the type and severity of the situation and limitations or constraints of the vessel. Commanding Officers maintain full responsibility for the operation and safety of their vessel and personnel and therefore, will/may:

- Be called upon to be interim On-scene Commander.
- Be the principal point of contact aboard ship for the Environmental Response Duty Officer or On Scene Commander.
- Investigate spill reports for the purpose of confirmation.
- Provide surveillance and monitoring of third party (or pollutant) as required.
- Initiate early spill response; containment, boom or sorbent material deployment, clean up and recovery procedures.
- Provide site safety, (i.e. fire fighting, first aid and crowd control).

Fleet does maintain their own limited capabilities to respond to their needs as required.

Canadian Coast Guard Bases

In preparation for and during a pollution incident, CCG bases may also provide resources for response. These resources are generally within the scope of normal base activities and include:

- Small vessel use
- Base facilities (boardrooms, workshops)
- Helicopter landing pads
- Boat launch and docking slips
- Staging areas

Safety, Security and Emergency Services Branch – DFO Corporate Services

For large spills of a significant nature the Regional Manager of Safety, Security & Emergency Services may provide the following:

- Advice and recommendations to the On Scene Commander on issues of site and employee safety and the application of departmental security policy measures.
- General occupational health & safety and security advice to the On-Scene Commander/Deputy On-Scene Commander as per the departmental Loss Control Manual.

- A Health & Safety Officer to perform the functions of the Heath & Safety Officer described in the Response Management System User Guide. This person will report directly to the OSC or FMO throughout the duration of the response.

On occasions when the Regional Manager of Safety & Security (or delegate) is not available, or when spills are of a minor nature, the On-Scene Commander shall appoint a member of the response team to fulfill the general duties required.

Communications Branch – DFO Communications
Communications team manages the media (external) handling inquiries from print, radio, television and internet news organizations through the application of *Fisheries & Oceans Crisis Communications Plan*. Communications branch coordinates all aspects of information being released to ensure the public is getting the most relevant, accurate information as soon as practicable.

Legal Services
The DFO Legal Services in CCG Headquarters section will provide legal advice and guidance in the event of a marine pollution incident where CCG may or has been engaged. This especially includes advice on the issuance of Letters of Undertaking (LOUs) and in situations where Canadian Coast Guard may have to take command and control of an incident away from the Polluter.

Other DFO Resources
Indirectly, but just as significant in the event of a spill, is the availability of other DFO resources. This includes any and all appropriate functions including, but not limited to the following:

- Trenton Joint Rescue Coordination Centre – CCG, Maritime Services Directorate, Search and Rescue Branch (SAR)
- Finance and Administration – Human Resources and Corporate Services Directorate
- Human Resources - Human Resources and Corporate Services Directorate
- Facilities – Real Property
- Other Technical Resources – CCG, Integrated Technical Services Directorate
- Fish Habitat Branch – Habitat Fisheries and Oceans Management

3.4 Internal Partners – Other Government Departments

Other federal departments which provide direct assistance or have specific mandates which directly affect response activities include:

Environment Canada (EC)
There are two (3) Environment Canada regions located within Central & Arctic region. They are Ontario, Prairie and Northern and Pacific and Yukon Regions.

The Environmental Emergencies Section provides:

- In Ontario, the Co-chair (with the Ontario Ministry of the Environment (MOE)) of the Regional Environmental Emergencies Team (REET).
- In the Arctic (consisting of the three Territories), the Co-chair (with the relevant Territorial Government, Department of Environment) for the Arctic Regional Environmental Emergencies Team.
- Coordination of the Shoreline Cleanup and Assessment Teams (SCAT).
- Advice concerning environmental impacts associated with vessel source spills, resource sensitivity and prioritization, environmental forecasting, spill and cleanup monitoring and clean up techniques and priorities
- Sampling assistance, identification and characterization of materials

The REET serves as a mechanism for the provision of consolidated, coordinated and comprehensive environmental information and advice concerning the fate and effects of hazardous and noxious substances, spill trajectories, resources and shoreline protection strategies, clean up priorities, physical and chemical counter measures, remedial endpoints, damage assessment, and the management of hazardous wastes generated during a spill and other matters which arise while planning and responding to emergency events which affect or risk environmental quality. In the planning mode REET members meet to improve contingency plans, resolve regional preparedness issues and exchange new scientific and response ideas.

In Ontario Region, Environment Canada has divided the province into eighteen (18) REET areas and plans to hold one (1) REET meeting per area per year, consolidating some areas where possible and maintaining annual meetings in the higher risk areas (Windsor, Sarnia, Sault Ste. Marie).

Two of three primary Arctic REET (AREET) areas are in Prairie and Northern Region: the Northwest Territories and Nunavut Territory. There is no REET established in Alberta, Saskatchewan and Manitoba.

The Meteorological Service of Canada (part of EC and REET) provides:

- Meteorological forecasting

The Canadian Wildlife Service (part of EC and REET) provides

- Advice on wildlife protection, rescue and rehabilitation
- Permits for wildlife hazing and capture

Transport Canada (TC)

The Environmental Response Systems Division in Ottawa is responsible for Canada's Marine Oil Spill Preparedness and Response Regime. It:

- works with other federal agencies and departments, such as Fisheries and Oceans Canada, the Canadian Coast Guard and Environment Canada to establish guidelines and regulatory framework for preparedness and response to oil spills and spills of noxious and hazardous substances into Canada's marine environment.

- Manages the National Aerial Surveillance Program

There are two Transport Canada regions located within Central & Arctic region. They are Ontario and Prairie and Northern regions.

The Aircraft Services Directorate provides:

- Aerial surveillance as part of the Prevention mandate within Transport Canada, and can provide aerial spill tracking, recording, and personnel transport.

The Marine Safety Branch provides:

- Technical advice and recommendations to the On-Scene Commander or the Ship Owner regarding, but not limited to, lightering, damage assessment and salvage.

  Note: The MOU between Transport Canada and Fisheries & Oceans Respecting Marine Transportation Safety & Environmental Protection (May 1996) Annex D – E-5 states that "Transport Canada and Fisheries and Oceans will jointly approve salvage operations, emergency lightering or discharge of cargo." After discussing this clause with two senior surveyors, they both agree – Marine Safety does not approve salvage plans. Marine Safety advises and recommends only.
- Restriction of transit or movement of a vessel following a damage assessment.
- Spill investigation and enforcement of the various aspects of the pollution prevention conventions and legislation in Canada
- Regional planning, in conjunction with EC and CCG, for the selection of Places of Refuge. Note: in the Great Lakes and connecting channels, selection of a place of refuge will be determined in conjunction with the USCG and USEPA.
- Monitoring of the spill preparedness activities of Oil Handling Facilities (OHFs) and certified Response Organizations (ROs) through a review and audit process.

Indian and Northern Affairs Canada (INAC)

Canadian Coast Guard (CCG) works most closely with INAC in Nunavut (NU) and the Northwest Territories (NT). INAC has lead responsibilities in the Arctic for spills on water which do not originate at federal facilities, exploration facilities or from ships and barges. INAC also, by letter of agreement, will investigate ship-source spills on behalf of CCG. INAC is also a member of the Beaufort Sea Emergency Preparedness Working Group, along with CCG/DFO, EC, TC and other appropriate agencies.

National Energy Board (NEB)

Based in Calgary, Alberta, the National Energy Board is an independent Agency that reports to parliament through the Ministry of Natural Resources. The NEB is the

Lead Agency for spills that occur at offshore and nearshore oil and gas exploration and production facilities.

In the event of a marine pollution incident where CCG is requested for assistance as a resource agency, CCG is available to provide pollution response expertise as indicated under Section 7.2 of the *National Response Plan* as it relates to NEB.

Public Safety Canada

Public Safety Canada is the federal coordinating department responsible for engaging relevant federal departments in an integrated Government of Canada response to an emergency.

For emergencies requiring an integrated Government of Canada response, federal support is based on a regional "single- window" concept. This concept is intended to facilitate regional interdepartmental and intergovernmental coordination, while not unduly restricting operations. Coordination includes sharing of pertinent information in order to maintain situational awareness.

The Government Operations Centre (GOC) is a 24/7facility where an integrated Government of Canada response is managed. It is the focal point of information management flow and provides strategic-level activities. It's permanent staff includes watch officers, duty officers specializing in national communications as well as a geomatics team to map incidents.

Indirect support from other federal departments in the form of advice or resources also comes from: Heritage Canada (Parks Service) in the form of support to REET, National Defense regarding assistance and resources, RCMP with respect to investigations and those sections or departments specifically identified in the various Memorandums of Understanding (MOU) as outlined in Section 2 of this chapter.

3.5 External Partners - Provincial and Territorial Ministries and Departments

In general, liaison with provincial and territorial concerns is facilitated through REET (Regional Environmental Emergencies Team), which is chaired by Environment Canada (EC) or, in the case of the Province of Ontario, is co-chaired by Environment Canada and the Ontario Ministry of the Environment (MOE). The following agencies have the primary mandate for marine or freshwater pollution response in their province or territory of jurisdiction:

Territory or Province	Department
Northwest Territories	Environment and Natural Resources
Nunavut	Department of Environment
Alberta	Alberta Environment
Saskatchewan	Saskatchewan Environment

Manitoba	Manitoba Conservation
Ontario	Ontario Ministry of the Environment

In emergency situations conflicts sometimes arise with respect to legal and administrative jurisdiction and application of standards and common practices. To facilitate these issues the various Ministries related to emergency measures are usually contacted to provide coordination and clarify where necessary the concerns. These include:

- Government of Nunavut – Department of Community of Government Services, Emergency Management Division
- Government of the Northwest Territories – Department of Municipal and Community Affairs – Emergency Services Division
- Government of the Yukon Territories – Department of Community Services, Emergency Measures Organization
- Government of Ontario - Ministry of the Community Safety & Correctional Service, Emergency Measures Ontario
- Government of Manitoba –Manitoba Emergency Measures Organization
- Government of Saskatchewan – Resource Management and Corrections & Public Safety, Saskatchewan Emergency Measures Organization
- Government of Alberta – Ministry of Municipal Affairs, Public Safety Division, Emergency Management Alberta

Provincial Governments can provide consolidated access to local, municipal and provincial resources.

Central & Arctic Region recognizes that First Nations have a vested interest in response operations that may occur in their territory and will ensure that they are represented on the REET or have access to the Federal Monitoring Officer or On Scene Commander through the CCG Liaison Officer.

3.6 Clients

With respect to ship-source pollution incidents, there are three major groups the Canadian Coast Guard will be directly engaged with. These are Oil Handling Facilities, Legislated Ships and Ships as defined in *Part XV* of the *Canada Shipping Act.*

Oil Handling Facilities (OHF)

Operators of facilities that transfer oil to or from oil tankers over 150 gross registered tonnes or other vessels over 400 gross registered tonnes are required by the Canada Shipping Act (2001) to:

- Have an Oil Pollution Emergency Plan (OPEP) on site.
- Have a declaration conforming to the regulations on site.
- Take reasonable measures to implement their required oil pollution emergency plan in the event of an oil pollution incident.

- Have on site the resources required to contain a spill of oil equal to the facility's rated capability within one hour.
- Begin recovery/cleanup operations of oil equal to the facility's rated capability within 6 hours.
- Have an arrangement with a certified Response Organization (RO) that permits the handling of spills beyond the rated capabilities of the Oil Handling Facility.[1]

Legislated Ships

In Canadian waters, ships over 400 gross registered tonnes and oil tankers over 150 gross registered tonnes are required to have a Shipboard Oil Pollution Emergency Plan (SOPEP) and an arrangement with a certified Response Organization (RO) to respond to an oil pollution incident of an amount equivalent to the maximum amount of product that the vessel can carry as fuel and/or as cargo up to a maximum of 10,000 tonnes.[1]

Other ships as defined by Part XV of the Canada Shipping Act (CSA)

Any ship that is less than 400 GRT or any tanker less than 150 GRT is still covered by the *Canada Shipping Act (2001)* in that it must report the potential or actual pollution incident to a Pollution Response Officer, or in the case of an incident in Canadian Arctic Waters as defined by the Arctic Waters Pollution Prevention Act to a Pollution Prevention Officer. The ship must take immediate steps to mitigate or remedy the situation. These ships are not required to have a Shipboard Oil Pollution Emergency Plan nor an arrangement with a certified Response Organization.

3.7 External Resources

There are two main categories of external resources that the Canadian Coast Guard (CCG) will engage. These are the Response Organizations certified by Transport Canada under the *Canada Shipping Act (2001)* and other contractors.

Response Organizations (ROs)

Response Organizations are privately established pollution response companies certified by Transport Canada. These companies hold a certificate of designation to handle oil spills of up to 10,000 tonnes (T). Response Organizations can provide the polluter or any lead agency with the resources, trained personnel and operational management structure to deal with a marine oil pollution incident within its identified Geographical Area of Response (GAR).

The Eastern Canada Response Corporation (ECRC) is the only certified response organization in Central & Arctic Region. The company is certified to ten thousand tonnes (10 000T) and two of its three regions cover Central & Arctic Region.

[1] There is no requirement for an Oil Handling Facility nor a Legislated Ship to have an arrangement with a Response Organization certified by Transport Canada in Canadian waters north of 60° North Latitude

1) ECRC Great Lakes Region is managed from the Response Centre in Corunna, Ontario. Its area of coverage includes all waters
   - south of 60 degrees north in the provinces of Alberta, Saskatchewan, Manitoba and Ontario to that portion of the St. Lawrence River in the Province of Ontario
   - to a line drawn between Butternut Bay (Latitude 44 31' 12" north and Longitude 75 46' 54" west) on the Canadian side
   - to Oak Point (Latitude 44 30' 48" north and Longitude 75 45' 20" west) on the US side of the St. Lawrence River.

2) ECRC Quebec Region (also known as Societé d'Intervention Maritime Est du Canada - SIMEC) is managed from the Response Centre in Quebec City, Quebec and has staffed Response Centres in Verchères, Quebec and in Sept-Iles, Quebec. Their coverage includes:
   - James Bay, Ungava Bay and in Hudson Bay south of the sixtieth parallel North and that portion of the St. Lawrence River in the Province of Ontario
   - to a line drawn between Butternut Bay (Latitude 44 31' 12" North and Longitude 75 46' 54" West) on the Canadian side to Oak Point (Latitude 44 30' 48" north and Longitude 75 45' 20" West) on the US side of the St. Lawrence River.

There are no certified response organizations established north of 60° N latitude.

Although resources from the Response Organizations in the south may be made available for use north of 60°, they must obtain the necessary approvals to move equipment from their designated area of response.

Contractors

Private sector contractors may be engaged by the CCG as required. All standard government contracting rules apply.

Section 4 – PREPAREDNESS

4.1 Overview

Oil spill preparedness is defined by the advanced planning used to create systems to effectively and efficiently combat the range of spills likely to be encountered.

In Central and Arctic Region, preparedness involves:

- The development of regional procedures to be followed in the event of an incident, coordinated by the Planning section.
- The implementation, training and maintenance of the Response Management System (RMS) to manage and combat the incident.
- The identification of priorities, development of strategies, logistics and tactics necessary to fulfill those priorities, lead by the Planning section.
- The liaising with internal and external partners, clients and resources that may be involved in pollution response activities, lead by the Planning section.
- The training and continued maintenance and upgrading of skills, coordinated through the Training specialist.
- The exercising and quality assurance activities required to continuously reinforce the training and contingency planning activities, facilitated through the Exercise specialist.
- The asset management including the acquisition, lifecycle maintenance, operational readiness and storage of equipment lead by the Operations section and Inventory specialist.
- The integration of other Canadian Coast Guard Assets and Human Resources, when necessary, through the Training and Exercising processes.

The Memorandum of Understanding (MOU) between the Director General/Maritime Services (MS) and the Director General/Integrated Technical Support (ITS) of the Canadian Coast Guard (March 2004) specifies that the ITS Directorate will be the single CCG focus for the life cycle management of all CCG physical assets and for the development of all technical solutions. It is unknown when ITS will assume the services of design, procurement, in-service support and disposal of all equipment and systems required to satisfy ER's mandate. In the interim, ER will remain the focal point.

4.2 Response Management System (RMS)

The Canadian Coast Guard uses the Response Management System (RMS) as its emergency management system. It is based on, and operates under the same principles as the Incident Command System (ICS) which was developed in the U.S. to coordinate multi-agency responses to large forest fires. The system was adjusted to reflect the current marine oil spill response regime and Canadian law. The Canadian Coast Guard does not implement the ICS principle of unified command, but will participate in any command structure used by the Polluter or Other Lead Agency.

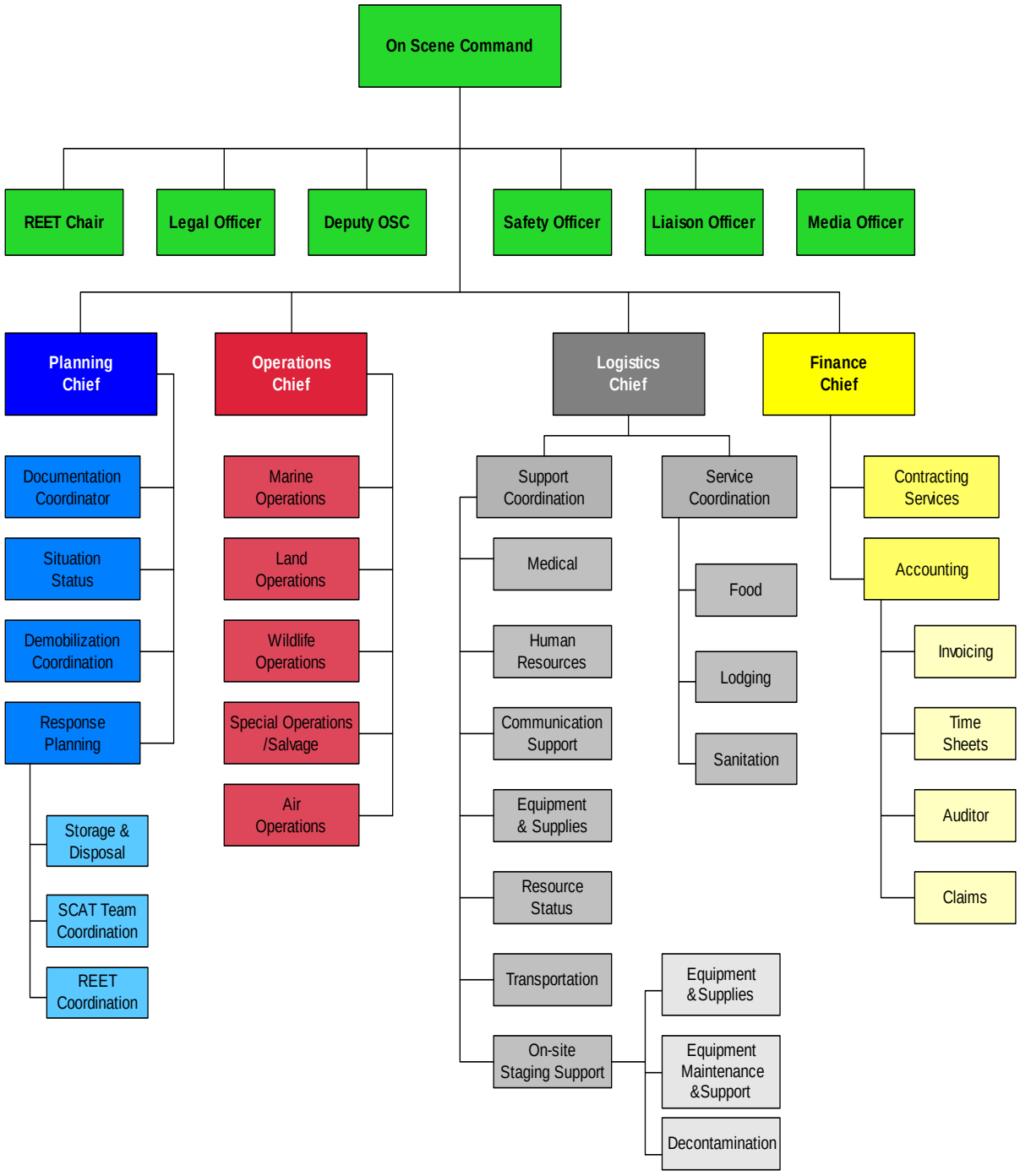
The RMS uses a “management by objectives” approach. It outlines the roles and responsibilities of individual positions, identifies the reporting structure, establishes a common set of terminology and uses standardized forms and paperwork. The central document in the RMS process is the Incident Action Plan, which documents the existing conditions and outlines objectives and strategies for recovery and response.

The system structure is designed to expand or contract to best fit the specific circumstances of the incident. Not all positions within the system will be staffed for every incident; in those cases the supervising position shall be responsible for all subordinate tasks/roles. Regional staff members have been designated as members of the Regional Response Team and may be called upon to fill specified roles in this management system (see Figure 4.1 for a fully expanded system design).

The system also contains management tools that can be used by the On Scene Commander and response personnel to better manage the system and the spill incident. These tools include a field operations guidebook, forms, reports, established meeting schedules and agendas. The RMS will also be used by the Federal Monitoring Officer and their Incident Monitoring Team while monitoring the Polluter’s response to an incident.

The detailed RMS process is contained in a separate document referenced in Section 9.1 of this plan (Response Management Systems User’s Guide, Version 3.0 (May 2006)).

Figure 4.1 - CCG RMS Command Structure



4.3 Planning

Area Plans

To facilitate an effective and efficient response, Canadian Coast Guard administers 16 area plans as an annex to the Central & Arctic Regional Response Plan. They are Keewatin, Baffin, Beaufort Sea & Amundsen Gulf, Great Slave Lake, Hudson & James Bay, Kitikmeot, Mackenzie River & Delta, Inland Waters S of 60, Lake Erie, Lake Huron, Lake of the Woods, Lake Ontario, Lake Superior, St. Lawrence, St. Mary's and St. Clair & Detroit areas. These plans incorporate detailed response information for specific manageable geographic areas or response communities. The normal operating period for an area plan is the first 12-24 hours of a spill response.

They are developed and maintained as follows:

1) Risk Analysis
   The risk analysis determines which communities or areas are most likely to be endangered by a potential oil spill and why, their associated environmental sensitivities, plus the typical type of spill that could be expected. When considering the environmental sensitivities, the focus is on what is most likely to be impacted and to consider as many factors as are applicable. A single factor discovered in the risk assessment is just one of many layers in the decision to make a site a priority.

2) Priority Identification/Verification
   Current priorities are discussed with members of the Regional Environmental Emergencies Team (REET) at planning meetings. It provides the opportunity for additions, deletions or modifications. Where there are no REET meetings held, community consultations are organized by the Planning section.

3) Strategy and Tactics Development
   Canadian Coast Guard determines RMS objectives for the agreed upon priorities. Strategies are designed, that name the activities relative to those objectives. Those activities may be response actions to be implemented, or may be the type of resources that could be affected by the spill. For area plan development, tactics provide the detail for implementing the selected strategies. Tactics then specify the resources, both human and equipment, to facilitate, to install or to maintain the strategy.

4) Updating
   Area plans are reviewed and updated annually.

Regional Procedure Development

Regional procedures for notification, verification, activation and cost recovery of a response are all described in the *Central & Arctic Regional Response Plan* of the *Canadian Coast Guard National Response Plan*. Supporting documentation in the

form of Standard Operating Procedures and supplementary plans (e.g. Health & Safety Plan and Media Relations Plan) are not included in the Regional Response Plan but are referenced in Section 9.

Liaison with External and Internal Partners, Clients and Resources

To ensure that all partners, clients and resources are aware of the Canadian Coast Guard's mandate and responsibilities as they pertain to pollution preparedness and response, the Environmental Response Planning Section takes the initiative to:

- Work with Internal Partners within Fisheries & Oceans to communicate the branch's needs in the event of a pollution incident.

  Exception: Coordination of the Duty Officer (DO) function between Environmental Response (ER) and the Regional Operations Centre (ROC) is coordinated by the Regional Emergency Operations Officer REOO).
- Work with other government departments that have a mandate for pollution response within their jurisdiction to communicate the role that Canadian Coast Guard plays in marine and freshwater pollution incidents and to share what resources Canadian Coast Guard maintains for pollution response activities and the mechanism to access these resources in the event that another Lead Agency may require them for a non-CCG mandated spill or other type of emergency.
- Liaise with potential clients (oil handling facilities, shipping companies and other operators) so that CCG expectations in the event of an incident are understood.
- Provide copies of area plans to CCG vessels that are relevant to their area of operations. CCG ER will brief Operations at the pre and post season conferences on any changes to the plans and/or to the captain and/or crew's responsibilities.
- Maintain a network of contractors that can provide services to Canadian Coast Guard in the event of a pollution incident that exceeds the resource capability of the region.
- Upon request of the Regional Advisory Councils (RACs) or Secretariat (Transport Canada) on Marine Oil Spill Response, provide information on Central & Arctic Region's preparedness and spill response activities.

Arctic Community Emergency Plans

The Canadian Coast Guard is committed to assisting Arctic communities in the development of the marine pollution component of their Community Emergency Plans. This commitment was made in 1999 when the CCG Arctic Response Strategy (ARS) was published. The Arctic Response Strategy has since been re-assessed and viable components have been incorporated into the text of this Plan.

4.4 Training Program and Curriculum

Introduction

The Training Curriculum of the Environmental Response Branch is focused on providing the necessary skills and knowledge for responders to function effectively during a spill response operation. As the competencies required for an effective spill response are described and organized within the Response Management System (RMS), so too can the training curriculum be described in the context of RMS.

With RMS as the framework for spill response, all response team members will be trained in theory and application of RMS. The level of training complexity will vary by level of individual responsibility, but all members will have fundamental knowledge of the structure and processes that drive the RMS.

In addition to the training curriculum described in this section, it is understood that there are competencies and certifications required that are not specific to ER or spill response. These would include driver's licenses, radio operator's licenses, and familiarity with basic electronic equipment such as phones, fax machines, cell phones and laptop computers.

Training Curriculum

Command Staff

During a spill response operation, the command staff will vary depending on the size and complexity of the spill.
On a smaller spill, senior ER staff members may be appointed to command positions with few subordinate or supporting positions.
On larger scale spills, the OSC may be the Director of Maritime Services, or Assistant Commissioner Canadian Coast Guard, with multiple support positions from ER staff, CG fleet, base personnel and contractors.

To adequately prepare personnel for the management functions of spill response, the following curriculum has been identified:

On Scene Command Course (OSC)
This course trains participants in all aspects of spill response including planning, implementation, and supervision. Other topics include legislation, legal issues, financial responsibilities, and media relations. Prerequisites include BOSRC, MSROC, PPO designation, media relations and management training.

Response Management System Course (RMS)
The current RMS curriculum is an introductory two-day course on the system and its user's guide. It is anticipated that future development will include multiple levels of training which will include organizational structure and

responsibilities, as well as in-depth requirements of each position within this emergency management structure.

Federal Monitoring Course (FMO) - Proposed
Subject to national development, this course will augment the On Scene Command Course to provide those persons designated as Canadian Coast Guard Federal Monitoring Officers the necessary skills and knowledge to perform FMO duties.

Operations Section

During a spill response operation, the operations section of the RMS may be populated by regional ER staff, CCG fleet officers and crew, CCG/DFO base personnel or contractors. The resident knowledge of this group will vary, and a comprehensive ER training program exists to train responders in spill response operations. Training for members of the CCG Regional Response Team (RRT) personnel is offered in the following three areas:

(a) Safety Training
(b) Operational Training
(c) Specialty Training

(a) Safety Training

Health and Safety training is required to ensure compliance with federal and provincial legislation with the ultimate goal of ensuring the health and safety of response personnel. Additional video and printed reference material is available through the Canadian Coast Guard ER Training Officer.

Site Safety Course
The Site Safety Course is designed for response personnel prior to commencing work on a response site. Topics include employer and employee responsibilities, classification and hazards of petroleum products, and the safety practices and considerations associated with both water-based and shore-based operations. Site safety training is mandatory for Regional Response Team members and all volunteers or short time workers who may be employed during a response.

Workplace Hazardous Materials Information System (WHMIS)
This 3-hour course is provided to Canadian Coast Guard employees to ensure compliance with appropriate worker safety legislation. It was developed to ensure workers have the necessary information to work safely with hazardous materials in their workplace.

First Aid/CPR
This 16 hour course provides the participants with the skills and knowledge to successfully obtain the St. John Ambulance Standard First Aid Certificate. The primary focus of this 14-hour course is to provide adequate knowledge

and level of skill to persons in positions of responsibility to provide for persons suffering from respiratory and circulatory arrest. Preventative measures are discussed.

Small Non-Pleasure Vessel Basic Safety Course - MED A3
The 8-hour MED A3 course is *required by regulation* for crewmembers of small non-pleasure vessels of not more than 150 GT operating not more than 20 miles offshore. Topics include marine hazards and emergencies, marine firefighting, lifesaving appliances and abandonment and survival and rescue skills.

Transportation of Dangerous Goods (TDG)
This 6-hour course provides personnel with the responsibility for the transportation of dangerous goods to be aware of and comply with safety measures and appropriate legislation concerning TDG.

(b) Operational Training
There are various levels of oil spill response courses designed for response team members, ships crews and other responders who may be expected to assist with marine oil spill response. Operational training related to the assessment and response to petroleum spills is delivered by ER while training for response to hazardous and noxious materials spills is obtained outside of the Branch.

First Responder Oil Spill Training (FROST)
This 1 day course is designed specifically for CCG personnel in Central & Arctic Region who are designated custodians of First Response Units (FRUs), and may be tasked with deployment of the pollution countermeasures equipment. It has also been adapted for use in communities north of 60° where Arctic Community packs function as first response units.
It teaches First Responders to:

- assess an oil spill according to its extent, possible source and likely behavior
- deploy boom for containment and protection purposes and in support of response activities
- work safely at the spill site

Basic Oil Spill Response Course (BOSRC)
This 20 hour course instructs First Responders how to:

- assess an oil spill according to its extent, possible source and likely behavior
- deploy boom for containment and protection purposes and in support of response activities
- operate oil recovery equipment
- undertake basic shoreline cleanup operations
- work safely at the spill site

Marine Spill Response Operations Course (MSROC)
This 40-hour course will enable trained and experienced personnel to coordinate and supervise the response operations of a marine oil spill. It is intended to train individuals to be On Scene Commander (OSC) for small (tier 1) spills, or operations section chief on larger spills. Topics include legislative framework, safety, equipment suites and strategies, media relations, RMS, shoreline assessment and cleanup techniques, and disposal. Prerequisites include BOSRC, a Radio Operator License and current or future deployment to a spill response team.

Environmental Response Duty Officer (ERDO) Training
This 15 hour course is a prerequisite for duty officers for the ER branch and the regional operations centre. It introduces the participant to CCG mandate, lead agency responsibilities and introductory spill assessment techniques. It also integrates delivery of training on the Marine Pollution Incident Reporting System (MPIRS), the database used to capture spill report and response information.

Pollution Response Officer (PRO) Training
This three day course is currently provided by the Environmental Response Branch of the Canadian Coast Guard and is required training for all Environmental Response personnel. Participants who successfully complete this course earn the designation of Pollution Response Officer under Part 8 of the Canada Shipping Act (2001). This course examines the powers of a PRO, specific procedures related to vessel directions and detentions and the legal framework and implications surrounding the execution of those powers. Course participants also learn sampling procedures and gain an understanding of the role of other government agencies involved in a marine pollution incident.

Pollution Prevention Officer (PPO) Training
This 40 hour course is currently provided by the Marine Safety Branch of Transport Canada. It is a prerequisite for any officer of the Canadian Coast Guard to be delegated Pollution Prevention Officer (PPO) powers under the *Arctic Waters Pollution Prevention Act*. Participants learn the existing pollution prevention and response regime, the powers of a PPO and the specific tasks of prevention, control, investigation and prosecution.

Small Vessel Operator Proficiency
This 21-hour course meets the training needs of the small vessel master. This course is required by regulation (for vessels less than 5GT on sheltered and near coastal voyages) and teaches participants to effectively manage safety of those on board, protect the vessel from damage and protect the marine environment.

Basic Barge Operator Training
This course was developed and is delivered by regional ER staff. Through both classroom and practical sessions, the course introduces participants to safe boating practices and procedures, rules of the road, collision regulations, load plans for pollution response vessels, safe deployment of oil spill response equipment and basic trailer towing and maneuvering.

Single Side Sweep System
The single side sweep is an equipment suite designed to allow one vessel to perform oil containment and recovery, and allow for temporary storage. This two day training session is provided to some ER staff and crews of Canadian Coast Guard vessels that can support this equipment. This training typically is conducted with crews who have previously completed BOSRC.

HAZMAT Awareness
This 6-hour course is intended for First Responders on the scene of a hazardous materials incident and shows how to assess the incident. Topics include; First Responder's role and responsibilities, scene safety, recognizing and identifying hazardous materials, incident management, and sources of assistance.

HAZMAT Technicians Level
This 40-hour course is designed for responders to releases or potential releases of hazardous substances. The focus is on recognizing and evaluating a hazardous materials incident, organizing the response team, protecting response personnel, identifying and using response resources, implementing basic control measures, decision-making, and protecting the public and environment. Emphasis is on hands-on use of equipment practically applying lecture information through exercises. Participants will wear fully encapsulating suits.
Prerequisite: Hazmat Awareness.

(c) Specialty Training
Specialty training includes training that only select members of the Regional Response Team (RRT) will have to apply.

Shoreline Clean up and Assessment (SCAT)
This 24-hour course covers how oil impacts the shoreline. Specific topics include shoreline types and effects of oil, wind, waves and ice on shorelines. Shoreline protection and cleanup methods are described in depth. Field exercises are conducted as part of the training.

Media Training
This 16-hour course is designed to provide participants with the skills and knowledge to communicate effectively and proficiently with various forms of media. Topics include; developing and disseminating incident information to

news media, incident personnel, other appropriate agencies and organizations.

Communications System Training
This 8 hours hands-on course provides participants with the knowledge and skills to provide communications in support of a spill response. Topics include; mobile telephone, fax, and intercom set up, preparing communication plans, and internal/external spill response communications.

Wildlife Rehabilitation
The capture and treatment of oiled wildlife is typically assigned to the trained experts at Canadian Wildlife Service (CWS). This CWS training is periodically made available to outside agencies, and some ER staff may participate to facilitate a better understanding of each others' role at the time of a spill.

Financial Management
This training is provided by the Public Service Commission (PSC) and teaches government spending and cost accounting principles. It is imperative that any response team member who may have to purchase assets or manage contracts be familiar with these practices and procedures.

Planning Section
During a spill response operation, the planning section of the RMS will likely be populated with ER staff whose substantive positions are as Planning Officers within the branch. Therefore, the planning skills and training required to effectively and efficiently perform these tasks should be resident within our branch staff.

Should additional personnel be required to fulfill these roles, they would require training in RMS, as well as Site Safety (as required by OSH regulation). The required planning skills and spill response knowledge may be acquired through various training or experience factors, and would be assessed prior to assignment on the response team. In addition to planning skills, preferred training might include SCAT, FROST and/or BOSRC, and MSROC.

Logistics Section
During a spill response operation, the logistics section of the RMS will likely be populated with ER staff whose substantive position involves the tracking of spill response equipment inventory and human resources within the region. Therefore, the skills and training required to efficiently and effectively perform the logistics function should be resident within our regional ER staff.

Should additional personnel be required to fulfill these roles, they would require training in RMS, as well as Site Safety (as required by OSH regulation). The required logistical skills may be acquired through various training or experience factors (knowledge of IRCMS and TMA, BOSRC training) and would be assessed prior to assignment on the response team.

Finance Section
During a spill response operation, the finance section of the RMS will likely be populated by regional finance staff whose substantive positions involve government expenditure and cost accounting knowledge and application. Therefore, the skills and knowledge required to effectively and efficiently perform the finance function should be resident within regional Canadian Coast Guard staff. These personnel will require RMS and Site Safety training prior to deployment on a spill response team.

Training Records
Records for personnel trained in spill response and/or emergency management are maintained by the Region.

4.5 Exercise Program

Introduction
Under the guidelines of the National Exercise Program (NEP), the Environmental Response Branch will implement a Regional Exercise Program. This program will be conducted over a three-year cycle. Coordination of the program will be the responsibility of the Regional Exercise Officer (RXO) of the Environmental Response Branch. Exercises will be designed and conducted in coordination with departmental staff, CCG base staff and CCG vessels on a regular basis. The purpose of the Regional Exercise Program is to validate environmental response training and regional emergency preparedness standards, policies and procedures.

Canadian Coast Guard will, through regional and area-specific exercising, ensure high priority initiatives such as exercising complex equipment (i.e. Lori Brush skimmers, sweep systems and command/communications facilities) are undertaken and will use industry and private sources of personnel where possible and/or appropriate.

Exercise Planning Matrix
The matrix below represents a typical three year exercising cycle followed by Canadian Coast Guard. The program cycle is designed to test all 17-response functions as outlined under NEP as well as including the different types of exercises. It includes internal, external (with other government departments as well as private sector organizations) and international exercises.

Table 4.1 *- Central & Arctic Region Exercise Matrix*

EXERCISE TYPE	YEAR1	YEAR2	YEAR3
Notification	**Quarterly**	**Quarterly**	**Quarterly**
Management	**2**	**2**	**2**
Operational drills	**3**	**3**	**3**
Combined Functional	**1**	**1**	**1**
Full Scale	**0**	**1**	**0**

Notification exercises will test the regional call-out system. Some of these exercises will be internal to the branch, some will be a full regional call-out to all CCG and DFO staff as well as to external resources (eg: freight contractors to check their availability to move Marine Emergency Response Trailers (MERTs) or First Response Units (FRUs).

Management exercises will focus on the development of the spill through the Response Management System (RMS).

Operational Drills will focus on equipment deployments in packages (i.e. a First Response Unit, NOFI V-Sweep).

Combined Functional exercises will be an equipment deployment (operational drill) with the goal of implementing a tactic designed in one of the Region's Area Plan Annexes.

A *Full Scale* exercise will incorporate a management-type exercise with the concurrent deployment of a spill countermeasure system (system = pollution containment, recovery, primary and secondary storage devices)

Exercising Partnership

Canadian Coast Guard will endeavor to participate, by request and on a situation by situation basis, in exercises lead by Oil Handling Facilities (OHFs), certified Response Organizations (ROs) and other government agencies throughout the Region.

Central and Arctic Region is a part of the Canadian Coast Guard response community and as such is also part of the International Response Community. Canadian Coast Guard's regional boundaries are in such close proximity with our United States neighboring response communities that joint exercising is a high priority. Specifically this region conducts joint exercises in the geographic areas of the Great Lakes and the Beaufort Sea with the United States Coast Guard's (USCG) (9^{th}) ninth (Great Lakes) and (17^{th}) seventeenth (Alaska) districts, respectively.

Exercise Evaluation and Shared Learnings

An important part of the National Exercise Program is the evaluation and use of subsequent findings. Four types of information can be learned from an exercise, all of which lead to improvement of overall response capability.

1) Contingency planning
2) Response techniques
3) Response training
4) Exercise program development

The primary sources of the information and learning will be the formal exercise evaluation report that is produced for every exercise by the evaluation team. This formal exercise report will follow the format laid out in Section 11 of the *Canadian Coast Guard National Exercise Program Planning and Evaluation Guide*.

4.6 Inventory Management, Maintenance and Infrastructure

Inventory Response Control Management System

To ensure that a nationally consistent and effective state of preparedness is maintained, an Inventory Response Control & Management System (IRCMS) has been implemented which utilizes The Management Authority database as its main tool. CCG HQ administers this system in concert with regional IRCMS Officers. In this region the program is administered by the Logistics and Statistics Officer in the Operations Section.

This system has been developed to:

- Maintain a real time record of the location and quantity of resources;
- Maintain a proper state of readiness through a pro-active approach using work orders and preventative maintenance;
- Assist in keeping response managers informed about Environmental Response's state of preparedness;
- Assist in the tracking of National Response Team personnel or equipment assigned to National or International incidents

Pre-positioned Equipment Caches and Depots

Central and Arctic Region covers an extremely large geographical and culturally diverse portion of Canada. There are, in essence, two zones of operation which are entrenched in the *Canada Shipping Act*. These are:

- the Arctic Zone, or all areas of Canadian jurisdiction north of 60^0 North Latitude; and
- the Central Zone, dominated in a marine transportation sense by the Great Lakes, but which include the southern portions of Hudson and James Bay, along with the major waterways and watersheds of Lake Winnipeg, Winnipegosis, Lake of the Woods, and Lake Athabasca.

The Environmental Response (ER) Branch has pre-positioned equipment to facilitate and maintain an effective response operation. Response strategies in each of the two zones (Central or Arctic) are based upon identification of local and regional response. This is means that the equipment generally required for such a spill size is contained within the Region. This capacity is supplemented by nationally available resources, which would be "cascaded" from/to other regions when and if required. Preparedness capacities in other regions are identified in their respective Regional Response Plans.

Arctic Zone

Arctic Community Packs (ACPs) are placed in northern communities for rapid (local) initial response. Canadian Coast Guard provides initial response training to members of the communities so that they may effectively deploy equipment in the ACPs in the event of a spill. Access (keys) for the ACPs have been given to an official in each community in most cases. The Senior Response Officer (ER-Hay River) maintains the current key holder listing.

The inventory for each Canadian Coast Guard Arctic Community Pack location is listed in Table 4-2. The program has received funding under the Health of the Oceans Initiative to proceed with placing Arctic Community Packs in additional sites. The equipment profiles at the existing Arctic Community Pack sites will be changed to reflect characteristics of the community. The inventory at all communities will be "site specific" and will coincide with response strategies designed by the ER planning group. The locations for the proposed additional Arctic Community Packs are: Baker Lake, Broughton Island (Qikiqtarjuaq), Chesterfield Inlet, Churchill, Hall Beach, Kimmirut, Iqaluit, Pangnirtung, Tuktoyaktuk and Yellowknife.

The main base of operations with Environmental Response dedicated personnel is located in Hay River, Northwest Territories. This base is home to a Rapid Air Transportable (RAT) cache of equipment known as the "RAT150". The RAT150T used in conjunction with the "Delta" (Δ) 1000T meets planning standards for a 1000 tonne (T) response. The selection of equipment for the RAT150 must meet pumping rates / capacities of 1000T thresholds and be complimentary[2] to the equipment held in the Δ1000T depots.

The response package, warehoused in Hay River, will be maintained in 100% readiness during the shipping season. The equipment will be broken down and be containerized such that it will fit through the smallest cargo door of any of the selected aircraft. Equipment will be TDG compliant, be palletized as appropriate, and labelled for ease of selection and loading.

[2] The logistics of moving large bulky items (ISO containers) in the arctic necessitates a LCM, deck barge, cargo vessel, icebreakers or any combination thereof. Consequently it is estimated that the 1000T design capacity would be available staged on-scene in 5 - 7 days. Following the doctrine *something sooner rather than everything later* having 150T of the 1000T equipment suite air-lifted within 48 hours is preferable to having nothing until the entire 1000T capacity arrives a week later.

Table 4-2 *- Canadian Coast Guard Arctic Community Pack Locations*

LOCATION	EQUIPMENT SUMMARY			
	Boom (24")	**Skimmers**	**Boats**	**Storage**
Arctic Bay (Ikpiarjuk)	3,650'	TDS-118	16' Aluminum	Open top Tank
Cambridge Bay (Ikaluktutiak)	1,350'	TDS-118	16' Aluminum	Open top Tank
Cape Dorset (Kinngait)	1500'	TDS-118	16' Aluminum	Open top Tank
Clyde River (Kangiqtugaapik)	4,500'	TDS-118	16' Aluminum	Open top Tank
Coppermine (Kugluktuk)	1,350'	TDS-118	16' Aluminum	Open top Tank
Coral Harbour (Salliq)	1,500'	TDS-118	16' Aluminum	Open top Tank
Gjoa Haven (Uqsuqtuuq)	1,350'	TDS-118	16' Aluminum	Open top Tank
Holman (Ulukhaktok)	1,500'	TDS-118	16' Aluminum	Open top Tank
Rankin Inlet (Kangiqsiniq)	2,200'	TDS-118	16' Aluminum	Open top Tank
Resolute (Qausuittuq)	1,350'	TDS-118	16' Aluminum	Open top Tank
Hay River FRU +	1,000'	-	37' Seatruck 42' Cutter	-

In combination with the RAT150T, equipment found in the ∆1000T depots will be at a 1000T capacity. Hence, the delta or "∆" is the difference between the RAT150T and a full 1000T. The ∆1000T depots will have containerized heavier equipment (not suitable for air transport to smaller communities) augmenting the RAT150T to a 1000T capacity, ready to be loaded on deck barge, Canadian Coast Guard icebreaker or freighter. While response personnel cascade in to the spill site pre-identified local, CCG base and available ER personnel will mobilize to the centres and load the equipment on suitable marine transport.

Three ∆1000T depots are strategically located in the northern communities of Tuktoyaktuk (NorthWest Territories), Iqaluit (Nunavut), and in Churchill (Manitoba). For the purposes of response in Central & Arctic Region, Churchill is included in the Arctic Zone of operations despite it being south of 60° North Latitude due to the similarities in response characteristics that it shares with locations north of 60° North Latitude.

Table 4-3 *- Canadian Coast Guard Arctic Design Inventory*[3]

PCM equipment	Description	Hay River RAT150T	Tuk Δ1000T	Iqaluit Δ1000T	Churchill Δ1000T
Skimmers	Light to medium product /disk type	3	1	1	1
	Heavy product /weir type	0	2	2	2
Boom	24" river type	0	10000'	10000'	10000'
	24" lay-flat type	5000'	0	0	0
Land storage	4T Open top tank	0	0	0	0
	8T Open top tank	7	3	3	3
	45T shore bladders	3	0	0	0
O/w storage	Total (in 5-25T Seaslugs)	50	250T	250T	250T
Pumps	2" low pres / volume style	4	1	1	1
	4" trash	5	1	1	1
	3" positive displacement	6	1	1	1
Vessels	"Car-topper" + 9.9hp	0	0	0	0
	Seatruck	0	2	2	2
	RAT RHI	2	0	0	0
Generators	5KW gas	7	2	2	2
Pressure washer	Larger hot water type	1	1	1	1
	Small cold water type	3	1	1	1
Incinerator	Sorbent	2	0	0	0
	Liquid waste	2	0	0	0

Central Zone

The Central zone is dominated by the Great Lakes and has well defined road transportation infrastructure.

Local / first response inventories have been established at all regional Canadian Coast Guard shore-side facilities that have fleet assets or a significant number of program vessels and that have operational personnel to deploy the equipment. Standardized inventory consists of a 20-24' trailer with a 1000' (nominal) of 24" boom and related accessories.

The 2500T Rapid Road Transportable cache is centred around the St. Mary's River and from time to time in major CCG facilities in Ontario. The response package warehoused in a series of 45' transport trailers will be maintained in 100% readiness during the shipping season. The primary purpose of the RRT 2500T system is significant containment of resources; shoreline, sheltered, and off-shore sweep and recovery ability; and staging and storage transfer area equipment.

[3] Inventories in Tuktoyaktuk and Iqaluit are at 95% completion. The Churchill Depot is at about 50% (pending the construction of a new and adequate facility) with the bulk of the inventory in storage at the Thundar Bay Coast Guard base. The RAT 150 needs an evaluation of the command and control component as well as storage for the second Saccke burner.

Table 4-4 *Canadian Coast Guard RRT 2500T Design Inventory*

PCM equipment	Description	BOOMERT #1-5 (each)	SKIMMERT #1 and #2[4]	Softside
Skimmers	Light to medium product/ disk type	-	3	
	Heavy product/ weir type	-	1	1
Boom	24" river type	4000'		
Sweep	36" Nofi V-sweep	-		1
Land storage	4T Open top tank	-	7	1
O/w storage	25T Towable bladders	-	4	4
Pumps	3" positive displacement	-	4	1
Generators	5KW gas	-	2	

Table 4-5 *Canadian Coast Guard locations for First Response Units (FRUs)*

Location	Relevant Area Plan(s)	Primary custodian	Secondary custodian
Amherstburg	Lake Erie/St. Clair-Detroit	SAR crew	ITS field services
Cobourg	Lake Ontario	SAR crew	
Gimli	Lake Winnipeg	SAR crew	
Goderich	Lake Huron	SAR crew	
Kenora	Lake of the Woods	ITS field services	
Kingston	Lake Ontario	SAR crew	
Meaford	Lake Huron	SAR crew	
Parry Sound	Lake Huron	ER personnel	ITS field services
Port Dover	Lake Erie	SAR crew	
Port Weller	Lake Ontario	SAR crew	
Prescott	St. Lawrence River	ER personnel	ITS field services
Selkirk	Lake Winnipeg	ITS field services	
Thunder Bay	Lake Superior	SAR crew	ITS field services
Tobermory	Lake Huron	SAR crew	
Hay River	Mackenzie River & Delta	ER personnel	ITS field services

[4] An additional SkimMERT is being added this year to accommodate additional hoses. The exact configuration of each SKIMMERT is not known yet so the inventories will remain listed together for this year.

Section 5 - RESPONSE OPERATIONS

5.1 Pattern of Response

Based upon the principles outlined in the *National Response Plan*, *(Sections 1.3, 1.5 & 4.4),* Central and Arctic Region assesses, notifies relevant parties, and initiates the tasking/deployment of necessary resources. This is based upon the determination of CCG's role as Lead or Resource Agency and the appropriate CCG Posture. The Duty Officer (DO) is tasked with this initial assessment, which is then verified by the Superintendent, Environmental Response. The appropriate response is activated by the Superintendent who in turn assigns an On-scene Commander (OSC) or Federal Monitoring Officer (FMO) and notifies Canadian Coast Guard (CCG) Management. Upon termination of the incident cost recovery actions are undertaken. To illustrate the generic process see Figure 5-1-Typical Sequence of Events and Table 5-1-Typical Functions Descriptions has been provided.

CCG Expectations of Ships for Response

In most instances when a spill occurs the initial report will trigger the mobilization of local response organizations. It is not normally practical for ship personnel to be directly involved in the clean up activities.

Small Spills

Ships are expected to take whatever actions listed in their Shipboard Oil Pollution Emergency Plan (SOPEP) that are reasonable and necessary to prevent the oil from escaping over the side and having done so, to take action to clean-up the oil contained on deck. Spilled oil should not be washed overboard, nor should degreasers or dispersants be used on spilled oil in the water. Once the oil is in the water, the ship's ability to respond in a practical manner is greatly reduced. It is Canadian Coast Guard's expectation that a response organization or other competent contractor be called upon to provide operational response capability at the discretion of the Polluter.

Where there is no availability of local response contractors or where there is a delay in response activation, the Master of the vessel should consider the use of available materials to contain and clean up the spilled oil by, for example, using ship-stocked absorbent material or utilizing mooring ropes or air filled hoses as makeshift booms.

Large Spills

The ship is restricted as to what action it can take to respond to a major spill. In the case of a casualty the safety of the ship and crew take priority. Therefore the ship's actions will be limited to reporting the incident details

to the appropriate authorities and to ensure that a response is initiated. In large spills it is Canadian Coast Guard's expectation that the Polluter appoint an On-Scene Commander (OSC) which may be a representative of the company that owns the ship or the ship's insurer.

Canadian Coast Guard needs to be kept informed as to the escalating response costs accrued by the Polluter during a response in order to prepare for the possibility that the Polluter will cease their response activities once their Limit of Liability is reached.

CCG expectations of Oil Handling Facilities (OHF) for Response

In most instances when a spill occurs, the initial report will trigger the mobilization of the facility response team. It is normal, in most cases, for the oil handling facility personnel to be the initial responders when a spill occurs.

Small Spills

For the purpose of this plan, a small spill will be defined based on the maximum oil transfer rate of the oil handling facility (i.e. what Level it is assigned under the *Canada Shipping Act, 2001),* which directly links to the minimum spill size to which it must be prepared to respond to within one hour. Oil handling facilities are required to have the resources on site to contain a spill of a minimum size within one hour and have the resources required to recover, or where the oil cannot be recovered the resources to control a spill of a minimum spill size within six hours. Response organizations may be called upon to provide additional operational response capability at the discretion of the Polluter.

Large Spills

For the purposes of this plan, any spill above the facility's minimum spill size will be characterized as a large spill. Oil handling facility personnel are still expected to deploy their on-site equipment. Response organizations will likely be called upon to provide additional operational response capability at the discretion of the Polluter.

***Figure 5-**1 - Pattern of Response – Typical Sequence of Events*

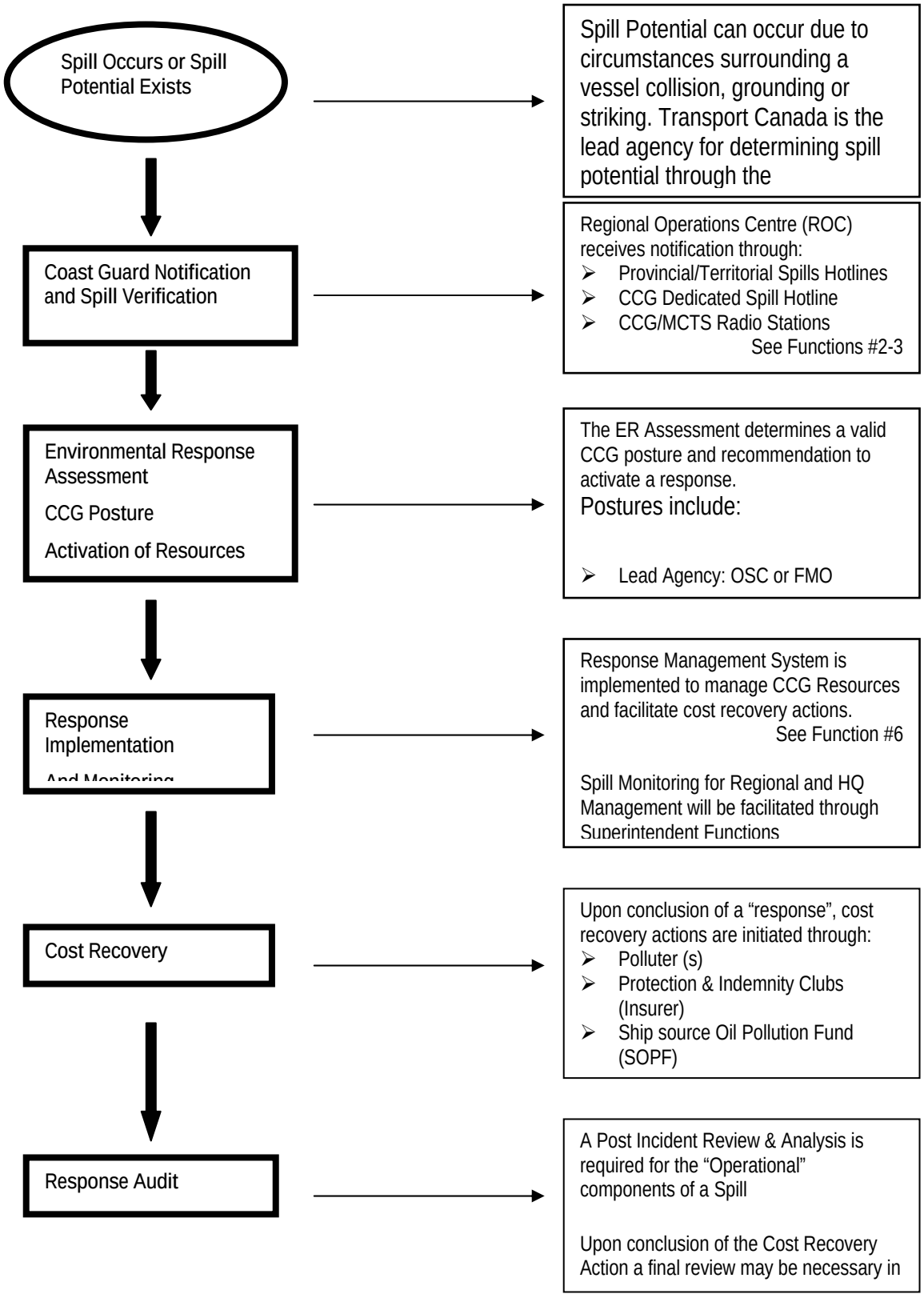


Table 5-1 *- Pattern of Response – Function Descriptions*

Function		***Description***
1	**Responsible Party/Third Party Functions** *(Spill occurs or sufficient potential risk exists)*	• Spill is sighted/reported. Spill reports originate from source (to regulatory body) or by third party (to various emergency or dedicated pollution hotlines) • Transport Canada is responsible for determining potential risk
2	**Spills Hotline Functions** *(Canadian Coast Guard Notification)*	• Assessment for dissemination • Dissemination (fan out according to applicable procedures) to relevant parties, calls from other spill hotlines are received by CCG-ROC.
3	**CCG-ROC Duty Officer Functions** *(Canadian Coast Guard Spill Verification)*	• Spill Assessment-pollution verification ➢ Mandate Confirmation ➢ Pollution Verification ➢ Source Credibility • Notification to ERDO • Dissemination • Initiation of MPIRS
4	**ER Duty Officer Functions** *(Environmental Response Assessment – CCG Posture)*	• Spill Assessment-response analysis • Source Control/Mitigation • Safety Issues • Tactical & Logistical Issues • Recommendation to Superintendent of likely Response Posture • Documentation – MPIRS
5	**Superintendent Functions** *(Environmental Response Assessment – Activation of CCG Resources)*	• Response Posture Evaluation ➢ Potential Risk to CCG Personnel and Equipment ➢ Propriety of request ➢ International Implications • Identification of OSC/FMO • Obtain an Order-In-Council (Arctic) • Obtain a Finance Code & Regional File Number • Notification of Senior Management and ongoing monitoring • MPIRS documentation • Obtain AC CCG sign off on MPIRS situation report
6	**OSC/FMO Functions** *(Response Implementation*	• Management or monitoring of response using the Response Management System (RMS). Escalation or de-escalation in accordance with needs of the incident. • Consolidation of all documentation upon conclusion of the response for Cost Recovery purposes. • Coordinate final debrief to facilitate future improvements to the systems and processes in place.
7	**Chief Financial Officer Function** *(Cost Recovery)*	• Utilizing CCG Ship-source and Marine Pollution Response Costing Principles and Documentation Standards (DFO 6332) compile pollution response costs recovery claim.

8.	**Internal** **Review Team Functions** *(Audit)*	• Utilizing the National Exercise Program Planning and Evaluation Guide, a Team is selected to complete the Post-Incident Review of an incident. • Improvements & corrective actions are to be documented

5.2 Spill Potential or Pollution Risk Assessment

Given an actual spill (i.e. pollutant in the water), the activities specified in this plan are rather obvious. However, in the event of vessel grounding, striking or collision that does not immediately result in a release, the responsibility for determining the risk of pollution rests with a Pollution Prevention Officer (PPO) within the Marine Safety (MS) branch of Transport Canada (TC). Should TC-MS be unable to make that determination, the Canadian Coast Guard (CCG), Environmental Response Duty Officer (ERDO) will complete that requirement. In some cases this may involve engaging a marine architect as no accredited expertise for vessel stability assessment resides within the ER section.

For all other areas where Canadian Coast Guard is the Lead Agency, this activity shall be considered the responsibility of the Canadian Coast Guard, Environmental Response Duty Officer.

5.3 Notification

To facilitate the notification of Canadian Coast Guard, and in addition to the existing Marine Communications system, a series of call-out or “Spill Hotline” agreements with the Province of Ontario, Nunavut and Northwest Territories and other Federal Departments within the Region have been implemented.

In addition, Central and Arctic Region, provides a 24 hr public access spills hotline:

24 hour toll free - Spills Hotline:
1-800-265-0237

Notification may occur through various mechanisms, depending upon the manner in which the spill (incident) occurs.

5.4 Verification

In all cases, spill information is initially processed and verified through the Regional Operations Centre (ROC) located in Sarnia, Ontario (See Section 3.3 – Organization). The ROC Officer on duty:

1. Determines whether the pollution is within Canadian Coast Guard’s mandate as Lead Agency or as a potential Resource Agency
2. Establishes the credibility of the source

3. Identifies the following:
    - Incident name (nature of incident)
    - Time of call (local / UTC)
    - Time of spill (local/UTC) *(if available)*
    - Reported by / call back particulars
    - Source determination
    - Incident background and description of clean-up activities (if any)
    - On-scene environmental/atmospheric conditions
    - Pollutant type and quantity
    - Verifying party contact information (as applicable)
4. Initiates an MPIRS entry for the following cases:
    - Originally pursuing verification as Canadian Coast Guard mandate but additional information about source changes lead to another agency
    - Canadian Coast Guard mandate and verified no pollution
    - Canadian Coast Guard mandate and verified pollution
    - Likely to impact on / impacting on foreign waters
    - Significant impact on region, though not falling under Canadian Coast Guard mandate.
    - Request for Canadian Coast Guard as a resource agency.
5. Enters information into MPIRS (indicated in #3 above) as well as name of paged ERDO.

This information is then relayed to the Environmental Response Duty Officer to determine Canadian Coast Guard posture. It should be noted that all spill incidents, irrespective of CCG's mandate, may require Canadian Coast Guard resources if requested (see Resource Agency Role in Section 1.5 of the *National Response Plan).*

By agreement, spill verification will be completed by the Regional Operations Centre (ROC) Duty Officer. The verification will be complete when the ER Duty Officer is advised where Canadian Coast Guard is Lead Agency. (see Figure 5.2 Pollution Verification Process and Figure 5.3 Response Analysis Process)

5.5 Spill Assessment – Environmental Response Duty Officer

To facilitate the requirement for efficient and rapid notification and assessment of incidents, Central and Arctic Region, in accordance with the *National Response Plan,* Section 4.4, has instituted a 24-hr year round monitoring regime integrated with the Regional Operations Centre (ROC). The following sections identify the context in which this activity is carried out.

Coordination

The coordination of the ER Duty Officer is the responsibility of the ER Regional Emergency Operations Officer (REOO). These duties include assigning shifts in an equitable manner, keeping records of the duty officer schedules, maintaining equipment required to perform ER Duty Officer functions, reviewing individual ER Duty Officer performance, reviewing ER Duty Officer procedures, and liaising with the ROC and National HQ.

Performance

The ER Duty Officer function shall be performed by the following positions provided sufficient experience, appropriate training, and at the discretion of the Superintendent ER:

- ✓ Senior Officers
- ✓ Those in capacity to act for Senior Officer.

Review

The ER Duty Officer procedures shall be reviewed in reaction to:

- Changes at the Regional Operations Centre (ROC) affecting the ER Duty Officer function
- Changes in Canadian Coast Guard (CCG) policy on the response to ship source pollution
- In consideration of accepted recommendations stemming from exercises and operational responses.

The individual officer performance shall be reviewed in context of their execution of a spill assessment.

Responsibilities

At the beginning of the ER Duty Officer's shift the following are required:

- Functioning communication equipment (pager, cell phone/Blackberry);
- The necessary analytical tools (e.g. spill assessment forms, Greenwood's Guide to Great Lakes Shipping, Area Plans, Oil Spill Response Field Guide, OSH reference tools, and the CANUTEC Emergency Response Guide book.)

During the ER Duty Officers shift the following are required to be complete:

- MPIRS cases for any spill reports that required ER Duty Officer analysis by noon of the next business day;
- Extra Duty Reports;
- Notification of the next ER Duty Officer and the ER Regional Emergency Operations Officer of any on-going cases.

Availability

The availability of the ER Duty Officer is 24 hours/7 days a week. Pages must be responded to within 10 minutes of notification. Should the ER Duty Officer (DO) be unable to fulfill their duties at any time during the shift, they are required to

notify the ER Regional Emergency Operations Officer (REOO) immediately who will notify the ROC of any changes immediately. The following activities conflict with the performance of the ER Duty Officer function:

- travel out of country / region / pager range;
- inability to respond immediately due to performance of other job functions (instructing a course, running an exercise, delivering a presentation, involved in a maintenance run that would be too difficult to reschedule, chairing a meeting, or participating in any activity that requires attendance or would be inappropriate to leave);
- inability to respond immediately due to personal reasons (vacation, sickness, etc.).

Should an individual become unavailable for a significant portion of the shift for reasons noted above, that shift may be assigned to another officer at the discretion of the ER Regional Emergency Operations Officer.

Function

The primary function of the ER Duty Officer is to complete an initial incident assessment and analysis, making a recommendation to the Superintendent of ER as to the appropriate course of action. **

The initial assessment will be complete for the following cases:

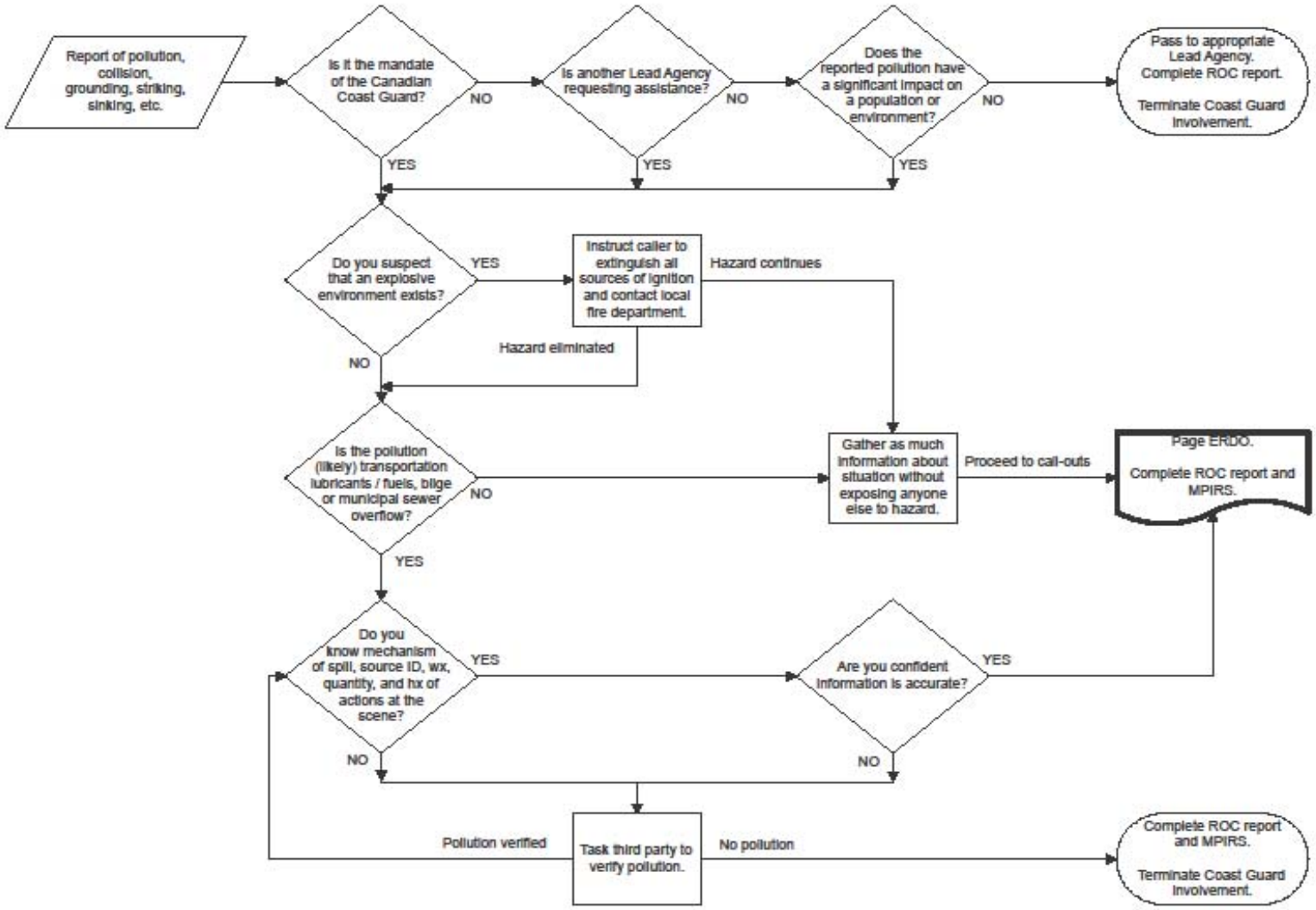
- Canadian Coast Guard mandate and verified pollution
- Likely to impact on / impacting on foreign waters
- Significant impact on region, though not falling under Canadian Coast Guard mandate.
- Request for Canadian Coast Guard as a resource agency.

The analysis function is complete when the Superintendent ER is informed and advised of the recommended course of action that will consider the following (see flow chart):

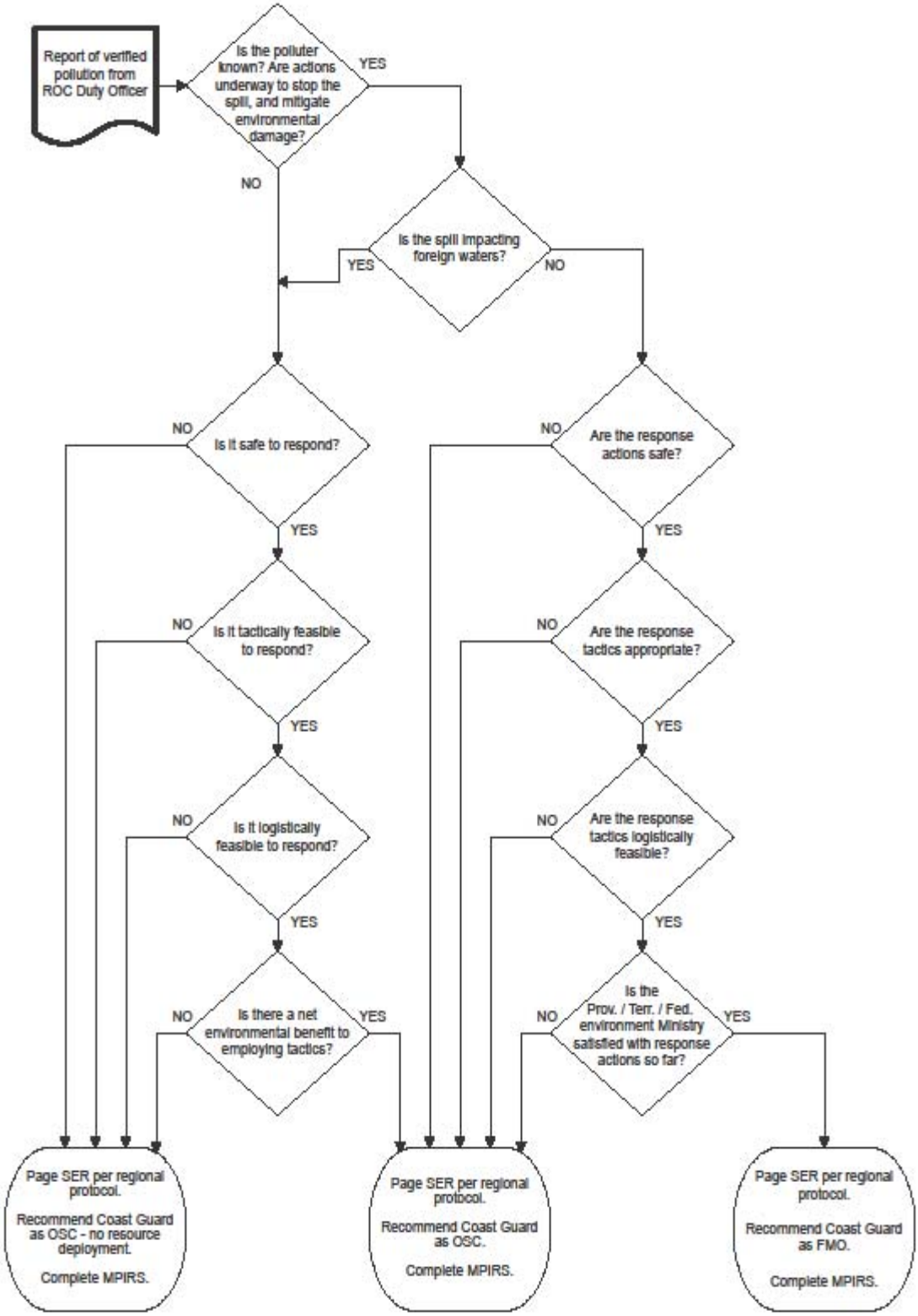
- polluter's actions and intentions (if applicable);
- safety concerns, tactical, logistical, and environmental feasibility of any response.

** The ER Duty Officer does not need to notify the Superintendent of any incidents that require "no activation" of CCG resources (assets/personnel) in monitoring/clean-up activity.

Spill assessment: *pollution verification process*



Spill assessment: *response analysis process*



5.6 Activation of Canadian Coast Guard Response Resources

In the event of small (0-150 T) to medium size (150-1000 T) spill incidents, the Superintendent, Environmental Response, acting upon the assessment provided by the Duty Officer, initiates/activates the appropriate response. This entails, but is not limited to, the following activities:

- Identification of overall health and safety risks to response personnel.
- Establishing the propriety of the recommended response posture. This includes the verification of international issues in border areas.
- Verification of Canadian Coast Guard capability to respond, impact on normal regional operations and, if necessary, the potential requirement for the notification and activation of the National Response Team.
- Assignment of the designated On-Scene Commander (OSC) or Federal Monitoring Officer (FMO). SROs are typically assigned as FMO/OSC for incidents occurring within their geographic area.
- Obtaining the necessary Order-in-Council, for spills in Arctic Waters
- Obtaining the financial project code, and forwarding it to the OSC/FMO.
- Signing a contract with the Response Organization (RO) in accordance with PWGSC contracting rules.
- Creation and dissemination of initial situation report to Regional and National management in accordance with the *Safety and Environmental Response Systems (SERS) – Incident Notification Guidelines*.
- Completion of MPIRS to document above activities.

For significantly larger spill incidents (1000T and above) the Superintendent, Environmental Response shall immediately assume the OSC/FMO role, notify Regional and National management of the situation and initiate the Response Management System (RMS) (and activation of the National Response Team, if necessary) in addition to the above activities. Upon stabilization of the immediate emergency, the Assistant Commissioner, Canadian Coast Guard, Central and Arctic Region and/or Director General, Canadian Coast Guard shall assess the requirement for assigning a new OSC/FMO.

5.7 Response Implementation

As stated previously (Section 4 - Preparedness), the Canadian Coast Guard will employ the Response Management System (RMS) as its primary management and operational tool. At the heart of this system is the development of clear obtainable objectives and the implementation of the supporting tactical deployment. This is achieved through the creation of incident action plans spanning specified operational time periods. For small spills these plans can be rather informal. As spill size and impacts increase, so to will the complexity of

operational assignments and hence a need for greater formalization of the Incident Action Plan.

All operations shall be carried out in accordance with the Guiding Principles set out in *Section 1.3* of the *National Response Plan* and the *Oil Spill Response Field Guide* (ISBN 0-660-16112-5).

Central and Arctic Region covers an extremely large geographical and culturally diverse portion of Canada. There are, in essence, two zones of operation which are entrenched in the *Canada Shipping Act*.
These are the:

- Arctic zone, or all areas of Canadian jurisdiction north of 60^0 N Latitude;
- Central zone, dominated in a marine transportation sense by the Great Lakes, but which include the southern portions of Hudson, James and Ungava Bay, along with the major waterways and watersheds of Lake Winnipeg, Winnipegosis, Lake of the Woods, and Lake Athabasca.

Arctic zone – first response
The highest risk of pollution in the arctic is during a ship fuel transfer to facilities in Canada's northern communities. Should pollution occur, the vessel and oil handling facility have responsibilities to implement their Oil Pollution Emergency Plans (OPEP) that deal with source control. The next step would be for the community to respond using its response plan, protecting the identified priority area(s) and employing the response equipment in an Arctic Community Pack, if so equipped.

Arctic zone – escalation
If the pollution is beyond the ship, facility, and community response then the Rapid Air Transportable (RAT)150T will be the first line Canadian Coast Guard ER response (Arctic icebreakers or Special River Nav-aid Tenders may have been on-scene first). Upon activation of the RAT150T, standing offers with aviation contractors will be called up. Closest ER personnel will be dispatched to the community to assess, plan, assemble (and train) responders, while preparing to stage the in-coming equipment. The Hay River base personnel will transport the pallets to the airport where they will be loaded into the awaiting airframe. Upon arrival the pallets will be unloaded and a trailer tongue and wheels affixed to the pallet to facilitate movement (by ATV if necessary) to a forward staging area and ultimately to a beach site. The timeframe for full forward staged capacity with personnel at any community with suitable runways is under 48 hours.

The hospitality industry of Arctic communities can be rapidly overwhelmed with the influx of as little as 10 people. Experience has shown that these communities could only support 10-15 additional personnel and only offer 10-15 community responders. Consequently, the RAT was designed considering the amount and type of equipment that is most easily handled by a combination of trained

Canadian Coast Guard personnel and community responders. The RAT150T response is predicated on an in-community response with the following positions identified in the table below:

Table 5-2 *Anticipated personnel usage for the RAT150T in an Arctic community*

Position	Canadian Coast Guard responder	Community responder
OSC	X	
OSC support		X
Chief Ops & Planning	X	
Logs – services	X	X
Logs – support	X	X
Ops skimming (A)	X	X
Ops skimming (B)	X	X
Ops shoreline (A)	X	X X X X
Ops shoreline (B)	X	X X X X
Ops booming vessel (A)	X	X
Ops booming vessel (B)	X	X
Transfer / disposal	X	X
Totals	**11**	**16**

Upon escalating beyond a RAT150T response, the Δ1000T will be stood up. Standing offers / arrangements with local contractors will be activated to move the containers / seatrucks to a location where they can be transferred to a ship / barge. If required, closest Canadian Coast Guard base personnel will be dispatched to the depot to assist. The closest suitable marine transportation asset will also be contracted to move the equipment to the spill site. The timeframe for full forward staged capacity with personnel is estimated at one week.

As the 150T response is predicated on an in-community response a larger spill would have to be supported by a Canadian Coast Guard icebreaker, rented camp barge, or flown in from surrounding communities.

Table 5-3 *Anticipated personnel usage for the 1000T in an Arctic community.*

Position	Canadian Coast Guard ER responder	CCG Fleet or professional contractor	Community responder
OSC	X		
OSC support		X	X
Chief of Planning	X		
Plan – response	X		
Plan – demobilization	X		
Chief of Logs	X		
Logs – services		X	X
Logs – support	X X	X X X	
Chief of Ops	X		
Air Ops		X	
Ops on-water	X X	X X X X	
Ops shoreline	X X		X X X X X X X X X
Ops booming	X X	X X X X	
Transfer / disposal	X	X	X
Totals	**14**	**13**	**13**

Central Zone – first response

The highest risk of pollution occurring in the region is found in the Great Lakes. Statistically the areas in the Great Lakes of highest risk are the connecting channels due to volumes, numbers of transits, and convergence factors (existing VTS / navigational aid systems recognize this). Areas with traditionally high pleasure craft and small commercial craft traffic experience frequent (though low in volume) pollution incidents.

If the pollution is in the local vicinity of a Canadian Coast Guard Search and Rescue (SAR) station or facility with operational staff, a First Response Unit (FRU) may be deployed as an initial attempt at containment. If more equipment sweeps systems or recovery units are required then the Rapid Road Transportable (RRT) 2500T will be activated.

Transfer of Lead Agency

Transfer of Lead from CCG

Should an incident initially appear to fall within the jurisdiction of the Canadian Coast Guard yet later is determined to be another government agency's

responsibility, the CCG-appointed OSC or FMO will verbally acknowledge the transfer of Lead Agency responsibility followed by written confirmation on the terms of the transfer (this may require time for termination of a response contract with CCG and the establishment of a response contract with the appropriate Lead Agency.) When the Lead is transferred from CCG to another Lead Agency, CCG will submit an invoice of its response costs to the Lead Agency for response activities undertaken up to the time of transfer recognition.
Should the Lead Agency wish to retain CCG as a Resource Agency, the criteria in Section 7 of the *National Response Plan* of the *CCG National Marine Spills Response Plan* will apply.

Transfer of Lead to CCG
When the Lead is transferred to Canadian Coast Guard from another agency, the Canadian Coast Guard will incorporate the appropriate costs borne by the other agency in the initial stages of the spill into its claim to the Polluter or to the Ship Source Oil Pollution Fund, (SOPF) as the case may be.

Safety Procedures and Considerations

All petroleum cargoes are considered hazardous substances. Canadian Coast Guard command, clean-up, monitoring and verification personnel have protective equipment and training available to them up to Level “D”. All Environmental Response branch staff have been issued with a variety of personal protective equipment (PPE) and are expected to deploy to a spill site (includes exercises and training) with all appropriate gear. Safety glasses and rain suits with rubber boots and gloves are appropriate for Canadian Coast Guard's traditional verification of and response to oil pollution.

Bulk chemical carriers, rail cars, road trailers, sour (H2S) petroleum products or BTX (benzene, toluene, xylene) carried on oil tankers are all sources of substances for which Canadian Coast Guard personnel are not readily equipped for. In most cases where the pollutant reported is suspected to be from one of these sources Canadian Coast Guard assets should not be tasked to verify. If it falls within Canadian Coast Guard mandate the ER program personnel will get directly involved in the verification, likely looking to other government departments or contractors to continue with the assessment and response.

When the pollution is reported to the ROC by a member of the public, or by a credible professional as a mystery spill, closer examination of the circumstances or probable cause of the pollution will occur as part of spill verification. During the conversation with the individual reporting the incident the ROC Duty Officer will want to find out what it is that they observed. These are:

- Colour [typical petroleum silvery to rainbow to dark purple / brown or is it frothy, green organic matter, rusty, etc.]
- Odour [does it smell like gas, diesel, rotten eggs, no odour]
- Proximity to any likely source [vessel, industrial outfall, municipal outfall, midlake, mid channel, washed up industrial storage drum]

- Volumes [football field sized, shopping mall parking lot big, or a thin ribbon]
- Other factors [heavy rainfall in last 12 hours; seasonal conditions / times / areas known for algae blooms; fish or animal kills].

By picking up on any "flags" during an assessment it can be reasonably determined whether the pollution should not/should be classified as a hazardous substance (for which CCG personnel are unable to respond to). The ER duty officer will consult with experts in Environment Canada (EC), Spills Action Centre (SAC), and CANUTEC, as appropriate to determine the safety for personnel.

Alternative countermeasures

Alternative countermeasures are those non-mechanical techniques utilized in oil spill response operations such as in-situ burning, dispersant application, and shoreline cleaner application.

Central Zone

The likelihood of approval of in-situ burning operations on the Great Lakes or in connecting channels or inland lakes is minimal. The use of dispersants in the Great Lakes, connecting channels or in inland waterways will not be considered. Shoreline cleaner agents approved by Environment Canada may be considered.

Arctic Zone

In view of the difficulties associated with mounting an effective response in the Arctic, the CCG has recommended that further research be done in the areas of in-situ burning, the use of dispersants (reference Quebec paper) and other oil in ice recovery methods. This research should be operational R&D and assume that the product spilled is Arctic diesel and that the spill occurs during the Arctic shipping season.

5.8 Summary Report and Post Incident Review

It is regional policy to provide a Summary Report and/or conduct a formal Post Incident Review for incidents deemed noteworthy or valuable by the OSC/FMO or Assistant Commissioner, Canadian Coast Guard.

Summary Report

The summary report shall contain at minimum the following, but can include any information deemed relevant by the OSC/FMO.

Summary Incident Report Format

(a) Overview of Crisis Event

- spill source (not cause), initial environmental conditions and assessment of situation

(b) Spill chronology
- spill response activities and climate/wind /sea condition data
- key response objectives (success and failures in implementation), major shifts in tactics, other agencies involvement

(c) Costs and cost recovery issues
- total estimated cost summary
- identification of Cost Recovery requirements and options

(d) References
- Situation Reports

Post Incident Review

The main objective of a Post Incident Review is the evaluation of the incident to ultimately improve Canadian Coast Guard's effectiveness at spill response. To that end, this requirement is essentially similar to the principles of exercise evaluation. Therefore, when required, the review shall be conducted in accordance with the principles contained in the *National Exercise Program – Evaluation guidelines, Chapter 11*.

This entails six distinct tasks:

1) Brief the Evaluation Team
2) Brief the Response Team
3) Evaluate the Incident
4) Prepare a Preliminary Summary of Key Observations
5) Hold an Incident Debriefing Session
6) Prepare an Official Post Incident Evaluation Report

Post Incident Evaluation Report Format

(a) Executive Summary -Summarizes overall findings and observations

(b) Overview of Incident Objectives -Briefly describes the key objectives, environmental conditions and initial situation assessment

(c) Evaluation Techniques and Criteria - Describes the technique(s) (i.e. self, peer or independent evaluation) and the major evaluation criteria used

(d) Assessment of Key Incident Objectives - This provides a critical appraisal of the incident objectives or major shifts in tactics. Each key objective assessment will include the following:

Findings – A summary statement describing key positive and negative findings.

Specific Observations - Observed decisions and tasks noted during the incident by responders, management and interested parties.

Conclusions - Assessment of the impact of the finding on overall achievement of the incident objective(s)

Recommendations – A description of potential corrective or follow-up action required to implement the findings to improve overall marine spill response preparedness.

(e) Appendices or Attachments - May or may not be required

Section 6 – CLAIMS & COST RECOVERY

6.1 Purpose

The purpose of this section of the *Regional Response Plan* is to outline the requirements and regional processes to assist in the creation of a claim to the relevant fund or directly to a polluter.

The ability of Canadian Coast Guard to recover or pursue recovery of response expenses or costs associated with monitoring activities is set out in the *Marine Liability Act, Part 6, "Liability and Compensation for Pollution"*. This ability to recover costs is seen as the embodiment of the polluter-pay-principle set out in the *National Response Plan, Guiding Principles, Section 1.3*.
Note: That at this time there is no mechanism to recover monitoring costs from an oil handling facility.

In addition to the above and recognizing the potential financial risks and impacts to Canada, Canadian legislation also provides for the creation and maintenance of a Ship-Source Oil Pollution Fund, (SOPF). This fund, in addition to the International Oil Pollution Compensation Fund (IOPCF) and the Protection & Indemnity (P&I) Clubs, provides for the assessment of claims/loss against member ships and/or shipping companies. Neither of these funds hinder nor otherwise limit Canadian Coast Guard's ability to lay claims directly against a Polluter. However, the Polluter is only required to reimburse a claim up to its Limit of Liability. This limit is calculated using the guidelines established in the *Convention on Limitation of Liability for Maritime Claims (LLMC), 1976*.

6.2 Policy Guidelines

The following points serve as regional guidelines for pursuing cost recovery activities:

- The decision to seek cost recovery should be made based on common sense and in consultation with other operational and finance team members.
- Cost recovery should be avoided in situations where the administrative costs of recovery action exceed the dollars expected to be recovered.
- Cost recovery embodies the "Polluter Pays" principle.
- Costs incurred while acting as a resource agency must be recovered from the lead agency.
- Costs incurred while acting as OSC/FMO are recoverable from either the polluter, its P&I Club, the Ship-Source Oil Pollution Fund or from the International Oil Pollution Compensation Fund.

6.3 Responsibilities

On-Scene Commander/Federal Monitoring Officer (OSC/FMO)
The OSC/FMO is responsible for ensuring that complete and accurate documentation is provided for a timely and effective cost recovery process. The OSC/FMO is responsible for preparing all documentation necessary to initiate cost recovery.

Regional Finance Staff
Response, monitoring and administrative costs must be calculated in accordance with national financial accounting and recording practices. Senior administrative officers within Maritime Services may be called upon to provide expert advice as required. It is recommended that a regional finance representative be on-scene as soon as possible to help establish procedures, to safeguard documentation, and to ensure the integrity of the costing process.

Environmental Response Headquarters
The Environmental Response Senior Advisor for Cost Recovery and Claims will submit those claims that are intended for the Ship-Source Oil Pollution Fund and to International Fund Conventions in accordance with the guidelines specified by each. The Advisor will also issue equipment charge-out rates periodically for use by all regions.

6.4 Process
The Response Management System (RMS) documentation (field notes, Incident Action Plans, Minutes and meeting records, time sheets and any and all expense records, invoices/requisitions etc.) shall form the basis of data for the Cost Recovery action.

The Region will initiate cost recovery actions against the Polluter. Should the Polluter be unable or unwilling to pay the costs, the Region will forward the claim to HQ Senior Advisor for Cost Recovery and Claims for submission to the Ship-Source Oil Pollution Fund. Should the costs of the response exceed the Limit of Liability of the Polluter, reimbursement of costs will be through the SOPF and then through the IOPCF. Claims associated with mystery spills will be submitted directly to HQ for a claim against the SOPF.

6.5 Documentation
Proper documentation alleviates the need to reconstruct the incident after the fact, reduces the volume of questions, and adds credence to the claim. The key source of information that enables various parties to determine the degree of reasonableness of the actions taken and the costs claimed is the part of the cost recovery summary known as a “narrative”. That justification is considered to be a critical component to successful and timely claims.

The regional guideline for producing cost summaries and documentation handling is as follows:

Incidents of minimum complexity and limited expenditures (under $15K)

- Expenditures may be summarized within the body of the Final Report, including any description of "calculated" values (i.e. administration costs)
- Original invoices shall be kept on the dedicated spill file.

Incidents of medium complexity and moderate expenditures (up to $50K)

- Expenditures will be summarized in a single table by Cost Element within the body of the Final Report.
- A supporting cost summary document or appendix shall be created to provide a detailed cost summary by date. Copies of the expenditure documentation will be included.
- Original invoices shall be kept on the dedicated spill file organized by date.

Incidents of high complexity and significant expenditures ($50K plus)

- Expenditures will be summarized in a single table by Cost Element within the body of the Final Report. (similar to medium complexity incidents)
- A supporting cost summary document will be created summarizing the daily expenditures by individual cost element, followed by a cumulative summary of each cost element (spreadsheet of all daily summaries). The sum total of all cost elements will then be summarized for use in the final report.
- Due to the volume of transactions, copies of the expenditure documents will not be provided in the supporting cost summary document.
- Original invoices will be kept in their original state, filed by date and archived when feasible to a dedicated file.

Table 6.1 Sample Cost Element Table

Cost Element	Description
Personnel	Includes hourly regular and overtime costs associated with CCG Staff (includes EBP)
Equipment	Includes cost of all CCG assets, based upon established charge out rates
Purchases/Expendables	Includes expendables such as office supplies and PPE
Travel	Includes meals and accommodation costs incurred by CCG staff accordance with TB travel directive.
Contractors	Includes the costs of all private sector contractor/goods and services.
Administration	Includes the cost of CCG administration.
Total Estimated Cost	

6.6 References

- CCG Ship Source and Marine Pollution Response Costing Principles and Documentation Standards DFO2004-6332
- Cost Recovery of Ship Source and Marine Pollution Response Directive # D-4010-2001-01
- Cost Recovery Related Policies, Memorandum dated October 26, 1998, File AWE 1001-5-2-1 (AWEA)

6.7 Third Party Claims

While monitoring or responding to an incident, Canadian Coast Guard will refer all inquiries regarding third party claims to the Polluter. In the case of a mystery spill, the Canadian Coast Guard will encourage claimants to submit a claim directly to the Ship Source Oil Pollution Fund.

Section 7 - PLAN MAINTENANCE AND CUSTODIANS

7.1 *Maintenance Process*

Responsibility
The *Regional Response Plan* of the *Canadian Coast Guard Marine Spills Response Plan* for Central & Arctic Region is the responsibility of:

Assistant Commissioner, Canadian Coast Guard
Central & Arctic Region
520 Exmouth Street
Sarnia, Ontario
N7T 8B1
fax (519) 383-1991

Revision Requests
All requests or suggestions for revision to this plan should be forwarded, in writing, to the above noted address and should include the following information:

- Originator (including return address and telephone number)
- Date
- Subject (i.e. request for revision)
- Suggested change (including section and page number references)
- Reason for revision

All formally received requests will be acknowledged in writing and assessed for inclusion into the plan. Upon approval the revision will be distributed accordingly.

Revision Record
Upon receiving a revision transmittal, recipients are requested to ensure that its number is next in sequence to the previous issue, process the amendments according to the transmittal instructions and complete the revision record in this section.

Should there be any discrepancies or questions, the recipient should contact the Canadian Coast Guard, Assistant Commissioner, Central & Arctic Region at the above address.

The onus is on the plan holder to maintain a current plan.

7.2 *Canadian Coast Guard Custodians*

This document is structured to reflect the fundamental phases of Environmental Response (ER) activities and hence reflects the co-operative nature of each

aspect of the Central and Arctic Region Environmental Response organization. In conjunction with this, each component has been assigned to a specific section within the branch (e.g. training is the responsibility of the Training Officer). The Assistant Commissioner – Canadian Coast Guard, Central and Arctic Region retains the overall responsibility for the document's implementation. The Emergency Plan Development Officer (EPDO) facilitates the physical management and co-ordination of this document.

These custodial relationships herein are designed to facilitate the annual review and maintenance of the *Regional Response Plan*.

Letter of Promulgation	Emergency Plan Development Officer
Record of Revision	Plan Holders
Section 1 – Introduction	Emergency Plan Development Officer
Section 2 - Agreements & Memoranda of Understanding	Emergency Plan Development Officer
Section 3 – Organization	Emergency Plan Development Officer
Section 4 – Preparedness 4.2 RMS	 Regional Training Officer
4.3 Planning	Emergency Plan Development Officer
4.4 Training	Regional Training Officer
4.5 Exercising	Regional Exercise Officer
4.6 Inventory Maintenance & Management	Regional Emergency Operations Officer
Section 5 – Response Operations	Regional Emergency Operations Officer
Section 6 – Claims & Cost Recovery	TBD
Section 7 - Plan Maintenance & Custodians	Emergency Plan Development Officer
Section 8 – Contacts	Emergency Plan Development Officer
Section 9 – References & Annexes	Responsibility for each annex is assigned in each Annex.

All unassigned sections shall be considered the responsibility of the Emergency Plan Development Officer unless otherwise indicated.

7.3 Plan Distribution

The *Regional Response Plan* shall be distributed to all holders of the *Canadian Coast Guard Marine Spills Response Plan*, in accordance with the Area of Responsibility set in Section 1 - Introduction. This includes the relevant Federal and Provincial Lead Agencies as described in the National Response Plan Section 1, sub-section 1.5; all Canadian Coast Guard Management; Facilities and Vessels; all Oil Handling Facilities and relevant certified Response Organizations by request and in accordance with Transport Canada-Marine

Safety, Compliance and Enforcement division. All subsequent revisions will be automatically distributed to these plan holders.

Any member of the general public wishing to obtain a copy may do so through the Fisheries and Oceans, Canadian Coast Guard, National Headquarters. These plan holders will not be advised of revisions.

Section 8 – CONTACTS

8.1 Pollution Reports for Canadian Coast Guard, Central & Arctic Region

To report a pollution emergency anywhere within Central & Arctic Region telephone the Canadian Coast Guard, Regional Operations Centre (ROC) toll free at:

1-800-265-0237

or report via

Marine Radio on VHF, Channel 16.

8.2 Other Lead Agencies that Maintain Spill Report Lines

- Ontario Ministry of the Environment - Spills Action Centre: 1-800-268-6060
- Territorial Spills Line – Arctic Alarm: 1-867-920-8130
- Manitoba Conservation: 1-204-944-4888
- Saskatchewan Environment - Saskatchewan Spill Centre: 1-800-667-7525
- Alberta Environment: 1-800-222-6514

8.3 Canadian Coast Guard, Environmental Response Branch (CCG/ER) Phone List – Regular Office Hours

Regional Office, Canadian Coast Guard **520 Exmouth Street** **Sarnia, ON N7T 8B1**	
Title	**Telephone**
Superintendent, Environmental Response	519-383-1954
Emergency Plan Development Officer	519-464-5126
Assistant Contingency Planning Officer	519-383-1953
Regional Exercise Officer	519-383-1978
Regional Emergency Operations Officer	519-383-1956
Environmental Training Officer	519-383-1957
Administrative Assistant	519-383-1951

Canadian Coast Guard Base **42037 McKenzie Highway** **Hay River, NT X0E 0R9**	
Title	**Telephone**
Senior Response Officer	867-874-5557
Response Specialist	867-874-5558
Response Specialist	867-874-5559

Canadian Coast Guard Base **PO Box 1000, 401 King Street** **Prescott, ON K0E 1T0**	
Title	**Telephone**
Senior Response Officer	613-925-2865 x 157
Response Specialist (2)	613-925-2865 x 262
Logistics and Statistics Officer	613-925-2865 x 126

Canadian Coast Guard Base **28 Waubeek Street** **Parry Sound, ON P2A 1B9**	
Title	**Telephone**
Senior Response Officer	705-746-2196 x 228
Response Specialist	705-746-2196 x 270
Response Specialist	705-746-2196 x 201

Section 9 – REFERENCES & ANNEXES

9.1 References

The following list includes those documents which supplement the Regional Response Plan.

Supplement	Custodian
Environmental Response Manual – Standard Operating Procedures and Directives	Canadian Coast Guard, Environmental Response, Headquarters
Response Management System User's Guide, version 3.0 (May 2006)	Canadian Coast Guard, Environmental Response, Headquarters
Environmental Response Superintendent's Manual	Superintendent, Environmental Response, Regional Office
Environmental Response Regional Health & Safety Plan	Environmental Response, Regional Emergency Operations Officer
National Exercise Program (NEP) Manual	Canadian Coast Guard, Environmental Response Headquarters
Inventory Control and Response Management System – TMA database	Regional Logistics and Statistics Officer, Environmental Response
DFO Crisis Communications Plan	DFO Corporate Services, Communications Branch

9.2 Annexes

The following Area Plans make up the Annexes to the Regional Chapter:

1) St. Lawrence River and Lake Francis
2) Lake Ontario
3) Lake Erie
4) St. Clair and Detroit River
5) Lake Huron, Georgian Bay and North Channel
6) St. Mary's River
7) Lake Superior
8) Lake of the Woods
9) Inland waters (South of 60°N Latitude)
10) Hudson and James Bay
11) Baffin Region
12) Keewatin Region
13) Kitikmeot Region
14) Great Slave Lake Region
15) Mackenzie River and Delta
16) Beaufort Sea and Amundsen Gulf

APPENDIX C - COASTAL SHIPPING

a) SHIPBOARD OIL POLLUTION EMERGENCY PLAN
b) INSURANCE CERTIFICATES FOR SHIPS
c) BAKER LAKE AREA OPERATIONAL PROCESSES

The WOODWARD GROUP OF COMPANIES

Coastal Shipping Ltd.
The Woodward Group of Companies
114 Main Street, P.O. Box 910
Lewisporte, NL A0G 3A0 CANADA

SHIPBOARD MARINE POLLUTION EMERGENCY PLAN (SMPEP)

In accordance with MARPOL 73/78, Annex I
IMO Res. MEPC. 78(43)

MT "ALSTERSTERN"
IMO 9053220

CONFIRMATION OF ACKNOWLEDGE

Shipboard Marine Pollution Emergency Plan

Date Entered:	Rank:	Name:	Signature:
			.

INDEX OF CORRECTIONS

Date of Correction	SMPEP pages exchange (date)		APPENDIX 2 Date of Current List of Contact Points
	IN	OUT	

SHIPBOARD MARINE POLLUTION EMERGENCY PLAN

In accordance with Regulation 37 of Annex I and Regulation 17 of MARPOL 73/78

SHIP'S IDENTIFICATION

GL- REGISTER - NUMBER	34583
NAME OF SHIP	ALSTERSTERN
CALL SIGN	XJAZ
IMO NUMBER	9053220
TYPE OF SHIP	CHEMICAL / OIL TANKER
PORT OF REGISTRY	ST. JOHN'S
GROSS TONNAGE	11426
FLAG	CANADA
OFFICIAL NUMBER	835794

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INTRODUCTION

1. This Shipboard Marine Pollution Emergency Plan (hereafter referred to as the "Plan") is written in accordance with the requirements of regulation 37 of Annex I and regulation 17 of Annex II of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 there to and amended by Res. MEPC. 78 (43).
As recommended by IMO this plan is a **combination of a SOPEP and a Shipboard Marine Pollution Emergency Plan for noxious liquid substances.**

2. The purpose of the Plan is to provide guidance to the Master, officers and operating personnel onboard the Ship, with respect to the steps to be taken when an oil or marine pollution incident has or is likely to occur. The appendices contain communication data of all contacts referenced in the Plan, as well as other reference material.

3. The Plan contains all information and operational instructions required by the "Guidelines for the development of the Shipboard Marine Pollution Emergency Plan" as developed by the Organization (IMO) and published under MEPC. 85(44) and MPEC.54 (32) amended by MPEC.86(44). .

4. This Plan has been examined byGermanischer Lloyd or GL on behalf of Transport Canada and, except as provided below, no alteration or revision shall be made to any part of it without prior approval by or on behalf of GL.

5. Changes to Sections 4 and the appendices will not be required to be approved by the Board. The appendices should be maintained up to date by the Owners, Operators, and Managers.

6. For the purposes of this Plan, the Master is taken to be that person who is a member of the vessel's operational personnel and to which is given senior responsibility for the vessel and any circumstances pertaining thereto.

7. Before entering a port of call, the Master should be aware of local emergency response procedures and organizations and have up to date contact information readily available.

SECTION 1 • Preamble

1.1 This Plan is intended to assist the ship's personnel in dealing with an unexpected discharge of oil or noxious liquid substances (NLS). Its primary purpose is to set in motion the necessary actions to stop or minimize the discharge of those substances and to mitigate its effects.

1.2 Effective planning ensures that the necessary actions are taken in a structured, logical and timely manner.

1.3 The primary objectives of this Plan are to:

- prevent pollution
- stop or minimize outflow when a damage to the ship or its requirement occurs
- stop or minimize outflow when an operational spill occurs in excess of the quantity or instantaneous rate permitted under the present Convention.

1.4 Further, the purpose of the Plan is to provide the Master, officers and certain crew members with a practical guide to the prevention of marine spills and in carrying out the responsibilities associated with regulation 37 of Annex I and Reg. 17 of Annex II of MARPOL 73 / 78.

- procedures to report an oil / marine incident.
- Coastal States (Focal Points) and Port Contact Lists to be contacted in the event of any pollution incident.
- co-ordination with national and local Authorities in combating a pollution.

1.5 In summary, the Plan will serve to promote a practiced response when the ship's personnel is faced with a spill.

1.6 Although the Plan is designed as a ship-specific tool it must be also be considered as an additional instrument and is a link to shore-based plans. With this the Plans allows an efficient co-ordination between the ship and shore-based Authorities /Organizations in mitigating the effects of any pollution incident.

1.7 The Plan includes a summary flowchart (See page 8) to guide the Master through reporting and acting procedures required during an oil pollution incident response.

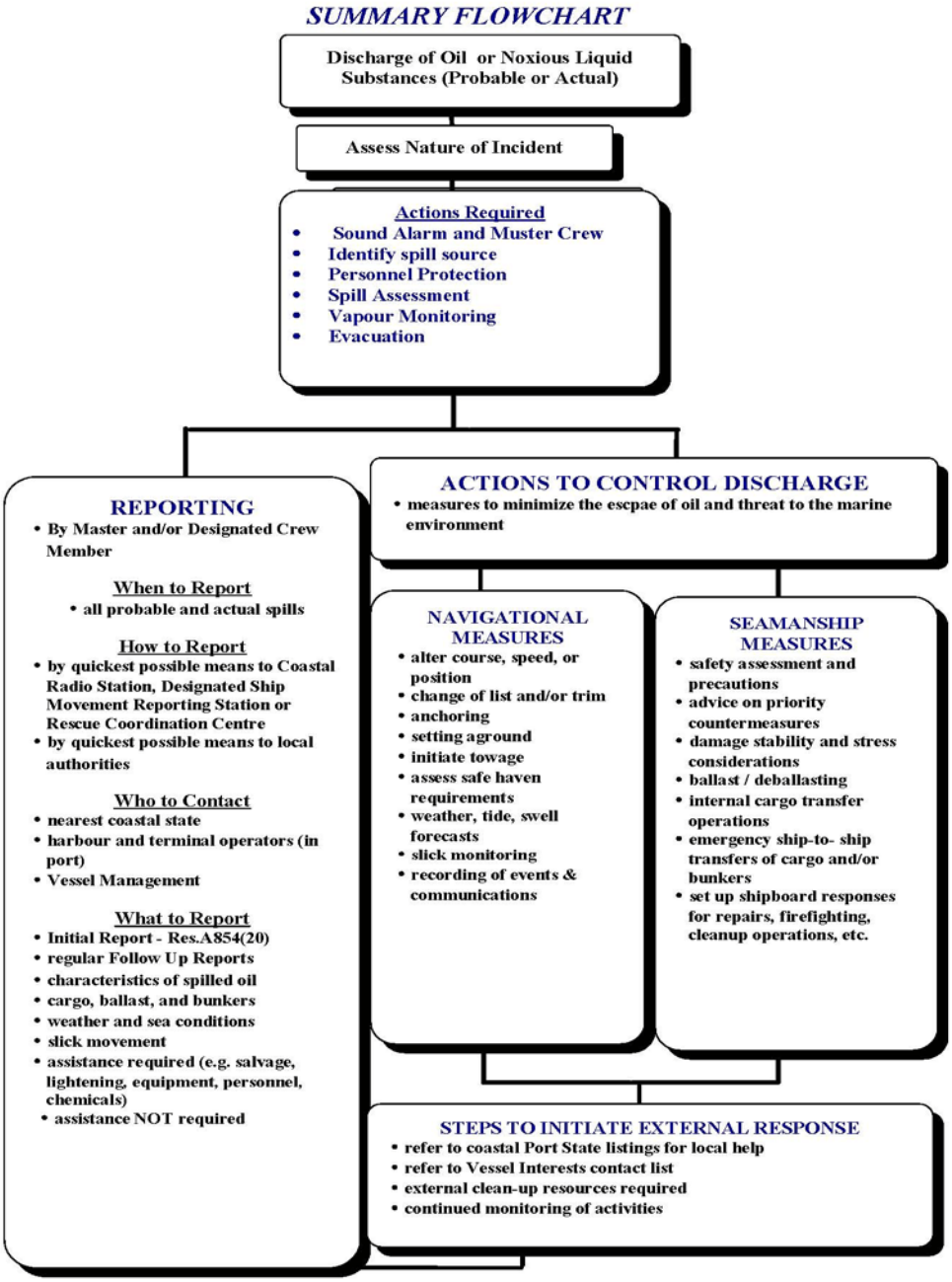
1.8 The Plan is likely to be a document used on board by the Master and the officers of the ship and must therefore be available in the working language used by them.

1.9 The Plan is not applicable if the vessel operates in U.S waters within the EEZ (exclusive economic zone). The Vessel Response Plan (VRP) has to be activated.

1.10 All Procedures in this Plan are in line with Coastal emergency procedures which can be found in the file Emergency Preparedness as part of the Safety Management System (SMS). They should be referred to in any case for obtaining additional information.

SHIPBOARD MARINE POLLUTION EMERGENCY PLAN - SUMMARY FLOWCART

This flow diagram is an outline of the course of action that shipboard personnel should follow in responding to a pollution emergency based on the guidelines published by the Organization. This diagram is not exhaustive and should not be used as a sole reference in response. Consideration should be given inclusion of specific reference to the Plan. The steps are designed to assist ship personnel in action to stop or minimize the discharge of oil or NLS and mitigate its effects. These steps fall into two main categories - reporting and actions.



SECTION 2: Reporting Requirements

2.1 GENERAL

The reporting requirements of this section comply with those of regulation 37 Annex I and 17 Annex II of MARPOL 73 / 78.
When the ship is involved in an incident which results in the discharge of oil or NLS, the Master is obliged under the terms of MARPOL 73 / 78 to report details of the incident, without delay, to the nearest Coastal state by means of the fastest telecommunication channels available.

The intent of these requirements are to ensure that Coastal States are informed, without delay, of any incident giving rise to pollution, or threat of pollution of the marine environment, as well as of the assistance and salvage measures, so that appropriate action may be taken.

Without interfering with ship owner's liability, some coastal states consider that it is their responsibility to define techniques and means to be taken against a marine pollution incident and approve such operations which might cause further pollution i.e. lightening. States are in general entitled to do so under the International Convention relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, 1969 and the Protocol relating to Intervention on the High Seas in Cases of Pollution by Substances other than Oil, 1973

2.2 Reporting Procedures

For easy reference the reporting requirements in the context of this plan are divided in to the following information blocks:

2.2.1 When to Report

Taking the summary flowchart as shown on page 5 as a basic guide into consideration reports are necessary in the following cases:

2.2.1.1 Actual discharge

The Master is obliged to report to the nearest Coastal state whenever there is a discharge of oil resulting

- from damage to the ship
- from damage to the ship's equipment
- for the purpose of securing the safety of a ship or saving life at sea
- during the operation of the Ship in excess of the quantity or instantaneous rate permitted under the present Convention.

2.2.1.2 Probable discharge

The Master is obliged to report even when no actual discharge of oil or NLS has occurred but there is a probability that one could.

However, as it is not practicable to lay down precise definitions of all types of situations involving probable discharge of oil / NLS which would warrant an obligation to report the Master

is obliged to judge by himself whether there is such a probability and whether a report should be made.

Therefore, it is recommended that, at least, the following events

- damage, failure or breakdown which affects the safety of the ship (e.g. collision, fire, grounding, explosion, structural failure, flooding, cargo, cargo shifting, list, etc.)

or

- failure or breakdown of machinery or equipment which results in impairment of the safety of navigation (e.g. failure or breakdown of steering gear, propulsion, electrical generating system, essential shipborne navigation aids etc.)

are carefully considered by the Master - taking into account the nature of the damage failure or breakdown of the ship, machinery or equipment as well as the ship's location , proximity to land, weather, state of the sea and traffic density - as cases in which a probable discharge is more likely.

If in doubt, the Master should always make a report in cases aforementioned.

In all cases the Authorities should be kept informed by the Master as how the situation progress and be advised when all threats of pollution has passed.

2.2.2 Information Required

As required in article 8 and Protocol I of MARPOL 73 / 78 Convention the Master or other persons having charge of the ship should report the particulars of any pollution incident. In this context the International Marine Organization (IMO), in 1997, adopted Resolution A. 851 (20) "General Principles for Ship Reporting Systems and Ship Reporting Requirements, including Guidelines for Reporting Incidents involving Dangerous Goods, Harmful Substances and / or Marine Pollutants"

The intent of the Resolutions aforementioned is to enable Coastal States and other interested parties to be informed, without delay, of any incident giving rise to pollution, or threat of pollution of the marine environment, as well as of assistance and salvageable measures, so that appropriate action may be taken.

Nothing in this chapter relieves the Master in using sound judgment to make sure that any incident or probable discharge is reported as quick as possible in the prevailing situation.

When Transmitting initial reports to the authorities of the nearest Coastal State, the Master or other persons dealing with such a transmission should take note of IMO Resolution A 851(20).

Especially, the format of the initial report as well as supplementary of the follow up reports should conform with the guidance contained in Resolution A 851(20). All reporting whether initial or follow up, should follow IMO's reporting format as outlined below and should contain the following information:

FORMAT AND INFORMATION REQUIRED FOR OFFICIAL REPORT

AA VESSEL NAME, CALL SIGN, FLAG

BB DATE AND TIME (GMT) OF INCIDENT: 11/1935 meaning 11th of month at 7:35 pm.

CC SHIPS POSITION: 2230N 0600E meaning 22 deg. 30 min. N, 6 deg. E

or

DD SHIPS POSITION BY TRUE BEARING (3 DIGITS) AND DISTANCE FROM CLEARLY IDENTIFIED LANDMARK.

EE TRUE COURSE (3 DIGITS)

FF SPEED IN KNOTS AND TENTHS OF A KNOT (3 DIGITS)

LL ROUTE INFORMATION - INTENDED TRACK

MM RADIO STATIONS AND FREQUENCIES GUARDED

NN TIME OF NEXT REPORT (same as in BB)

OO DRAFT (4 DIGITS - meters and centimeters)

PP TYPES AND QUANTITIES OF CARGO AND BUNKERS ON BOARD

QQ BRIEF DETAILS OF DAMAGE, LIMITATIONS ETC. (must include condition of vessel and ability to transfer cargo, ballast, or fuel)

RR BRIEF DETAILS OF ACTUAL POLLUTION (oil type, estimate of quantity discharged, whether discharge continues, cause, estimate of slick movement)

SS WEATHER AND SEA CONDITIONS (wind force/direction, relevant tidal and/or current information)

TT NAME, ADDRESS, FAX, TELEPHONE NUMBERS OF VESSEL OWNER OR REPRESENTATIVE

UU DETAILS OF LENGTH, BREADTH, TONNAGE, AND TYPE OF VESSEL

WW TOTAL NUMBER OF PERSONS ON BOARD

XX MISC. DETAILS (This includes brief details of incident, actions taken, injuries sustained and assistance required. If no outside assistance is required, then this should be clearly stated.)

SHIPBOARD MARINE POLLUTION EMERGENCY PLAN

INITIAL NOTIFICATION

AA(SHIPS NAME; CALL SIGN; FLAG)

BB(DATE AND TIME OF EVENT; UTC)

D	D	H	H	M	M

CC (POSITION; LAT; LONG)

				N	S
d	d	m	m		

					E	W
d	d	d	m	m		

OR

DD (BEARING; DISTANCE FROM LANDMARK)

d	d	d	N miles

EE (COURSE)

d	d	d

FF(SPEED)

kn	kn	1/ 10

LL (INTENDED TRACK)

MM (RADIO STATION(S) GUARDED)

NN (DATE AND TIME OF NEXT REPORT; UTC)

D	D	H	H	M	M

OO (DRAFT; METERS, centimeters)

M	M	cm	cm

PP(TYPE AND QUANTITY OF CARGO/ BUNKERS ON BOARD)

QQ (BRIEF DETAILS OF DEFECTS/ DEFICIENCIES/ DAMAGE)

RR (BRIEF DETAILS OF POLLUTION; INCLUDING ESTIMATE OF QUANTITY LOST)

SS (CONTACT DETAILS OF WEATHER AND SEA CONDITIONS)

Wind: Direction / Speed (Beaufort)

SWELL: Direction / Height (m)

TT (CONTACT DETAILS OF SHIP´S OWNER/ OPERATOR/ AGENT)

UU (SHIP SIZE AND TYPE)

XX (ADDITIONAL INFORMATION)

All follow up reports by the Master should include information relevant to the Coastal State Authorities to keep them informed as the incident develops.

Follow up reports should include information on any significant changes in the ship's condition, the rate of release and spread of the substances, weather and sea conditions and clean-up activities underway.

In this context details of bunker and cargo disposition, condition of any empty tanks and nature of any ballast carried are information needed by those involved in order to assess the threat posed by an actual or probable discharge from the damaged ship.

2.2.3 Whom to Contact

The Master is responsible for reporting any incident involving an actual or probable discharge of oil or NLS.
Contact information for coastal State and other concerned parties (port contacts, vessel interest contacts) is located in Section 4.

2.2.3.1 Coastal State Contacts

The vessel, in accordance with the regulations, has onboard a **declaration** that the vessel's management has, in accordance with 167 of the Canada Shipping Act 2001, entered into an arrangement with response organization, **ECRC** to which a certificate of designation has been issued pursuant to section 169 in respect of the quantity of oil that is carried both as fuel and cargo on board the vessel.

The **Director of Operations**, identified in the **declaration** , shall be responsible for contacting and mobilizing the response organization, **ECRC at 613-930-9690**.

2.2.3.2 Port Contacts

As Ports of Call vary, MASTER to ensure that pprior t entering port any local contacts are obtained and displayed in MASTERS designated location. After departure contacts are to be added to manual and updated as necessary.

2.2.3.3 Vessel Interest Contacts

Vessel interest contacts are outlined on **page 31**

SECTION 3: Steps to Control Discharge

Ship personnel will most probably be in the best position to take quick action to mitigate or control the discharge of oil or noxious liquid substances from their ship

Therefore, this Plan provides the Master with clear guidance on how to accomplish this mitigation for a variety of situations.

It is the Master's responsibility to initiate a response in the event of a discharge of oil/NLS or substantial threat of discharge - actual or probable - into waters.

In no case action should be taken that in any way could jeopardize the safety of personnel either onboard or ashore.

In cases of a discharge of a noxious liquids substances the Master has to refer to the "Material Safety Data Sheet" (MSDS) provide onboard for any NLS cargo. Consideration to be made to any danger resulting from discharge of such substances, i.e. mixing with water, air, other materials / substances.

Special consideration is to be taken in case of the necessity to transfer cargo into another compartment onboard the compatibility of the material to be transferred and the material of pipes and tanks to be used for such actions.

In cases of small spills on deck, the vessel's crew should take whatever actions are necessary to prevent oil from escaping over the side. Once the spill is contained on deck, the crew will need to take action to clean up the oil. SPILLED OIL SHALL NOT BE WASHED OVER THE SIDE. Once oil is in the water, the crew's ability to respond in a practical manner is greatly reduced.

The following list specifies different kinds of possible operational spills with regard to reactions to be taken.

3.1 OPERATIONAL SPILLS

3.1.1 Operational Spill Prevention

All crew members shall maintain a close watch for the escape of oil or NLS during bunker or cargo operations.

Prior to bunker or cargo transfer the competent crew members should mobilize the spill equipment, as far as available on board, and place it close to the planned operation, e.g. along the railing on the side at which bunker operation takes place. All deck scuppers and open drains must be effectively plugged. Accumulations of water should be drained periodically and scupper plugs replaced immediately after the water has run off. Any free floating substances should be removed prior to draining.

Bunker or Cargo tanks which have been topped up should be checked frequently during the remaining operations to avoid an overflow.

Unless there are permanent means for retention of any slight leakage at ship / shore connections for bunker or cargo transfer, it is essential that a drip tray is in place to catch any leaking substance.

All crew members of the ship's crew should be familiar with the fundamentals of the ship's vital systems including the ventilation and electrical systems. Crew members should be able to isolate the accommodation and/or machinery spaces using the louvers and fan shutoffs and, from the distribution panels, isolate electrical circuits in areas of risk.

In the event of an operational spill which occurs during bunkering or cargo operations, it is important that the bunkering party terminate any and all bunkering operations and close all manifold valves.

Before closing any manifold valves, the bunkering / cargo party must immediately inform the terminal / loading master so that they may take action to eliminate the possibility of over-pressurization of the shore side transfer components.

After dealing with the cause of the spill, it may be necessary to obtain permission from local authorities and/or the terminal before resuming bunkering or cargo operations.

If the possibility of fire or explosion exists, nonessential air intakes to accommodations and machinery spaces should be closed and all sources of ignition should be eliminated. See Section 1.3.3 of this Plan.

Care must be taken to consider stability and stress when taking action to mitigate the spillage of oil. Internal transfers should be undertaken only with a full appreciation of the likely impact on the vessel's overall stress and stability. Please refer to the "Approved Stability Book" carried on board.

Operational Spill Checklist

Action Considered	Designated Person	Completed
Sound emergency alarm	Person Discovering Incident	Y / N
Mobilize Oil Pollution Prevention Team	Chief Engineer / Master	Y / N
Cease all bunkering operations	Chief / 2nd Engineer	Y / N
Locate source of leakage	Chief / 2nd Engineer	Y / N
Operate manifold valves	Chief / 2nd Engineer	Y / N
Close all nonessential vent intakes and tank vents as required	Chief / 2nd Engineer	Y / N
Stop or reduce outflow	Chief Engineer / Deckhand	Y / N
Assess fire risk	Chief Officer	Y / N
Commence clean up	Chief Officer	Y / N
Assess Stress / Stability	Master / Chief Officer	Y / N
Transfer fuel from damaged area to slack tanks or other containment space	Chief / 2nd Engineer	Y / N

Request outside assistance if required	Master	Y / N
Counter excessive list if required / possible	Chief Officer	Y / N

3.1.2 Pipeline Leakage

In the event of leakage from an oil / NLS pipeline, valve, hose or metal arm, the Chief Engineer must ensure that the following actions are taken:

- Stop oil flow, close manifold and other valves.
- Sound emergency alarm and mobilize Oil Pollution Prevention Team
- Locate source and drain affected section into an available empty or slack tank. Repair if possible
- If there is any possibility of vapours entering the engine room or accommodation intakes, appropriate preventative steps must be taken quickly.
- Absorb spill with any absorbent materials on hand and dispose of oil soaked materials in an appropriate container.
- If oil is overboard, report to proper authorities immediately (as per section 4 of this plan).

3.1.3 Tank Overflow

In the event of an oil tank overflow, the Chief Engineer must ensure that the following actions are taken:

- Stop oil flow, close manifold and other valves.
- Sound emergency alarm and mobilize Oil Pollution Prevention Team
- Place drain buckets under overflow pipes to contain possible spills.
- If there is any possibility of vapours entering the engine room or accommodation intakes, appropriate preventative steps must be taken quickly.
- Drain or transfer oil to slack or empty tanks if possible with due consideration paid to vessel stability. If no slack or empty tanks are available, oil may be pumped back ashore through delivery lines, having first gained permission to do so.
- Absorb spill with any absorbent materials on hand and dispose of oil soaked materials in an appropriate container.
- If oil is overboard, report to proper authorities immediately (as per section 4 of this plan).

3.1.4 Hull Leakage

If oil is noticed on the water near the vessel during normal operations and cannot be accounted for, the possibility of hull leakage should be suspected.

In the event of a hull leakage, the Master must ensure that the following actions are taken:

- Sound emergency alarm and mobilize Oil Pollution Prevention Team.
- Stop any transfer or bunkering operations.
- Identify damage and report to proper authorities immediately (as per section 4 of this plan). Consider a diver if necessary and possible.

- If possible, contain spill using materials on hand and dispose of oil soaked materials in an appropriate container.
- If there is any possibility of vapours entering the engine room or accommodation intakes, appropriate preventative steps must be taken quickly.
- Transfer fuel away from suspected leaks to empty or slack tanks if possible, or to a ballast tank if necessary. If in port, arrangements can be made to pump oil ashore to tanks or trucks. Due consideration is to be paid to vessel stress and stability.
- If it is not possible to identify the leaking tank, reduce level in all tanks in the vicinity, giving due consideration to vessel stress and stability.

3.1.5 Spills caused by Equipment in Machinery Spaces

- If operational spills are caused by failure of equipment in machinery spaces, any further operation of this equipment should be stopped immediately and measures are to be taken to avoid a spill. Such equipment may be
  - Oily - water separating equipment or oil filtering equipment or oil filtering equipment to de-oil bilge water from the engine room bilges.
  - Valves in pipes connecting ballast / cargo systems
  - Cooling pipes in cooler systems
  - Gearing of bow thruster
  - Stern tubes

- Sound emergency alarm and mobilize Oil Pollution Prevention Team.
- Absorb spill with any absorbent material in hand and dispose of oil soaked materials in an appropriate container.
- Do not restart equipment until problem has been rectified.

3.2 Spills Resulting from Casualties

In the event of a casualty the Master's first priority will be to ensure the safety of personnel and the vessel and initiate action to prevent escalation of the incident and marine pollution.

3.2.1 Ship grounded / stranded

If the vessel grounds, the Master must ensure that the following actions are taken:

- Sound emergency alarm, muster crew, and Mobilize Oil Pollution Prevention Team once safe to do so.
- Eliminate all avoidable sources of ignition and ban smoking onboard. Action bust be taken to prevent hazardous vapours from entering accommodation and machinery spaces. See section 1.1.3.
- Identify damage by means of a visual inspection.
- Take soundings around vessel to determine the nature and gradient of seabed.
- Check differences in tidal range at grounding site.
- Evaluate tidal current in grounding area.
- Take soundings of all tanks on shell and compare with departure soundings.

- Determine probability and/or quantity of oil released
- If oil release is determined or is probably, this is to be included in the casualty report.
- Determine other possible hazards to the vessel such as sliding off the grounding site or further damage from seas / swell, and torsion forces.

At this point, determine risk of additional damage to vessel by attempting to refloat. If remaining aground is determined to be less of a risk then:

- Use anchors to prevent vessel movement.
- Take on ballast in empty tanks with due consideration paid to stress and stability. Please refer to the approved stability book.
- Consider transfer of fuel from damaged tanks with due consideration paid to stress and stability. Please refer to the approved stability book.
- Reduce longitudinal stress on the hull by transfer of fluids internally. Please refer to the approved stability book.
- If the change in stability and stress cannot be calculated onboard, contact the vessel's management to arrange for the necessary calculations. Refer to appendix 3 for information which should be provided.

3.2.1.1 Prevention of Fire and Explosion

If a fire or explosion occurs on board, the vessel's fire control party must ensure that the following actions are taken:

- Sound emergency alarm, muster crew, and mobilize Oil Pollution Prevention Team once safe to do so.
- Determine extent of damage and what damage control measures can be taken.
- Determine whether there are casualties.
- Request assistance as deemed necessary.
- Take necessary actions to prevent smoke and other hazardous vapours from entering the accommodation and machinery spaces.
- Assess possibility of oil leakage.
- Determine possible actions to control the discharge of oil. This will depend largely on the damage to the ship and cargo.
- If there is a discharge or possible discharge of oil, this to be included in the casualty report.
- Should abandonment be necessary, the Master must ensure that every effort is made to maneuver survival craft upwind of any oil spill.

3.2.1.2 Hull Damage / Hull Failure / Containment Failure

If the vessel suffers structural hull failure, the Master must ensure that the following actions are taken:

- Sound emergency alarm, muster crew, and mobilize Oil Pollution Prevention Team once safe to do so.

- Reduce speed or stop to minimize stress on hull.
- Assess immediate danger of sinking or capsizing.
- Initiate damage control measures if possible.
- If lightening is required, all efforts should be made to wait for a barge or other ship to receive the cargo.
- If oil has spilled, or if it is necessary to jettison oil to maintain stability, make a report as per section 2.
- If the change in stability and stress cannot be calculated onboard, contact the vessel's management to arrange for the necessary calculations.
- Consider forecasted weather conditions and their effect on the situation.
- Should abandonment be necessary, the Master must ensure that every effort is made to maneuver survival craft upwind of any oil spill.

3.2.1.3 Procedures to reduce or Stop Outflow of Oil or NLS

The Master should assess the possibility of damage to the environment and whatever action can be taken to reduce further damage from any release, such as;

- Transfer /cargo internally, provided shipboard piping system is in an operational condition and in careful view of the compatibility of the substance and the tanks/pipes used for transfer, and taking into account the impact on the ship's overall stress and stability.
- Isolate damaged/penetrated tanks hermetically to ensure that hydrostatic pressure in tanks remains intact during tidal changes.
- Evaluate the necessity of transferring bunkers / cargo to barges or other ships and request such assistance accordingly.
- Evaluate the possibility of additional release of oil or NLS in close co-operation with coastal states.

In case of large differences between the tide levels, the Master should try to isolate the damaged tanks to reduce additional to reduce additional loss of substances.

3.2.1.4 Refloating by own means

The Master should also evaluate the question of refloating the vessel by own means. Before such an attempt is made, it must be determined:

- whether the ship is damaged in such a way that it may sink, break up or capsize after getting off
- whether the ship , after getting off, may have maneuvering problems upon leaving the dangerous area on its own.
- whether machinery, rudder or propeller are damaged due to grounding or may be damaged by trying to get off ground by own means.
- whether the ship may be trimmed or lightened sufficiently to avoid damage to other tanks in order to reduce additional pollution.
- weather evaluation; whether there is time/reason to await improvements in weather or tide.

- whether ship's structure permits refloating/consultation of GL Emergency Response Service
- whether all steps of Coastal Shipping Ltd. procedure "Grounding" have been complied with.

3.2.1.5 Securing the Ship

If the risk of further damage the ship is greater in an attempt to refloat the ship by own means, than in remaining aground until professional assistance has been obtained, the ship's Master should try to secure the ship as much as possible:

- Trying to prevent the ship from moving from its present position
- By dropping anchors (adequate water depth and anchor ground provided)
- By taking ballast into empty tanks, if possible
- Trying to reduce longitudinal strain on hull by transferring ballast or bunkers internally
- Reducing fire risk by removing all sources of ignition.

Inform in line with Section 2 all parties interested about Grounding and the actions taken so far.

3.2.2 Fire /Explosion

Should an explosion and a fire occur onboard, sound the GENERAL ALARM immediately.
Further actions should be initiated in accordance with the ship's Muster List.
In case of fire and explosion the following priorities exist:

- Rescuing lives
- Limiting damage /danger to the ship and cargo
- Preventing environmental pollution

The Coastal Shipping Emergency Procedure **" Fire and Explosion"** in the file Emergency Preparedness should be complied with.

Steps to control the discharge of oil will depend largely on the damage to the ship and cargo.
Special information thereto is contained in subparagraphs 3.2.4, 3.2.5 and 3.2.6.
Inform in line with Section 2 all parties interested about the Fire /Explosion and the actions taken so far.

3.2.3 Collision

The Master shall follow the emergency plan as given in Coastal Shipping Ltd Emergency procedure "Collision" in file: Emergency Preparedness as follows:

- Sound emergency alarm, muster crew, and mobilize Oil Pollution Prevention Team once safe to do so.
- Determine whether there are casualties.
- If there is a possibility of fire or explosion, eliminate all avoidable sources of ignition and ban smoking onboard. Action should be taken to prevent flammable vapours from entering the accommodation and machinery spaces. .

- Decide whether separation of vessels may cause or increase spillage of oil, or increase the risk of sinking.
- If any oil tanks are penetrated, isolate these tanks or transfer oil to slack or empty tanks with due attention paid to stress and stability of the vessel. Please refer to the approved stability book.
- If there is an oil spill, make a report as per section 4.
- If possible to maneuver, the Master, in conjunction with the appropriate shore authorities should consider moving his ship to a more suitable location in order to facilitate emergency repair work or lightening operations, or to reduce the threat posed to any sensitive shoreline areas.

3.2.4 Excessive List

Should the ship for some reasons suddenly start to list excessively during discharging/loading operations, or bunkering, all ongoing operations should be stopped immediately until the cause has been determined.

The Officer on duty should inform the Master and/or Chief Officer without delay.

The Master should try to determine the reason for excessive list, and take steps to rectify the situation and to stabilize the ship's condition:

- Check reasons for list
- Soundings / Ullage to be taken in all tanks
- Bunker / Ballast / Cargo pumps to be made ready
- Consider measures to minimize list in transferring liquid from one compartment to another
- Ensure water tightness of empty spaces
- Close all opening
- Secure vent pipes to avoid ingress of water
- If bunkering: Change to corrective tanks for rectifying the situation
- If ballasting/deballasting: Change to corrective tanks to rectify the situation
- If there is reason to believe that the list may cause any spill, notify as per Section 4
- If the ship's crew is in jeopardy, prepare lifeboats for launching, and notify as per Section 4

If the situation is brought under control, inform all parties interested.

3.2.5 Dangerous reaction of cargo

In case of spillage of NLS cargo on deck, to the sea or incidents mixture with other cargo through internal tanks leakage consider dangerous reactions of such mixture. Promptly consult the Material Sheet Data Sheet (MSDS) available for the cargo shipped to the information provided. Take necessary actions for the safety of the crew for the case of (possible) contamination with spilled material or its vapours

3.2.6 Other dangerous cargo and/or vapour release

In case release of dangerous liquid noxious substances take necessary actions for the protection of the crew against health hazards, especially by contamination with materials or its toxic vapours. Avoid material or vapours spreading over the ship. If any dangerous material or vapour is released from any part of the containment system, take arrangements to free the deck area as far as possible by turning the ship to have the accommodation upwind of the point of release.

Evacuate crew members from the endangered area. If persons have to carry out any unavoidable duties within the endangered area, care for the personal protection for those persons to avoid direct contact.
All possible sources of ignition should be eliminated and non-essential air intakes shut down to prevent intake of vapour into accommodation and engine spaces.

Take measures to reduce tanks level or pressure to stop any emission of material or vapour.

Report about such spillage to nearest coastal state in order to arrange precautionary measures for the environment.

3.2.7 Loss of tank environmental control

Consider any hazards arising out of loss of environmental control in view of possible explosion dangers by contacting the Material Safety Data Sheets (MSDS) of the cargo concerned.
Avoid any intake of air into the uncontrolled spaces to avoid a dangerous mixture to be built within the respective.

3.2.8 Ship submerged/foundered/wrecked

If the ship is wrecked to the extent that it or parts of it are submerged, take all measures to evacuate all persons onboard. Avoid contact with any spilled cargo or oil . Alert other shops and/or the nearest coastal state for assistance in rescuing lives and the as far as possible.

3.3 Priority Actions

Top priority shall in all cases of emergency be put on the safety of the persons onboard and to take actions to prevent escalation of the incident.
Immediate consideration should be given to the protective measures against fire, fire explosions and personal exposure to toxic vapour.
Detailed information about damage sustained to the ship and its containment system has to be obtained.
On the basis of the information the Master can decide next actions for the protection of lives, the ship, the cargo and the environment.
The Master should take into account the following when he is determining whether salvage assistance will be needed or not:

- Nearest land or hazard to navigation
- Vessel's set and drift

- Estimated time of casualty repair
- Determination of nearest capable assistance and its response time.

Detailed information about the cargo, especially NLS Cargo has to be available and to be referred to further actions regarding the cargo.

In case of necessary movement of cargo within the ship careful consideration is to be given to hull strength and stability as well as to the compatibility of all material. (cargo, tanks, coating, piping) in view of any transfer actions planned.

Plans/tables about location and specification of the current cargo as well as bunkers and ballast have to be readily available.
Information about Current cargo/bunker/ballast distribution and the Material Safety Data Sheets (MSDS) for the carried cargo substances are available at:

- Cargo, bunkers, ballast distribution: Cargo Office
- Material Safety Data Sheets (MSDS); Alleyway opposite of the cargo office

3.4 Mitigating Activities

If safety of both the ship and the personnel has been addressed the Master shall care for the following issues:

- Assessment of the situation and monitoring of all activities as documented evidence
- Care for further protection of the personnel, use of protection gear, assessment of further risk for health and safety
- Containment of the spilled material by absorption and proper and safe disposal of all material onboard until proper delivery ashore under close guidance of the safety information given by the Product Data Sheet
- Decontamination of Personnel after finishing the cleanup process.

3.5 Transfer of Bunker/Cargo - Lightering

If the ship has sustained extensive structural damage, it may be necessary to transfer all or part of the cargo/bunker to another ship. In Ship to Ship transfer operations involving a specialized service ship, the Master of that ship will normally be in overall charge.
In the case of non-specialized ships the Master or other person in overall charge of the operation should be mutually agreed and clearly established by the Masters concerned prior to the start of operations.
The actual bunker/cargo transfer should be carried out in accordance with the requirements of the receiving ship.
In all cases each Master remains responsible for the safety to be jeopardized by the action of the other Master, his owner, regulatory officials or others.

The ship to ship transfer operations should be coordinated with the appropriate responsible local Authority. When selecting the area of operation the Masters should consider the following points:

- The need to notify and obtain the agreements of any responsible authority
- The destinations of the ships concerned
- The shelter provided, particularly from sea and swell
- The sea area and depth of water, which should be sufficient for maneuvering during mooring, unmooring, and transfer operations and allow a safe anchorage if operations have to be undertaken at anchor
- The traffic density
- The weather conditions and weather forecasts.

Further, before commencing Ship to Ship Transfer operations each ship should carry out, as far as possible, appropriate preparations like

- Pre-mooring preparations of the ship
- Positioning of fenders if such equipment is available on board
- Mooring equipment arrangements
- Checking the communication channels between the two ships.

In addition to the general principles of Ship to Ship operations as aforementioned the Master should take note of supplemented instructions issued in the Coastal Shipping Ltd bunkering procedures.

3.6 Damage Stability and Hull Stress Calculation

Whenever the tank status changes in the course of the incident the stability and stress of the vessel has to be checked using the class approved cargo computer.

In case of hull damage stability shall instantly be checked using the appropriate application of the cargo computer. The damage control plan should be referred to. In addition to that the **GL Emergency Response Service** is to be consulted for proper stress and stability calculations.

Whenever possible the contact to the **GL Emergency Response Service** will be via Coastal Shipping Ltd. office in order to reduce the workload onboard.
Otherwise the vessel can contact the **GL Emergency Response Service** directly using the following numbers:

Phone: **011-49-40-3614-9134**
Mobile: **011-49-172-405-9713**
Fax: **011-49-40-361-493-620**
email: **matthias.galle@gl-group.com**

Vessel Stress and Stability Information

VOYAGE PARTICULARS

Departure Port

Departure Date

Time (GMT)

VESSEL CONDITION IMMEDIATELY BEFORE CASUALTY

Mean Draft Forward

Mean Draft Aft

KG(solid)

KG(fluid)

LCG of Vessel

Condition of Tanks and Compartments

#	COMPARTMENT	S.G.	TONNES

3.7 General Responsibilities of the Master and designated Officers / crew members

The responsibilities of the Master Officers and the crew onboard in the event of a spill actual or probable to bring the accident under control on board, limit overflows or cleanup procedures, and to secure the ship immediately if an incident occurs.

The following is an example which can be used by the Master to aid in designating officers. Should changes to the team be made, please make a record in this section :

Master
Chief Mate
Chief Engineer

In the event of an emergency, the team should be called out as soon as it is safe to do so.

The team should be given necessary training in the use of such equipment as oil absorbents that the vessel may carry. All members crew should be aware of their duties should an oil spill occur.

Master

- In overall charge.
- Informs terminal authorities or coastal authorities of incident.
- Informs the local agent and requests agent to inform the local underwriter's representative.
- Advises the company's head office of the situation. Keeps everyone updated at regular intervals. and advises of any changes in status of the emergency.
- Keeps log of all events and progress of actions.

Chief Mate

- In charge of deck / cargo operations.
- In charge of lifeboats if required.
- Keeps the Master informed and updated on the situation and of the results of steps taken to contain any spills and limit outflow.
- Insures all openings in the deck and superstructure are closed to limit vapour entry.
- Position sorbent / clean up material to prevent any fluid escape.

Chief Engineer

- In charge of bunkering operations.
- Organizes distribution of oil spill detergents if required.
- Stops bunkering operations if applicable.
- Stops pumps and any unnecessary pieces of machinery.

Other Personnel

Deck Officer on duty

- Alerts and informs Chief Officer / Chief Engineer on the situation.

- Mobilize off duty crew as necessary.

Engineer on duty

- Assist the Chief Engineer.
- Prepare for fire fighting.
- Ensure sufficient power and water to deck.
- Organizes onboard clean up equipment.

Deck Officer off duty

- Under the direction of the Master, responsible for the reporting and record keeping of all events.

On duty Ratings

- Alerts the Officer on duty of any leakage.
- Position sorbent / clean up material to prevent any fluid escape.

Off duty personnel

- Assist as required

SECTION 4: National and Local Co-Ordination Steps to Control Discharge

In accordance with the Canadian Pollutant Discharge Reporting Regulations, the Master or Owner of a ship must report, without delay, any discharge or anticipated discharge of a pollutant in Canadian waters or fishing zones, to a Pollution Prevention Officer (PPO). Reports must be made in the manner described in Guidelines for Reporting Incidents Involving Dangerous Goods, Harmful Substances and/or Marine Pollutants, TP 9834, or "General Principles for Ship Reporting Systems and Ship Reporting Requirements, including Guidelines for Reporting Incidents Involving Dangerous Goods, Harmful Substances and/or Marine Pollutants" adopted by the IMO by Resolution A.851(20). These initial reports can be made to Marine Communication and Traffic Service (MCTS) or any other Canadian Coast Guard Radio Station (CGRS), on the frequencies listed in the publication, Radio Aids to Marine Navigation (RAMN).

Alternatively, spills may be reported to the appropriate regional center or nearest Vessel Traffic Service Center on VHF channel 16:

CANADA

Atlantic Region

St. John's, NL	Tel:	1-800-563-9089
Halifax, NS	Tel:	1-800-565-1633

Central & Arctic Region

Quebec City, QC	Tel:	1-800-363-4735
Sarnia, ON	Tel:	1-800-265-0237

Western Region

Vancouver, BC	Tel:	1-800-889-8852

GREENLAND

Spill Notification Point

Joint Arctic Command	Tel:	+299 36 40 00
MRCC Greenland	Fax:	+299 36 40 29
Aalisartut Aqquttaat 47	Email:	ako@mil.dk
Po Box 1072, 3900 Nuuk, Greenland		ako-commcen@mil.dk

Competent National Authority

Greenland Bureau of Minerals and Petroleum (BMP)	Tel:	(+299) 34 68 00
Imaneq 1A 201,	Fax:	(+299) 32 43 02
PO Box 930, 3900 Nuuk, Greenland	Email:	bmp@nanoq.gl
	Web:	www.bmp.gl

Note:

The following contacts have been included as they are within the expected range of operation of the Vessel. Due to the nature of the Vessel's voyages and varied ports of call this list should not be considered exhaustive. For this reason space has been included at the end of this section for addenda.

Within Canada, administrative inquiries related to pollution prevention, compliance and enforcement, vessel regulations, design and construction should be directed to:

Transport Canada
Marine Safety and Security
330 Sparks Street
Ottawa, Ontario
K1A 0N5
Tel: (613) 998-0610 Fax: (613) 954-1032

Inquiries relating to pollution response should be directed to:

Commissioner
Canadian Coast Guard
Department of Fisheries and Oceans
6th Floor, Centinnial Towers
200 Kent Street
Ottawa, Ontario
K1A 0E6
Tel: (613) 990-0999/7728 Fax: (613) 990-1866 Email: info@dfo-mpo.gc.ca

ECRC East Coast Response Corporation
1201-275 Slater Street
Ottawa, Ontario
K1P 5H9
Tel:(613) 230-7369

Additional Contact Information

Region	
Spill Notification Point	Contact Numbers

Region	
Spill Notification Point	Contact Numbers

Region	
Spill Notification Point	Contact Numbers

Region	
Spill Notification Point	Contact Numbers

VESSEL INTEREST CONTACTS

VESSEL MANAGEMENT

Coastal Shipping Limited (Owners)
P. O. Box 300, Station C
Happy Valley-Goose Bay, NL
A0P 1C0
Canada
Ph: (709) 896-2421
Fax: (709) 896-5028

24 HOUR EMERGENCY CONTACTS

General Manager	Dennis White	(709) 896-2421 work (709) 896-1404 cell (709) 896-2870 home
Engineering Superintendent	Jim Babij	(709) 579-6127 work (709) 727-5065 cell (709) 576-0160 home
	Kevin Brewer	(709) 579-6127 work (709) 682-0826 cell (709) 227 2600 home
Fleet Manager	Phillip John	(709) 535-6944 work (709) 541-1807 cell pjohn@woodwards.nf.ca
Designated Person Ashore	Craig Whiteway	(709) 834-1320 work (709) 727-4848 cell cwhiteway@woodwards.nf.ca

APPENDICES:

Appendix I:

- **Spill Equipment Inventory**

Appendix II:

- **General Arrangement**
- **Layout of General Arrangement Stowage Plan**
- **Diagram of Fuel Bunkering**
- **Tank Plan**
- **Capacity Plan**
- **Diagram of Fuel Service Lines**
- **Lubricating Oil System**
- **Stripping System**

APPENDIX I

SPILL EQUIPMENT "MT ALSTERSTERN"

LOCATION PLAN

Date Checked (dd/mm/yy):

Quantity	Unit	Description
		BOX 2 (CATWALK)
100	Pcs	Oil sorbent pads / sheets
1	Bag	Sorbent boom
2	Bags	Saw Dust
2	Bags	Granules
		BOX 3 (CATWALK)
3	Pcs	Compressed air breathing apparatus
1	Pc	Chemical suit (gas tight)
2	Pairs	Rubber boots
2	Pcs	Safety lamp
2	Pcs	Face mask
3	Pcs	Safety goggles
2	Pcs	Rubber gloves
3	Pcs	CHEMTEX chemical clothing
		BOX 4 (CATWALK)
2	Pcs	Sorbent blanket
2	Bags	Sorbent boom
25	Ltr.	Oil spill dispersant (SEACARE)
1	Pc	Pressure sprayer
1	Pc	Non sparking shovel
2	Pcs	Safety goggles
2	Pairs	Rubber gloves
2	Pairs	Rubber boots
2	Pcs	Plastic scoop
2	Pcs	Galvanized scoop
2	Pcs	Rain suit
		BOX 5 (BLOWER EXHAUST)
2	Bags	Saw dust
2	Bags	Granules
		BOX 6 (ACCOMMODATION)
2	Pcs	Compressed air breathing apparatus
2	Pcs	Chemical suit (gas tight)
2	Pcs	Safety helmet
2	Pcs	Safety lamp
1	Pc	Air drill
2	Pcs	Safety goggles
2	Pairs	Gloves
2	Pairs	Rubber boots
		SAFETY LOCKER #415
7	Pcs	Foam spray (Montage Schaum)
		FORECASTLE
4	Bags	Saw dust
		AFT WET LOCKER
14	Bags	Saw dust
5	Bags	Granules

****TO BE CHECKED MONTHLY AND DATE OF INSPECTION RECORDED****

APPENDIX II

STEAMSHIP MUTUAL

CERTIFICATE OF ENTRY AND ACCEPTANCE

This is to certify that the ship below has been entered for insurance in
The Steamship Mutual Underwriting Association (Bermuda) Limited
for

Class 1 - Protection and Indemnity

With effect from

Noon G.M.T 20/02/2013 to Noon G.M.T 20/02/2014

until sold, lost, withdrawn or the entry is terminated in accordance with the Rules, to the extent specified and in accordance with the Act, Bye-Laws and the Rules from time to time in force and the special terms specified overleaf.

For the account of:

Coastal Shipping Ltd (Owner)

and Joint Members, if any, under Rule 9 (i) as listed overleaf

whose names have been entered in the Register of Members of the Club as a Member.

Vessel Name:	**"DORSCH"**		
Gross Tonnage:	**6,729**	Built:	**1980**
Class:	**GL**	IMO no:	**8007195**
Port of Registry:	**ST. JOHN`S, NFL.**		

THIS CERTIFICATE OF ENTRY IS EVIDENCE ONLY OF THE CONTRACT OF INDEMNITY INSURANCE BETWEEN THE ABOVE NAMED MEMBER(S) AND THE ASSOCIATION AND SHALL NOT BE CONSTRUED AS EVIDENCE OF ANY UNDERTAKING, FINANCIAL OR OTHERWISE, ON THE PART OF THE ASSOCIATION TO ANY OTHER PARTY.
IN THE EVENT THAT A MEMBER TENDERS THIS CERTIFICATE AS EVIDENCE OF INSURANCE UNDER ANY APPLICABLE LAW RELATING TO FINANCIAL RESPONSIBILITY, OR OTHERWISE SHOWS OR OFFERS IT TO ANY OTHER PARTY AS EVIDENCE OF INSURANCE, SUCH USE OF THIS CERTIFICATE BY THE MEMBER IS NOT TO BE TAKEN AS ANY INDICATION THAT THE ASSOCIATION THEREBY CONSENTS TO ACT AS GUARANTOR OR TO BE SUED DIRECTLY IN ANY JURISDICTION WHATSOEVER. THE ASSOCIATION DOES NOT SO CONSENT.

NOTES

1. REFERENCE IS REQUESTED TO THE RULES AS TO THE CIRCUMSTANCES OF ENTRY BEING CANCELLED AND AS TO THE CIRCUMSTANCES OF AN ALTERATION IN THE RULES OR BYE-LAWS.

2. THE RULES ARE PRINTED ANNUALLY IN BOOK FORM, INCORPORATING ALL PREVIOUS ALTERATIONS AND A COPY IS SENT TO EACH MEMBER. ALTERATIONS CAN BE MADE BY ORDINARY RESOLUTION FOLLOWING A GENERAL MEETING NOTIFIED TO ALL MEMBERS.

3. THIS CERTIFICATE OF ENTRY SUPERSEDES ANY PREVIOUS CERTIFICATE OF ENTRY IN RESPECT OF THESE RISKS AND ENTERED SHIP(S). SAVE AS OTHERWISE EXPRESSLY PROVIDED HEREIN ANY SUCH PREVIOUS CERTIFICATE OF ENTRY SHALL REMAIN IN FULL FORCE AND EFFECT UP TO THE DATE OF THIS CERTIFICATE OF ENTRY.

STEAMSHIP MUTUAL MANAGEMENT (BERMUDA) LTD.
MANAGERS

Hamilton, Bermuda - 07/02/2013

Certificate Number - 43113/ 1

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Limit of Liability

Cover hereunder for all claims in respect of Oil Pollution shall be limited to US$ 1,000,000,000 each vessel any one accident or occurrence.

Inclusions of Cover

Cover as per Rules including but not limited to:

Liabilities in respect of Cargo in accordance with Rule 25 xiii and/save as may be more particularly set out in this Certificate of Entry.

Liability to Persons including Crew for illness, injury or death in accordance with Rule 25 i-iii, and/save as may be more particularly set out in this Certificate of Entry.

Liability for Loss of or Damage to Fixed and Floating Objects (including docks, jetties etc.) in accordance with rule 25 vii and/save as may be more particularly set out in this Certificate of Entry.

Liabilities in respect of Pollution in accordance with Rule 25 vi and/save as may be more particularly set out in this Certificate of Entry.

Liabilities in respect of Wreck Removal in accordance with Rule 25 xi and/save as may be more particularly set out in this Certificate of Entry.

Subject to the Rules and the Member's terms of entry this vessel is covered for trading to Arctic Waters.

Warranties

Vessel carrying non-persistent oil cargoes only, or held covered at terms and conditions to be agreed.

Trading between 15th June and 30th November annually, and to be laid-up at a safe port with less than 1/4 crew onboard for the remainder of the time

Trading Canadian waters only

Deductibles

US$5,235 - from all other cargo claims, each single voyage.

US$4,000 - from all other claims, any one accident or occurrence.

Other Conditions

Sanctions Clause

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It is a condition of this insurance that no coverage will be provided and no entries will be accepted in respect of:

1. Vessels owned, managed, operated or chartered by a party (who need not be a Member or prospective Member of the Club); and/or

2. Vessels;

designated under any legislation, regulation or order of any State or International Organisation which howsoever exposes those vessels and/or the Club and/or the Member entering such vessels and/or any other Member of the Club to the risk of being or becoming subject to any sanction, prohibition or adverse action whatsoever.

If, notwithstanding this condition,

(a) a vessel, in relation to which cover has been provided, or the entry of which has been accepted by the Club (whether or not a certificate of entry has been issued) ; or

(b) such vessel's owner, manager, operator or charterer, (whether or not a Member of the Club)

is or becomes so designated, the entry of that vessel and/or the coverage provided to the Member, shall cease forthwith and no claims, liabilities, costs or expenses shall be paid by or recoverable from the Club in relation thereto.

In the event that any vessel entered (whether or not a certificate of entry has been issued), or a vessel in relation to which cover has been provided, is employed on any voyage, in any trade, or for the carriage of cargo in breach of any legislation, regulation or order of any State or International Organisation which howsoever exposes the Club to the risk of being or becoming subject to any sanction, prohibition or adverse action whatsoever, the insurance of that vessel and/or the coverage provided to the Member shall cease forthwith and no claims, liabilities, costs or expenses in relation thereto, and arising after the date of such cessation, shall be recoverable hereunder. Save that at any time after such cessation, if the Directors in their absolute discretion so determine, that vessel's entry in the Club or the coverage in relation to that vessel, may be reinstated on such terms and conditions and from such date and time as the Directors or the Managers direct.

Crew Clauses

CANADIAN COMPENSATION EXCLUSION CLAUSE

Excluding any and all liability to crew and/or others employed on or about the vessel under any and all Workmens' Compensation Acts or equivalent legislation applicable under Canadian Federal or Provincial Law

Premium

Cancelling Returns only.

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Additional Parties

Joint Members

The cover afforded to:

1. Woodwards Oil Ltd (Other)
2. Labrador Leasing Ltd (Operator)
3. Labrador Motors Ltd (Operator)
4. Woodwards Ltd (Other)
5. Arctic Services Ltd (Other)

as Joint Member shall extend only to risks, liabilities, costs and expenses arising out of operations and/or activities customarily carried on by or at the risk and responsibility of shipowners and which are within the scope of the cover provided under the terms, conditions and exceptions provided by the Rules and by this Certificate of Entry.

The conduct of any one Joint Member which is sufficient to bar that Joint Member's right of recovery under the terms, conditions and exceptions provided by the Rules and by this Certificate of Entry shall bar absolutely the rights of recovery of all Joint Members thereunder.

All Joint Members shall be jointly and severally liable to pay contributions due to the Club in respect of this entry, and the receipt by any one Joint Member of any sums payable by the Club in respect of this entry shall be sufficient discharge of the Club for the same.

There shall be no recovery out of the funds of the Club in respect of any liability, costs and expenses arising out of or as a result of any claim, dispute or difference between any Joint Members, affiliates and/or any others insured to any extent under one entry.

Loss Payable Clause

Payment of any recovery the Owner is entitled to receive out of the funds of the Association in respect of any liability, costs or expenses incurred by him shall be made to the Owner or to his order unless and until the Association receives notice from:

The Royal Bank of Canada

that the Owner is in default under the Mortgage, in which event all recoveries shall thereafter be paid to:

The Royal Bank of Canada

or their order; provided always that no liability whatsoever shall attach to the Association, its Managers or their Agents for failure to comply with the latter obligation until after the expiry of two clear business days from the receipt of such notice. The Association shall, unless it receives from the Mortgagee notice to the contrary, be at liberty at the request of the Owner to provide bail or other security to prevent the arrest or obtain the release of the vessel, without liability to the Mortgagee.

Affiliated Companies Clause
It is noted that cover has been extended as follows, subject to the terms of Rule 9 (ii):

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Should a claim in respect whereof a Member named in this Certificate of Entry is insured by the Association be made or enforced through an Affiliated, Associated or Subsidiary Company of such Member, the Association shall if so requested by the Member indemnify such Company against any loss which as a consequence thereof such Company shall have incurred in that capacity provided always that nothing herein contained shall be construed as extending to any amount which would not have been recoverable from the Association by the Member had such claim been made or enforced against him. Once the Association has made such indemnification it shall not be under any further liability and shall not make any further payment to any person or Company whatsoever, including the Member, in respect of that claim.

Conduct of any one of the parties insured under this entry which is sufficient to bar the insured's rights hereunder shall bar the rights of recovery of all the said insured.

Addenda

War Risk Extension Clause

1) Cover excluded under Rule 21 is hereby reinstated subject to the terms set out in this Certificate of Entry and any Endorsement thereto, and to the following conditions.

2) This special cover shall be subject to an excess of either:

a) the "proper value" of the entered ship as defined in the Note to Rule 25 xv, (which, for the purpose of this War Risk Extension only, shall be deemed not to exceed US$100 million), or
b) the amount recoverable in respect of the claim under any other policy of insurance, whether of war risks or otherwise,

whichever shall be the greater, save that such excess shall not apply where the entry of the ship is solely in the name of or on behalf of a Charterer other than a Charterer by Demise or Bareboat Charterer, provided that the Directors may authorise the payment, in whole or in part, of any claim or part of a claim which falls within such excess, if in their discretion and without having to give any reasons for their decision they decide that the Owner should recover from the Club.

3) Subject to the exception set out below, the limit applying to this special cover shall be US$500 million, any one event each vessel or any limit set out elsewhere in this Certificate, whichever shall be the lesser.

4) All perils included in the special cover shall be subject to the following:

Chemical, Biological, Bio-chemical, Electromagnetic Weapons and Computer Virus Clause:

In no case shall this insurance cover loss damage liability or expense directly or indirectly caused by or contributed to by or arising from
a) any chemical, biological, bio-chemical or electromagnetic weapon;
b) the use or operation, as a means for inflicting harm, of any computer virus.

5) At any time or times before, or at the commencement of, or during the currency of any Policy Year of the Club, the Directors may in their discretion determine that any ports, places, countries, zones or areas (whether of land or sea) be excluded from the insurance provided by this P&I war risks cover. Save as otherwise provided by the Directors, this P&I war risks cover shall cease in

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respect of such ports, places, countries, zones or areas at midnight on the seventh day following the issue to the Members of notice of such determination in accordance with the terms of the cover provided pursuant to Rule 21 of the Club's Rules. Unless and to the extent that the Directors in their discretion otherwise decide there shall be no recovery from the Club under this P&I war risks cover in respect of any claim howsoever arising out of any event, accident or occurrence within the said area after such date.

6) Whether or not notice has been given under Clause (5) above, this P&I war risks cover shall terminate automatically:

i) upon the outbreak of war (whether there be a declaration of war or not) between any of the following countries:

United Kingdom, United States of America, France, the Russian Federation, the People's Republic of China and this insurance excludes loss, damage, liability or expense arising from such outbreak of war;

ii) in respect of any vessel, in connection with which cover is granted hereunder, in the event of such vessel being requisitioned either for title or use and this insurance excludes loss, damage, liability or expense arising from such requisition.

7) Notwithstanding any other term or condition of this insurance, the Directors may in their discretion cancel this special cover giving 7 days' notice to the Members (such cancellation becoming effective on the expiry of 7 days from midnight of the day on which notice of cancellation is issued by the Club and the Directors may at any time after the issue of notice of such cancellation resolve to reinstate special cover pursuant to the proviso to the terms of the cover issued pursuant to Rule 21 on such terms and conditions and subject to such limit as the Directors in their discretion may determine.

8) When either a Demise, Time, Voyage, Space or Slot Charterer and/or the Owner of the Entered Ship are separately insured for losses, liabilities, or the costs and expenses incidental thereto covered under Rule 21 of the Club and/or the equivalent Rule of any other Association which participates in the Pooling Agreement and General Excess Loss Reinsurance Contract, the aggregate of claims in respect of such losses, liabilities, or the costs and expenses incidental thereto covered under Rule 21 of the Club and/or the equivalent Rule of such other Association(s), shall be limited to the amount set out in the Certificate of Entry in respect of any one ship, any one incident or occurrence. If such claims exceed this limit, the liability of the Club in respect of each Certificate of Entry shall be limited to that proportion of the limit that claims recoverable from the Club under that Certificate bear to the aggregate of the said claims recoverable from the Club and from such other Association(s), if any.

9) Cover for acts of terrorism as defined in the U.S. Terrorism Risk Insurance Act of 2002 (TRIA) is included hereunder, subject to the conditions set out above, the estimated cost of this element of coverage being US0.25 cents per entered gross ton.

10) The Club shall not provide insurance hereunder for any losses, liabilities, costs or expenses if the provision of such insurance would create a liability for the (Insured Owner) under the Tanker Oil Pollution Indemnification Agreement 2006 to contribute to the IOPC Supplementary Fund.

11) Sanctions Clause - Excluding coverage for liabilities, costs and expenses to the extent that the payment of any claim or the provision of any benefit in respect of those

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liabilities, costs and expenses would expose the Club and/or their reinsurers hereunder to any sanction, prohibition or restriction under United Nations Resolutions or the trade or economic sanctions, laws or regulations of the European Union, United Kingdom or United States of America.

Bio-Chem Clause

1.1 Subject to the terms and conditions and exclusions set out herein, cover is extended to include the liability of the Member:
(a) To pay damages, compensation or expenses in consequence of the personal injury to or illness or death of any seaman (including diversion expenses, repatriation and substitute expense and shipwreck unemployment indemnity),
(b) For the legal costs and expenses incurred solely for the purpose of avoiding or minimising any liability or risk insured by an Association (other than under the Omnibus Rule)
1.2 Where such liability is not recoverable under either:
(a) cover provided by the Club for such liabilities, costs, losses and expenses as would be covered under the Rules but for the exclusion of war risks in Rule 21, or
(b) Any underlying war risk policies covering the same risks,
1.3 Solely by reason of the operation of an exclusion of liabilities, costs, losses and expenses directly or indirectly caused by or contributed to by or arising from :
(a) Any chemical, biological, bio-chemical or electromagnetic weapon
(b) the use or operation, as a means for inflicting harm, of any computer, computer system, computer software program, malicious code, computer virus or process or any other electronic system,
1.4 Other than liabilities, costs, losses and expenses arising from:
(i) Explosives or the methods of the detonation or attachment thereof
(ii) The use of the entered ship or its cargo as a means for inflicting harm, unless such cargo is a chemical or bio-chemical weapon.
(iii) the use of any computer, computer system or computer software program or any other electronic system in the launch and/or guidance system and/or firing mechanism of any weapon or missile.

2. Excluded Areas
2.1 The Directors may in their discretion decide that there shall be no recovery in respect of any liabilities, costs, losses and expenses directly or indirectly caused by or contributed to by or arising out of any event, accident or occurrence within such ports, places, zones or areas, or during such period as they may specify.
2.2 At any time or times before, or at the commencement of, or during the Policy Year, the Club may by notice to the Member change, vary, extend, add to or otherwise alter the ports, places, countries, zones and periods specified in Clause 2.1 from a date and time specified by the Club not being less than 24 hours from midnight on the day the notice is given to the Member.

3. Cancellation
Cover hereunder may by notice to the Member be cancelled by the Club from a date and time specified by the Club, not being less than 24 hours from midnight on the day notice of cancellation is given to the Member.

4. Limit of Liability
4.1 Subject to Clause 4.2 the limit of liability of the Club under this extension of cover in respect of all claims shall be in the aggregate US$30 million each ship any one accident or occurrence or series thereof arising from any one event.

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4.2 In the event that there is more than one entry by any person for Bio-Chem cover as provided herein in respect of the same ship with the Club and/or any other insurer which participates in the Pooling Agreement or General Excess Loss Reinsurance Contract, the aggregate recovery in respect of all liabilities, costs, losses and expenses arising under such entries shall not exceed the amount stipulated in Clause 4.1 and the liability of the Club under each such entry shall be limited to such proportion of that amount as the claims arising under that entry bear to the aggregate of all such claims recoverable from the Club and any such other insurer.

5. Deductible
The deductible shall be the deductible applicable to the relevant cover set out in the Certificate of Entry.

6. Law and Practice
This clause is subject to English law and practice.

Association:
The Steamship Mutual Underwriting Association (Bermuda) Limited
Washington Mall 1, PO Box HM 447, Hamilton HM BX, Bermuda
Tel: (441) 295-4502 Fax: (441) 292-8787

Managers:
Steamship Mutual Management (Bermuda) Limited
Washington Mall 1, PO Box HM 447, Hamilton HM BX, Bermuda
Tel: (441) 295 4502 Fax: (441) 292 8787

Managers' London Representative:
Steamship Insurance Management Services Limited
Authorised and Regulated by the United Kingdom Financial Services Authority
Aquatical House, 39 Bell Lane, London E1 7LU
Tel: 020 7247 5490 Website: www.simsl.com
Registered No: 3855693 England

Heather J. Cooper

STEAMSHIP MUTUAL

CERTIFICATE OF ENTRY AND ACCEPTANCE

This is to certify that the ship below has been entered for insurance in
The Steamship Mutual Underwriting Association (Bermuda) Limited
for

Class 1 - Protection and Indemnity

With effect from

Noon G.M.T 20/02/2013 to Noon G.M.T 20/02/2014

until sold, lost, withdrawn or the entry is terminated in accordance with the Rules, to the extent specified and in accordance with the Act, Bye-Laws and the Rules from time to time in force and the special terms specified overleaf.

For the account of:

Coastal Shipping Ltd (Owner)

and Joint Members, if any, under Rule 9 (i) as listed overleaf

whose names have been entered in the Register of Members of the Club as a Member.

Vessel Name:	**"NANNY"**		
Gross Tonnage:	**6,544**	Built:	**1993**
Class:	**DNV**	IMO no:	**9051399**
Port of Registry:	**ST. JOHN`S, NFL.**		

THIS CERTIFICATE OF ENTRY IS EVIDENCE ONLY OF THE CONTRACT OF INDEMNITY INSURANCE BETWEEN THE ABOVE NAMED MEMBER(S) AND THE ASSOCIATION AND SHALL NOT BE CONSTRUED AS EVIDENCE OF ANY UNDERTAKING, FINANCIAL OR OTHERWISE, ON THE PART OF THE ASSOCIATION TO ANY OTHER PARTY.
IN THE EVENT THAT A MEMBER TENDERS THIS CERTIFICATE AS EVIDENCE OF INSURANCE UNDER ANY APPLICABLE LAW RELATING TO FINANCIAL RESPONSIBILITY, OR OTHERWISE SHOWS OR OFFERS IT TO ANY OTHER PARTY AS EVIDENCE OF INSURANCE, SUCH USE OF THIS CERTIFICATE BY THE MEMBER IS NOT TO BE TAKEN AS ANY INDICATION THAT THE ASSOCIATION THEREBY CONSENTS TO ACT AS GUARANTOR OR TO BE SUED DIRECTLY IN ANY JURISDICTION WHATSOEVER. THE ASSOCIATION DOES NOT SO CONSENT.

NOTES

1. REFERENCE IS REQUESTED TO THE RULES AS TO THE CIRCUMSTANCES OF ENTRY BEING CANCELLED AND AS TO THE CIRCUMSTANCES OF AN ALTERATION IN THE RULES OR BYE-LAWS.

2. THE RULES ARE PRINTED ANNUALLY IN BOOK FORM, INCORPORATING ALL PREVIOUS ALTERATIONS AND A COPY IS SENT TO EACH MEMBER. ALTERATIONS CAN BE MADE BY ORDINARY RESOLUTION FOLLOWING A GENERAL MEETING NOTIFIED TO ALL MEMBERS.

3. THIS CERTIFICATE OF ENTRY SUPERSEDES ANY PREVIOUS CERTIFICATE OF ENTRY IN RESPECT OF THESE RISKS AND ENTERED SHIP(S). SAVE AS OTHERWISE EXPRESSLY PROVIDED HEREIN ANY SUCH PREVIOUS CERTIFICATE OF ENTRY SHALL REMAIN IN FULL FORCE AND EFFECT UP TO THE DATE OF THIS CERTIFICATE OF ENTRY.

STEAMSHIP MUTUAL MANAGEMENT (BERMUDA) LTD.
MANAGERS

Hamilton, Bermuda - 07/02/2013

Certificate Number - 43117/ 1

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Limit of Liability

Cover hereunder for all claims in respect of Oil Pollution shall be limited to US$ 1,000,000,000 each vessel any one accident or occurrence.

Inclusions of Cover

Cover as per Rules including but not limited to:

Liabilities in respect of Cargo in accordance with Rule 25 xiii and/save as may be more particularly set out in this Certificate of Entry.

Liability to Persons including Crew for illness, injury or death in accordance with Rule 25 i-iii, and/save as may be more particularly set out in this Certificate of Entry.

Liability for Loss of or Damage to Fixed and Floating Objects (including docks, jetties etc.) in accordance with rule 25 vii and/save as may be more particularly set out in this Certificate of Entry.

Liabilities in respect of Pollution in accordance with Rule 25 vi and/save as may be more particularly set out in this Certificate of Entry.

Liabilities in respect of Wreck Removal in accordance with Rule 25 xi and/save as may be more particularly set out in this Certificate of Entry.

Subject to the Rules and the Member's terms of entry this vessel is covered for trading to Arctic Waters.

Warranties

Vessel carrying non-persistent oil cargoes only, or held covered at terms and conditions to be agreed.

Trading between 15th June and 30th November annually, and to be laid-up at a safe port with less than 1/4 crew onboard for the remainder of the time

Trading Canadian waters only

Deductibles

US$5,235 - from all other cargo claims, each single voyage.

US$4,000 - from all other claims, any one accident or occurrence.

Other Conditions

Sanctions Clause

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It is a condition of this insurance that no coverage will be provided and no entries will be accepted in respect of:

1. Vessels owned, managed, operated or chartered by a party (who need not be a Member or prospective Member of the Club); and/or

2. Vessels;

designated under any legislation, regulation or order of any State or International Organisation which howsoever exposes those vessels and/or the Club and/or the Member entering such vessels and/or any other Member of the Club to the risk of being or becoming subject to any sanction, prohibition or adverse action whatsoever.

If, notwithstanding this condition,

(a) a vessel, in relation to which cover has been provided, or the entry of which has been accepted by the Club (whether or not a certificate of entry has been issued) ; or

(b) such vessel's owner, manager, operator or charterer, (whether or not a Member of the Club)

is or becomes so designated, the entry of that vessel and/or the coverage provided to the Member, shall cease forthwith and no claims, liabilities, costs or expenses shall be paid by or recoverable from the Club in relation thereto.

In the event that any vessel entered (whether or not a certificate of entry has been issued), or a vessel in relation to which cover has been provided, is employed on any voyage, in any trade, or for the carriage of cargo in breach of any legislation, regulation or order of any State or International Organisation which howsoever exposes the Club to the risk of being or becoming subject to any sanction, prohibition or adverse action whatsoever, the insurance of that vessel and/or the coverage provided to the Member shall cease forthwith and no claims, liabilities, costs or expenses in relation thereto, and arising after the date of such cessation, shall be recoverable hereunder. Save that at any time after such cessation, if the Directors in their absolute discretion so determine, that vessel's entry in the Club or the coverage in relation to that vessel, may be reinstated on such terms and conditions and from such date and time as the Directors or the Managers direct.

Crew Clauses

CANADIAN COMPENSATION EXCLUSION CLAUSE

Excluding any and all liability to crew and/or others employed on or about the vessel under any and all Workmens' Compensation Acts or equivalent legislation applicable under Canadian Federal or Provincial Law

Premium

Cancelling Returns only.

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Additional Parties

Joint Members

The cover afforded to:

1. Woodwards Oil Ltd (Other)
2. Labrador Leasing Ltd (Operator)
3. Labrador Motors Ltd (Operator)
4. Woodwards Ltd (Other)
5. Arctic Services Ltd (Other)

as Joint Member shall extend only to risks, liabilities, costs and expenses arising out of operations and/or activities customarily carried on by or at the risk and responsibility of shipowners and which are within the scope of the cover provided under the terms, conditions and exceptions provided by the Rules and by this Certificate of Entry.

The conduct of any one Joint Member which is sufficient to bar that Joint Member's right of recovery under the terms, conditions and exceptions provided by the Rules and by this Certificate of Entry shall bar absolutely the rights of recovery of all Joint Members thereunder.

All Joint Members shall be jointly and severally liable to pay contributions due to the Club in respect of this entry, and the receipt by any one Joint Member of any sums payable by the Club in respect of this entry shall be sufficient discharge of the Club for the same.

There shall be no recovery out of the funds of the Club in respect of any liability, costs and expenses arising out of or as a result of any claim, dispute or difference between any Joint Members, affiliates and/or any others insured to any extent under one entry.

Affiliated Companies Clause
It is noted that cover has been extended as follows, subject to the terms of Rule 9 (ii):

Should a claim in respect whereof a Member named in this Certificate of Entry is insured by the Association be made or enforced through an Affiliated, Associated or Subsidiary Company of such Member, the Association shall if so requested by the Member indemnify such Company against any loss which as a consequence thereof such Company shall have incurred in that capacity provided always that nothing herein contained shall be construed as extending to any amount which would not have been recoverable from the Association by the Member had such claim been made or enforced against him. Once the Association has made such indemnification it shall not be under any further liability and shall not make any further payment to any person or Company whatsoever, including the Member, in respect of that claim.

Conduct of any one of the parties insured under this entry which is sufficient to bar the insured's rights hereunder shall bar the rights of recovery of all the said insured.

Addenda

War Risk Extension Clause

1) Cover excluded under Rule 21 is hereby reinstated subject to the terms set out in this

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Certificate of Entry and any Endorsement thereto, and to the following conditions.

2) This special cover shall be subject to an excess of either:

a) the "proper value" of the entered ship as defined in the Note to Rule 25 xv, (which, for the purpose of this War Risk Extension only, shall be deemed not to exceed US$100 million), or
b) the amount recoverable in respect of the claim under any other policy of insurance, whether of war risks or otherwise,

whichever shall be the greater, save that such excess shall not apply where the entry of the ship is solely in the name of or on behalf of a Charterer other than a Charterer by Demise or Bareboat Charterer, provided that the Directors may authorise the payment, in whole or in part, of any claim or part of a claim which falls within such excess, if in their discretion and without having to give any reasons for their decision they decide that the Owner should recover from the Club.

3) Subject to the exception set out below, the limit applying to this special cover shall be US$500 million, any one event each vessel or any limit set out elsewhere in this Certificate, whichever shall be the lesser.

4) All perils included in the special cover shall be subject to the following:

Chemical, Biological, Bio-chemical, Electromagnetic Weapons and Computer Virus Clause:

In no case shall this insurance cover loss damage liability or expense directly or indirectly caused by or contributed to by or arising from
a) any chemical, biological, bio-chemical or electromagnetic weapon;
b) the use or operation, as a means for inflicting harm, of any computer virus.

5) At any time or times before, or at the commencement of, or during the currency of any Policy Year of the Club, the Directors may in their discretion determine that any ports, places, countries, zones or areas (whether of land or sea) be excluded from the insurance provided by this P&I war risks cover. Save as otherwise provided by the Directors, this P&I war risks cover shall cease in respect of such ports, places, countries, zones or areas at midnight on the seventh day following the issue to the Members of notice of such determination in accordance with the terms of the cover provided pursuant to Rule 21 of the Club's Rules. Unless and to the extent that the Directors in their discretion otherwise decide there shall be no recovery from the Club under this P&I war risks cover in respect of any claim howsoever arising out of any event, accident or occurrence within the said area after such date.

6) Whether or not notice has been given under Clause (5) above, this P&I war risks cover shall terminate automatically:

i) upon the outbreak of war (whether there be a declaration of war or not) between any of the following countries:

United Kingdom, United States of America, France, the Russian Federation, the People's Republic of China and this insurance excludes loss, damage, liability or expense arising from such outbreak of war;

ii) in respect of any vessel, in connection with which cover is granted hereunder, in the event of such vessel being requisitioned either for title or use and this insurance excludes loss, damage,

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liability or expense arising from such requisition.

7) Notwithstanding any other term or condition of this insurance, the Directors may in their discretion cancel this special cover giving 7 days' notice to the Members (such cancellation becoming effective on the expiry of 7 days from midnight of the day on which notice of cancellation is issued by the Club and the Directors may at any time after the issue of notice of such cancellation resolve to reinstate special cover pursuant to the proviso to the terms of the cover issued pursuant to Rule 21 on such terms and conditions and subject to such limit as the Directors in their discretion may determine.

8) When either a Demise, Time, Voyage, Space or Slot Charterer and/or the Owner of the Entered Ship are separately insured for losses, liabilities, or the costs and expenses incidental thereto covered under Rule 21 of the Club and/or the equivalent Rule of any other Association which participates in the Pooling Agreement and General Excess Loss Reinsurance Contract, the aggregate of claims in respect of such losses, liabilities, or the costs and expenses incidental thereto covered under Rule 21 of the Club and/or the equivalent Rule of such other Association(s), shall be limited to the amount set out in the Certificate of Entry in respect of any one ship, any one incident or occurrence. If such claims exceed this limit, the liability of the Club in respect of each Certificate of Entry shall be limited to that proportion of the limit that claims recoverable from the Club under that Certificate bear to the aggregate of the said claims recoverable from the Club and from such other Association(s), if any.

9) Cover for acts of terrorism as defined in the U.S. Terrorism Risk Insurance Act of 2002 (TRIA) is included hereunder, subject to the conditions set out above, the estimated cost of this element of coverage being US0.25 cents per entered gross ton.

10) The Club shall not provide insurance hereunder for any losses, liabilities, costs or expenses if the provision of such insurance would create a liability for the (Insured Owner) under the Tanker Oil Pollution Indemnification Agreement 2006 to contribute to the IOPC Supplementary Fund.

11) Sanctions Clause - Excluding coverage for liabilities, costs and expenses to the extent that the payment of any claim or the provision of any benefit in respect of those liabilities, costs and expenses would expose the Club and/or their reinsurers hereunder to any sanction, prohibition or restriction under United Nations Resolutions or the trade or economic sanctions, laws or regulations of the European Union, United Kingdom or United States of America.

Bio-Chem Clause

1.1 Subject to the terms and conditions and exclusions set out herein, cover is extended to include the liability of the Member:
(a) To pay damages, compensation or expenses in consequence of the personal injury to or illness or death of any seaman (including diversion expenses, repatriation and substitute expense and shipwreck unemployment indemnity),
(b) For the legal costs and expenses incurred solely for the purpose of avoiding or minimising any liability or risk insured by an Association (other than under the Omnibus Rule)
1.2 Where such liability is not recoverable under either:
(a) cover provided by the Club for such liabilities, costs, losses and expenses as would be covered under the Rules but for the exclusion of war risks in Rule 21, or
(b) Any underlying war risk policies covering the same risks,
1.3 Solely by reason of the operation of an exclusion of liabilities, costs, losses and expenses

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directly or indirectly caused by or contributed to by or arising from :
(a) Any chemical, biological, bio-chemical or electromagnetic weapon
(b) the use or operation, as a means for inflicting harm, of any computer, computer system, computer software program, malicious code, computer virus or process or any other electronic system,
1.4 Other than liabilities, costs, losses and expenses arising from:
(i) Explosives or the methods of the detonation or attachment thereof
(ii) The use of the entered ship or its cargo as a means for inflicting harm, unless such cargo is a chemical or bio-chemical weapon.
(iii) the use of any computer, computer system or computer software program or any other electronic system in the launch and/or guidance system and/or firing mechanism of any weapon or missile.

2. Excluded Areas
2.1 The Directors may in their discretion decide that there shall be no recovery in respect of any liabilities, costs, losses and expenses directly or indirectly caused by or contributed to by or arising out of any event, accident or occurrence within such ports, places, zones or areas, or during such period as they may specify.
2.2 At any time or times before, or at the commencement of, or during the Policy Year, the Club may by notice to the Member change, vary, extend, add to or otherwise alter the ports, places, countries, zones and periods specified in Clause 2.1 from a date and time specified by the Club not being less than 24 hours from midnight on the day the notice is given to the Member.

3. Cancellation
Cover hereunder may by notice to the Member be cancelled by the Club from a date and time specified by the Club, not being less than 24 hours from midnight on the day notice of cancellation is given to the Member.

4. Limit of Liability
4.1 Subject to Clause 4.2 the limit of liability of the Club under this extension of cover in respect of all claims shall be in the aggregate US$30 million each ship any one accident or occurrence or series thereof arising from any one event.
4.2 In the event that there is more than one entry by any person for Bio-Chem cover as provided herein in respect of the same ship with the Club and/or any other insurer which participates in the Pooling Agreement or General Excess Loss Reinsurance Contract, the aggregate recovery in respect of all liabilities, costs, losses and expenses arising under such entries shall not exceed the amount stipulated in Clause 4.1 and the liability of the Club under each such entry shall be limited to such proportion of that amount as the claims arising under that entry bear to the aggregate of all such claims recoverable from the Club and any such other insurer.

5. Deductible
The deductible shall be the deductible applicable to the relevant cover set out in the Certificate of Entry.

6. Law and Practice
This clause is subject to English law and practice.

Association:
The Steamship Mutual Underwriting Association (Bermuda) Limited
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Managers:
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Washington Mall 1, PO Box HM 447, Hamilton HM BX, Bermuda
Tel: (441) 295 4502 Fax: (441) 292 8787

Managers' London Representative:
Steamship Insurance Management Services Limited
Authorised and Regulated by the United Kingdom Financial Services Authority
Aquatical House, 39 Bell Lane, London E1 7LU
Tel: 020 7247 5490 Website: www.simsl.com
Registered No: 3855693 England

BAKER LAKE AREA OPERATIONAL PROCESSES

To further support safe operations in the Baker Lake area between Woodward and Atlantic Towing, the following information and procedures will be adopted starting in the 2013 season.

1.0 COMMUNICATION PROTOCOL

Daily e-mail sent out by each vessel to all vessels by 8:00am. Distribution of e-mail would include all ATL, Woodward and Desgagnes vessels in the area.

E-mail to include:

- Current position
- ETA thru narrows
- Communication equipment status

Long Distance Communication

- Primary – satellite phone
- Secondary – Sat-C

Short Distance Communication

- VHF communication – channel 16

2.0 ATL COMMUNICATION INFORMATION

Atlantic Beech

- E-mail: 43252810@stratosmobile.net
- Cellular: (902) 229-3904
- Satellite: 011-8707-6481-1379

Atlantic Teak

- E-mail: 432521310@stratosmobile.net
- Cellular: (506) 343-4539
- Satellite: 011-8707-6487-5881

ATL VHF working channel is 69

WOODWARD COMMUNICATION INFORMATION

Dorsch

- E-mail: 431699913@stratosmobile.net
- Cellular: 1-709-727-6027
- Satellite: 1-613-980-6750

Nanny

- E-mail: 43169764@statosmobile.net
- Cellular: 1-709-690-4025
- Satellite: 1-613-855-6114

Alsterstern

- E-mail: 431605510@statosmobile.net
- Cellular: 1-709-541-0861
- Satellite: 1-613-855-4412

Havelstern

- E-mail: 431605711@statosmobile.net
- Cellular: 1-709-541-0083
- Satellite: 1-613-855-6115

Travestern

- E-mail: 431600532@statosmobile.net
- Cellular: 1-709-541-2029
- Satellite: 1-613-855-6121

WOODWARD VHF working channel is 10

DESGAGNES TRANSARCTIK INC.

Sedna Desgaganes

- E-mail: captain.sedna@desgagnes.com
- Cellular: (581) 998-3961
- Satellite: (418) 907-1134

Zelada Desgaganes

- E-mail: captain.zelada@desgagnes.com
- Cellular: (581) 998-6295
- Satellite: (418) 241-6175

Master Claude A. Desgagnes

- E-mail: captain.claudea@desgagnes.com
- Cellular: (418) 802-8596
- Satellite: (418) 907-8409

Master Rosaire A. Desgaganes

- E-mail: captain.rosairea@desgagnes.com
- Cellular: (418) 254-2355
- Satellite: (514) 907-5719

3.0 RULES OF THE WATER WAYS

Note: Outbound refers to Tanker and/ or Tug & Barge leaving Baker Lake for Helicopter Island
Inbound refers to Tanker and/or Tug & Barge leaving Helicopter Island for Baker Lake

Helicopter Island to Baker Lake

Inbound ATL Tug will contact outbound Woodward Tanker by e-mail to get its transit time thru the narrows . Tug and barge will depart Helicopter Island 3 and ½ hours prior to the transit time of the Tanker. It takes 3 hours for the Tug and Barge to reach the narrows from Helicopter Island. This allows plenty of time for all 4 vessels to transit the narrows. A couple of minutes before entering

Inbound ATL Tug and Barge **WILL ALWAYS** depart Helicopter Island prior to inbound Woodward Tanker. Inbound Woodward Tanker **WILL ALWAYS** follow inbound ATL Tug and Barge until to entrance of Baker Lake (no passing). Inbound ATL Tug and Barge and inbound Woodward Tanker will communicate on VHF channel 16 and should give a "security call" on channel 16 before entering the channel (satellite used as back up). All vessels (inbound and outbound) will use VHF channel 16 for communication (satellite used as back up).

Inbound ATL Tug and Barge will pass thru the narrows first, followed by the inbound Woodward Tanker. Outbound Woodward Tanker will pass thru the narrows next, followed by the outbound ATL Tug and Barge.

Baker Lake to Helicopter

Outbound Woodward Tanker will depart for the narrows. When reaching the narrows, outbound Woodward Tanker **WILL NEVER** proceed until inbound traffic has cleared the narrows. Outbound Woodward Tanker will hold position above the narrows just south of Bannerman Island.

Outbound ATL Tug and Barge will depart for the narrows. When reaching the narrows, outbound ATL Tug and Barge **WILL NEVER** proceed until inbound traffic has cleared the narrows. Outbound ATL Tug and Barge will hold position above the narrows just south of Bannerman Island.

Once inbound vessel traffic has cleared the narrows, the outbound Woodward Tanker will proceed thru the narrows first. The outbound ATL Tug and Barge **WILL ALWAYS** proceed thru the narrows after the outbound Woodward Tanker. All vessels (inbound and outbound) will use VHF channel 16 for communication (satellite used as back up).

FUEL HOSE POSITIONING

The fuel hose from the Woodward Tanker will be connected to the far side of the vessel away from the spud barge. The fuel hose will lay directly to shore, where a support structure will guide the fuel hose along the shore line until it mates with the shore manifold. This eliminates the risk of the ATL Tug and Barge coming into contact with the fuel hose while departing/ arriving at the spud barge. Also, a tender will be near the cargo hose with a line in order to move the hose away from the tug and barge.

In case of foul weather, where the tug and barge must cast off in a hurry, pumping operations will be suspended for a very short period of time, while the tug and barge depart.

APPENDIX D - TRANSPORT CANADA GUIDELINE TP- 9834E

Guidelines for Reporting Incidents Involving Dangerous Goods, Harmful Substances and /or Marine Pollutants

Transport Canada Transports Canada

TP 9834E
(07/2009)

Guidelines for Reporting Incidents Involving Dangerous Goods, Harmful Substances and/or Marine Pollutants

2ND EDITION
JULY 2009

TC-1003421

Canada

Responsible Authority	Approval
The Director Operations and Environmental Programs is responsible for this document, including any change, correction, or update.	Director Operations and Environmental Programs Marine Safety

Original Date Issued: December, 1995 **Date Revised: July, 2009**

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TP 9834E
(07/2009)

TC-1003421

DOCUMENT INFORMATION

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Next Review **May 2010**

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1	**July 2009**	**All**	**T. Morris**	Updated to reflect the *Canada Shipping Act, 2001* and the amendments to IMO Resolution A.851(20) in Resolution MEPC.138(53).

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INTRODUCTION

These Guidelines comply as far as practicable with the general principles and standard reporting format procedures described in Resolution A.851(20) of the 20th Session of the Assembly of the International Maritime Organization (IMO), adopted 27 November 1997, as amended by Resolution MEPC.138(53).

The intent of these Guidelines is to enable the proper authorities to be informed without delay so that appropriate action may be taken when:

1. any incident occurs involving the loss, or likely loss, overboard of packaged dangerous goods in the sea; or
2. any incident occurs giving rise to pollution, or threat of pollution to the marine environment, as well as of assistance and salvage measures; or
3. any oil pollution incident occurs involving the loading or unloading of oil to or from a vessel at an oil handling facility.

The *Pollutant Discharge Reporting Regulations, 1995* stipulate that a vessel's master or owner must make reports required under the Regulations in the manner described in these Guidelines or IMO Resolution A.851(20). The Regulations also stipulate that the operator of an oil handling facility must make reports in a manner described in these Guidelines. These Guidelines should then be used in conjunction with the *Pollutant Discharge Reporting Regulations, 1995* when harmful substances and/or marine pollutants are involved. Where any discrepancy exists between the regulations and the Guidelines, the requirements of the regulations shall prevail.

1. ABBREVIATIONS

HF	High Frequency
IMO	International Maritime Organization
MARPOL	*The International Convention for the Prevention of Pollution from Ships*, 1973, and the *Protocols* of 1978 and 1997, as amended from time to time
MF	Medium Frequency
UN	United Nations
UTC	Coordinated Universal Time
VHF	Very High Frequency

2. DEFINITIONS

2.1 In these Guidelines,

"dangerous goods" means goods that by reason of their nature, quantity or mode of stowage are either singly or collectively liable to endanger the lives of the passengers or imperil the vessel and includes all substances determined by the Governor in Council, in regulations made by him, including the *Cargo, Fumigation and Tackle Regulations*, to be dangerous goods; *(marchandises dangereuses)*

"harmful substance in packaged form" means any substance which is identified as a marine pollutant in the International Maritimes Dangerous Goods Code (IMDG Code); *(substance nuisible en colis)*

"in bulk" means in a hold or tank that is part of the structure of the vessel, without any intermediate form of containment; *(en vrac)*

"incident" includes the discharge of a pollutant, a dangerous good or a harmful substance in packaged form or their anticipated discharge; (*incident)*

"marine safety inspector" means a person appointed as a marine safety inspector under section 11 of the *Canada Shipping Act, 2001; (inspecteur de la sécurité maritime)*

"marine communications and traffic services officer" means a person designated as a marine communications and traffic services officer by the Minister of Fisheries and Oceans under subsection 126(2) of the *Canada Shipping Act, 2001; (fonctionnaire chargé des services de communications et de trafic maritimes)*

"packaged form" means the forms of containment specified for harmful substances or dangerous goods in the International Maritimes Dangerous Goods Code (IMDG Code); *(en colis)*

"pollution prevention officer" means a person designated as a pollution prevention officer pursuant to section 14 of the *Arctic Waters Pollution Prevention Act*; *(fonctionnaire chargé de la prévention de la pollution)*

"waters under Canadian jurisdiction" means the internal waters of Canada as described in section 6 of the *Oceans Act*, the territorial sea of Canada as described in section 4 of the *Oceans Act* and the exclusive economic zone of Canada as described in section 13 of the *Oceans Act*, , and includes the shipping safety control zones prescribed pursuant to section 11 of the *Arctic Waters Pollution Prevention Act*. *(eaux de compétence canadienne)*

3. HOW TO MAKE A REPORT

3.1 The report should be transmitted in the following manner:

1. when an incident occurs involving a vessel in waters under Canadian jurisdiction, the report shall be made with the highest possible priority and using the quickest means available to a marine safety inspector, or for incidents occurring in a shipping safety control zone, to a pollution prevention officer;
2. when the vessel referred to in paragraph 3.1.1 is in a radio telecommunications area that is covered by Canadian Coast Guard Marine Communications and Traffic Services, the report should, where expedient, be routed through that system to a marine communications and traffic services officer;
3. when an incident occurs involving a Canadian vessel outside waters under Canadian jurisdiction, the report should be made to the nearest coastal State through an appropriate coast station, preceded by the safety signal (if the incident affects the safety of navigation), or by the urgency signal (if the incident affects the safety of the vessel or persons);
4. on appropriate frequencies (in the bands 405-525 kHz, 1605-2850 kHz or 156-174 MHz);
5. when the vessel is not within reach of a MF or VHF coast station, to the most appropriate HF coast station or on the relevant maritime satellite communication system;
6. when the vessel is within or near an area for which a vessel reporting system has been established, to the designated shore establishment responsible for operation of that system;
7. the format and procedures should, when practicable, comply with the relevant requirements of Section A2 in the Appendix, *Standard Reporting Format and Procedures*; and
8. in addition to any report referred to in paragraph 3.1.1, when an oil pollution incident occurs involving a vessel at a designated oil handling facility, the operator of the oil handling facility shall:
    1. report with the highest possible priority and using the quickest means available, to the federal emergency telephone number identified in the facility's oil pollution emergency plan;
    2. report in writing any incident involving oil to the Transport Canada Marine Safety office nearest to the facility; and
    3. report, when practicable, in compliance with the relevant requirements of Section A2 of the Appendix, *Standard Reporting Format and Procedures*.

4. CONTENT OF REPORT

4.1 Reports should contain the specific information listed in Section A3 of the Appendix, *Detailed Reporting Requirements*.

5. SUPPLEMENTARY REPORT

5.1 Particulars not immediately available should be inserted in a supplementary message or messages.

5.2 When harmful substances and/or marine pollutants are involved, a supplementary message should follow immediately or as soon as possible after the initial report. Information that is essential for the protection of the marine environment, as appropriate to the incident, should be included. That information should include Items P, Q, R, S and X, as listed in Section A2 of the Appendix.

6. PROBABILITY OF DISCHARGE

6.1 The probability of a discharge resulting from damage to the vessel or its equipment is a reason for making a report. In judging whether there is such a probability and whether a report should be made, the following factors, among others, should be taken into account:

1. the nature of the damage, failure or breakdown of the vessel, machinery or equipment; and
2. sea and wind state and also traffic density in the area at the time and place of the incident.

6.2 It is recognized that it would be impracticable to lay down precise definitions of all types of incidents involving probable discharge which would warrant an obligation to report. Nevertheless as a general guideline, the master of the vessel should make reports in cases of:

1. damage, failure or breakdown which affects the safety of vessels. Examples of such incidents are collision, grounding, fire, explosion, structural failure, flooding, cargo shifting; and
2. failure or breakdown of machinery or equipment which results in the impairment of the safety of navigation. Examples of such incidents are failure or breakdown of steering gear, propulsion plant, electrical generating system, essential shipborne navigational aids.

7. REPORT ON ASSISTANCE OR SALVAGE

7.1 The master of any vessel engaged in or requested to engage in an operation to render assistance or undertake salvage should report, as far as practicable, Items A, B, C (or D), E, F, L, M, N, P, Q, R, S, T, U, X of the *Standard Reporting Format* (Appendix). The Master should ensure that the coastal State is kept informed of developments.

APPENDIX

A1. PROCEDURES

A1.1 Reports should be sent as follows:

Dangerous Goods Report - Packaged form (DG)	When an incident takes place involving loss, or likely loss overboard of packaged dangerous goods, including those in freight containers, portable tanks, road and rail vehicles and shipborne barges, into the sea.
Harmful Substances Report in Bulk (HS)	When an incident takes place involving the discharge or probable discharge of oil (Annex I of MARPOL) or noxious liquid substances in bulk (Annex II of MARPOL).
Harmful Substances Report - packaged form (MP)	In the case of loss or likely loss overboard of harmful substances in packaged form, including those in freight containers, portable tanks, road and rail vehicles and shipborne barges, identified in the *International Maritime Dangerous Goods Code* as marine pollutants (Annex III of MARPOL).

A2. STANDARD REPORTING FORMAT AND PROCEDURES

A2.1 Sections of the reporting format which are inappropriate should be omitted from the report.

A2.2 Where language difficulties may exist, the languages used should include English, using where possible the *Standard Marine Navigational Vocabulary.*

A2.3 Alternatively, the *International Code of Signals* may be used to send detailed information. When the International Code is used, the appropriate indicator should be inserted in the text, after the alphabetical index.

A2.4 For route information, latitude and longitude should be given for each turn point, expressed as in Item C below, together with type of intended track between these points, for example “RL” (rhumb line), “GC” (great circle) or “coastal”, in the case of coastal sailing the estimated date and time of passing significant points expressed by a 6 digit group as in Item B below.

Telegraphy	**Telephone (alternative)**	**Function**	**Information Required**
Name of system (e.g., AMVER/ MAREP/ ECAREG/ NORDREG/ WESTREG)	Name of system (e.g., AMVER/ MAREP/ ECAREG/ NORDREG/ WESTREG)	System Identifier	Ship Reporting system or nearest appropriate coast radio station
DG	Dangerous goods report – packaged form	Type of report	Dangerous goods report – packaged form

Telegraphy	Telephone (alternative)	Function	Information Required
HS	Harmful substances report - in bulk	Type of report	Harmful substances report - in bulk
MP	Harmful substances report - packaged from	Type of report	Harmful substances report - packaged from
A	Vessel (alpha)	Vessel identity	Name, call sign or ship station identity, and flag
B	Time (bravo)	Date and time of event	A 6 digit group giving day of month (first two digits), hours and minutes (last four digits). If other than UTC state time zone used
C	Position (charlie)	Position	A 4 digit group giving latitude in degrees and minutes suffixed with N (north) or S (south) and a 5 digit group giving longitude in degrees and minutes suffixed with E (east) or W (west); or
D	Position (delta)	Position	True bearing (first 3 digits) and distance (state distance) in nautical miles form a clearly identified landmark (state landmark)
E	Course (echo)	True course	A 3 digit group
F	Speed (foxtrot)	Speed in knots & tenths of knots	A 3 digit group
G	Departed (golf)	Port of departure	Name of last port of call
H	Entry (hotel)	Date, time and point of entry into System	Entry time expressed as in (B) and entry position expressed as in (C) or (D)
I	Destination and ETA (india)	Destination and estimated time of arrival	Name of port and date time group expressed as in (B)
J	Pilot (juliet)	Pilot	State whether a deep sea or local Pilot is on board
K	Exit (kilo)	Date, time and point of exit from system or arrival at the vessel's destination	Exit time expressed as in (B) and exit position expressed as in (C) or (D)
L	Route (lima)	Route information	Intended track
M	Radio communications (mike)	Radio communications	State in full names of stations/frequencies guarded

Telegraphy	**Telephone (alternative)**	**Function**	**Information Required**
N	Next report (november)	Time of next report	Date time group expressed as in (B)
O	Draught (oscar)	Maximum present static drought in metres	4 digit group giving metres and centimetres
P	Cargo (papa)	Cargo on board	Cargo and brief details of any dangerous cargoes as well as harmful substances and gases that could endanger persons or the environment (See *Detailed Reporting Requirements*)
Q	Defect, damage, deficiency, limitations (quebec)	Defects/damage deficiencies/ other limitations	Brief details of defects, damage, deficiencies or other limitations (See *Detailed Reporting Requirements*)
R	Pollution/ dangerous goods lost overboard (romeo)	Description of pollutant or dangerous goods lost overboard	Brief details of type of pollution (oil, chemicals, etc.) or dangerous goods lost overboard; position expressed as in (C) or (D) (See *Detailed Reporting Requirements*)
S	Weather (sierra)	Weather conditions	Brief details of weather and sea conditions prevailing
T	Agent (tango)	Vessel's representative and/or owner	Details of name and particulars of vessel's representative or owner or both for provision of information (See *Detailed Reporting Requirements*)
U	Size and type (uniform)	Vessel size and type	Details of length, breadth, tonnage, and type etc. as required
V	Medic (victor)	Medical personnel	Doctor, physician's assistant, nurse, no-medic
W	Persons (whiskey)	Total number of persons on board	State number
X	Remarks (x-ray)	Miscellaneous	Any other information - including as appropriate brief details of incident and of other vessels involved either in incident, assistance or salvage (See *Detailed Reporting Requirements*)

Telegraphy	Telephone (alternative)	Function	Information Required
Y	Relay (yankee)	Request to relay report to another system e.g., AMVER, AUSREP, JASREP, MAREP etc.	Content of report
Z	End of report (zulu)	End of report	No further information required

A3. DETAILED REPORTING REQUIREMENTS

A3.1 Dangerous Goods Reports - Packaged Form (DG)

A3.1.1 Primary report should contain Items, A, B, C (or D), M, Q, R, S, T, U, X of the *Standard Reporting Format*; details for Item R should be as follows:

R

1. Correct technical name or names of goods.
2. UN number or numbers.
3. IMO Hazard class or classes.
4. Names of manufacturers of goods when known, or consignee or consignor.
5. Types of packages including identification marks. Specify whether portable tank or tank vehicle, or whether vehicle or freight container or other cargo transport unit containing packages. Include official registration marks and numbers assigned to the unit.
6. An estimate of the quantity and likely condition of the goods.
7. Whether loss floated or sank.
8. Whether loss is continuing.
9. Cause of loss.

A3.1.2 If the condition of the vessel is such that there is danger of further loss of packaged dangerous goods into the sea, items P and Q of the *Standard Reporting Format* should be reported; details for P should be as follows:

P

1. Correct technical name or names of goods.
2. UN number or numbers.
3. IMO Hazard class or classes.
4. Names of manufacturers of goods when known, or consignee or consignor.
5. Types of packages including identification marks. Specify whether portable tank or tank vehicle, or whether vehicle or freight container or other cargo transport unit containing packages. Include official registration marks and numbers assigned to the unit.
6. An estimate of the quantity and likely condition of the goods.

A3.1.3 Particulars not immediately available should be inserted in a supplementary message or messages.

A3.2 Harmful Substances Reports - In Bulk (HS)

A3.2.1 In the case of actual discharge, primary HS reports should contain Items A, B, C (or D), E, F, L, M, N, Q, R, S, T, U, X of the *Standard Reporting Format*. In the case of probable discharge, item P should also be included. Details for P, Q, R, T and X should be as follows:

P

1. Type of oil or the correct technical name of the noxious liquid substances on board.
2. UN number or numbers if available.
3. Pollution category (X, Y or Z), for noxious liquid substances.
4. Names of manufacturers of substances if appropriate and known, or consignee or consignor.
5. Quantity.

Q

1. Condition of the vessel as relevant.
2. Ability to transfer cargo/ballast/fuel.

R

1. Type of oil or the correct technical name of the noxious liquid substances discharged into the sea.
2. UN number or numbers if available.
3. Pollution category (X, Y or Z), for noxious liquid substances.
4. Names of manufacturers of substances if appropriate and known, or consignee or consignor.
5. An estimate of the quantity of the substances.
6. Whether loss floated or sank.
7. Whether loss is continuing.
8. Cause of loss.
9. Estimate of the movement of the discharge or loss, giving current conditions if known.
10. Estimate of the surface area of the spill if possible.

T

1. Name, address, telex and telephone number of the vessel's owner and representative (charterer, manager or operator of the vessel or their agent).

X

1. Action being taken with regard to the discharge and the movement of the vessel.
2. Assistance or salvage efforts which have been requested or which have been provided by others.
3. The master of an assisting or salvaging vessel should report the particulars of the action undertaken or planned.

A3.2.2 Particulars not immediately available should be inserted in a supplementary message or messages.

A3.3 Harmful Substance Reports - Packaged Form (MP)

A3.3.1 In the case of actual discharges, primary MP reports should contain Items A, B, C (or D), M, Q, R, S, T, U, X of the *Standard Reporting Format*. In the case of probable discharge, Item P should also be included. Details of P, Q, R, T and X should be as follows:

P

1. Correct technical name or names of goods.
2. UN number or numbers.
3. IMO Hazard class or classes.
4. Names of manufacturers of goods when known, or consignee or consignor.
5. Types of packages including identification marks. Specify whether portable tank or tank vehicle, or whether vehicle or freight container or other cargo transport unit containing packages. Include official registration marks and numbers assigned to the unit.
6. An estimate of the quantity and likely condition of the goods.

Q

1. Condition of the vessel as relevant.
2. Ability to transfer cargo/ballast/fuel.

R

1. Correct technical name or names of goods.
2. UN number or numbers.
3. IMO Hazard class or classes.
4. Names of manufacturers of goods when known, or consignee or consignor.
5. Types of packages including identification marks. Specify whether portable tank or tank vehicle, or whether vehicle or freight container or other cargo transport unit containing packages. Include official registration marks and numbers assigned to the unit.
6. An estimate of the quantity and likely condition of the goods.
7. Whether lost goods floated or sank.
8. Whether loss is continuing.
9. Cause of loss.

T

1. Name, address, telex and telephone number of the vessel's owner and representative (charterer, manager or operator of the vessel or their agent).

X

1. Actions being taken with regard to the discharge and movement of the vessel.
2. Assistance or salvage efforts which have been requested or which have been provided by others.
3. The master of an assisting or salvaging vessel should report the particulars of the action undertaken or planned.

A3.3.2 Particulars not immediately available should be inserted in a supplementary message or messages.

A4. PRIMARY REPORT FORMS

A4.1 Dangerous Goods Report - Packaged Form (DG)

Function		**Report**
DG	Type of report	/DG//
A	Vessel identity	A/ /__ __ __ __//
B	Date and time of event	B/ __ __ __ __ __ __ Z //
C	Position	C/__ __ __ __N S __ __ __ __ __ E W//
D*	Position	D/ //
M	Radio communications	M/ //
P**	Cargo on board	P/*** //
Q**	Defect, damage, deficiency, other limitations	Q/ //
R	Description of dangerous goods lost overboard	R/*** //
S	Weather conditions	S/ //
T	Agent	T/ //
U	Vessel size and type	U/ //
X	Remarks	X/ //

* Report either Item C or D.

** Include if the condition of the vessel is such that there is danger of further loss of packaged dangerous goods into the sea.

*** See *Detailed Reporting Requirements* (Appendix A3.1).

A4.2 Harmful Substances Report - In Bulk (HS)

Function		**Report**
HS	Type of report	/HS//
A	Vessel identity	A/ /__ __ __ __//
B	Date and time of event	B/ __ __ __ __ __ __ Z //
C	Position	C/__ __ __ __N S __ __ __ __ __ E W//
D*	Position	D/ //
E	True course	E/ __ __ __ //
F	Speed in knots and tenths of knots	F/ __ __ __ //
L	Route information	L/ //
M	Radio communications	M/ //
N	Next report	N/__ __ __ __ __ __ Z//
P**	Cargo on board	P/*** //
Q	Defect, damage, deficiency, other limitations	Q/*** //
R	Description of dangerous goods lost overboard	R/*** //
S	Weather conditions	S/ //
T	Agent	T/*** //
U	Vessel size and type	U/ //
X	Remarks	X/*** //

* Report either Item C or D.

** Include in the case of a probable discharge.

*** See *Detailed Reporting Requirements* (Appendix A3.2).

A4.3 Harmful Substances Report - Packaged Form (MP)

Function		**Report**
MP	Type of report	/MP//
A	Vessel identity	A/ /__ __ __ __//
B	Date and time of event	B/ __ __ __ __ __ __ Z //
C	Position	C/__ __ __ __N S __ __ __ __ __ E W//
D*	Position	D/ //
M	Radio communications	M/ //
P**	Cargo on board	P/*** //
Q	Defect, damage, deficiency, other limitations	Q/*** //
R	Description of dangerous goods lost overboard	R/*** //
S	Weather conditions	S/ //
T	Agent	T/*** //
U	Vessel size and type	U/ //
X	Remarks	X/*** //

* Report either Item C or D.

** Include in the case of a probable discharge.

*** See *Detailed Reporting Requirements* (Appendix A3.3).

APPENDIX E - AGNICO EAGLE SPILL RESPONSE TRAINING RECORDS

Fisheries and Oceans Canada | Pêches et Océans Canada

Canadian Coast Guard | Garde côtière canadienne

This is to certify that:

Robin Allard

has attended the

Marine Spill Response Operations Course

Instructor

Superintendent, Environmental Response

January 2012

Canada

Group Training Report

AGNICO EAGLE

Agnico-Eagle Mines Ltd.
Meadowbank Division

Course Name:

Trainer's Name: Jamie Kataluk

Date: 2013-07-10

M		Name	Company	Signature	Hours TRG.	Hours ASS.	Total Hours	Code
	1	Potogu Noah		Potogu Noah	✓		2	
	2	George Anirniq	AEM	George Anirniq	✓		2	
	3	Sam Qarliksaq	AEM	Sam Qarliksaq	✓		2	
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
	12							
	13							
	14							
	15							
	16							
	17							

Trainer's signature: Jamie Kataluk

Date:

Induction Department Signatures:	
Human Resources:	
Camp:	
Nurse:	
Security:	
Health & Safety:	
Environment:	
Training:	

Comments:

Codes:	Assessment Codes:
1. AEM Permit	A+: Very Good
2. Restrictive Permit	A : Good
3. Temporary Permit	B : Average
4. Training Completed	C : Below Average
5. Training Not Completed	
6. Fail	

Group Training Report

Course Name: Emergency Planning and Spill Response Awareness

Trainer's Name: Trever Miller

Date: Jan. 15/2013

Agnico-Eagle Mines Ltd.
Meadowbank Division

M		Name	Company	Signature	Hours TRG.	Hours ASS.	Hours Total Hours	Code
	1	Jeffrey Pratt	AEM				10	
	2	Fanny Laporte	AEM				10	
	3	Richard Jackson	AEM				10	
	4	Tom Thomson	AEM				10	
	5	Maurice Barrieau	AEM				10	
	6	David Alexander	AEM				10	
	7	Martin Theriault	AEM				10	
	8							
	9							
	10							

COMMENTS:

Trainer's signature:

Date: January 15, 2013

Codes:	Assessment Codes:
1. AEM Permit	A+: Very Good
2. Restrictive Permit	A : Good
3. Temporary Permit	B : Average
4. Training Completed	C : Below Average
5. Training Not Completed	
6. Fail	

Tom Thomson

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

- **Incident** - 45 m^3 diesel spills/plus oil/acid – Originates on Land, flows into the River
- **Spill** - occurred 22:00 hrs on March 20, 2013
- **River** – water flow, 5 km/hr, braided channels; approx 15 km to Baker Lake
- **Lake** – winds from the North West at 20 km/hr. Tide is high.

Km 23 - Bridge 3

1. List the **issues** linked to this scenario:

Response Time + Moving Equipment / Resources to the Area
Light + Temperature
Fish Bearing Stream
Speed of Containment / Cut off Point
Vast Contaminated area - Type of Contaminate

* Safety of Personel, Communications, Environment, Equipment

2. What **resources** are required?

Baker Lake Contractor / Peters Exp.
Baker Lake Command Center, Camp, at Spill Location
Ert Personal + Relieve
Emergency Trailer - Environmental
Emergency C-Cans / Roll offs
Lighting / Generators
Transportation
Safety officer(s)
AEM Personal from Baker Lake
Mapping of Area

3. What are the **initial spill response steps and what does your ICS look like**?

3rd Control / Crisis Centre
On Site Commander
Baker Lake
Logistic, Planning, Finance

1) Review ERP + Spill Contingency Plan
Prepare J.H.A on Spill

Establish Safety Zones - Hot, Warm, Cold

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4. What is your oil spill containment and recovery **strategy**?

Shut off/Stop Spill - Identify Source
Contain Spill - Trench - Bell or (POE)
Maritime Booms & Absorbants
Estimate Direction of spill & find a cut off points
By Using 10-30-4 - Protect Shoreline and diverting flow

* Pre plan - Plan it now

5. What is your strategy for shoreline **cleanup** operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

Vacuum Pump, Absorbants, Oil/water Separater
- Excavate cont Soil
- Vegatated/Rocky Shorelines
-
- Sample & Monitored until we have clearances from DFO, ENV Canada

- Do a quick wash & leave it for Bio remediation

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6. What are some **safety** issues?

[redacted], Drinking Water - Baker Lake

Temperature + H2S of Response Team
LEL's
water + ice

7. How do you manage your **waste**?

Quatrex, 45 Gallons, oil/water separator

Contaminated Soil pad

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

Same as #3 - Notify Proper Personal / Authorities Additional
DFO, EC, Baker Lake Res.

SWAT Consulting Inc.

Fanny Laporde.

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

45 000 Litres KM 23

- **Incident -** 45 m^3 diesel spills/plus oil/acid – Originates on Land, flows into the River
- **Spill** - occurred 22:00 hrs on March 20, 2013
- **River** – water flow, 5 km/hr, braided channels; approx 15 km to Baker Lake
- **Lake** – winds from the North West at 20 km/hr. Tide is high.

KM 23.

1. List the **issues** linked to this scenario:

Communication issu

- Contamination Back to land / Water contamination / Wildlife. To White ~~Hills~~ lake. (Fishing major site for invit)
- Time of day and distance from Camp.
- March → Still snow – could be cold
- Accident → Health & Safety (Driver) and the Responder
- Acid → add another safety issue ↓ less.
- Baker Lake water intake
- Public relation case / inform the Lobby appropriate person Community

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2. What **resources** are required? * 60 people ✓

- Labour → with incident Command Plan / everybody has a task in the organization / ERT Team.
- Commandement Trailer & facilities close to site ✓
  ↳ could be a container, heated
- decontamination area.
- Machinery → loader → TRUCK → ~~shovel~~ shovel. ✓
- Disposal and containing material DRUMS/45gall (berm - secondary material) Vacum - emergency trailer with supply.
- Towerlight → because it is night ✓ zodiak empty tanker.
  helicopter for next morning.

3. What are the **initial spill response steps and what does your ICS look like**?

Command ICS:

INFO. ①
- MSDS Sheets - Planning - Logistic
- JHA
- S.R.P spill response plan. / ERP. / SRP /

② Find ressources / General Briefing.

③ Logistic and reassess at all change (F.L.R.A)
  ↳ operations.
  - Isolation
  - Contain
  - Recovery - Remediate
  - wild life
  - Waste management
  - Sampling.

Level 3 ~~SPILL~~ emergency

Because it is night and impact can be desastrous

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4. What is your oil spill containment and recovery **strategy**?

0A → Make the environment safe for me and my Team - Gaz det for - PPE

1 Stop the leak

3 2 dig a ~~ditch~~ trench to protect the water (shore)

3 evalwate where the contaminent are → wind → slope → current.

4 Instal maritime bariere to contain (or) the biggest part of the oil.

5 Snow barrier if needed.

2 6 cut all entries to other ponds and rivers

7 Vaccum the containment and dispose the waste adequatly.

8 transpos what is still in the taken to another contaiter

5. What is your strategy for shoreline **cleanup** operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

Tundra / Rock

→ Inspect the shore / contain with ~~snow~~ trenches / bell hole. Maritime barrier.

→ Monitoring often and sample

→ When melting / sample and Vaccum if needed Quick wash.

→ let nature take over.

→ if ~~too~~ too much → excavate the shore and remove contaminent. and dispose

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6. What are some **safety** issues? Under the ice. → leave it.

→ LEL / Fire / toxic Gazes.

→ Water / ice / cold for response team and equipment.

→ darkness → uneven Ground / strain ankle

7. How do you manage your **waste**? 45 Gall.

Used Fuel → sent back south to appropriate place

used absorbant supply → ship down south in Quadrex

material → Land farm brought to

Clean and rinse - PPE

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

see # 4 ~~Exercise~~ answer. ✓

→ cut the Hamlet Water intake. ✓

inform additional Authorities.

Skimmers Vessels

Boats. V V J

SWAT Consulting Inc.

Jeff Pratt

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

- **Incident** - 45 m^3 diesel spills/plus oil/acid – Originates on Land, flows into the River
- **Spill** - occurred 22:00 hrs on March 20, 2013
- **River** – water flow, 5 km/hr, braided channels; approx 15 km to Baker Lake
- **Lake** – winds from the North West at 20 km/hr. Tide is high.

1. List the **issues** linked to this scenario:

- 90km From mine
- Dark out
- Very Cold
- Vacinity to lake
- low tide will suck out

2. What **resources** are required?

- Personnel
- Command center both on site & Baker Lake
- Lightening
- Amenities for personnel
- Spill Response Equipment
- Transportation

3. What are the **initial spill response steps and what does your ICS look like**?

- Alert ERT and immobilize
- Alert ICS

ICS - Review of Spill Contingency - Planning for mobilization

- ERT Captain would assess situation and report incident command

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4. What is your oil spill containment and recovery **strategy**?

~~Goal~~

- Stop the release - Plug hole or build berm.
- Contain release - Do Not Let Enter Lake
  - Place boom along ~~mouth~~ deltas From the tributaries.
  - Have to create ice road to down stream collection point.
  - ~~Use~~ Extract contaminent from down stream boom point*

5. What is your strategy for shoreline **cleanup** operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

- Create Hot, Warm, Cold Zones
- Rocky Sandy Substate
- Leave to summer Valatilize

6. What are some **safety** issues?

- No light
- Cold Weather
- PPE for Chemicals

7. How do you manage your **waste**?

- Quatrex bags
- Totes for liquid Contaminants

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

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M. Theriault

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

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1. List the **issues** linked to this scenario:

- BL water intake
- impact to the land / to the water
- Going towards white hills lake (fishing lake)
- Distance from camp / time of event / Weather
- H/S for the driver and responder + possible acid reaction
- Spalding of cont.
- Wildlife (fish)
- Public relationship (Must have the appropriate person)
- Dispersion
- Communication, Road Access

2. What **resources** are required?

- Equipment : Boat, Maritime Barrier, Shovel, truck, Quadrex waste disposal, secondary containment, Spot (toward light) Vaccum (Emergency trailer)

Decontamination unit, Commandement unit

- Personnal : Labour, ERT, IC, public relationship

Helicopter

3. What are the **initial spill response steps and what does your ICS look like**?

Planning { MSDS sheet, JHA, ERP, SRP,

Logist. { General Briefing
Find ressource and equipment and make them available

Operation → Field Level Risk Assessment
↳ Isolation - contain - Recovery ~~ect~~. Wildlife - Waste Management
Sampling

Reassess between field and Management by IC.

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4. What is your oil spill containment and recovery **strategy**?

Make sure everything is safe, gaz detector, PPE ect.

Plug the hole / Stop the leak

Dig a ditch (trench) close to the shore

Evaluate the location of the contaminate in the watere

Install maritime barrier to enclose (isolate) the leaking shore

Cut all entries to other channels

Vaccum the accumulate diesel / transfert the diesel left in the tanker

Adequately dispose the waste

5. What is your strategy for shoreline **cleanup** operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

inspect the shore, keep the maritime barrier containing the fuel close to shore, monitore and sample if needed, vaccuum, let nature take over

WASH IT

If too much contaminant keep coming from the underground, dig everything

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6. What are some **safety** issues?

- LEL / fire / toxic gasses
- WATER / ICE
- cold weather
- Heavy equipment
- Uneven soil, darkness (strain ankle)

7. How do you manage your **waste**?

- used fuel send back south to appropriate location
- Absorbant stuff used (quadrex) burned or ship down south
- Contaminated soil send to landfarm
- Rinse all the PPE

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

See question #4

R-Jackson

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

23 24

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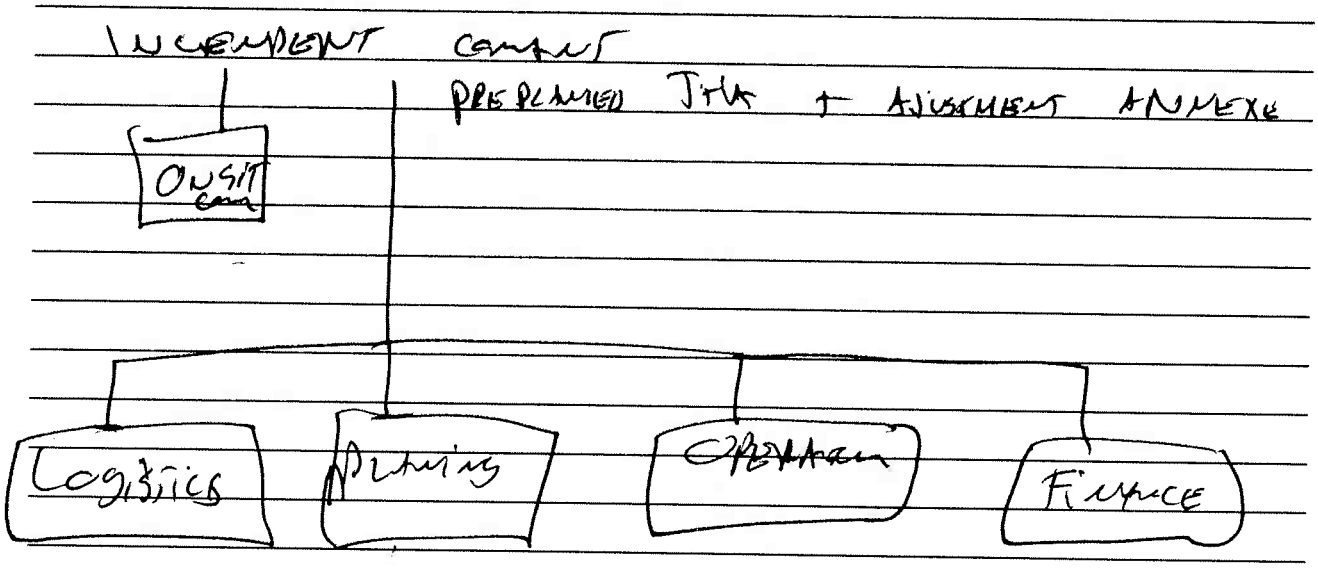
1. List the **issues** linked to this scenario:

- RESPONSE TIMES
- MOVING RESOURCES + EQUIP
- LIGHT FACTOR
- FISH BEARING
- SPEED OF CONTAINMENT
- VAST CONTAMINATED AREA
-

2. What **resources** are required?

- BLCS + PETER EXPEDITING HEAVY EQUIPMENT
- ERT PERSONEL + RELIEF PERSONEL
- COMMAND CENTER ON SITE + AT CAMP
- EMERGENCY SEAT CANS ROLLOFF BIN
- LIGHTING + GENERATORS
- INFORMATION + SAFETY OFFICER
- MAPPING OF THE AREA
-

3. What are the **initial spill response steps and what does your ICS look like**?



RL

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4. What is your oil spill containment and recovery **strategy**?

CONTAIN SPILL (STOP SPILL AT THE SOURCE
PREVENT FURTHER ENTRY/ TRENCH BELL HOLE
ESTIMATE DIRECTION OF SPILL MARITIME BOOMING
FIND CUT OFF POINTS
BY USING 10/30 @ 4 KNOTS DIRECT FLOW TO AND
PROTECT SHORE LINE

5. What is your strategy for shoreline **cleanup** operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

- VACU PUMP
- PADS
- SORBANTS
-

6. What are some **safety** issues?

LEL
COLD T°
~~SOUR~~ INHALATION
CONTAMINATION
FIRE
WATER OVER RUN

7. How do you manage your **waste**?

QUANTUM TANKS
45 Gal DRUMS
OIL WAT SEPERATOR
CAN TRANSFER SAIC PUMP

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

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D. ALEXANDER

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

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1. List the **issues** linked to this scenario:

WATER INFILTRATION 90KM away
Sound alarm Pitch DARK
Extreme cold
Set-up block before RIVER ~~EMPTIES~~ EMPTIES INTO BAKER LAKE
Low tide when it comes will make it worse

2. What **resources** are required?

~~ERT RESPONSE~~ - ~~ALERT~~ BAKER LAKE FIRE DEPT.
COMMAND CENTRE AT MEADOW + BAKER
LIGHTING
WARM-UP ~~FOR~~ STAFF
SPILL RESPONSE EQUIP.
TRANSPORT FROM MINE
50-60 people fly/bus off at MB

3. What are the **initial spill response steps and what does your ICS look like**?

~~ALERT ERT~~ ALERT ERT, INCL. ENVIRO, MINE SUPER, ~~H+S~~ SUPER, SITE SERVICES HR
REVIEW CONTINGENCY PLAN, PLANNING FOR MOBILIZATION
ERT CAPTAIN - WITH ENVIRO, WOULD ASSES REPORT BACK TO the ICS

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4. What is your oil spill containment and recovery **strategy**?

STOP ~~CONTAIN~~ SPILL CONTAIN FROM entry into LAKE.
PLUG THE HOLE IN TRUCK OR BUILD BERM
↳ CREW ASSIGNED.
- INSTALL BOOM ALONG THE DELTA MOUTH OF THE RIVER JUST BEFORE IN ENTERS THE LAKE
- MAKE ICE ROAD TO DOWNSTREAM COLLECTION POINT
= WITH VACUUM TRUCK
-ESTABLISH ZONES

5. What is your strategy for shoreline **cleanup** operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

ROCKY, SANDY SUBSTRATE. WAIT TIL SUMMER
VALITISE.
ZONE OFF.

6. What are some **safety** issues?

PITCH DARK - NEED
Cold Weather
PROPER PPE

7. How do you manage your **waste**?

VACUUM TRUCK

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

CELLULOSE BOOMS

SWAT Consulting Inc.

M. BARIBEAU

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

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1. List the **issues** linked to this scenario:

- 90 kms From Site
- Patch dark, Very cold.
- Safety to Lake.
=> Set up on site operational Post.
=> Low tide will clean water away.
=>

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2. What **resources** are required?

=> Manpower - 6 ppl
=> Boat, Light Tower, ammunity.
=> Bobcat, Lake Fire flight.
=> Personnel transportation.
=> Mean of communication.
=> Small Loader, Vacuum Truck. -

3. What are the **initial spill response steps and what does your ICS look like**?

- Set up ICS
- H&S, Env/Regulat, HR, Site Service, General Service. spill.
- Review Emergency contingency Plan.
- Plan mobilization. => ERT Captain. assess situation and Report, =>

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4. What is your oil spill containment and recovery **strategy**?

Stop the Release, prevent further entry
- shut off flows, Build Berms,
→ Block off.

Make use Boat to collection Pond,

5. What is your strategy for shoreline **cleanup** operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

Rocky Sand wants clean till Summer.

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6. What are some **safety** issues?

- Measuring ice thickness
- Wear Proper PPE, ++
- Lighting
- cold weather
- acid
- 2 ashers Zones

7. How do you manage your **waste**?

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

Group Training Report

Course Name:

Trainer's Name:

Date: 2013-01-16

Agnico-Eagle Mines Ltd.
Meadowbank Division

M		Name	Company	Signature	Hours TRG.	Hours ASS.	Hours Total Hours	Code
	1	Jamie Kataluk	AEM				10	
	2	Robin Allard	AEM				10	
	3	Dave Holmston	AEM,					
	4	Alain Genesse	A-E-M					
	5	Stéphane Larose	AEM					
	6	Luc Blanchette	FGL					
	7							
	8							
	9							
	10							

COMMENTS:

Trainer's signature: _____

Date: _____

Codes:
1. AEM Permit
2. Restrictive Permit
3. Temporary Permit
4. Training Completed
5. Training Not Completed
6. Fail

Assessment Codes:
A+: Very Good
A : Good
B : Average
C : Below Average

STÉPHANE LACOSE

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

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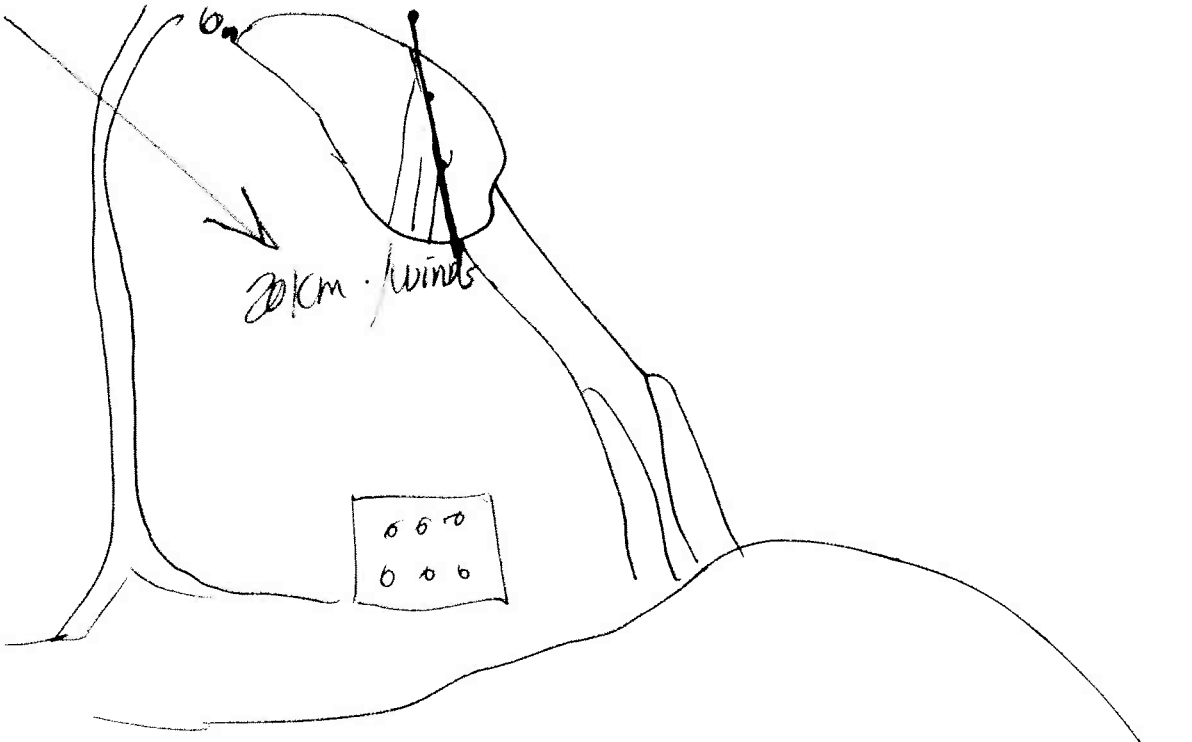

1. List the **issues** linked to this scenario:

→ 45 m^3 diesel / oil / acid flowing to the river heading to Baker lake. (15 km away)
→ Give less than 3 hours to react.
→ Contain the spill before the lake (Before to 2 rivers)
→ Secure and take care of the driver.

2. What **resources** are required?

- Helicopter to have look on the scene (Speed of the spill)
- 1 team at the scene (accident) to contained the spill at the source
- 1 team further down to stop the flow before the lake.
- Boats / maritime barrier / boom, etc... light plan
- ERT TEAM in case of fire.
- empty tanker to pump in.
- Good communication
- MSDS → Proper PPE

3. What are the **initial spill response steps and what does your ICS look like**?

- Scene survey (analyse) (inspection)
- Make the plan (planning)
- Decision (delegatee people)
- Execution
- Call proper authority

command

PLANNING OPERATION logistique cost

Safety first!!!

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4. What is your oil spill containment and recovery **strategy**?

→ Install barrier before the rivers (less contamination)
→ Recover the fuel/oil (Skimmer)

5. What is your strategy for shoreline **cleanup** operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

→ Assess the shoreline situation and ask trained people to evaluate if we need to clean and what we have to do.
→ Flush
→ Is it transferable?

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6. What are some **safety** issues?

- Risk of fire
- Falling into water / ice
- Poor visibility at night.
- Hypothermia
- Cold water.
- PPE (:

7. How do you manage your **waste**?

- Bring to the proper facility disposal (ENV. DEPT.) (QUATREX BAG)

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

- Protect the water intake of the town.
- Do whatever it takes at all cost.
- Inform community

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Dave Holmstrom.

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

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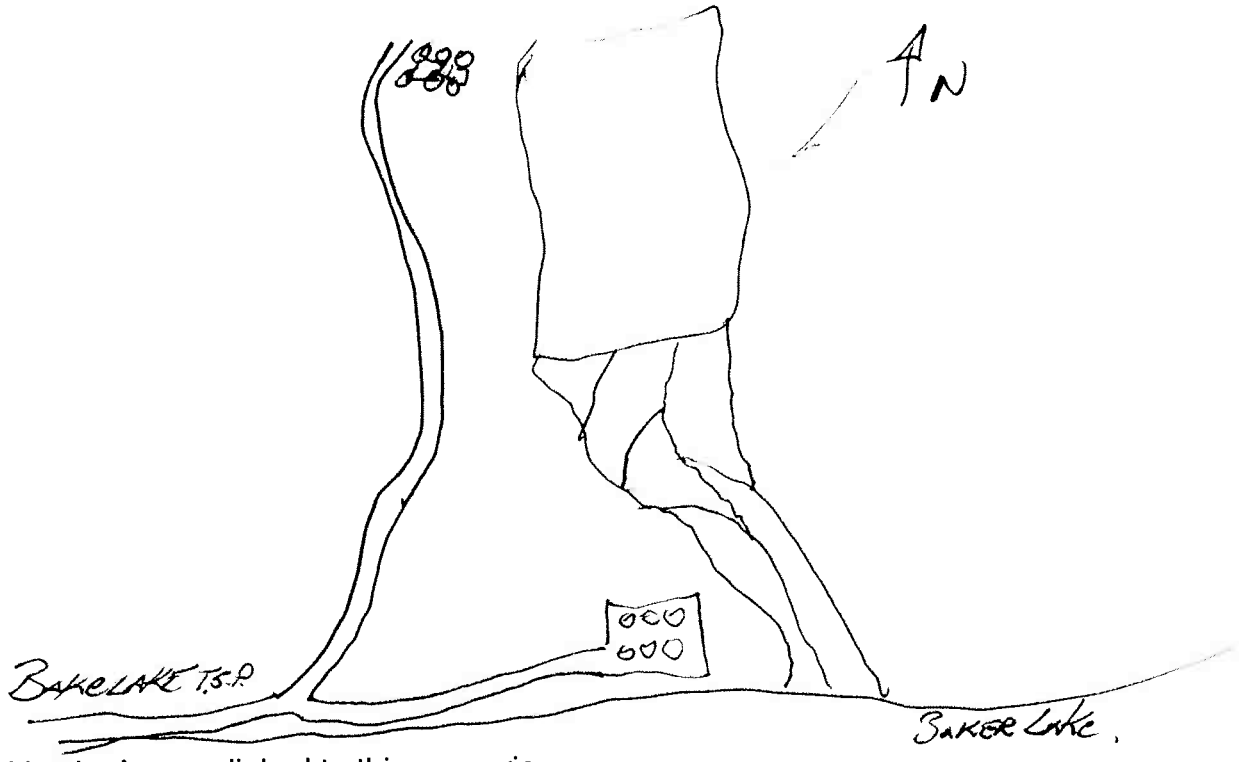


1. List the **issues** linked to this scenario:

- POTENTIAL RISK TO Baker Lake portable drinking water.
- FAST moving water (FRESHET). High travel rate / ICE,
- POTENTIAL Impact to spawning grounds.
- IS IT STOPPED? - Truck Rollover ??? Contained
- what are the sensitive areas.
- Time Frame / Braided channel extended shoreline
- LEL.
- Road traffic / Security

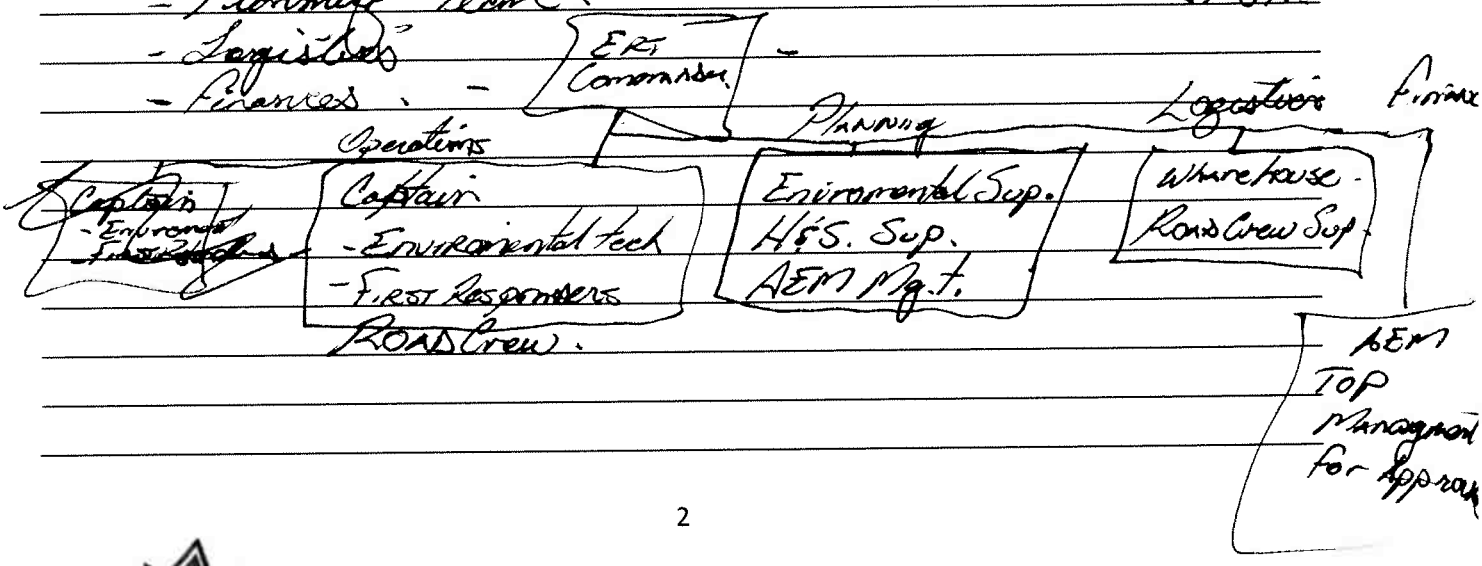
2. What **resources** are required?

- pump trucks - helicopter, - boat
- personal facilities - food, PPE, Bathroom - ~~B~~
- personal - clean up, communication, H&S, Environmental.
- ~~D~~ stop & containment resources - booms, pumps, coil
- ~~stop~~ - ~~stop pockets~~, C-Cuts for ~~Ditch~~, earth movers, storage -
- ERP, ~~Ed~~ Spill contingency Plan, OPEP, JHA.
- WHMIS,
- Level C, for first 6 hours. Level D After.
- TIER 3 response. initially

3. What are the **initial spill response steps and what does your ICS look like**?

- Call appropriate personal.
- Evaluate Spill - Immediate danger threat level.
- ~~Check~~ Identify Incident Command, team - with ERP
  - Operations personal.
  - Planning Team.
  - Logistics
  - Finances.

- Spill response plan
- JHSA



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4. What is your oil spill containment and recovery **strategy**?

- STOP Source.
- Based on Evaluation = ~~contain~~ Establish Booms for River Containment
  - Recover land based spills using
  - haul truck, Hoe, Loader. ~~Front~~
  - create ditch pump oil - from there.
  - Water containment - skimmer cleanup.
  - pump from bottom of V, U, J Boom.
  - Install booms at 30° of J.
  - Install ~~pumps~~ bell hole. pump from there.

5. What is your strategy for shoreline **cleanup** operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

~~Shoreline~~ Shoreline types.
- Rock
- Konsrd Organics.

Using SCAT.
Identified shoreline types - rock - nothing
- Tundra - Absorbants
+ and natural recovery.
- is it transferable.

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6. What are some **safety** issues?

- LEL, Benzine,
- Tired personel.
- recovery of truck
- water / ice operation - PPE's / Assesment.
- other road traffic.
- Possibility of Community water supplys
- Wild Animals.

7. How do you manage your **waste**?

Hazmat / Quadrex / Totes / Drums / Soil Pads.
Soil farms, Incinerate

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

- U-Boom
- V-Boom.
- 5-Boom.
- Corral it.
- Tostall Booms @ POE.

Robin Allard

SWAT OILSPILL ISSUES WORKSHOP

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1. List the **issues** linked to this scenario:

Flow in River
→ close Baker Lake - Potential
→ Ice → Flow Forecast
→ Potential Impact to wildlife
Stop possible a spot
Sensitive area
TIME FRAME
+ Surface for Braided.
Road usus.

Safety Driver
LOL ISSUE.
High flow.

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2. What **resources** are required?

→ pump truck / Machinery
Personnal facilities . Food / PPE / Tent
HR
Spill - Stop / containment ressources / Lights
Helicopter
Communication
H/S
Environment Dept / Rep.
Documentation (ERP / Spill / OPEP) - JHA / BOAT
WHMIS

TIER III / →

3. What are the **initial spill response steps and what does your ICS look like**?

Evaluate / call
→ STOP if possible / Safety ERP / Spill RP /
Immediate Danger

→ ICS

C → ~~SIT~~ - OSC

O	P	L	F
Capt.	Env.	Wash	Management
Tech.	[illegible]	P/L	
Responders	H/S		
Saber			
Coad			

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4. What is your oil spill containment and recovery **strategy**?

→ Prevent from going to WATER.
→ Booms for containment.
→ Recover Truck / DITCH / VAC TRUCK
HOE - IF POSSIBLE

→ WATER CONTAINMENTS - Bottom/Bund.
→ Collect. Skimmer /

Protect Shoreline

5. What is your strategy for shoreline **cleanup** operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

SCAT
Rocks / Organic Matter -
↳ No SHEEN / Small minimal.

Tool - Hydro
Op → Shoreline / mm Natural

TRANSFERT

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6. What are some **safety** issues?

Tired
Recovery of fuel
ON WATER/ICE OPERATION / assistant.
to
FAST WATER.

DRINKING WATER.

7. How do you manage your **waste**?

HAZMAT / QUADREX / TOTES / DRUMS
65?

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

1 BOOM
1 BOOM
1 BOOM.

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LUC BLANCHETTE

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

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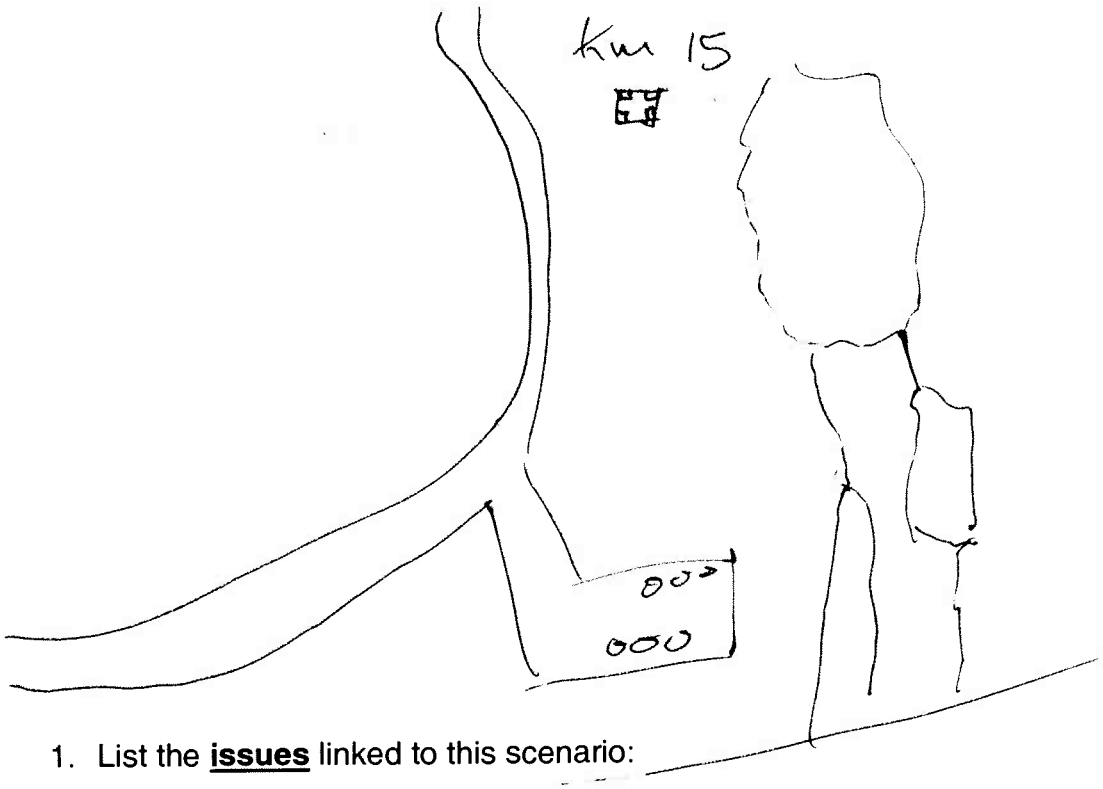

1. List the **issues** linked to this scenario:

- POSSIBLE CONTAMINATION OF COMMUNITIES WATER SUPPLY
- FRESHET WILL MAKE IT HARDER TO COLLECT CONTAMINANTS.
- BRAIDED CHANNELS INCREASE THE CHANCES OF MORE CONTAMINATED AREA
- MAY DISTURB SPAWNING AREAS → FISH
- TIDES WILL INCREASE THE CONTAMINATION OF SOIL.
- SHORT TIME FRAME
- SAFETY OF THE DRIVER
- LEL'S
- OTHER ROAD USERS.

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2. What **resources** are required?

- HEAVY EQUIPMENTS TO BUILD TRENCHES
- ENOUGH MATERIAL TO DO ENTIRE CLEANUP. (LAND & RIVER)
- PROPER PPE TO PROVIDE TO ALL PERSONEL
- ENOUGH MATERIAL TO DISPOSE CONTAMINATED MATERIAL (TOTES, SEALED DRUMS
- ADEQUATE MATERIAL TO BRING CONTAMINATED MATERIAL TO MINE SITE.
- SAFETY MONITORING DEVICE BEFORE STARTING ANY CLEANUP.
- PROPER COMMUNICATION.
- MSDS.
- MATERIAL TO MOVE THE TRUCK.
- H&S AND ENVIRONNEMENT PERSONNEL.
-

3. What are the **initial spill response steps and what does your ICS look like**?

- CODE 1 RADIO CALLED
- IC INFORMS TEAM OF SITUATION AND DOES HEADCOUNT BEFORE DEPLOYING TEAM
- COMMAND CENTRE SET UP - INCLUDE MANAGEMENT TO ASSISTS IN DECISION
- MONITOR AND DEVELOPPE A SAFETY ZONE IN THE SPILL AREA.
- IDENTIFY HAZARDS.
-

COMMAND

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4. What is your oil spill containment and recovery **strategy**?

- PREVENT FURTHER ENTRY.
- BUILD TRENCHES OF BARRIERS TO AVOID THE SPREADING OF THE SPILL.
- PLACE BOOMS INSIDE BARRIERS TO PICK UP CONTAMINANTS
- ONCE BOOMS ARE FULL - REPLACE WITH NEW ONES. PLACE CONTAMINATED BOOMS IN PROPER CONTAINERS.
- SEND QUADREX BAGS TO MINE SITE AND PLACED INSIDE SEACANS, PROPERLY LABELLED
- WATER → PLACE MARITIME BARRIER INSIDE LAKE. PLACE BOOMS OR ABSORBS ON SHORE TO PROTECT SOIL ALSO ALONG MARITIME BARRIERS.

5. What is your strategy for shoreline **cleanup** operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

- ASSES THE SHORELINE.
- FLUSH THE SHORELINE
- STOP THE CLEANING WHEN CONTAMINANTS IS NOT TRANSFERABLE.

6. What are some **safety** issues?

- TIRENESS OF THE CREW
- LELS
- REMOVAL OF THE TRUCK
- WORK ON ICE AND NEAR EAST WATER.
- WILDLIFE

7. How do you manage your **waste**?

- PUT IT INTO DRUMS OR TOTES TO BURN IT OR STORE IT → MINE SITE.
- ~~IF IT HITS THE WATER, SET UP A V, J OR U BOOM.~~

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

SET UP A V, J OR U BOOM.

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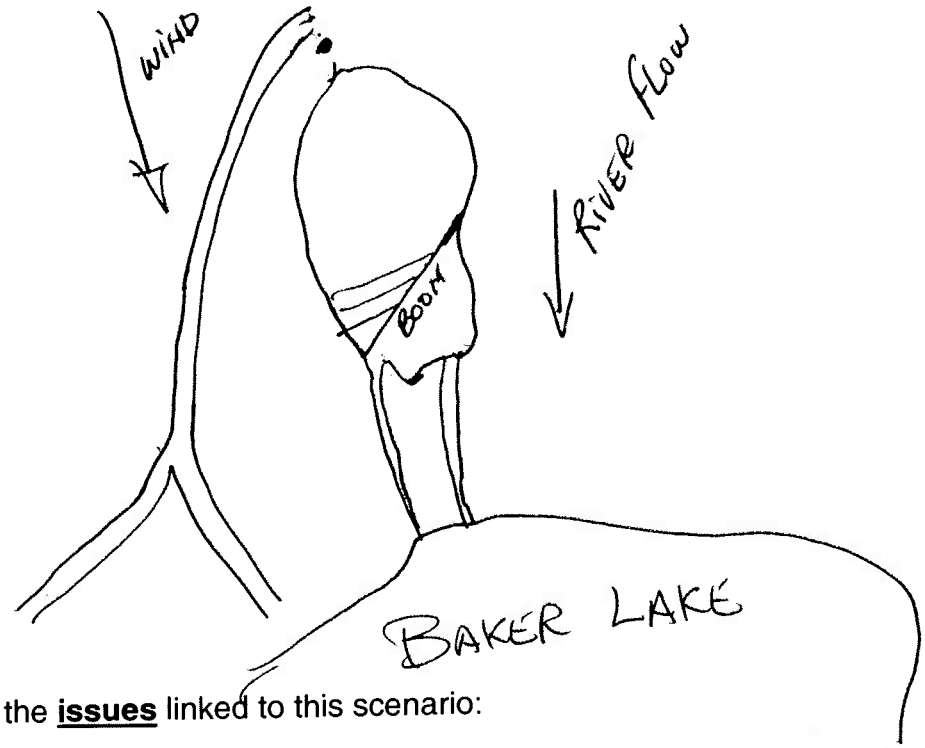
ALAIN GENESSE

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

- **Incident** - 45 m^3 diesel spills/plus oil/acid – Originates on Land, flows into the River
- **Spill** - occurred 22:00 hrs on ~~March~~ June 20, 2013
- **River** – water flow, 5 km/hr, braided channels; approx 15 km to Baker Lake
- **Lake** – winds from the North West at 20 km/hr. Tide is high.



1. List the **issues** linked to this scenario:

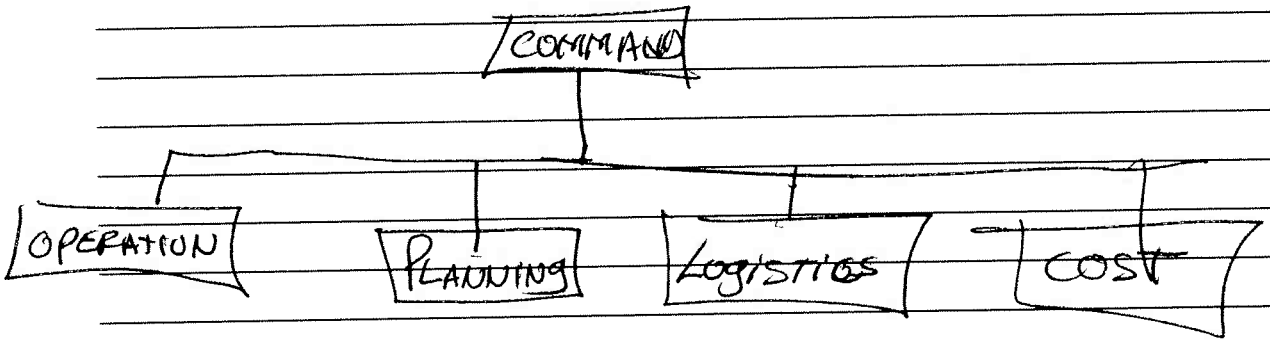
- DIESEL FLOWING INTO THE RIVER, HEADING TO BAKERLAKE (15 KM AWAY) GIVING US LESS THAN 3 HRS TO CONTAIN THE SPILL BEFORE IT GETS TO THE LAKE.
- ISOLATE THE VEHICULE.
- MAKE SURE THE DRIVER IS OK.

2. What **resources** are required?

- HELICOPTER TO ASSESS THE SPILL ON THE RIVER AND THE ACTUAL SPEED OF THE SPILL.
- A TEAM OF RESPONDERS AT THE ACCIDENT TO CONTAIND THE SPILL AT THE SOURCE.
- ANOTHER TEAM FURTHER DOWN STREAM BEFORE THE LAKE TO PREVENT ANY SPILL INTO THE LAKE
- NEED BOATS, MARITIME BARRIERS, SKIMERS, LIGHT PLANTS
- E.R.T. TEAM IN CASE OF FIRE
- M/T TANKER TRUCK TO PUMP THE REST OF THE LOAD
- M.S.D.S. - P.P.E.

3. What are the **initial spill response steps and what does your ICS look like**?

- ANALIZE THE SCENE, DELEGATE PEOPLE
- MAKE A PLAN, MAKE A DECISION, TAKE ACTION
- CALL PROPER AUTHORITY
- SAFETY



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4. What is your oil spill containment and recovery **strategy**?

- INSTALL BOOM ACROSS THE RIVER (POUND) BEFORE IT GETS INTO THE 2 RIVERS (CREEK) AND THE Big LAKE

FABRICATE A BERM

10-30-4 BARRIER

5. What is your strategy for shoreline **cleanup** operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

- ASSESS THE SHORELINE SITUATION, ASK TRAINNED PEOPLE TO EVALUATE IF WE NEED TO CLEAN, IF YES WHAT IS THE BEST WAY TO DO IT. (ANY FRAGILE SYSTEM)

- IS IT TRANSFERABLE? YES OR NO

6. What are some **safety** issues?

- RISK OF FIRE
- FALLING INTO WATER
- DEALING WITH POOR VISIBILITY (DARK AT NIGHT)
- WATER & ICE
- POTABILITY

7. How do you manage your **waste**?

- BRING TO THE PROPER DISPOSAL FACILITY.

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

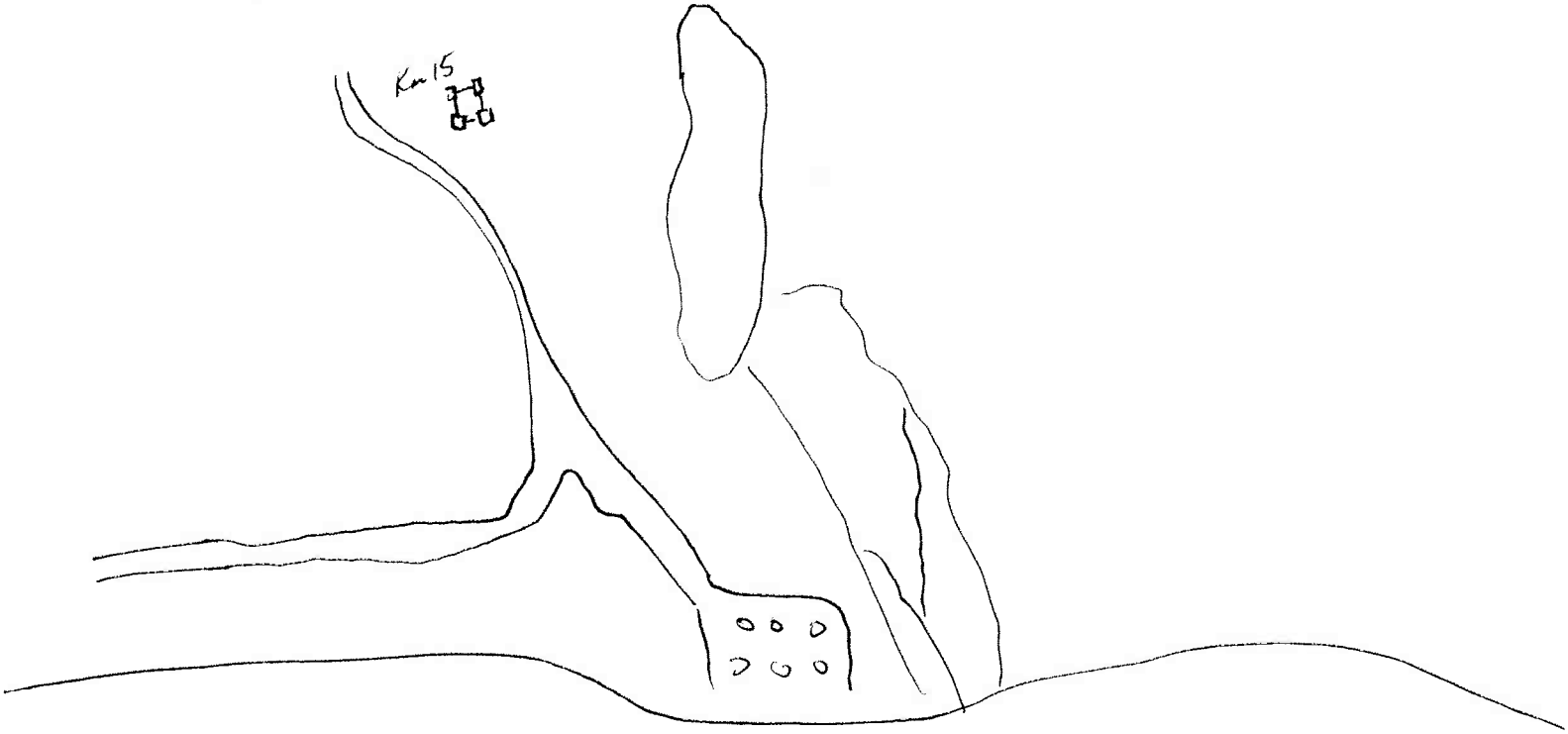
- PROTECT THE WATER INTAKE FOR THE TOWN
- DO WHATEVER IT TAKES AT ALL COST.
- INFORM THE COMMUNITY.
- U-BOOM, V-BOOM, J-BOOM

Janie Katalnik

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover considered Tier 3 incident

- **Incident -** 45 m^3 diesel spills/plus oil/acid – Originates on Land, flows into the River
- **Spill** - occurred 22:00 hrs on ~~March~~ June 20, 2013
- **River** – water flow, 5 km/hr, braided channels; approx 15 km to Baker Lake
- **Lake** – winds from the North West at 20 km/hr. Tide is high.



1. List the **issues** linked to this scenario:

possible contamination of communitys water supply
freshet will make it harder to collect contaminants
braided channels - increases chances of more contamination area
may disturb spawning areas - fish
tides will increase contamination of soil
response time
other road users

2. What **resources** are required?

heavy equipment to build trenches (COMMS) ERP
enough material to do entire clean up
proper PPE for all ~~personell~~ personnel
enough material to dispose contaminated material - totes, sealed drums
adequate equipment to bring contaminated material to mine site
safety monitoring devices before starting any clean up

3. What are the **initial spill response steps and what does your ICS look like**?

- Code 1 on radio called - safety
- IC informs team of situation and does a head count before deploying team
- command centre setup - include management to assist in decisions
- ~~location~~ develop a safety zone in spill area

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4. What is your oil spill containment and recovery **strategy**?

land - build bell holes or barriers to avoid spreading of contaminants
- place booms inside barriers to pick up contaminants
- once booms are full, replace with new ones - place contaminated booms into Quattrex bags
- send Quattrex bags to mine site and placed inside seacans - properly labelled

water - place maritime barrier inside lake
place booms along shore to protect soil - also along maritime barrier
collect

5. What is your strategy for shoreline **cleanup** operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

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6. What are some **safety** issues?

LEL
fatigue
water and ice
removal of truck
other road users
fast water
wildlife

7. How do you manage your **waste**?

place contaminated material - rags, booms - inside Quatrex bags
send bags to mine site - placed into seacans

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

Group Training Report

Course Name:

Trainer's Name: Robin Allard

Date: June 18, 2013

AGNICO-EAGLE

Agnico-Eagle Mines Ltd.
Meadowbank Division

M		Name	Company	Signature	Hours TRG.	Hours ASS.	Total Hours	Code
	1	JEAN-CLAUDE POITRAS	AEM		1.5		1.5	4
	2	Bernard Paradis	AEM		1.5		1.5	4
	3	MICHEL POITRAS	PRO-AB		1.5		1.5	4
	4	SERGE PARÉ	A.E.M		1.5		1.5	4
	5	RAY CARLSON	AEM		1.5		1.5	4
	6							
	7							
	8							
	9							
	10							
	11							
	12							
	13							
	14							
	15							
	16							
	17							

Trainer's signature:

Date: 18 June, 2013

Induction Department Signatures:	
Human Resources:	
Camp:	
Nurse:	
Security:	
Health & Safety:	
Environment:	
Training:	

Comments:

Codes:	Assessment Codes:
1. AEM Permit	A+: Very Good
2. Restrictive Permit	A : Good
3. Temporary Permit	B : Average
4. Training Completed	C : Below Average
5. Training Not Completed	
6. Fail	

Group Training Report

Course Name: Emergency Spill Response

Trainer's Name: Martin Thériault

Date: 20/09/12

Agnico-Eagle Mines Ltd.
Meadowbank Division

M		Name	Company	Signature	Hours TRG.	Hours ASS.	Total Hours	Code
	1	SYLVAIN Côté	AEM		1	1/2	1 1/2	4
	2	Mark Nukik	AEM	Mark Nukik	1	1/2	1 1/2	4
	3	HENRICK OUCHESS		HENRICK OUCHESS	1	1/2	1 1/2	4
	4	Tim Chapple	AEM		1	1/2	1 1/2	4
	5							
	6							
	7							
	8							
	9							
	10							

COMMENTS:

Trainer's signature:

Date: 2012-09-20

Codes:	Assessment Codes:
1. AEM Permit	A+: Very Good
2. Restrictive Permit	A : Good
3. Temporary Permit	B : Average
4. Training Completed	C : Below Average
5. Training Not Completed	
6. Fail	

127484

Group Training Report

Agnico-Eagle Mines Ltd.
Meadowbank Division

Course Name: Emergency Spill Response
Trainer's Name: Martin Theriault

Date: 25/09/12

M		Name	Company	Signature	Hours TRG.	Hours ASS.	Total Hours	Code
	1	Alexandre Arcand	AEM		1	1/2	1 1/2	4
	2	Ronald Falardeau	AEM		1	1/2	1 1/2	4
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							

COMMENTS:

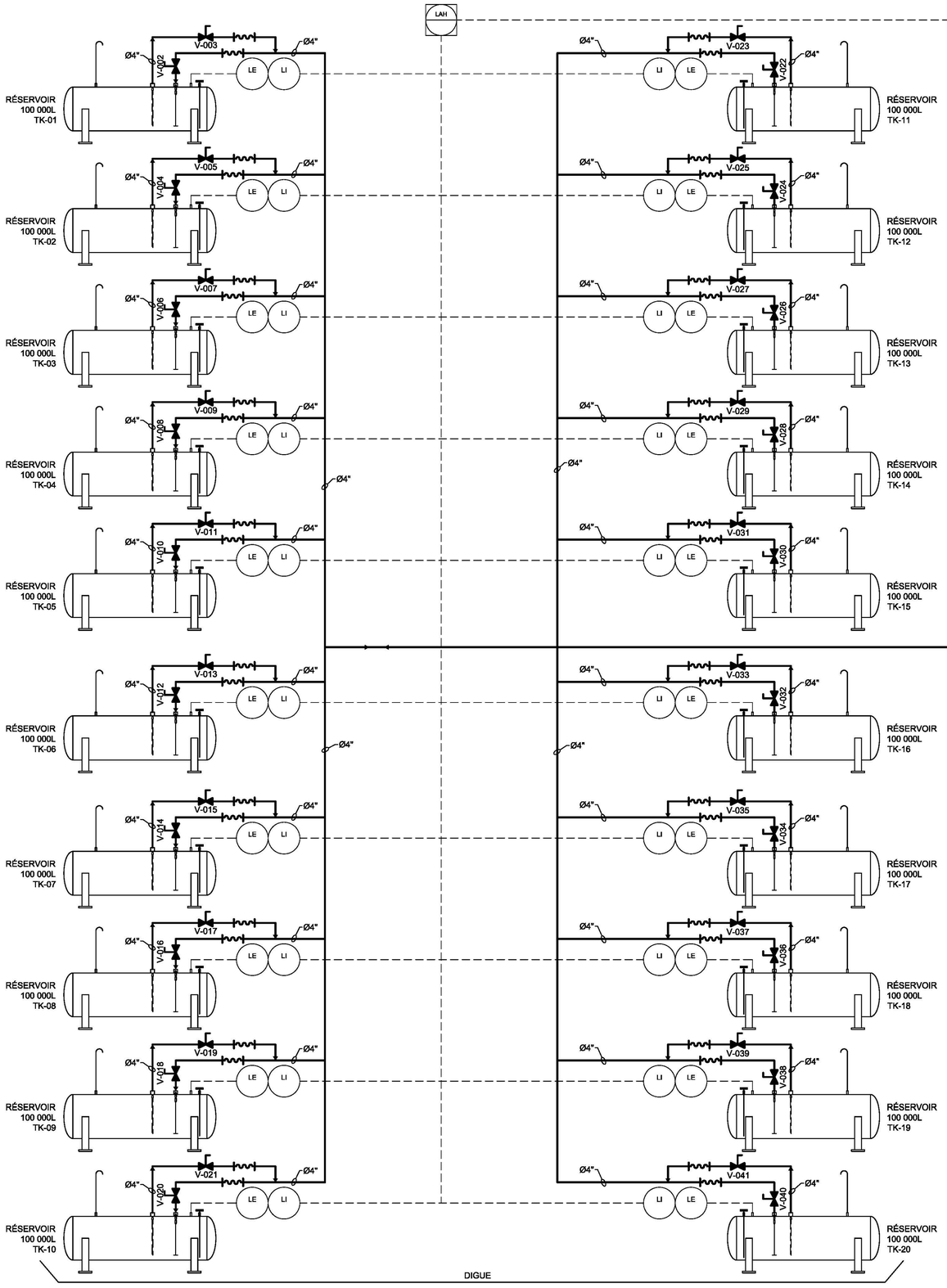
Trainer's signature:

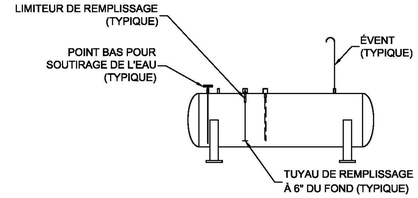
Date: 2012-09-25

Codes:
1. AEM Permit
2. Restrictive Permit
3. Temporary Permit
4. Training Completed
5. Training Not Completed
6. Fail

Assessment Codes:
A+: Very Good
A : Good
B : Average
C : Below Average

APPENDIX F - JET-A CONSTRUCTION DOCUMENTS





DÉTAIL TYPIQUE
RÉSERVOIR 100 000L
N/A

LÉGENDE

- LIGNE DE PROCÉDÉ PRIMAIRE
- LIGNE DE PROCÉDÉ SECONDAIRE
- CONTOUR DE BÂTIMENT
- LIGNE D'INSTRUMENTATION
- TUYAU FLEXIBLE
- BOYAU FLEXIBLE
- ACCOUPLEMENT RAPIDE
- VALVE MANUEL
- VALVE MOTORISÉE
- BOUCHON
- LIMITEUR DE REMPLISSAGE
- PRV — VALVE DE SURPRESSION EN LIGNE
- LE — SONDE DE NIVEAU
- LI — INDICATEUR DE NIVEAU
- VC — VANNE DE CONTRÔLE

NOTE: VOIR LE DESSIN RM4706-001-MP-100 POUR LA LISTE DE MATÉRIEL.

Client :
SM CONSTRUCTION INC.

Plan clé :

Professionnels :

POUR CONSTRUCTION
STAVIBEL 2013-08-04

RÉV.	DATE	ÉMISSIONS	PAR	VÉR.	APP.
00	2013-08-04	ÉMIS POUR CONSTRUCTION	ST.M.	J.F.	J.F.

Sceau(x) :
J. FAUCHER LICENSEE NIVINJJ 2013-08-04

Stavibel inc.
150, rue Gamble Ouest.
Rouyn-Noranda (Québec) J9X 2R7
Tél. : 819 764-5181 Téléc. : 819 797-0158
Courriel : stavibel-rn@stavibel.qc.ca
www.stavibel.qc.ca
STAVIBEL SERVICES D'INGÉNIERIE

Projet :
AGNICO EAGLE
MEADOWBANK - BAKER-LAKE
INSTALLATIONS JET-A

Titre :
MÉCANIQUE - PROCÉDÉ
MEADOWBANK
BAKER-LAKE
DÉPÔT JET-A
TUYAUTERIE
DIAGRAMME DE PROCÉDÉ ET D'INSTRUMENTATION

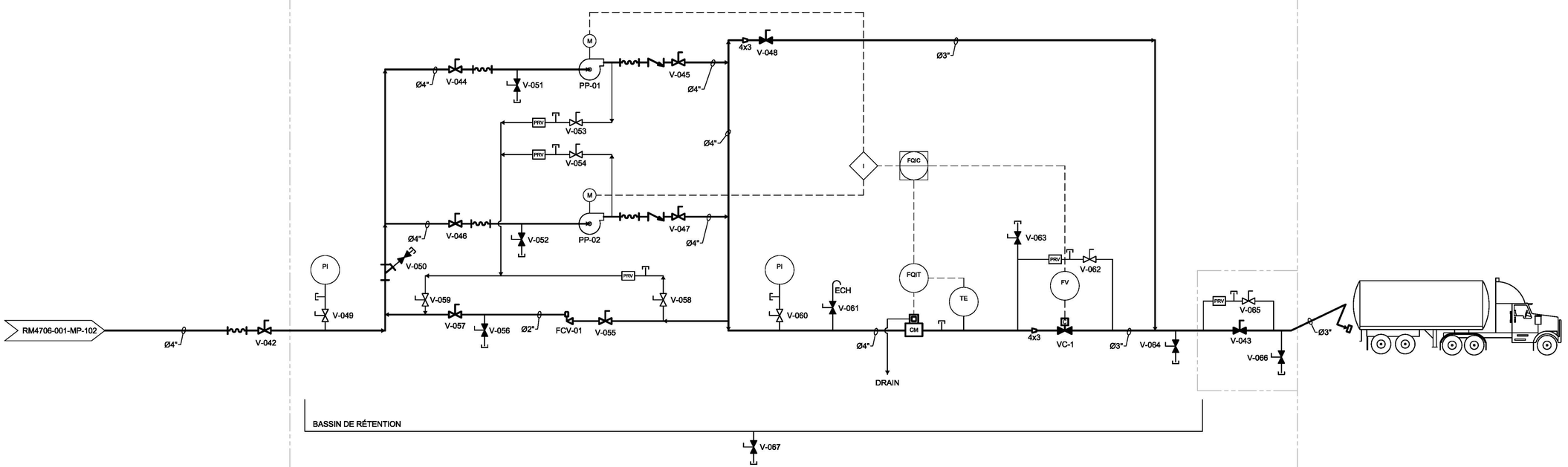
Dessiné par : Amélie Deslongchamps	Date orig. : 2013-06-06
Conçu par : Jonathan Faucher, ing.	Chargé de projet : Jonathan Faucher, ing.
Vérifié par : Jonathan Faucher, ing.	Projet n° : RM4706-001
Approuvé par : Jonathan Faucher, ing.	Référence : -
Échelle : N/A	Dessin n° : RM4706-001-MP-102
	Rév. n° : 00

LÉGENDE

LIGNE DE PROCÉDÉ PRIMAIRE	LIGNE D'INSTRUMENTATION
LIGNE DE PROCÉDÉ SECONDAIRE	VANNE DE DÉBIT (FV)
CONTOUR DE BÂTIMENT	SONDE DE TEMPÉRATURE (TE)
BRAS DE CHAGEMENT	MANOMÊTRE (PI)
TUYAU FLEXIBLE	DÉBITMÈTRE, TRANSMETTEUR (FQIT)
BOUCHON	
VALVE MANUEL	
CALPET ANTI-RETOUR	
VANNE DE CONTRÔLE	
VALVE DE SURPRESSION	
VALVE DE SURPRESSION EN LIGNE (PRV)	
POMPE	
CHAMBRE À MESURER (CM)	
MOTEUR (M)	
ÉCHANTILLONEUR (ECH)	

NOTE: VOIR LE DESSIN RM4706-001-MP-100 POUR LA LISTE DE MATÉRIEL.

STATION DE POMPAGE



Client :

SM CONSTRUCTION INC.

Plan clé :

Professionnels :

POUR CONSTRUCTION
STAVIBEL 2013-08-04

Rév.	DATE	ÉMISSIONS	PAR	VÉR.	APP.
00	2013-08-04	ÉMIS POUR CONSTRUCTION	ST.M.	J.F.	J.F.

Sceau(x) :

Stavibel inc.
150, rue Gamble Ouest
Rouyn-Noranda (Québec) J9X 2R7
Tél. : 819 764-5181 Téléc. : 819 797-0158
Courriel : stavibel-rn@stavibel.qc.ca
www.stavibel.qc.ca

Projet :

AGNICO EAGLE
MEADOWBANK - BAKER-LAKE
INSTALLATIONS JET-A

Titre :

MÉCANIQUE - PROCÉDÉ
MEADOWBANK
BAKER-LAKE
DÉPÔT JET-A - STATION DE POMPAGE
TUYAUTERIE
DIAGRAMME DE PROCÉDÉ ET D'INSTRUMENTATION

Dessiné par : Amélie Deslongchamps	Date orig. : 2013-06-17
Conçu par : Jonathan Faucher, ing.	Chargé de projet : Jonathan Faucher, ing.
Vérifié par : Jonathan Faucher, ing.	Projet n° : RM4706-001
Approuvé par : Jonathan Faucher, ing.	Référence : -
Échelle : N/A	Dessin n° : RM4706-001-MP-103 — Rév. n° : 00

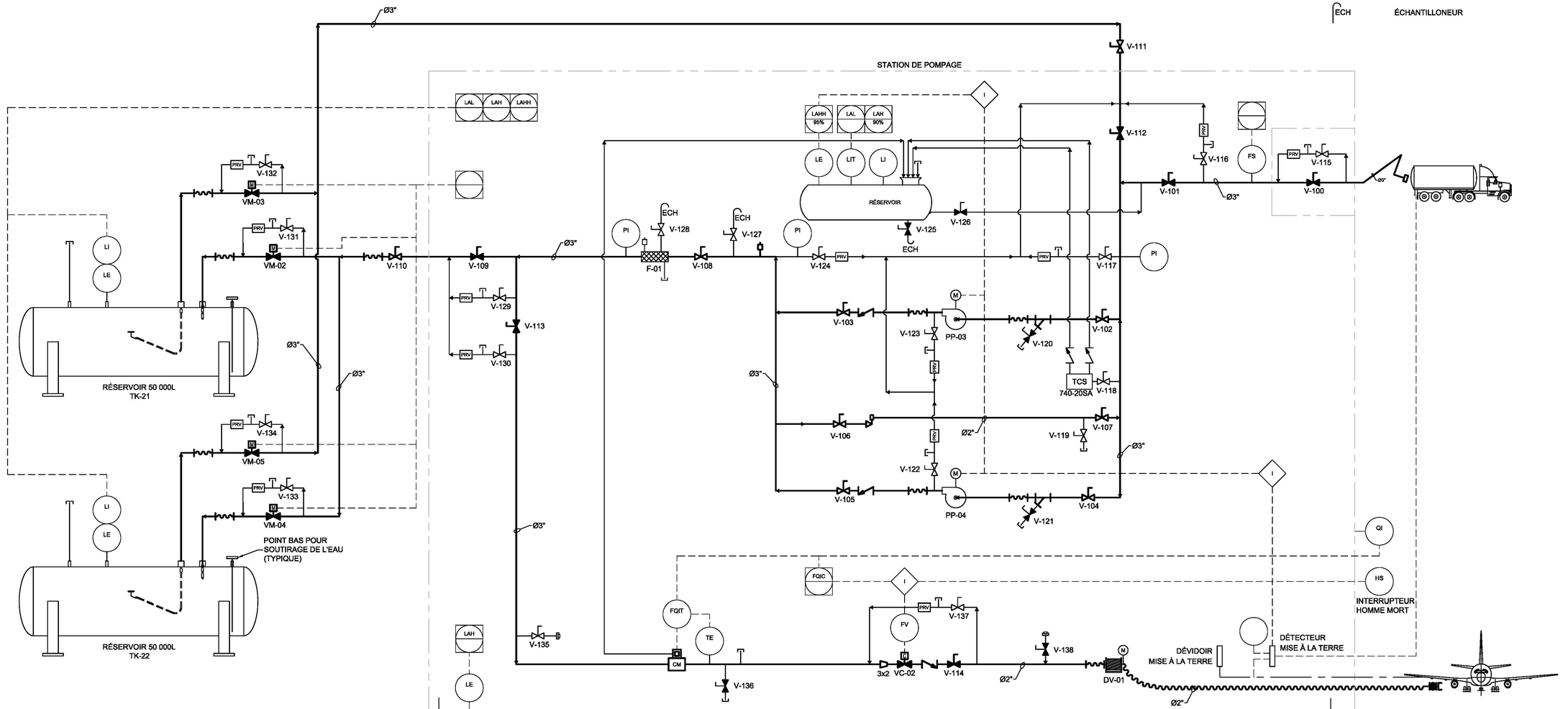
LÉGENDE

- LIGNE DE PROCÉDÉ PRIMAIRE
- LIGNE DE PROCÉDÉ SECONDAIRE
- CONTOUR BÂTIMENT
- LIGNE D'INSTRUMENTATION
- LIGNE ÉLECTRIQUE

- TE — SONDE DE TEMPÉRATURE
- PI — MANOMÊTRE
- LI — INDICATEUR DE NIVEAU
- LE — SONDE DE NIVEAU
- FV — VANNE DE DÉBIT
- FQIT — DÉBITMÈTRE, TRANSMETTEUR

- BRAS DE CHAGEMENT
- TUYAU FLEXIBLE
- BOUCHON
- VALVE MANUEL
- CALPET ANTI-RETOUR
- VANNE DE CONTRÔLE
- VALVE DE SURPRESSION
- VALVE DE SURPRESSION EN LIGNE
- ÉLIMINATEUR D'AIR
- FILTRE
- POMPE
- CHAMBRE À MESURER
- MOTEUR
- VANNE DE DÉBIT
- ÉCHANTILLONEUR

NOTE: VOIR LE DESSIN RM4706-001-MP-101
POUR LA LISTE DE MATÉRIEL.



Client :

SM CONSTRUCTION INC.

Plan clé :

Professionnels :

POUR CONSTRUCTION
STAVIBEL 2013-08-04

Rév.	DATE	ÉMISSIONS	PAR	VÉR.	APP.
00	2013-08-04	ÉMIS POUR CONSTRUCTION	ST.M.	J.F.	J.F.

Sceau(x) :

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www.stavibel.qc.ca

Projet :

AGNICO EAGLE
MEADOWBANK - BAKER-LAKE
INSTALLATIONS JET-A

Titre :

MÉCANIQUE - PROCÉDÉ
AÉROPORT

POSTE D'AVITAILLEMENT - JET-A
TUYAUTERIE
DIAGRAMME DE PROCÉDÉ ET D'INSTRUMENTATION

Dessiné par : Amélie Deslongchamps	Date orig. : 2013-06-17
Conçu par : Jonathan Faucher, ing.	Chargé de projet : Jonathan Faucher, ing.
Vérifié par : Jonathan Faucher, ing.	Projet n° : RM4706
Approuvé par : Jonathan Faucher, ing.	Référence : -
Échelle : N/A	Dessin n° : RM4706-001-MP-104 — Rév. n° : 00

APPENDIX G - EMERGENCY CONTROL CENTER DUTY CARDS

Name: _____

Date: _____

Time assumed Role: _____

Manager On Duty - Duty Card	Completed	Time
1. Notified of an emergency – Make decision to have the whole Management Paged – control group		
2. Brief Management Team on the emergency		
3. Appoint a Scribe – Engineering department		
4. Decide if communications are to be cut – Notify IT		
5. Ensure that the emergency remains confidential – limit what is said to employees		
6. Conduct a head count – (Muster Stations) Assign duty to Geology Department		
7. Ensure unaffected Departments are put on Standby – E.g.: mine dept. – may need equipment		
8. Ensure all Service Departments are put on Standby – as required by ERT – Camp / Mine / Site Services / Maintenance / Manpower / Equipment / Tools / Equipment		
9. Ensure Power House is on standby		
10. Ensure that Protocol is on standby – flights to and from site for our workers / Mutual Aid teams		
11. Ensure Warehouse is on standby: Note: list of materials taken will be kept and accounted for after the emergency is over		
12. Do we need radios, ERP, Site Drawings out for incident command team		
13. Security / Close Roads		

Once Emergency is over:		
1. Initiate the “Emergency Stand Down” when required		
2. Follow up with HR Designate on any victim or surviving members concerns		
3. Hold a de-briefing with Personnel prior to them exiting the site		
4. Gather any information for Corporate HQ and Regulatory Agencies (Mines Inspector)		
5. Prepare and facilitate a Debriefing Session		
6. **General Manager will liaise with media with ALL information going out from site.**		
*** Write notes on reverse side and return this Card to Scribe after the Incident Debriefing for compilation purposes**		
No information will be relayed to Corporate or Media without the expressed confirmation of the Manager on Duty.		

Name: _____

Date: _____

Time assumed role: _____

Health & Safety Department or Designate Duty Card	**Completed**	**Time**
Print Name:		
1. Report to Command Centre		
2. Offer support to all Incident Command Group Management Team Members		
3. Account for all persons in Health and Safety Dept.		
4. Liaison between Emergency Response Teams and Incident Command Group Management Team Members		
5. Review remaining Emergency Response Capabilities: manning, equipment, resources		
Questions to ask: a) Do we need to stop operations? (Ex: SCBA use – if SCBA's are required for emergency, and we have other confined space work occurring, do we cancel? b) Do we need to reduce or have rescuers stand down during an emergency to ensure that we have adequate numbers available for continuation of normal operations? c) (Ex: mine rescue team called out to an emergency, 12 people show up, only 6 is required for emergency, and then 6 can stand down and go back to work and be available if another emergency occurs at same time. d) If people and equipment are available to meet		

Regulation requirements, then normal operations can continue. If not – consider putting alternate plans in place.		
6. Respond to any field requests		
7. Maintain notes of all decisions made with times as required.		
8. Organize and manage any site security requirements		
9. Liaison with any other emergency resource provider		
10. Provide information updates to the Incident Command Group		
11. Maintain Health and Safety Standards at the Mine Site during any incident		
12. Assist with any trauma management situations and Post Incident Debriefing sessions as required		
13. Participate in the incident debriefing session		
14. Liaison with the Department Head where incident occurred and help with incident investigation process		
15. Advise on corrective action initiatives		
16. Communicate with Mines Inspector – Serious Injury / Dangerous Occurrence – only after approval of Manager on duty		
***Write notes on reverse side and return this Card to scribe after the Incident Debriefing**		

Name: _____

Date: _____

Time assumed role: _____

Department Head where incident occurred Duty Card	**Completed**	
Print Name:		
1. Report to Command Centre		
2. Gather all available information and share with Incident Command Group Team Members		
3. Account for all persons under area of responsibility – (Need to determine who is missing and where they may be)		
4. Confirm effective Communications with Responders and Relative Supervisors		
5. Confirm Incident losses and status of the incident		
6. Designate an Assistant if required		
7. Assess current resources and determine if additional resources are required		
8. Manage Personnel duty hours, needs, food and other		
9. Visit the incident scene if required – and Safe to do so		
10. Assemble any information required for a report		
11. Attend the Incident Debriefing		
***Write notes on reverse side and return this Card to Scribe after the Incident Debriefing**		

Name: _____

Date: _____

Time assumed role: _____

Logistics or Designate Duty Card	**Completed**	**Time**
Print Name:		
1. Report to Command Centre		
2. Account for all persons under area of responsibility		
3. Ensure that flights are arranged for outgoing and incoming purposes when required		
4. Ensure IT is available upon request – (cut communications) fix radios etc.		
5. Arrange transportation of all personnel as required		
6. Arrange for provision of food, water, temporary shelter, radios, PPE, etc. when required		
7. Assemble any information required for a report		
8. Participate in the Incident Debriefing		
***Write notes on reverse side and return this Card to scribe after the Incident Debriefing**		

Name: _____

Date: _____

Time assumed role: _____

Warehouse or Designate Duty Card	**Completed**	**Time**
Print Name:		
1. Report to Command Centre		
2. Account for all persons under area of responsibility		
3. Assemble lists for inventory of possible equipment or supply needs		
4. Source any supplies and equipment that is requested by the Manager on Duty		
5. Source any requests for external services or supplies		
6. Designate an Assistant if Required		
7. Schedule Support Staff Personnel if required		
8. Ensure that someone is available at all times during the entire emergency to supply equipment materials as necessary		
9. Assemble any information required for a report		
10. Participate in the Incident Debriefing		
***Write notes on reverse side and return this Card to scribe after the Incident Debriefing**		

Name: _____

Date: _____

Time assumed role: _____

Human Resources/Designate Duty Card	**Completed**	**Time**
Print Name:		
1. Report to Command Centre		
2. Account for all persons under area of responsibility		
3. Set up a format for any media communications		
4. Confirm information accuracy if required		
5. Designate an Assistant if required		
6. Ensure proper notification systems are followed (RCMP are responsible for initial notification of family in fatal events)		
7. Coordinate any follow up visits to family of victims		
8. Confirm that Employee Assistance Program, Critical Incident Stress or Victim Services is available to injured or survivors or Post Traumatic Stress sufferings of any personnel		
9. Assemble any information required for a report		
10. Help Manager on Duty prepare communication to advise workforce		
11. Participate in the Incident Debriefing		
12. **All communication to media will be done through the Manager on Duty**		
***Write notes on reverse side and return this Card to scribe after the Incident Debriefing**		

Name: _____

Date: _____

Time assumed role: _____

Emergency Response Team Captain Duty Card	**Completed**	**Time**
Print Name:		
1. Respond to the scene or requested area with all available and applicable equipment		
2. Confirm communication with the Incident Commander at Base Station		
3. Contact Department Head of affected area for any request or directions through Incident Commander		
4. Direct emergency activities with your Team		
5. Maintain Safe Working Standards with you team		
6. Offer periodic Status Reports to Incident Commander at Base Station		
7. Secure the incident scene – as per Regs. 16.03/16.04		
8. Liaison with any other external emergency personnel		
9. Ensure area clearances with Helicopter Pilots – if required		
10. Respond accordingly within you and your team's capabilities		
11. Request any additional resources through your Incident Commander at Base Station		
12. Assemble any information required for a report		

13. Attend the Incident Debriefing		
14. Take Cell Phone with them when going off site – phone number is 867-793-1330		
***Write notes on reverse side and return this Card to scribe during the Incident Debriefing**		

Note: Captain must have a report that will be submitted at completion of emergency which includes all of the above.

Name: _____

Date: _____

Time assumed role: _____

Environmental Department Duty Card	**Completed**	**Time**
Print Name:		
1. Report to Command Centre		
2. Account for all persons in area of responsibility		
3. Be available as a resource to Incident Command Group		
4. Maintain a log of events, calls, requests, external personnel and contact lists if requested		
5. Liaison with all field operations on the incident when involving spills/chemicals		
6. Liaise with Government Regulators as necessary for reporting spills/chemicals etc. upon approval of Manager on Duty.		
7. Designate an Assistant if required to help out in the field		
8. Direct external Emergency Spill Response Personnel to proper location(s) if required		
9. Assemble any information required for a report		
10. Attend the Incident Debriefing		
***Write notes on reverse side and return this Card to scribe during the Incident Debriefing**		

Name: _____

Date: _____

Time assumed role: _____

Maintenance Department Duty Card	**Completed**	**Time**
Print Name:		
1. Report to Command Centre		
2. Account for all persons in area of responsibility		
3. Be available as a resource to Incident Command Group		
4. Maintain a log of events, calls, requests, external personnel and contact lists		
5. Liaison with all field operations on the incident when involving equipment, machinery		
6. Have personnel available to deal with broken down machinery etc.		
7. Designate an Assistant if required to help out in the field		
8. Make equipment and manpower available if required by Emergency Response Team		
9. Assemble any information required for a report		
10. Attend the Incident Debriefing		
***Write notes on reverse side and return this Card to scribe during the Incident Debriefing**		

Name: _____

Date: _____

Time assumed role: _____

Mine Department Duty Card	**Completed**	**Time**
Print Name:		
1. Report to Command Centre		
2. Account for all persons in area of responsibility		
3. Be available as a resource to Incident Command Group		
4. Maintain a log of events, calls, requests, external personnel and contact lists		
5. Liaison with all field operations on the incident when involving incidents in the pit		
6. Ensure that contractors in area of responsibility are notified and accounted for		
7. Designate an Assistant if required to help out in the field		
8. Make equipment and manpower available as necessary to help Emergency Response Teams		
9. Assemble any information required for a report		
10. Attend the Incident Debriefing		
***Write notes on reverse side and return this Card to scribe during the Incident Debriefing**		

Name: _____

Date: _____

Time assumed role: _____

Engineering Department Duty Card	**Completed**	**Time**
Print Name:		
1. Report to Command Centre		
2. Account for all persons in area of responsibility		
3. Be available as a resource to Incident Command Group		
4. Maintain a log of events, calls, requests, external personnel and contact lists (SCRIBE) for the incident		
5. Liaison with all field operations on the incident when involving incidents where engineering is required		
6. Designate an Assistant if required to help out in the field		
7. Make equipment and manpower available as necessary to help Emergency Response Teams		
8. Assemble any information required for a report		
9. Attend the Incident Debriefing		
***Write notes on reverse side and return this Card to scribe during the Incident Debriefing**		

Name: _____

Date: _____

Time assumed role: _____

Geology Department Duty Card	**Completed**	**Time**
Print Name:		
1. Report to Command Centre		
2. Account for all persons in area of responsibility		
3. Be available as a resource to Incident Command Group		
4. Conduct a proper head count of all persons assembled in the Muster Stations (Procedure can be found in Emergency Response Plan)		
5. Maintain a log of events, calls, requests, external personnel and contact lists		
6. Designate an Assistant if required to help out in the field		
7. Make equipment and manpower available as necessary to help Emergency Response Teams		
8. Assemble any information required for a report		
9. Attend the Incident Debriefing		
***Write notes on reverse side and return this Card to scribe during the Incident Debriefing**		

Name: _____

Date: _____

Time assumed role: _____

Site Services Department Duty Card	Completed	Time
Print Name:		
1. Report to Command Centre		
2. Account for all persons in area of responsibility		
3. Be available as a resource to Incident Command Group		
4. Ensure that manpower, equipment is available for the proper function and maintenance of fire sprinkler systems		
5. Ensure that manpower, equipment is available to maintain an open road (AWPR) to Baker Lake		
6. Ensure that manpower is available as airport marshal and for moving material arriving in aircraft, fuel, etc.		
7. Ensure that manpower, equipment is available for transportation of men/gear to help Emergency Response Teams		
8. Maintain a log of events, calls, requests, external personnel and contact lists		
9. Designate an Assistant if required to help out in the field		
10. Make equipment and manpower available as necessary to help Emergency Response Teams		
11. Assemble any information required for a report		
12. Attend the Incident Debriefing		

***Write notes on reverse side and return this Card to scribe during the Incident Debriefing**		

Name: _____

Date: _____

Time assumed role: _____

Electrical Department Duty Card	**Completed**	**Time**
Print Name:		
1. Report to Command Centre		
2. Account for all persons in area of responsibility		
3. Be available as a resource to Incident Command Group		
4. Ensure that personnel and equipment is available to maintain the required power supply		
5. Maintain a log of events, calls, requests, external personnel and contact lists		
6. Designate an Assistant if required to help out in the field		
7. Make equipment and manpower available as necessary to help Emergency Response Teams		
8. Assemble any information required for a report		
9. Attend the Incident Debriefing		
***Write notes on reverse side and return this Card to scribe during the Incident Debriefing**		

Name: _____

Date: _____

Time assumed role: _____

Mill Department Duty Card	**Completed**	**Time**
Print Name:		
1. Report to Command Centre		
2. Account for all persons in area of responsibility		
3. Be available as a resource to Incident Command Group		
4. Conduct a proper head count of all persons assembled in the Arctic Corridor Muster Station		
5. Maintain a log of events, calls, requests, external personnel and contact lists		
6. Designate an Assistant if required to help out in the field		
7. Make equipment and manpower available as necessary to help Emergency Response Teams		
8. Assemble any information required for a report		
9. Attend the Incident Debriefing		
***Write notes on reverse side and return this Card to scribe during the Incident Debriefing**		

Name: _____

Date: _____

Time assumed role: _____

Camp/Housekeeping Department Duty Card	**Completed**	**Time**
Print Name:		
1. Report to Command Centre through HR		
2. Account for all persons in area of responsibility		
3. Be available as a resource to Incident Command Group		
4. Ensure an adequate supply of food when requested		
5. Ensure that an adequate supply of blankets, washers/dryers are available when requested		
6. Maintain a log of events, calls, requests, external personnel and contact lists		
7. Designate an Assistant if required to help out in the field		
8. Make equipment and manpower available as necessary to help Emergency Response Teams		
9. Assemble any information required for a report		
10. Ensure that HR has all available information		
***Write notes on reverse side and return this Card to scribe during the Incident Debriefing**		

Name: _____

Date: _____

Time Assumed Role: _____

To be filled out by Incident Commander:

Incident Commander Duty Card	Completed	Time
Print Name:		
1. Initiate an emergency response as required		
2. Ensure communications with Emergency Response Team Captain and be there to request assistance or resources		
3. Ensure incident scene is secured as required		
4. Liaise between Emergency Response Team and Incident Command Group		
5. Ensure that all gear, equipment, supplies required by Emergency Response Team is made available to them		
6. Have the gear, equipment, supplies brought to Emergency Response Teams when required		
7. Assemble any information required for a report		
8. Request any additional resources at any time required		
9. Attend the Incident Debriefing if requested		
***Write notes on reverse side and return this Card to ICS during the Incident Debriefing**		

Name: _____

Date: _____

Time assumed role: _____

Scribe Duty Card	**Completed**	**Time**
Print Name:		
1. Report to Command Centre		
2. Scribe all accounts of activity in chronological order		
3. Scribe information as requested by the Incident Command Group – Manager on Duty		
4. Provide a detailed report at end of incident		
5. Assemble any information required for a report		
***Write notes on reverse side and return this Card to ICS during the Incident Debriefing**		

APPENDIX H - IN SITU BURNING

Open-water Response Strategies: In-situ Burning

What is in-situ burning?

"In-situ" is Latin for "In-place." In-situ burning involves controlled burning of oil that has spilled from a vessel or a facility, at the location of the spill. Typically, the oil is contained within a boom and ignited using a hand-held igniter or an igniter suspended from a helicopter. The burn will continue only as long as the oil is thick enough—usually about 1/10 of an inch or 2 to 3 millimeters. When conducted properly, in-situ burning significantly reduces the amount of oil on the water and minimizes the adverse effect of the oil on the environment.

Why conduct in-situ burning?

When a spill occurs it is best to minimize the spread of the oil slick and remove as much of the oil as possible at the site of the spill. In-situ burning may provide a response method to help achieve this goal. Under favorable conditions in-situ burning is a fast, efficient, and relatively simple way of removing spilled oil from the water. Furthermore, it greatly reduces the need for storage and disposal of the collected oil and the waste it generates. When an oil spill occurs in ice-covered water or in a marsh, in-situ burning may be the only spill response method available. In-situ burning, however, should complement, not exclude, other means of spill response. When possible, spill responders start mechanical recovery immediately, using booms, skimmers, and other equipment. They may also use dispersants if conditions allow it.

How is in-situ burning done?

On open water, in-situ burning is likely to be done by two boats towing a fire-resistant boom in a U configuration. The open end of the U is maneuvered through the oil slick and a "boomful" of oil is collected. The boom is towed away from the main slick and the oil is ignited. During the burning, the pooled boom slowly advances ahead of the current to ensure that the oil is concentrated at the back end of the boom and maintains maximum thickness. After the oil is burned, the process may be repeated for as long as in-situ burning is feasible.

When a spill occurs in a river and the current is not too swift (below one knot) a fire-resistant boom may be anchored across the river to collect the oil. When the oil layer in the boom is thick enough, the oil is ignited.

In both cases it is possible to stop the burn by releasing one end of the boom, or by towing it faster so that the oil is no longer contained.

In-situ burning has been done successfully on numerous occasions when oil was trapped in ice, or spilled into sensitive marshland. Unlike burning on open water, burning on land is more difficult to extinguish.

What are the limiting factors?

One of the disadvantages of in-situ burning is that any of a number of factors may prevent its use.

Environmental

Oil thickness

In order to burn on the water, oil has to be thicker than 1-2 millimeters. During combustion the oil vapors ignite and burn, rather than the liquid itself. About 2-3% of the heat generated by the combustion is returned to the oil layer where it causes additional vapors to escape and burn (Buist 1994). When the oil layer is thinner than 1-2 mm, the heat is lost to the water, not enough vapors are released, and combustion ceases.

Waves and wind

Experiments have shown that in-situ burning is possible only under relatively calm conditions. When winds are stronger than approximately 20 knots and waves are higher than 3 feet, burning becomes increasingly difficult because the oil cannot be contained in a boom and because it would rapidly emulsify due to wave action (Allen 1993).

Current

The same limitations that apply to ordinary booms apply to fire-proof booms. When the current is stronger than about one knot the boom cannot contain the oil, which splashes above the boom or escapes beneath it.

Emulsification

Emulsification occurs when crude oil spilled on the water takes in microscopic droplets of water. This usually requires mixing energy in the form of waves. When oil emulsifies its viscosity greatly increases, the total volume of "oily material" increases and most significantly for in-situ burning, ignition and combustion of the spilled oil become increasingly difficult. Water-in-oil emulsion of over 50% will preclude in-situ burning of even light crudes or refined products, while much less than that is required for heavier crudes. It is interesting to note that experiments with emulsion breakers applied to and mixed into the oil enable a mixture of 60% water in oil emulsion to ignite and burn in a fairly normal fashion (Buist, 1995).

Operational

Boom

The present open-water in-situ burning technique requires a fire-resistant boom. This boom needs to withstand the combined forces of heat exceeding 2,000˚F, wave action, and towing. The most prevalent boom is made of

ceramic fireproof fabric; other booms are made of stainless steel material. Tests and real burns have shown that further improvements are needed in order to make fireproof booms viable for several consecutive burns. A program to test new booms and improve existing ones is underway (Walton 1997).

Booms are stockpiled in different locations around the nation where in-situ burning has been incorporated as a spill response technique. However, lack or insufficient amount of fireproof boom will limit or prevent the execution of open-water in-situ burning.

Human health

Human health has been one of the major concerns regarding in-situ burning. Essentially, in-situ burning converts the oil from a slick on the water into airborne gases and particulates that may travel long distances and potentially come in contact with people. To prevent possible human health impact, policies and guidelines have been established to limit in-situ burning to condition that will not risk the general population.

Natural resources

In general, any action that limits the spread of the spilled oil or treats it in-situ is seen as beneficial to wildlife and other natural resources. However, there may be situations in which in-situ burning may threaten natural resources. In-situ burning policies adopted by regions around the US incorporate provisions for protection of natural resources when conducting in-situ burning.

Approval

In-situ burning has a narrow window of opportunity. Approval for burning should be given either ahead of time (preapproval) or quickly on a case-by-case basis. If the approval process takes longer than it takes to prepare for the burn, the opportunity for using in-situ burning may be lost.

Emissions from in-situ burning

Studies of the emissions from in-situ burning have shown fairly consistent results. About 85 to 95% of the burned oil becomes carbon dioxide and water, 5 to 15% of the oil is not burned efficiently and is converted to particulates, mostly soot, and the rest, 1-3%, is comprised of nitrogen dioxide, sulfur dioxide, carbon monoxide, polynuclear aromatic hydrocarbons (PAH), ketones, aldehydes, and other combustion by-products (Ferek 1997). No "exotic" chemicals are formed. Rather, the burning of oil on water seems to be similar to burning the oil in a furnace or a car, with the exception that the burn is oxygen-starved and not very efficient, so that it generates ample amount of black soot particulates that absorb sunlight and create the black smoke.

Past burns

Many in-situ burns of oil were conducted over the years or occurred accidentally, in different types of environments. Most of them were successful in removing part or most of the spilled oil. A few examples are given below:

Burmah Agate

In November 1979, the tanker *Burmah Agate* carrying 14 million gallons of crude oil collided with a freighter near Galveston, Texas. The oil ignited and burned for more than a week, creating a large smoke plume. It is estimated that about 75% of the oil burned (Buist 1994).

Exxon Valdez

In March 1989 the tanker *Exxon Valdez* ran aground on Blight Reef in Prince William Sound, Alaska, spilling approximately 11 million gallons of North Slope crude oil. On the second day of the spill, in calm weather, between 15,000 and 30,000 gallons of the oil was collected and burned, using 150 meters of fireproof boom towed by two boats. This successful burn using a fireproof boom boosted the efforts to incorporate in-situ burning as a spill response method.

Kuwait

By far the largest in-situ burning to date occurred in 1991 in Kuwait, when the retreating Iraqi forces set ablaze about 700 oil wells. At the height of this environmental disaster, about 6 million barrels of oil were burned daily (Ferek 1997). It is estimated that more than a billion barrels of oil were burned over nine months until the fires were extinguished. The fires created a massive smoke plume that darkened the sky in the area for many months. When the flames subsided, it became apparent that the massive fires greatly reduced the amount of oil that actually spilled and polluted both the landscape and the marine environment, and that the long-lasting effects of the smoke plume were minimal.

San Jacinto River

Following massive floods, four pipelines containing gasoline, diesel fuel, light crude oil, and liquefied petroleum gas ruptured over the San Jacinto River near Houston in October 1994 and caught fire. The fire lasted for several days. When the floods subsided, a boom was anchored across part of the river to collect the oil escaping from the fire. The oil was ignited and burned in the boom for about 12 hours. Both the accidental and deliberate burning significantly reduced the extent of environmental impact (NTSB 1996).

Marsh burns

In recent years, in-situ burning has been conducted on land more often than on open water. In April 1993, spilled jet fuel was ignited in an ice covered marsh near Brunswick Air Force Base in Maine. After mechanical removal reached the limit of its efficiency, about 30,000 gallons remained in the marsh,

and were almost completely burned. Pipeline spills were ignited both in Texas, near Copano Bay in January 1992 and at the Rockefeller Nature Refuge in Louisiana in March 1995. In both cases most of the oil was burned. Studies are being conducted to assess marsh recovery.

Human health concerns

One of the main objections for conducting in-situ burning was based on the concern that the smoke generated could affect the health of the general public downwind of the burn. The health and safety of the responders conducting the burn was also a consideration.

Responders

Safety hazards for in-situ burning operations are similar to those of ordinary skimming at sea, with the added hazards related to the combustion process. Several points are especially useful to keep in mind:

- A specific burn plan should be prepared in order to methodically address safety hazards, protection measures, training requirements, communication, and other operational elements that have to be considered for a successful and safe burning operation. A burn site safety plan should be included in the general burn plan.
- The burning should be controlled, and flashback to the source prevented. Great care must be taken so that the fire is controlled at all times.
- Ignition of the oil slick, especially by aerial ignition methods (such as the helitorch), must be well coordinated with neighboring vessels and be carefully executed. Proper safety distances should be kept at all times.
- In-situ burning at sea will involve several vessels working relatively close to each other, perhaps at night or in other poor-visibility conditions. Such conditions are hazardous by nature and require a great degree of practice, competence, and coordination.
- Response personnel must receive the appropriate safety training. Training should include proper use of personal protective equipment, respirator training and fit-testing, heat stress considerations, first aid, small boat safety, and any training required to better prepare them to perform their job safely.

Safety hazards are substantial and should be given due attention. Usually they pose a much greater risk to the responders than chemical exposure.

General public

In-situ burning generates mostly carbon dioxide and water, particulates, and small quantities of nitrogen oxides, sulfur dioxide, ketones, aldehyde, and other minor combustion gases. PAHs, some of which are suspected human carcinogens, are found in minute concentrations, adsorbed to the soot particulates. Studies on in-situ burning smoke components indicate that particulates in the smoke plume remain the only agent of concern more than

a mile or two downwind. The gases created in the burn dissipate to background levels a short distance downwind, and the level of PAHs attached to the particulates is much below the level of concern (Fingas 1994). Public exposure to smoke particulates from the burn is not expected unless the smoke plume sinks to ground level. However, since the general public may include individuals sensitive to air pollutants their tolerance to particulates may be significantly lower than that of the responders.

Particulate size

Since 10 micrometers (μm) in diameter is the size below which particulates may be inhaled and become a burden on the respiratory system, scientists divide the particulate mass into "total" particulates, which include any size measurable, and "PM-10," which is the fraction of particulates smaller than 10 μm in diameter.

Particulate size also plays a crucial role in determining how long they will be suspended in the air. Larger particulates (tens of μm in diameter) would precipitate rather quickly close to the burning site. Smaller particulates (ranging from a fraction of a μm to several μm in diameter) would stay suspended in the air for a long time and be carried over long distances by the prevailing winds. Particulates small enough to be inhaled (PM-10) are also the ones to remain suspended. If those particulates do not descend to ground level (where people are), they will not threaten the population downwind.

Particulate level of concern

The general public may be protected by minimizing exposure and conducting the burn only when conditions are favorable and exposure to particulates from the burn is below the level of concern. The National Response Team-recommended level of concern for the general public is 150 micrograms of particulates per one cubic meter of air, over a one hour period (NRT 1995). This level is much more conservative than the present legal requirement set at 150 microgram of particulates in a cubic meter of air, but averaged over 24 hours. In the process of adopting in-situ burning, the different regions around the country adopted the NRT's recommendation for a health-protective particulate level of concern.

Monitoring and modeling the smoke plume

The easiest and simplest way to monitor the smoke plume is by visual observation, which provides useful information on the plume direction and behavior. However, to try and assess the smoke component in the plume, instruments tethered from a blimp collected data on gases and particulate composition and concentration, while remote controlled helicopters took samples in the smoke, and a Light Detection and Ranging (LIDAR) instrument, which uses laser beams to detect particulate concentration in the plume was used from an aircraft in several test burns (Fingas 1994). These methods were very useful in providing information on the smoke

composition and component concentrations, but they can't be used on a real-time basis to provide immediate feedback during the burn itself.

Real-time aerosol monitors are now available. They are small and portable, may be carried by hand and in a helicopter, and are easy to operate. Since they count particles by light scattering, their output is not as accurate as more traditional methods that weigh the particulates as they accumulate on a filter media. However, these instruments may provide useful real-time feedback during in-situ burning operations if population exposure to the smoke plume becomes an issue.

Modeling is another approach to estimating the concentration of particulates in the plume. Several models were developed, including a relatively simple model developed by NOAA, and ALOFT, a complicated model developed by the National Institute of Standards and Technology. Using information available on atmospheric conditions, burn parameters, and even terrain characteristics, this model, which is now available for use on a powerful PC, can predict the plume behavior and both ground and plume particulate concentrations over distance. The model has been used for several test burns, and was found to be reasonably accurate. Models are particularly useful for planning purposes and for situations in which direct air sampling is not possible.

Environmental Concerns

Burn residue

Generally, the composition of burn residue is similar to that of the original oil. The difference is that the residues have less volatile hydrocarbons with low boiling points, and are denser and more viscous than unburned oil.

Experience has shown that the burn residues may either float or sink. In a controlled test burn during the *Exxon Valdez* spill, an estimated 15,000 to 30,000 gallons of Prudhoe Bay crude oil were burned. Following this burn, about 300 gallons of “stiff, taffy-like burn residue that could be picked up easily” remained (Allen 1990).

During the 1991 explosion and burning of the tanker *Haven* off Genoa, Italy, burn residues sank. Reliable estimates of the amount of oil actually burned were not possible, but the tanker was laden with 141,000 tons of Iranian heavy crude, and very little remained in the wreck following the accident and fire. Moller (1992) reported that several 1991 surveys confirmed that there was sunken oil offshore and along the coast.

In other cases, the residues stay afloat while warm, but sink as they cool off. In a series of test burns in Prudhoe Bay, Alaska using Alaska North Slope crude,

it was found that, as the residues cooled, some of it sank (Buist 1995). The sunken residues formed a brittle solid, while the residues that stayed afloat were semi-solid tar. It seems, therefore, that prompt collection of the residues can at least in some cases prevent the residues from sinking.

Direct temperature effect

Burning oil on the surface of the water could adversely affect those organisms at or near the interface between oil and water, although the area affected would presumably be relatively small. Observations during large-scale burns using towed containment boom did not indicate a temperature impact on surface waters. Thermocouple probes in the water during the Newfoundland test burn showed no increase in water temperatures during the burn (Fingas 1994). It appears that the burning layer may not remain over a given water surface long enough to change the temperature because the ambient-temperature seawater is continually being supplied below the oil layer as the boom is towed.

Water-column toxicity

Environment Canada coordinated a series of studies to determine whether in-situ burning caused water-column toxicity beyond that attributable to allowing the slick to remain on the surface of the water. While these studies centered on the Newfoundland in-situ burn field trials conducted in August 1993, they also included laboratory tests to investigate potential effects in a more controlled environment (Daykin 1994).

Results from the laboratory and field studies indicated that, although toxicity increased in water samples collected beneath oil burning on water, this increase was generally no greater than that caused by the presence of an unburned oil slick on water. Chemical analyses performed along with the biological tests reflected low hydrocarbon levels in the water samples.

Effect on surface microlayer

The surface of the water represents a unique ecological niche called the “surface microlayer,” which has been the subject of many recent biological and chemical studies. The microlayer, often considered to be the upper millimeter or less of the water surface, is habitat for many sensitive life stages of marine organisms, including eggs and larval stages of fish and crustaceans, and reproductive stages of other plants and animals. It is known that cod, sole, flounder, hake, anchovy, crab, and lobster have egg or larval stages that develop in this layer.

There is little doubt that in-situ burning would kill the organism in the area of the burn. However, when considering the small area affected by in-situ burning, the rare nature of this event, and the rapid renewal of the surface microlayer from adjacent areas, the long-term biomass loss is negligent (Shigenaka 1993).

Birds and mammals

In the wake of a major oil spill, any spill response method that would prevent the oil from spreading and impacting large areas is clearly advantageous for birds and mammals. During the *Exxon Valdez* spill thousands of birds were killed by the oil spreading hundreds of miles away from its source. Based upon our limited experience, birds and mammals are more capable of handling the risk of a local fire and temporary smoke plume than of handling the risk posed by a spreading oil slick. Birds flying in the plume can become disoriented and could suffer toxic effects. This risk, however, is minimal when compared to oil coating and ingestion, the result of birds' exposure to the oil slick.

The effect of in-situ burning on mammals is yet to be seen. It is not likely that sea mammals will be attracted to the fire, and the effect of smoke on marine mammals is likely to be minimal. Mammals, on the other hand, are adversely affected by oil ingestion and oil coating of their fur. Therefore, reducing the spill size by burning the spilled oil can reduce the overall hazard to mammals.

Once coated by oil, neither birds nor mammals have responded well to rehabilitation efforts, and although much has been learned and rehabilitation methods have greatly improved, the success rate of wildlife rehabilitation has been moderate at best.

Burning vs. Evaporation

Leaving the oil untreated has a deleterious effect on air quality. Spilled oil left untreated would evaporate at a rate that depends upon the type of oil, time elapsed from release, wind, waves, and water and air temperatures. The amount evaporated is substantial. The ADIOS oil behavior model developed by NOAA predicts that 33% of spilled Alberta Sweet crude would evaporate after 24 hours in 70˚F water and 10 knot wind, and after five days 43% would have evaporated. This evaporation pattern, similar in other oil types, emphasizes the need for quick action if in-situ burning is selected as the response tool.

The decision of whether to burn involves a tradeoff: burning the oil would reduce or eliminate the environmental impact of the oil slick and convert most of the oil to carbon dioxide and water. Burning, however, would generate particulates and cause air pollution. Not burning the oil would enable the slick to spread over a large area and affect the environment. Particulates would not be produced, but up to 50% of the oil would evaporate, causing a different kind of air pollution.

Waste generation

Review of the environmental impacts would not be complete without considering the waste an oil spill can potentially generate. It was estimated that 350 miles of sorbent boom was used during the first summer of the *Exxon Valdez* cleanup (Ferriere 1993), more than 25,000 tons of sorbent material of all kinds was sent to landfills, and oily water twice the volume of the oil spilled (from skimming a fraction of the oil) had to be treated (Fahys 1990). Enough energy was used that summer to support the energy needs of 11,000 people, power 1,300 boats of all sizes, and provide hot water equal to the needs of a city of 500,000 people (Ferriere 1993).

In-situ burning of oil is going to generate waste. Even the most efficient burning will leave a taffy-like residue that will have to be collected and treated or disposed of. Burning the oil at sea will not be as efficient as burning it in engines, furnaces, or power plants, and will generate a substantial amount of particulates. However, by minimizing the solid and liquid waste generated by beach cleanup, and by reducing the energy required to support the response operation, burning even some of the oil at sea is likely to reduce the overall waste generation of a spill.

Summary

Like any spill response method, in-situ burning can offer important advantages over other response methods in specific cases, and may not be advisable in others, depending upon the overall mix of circumstances.

Pros:

- In-situ burning can potentially remove large quantities of oil from the surface of the water with a relatively minimal investment of equipment and manpower.

- Burning may offer the only realistic means of spill response where logistics and environmental conditions preclude other options, such as spills in ice-covered water.

- In-situ burning may prevent or significantly reduce the extent of shoreline impacts, including exposure of sensitive natural, recreational, and commercial resources.

- Burning rapidly removes oil from the environment, particularly when compared to shoreline cleanup activities that may take months or even years.

- In-situ burning reduces storage and disposal requirements by converting the oil to gases and particulates that naturally disperse in the atmosphere. Residues left at the end of the burn need to be collected and disposed of, but they represent a small fraction of the initial oil volume.

- In-situ burning is versatile. It may be conducted on open water, ice-covered water, on rivers, on wetlands and marshes, and on dry land.

Cons:

- The method generates large quantities of highly visible smoke that may adversely affect human population downwind.

- In-situ burning pose risks to response personnel, and requires training, communication, and coordination.

- Burn residues may sink and affect natural resources. The longer-term effects of burn residues on exposed populations of marine organisms have not been investigated. It is not known whether these materials would be significantly toxic in the long run

- In-situ burning can be done only over a short period of time following a spill. It requires fast action and response. Furthermore, in-situ burning can be done only in relatively calm weather.

- As of this writing, all the booms currently tested have suffered from flaws. A sturdy, long lasting, effective, and relatively inexpensive fireproof boom is not yet available.

References

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MEADOWBANK GOLD PROJECT

Spill Contingency Plan

Meadowbank Mine Site

All Weather Private Access Road (AWPAR)

Baker Lake Facilities

In Accordance with Water License 2AM-MEA0815

Prepared by:
Agnico Eagle Mines Limited – Meadowbank Division

Version 4
November 2013

EXECUTIVE SUMMARY

This document presents the Spill Contingency Plan for Agnico Eagle Mines Limited (AEM) Meadowbank Mine Site, All Weather Private Access Road (AWPAR) and Baker Lake Facilities, which is a requirement of the Meadowbank Gold Project Type A Water License No. 2AM-MEA0815 issued on June 09, 2008. The Spill Contingency Plan (SCP) designates lines of authority, responsibility, establishes proper reporting and details plans of action in the event of a spill. This plan applies to the operational phase of the mine and is applicable to all AEM employees and any contractors associated with the project located at latitude 65°01'52"N longitude 96°04'22"W approximately 70 km north of Baker Lake in Nunavut including the Baker Lake Marshalling Facilities located at latitude 64°18'36"N and longitude 95°58'04"W and the AWPAR.

IMPLEMENTATION SCHEDULE

As required by Water License 2AM-MEA0815, Part B, Item 16, the implementation schedule for this Plan is effective immediately (November 2013) subject to any modification proposed by the NWB as a result of the review and approval process.

DISTRIBUTION LIST

AEM - Environmental Superintendent

AEM – General Mine Manager

AEM – Engineering Superintendent

AEM – Health and Safety Superintendent

AEM – Geology Superintendent

AEM – Mill Superintendent

AEM – Maintenance Superintendent

AEM – Mine Superintendent

AEM – Site Services Superintendent

AEM – General Services Superintendent

DOCUMENT CONTROL

Version	Date (YMD)	Section	Page	Revision
1	08/08/08			Comprehensive plan for Meadowbank Mine Site, Exploration Camp and Baker Lake Facilities
2	11/12/04			Update of Contacts, Spill management materials, include AWPAR map and Spill KIT Location Map
3	12/07/25			Update of the hazardous materials stored on site
4	2013/11			Comprehensive revision and update with info for Baker Lake Jet-A Tank

Prepared By: _____

Jeffrey Pratt
Environmental Coordinator

Approved By: _____

Kevin Buck
Environmental Superintendent

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SECTION 1 • INTRODUCTION

1.1 PURPOSE AND SCOPE OF THE SPILL CONTINGENCY PLAN

The overall purpose of creating a spill contingency plan is to minimize the impacts of spills by the establishment of predetermined lines of response and plans of action. This plan has been designed to facilitate effective communication and the efficient clean-up of spills from potentially hazardous materials. These materials include:

- Hydrocarbon liquids such as diesel fuel, aviation fuel (Jet-A), gasoline, hydraulic oil;
- Soluble solids such as ammonium nitrate prill;
- Soluble liquids, such as glycols, acids, paints; and
- Corrosive liquids such as sulphuric acid and sodium cyanide.

More specifically the objectives of this Spill Contingency Plan (SCP) are to:

- Identify roles, responsibilities, and reporting procedures;
- Provide readily accessible emergency information to the cleanup crews, management, and government agencies;
- Comply with federal and territorial regulations and guidelines pertaining to the preparation of contingency plans and notification requirements;
- Promote the safe and effective recovery of spilled materials; and
- Minimize the environmental impacts of spills to water or land.

This plan has been prepared in accordance with the following reference documents:

- Indian and Northern Affairs Canada (INAC) 2007. *Guidelines for Spill Contingency Planning;*
- Government of Nunavut (GN), *Contingency Planning and Spill Reporting in Nunavut. A Guide to the New Regulations;*
- Government of Nunavut (GN) 2002, *Guideline General Management of Hazardous Wastes in Nunavut; and*
- Northwest Territories Resources Wildlife and Economic Development Environmental Protection Service. 1988. *Spill Contingency Planning and Reporting Regulations.*

SECTION 2 • PROJECT DESCRIPTION

The Meadowbank Gold Project, operated by Agnico Eagle Mines Limited, is located approximately 70 km north of the Hamlet of Baker Lake in Nunavut. The project is located on Inuit Owned surface lands (IOL BL-14) and has the following coordinates:

Latitude: 65°01'52"N
Longitude: 96°04'22"W
NTS map sheet 66H/1

Meadowbank Project components include marshalling facilities in Baker Lake, the 110 kilometer All Weather Private Access Road (AWPAR) from Baker Lake and the Meadowbank mine site (Figure 7). The Meadowbank mine site consists of the process plant, landfarm, sewage treatment plant, water intake, accommodation buildings, power plant, tank farm, warehouse, truck shop, emulsion plant, open pit (Figure 1) and Vault area (Figure 2). The Baker Lake Marshalling Area consists of a laydown transfer area to temporarily store materials prior to the delivery to the Meadowbank mine site. The Baker Lake fuel farm consists of six (6), ten (10) million liter tanks for diesel fuel, within secondary containment, (Figure 3) and twenty (20), 100,000L double walled tanks, within secondary containment, for aviation fuel (Figure 4). The fuel is delivered in bulk by sealift to the fuel farm. From there, fuel is hauled to the Meadowbank mine site by contractor tanker trucks on the AWPAR. Diesel fuel coming from the Baker Lake Tank Farm is stored at the Meadowbank site into a single 5.6 million liter tank, within secondary containment, and the aviation fuel into two (2) – 50,000L double walled tanks at the airstrip. From there, the diesel is redistributed into different storage tanks by an on-site tanker to mine site fuel tanks and Vault fuel storage tanks. Fuel storage locations have been designed to meet the CCME guidelines for Aboveground Storage Tank Systems Containing Petroleum and Allied Petroleum Products.

Emergency spill response equipment (i.e. spill kits) is installed at each fuel storage location. Spill kits contain the appropriate type, size and quantity of equipment for the volume and type of product present at the storage location. Transport trucks, heavy equipment and light vehicles are all equipped with spill kits.

Construction at the mine site began with the issuance of the Type A Water License and other pertinent authorizations in July 2008 with operations commencing in January 2010.

2.1 PREVENTION AND INSPECTIONS

The first step in spill contingency planning is to take actions to prevent spills from occurring. Transport, transfer and storage of materials are performed by trained personnel using secondary containment, with well-maintained equipment and containers. Refueling stations in Baker Lake and at the mine site are equipped with a lined area to contain any minor leaks or spills while refueling. Transfer of fuel from tanks to tanker trucks are performed with the aid of fuel pumps. Good housekeeping practices are adopted especially in areas such as storage facilities, loading and unloading zones. Site orientations are conducted with all employees and spill prevention and response is discussed in detail. Regular worksite inspections are conducted to identify measures to minimize the risk of spills. All personnel are trained to be aware of the potential hazards associated with the fuel/chemicals with which they are assigned to work. In addition to work site inspections conducted by area specific employees, the Environmental Department conducts weekly inspections to audit facilities handling or storing hazardous materials (Appendix A).

AEM supports the following general principles for spill prevention:

- Provide up to date and accessible Material Safety Data Sheets (MSDS) for all hazardous materials;

- Daily inspections fuel/chemical storage areas for leaks (including flex connectors and plumbing) and platform shifting;
- Daily inspections of hazardous materials storage areas;
- Train workers in the use of safe work procedures for hazardous materials, and procedures to clean up spills;
- Encourage workers to take reasonable measures to prevent spills;
- Keep drums/containers sealed or closed;
- Place drums/containers within a suitable form of secondary or spill containment;
- Keep “overpack” or “salvage” drums nearby to contain leaking drums;
- Keep storage areas secure from unauthorized access;
- Segregate incompatible materials;
- Ensure chemical storage areas are adequately protected from weather and physical damage; and
- Provide adequate spill response materials at storage areas (details of spill response equipment are outlined in Section 8).

Figure 1 : Layout Meadowbank Mine Site

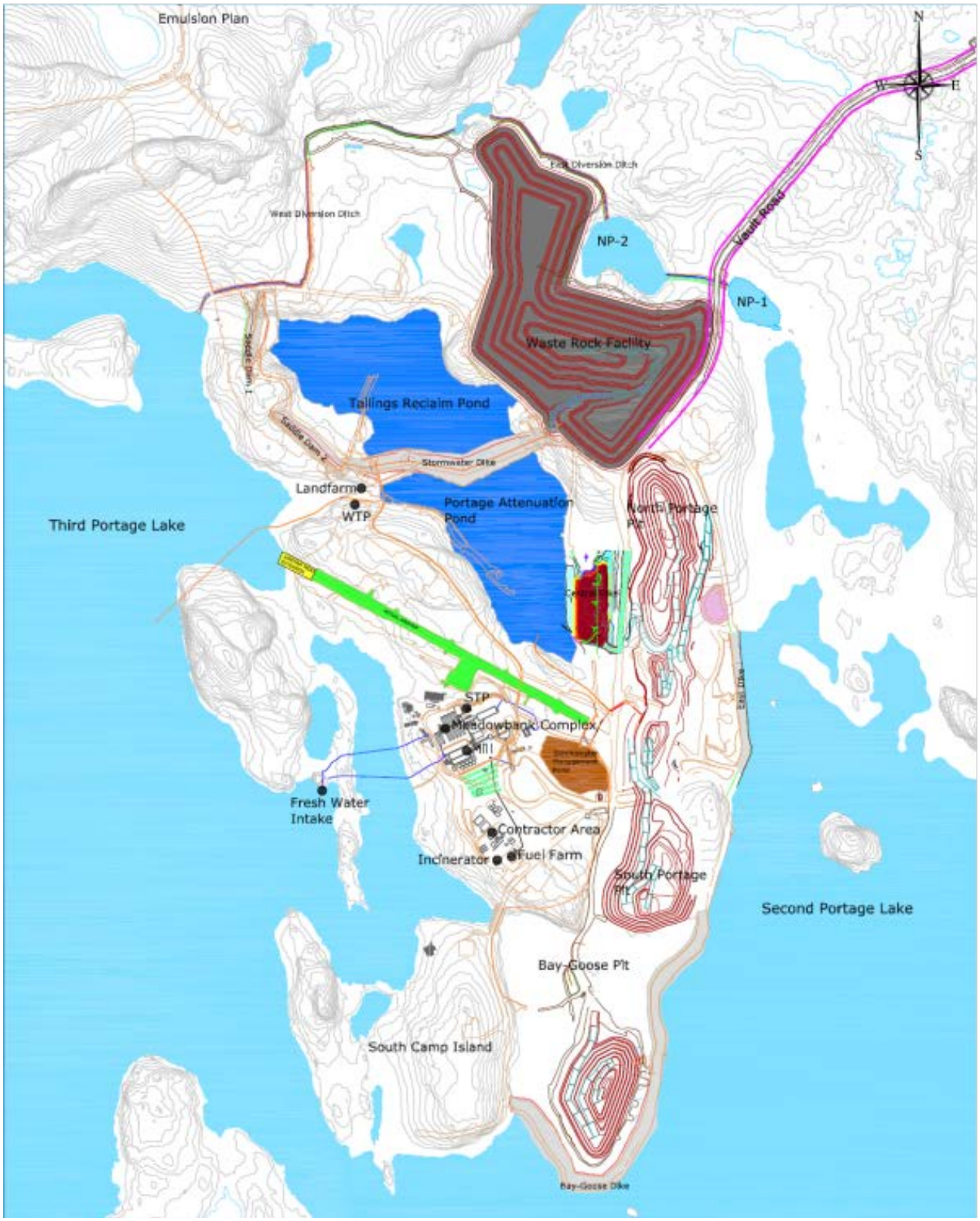


Figure 2 : Layout Vault

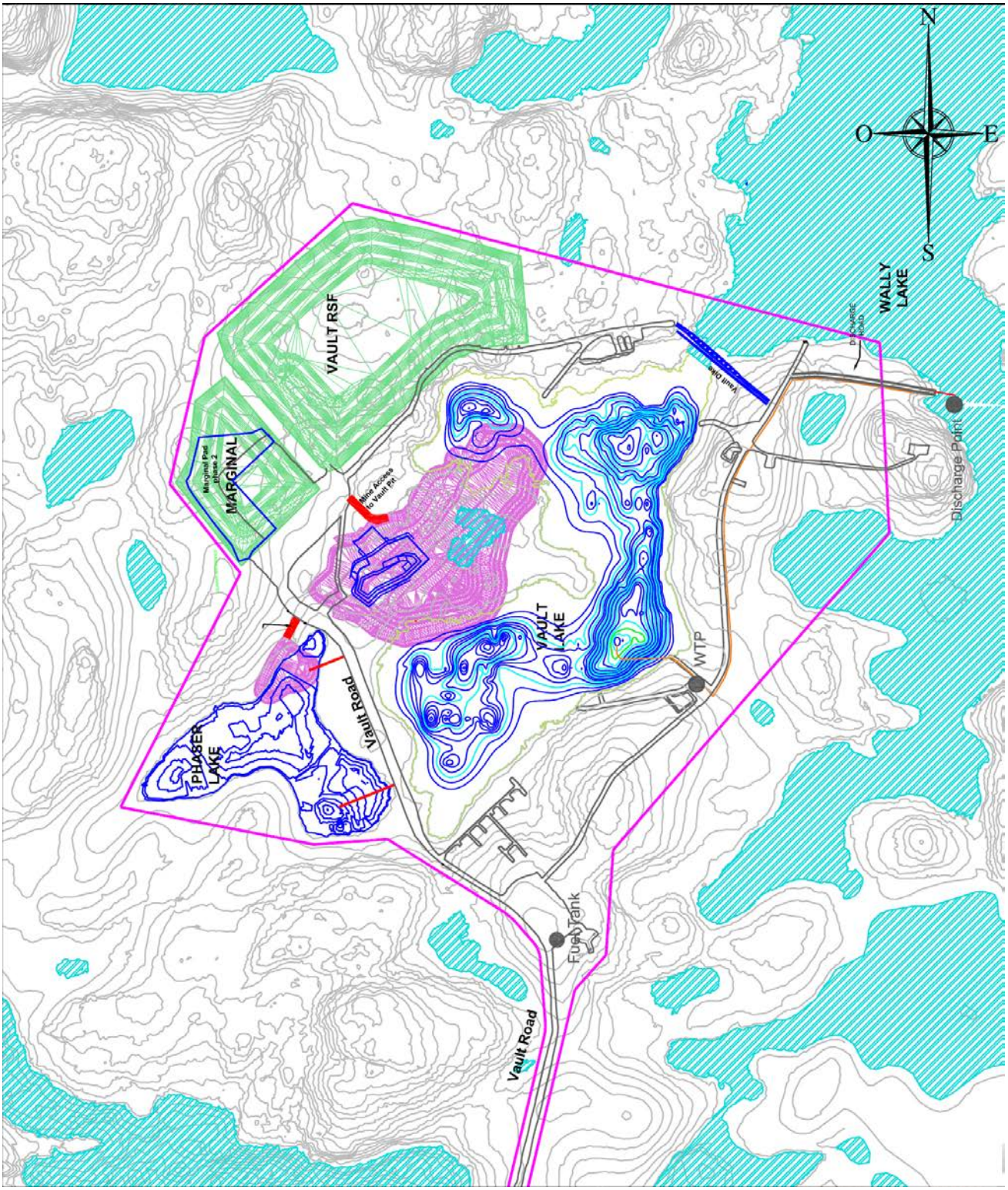
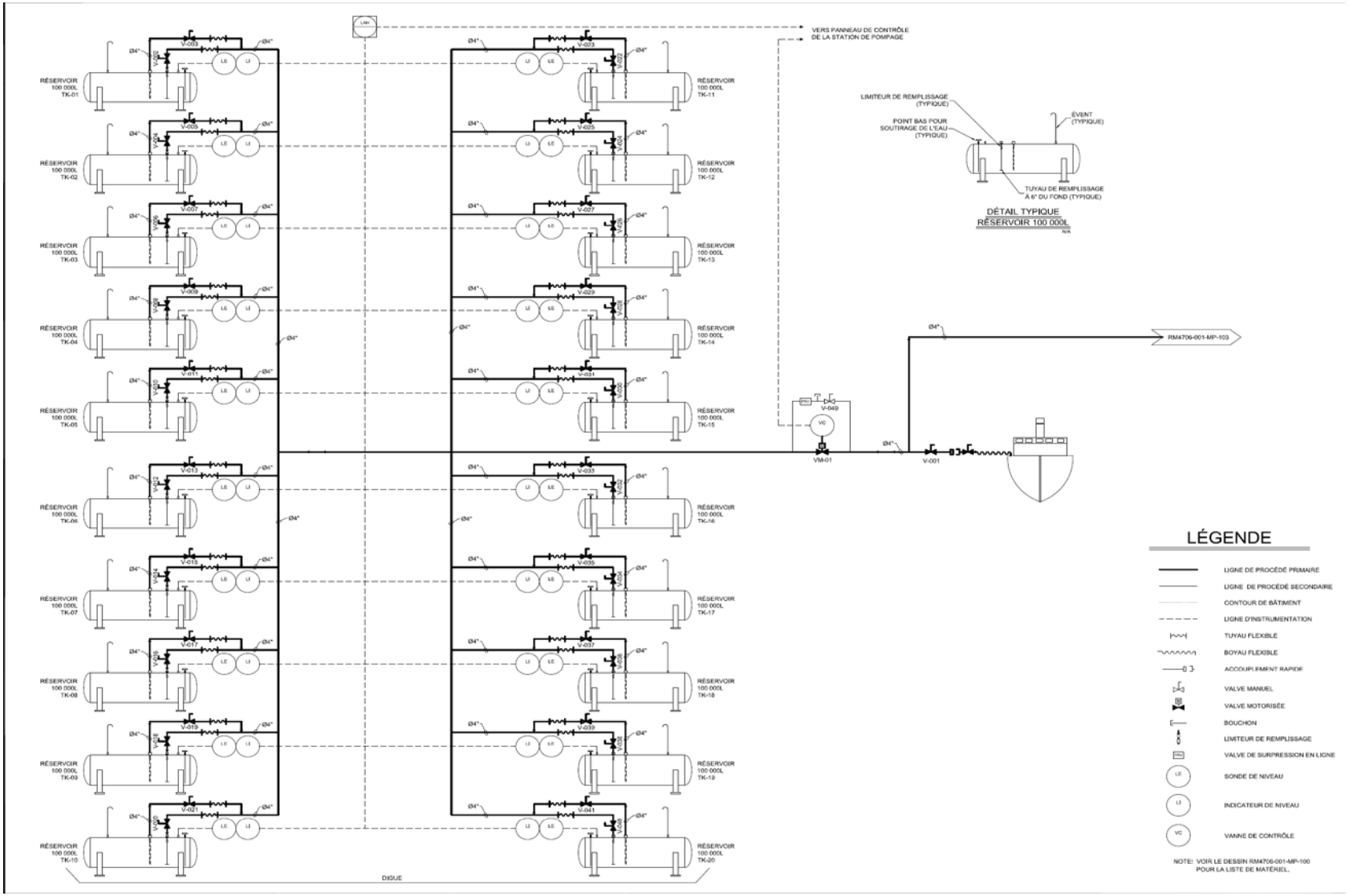


Figure 3 : Baker Lake Diesel Fuel Tank Farm

Figure 4 : Baker Lake Jet-A Fuel Tank Farm



SECTION 3 • DEFINITIONS

3.1 WHAT IS A SPILL?

For the purposes of this plan, a major spill is defined as an accidental release of product into the environment that has the potential for adverse impact. The emergency response team (ERT) must be notified immediately of a major spill or emergency. A tanker truck overturn on the AWPAR is considered as a major spill for the purpose of this plan and Section 7 provides response procedures for an incident of this type. All spills are to be reported to the Meadowbank Environmental Department. Generally, spills inside buildings/structures that are contained and are not likely to impact the external environment are not reportable to authorities and are treated as internal incidents. An AEM Incident Report is still required for internal reporting purposes. If there is doubt about whether a spill or release of a substance inside a building or structure could cause an environmental impact then the incident will be reported as a spill.

A minor spill is defined as any spill that does not involve highly toxic, highly reactive, or explosive chemicals in a situation that is not life threatening or pose a risk of adverse environmental effects. Furthermore, this type of spill presents a manageable physical or health hazard to personnel who, when wearing proper personal protective equipment, will not be exposed to any chemical at a level that exceeds any recognized action level or permissible exposure limit. Minor spills are still to be reported to the Environmental Department but they are not expected to involve emergency responders.

3.2 MATERIALS AND REPORTABLE (TO REGULATORY AUTHORITIES) SPILLS ON SITE

As a precaution, if there is any doubt as to whether the quantity spilled meets the minimum thresholds for reporting to regulatory authorities listed in Table 1, the spill incident will be reported. Furthermore, AEM maintain a detailed log of all spills, reportable to authorities or non-reportable of all materials listed in Section 1.1. As part of AEM's overall environmental management system and in the spirit of a continuous improvement of environmental performance, procedures will be implemented to ensure **all** spills are reported to the Meadowbank Environmental Department.

To ensure compliance with Section 36(3) of the *Fisheries Act* and Section 35 of the *Migratory Bird Regulations* all spills of fuel or hazardous materials, regardless of quantity into a water body (including frozen), shall be reported immediately to the NT-NU 24-HOUR SPILL REPORT LINE (at 867.920.8130).

Table 1 - Spill quantities that must be reported to the NT-NU 24-HOUR SPILL REPORT LINE

Transportation Class	Type of Substance	Compulsory Reporting Amount
1	Explosives	Any amount
2.1	Compressed gas (flammable)	Any amount of gas from containers with a capacity exceeding 100 L
2.2	Compressed gas (non-corrosive, non- flammable)	Any amount from containers with a capacity exceeding 100 L
2.3	Compressed gas	Any amount
2.4	Compressed gas (corrosive)	Any amount
3.1, 3.2, 3.3	Flammable liquid	100 L
4.1	Flammable solid	25 kg
4.2	Spontaneously combustible solid	25 kg

4.3	Water reactant solids	25 kg
5.1	Oxidizing substances	50 L or 50 kg
5.2	Organic peroxides	1 L or 1 kg
6.1	Poisonous substances	5 L or 5 kg
7	Radioactive substances	Any amount
8	Corrosive substances	5 L or 5 kg
9.1 (in part)	Miscellaneous substances	50 L or 50 kg
9.2	Environmentally hazardous	1 L or 1 kg
9.3	Dangerous wastes	5L or 5 kg
9.1 (in part)	PCB mixtures of 5 ppm or more	0.5 L or 0.5 kg
None	Other contaminants	100 L or 100 kg

***Note**: L = litre; kg = kilogram; PCB = polychlorinated biphenyls; ppm = parts per million.*

SECTION 4 • RESPONSE ORGANIZATION

This section addresses the response organization and the responsibilities of each individual during response to an incident.

Figure 5 illustrates AEM's Spill Reporting Procedure in the event of a major spill and Sections 4.1- 4.9 list the major responsibilities of site staff that will be participating in the emergency response management.

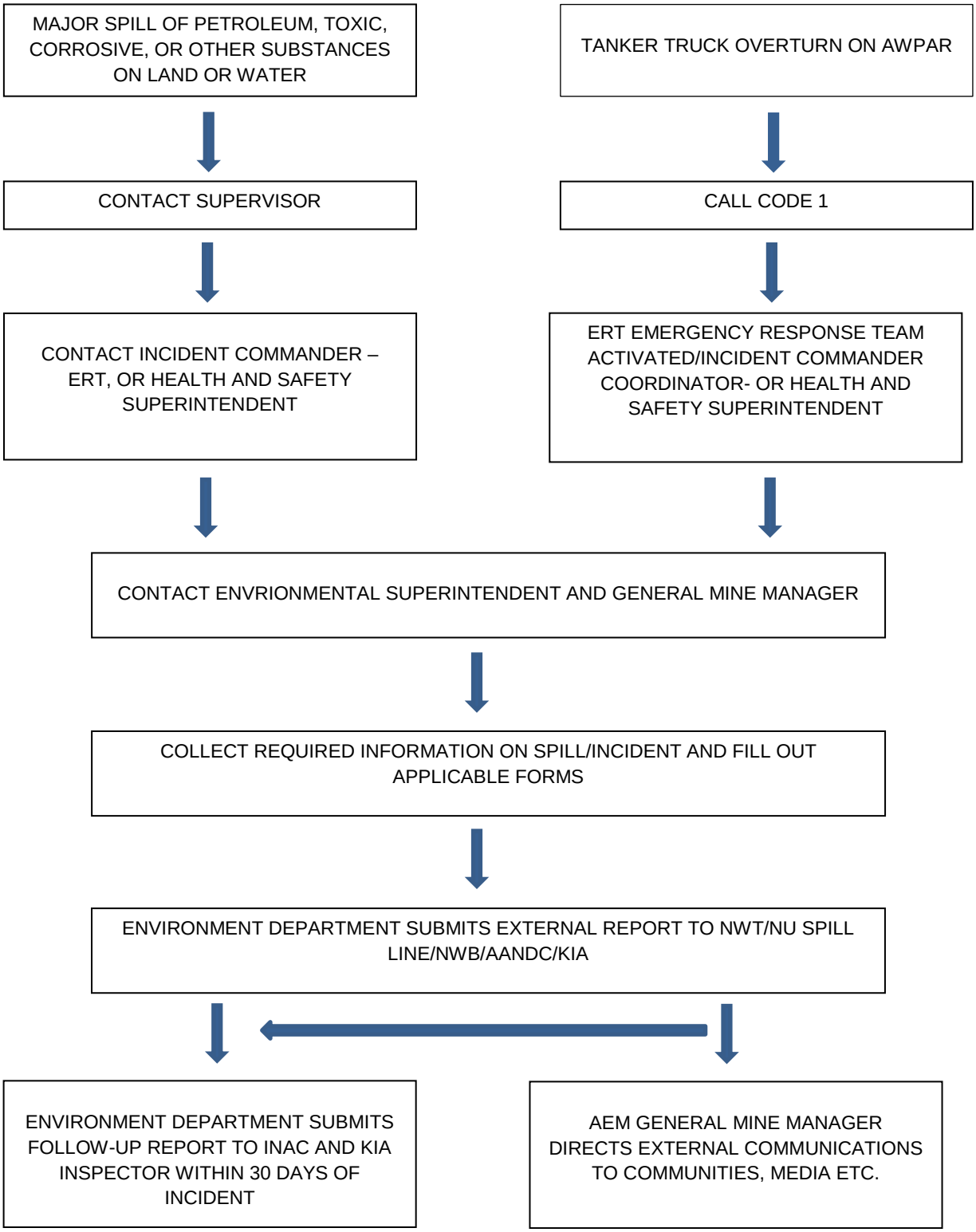
The first person (first responder) to notice, or come in contact with, any spill situation either initiates a Code 1 (for example in the case tanker truck overturn on AWPAR) or reports to his/her immediate supervisor (in the case of all other spills on land or water). The supervisor is responsible to report the incident to the designated Incident Commander for a major spill or to the environmental department for a minor spill. If a Code 1 is initiated, the Incident Commander will respond in conjunction with the ERT. Major responsibilities such as initial coordination, spill clean-up and mobilizing the ERT are part of the Incident Commander's duties.

The Incident Commander will contact the Environmental Superintendent and/or General Mine Manager or alternate, who in turn will inform the Senior Vice President, Environment and Sustainable Development. After all information has been collected, the Environmental Superintendent or alternate will submit a spill report and follow up spill report to the NWT/NU Spill Line, Nunavut Water Board, Kivalliq Inuit Association and Aboriginal Affairs and Northern Development Canada. Incidents that require media communications will be the responsibility of AEM General Mine Manager or alternate.

In the event of a major spill during a ship-to-ship transfer or due to unforeseen circumstances, the shipping company will be the sole proprietor for the spill. The containment and clean-up of inadvertent spills resulting from the tankers in transporting the fuel is the responsibility of the shipping company. In the unlikely event where a major fuel spill becomes unmanageable, the shipping company could call on external resources such as the Canadian Coast Guard for assistance. In these situations, AEM would provide whatever assistance it can to the shipping company[1]. Due to the lack of resources in which Agnico Eagle Mines (AEM) possess to counter act such a large scale marine spill, AEM's assistance would be limited to providing support to preserve the shore line environment. AEM would put its resources to the best use possible during such an event, and assist as much as possible with the resources at hand. The Shipboard Oil Pollution Emergency Plan (SOPEP) (Appendix B) is the responsibility of the shipping company; it covers the ship-to-ship transfer of fuel near Helicopter Island. Please refer to the *Oil Pollution Emergency Plan* for more details. In Appendix C you will find certificate of entry and acceptance boats of shipping company, communication protocol, safety management system for entry into confined water and monthly safety meeting forms.

[1] *The Emergency Response Team will not be equipped or trained to respond to spills offshore in the Marine environment. They will however be able to respond to spills in the near shore area.*

Figure 5 : Major spill/incident reporting procedure



4.1 FIRST RESPONDER

The person who has caused a spill or the first to observe the spill is the first responder. The responsibilities of the first responder are as follows:

- In case of a tanker truck overturn, initiate a Code 1. Remain on radio to provide guidance to the ERT;
- In case of spill to land or water, contact the supervisor to report the incident;
- Identify and contain the spill, IF SAFE TO DO SO; and
- Participate in spill response as a member of the clean-up crew.

4.2 SUPERVISOR

The responsibilities of the Supervisor are as follows:

- Initial assessment of the severity of the incident;
- Contacts the Incident Commander or Environmental Department;
- Gathers facts about the spill; and
- Participate in spill response as a member of the clean-up crew.

4.3 INCIDENT COMMANDER

Responsibilities of the Incident Commander are as follows:

- Assume complete authority over cleanup personnel and the spill scene, as well as assume responsibility for all mitigation efforts;
- Evaluate the initial situation and assess the magnitude of the problem;
- Activates the initial response plan;
- Alert and assemble key personnel in the response team, as deemed appropriate, to handle the situation;
- In consultation with the Environmental Superintendent or designate, develop the overall plan of action for containment and cleanup of the specific incident, as well as direct and implement the plan;
- Ensure assigned responsibilities are carried out and the activities of team members are coordinated;
- Assess the requirements for people, equipment, materials, and tools to contain the spill in light of what resources are immediately available; urgency will depend on the nature of the spill; and
- In consultation with the Environmental Superintendent or designate mobilize any additional resources that may be required and arrange for the transportation of necessary personnel and/or materials to the site.

4.4 EMERGENCY RESPONSE TEAM

AEM has an Emergency Response Team (ERT) that is trained and responsible for controlling the major spills as well as spills from tanker truck overturns along AWPAR, and assisting with medical and other emergencies that may occur at the camp. These team members attend regular training sessions.

4.5 EMERGENCY RESPONSE TEAM COORDINATOR

The responsibilities of the Emergency Response Team Coordinator (ERTC) are as follows:

- Mobilize all ERT personnel, equipment, personal protective equipment and supplies as required to the site of the spill;
- Assist Incident Commander in obtaining any additional resources not available on site;
- Ensure that appropriate PPE is worn properly;
- Assist in developing and implementing emergency response training programs and exercises; and
- Ensure that all spill response personnel receive adequate training to fulfill their responsibilities as part of the ERT.

4.6 ENIVRONMENTAL SUPERINTENDENT OR DESIGNATE

The Environmental Superintendent or designate is responsible for implementing and maintaining the SCP. In addition, the Environmental Superintendent's or designates responsibilities in the case of a spill are to:

- Liaise with the Incident Commander;
- Provide technical advice on the anticipated environmental impacts of the spill;
- Advise on the effectiveness of various containment, recoveries, and disposal options, and suggest the most appropriate approach;
- Prepare and submit any formal reports (see Appendix D for NWT/NU Spill Report Form) to regulators and AEM management detailing the occurrence of a spill;
- Contact the Senior Vice President Environment and Sustainable Development immediately for a major spill;
- Act as the spokesperson with regulatory and government agencies;
- If authorized by the General Mine Manager, act as a spokesperson with the public and media, as required;
- Implement a sampling protocol for the collection and analysis of samples to identify and monitor possible contaminant levels resulting from the spill;
- Ensure on-site resources for spill response and cleanup are available;
- Monitor the effectiveness of the cleanup operation and recommend further work, if necessary;

- Reviews incident occurrences and recommends preventative measures; and
- Assists in implementing training and simulation requirements for spill response personnel.

4.7 GENERAL MINE MANAGER ON DUTY

The General Mine Manager/designate is required to inform team members of the detailed nature of the operations to be performed in the event of a major spill during the operations phase. The responsibilities of the General Mine Manager/designate are as follows:

- Liaise with AEM personnel resources and keep them informed of cleanup activities; and
- Assist the Incident Commander and ERT as needed, particularly in obtaining any additional resources not available onsite for spill response and cleanup.

4.8 HEALTH AND SAFETY SUPERINTENDENT OR DESIGNATE

The following are the responsibilities of the Health and Safety Superintendent or designate in conjunction with the Training Department:

- Maintain emergency and health and safety records;
- Assist in conducting emergency spill response exercises;
- Track all emergency and health and safety training that on-site staff have received, and when retraining will be required;
- Notify the Incident Commander (related to ERT) when retraining is required;
- Ensure that employees are retrained in appropriate emergency response skills, Workplace Hazardous Materials Information System (WHMIS) training, Hazard Communication (HAZCOM), Occupational Health and Safety Administration (OHSA) training, first aid, and respirator fit-testing prior to expiry of existing training certification; and
- Consult with appropriate organizations regarding retraining requirements and schedules.

4.9 ON-SITE HEALTH CARE PROVIDERS

On-site medics are responsible for the following:

- Providing on-site first aid and other medical support; and
- Providing additional training for ERT members.

In addition to the health care providers on site, the Baker Lake Hamlet health professionals will be called first on the scene, if required.

4.10 SPILL RESPONSE TEAM CONTACT INFORMATION

Internal contact information is contained in Table 2 for all AEM personnel involved in spill recovery and subsequent reporting. Table 3 provides contact information for AEM contractors present at the mine site and

transportation contractors. Important external contacts such as regulatory agencies and health organizations are listed in Table 4. Table 5 provides contact information for external contractors should incident warrant assistance from outside sources.

Table 2 - Internal Contacts

Title	Name	Telephone No.
Senior Vice President Environment and Sustainable Development	Louise Grondin	416.847.8656 Cell:819.724.2020
General Mine Manager	Jean Beliveau	867.793.4610 ext.6843 Cell: 819.856.5605
Health and Safety Superintendent or Assistant Superintendent	Normand Ladouceur or Yves Levesque	867.793.4610 ext.6720 Cell: 816.856.6258 or 867.793.4610 ext.6720 Cell: 819.856.9051
Emergency Response Team	Andre Rouleau or Philippe Beaudoin	867.793.4610 ext.6809 Cell: 819.355.2191 or 867.793.4610 ext.6809 Cell: 450.847.4214
Environmental Superintendent	Kevin Buck	867.793.4610 ext.6838 Cell: 819.856.1956
Environmental Coordinator or Environmental Department	Jeffrey Pratt or Environmental Technicians	867.793.4610 ext.6728 or 867.793.4610 ext.6747
Incident Commander	Jeffrey Pratt/ Kevin Buck	867-793-4610 ext.6728
On site Medics	On-site Nurses	867.793.4610 ext.6734 or 6751
Site Security	On-site Security	867.793.4610 ext.6748

Table 3 - Contractor Contacts

Title	Telephone No.
Nolinor Aviation Services	Protocol Agent 867.793.4610 ext. 6808
First Air	867.446.1744
Calm Air	867.793.2873
Dyno Nobel Explosives Ltd.	867.793.4610 ext.6804
Woodward Group of Companies (Shipping)	709.896.2421 or 709.896.6569 (Dennis White)

Table 4 - External Contacts

Organization/Authority	Telephone Number	Fax Number
NT-NU 24-Hour Spill Report Line	867.920.8130 spills@gov.nt.ca	867.873.6924
Workers Safety and Compensation Commission	867.979.8637	867.979.8501
Kivalliq Inuit Association	867.645.5725	867.645.2348
Nunavut Water Board	867.360.6338	867.360.6369
AANDC Inspector	867.975.4548	867.979.6445
Environment Canada, Enforcement Branch	867.975.4644	867.975.4594
Department of Fisheries and Ocean (DFO) – Nunavut Regional Office	867.979.8000	867.979.8039
Manager, Environmental Protection, Government of Nunavut	867.975.7748	867.975.5981
Kivalliq Health Services – Baker Lake (Health Centre)	867.793.2816	867.793.2813
Baker Lake Hamlet Office	867.793.2874	
Baker Lake Fire Emergency	867.793.2900	

Table 5 - External Spill Response Contractor Phone Numbers

Contractor	Telephone No.	Area of expertise
Local		
Baker Lake Contracting & Supplies	867.793.2831	General Contracting and repairs
Peter's Expediting	867.793.2703	Transportation
NWT Ltd (Arctic Fuel)	867.793.2311	Fuel Transportation

SECTION 5 • ACTION PLAN

Spills may be the result of any of the following occurrences:

- Tanks, drums or containers may develop leaks or rupture;
- Failure of equipment such as valves, piping or containment structures;
- Overfilling;
- Improper storage;
- Spills during transfer of fuel, chemicals or waste products; and
- Spills resulting from accidents during transportation.

5.1 INITIAL ACTION

For all spill emergencies, it is required that priority actions be undertaken. These are:

- Respond Quickly;
- Ensure Safety; and
- Report the Spill.

5.1.1 Respond Quickly

- Identify the spilled material;
- Be alert – ensure safety of yourself and others by notifying them of the incident;
- Shut off ignition sources such as vehicles and unplug electrical equipment – NO SMOKING;
- Attend to the injured;
- Assess the severity of the spill; and
- Contact the Incident Commander, identify the location and request assistance as required. Incident Commander will mobilize the Emergency Response Team if required.

The primary form of ensuring safety is by using preventative measures. All personnel who deal with chemicals must have training in first aid and safe materials handling, including the Workplace Hazardous Materials Information System (WHMIS). In addition, regular training updates and site- specific exercises/drills are integral to preventing incidents.

5.1.2 Ensure safety

- Consult the MSDS and Product Guides for further information on the substance;

- Keep people away from spill site;
- Wear appropriate PPE such as impervious clothing, goggles, and gloves when containing the spill;
- Approach spill from upwind IF IT IS SAFE TO DO SO;
- Assess whether the spill, leak, or system failure can be readily stopped or brought under control;
- Stop product flow or leak if possible and IF IT IS SAFE TO DO SO;
- Do not contain compounds (e.g. gasoline, aviation fuel) if vapors might ignite – allow them to evaporate; and
- Depending on the type of compound spilled and IF IT IS SAFE TO DO SO, contain product using booms, berms, absorbent pads, earthen dike, trenches or improvise with materials at hand.

5.1.3 Report Spill

- Obtain all necessary information to complete the spill report form for spills that meet the criteria listed in Table 1. Spills that meet regulatory reporting criteria must be reported to the NWT-NU 24 Hour Spill Line/AANDC/Kivalliq Inuit Association (KIA) and the Nunavut Water Board by AEM Environment Staff. Minor spills that do not meet regulatory reporting criteria must still be reported. This must be done within 24 hours using the AEM internal Spill Report Form.; and
- For spills that meet regulatory reporting criteria, a detailed spill report will be submitted to the AANDC Water License Inspector and the KIA Land's Inspector by AEM Environment Staff no later than 30 days after the initial reporting of the spill. This report will contain the amount and type of spilled product, the GPS location of the spill and the measures taken to contain, cleanup and restore the spill site.

Procedures will vary depending on the season and materials spilled. The MSDS for spilled materials and/or Transport Canada's "Emergency Response Guidebook" must be consulted to ensure that safety procedures are followed. Response procedures specific to spills on land, water, snow and ice are presented in the following sections as general guidelines.

5.2 SPILLS ON LAND

Response to spills on land will include control techniques involving the use of two types of barriers: dikes and trenches. Barriers should be placed down-gradient (down-slope) from the source of the spill, and as close as possible to the source of the spill. Barriers will slow the progression of the material spilled and will also serve as containment to allow for recovery.

Depending on the volume spilled, the site of the spill as well as available material, a dike may be built with soil, booms, lumber, snow, etc. A plastic liner, if necessary, can be placed at the toe of and over the dykes to protect the underlying soil or other material and to facilitate recovery of the material. Dikes will be constructed in such a way as to accumulate a thick layer of free product in a single area (V-shaped or U-shaped).

Trenches are useful in the presence of permeable soil and when the spilled material is migrating below the ground surface. A plastic liner should be placed on the down-gradient edge of the trench to protect the underlying soil. Liners should not be placed at the bottom of the trench to allow water to continue flowing underneath the layer floating oil.

The use of absorbent materials to recover a large volume of spilled liquids such as petroleum based material should be avoided. Large volumes of free-product should be recovered, as much as possible, by using vacuums and pumps, and containerized. Mixtures of water and fuel may be processed through an oil-water separator. However absorbent materials work well for smaller volumes of spilled hydrocarbon based materials such as fuel. Absorbent sheets should be used to soak up residual fuel on water, on the ground (soil and rock), and on vegetation. Peat moss may also be sprinkled on vegetation to absorb films of petroleum products.

5.3 SPILLS ON WATER

Response to spills on water will include procedures that include containment, diversion and recovery techniques. The following elements must be taken into consideration when conducting response operations:

- Type of water body or water course (lake, stream, river);
- Water depth and surface area;
- Wind speed and direction;
- Type of shoreline; and
- Seasonal considerations (open-water, freeze-up, break-up, frozen).

The most common type of spill that could be anticipated is a petroleum hydrocarbon (fuel oil) spill during fuel transfers/transport. Containment of an oil slick in water will require the deployment of mobile floating booms to intercept, control, contain and concentrate (i.e., increase thickness) the floating oil. One end of the boom will be anchored to shore while the other will be towed by a boat and used to circle the oil slick and return it close to shore for recovery using a skimmer. Reducing the surface area of the slick will increase its thickness and thereby improve recovery. Mechanical recovery equipment (i.e., skimmers and oil/water separators) will be mobilized to site if required.

Measures will be taken to protect sensitive and accessible shoreline. The oil slick will be monitored to determine the direction of migration. In the absence of strong winds the oil will likely flow towards the discharge of the lake. Measures will be taken to block and concentrate the oil slick at the lake discharge using booms where it will subsequently be recovered using a portable skimmer, vacuum, or sorbent materials.

In small slowly-flowing rivers, streams, channels, inlets or ditches, inverted weirs (i.e., siphon dams) will be used to stop and concentrate moving oil for collection while allowing water to continue to flow unimpeded. In the case of floating oil, in a stream, heading for a culvert (i.e., at a road crossing) a culvert block will be used to stop and concentrate moving oil for collection while allowing water to continue to flow unimpeded. In both cases oil will then be recovered using a portable skimmer or sorbent materials.

In the case of spills in larger rivers, with fast moving currents, diversion booming will be used to direct the oil slick ashore for recovery. Single or multiple booms (i.e., cascading) may be used for diversion. Typically, the booms are anchored across the river at an angle. The angle will depend on the current velocity. Choosing a section of a river that is both wider and shallower will make boom deployment easier. Diversion booming may also be used to direct an oil slick away from a sensitive area to be protected.

5.4 SPILLS ON SNOW AND ICE

In general, snow and ice will slow the movement of hydrocarbons. The presence of snow may also hide the oil slick and make it more difficult to follow its progression. Snow is generally a good natural sorbent, as hydrocarbons will have a tendency to be soaked up by snow through capillary action. However, the use of snow as a sorbent material will be limited as much as possible. Snow and frozen ground will also prevent hydrocarbons from migrating down into soil or at least slow the migration process. Ice will prevent seepage of fuel into the water.

Most response procedures for spills on land discussed previously may be used for spills on snow and ice. The use of dykes (i.e., compacted snow berms lined with plastic sheeting) or trenches (dug in ice) will slow the progression of the fuel and will also serve as containment to allow recovery of the fuel.

Free-product will be recovered by using a vacuum, a pump, or sorbent materials. Contaminated snow and ice will be scraped up manually or using heavy equipment depending on volumes. The contaminated snow and ice will be placed in containers or within plastic lined berms on land.

5.5 DISPOSAL OF SPILLED MATERIAL

For this section you can refer to the *Landfarm Design and Management Plan.* All contaminated spill pads, and booms are placed within Quatrex bags for shipment to an approved disposal facility. All the petroleum hydrocarbon contaminated soil is placed into the landfarm for treatment. Spills over 100 L of non-petroleum hydrocarbon material (e.g. solvents, glycol) will be placed in drums and stored in the on-site hazardous material area for shipment south to approve facilities during barge season. Spills of non-petroleum hydrocarbon material fewer than 100 L will be placed in the Tailings Storage Facility. For spills fewer than 100 L of petroleum hydrocarbon contaminated snow will be placed in a designated area of the landfarm and treated as contact water after snowmelt. For spills over 100 L of petroleum hydrocarbon contaminated snow will be excavated and stored in labeled drums. After snow melt, the contaminated water will be pumped through the site's oil-water separator (carbon filter) to remove petroleum hydrocarbon residue. The treated water will be sampled per Part F, Item 6 of the NWB Water License, and discharged to the Stormwater Management Pond if criteria are met. If criteria are not met, water will be treated as hazardous material and shipped south. Also, after snowmelt, visible product will be cleaned up with absorbent pads or booms.

SECTION 6 • HAZARDOUS MATERIALS STORED ON SITE

A variety of petroleum products and other hazardous materials will be used as part of the mining operations. Large quantities of petroleum products will be stored at various sites. Explosives will also be stored on site. Other hazardous materials will be used but in smaller quantities. Nonetheless, all these products are considered as potential environmental and safety hazards.

Material Safety Data Sheets (MSDS) of all materials transported, stored and used on-site will be made available at strategic locations near to where hazardous materials or toxic substances are stored or utilized. Appendices E to J provide General Response Procedures for Spilled Chemical Substances.

Table 6 identifies the predominant hazardous materials transported, stored and generated at the site. You can refer to the *Hazardous Materials Management Plan* for more details.

Table 6 - Materials stored at site during operations

Material	Maximum Amount present on Site	Maximum Amount transported per unit	Storage Location
Acetylene	500 cylinders	300 cylinders per sea can	Inventory Lay down
Activated Carbon	350 Mt	10 Mt per sea can	Inventory Lay down and Process Plant lay down
Ammonium Nitrate	10 000 Mt	20 Mt per sea can	Emulsion plant
Ammonium Nitrate Fuel Oil (ANFO)	Manufactured on demand	20 000 kg per truck	Emulsion plant
Motor Oil	Estimated at 800 000L	20 800L per sea can	Inventory Lay down, garage
Trojan Boosters (Blasting Systems)	34 000 kg	15 Mt per sea can	Emulsion plant
Borax, Anhydrous	7 500 kg	3 375 kg per sea can	Inventory Lay down and Process Plant lay down
Calcium Chloride	600 000L	10 000L per sea can	Inventory Lay down
Calcium Hydroxide	NOT IN INVENTORY		Inventory Lay down
Calcium Oxide	NOT IN INVENTORY		
Calcium Peroxide	NOT IN INVENTORY		
Carbon Dioxide	10 cylinders	10 cylinders per sea can	
Copper Sulphate	500 Mt	20 Mt per sea can	Inventory Lay down and Process Plant lay down
Diesel Fuel	5.5 million Liters	40 000L per tanker	Tank farm
Dyno Split (Detagel)	135 000 kg	15 Mt per sea can	Emulsion plant

Nonel EZTL	1 400 kg	15 Mt per sea can	Emulsion plant
Nonel MS	1 800 kg	15 Mt per sea can	Emulsion plant
Ethylene Glycol	60 000L	10 000L per sea can	Inventory Lay down
Ferric Chloride Hexahydrate	NOT IN INVENTORY		
Ferric Subsulfate Solution	NOT IN INVENTORY		
Hydrofluoric Acid	NOT IN INVENTORY		
Hydrogen Peroxide	NOT IN INVENTORY		
Jet A Fuel	50 000L	11 000L Tanker	Tank, tarmac
Lead Acid Batteries	500L	500L per sea can	Warehouse
Magnafloc 10 (Flocculant)	300 Mt	15 Mt per sea can	Inventory Lay down
Nitric Acid	120 000L	8 000L per sea can	Inventory Lay down
Portland Cement	3 500 Mt	20 Mt per sea can	Dyke and Construction lay down
Sodium Cyanide	1 300 Mt	19 Mt per sea can	Inventory Lay down and Process Plant lay down
Sodium Hydroxide	10 kg	10 kg in sea can	Warehouse
Sodium Nitrate	10.2 Mt	5.1 Mt per sea can	Inventory Lay down
Sulfur	4 600 Mt	20 Mt per sea can	Inventory Lay down Process Plant lay down Quarry 1
Unleaded Gasoline	50 000L	40 000L tanker	Tank farm
Varsol	4 000L	2000 L per sea can	Inventory Lay down

SECTION 7 • POTENTIAL SPILL ANALYSIS

In order to prepare for emergency spill response, potential spill analysis was conducted and on various worst case scenarios. The exercise serves to identify potential risk areas, as well as to determine the fate of spilled products and their environmental effects. One potential scenario was identified for the Meadowbank Gold Project:

- Road between Baker Lake and the Meadowbank Mine Site – spill contents of a tanker truck into water body.

Scenario #1: Road Accident Tanker Truck Spill on AWPAR

Description of incident: Spill of the contents of a fuel tanker to the ground or water during transport from the Baker Lake to the Meadowbank Mine Site.

Potential causes: Vehicle accident, human error, mechanical failure

Hazardous products spilled: Diesel fuel, aviation fuel

Maximum volume spilled: 40,000 litres

Immediate receiving medium: Stream, river or lake

Distance and direction to nearest receiving body of water: N/A

Resources to protect: Streams, rivers and lakes

Estimated emergency response time: Maximum time is 90 minutes depending on location of spill (assuming truck driver is injured and cannot commence spill response procedures). Minimum time to respond to a spill on the AWPAR is 15 minutes.

Spill response procedures: Contain and recover oil slick downriver as described in Section 5.3, protect shorelines using sorbent booms. Collect free-product for temporary storage. Clean-up soiled shorelines. If the response crew arrives before the complete spill, seal the leak where feasible, contain and recover oil spill on ground using dykes, sumps or trenches as described in Section 5.2. Also if the truck driver is not injured, he will act as a first responder and immediately initiate the spill contingency plan as defined in Section 5 using the spill kit kept in the fuel trucks.

SECTION 8 • RESPONSE EQUIPMENT

8.1 GENERAL EQUIPMENT

This section addresses the emergency response machinery, equipment, tools and other resources that will be made available on-site for spill counter measures.

Mobile Equipment available to AEM, that will be used for spill contingency include:

- Graders
- Cranes
- Snowmobiles
- Vacuum Truck
- Loaders
- Backhoe
- Bulldozer
- Forklift
- Water Trucks
- Excavators
- Winch Trucks
- Pickup Trucks
- Generator Sets
- Fire Truck
- Aluminum Boats
- Fuel Trucks
- Bobcat
- Haul Trucks
- Snow Cat

If required, additional equipment on site will be made available to assist with spill recovery.

Temporary containment systems are also available on site and include:

- Booms
- Drums
- Tanks
- Tailings Pond
- Spill absorbent material packages/pads
- Silt fencing
- Maritime Barrier

Emergency transportations that will be used under an emergency situation are:

- Aircraft (fixed wing or helicopter)
- 4-wheel drive vehicles
- Snowmobiles
- Boats
- Tundra Buggy

Communication equipment on site includes radios, telephones, faxes and other wireless communication systems that will be used in the event of an emergency situation.

Spill Response kits are strategically located where required (Figure 6). Each department and work area is responsible for providing sufficient spill response kits in their respective work areas. The kits are kept in marked and accessible locations. The locations include all fuel storage areas, chemical storage areas and so on.

All of the mobile equipment on site (heavy equipment) contains an emergency spill kit.

An Environmental Emergency Trailer which is easily accessible and mobile is located on site which contains the following items:

- Pump Elastec
- Pump accessories
- Vaccum ends
- 45 gallons top
- Tubing 2 inches diameter
- Tubing 3 or 4 inches diameter
- Diesel Fuel jerry can (place on a miniberm)
- Spill kit accessory (red box)
- Drums opener
- Wescot (to open empty drum screw)
- Empty drums
- 2 drums berm
- 4 drums berm 4x8
- Tarp 20x30
- Tarp 30x50
- Oil white spill pads
- Universal boom 5x10
- Universal boom 8x10
- ABS pipe : 10' (4")
- ABS pipe : 10' (6")
- Cell U-Sorb
- Sphagsorb
- 3 Size of Wedge wood
- Plug pattie
- Quattrex bags
- Hand shovel
- Ice braker chisel
- Sledge hammer
- Rod bar (4')

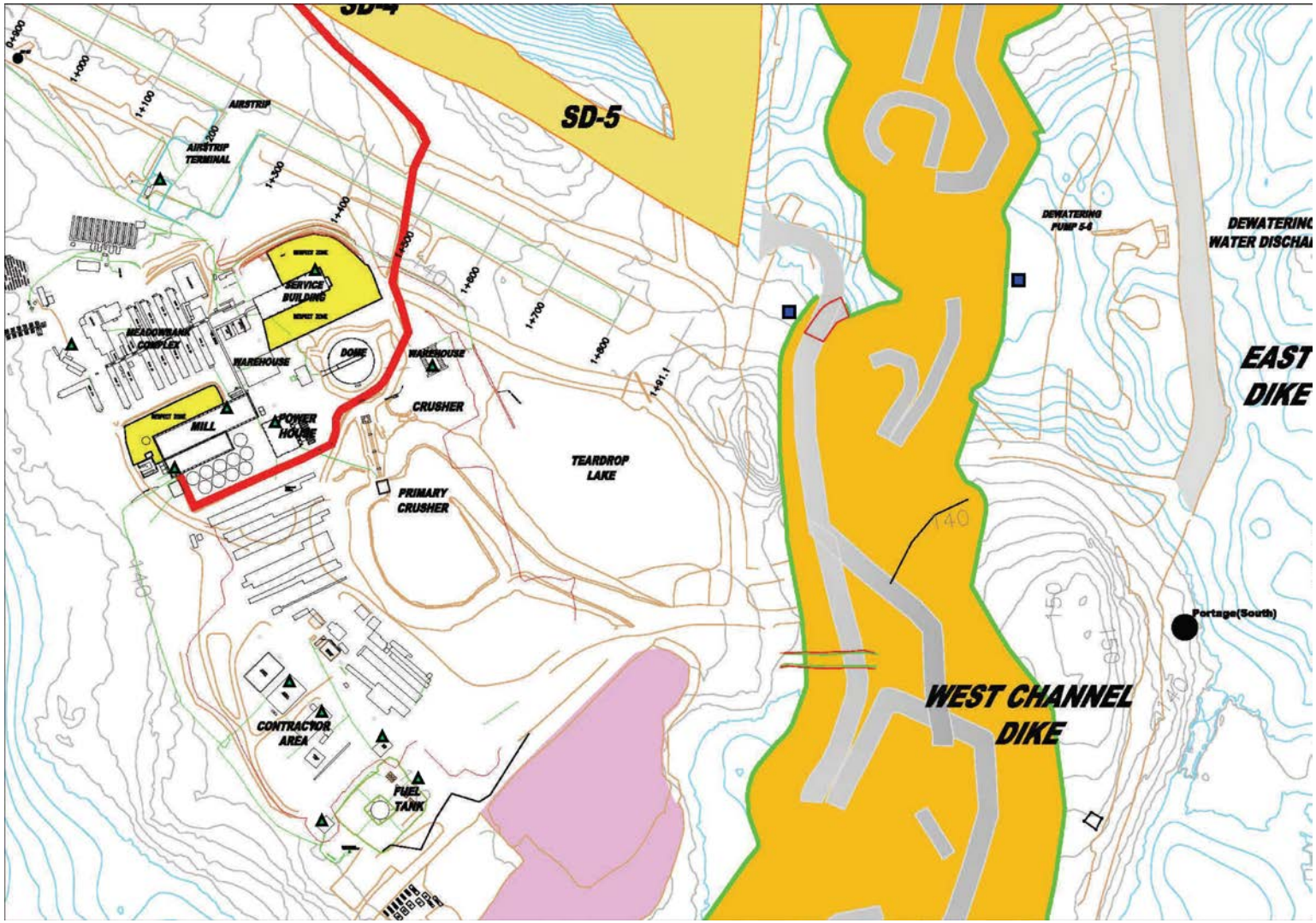
Along the AWPR there are 9 environmental emergency sea cans. These sea cans are strategically placed along the road at water crossings (Figure 7). Each environmental emergency sea can contains the following material:

- Empty drums (Sealed)
- Mini berm 36"x36" x4'
- 4 drum spill berm 4x8
- Tarp 20'x30'
- Tarp 30'x50'
- Oil white spill pads
- Universal boom 5"x10' (Chemical)
- Universal boom 8"x10' (Chemical)
- Oil only booms 5"x10' (Hydro-carbons)
- Maritime barrier (Baffle)
- ABS pipe : 10' (4")
- Cell U-Sorb
- Amerisorb peat moss

- Oil gator absorbent
- Plug pattie
- Quattrex bags
- Fork lift crate (pallets)
- Long handle round point shovel
- Chisel point crow bar 16 lbs 57"
- Ice braker chisel
- Sledge hammer 12 lbs 36"
- Rod bar (4')

If required, external resources are available in the Hamlet of Baker Lake and those contacts are found in Table 5.

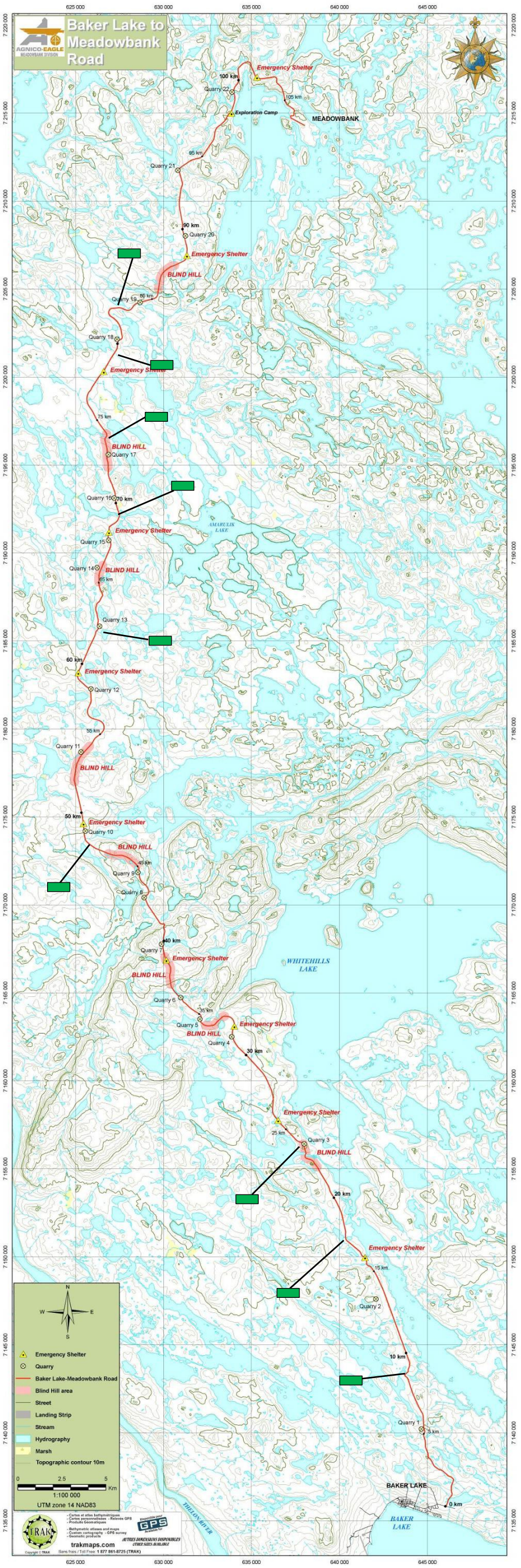
Figure 6 : Spill Response Equipment Location



Spill Kits

Large Spill Kits for Mine Ops

Figure 7 : Map of AWAPR Including Locations of Environmental Emergency Sea cans



SECTION 9 • TRAINING & EMERGENCY SPILL/EXERCISE

9.1 TRAINING

9.1.1 On-site Personnel

A designated ERT consisting of on-site personnel has been established. AEM will ensure that the ERT is trained and present for major spill response at all times. All members of the team are trained and familiar with emergency and spill response resources, including their location and access, the SCP, and appropriate emergency spill response methodologies. The ERT has up to 40 members, each of whom train 8 hours per month.

The following training is included:

- A review of the spill response plan and responsibilities of the ERT members;
- The nature, status, and location of fuel and chemical storage facilities;
- The on-site and off-site spill response equipment and how to use it;
- Emergency contact lists;
- Desktop exercises of “worst case” scenarios; and
- The likely causes and possible effects of spills.

Every employee at AEM receives spill and waste management training during their initial site orientation so they are able to respond to small spills and raise the alarm if a larger response is required. ERT members receive more extensive HAZMAT training and learn how to respond while wearing personal protective clothing. The road crew between Baker Lake and Meadowbank also received training regarding the actions that they have to do during an emergency or major spill on the road. You can find records of different trainings that AEM personnel have attended in Appendix K. The Environmental Department regularly attends tool-box sessions to provide information on spill response, spill prevention and spill reporting procedures.

SECTION 10 • LIST OF ACRONYMS

ANFO	Ammonium Nitrate Fuel Oil
AWPR	All Weather Private Road
CCME	Canadian Council of Ministers of the Environment
DFO	Fisheries and Oceans Canada
EMS	Environmental Management System
ERP	Emergency Response Plan
ERT	Emergency Response Team
ERTC	Emergency Response Team Coordinator
GN	Government of Nunavut
HCN	Hydrogen Cyanide
HMMP	Hazardous Materials Management Plan
AANDC	Aboriginal Affairs and Northern Development Canada
LEL	Lower Explosion Limit
AEM	Agnico Eagle Mines Limited
MSDS	Materials Safety Data Sheets
NIOSH	National Institute for Occupational Safety and Health
OHSP	Occupational Health & Safety Plan
PCB	Polychlorinated Biphenyls
PPE	Personal Protective Equipment
SCP	Spill Contingency Plan
TDG	Transportation of Dangerous Goods
WHMIS	Workplace Hazardous Materials

Appendix A

Environmental Department weekly inspection template

Environmental Inspection report for Refuelling station and Tank farm

Date: **Inspected By:**
Location: **Responsible department:**

Meadowbank:

Subject	Conform	Non-conform	N/A	Picture(s) #
Spills on the ground				
Spill kit				
Refuelling procedures followed (secondary containment at every connection and 3 persons)				
Water in secondary containment (If discharge is needed, NWB Type A Water License Part F needs to be followed)				
Date of last pipe and tank visual inspection (monthly)				
Date of last env. visual inspection (weekly)				
Non-smoking sign, Extinguisher and tank identification present				

Comments:_____
_____
_____
_____
_____

Recommendations:_____
_____
_____
_____
_____
_____

Environmental Inspection report for Refuelling station and Tank farm

Date: **Inspected By:**
Location: **Responsible department:**

Baker Lake:

Subject	Conform	Non-conform	N/A	Picture(s) #
Spills on the ground				
Spill kit				
Refuelling procedures followed (secondary containment at every connection and 3 persons)				
Water in secondary containment (If discharge is needed, NWB Type A Water License Part F needs to be followed)				
Date of last pipe and tank visual inspection (monthly)				
Date of last env. visual inspection (weekly)				
Non-smoking sign, Extinguisher and tank identification present				

Comments:_____
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Recommendations:_____
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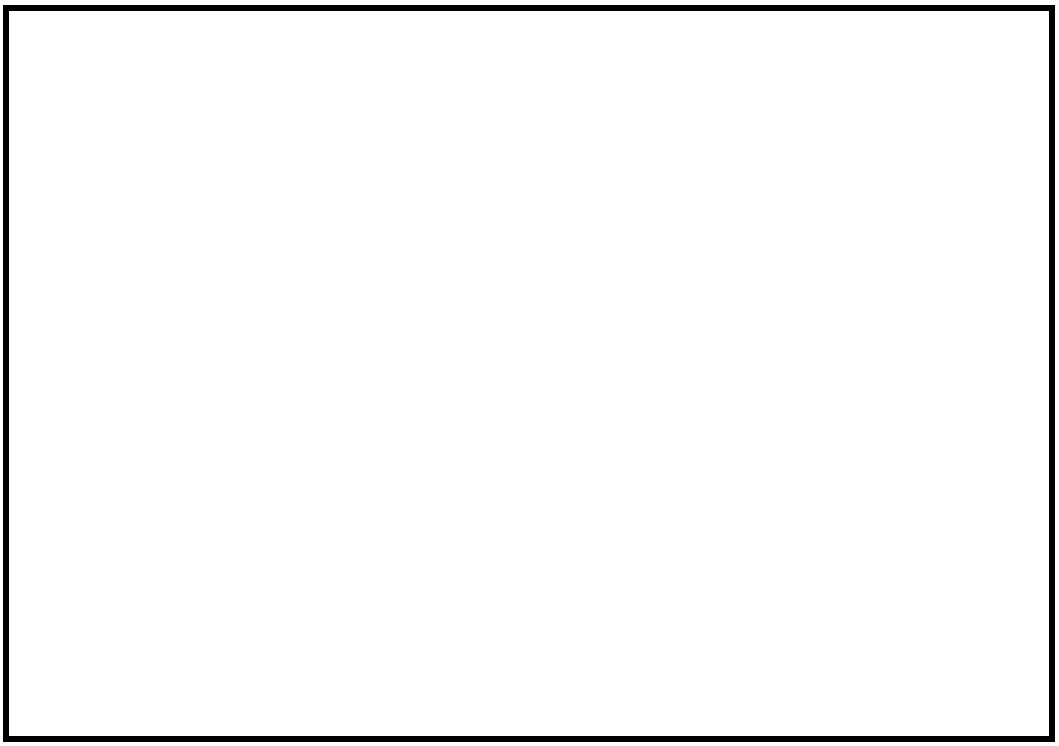
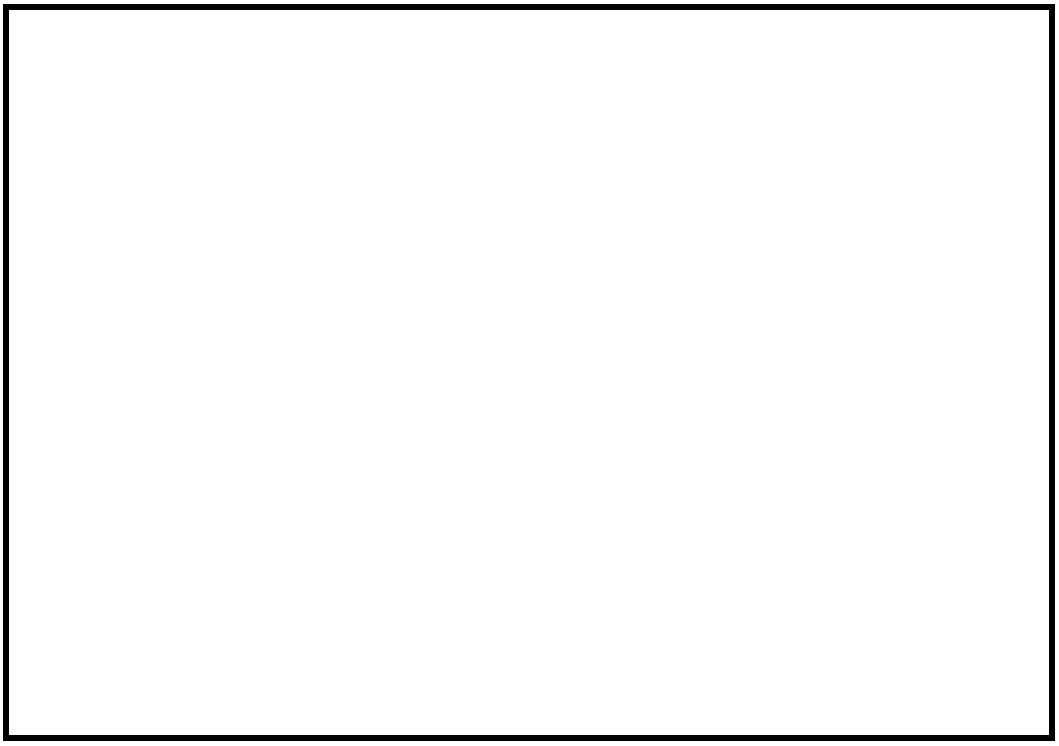


Picture 1: Description



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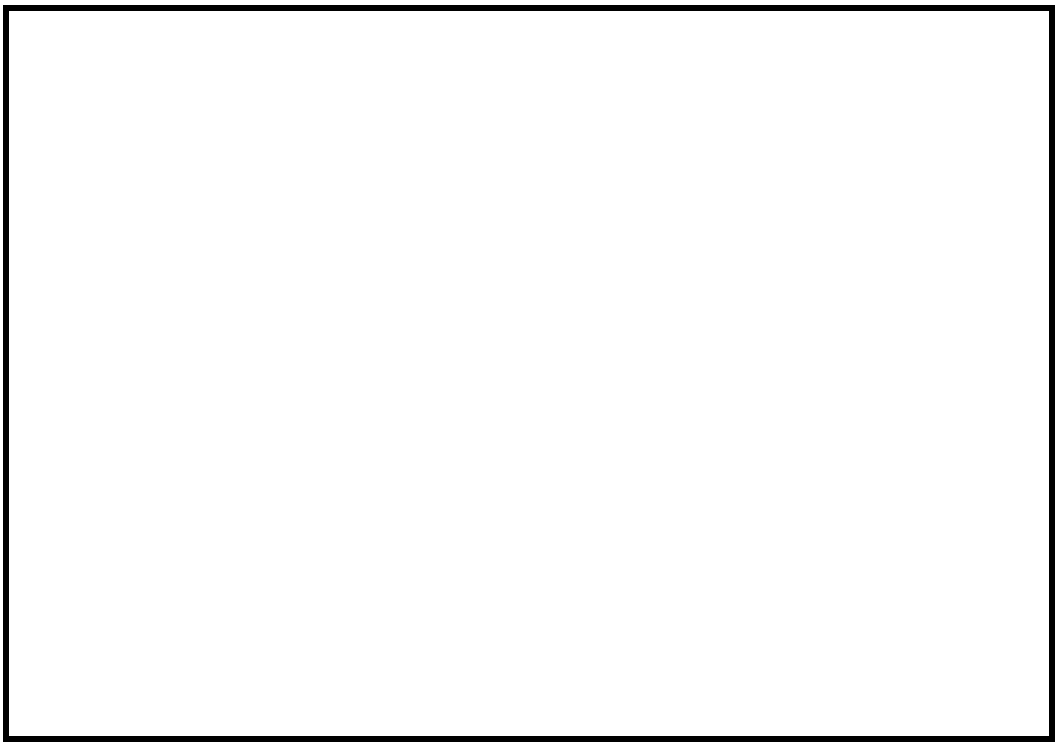

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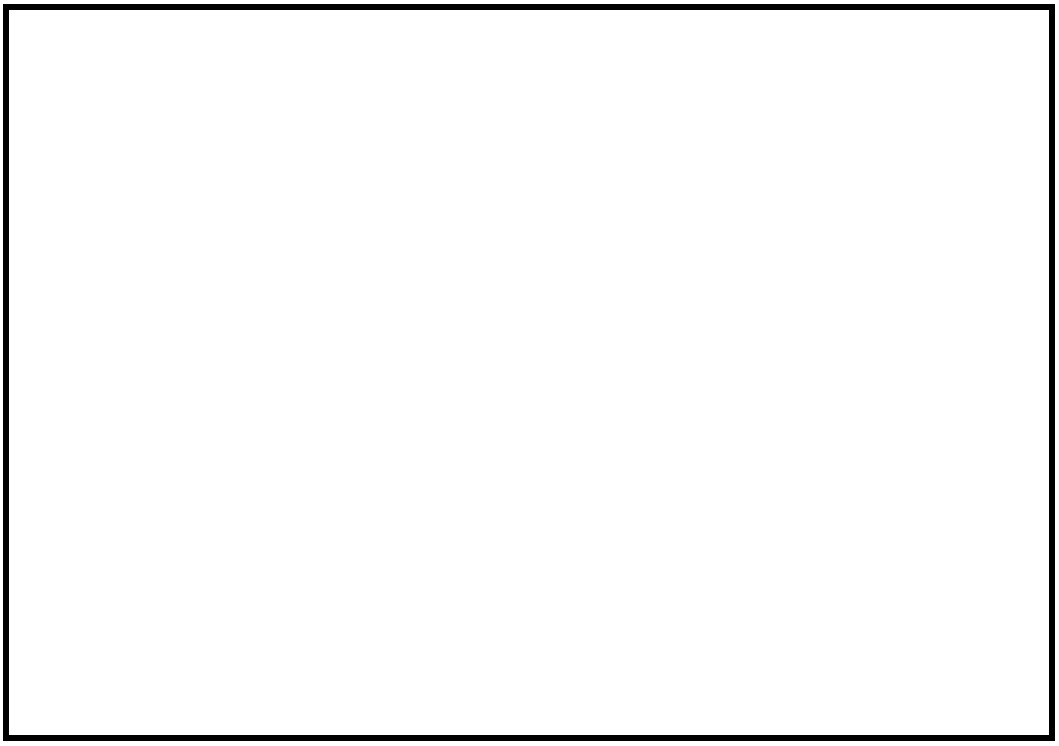

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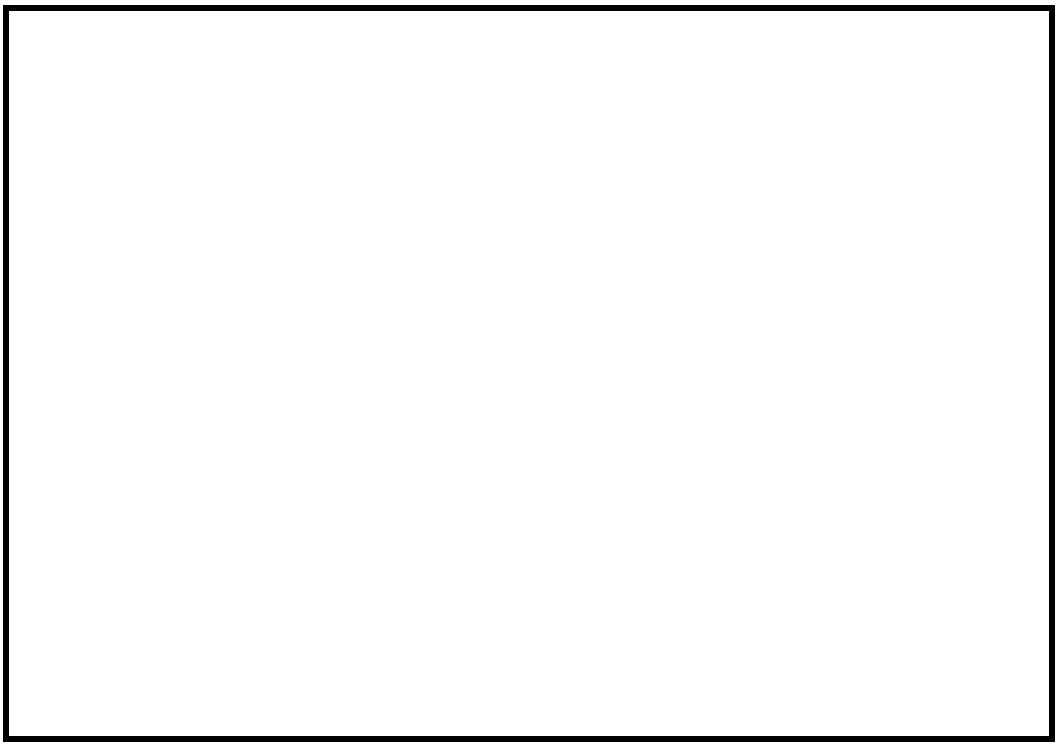

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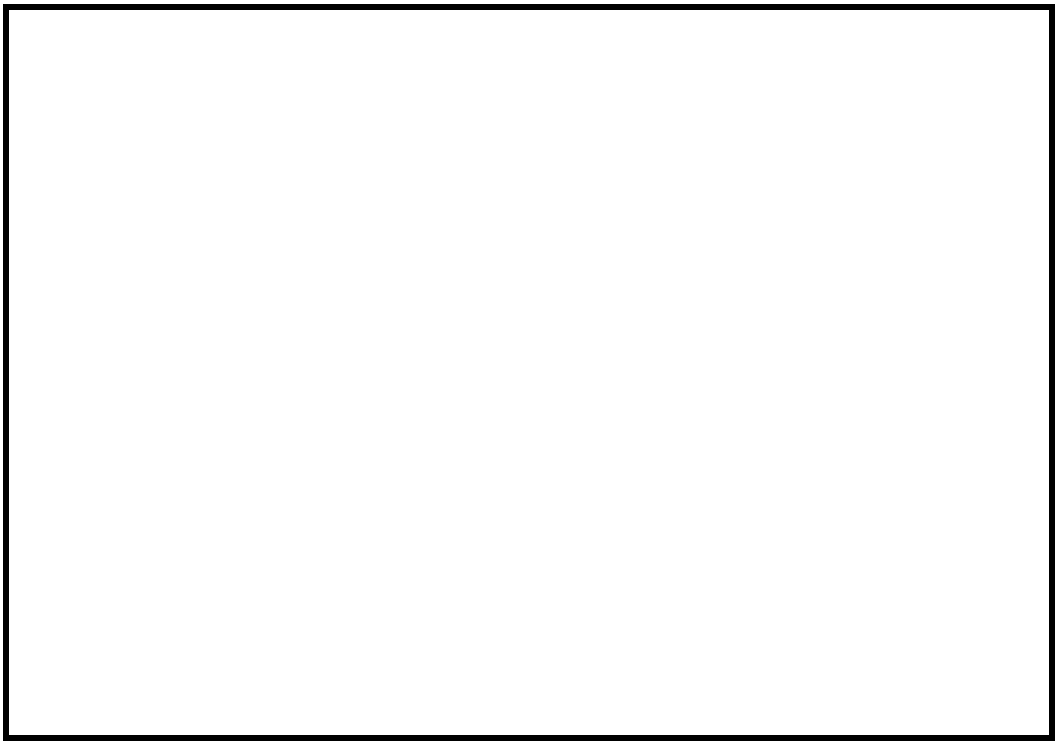

Picture 6: Description

HAZMAT Storage Area: Environmental Inspection report

Date: _____ **Inspected By: _____**

Location: _____ **Responsible department: _____**

Subject	Conform	Non-conform	N/A	Picture(s) #
Are storage containers clearly labelled to identify Hazmat substance?				
Are storage containers in good condition? Is there any visible damage or leaks? Can the doors be sealed shut?				
Is HAZMAT in containers properly segregated?				
Is HAZMAT arrangement to prevent from falling or dislodging?				
Where necessary – Is HAZMAT placed on pallets i.e. Drums?				
Where necessary – Are containers with product stored in an upright position?				
Where necessary – Are Quatrex bags closed properly?				
Do you see any potential environmental hazards posed by these HAZMAT containers/materials?				

Comments:_____
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Recommendations:_____
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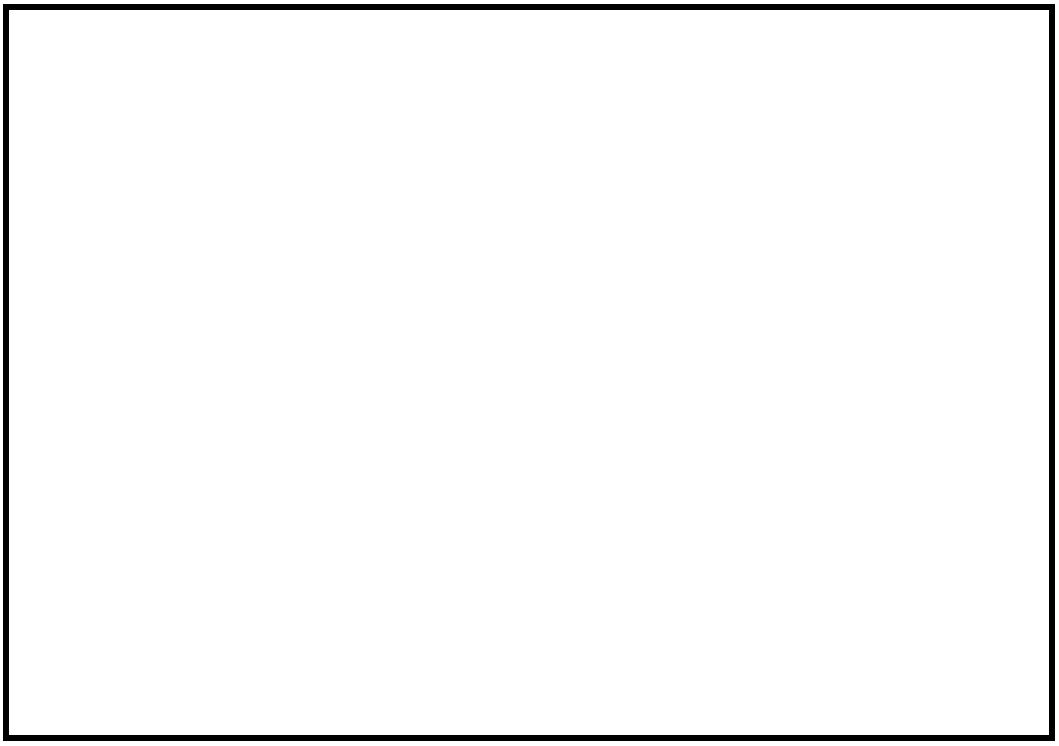

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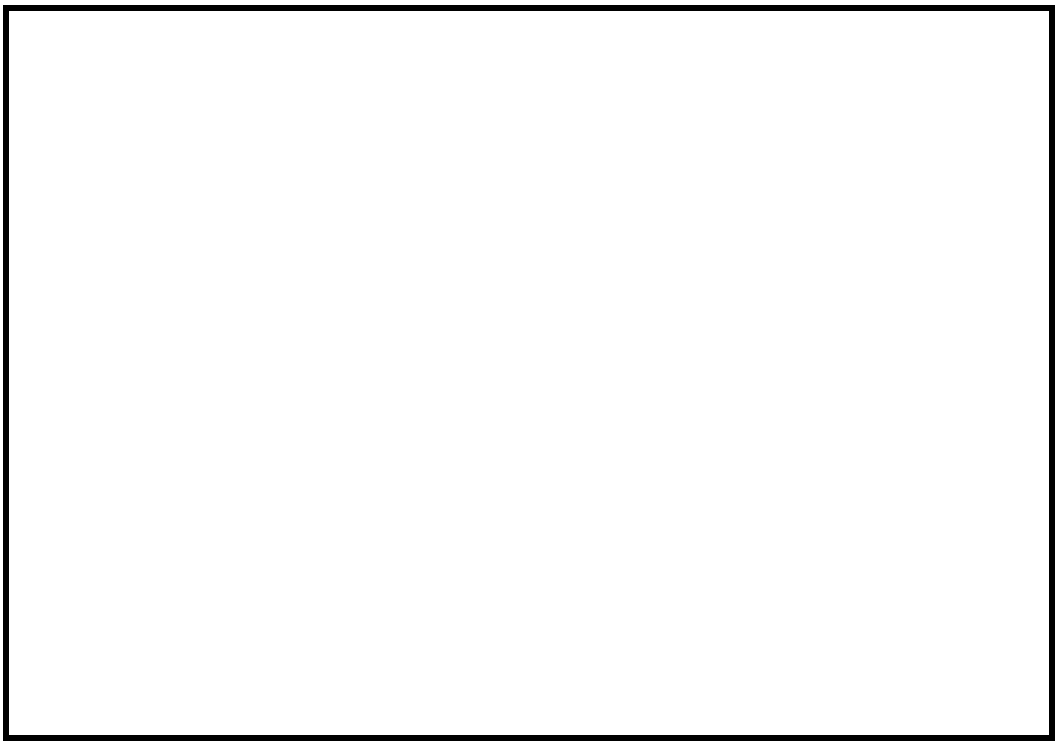
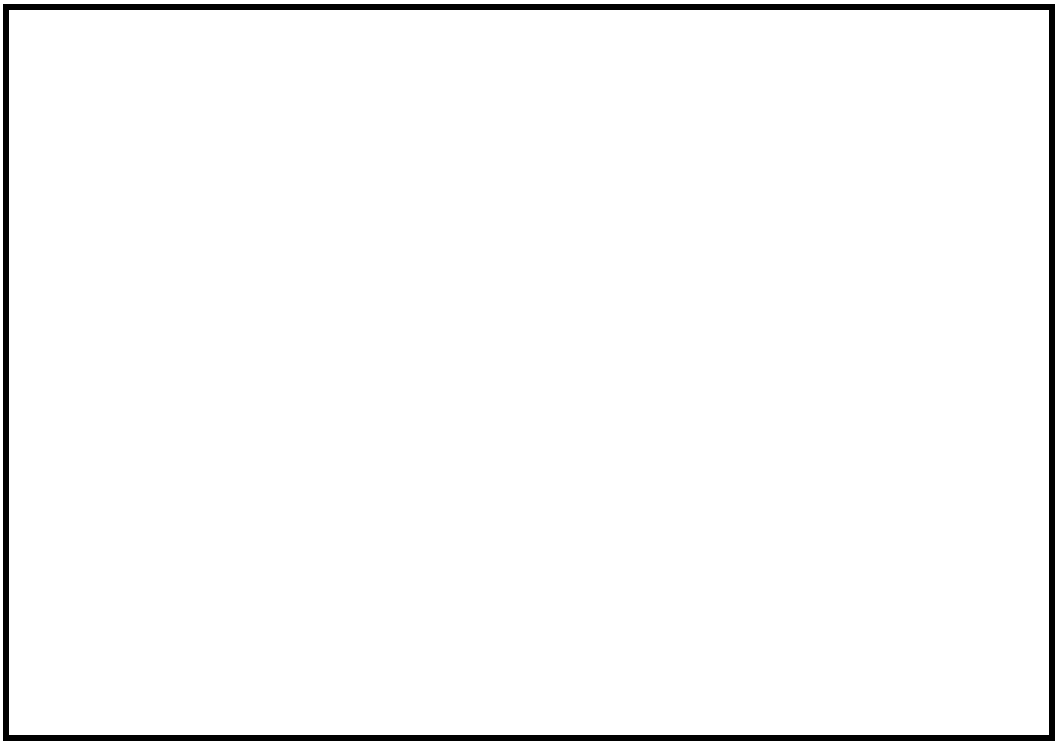
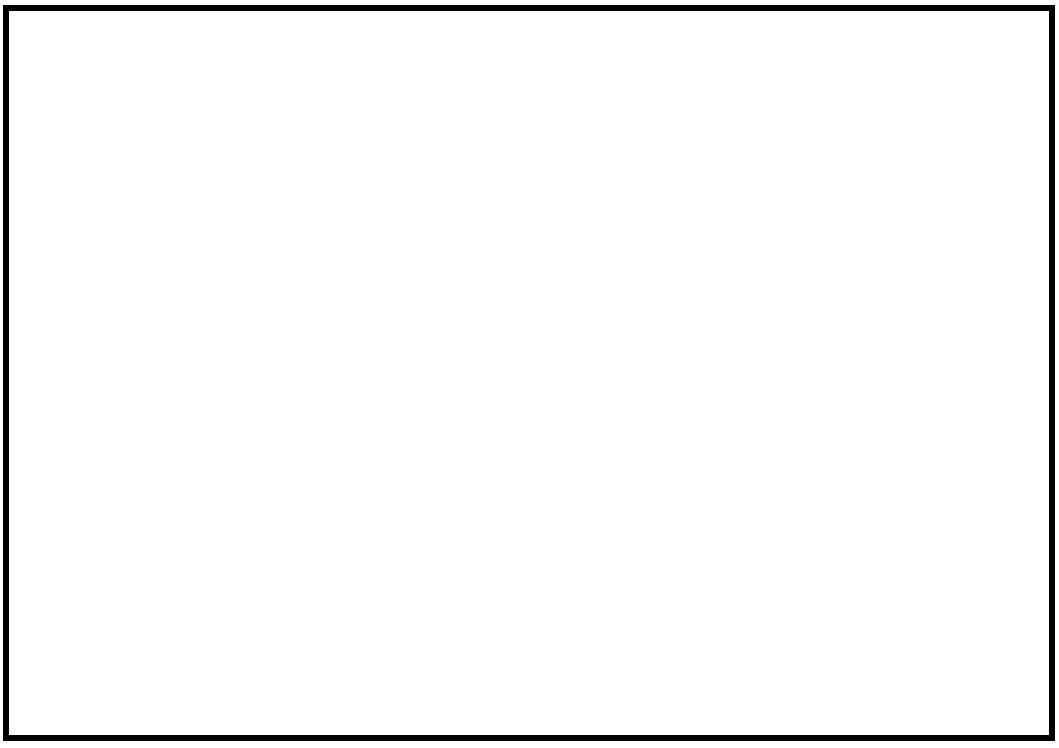


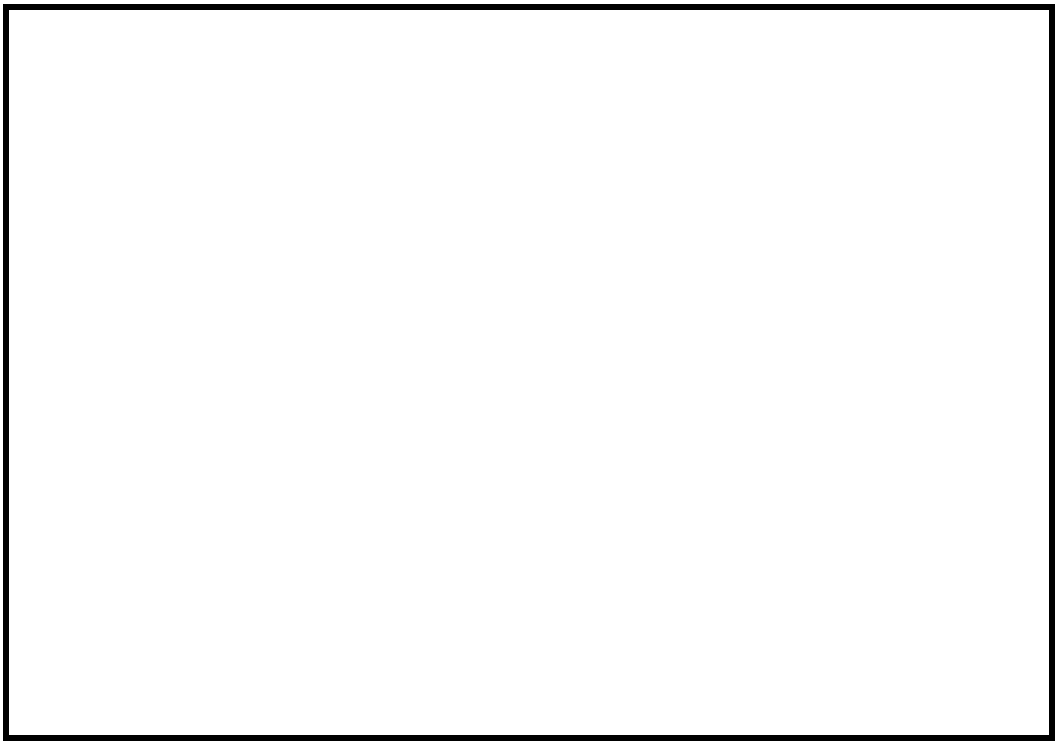
Picture 2: Description



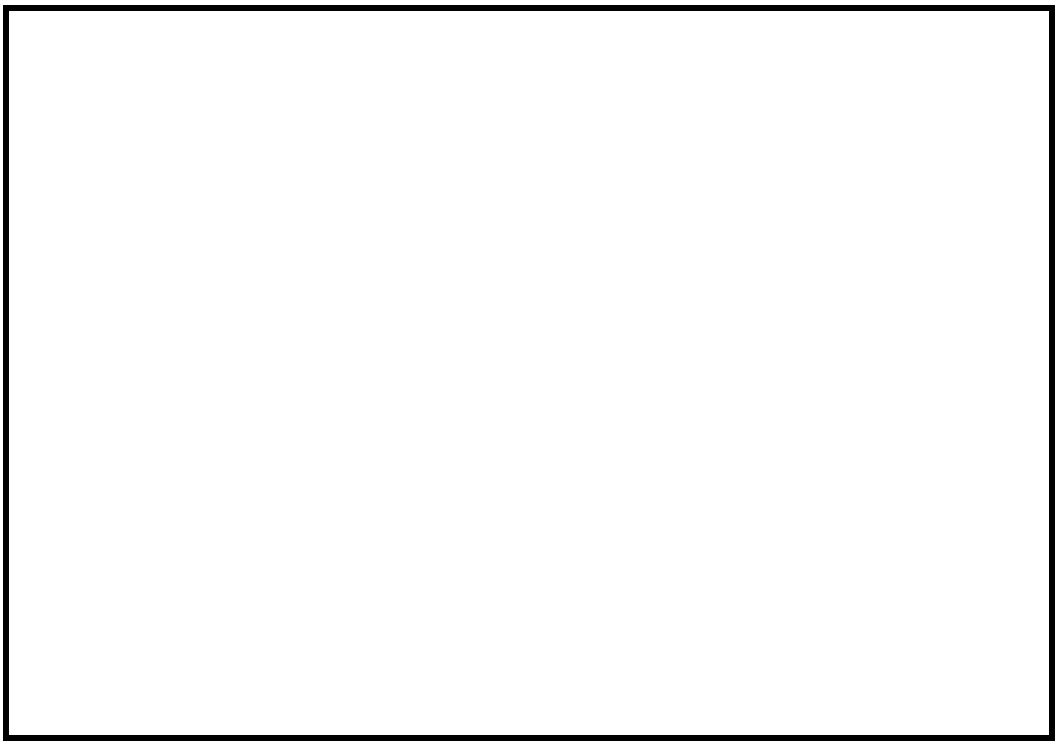
Picture 3: Description



Picture 4: Description



Picture 5: Description



Picture 6: Description

Appendix B

Shipboard Oil Pollution Emergency Plan

The WOODWARD GROUP OF COMPANIES

Coastal Shipping Ltd.
The Woodward Group of Companies
114 Main Street, P.O. Box 910
Lewisporte, NL A0G 3A0 CANADA

SHIPBOARD MARINE POLLUTION EMERGENCY PLAN (SMPEP)

In accordance with MARPOL 73/78, Annex I
IMO Res. MEPC. 78(43)

MT "ALSTERSTERN"
IMO 9053220

CONFIRMATION OF ACKNOWLEDGE

Shipboard Marine Pollution Emergency Plan

Date Entered:	Rank:	Name:	Signature:
			.

INDEX OF CORRECTIONS

Date of Correction	SMPEP pages exchange (date)		APPENDIX 2 Date of Current List of Contact Points
	IN	OUT	

SHIPBOARD MARINE POLLUTION EMERGENCY PLAN

In accordance with Regulation 37 of Annex I and Regulation 17 of MARPOL 73/78

SHIP'S IDENTIFICATION

GL- REGISTER - NUMBER	34583
NAME OF SHIP	ALSTERSTERN
CALL SIGN	XJAZ
IMO NUMBER	9053220
TYPE OF SHIP	CHEMICAL / OIL TANKER
PORT OF REGISTRY	ST. JOHN'S
GROSS TONNAGE	11426
FLAG	CANADA
OFFICIAL NUMBER	835794

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INTRODUCTION

1. This Shipboard Marine Pollution Emergency Plan (hereafter referred to as the "Plan") is written in accordance with the requirements of regulation 37 of Annex I and regulation 17 of Annex II of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 there to and amended by Res. MEPC. 78 (43).
As recommended by IMO this plan is a **combination of a SOPEP and a Shipboard Marine Pollution Emergency Plan for noxious liquid substances.**

2. The purpose of the Plan is to provide guidance to the Master, officers and operating personnel onboard the Ship, with respect to the steps to be taken when an oil or marine pollution incident has or is likely to occur. The appendices contain communication data of all contacts referenced in the Plan, as well as other reference material.

3. The Plan contains all information and operational instructions required by the "Guidelines for the development of the Shipboard Marine Pollution Emergency Plan" as developed by the Organization (IMO) and published under MEPC. 85(44) and MPEC.54 (32) amended by MPEC.86(44). .

4. This Plan has been examined byGermanischer Lloyd or GL on behalf of Transport Canada and, except as provided below, no alteration or revision shall be made to any part of it without prior approval by or on behalf of GL.

5. Changes to Sections 4 and the appendices will not be required to be approved by the Board. The appendices should be maintained up to date by the Owners, Operators, and Managers.

6. For the purposes of this Plan, the Master is taken to be that person who is a member of the vessel's operational personnel and to which is given senior responsibility for the vessel and any circumstances pertaining thereto.

7. Before entering a port of call, the Master should be aware of local emergency response procedures and organizations and have up to date contact information readily available.

SECTION 1 • Preamble

1.1 This Plan is intended to assist the ship's personnel in dealing with an unexpected discharge of oil or noxious liquid substances (NLS). Its primary purpose is to set in motion the necessary actions to stop or minimize the discharge of those substances and to mitigate its effects.

1.2 Effective planning ensures that the necessary actions are taken in a structured, logical and timely manner.

1.3 The primary objectives of this Plan are to:

- prevent pollution
- stop or minimize outflow when a damage to the ship or its requirement occurs
- stop or minimize outflow when an operational spill occurs in excess of the quantity or instantaneous rate permitted under the present Convention.

1.4 Further, the purpose of the Plan is to provide the Master, officers and certain crew members with a practical guide to the prevention of marine spills and in carrying out the responsibilities associated with regulation 37 of Annex I and Reg. 17 of Annex II of MARPOL 73 / 78.

- procedures to report an oil / marine incident.
- Coastal States (Focal Points) and Port Contact Lists to be contacted in the event of any pollution incident.
- co-ordination with national and local Authorities in combating a pollution.

1.5 In summary, the Plan will serve to promote a practiced response when the ship's personnel is faced with a spill.

1.6 Although the Plan is designed as a ship-specific tool it must be also be considered as an additional instrument and is a link to shore-based plans. With this the Plans allows an efficient co-ordination between the ship and shore-based Authorities /Organizations in mitigating the effects of any pollution incident.

1.7 The Plan includes a summary flowchart (See page 8) to guide the Master through reporting and acting procedures required during an oil pollution incident response.

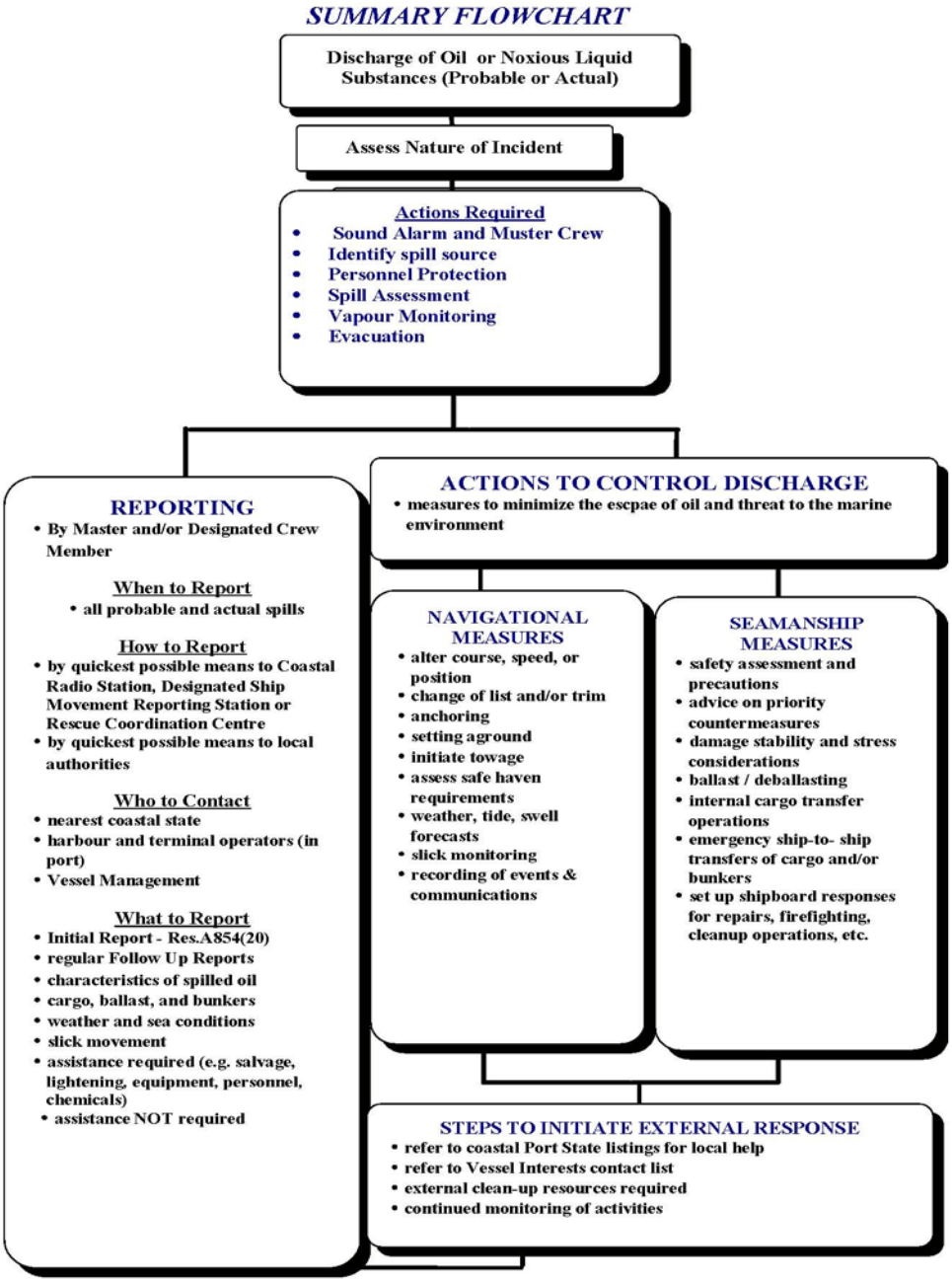
1.8 The Plan is likely to be a document used on board by the Master and the officers of the ship and must therefore be available in the working language used by them.

1.9 The Plan is not applicable if the vessel operates in U.S waters within the EEZ (exclusive economic zone). The Vessel Response Plan (VRP) has to be activated.

1.10 All Procedures in this Plan are in line with Coastal emergency procedures which can be found in the file Emergency Preparedness as part of the Safety Management System (SMS). They should be referred to in any case for obtaining additional information.

SHIPBOARD MARINE POLLUTION EMERGENCY PLAN - SUMMARY FLOWCART

This flow diagram is an outline of the course of action that shipboard personnel should follow in responding to a pollution emergency based on the guidelines published by the Organization. This diagram is not exhaustive and should not be used as a sole reference in response. Consideration should be given inclusion of specific reference to the Plan. The steps are designed to assist ship personnel in action to stop or minimize the discharge of oil or NLS and mitigate its effects. These steps fall into two main categories - reporting and actions.



SECTION 2: Reporting Requirements

2.1 GENERAL

The reporting requirements of this section comply with those of regulation 37 Annex I and 17 Annex II of MARPOL 73 / 78.
When the ship is involved in an incident which results in the discharge of oil or NLS, the Master is obliged under the terms of MARPOL 73 / 78 to report details of the incident, without delay, to the nearest Coastal state by means of the fastest telecommunication channels available.

The intent of these requirements are to ensure that Coastal States are informed, without delay, of any incident giving rise to pollution, or threat of pollution of the marine environment, as well as of the assistance and salvage measures, so that appropriate action may be taken.

Without interfering with ship owner's liability, some coastal states consider that it is their responsibility to define techniques and means to be taken against a marine pollution incident and approve such operations which might cause further pollution i.e. lightening. States are in general entitled to do so under the International Convention relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, 1969 and the Protocol relating to Intervention on the High Seas in Cases of Pollution by Substances other than Oil, 1973

2.2 Reporting Procedures

For easy reference the reporting requirements in the context of this plan are divided in to the following information blocks:

2.2.1 When to Report

Taking the summary flowchart as shown on page 5 as a basic guide into consideration reports are necessary in the following cases:

2.2.1.1 Actual discharge

The Master is obliged to report to the nearest Coastal state whenever there is a discharge of oil resulting

- from damage to the ship
- from damage to the ship's equipment
- for the purpose of securing the safety of a ship or saving life at sea
- during the operation of the Ship in excess of the quantity or instantaneous rate permitted under the present Convention.

2.2.1.2 Probable discharge

The Master is obliged to report even when no actual discharge of oil or NLS has occurred but there is a probability that one could.

However, as it is not practicable to lay down precise definitions of all types of situations involving probable discharge of oil / NLS which would warrant an obligation to report the Master

is obliged to judge by himself whether there is such a probability and whether a report should be made.

Therefore, it is recommended that, at least, the following events

- damage, failure or breakdown which affects the safety of the ship (e.g. collision, fire, grounding, explosion, structural failure, flooding, cargo, cargo shifting, list, etc.)

or

- failure or breakdown of machinery or equipment which results in impairment of the safety of navigation (e.g. failure or breakdown of steering gear, propulsion, electrical generating system, essential shipborne navigation aids etc.)

are carefully considered by the Master - taking into account the nature of the damage failure or breakdown of the ship, machinery or equipment as well as the ship's location , proximity to land, weather, state of the sea and traffic density - as cases in which a probable discharge is more likely.

If in doubt, the Master should always make a report in cases aforementioned.

In all cases the Authorities should be kept informed by the Master as how the situation progress and be advised when all threats of pollution has passed.

2.2.2 Information Required

As required in article 8 and Protocol I of MARPOL 73 / 78 Convention the Master or other persons having charge of the ship should report the particulars of any pollution incident. In this context the International Marine Organization (IMO), in 1997, adopted Resolution A. 851 (20) "General Principles for Ship Reporting Systems and Ship Reporting Requirements, including Guidelines for Reporting Incidents involving Dangerous Goods, Harmful Substances and / or Marine Pollutants"

The intent of the Resolutions aforementioned is to enable Coastal States and other interested parties to be informed, without delay, of any incident giving rise to pollution, or threat of pollution of the marine environment, as well as of assistance and salvageable measures, so that appropriate action may be taken.

Nothing in this chapter relieves the Master in using sound judgment to make sure that any incident or probable discharge is reported as quick as possible in the prevailing situation.

When Transmitting initial reports to the authorities of the nearest Coastal State, the Master or other persons dealing with such a transmission should take note of IMO Resolution A 851(20).

Especially, the format of the initial report as well as supplementary of the follow up reports should conform with the guidance contained in Resolution A 851(20). All reporting whether initial or follow up, should follow IMO's reporting format as outlined below and should contain the following information:

FORMAT AND INFORMATION REQUIRED FOR OFFICIAL REPORT

AA VESSEL NAME, CALL SIGN, FLAG

BB DATE AND TIME (GMT) OF INCIDENT: 11/1935 meaning 11th of month at 7:35 pm.

CC SHIPS POSITION: 2230N 0600E meaning 22 deg. 30 min. N, 6 deg. E

or

DD SHIPS POSITION BY TRUE BEARING (3 DIGITS) AND DISTANCE FROM CLEARLY IDENTIFIED LANDMARK.

EE TRUE COURSE (3 DIGITS)

FF SPEED IN KNOTS AND TENTHS OF A KNOT (3 DIGITS)

LL ROUTE INFORMATION - INTENDED TRACK

MM RADIO STATIONS AND FREQUENCIES GUARDED

NN TIME OF NEXT REPORT (same as in BB)

OO DRAFT (4 DIGITS - meters and centimeters)

PP TYPES AND QUANTITIES OF CARGO AND BUNKERS ON BOARD

QQ BRIEF DETAILS OF DAMAGE, LIMITATIONS ETC. (must include condition of vessel and ability to transfer cargo, ballast, or fuel)

RR BRIEF DETAILS OF ACTUAL POLLUTION (oil type, estimate of quantity discharged, whether discharge continues, cause, estimate of slick movement)

SS WEATHER AND SEA CONDITIONS (wind force/direction, relevant tidal and/or current information)

TT NAME, ADDRESS, FAX, TELEPHONE NUMBERS OF VESSEL OWNER OR REPRESENTATIVE

UU DETAILS OF LENGTH, BREADTH, TONNAGE, AND TYPE OF VESSEL

WW TOTAL NUMBER OF PERSONS ON BOARD

XX MISC. DETAILS (This includes brief details of incident, actions taken, injuries sustained and assistance required. If no outside assistance is required, then this should be clearly stated.)

SHIPBOARD MARINE POLLUTION EMERGENCY PLAN

INITIAL NOTIFICATION

AA(SHIPS NAME; CALL SIGN; FLAG)

BB(DATE AND TIME OF EVENT; UTC)

D	D	H	H	M	M

CC (POSITION; LAT; LONG)

				N	S
d	d	m	m		

					E	W
d	d	d	m	m		

OR

DD (BEARING; DISTANCE FROM LANDMARK)

d	d	d	N miles

EE (COURSE)

d	d	d

FF(SPEED)

kn	kn	1/ 10

LL (INTENDED TRACK)

MM (RADIO STATION(S) GUARDED)

NN (DATE AND TIME OF NEXT REPORT; UTC)

D	D	H	H	M	M

OO (DRAFT; METERS, centimeters)

M	M	cm	cm

PP(TYPE AND QUANTITY OF CARGO/ BUNKERS ON BOARD)

QQ (BRIEF DETAILS OF DEFECTS/ DEFICIENCIES/ DAMAGE)

RR (BRIEF DETAILS OF POLLUTION; INCLUDING ESTIMATE OF QUANTITY LOST)

SS (CONTACT DETAILS OF WEATHER AND SEA CONDITIONS)

Wind: Direction / Speed (Beaufort)

SWELL: Direction / Height (m)

TT (CONTACT DETAILS OF SHIP´S OWNER/ OPERATOR/ AGENT)

UU (SHIP SIZE AND TYPE)

XX (ADDITIONAL INFORMATION)

All follow up reports by the Master should include information relevant to the Coastal State Authorities to keep them informed as the incident develops.

Follow up reports should include information on any significant changes in the ship's condition, the rate of release and spread of the substances, weather and sea conditions and clean-up activities underway.

In this context details of bunker and cargo disposition, condition of any empty tanks and nature of any ballast carried are information needed by those involved in order to assess the threat posed by an actual or probable discharge from the damaged ship.

2.2.3 Whom to Contact

The Master is responsible for reporting any incident involving an actual or probable discharge of oil or NLS.
Contact information for coastal State and other concerned parties (port contacts, vessel interest contacts) is located in Section 4.

2.2.3.1 Coastal State Contacts

The vessel, in accordance with the regulations, has onboard a **declaration** that the vessel's management has, in accordance with 167 of the Canada Shipping Act 2001, entered into an arrangement with response organization, **ECRC** to which a certificate of designation has been issued pursuant to section 169 in respect of the quantity of oil that is carried both as fuel and cargo on board the vessel.

The **Director of Operations**, identified in the **declaration** , shall be responsible for contacting and mobilizing the response organization, **ECRC at 613-930-9690**.

2.2.3.2 Port Contacts

As Ports of Call vary, MASTER to ensure that pprior t entering port any local contacts are obtained and displayed in MASTERS designated location. After departure contacts are to be added to manual and updated as necessary.

2.2.3.3 Vessel Interest Contacts

Vessel interest contacts are outlined on **page 31**

SECTION 3: Steps to Control Discharge

Ship personnel will most probably be in the best position to take quick action to mitigate or control the discharge of oil or noxious liquid substances from their ship

Therefore, this Plan provides the Master with clear guidance on how to accomplish this mitigation for a variety of situations.

It is the Master's responsibility to initiate a response in the event of a discharge of oil/NLS or substantial threat of discharge - actual or probable - into waters.

In no case action should be taken that in any way could jeopardize the safety of personnel either onboard or ashore.

In cases of a discharge of a noxious liquids substances the Master has to refer to the "Material Safety Data Sheet" (MSDS) provide onboard for any NLS cargo. Consideration to be made to any danger resulting from discharge of such substances, i.e. mixing with water, air, other materials / substances.

Special consideration is to be taken in case of the necessity to transfer cargo into another compartment onboard the compatibility of the material to be transferred and the material of pipes and tanks to be used for such actions.

In cases of small spills on deck, the vessel's crew should take whatever actions are necessary to prevent oil from escaping over the side. Once the spill is contained on deck, the crew will need to take action to clean up the oil. SPILLED OIL SHALL NOT BE WASHED OVER THE SIDE. Once oil is in the water, the crew's ability to respond in a practical manner is greatly reduced.

The following list specifies different kinds of possible operational spills with regard to reactions to be taken.

3.1 OPERATIONAL SPILLS

3.1.1 Operational Spill Prevention

All crew members shall maintain a close watch for the escape of oil or NLS during bunker or cargo operations.

Prior to bunker or cargo transfer the competent crew members should mobilize the spill equipment, as far as available on board, and place it close to the planned operation, e.g. along the railing on the side at which bunker operation takes place. All deck scuppers and open drains must be effectively plugged. Accumulations of water should be drained periodically and scupper plugs replaced immediately after the water has run off. Any free floating substances should be removed prior to draining.

Bunker or Cargo tanks which have been topped up should be checked frequently during the remaining operations to avoid an overflow.

Unless there are permanent means for retention of any slight leakage at ship / shore connections for bunker or cargo transfer, it is essential that a drip tray is in place to catch any leaking substance.

All crew members of the ship's crew should be familiar with the fundamentals of the ship's vital systems including the ventilation and electrical systems. Crew members should be able to isolate the accommodation and/or machinery spaces using the louvers and fan shutoffs and, from the distribution panels, isolate electrical circuits in areas of risk.

In the event of an operational spill which occurs during bunkering or cargo operations, it is important that the bunkering party terminate any and all bunkering operations and close all manifold valves.

Before closing any manifold valves, the bunkering / cargo party must immediately inform the terminal / loading master so that they may take action to eliminate the possibility of over-pressurization of the shore side transfer components.

After dealing with the cause of the spill, it may be necessary to obtain permission from local authorities and/or the terminal before resuming bunkering or cargo operations.

If the possibility of fire or explosion exists, nonessential air intakes to accommodations and machinery spaces should be closed and all sources of ignition should be eliminated. See Section 1.3.3 of this Plan.

Care must be taken to consider stability and stress when taking action to mitigate the spillage of oil. Internal transfers should be undertaken only with a full appreciation of the likely impact on the vessel's overall stress and stability. Please refer to the "Approved Stability Book" carried on board.

Operational Spill Checklist

Action Considered	Designated Person	Completed
Sound emergency alarm	Person Discovering Incident	Y / N
Mobilize Oil Pollution Prevention Team	Chief Engineer / Master	Y / N
Cease all bunkering operations	Chief / 2nd Engineer	Y / N
Locate source of leakage	Chief / 2nd Engineer	Y / N
Operate manifold valves	Chief / 2nd Engineer	Y / N
Close all nonessential vent intakes and tank vents as required	Chief / 2nd Engineer	Y / N
Stop or reduce outflow	Chief Engineer / Deckhand	Y / N
Assess fire risk	Chief Officer	Y / N
Commence clean up	Chief Officer	Y / N
Assess Stress / Stability	Master / Chief Officer	Y / N
Transfer fuel from damaged area to slack tanks or other containment space	Chief / 2nd Engineer	Y / N

Request outside assistance if required	Master	Y / N
Counter excessive list if required / possible	Chief Officer	Y / N

3.1.2 Pipeline Leakage

In the event of leakage from an oil / NLS pipeline, valve, hose or metal arm, the Chief Engineer must ensure that the following actions are taken:

- Stop oil flow, close manifold and other valves.
- Sound emergency alarm and mobilize Oil Pollution Prevention Team
- Locate source and drain affected section into an available empty or slack tank. Repair if possible
- If there is any possibility of vapours entering the engine room or accommodation intakes, appropriate preventative steps must be taken quickly.
- Absorb spill with any absorbent materials on hand and dispose of oil soaked materials in an appropriate container.
- If oil is overboard, report to proper authorities immediately (as per section 4 of this plan).

3.1.3 Tank Overflow

In the event of an oil tank overflow, the Chief Engineer must ensure that the following actions are taken:

- Stop oil flow, close manifold and other valves.
- Sound emergency alarm and mobilize Oil Pollution Prevention Team
- Place drain buckets under overflow pipes to contain possible spills.
- If there is any possibility of vapours entering the engine room or accommodation intakes, appropriate preventative steps must be taken quickly.
- Drain or transfer oil to slack or empty tanks if possible with due consideration paid to vessel stability. If no slack or empty tanks are available, oil may be pumped back ashore through delivery lines, having first gained permission to do so.
- Absorb spill with any absorbent materials on hand and dispose of oil soaked materials in an appropriate container.
- If oil is overboard, report to proper authorities immediately (as per section 4 of this plan).

3.1.4 Hull Leakage

If oil is noticed on the water near the vessel during normal operations and cannot be accounted for, the possibility of hull leakage should be suspected.

In the event of a hull leakage, the Master must ensure that the following actions are taken:

- Sound emergency alarm and mobilize Oil Pollution Prevention Team.
- Stop any transfer or bunkering operations.
- Identify damage and report to proper authorities immediately (as per section 4 of this plan). Consider a diver if necessary and possible.

- If possible, contain spill using materials on hand and dispose of oil soaked materials in an appropriate container.
- If there is any possibility of vapours entering the engine room or accommodation intakes, appropriate preventative steps must be taken quickly.
- Transfer fuel away from suspected leaks to empty or slack tanks if possible, or to a ballast tank if necessary. If in port, arrangements can be made to pump oil ashore to tanks or trucks. Due consideration is to be paid to vessel stress and stability.
- If it is not possible to identify the leaking tank, reduce level in all tanks in the vicinity, giving due consideration to vessel stress and stability.

3.1.5 Spills caused by Equipment in Machinery Spaces

- If operational spills are caused by failure of equipment in machinery spaces, any further operation of this equipment should be stopped immediately and measures are to be taken to avoid a spill. Such equipment may be
  - Oily - water separating equipment or oil filtering equipment or oil filtering equipment to de-oil bilge water from the engine room bilges.
  - Valves in pipes connecting ballast / cargo systems
  - Cooling pipes in cooler systems
  - Gearing of bow thruster
  - Stern tubes

- Sound emergency alarm and mobilize Oil Pollution Prevention Team.
- Absorb spill with any absorbent material in hand and dispose of oil soaked materials in an appropriate container.
- Do not restart equipment until problem has been rectified.

3.2 Spills Resulting from Casualties

In the event of a casualty the Master's first priority will be to ensure the safety of personnel and the vessel and initiate action to prevent escalation of the incident and marine pollution.

3.2.1 Ship grounded / stranded

If the vessel grounds, the Master must ensure that the following actions are taken:

- Sound emergency alarm, muster crew, and Mobilize Oil Pollution Prevention Team once safe to do so.
- Eliminate all avoidable sources of ignition and ban smoking onboard. Action bust be taken to prevent hazardous vapours from entering accommodation and machinery spaces. See section 1.1.3.
- Identify damage by means of a visual inspection.
- Take soundings around vessel to determine the nature and gradient of seabed.
- Check differences in tidal range at grounding site.
- Evaluate tidal current in grounding area.
- Take soundings of all tanks on shell and compare with departure soundings.

- Determine probability and/or quantity of oil released
- If oil release is determined or is probably, this is to be included in the casualty report.
- Determine other possible hazards to the vessel such as sliding off the grounding site or further damage from seas / swell, and torsion forces.

At this point, determine risk of additional damage to vessel by attempting to refloat. If remaining aground is determined to be less of a risk then:

- Use anchors to prevent vessel movement.
- Take on ballast in empty tanks with due consideration paid to stress and stability. Please refer to the approved stability book.
- Consider transfer of fuel from damaged tanks with due consideration paid to stress and stability. Please refer to the approved stability book.
- Reduce longitudinal stress on the hull by transfer of fluids internally. Please refer to the approved stability book.
- If the change in stability and stress cannot be calculated onboard, contact the vessel's management to arrange for the necessary calculations. Refer to appendix 3 for information which should be provided.

3.2.1.1 Prevention of Fire and Explosion

If a fire or explosion occurs on board, the vessel's fire control party must ensure that the following actions are taken:

- Sound emergency alarm, muster crew, and mobilize Oil Pollution Prevention Team once safe to do so.
- Determine extent of damage and what damage control measures can be taken.
- Determine whether there are casualties.
- Request assistance as deemed necessary.
- Take necessary actions to prevent smoke and other hazardous vapours from entering the accommodation and machinery spaces.
- Assess possibility of oil leakage.
- Determine possible actions to control the discharge of oil. This will depend largely on the damage to the ship and cargo.
- If there is a discharge or possible discharge of oil, this to be included in the casualty report.
- Should abandonment be necessary, the Master must ensure that every effort is made to maneuver survival craft upwind of any oil spill.

3.2.1.2 Hull Damage / Hull Failure / Containment Failure

If the vessel suffers structural hull failure, the Master must ensure that the following actions are taken:

- Sound emergency alarm, muster crew, and mobilize Oil Pollution Prevention Team once safe to do so.

- Reduce speed or stop to minimize stress on hull.
- Assess immediate danger of sinking or capsizing.
- Initiate damage control measures if possible.
- If lightening is required, all efforts should be made to wait for a barge or other ship to receive the cargo.
- If oil has spilled, or if it is necessary to jettison oil to maintain stability, make a report as per section 2.
- If the change in stability and stress cannot be calculated onboard, contact the vessel's management to arrange for the necessary calculations.
- Consider forecasted weather conditions and their effect on the situation.
- Should abandonment be necessary, the Master must ensure that every effort is made to maneuver survival craft upwind of any oil spill.

3.2.1.3 Procedures to reduce or Stop Outflow of Oil or NLS

The Master should assess the possibility of damage to the environment and whatever action can be taken to reduce further damage from any release, such as;

- Transfer /cargo internally, provided shipboard piping system is in an operational condition and in careful view of the compatibility of the substance and the tanks/pipes used for transfer, and taking into account the impact on the ship's overall stress and stability.
- Isolate damaged/penetrated tanks hermetically to ensure that hydrostatic pressure in tanks remains intact during tidal changes.
- Evaluate the necessity of transferring bunkers / cargo to barges or other ships and request such assistance accordingly.
- Evaluate the possibility of additional release of oil or NLS in close co-operation with coastal states.

In case of large differences between the tide levels, the Master should try to isolate the damaged tanks to reduce additional to reduce additional loss of substances.

3.2.1.4 Refloating by own means

The Master should also evaluate the question of refloating the vessel by own means. Before such an attempt is made, it must be determined:

- whether the ship is damaged in such a way that it may sink, break up or capsize after getting off
- whether the ship , after getting off, may have maneuvering problems upon leaving the dangerous area on its own.
- whether machinery, rudder or propeller are damaged due to grounding or may be damaged by trying to get off ground by own means.
- whether the ship may be trimmed or lightened sufficiently to avoid damage to other tanks in order to reduce additional pollution.
- weather evaluation; whether there is time/reason to await improvements in weather or tide.

- whether ship's structure permits refloating/consultation of GL Emergency Response Service
- whether all steps of Coastal Shipping Ltd. procedure "Grounding" have been complied with.

3.2.1.5 Securing the Ship

If the risk of further damage the ship is greater in an attempt to refloat the ship by own means, than in remaining aground until professional assistance has been obtained, the ship's Master should try to secure the ship as much as possible:

- Trying to prevent the ship from moving from its present position
- By dropping anchors (adequate water depth and anchor ground provided)
- By taking ballast into empty tanks, if possible
- Trying to reduce longitudinal strain on hull by transferring ballast or bunkers internally
- Reducing fire risk by removing all sources of ignition.

Inform in line with Section 2 all parties interested about Grounding and the actions taken so far.

3.2.2 Fire /Explosion

Should an explosion and a fire occur onboard, sound the GENERAL ALARM immediately.
Further actions should be initiated in accordance with the ship's Muster List.
In case of fire and explosion the following priorities exist:

- Rescuing lives
- Limiting damage /danger to the ship and cargo
- Preventing environmental pollution

The Coastal Shipping Emergency Procedure **" Fire and Explosion"** in the file Emergency Preparedness should be complied with.

Steps to control the discharge of oil will depend largely on the damage to the ship and cargo.
Special information thereto is contained in subparagraphs 3.2.4, 3.2.5 and 3.2.6.
Inform in line with Section 2 all parties interested about the Fire /Explosion and the actions taken so far.

3.2.3 Collision

The Master shall follow the emergency plan as given in Coastal Shipping Ltd Emergency procedure "Collision" in file: Emergency Preparedness as follows:

- Sound emergency alarm, muster crew, and mobilize Oil Pollution Prevention Team once safe to do so.
- Determine whether there are casualties.
- If there is a possibility of fire or explosion, eliminate all avoidable sources of ignition and ban smoking onboard. Action should be taken to prevent flammable vapours from entering the accommodation and machinery spaces. .

- Decide whether separation of vessels may cause or increase spillage of oil, or increase the risk of sinking.
- If any oil tanks are penetrated, isolate these tanks or transfer oil to slack or empty tanks with due attention paid to stress and stability of the vessel. Please refer to the approved stability book.
- If there is an oil spill, make a report as per section 4.
- If possible to maneuver, the Master, in conjunction with the appropriate shore authorities should consider moving his ship to a more suitable location in order to facilitate emergency repair work or lightening operations, or to reduce the threat posed to any sensitive shoreline areas.

3.2.4 Excessive List

Should the ship for some reasons suddenly start to list excessively during discharging/loading operations, or bunkering, all ongoing operations should be stopped immediately until the cause has been determined.

The Officer on duty should inform the Master and/or Chief Officer without delay.

The Master should try to determine the reason for excessive list, and take steps to rectify the situation and to stabilize the ship's condition:

- Check reasons for list
- Soundings / Ullage to be taken in all tanks
- Bunker / Ballast / Cargo pumps to be made ready
- Consider measures to minimize list in transferring liquid from one compartment to another
- Ensure water tightness of empty spaces
- Close all opening
- Secure vent pipes to avoid ingress of water
- If bunkering: Change to corrective tanks for rectifying the situation
- If ballasting/deballasting: Change to corrective tanks to rectify the situation
- If there is reason to believe that the list may cause any spill, notify as per Section 4
- If the ship's crew is in jeopardy, prepare lifeboats for launching, and notify as per Section 4

If the situation is brought under control, inform all parties interested.

3.2.5 Dangerous reaction of cargo

In case of spillage of NLS cargo on deck, to the sea or incidents mixture with other cargo through internal tanks leakage consider dangerous reactions of such mixture. Promptly consult the Material Sheet Data Sheet (MSDS) available for the cargo shipped to the information provided. Take necessary actions for the safety of the crew for the case of (possible) contamination with spilled material or its vapours

3.2.6 Other dangerous cargo and/or vapour release

In case release of dangerous liquid noxious substances take necessary actions for the protection of the crew against health hazards, especially by contamination with materials or its toxic vapours. Avoid material or vapours spreading over the ship. If any dangerous material or vapour is released from any part of the containment system, take arrangements to free the deck area as far as possible by turning the ship to have the accommodation upwind of the point of release.

Evacuate crew members from the endangered area. If persons have to carry out any unavoidable duties within the endangered area, care for the personal protection for those persons to avoid direct contact.
All possible sources of ignition should be eliminated and non-essential air intakes shut down to prevent intake of vapour into accommodation and engine spaces.

Take measures to reduce tanks level or pressure to stop any emission of material or vapour.

Report about such spillage to nearest coastal state in order to arrange precautionary measures for the environment.

3.2.7 Loss of tank environmental control

Consider any hazards arising out of loss of environmental control in view of possible explosion dangers by contacting the Material Safety Data Sheets (MSDS) of the cargo concerned.
Avoid any intake of air into the uncontrolled spaces to avoid a dangerous mixture to be built within the respective.

3.2.8 Ship submerged/foundered/wrecked

If the ship is wrecked to the extent that it or parts of it are submerged, take all measures to evacuate all persons onboard. Avoid contact with any spilled cargo or oil . Alert other shops and/or the nearest coastal state for assistance in rescuing lives and the as far as possible.

3.3 Priority Actions

Top priority shall in all cases of emergency be put on the safety of the persons onboard and to take actions to prevent escalation of the incident.
Immediate consideration should be given to the protective measures against fire, fire explosions and personal exposure to toxic vapour.
Detailed information about damage sustained to the ship and its containment system has to be obtained.
On the basis of the information the Master can decide next actions for the protection of lives, the ship, the cargo and the environment.
The Master should take into account the following when he is determining whether salvage assistance will be needed or not:

- Nearest land or hazard to navigation
- Vessel's set and drift

- Estimated time of casualty repair
- Determination of nearest capable assistance and its response time.

Detailed information about the cargo, especially NLS Cargo has to be available and to be referred to further actions regarding the cargo.

In case of necessary movement of cargo within the ship careful consideration is to be given to hull strength and stability as well as to the compatibility of all material. (cargo, tanks, coating, piping) in view of any transfer actions planned.

Plans/tables about location and specification of the current cargo as well as bunkers and ballast have to be readily available.
Information about Current cargo/bunker/ballast distribution and the Material Safety Data Sheets (MSDS) for the carried cargo substances are available at:

- Cargo, bunkers, ballast distribution: Cargo Office
- Material Safety Data Sheets (MSDS); Alleyway opposite of the cargo office

3.4 Mitigating Activities

If safety of both the ship and the personnel has been addressed the Master shall care for the following issues:

- Assessment of the situation and monitoring of all activities as documented evidence
- Care for further protection of the personnel, use of protection gear, assessment of further risk for health and safety
- Containment of the spilled material by absorption and proper and safe disposal of all material onboard until proper delivery ashore under close guidance of the safety information given by the Product Data Sheet
- Decontamination of Personnel after finishing the cleanup process.

3.5 Transfer of Bunker/Cargo - Lightering

If the ship has sustained extensive structural damage, it may be necessary to transfer all or part of the cargo/bunker to another ship. In Ship to Ship transfer operations involving a specialized service ship, the Master of that ship will normally be in overall charge.
In the case of non-specialized ships the Master or other person in overall charge of the operation should be mutually agreed and clearly established by the Masters concerned prior to the start of operations.
The actual bunker/cargo transfer should be carried out in accordance with the requirements of the receiving ship.
In all cases each Master remains responsible for the safety to be jeopardized by the action of the other Master, his owner, regulatory officials or others.

The ship to ship transfer operations should be coordinated with the appropriate responsible local Authority. When selecting the area of operation the Masters should consider the following points:

- The need to notify and obtain the agreements of any responsible authority
- The destinations of the ships concerned
- The shelter provided, particularly from sea and swell
- The sea area and depth of water, which should be sufficient for maneuvering during mooring, unmooring, and transfer operations and allow a safe anchorage if operations have to be undertaken at anchor
- The traffic density
- The weather conditions and weather forecasts.

Further, before commencing Ship to Ship Transfer operations each ship should carry out, as far as possible, appropriate preparations like

- Pre-mooring preparations of the ship
- Positioning of fenders if such equipment is available on board
- Mooring equipment arrangements
- Checking the communication channels between the two ships.

In addition to the general principles of Ship to Ship operations as aforementioned the Master should take note of supplemented instructions issued in the Coastal Shipping Ltd bunkering procedures.

3.6 Damage Stability and Hull Stress Calculation

Whenever the tank status changes in the course of the incident the stability and stress of the vessel has to be checked using the class approved cargo computer.

In case of hull damage stability shall instantly be checked using the appropriate application of the cargo computer. The damage control plan should be referred to. In addition to that the **GL Emergency Response Service** is to be consulted for proper stress and stability calculations.

Whenever possible the contact to the **GL Emergency Response Service** will be via Coastal Shipping Ltd. office in order to reduce the workload onboard.
Otherwise the vessel can contact the **GL Emergency Response Service** directly using the following numbers:

Phone: **011-49-40-3614-9134**
Mobile: **011-49-172-405-9713**
Fax: **011-49-40-361-493-620**
email: **matthias.galle@gl-group.com**

Vessel Stress and Stability Information

VOYAGE PARTICULARS

Departure Port

Departure Date

Time (GMT)

VESSEL CONDITION IMMEDIATELY BEFORE CASUALTY

Mean Draft Forward

Mean Draft Aft

KG(solid)

KG(fluid)

LCG of Vessel

Condition of Tanks and Compartments

#	COMPARTMENT	S.G.	TONNES

3.7 General Responsibilities of the Master and designated Officers / crew members

The responsibilities of the Master Officers and the crew onboard in the event of a spill actual or probable to bring the accident under control on board, limit overflows or cleanup procedures, and to secure the ship immediately if an incident occurs.

The following is an example which can be used by the Master to aid in designating officers. Should changes to the team be made, please make a record in this section :

Master
Chief Mate
Chief Engineer

In the event of an emergency, the team should be called out as soon as it is safe to do so.

The team should be given necessary training in the use of such equipment as oil absorbents that the vessel may carry. All members crew should be aware of their duties should an oil spill occur.

Master

- In overall charge.
- Informs terminal authorities or coastal authorities of incident.
- Informs the local agent and requests agent to inform the local underwriter's representative.
- Advises the company's head office of the situation. Keeps everyone updated at regular intervals. and advises of any changes in status of the emergency.
- Keeps log of all events and progress of actions.

Chief Mate

- In charge of deck / cargo operations.
- In charge of lifeboats if required.
- Keeps the Master informed and updated on the situation and of the results of steps taken to contain any spills and limit outflow.
- Insures all openings in the deck and superstructure are closed to limit vapour entry.
- Position sorbent / clean up material to prevent any fluid escape.

Chief Engineer

- In charge of bunkering operations.
- Organizes distribution of oil spill detergents if required.
- Stops bunkering operations if applicable.
- Stops pumps and any unnecessary pieces of machinery.

Other Personnel

Deck Officer on duty

- Alerts and informs Chief Officer / Chief Engineer on the situation.

- Mobilize off duty crew as necessary.

Engineer on duty

- Assist the Chief Engineer.
- Prepare for fire fighting.
- Ensure sufficient power and water to deck.
- Organizes onboard clean up equipment.

Deck Officer off duty

- Under the direction of the Master, responsible for the reporting and record keeping of all events.

On duty Ratings

- Alerts the Officer on duty of any leakage.
- Position sorbent / clean up material to prevent any fluid escape.

Off duty personnel

- Assist as required

SECTION 4: National and Local Co-Ordination Steps to Control Discharge

In accordance with the Canadian Pollutant Discharge Reporting Regulations, the Master or Owner of a ship must report, without delay, any discharge or anticipated discharge of a pollutant in Canadian waters or fishing zones, to a Pollution Prevention Officer (PPO). Reports must be made in the manner described in Guidelines for Reporting Incidents Involving Dangerous Goods, Harmful Substances and/or Marine Pollutants, TP 9834, or "General Principles for Ship Reporting Systems and Ship Reporting Requirements, including Guidelines for Reporting Incidents Involving Dangerous Goods, Harmful Substances and/or Marine Pollutants" adopted by the IMO by Resolution A.851(20). These initial reports can be made to Marine Communication and Traffic Service (MCTS) or any other Canadian Coast Guard Radio Station (CGRS), on the frequencies listed in the publication, Radio Aids to Marine Navigation (RAMN).

Alternatively, spills may be reported to the appropriate regional center or nearest Vessel Traffic Service Center on VHF channel 16:

CANADA

Atlantic Region

St. John's, NL	Tel:	1-800-563-9089
Halifax, NS	Tel:	1-800-565-1633

Central & Arctic Region

Quebec City, QC	Tel:	1-800-363-4735
Sarnia, ON	Tel:	1-800-265-0237

Western Region

Vancouver, BC	Tel:	1-800-889-8852

GREENLAND

Spill Notification Point

Joint Arctic Command	Tel:	+299 36 40 00
MRCC Greenland	Fax:	+299 36 40 29
Aalisartut Aqquttaat 47	Email:	ako@mil.dk
Po Box 1072, 3900 Nuuk, Greenland		ako-commcen@mil.dk

Competent National Authority

Greenland Bureau of Minerals and Petroleum (BMP)	Tel:	(+299) 34 68 00
Imaneq 1A 201,	Fax:	(+299) 32 43 02
PO Box 930, 3900 Nuuk, Greenland	Email:	bmp@nanoq.gl
	Web:	www.bmp.gl

Note:

The following contacts have been included as they are within the expected range of operation of the Vessel. Due to the nature of the Vessel's voyages and varied ports of call this list should not be considered exhaustive. For this reason space has been included at the end of this section for addenda.

Within Canada, administrative inquiries related to pollution prevention, compliance and enforcement, vessel regulations, design and construction should be directed to:

Transport Canada
Marine Safety and Security
330 Sparks Street
Ottawa, Ontario
K1A 0N5
Tel: (613) 998-0610 Fax: (613) 954-1032

Inquiries relating to pollution response should be directed to:

Commissioner
Canadian Coast Guard
Department of Fisheries and Oceans
6th Floor, Centinnial Towers
200 Kent Street
Ottawa, Ontario
K1A 0E6
Tel: (613) 990-0999/7728 Fax: (613) 990-1866 Email: info@dfo-mpo.gc.ca

ECRC East Coast Response Corporation
1201-275 Slater Street
Ottawa, Ontario
K1P 5H9
Tel:(613) 230-7369

Additional Contact Information

Region	
Spill Notification Point	Contact Numbers

Region	
Spill Notification Point	Contact Numbers

Region	
Spill Notification Point	Contact Numbers

Region	
Spill Notification Point	Contact Numbers

VESSEL INTEREST CONTACTS

VESSEL MANAGEMENT

Coastal Shipping Limited (Owners)
P. O. Box 300, Station C
Happy Valley-Goose Bay, NL
A0P 1C0
Canada
Ph: (709) 896-2421
Fax: (709) 896-5028

24 HOUR EMERGENCY CONTACTS

General Manager	Dennis White	(709) 896-2421 work (709) 896-1404 cell (709) 896-2870 home
Engineering Superintendent	Jim Babij	(709) 579-6127 work (709) 727-5065 cell (709) 576-0160 home
	Kevin Brewer	(709) 579-6127 work (709) 682-0826 cell (709) 227 2600 home
Fleet Manager	Phillip John	(709) 535-6944 work (709) 541-1807 cell pjohn@woodwards.nf.ca
Designated Person Ashore	Craig Whiteway	(709) 834-1320 work (709) 727-4848 cell cwhiteway@woodwards.nf.ca

APPENDICES:

Appendix I:

- **Spill Equipment Inventory**

Appendix II:

- **General Arrangement**
- **Layout of General Arrangement Stowage Plan**
- **Diagram of Fuel Bunkering**
- **Tank Plan**
- **Capacity Plan**
- **Diagram of Fuel Service Lines**
- **Lubricating Oil System**
- **Stripping System**

APPENDIX I

SPILL EQUIPMENT "MT ALSTERSTERN"

LOCATION PLAN

Date Checked (dd/mm/yy):

Quantity	Unit	Description
		BOX 2 (CATWALK)
100	Pcs	Oil sorbent pads / sheets
1	Bag	Sorbent boom
2	Bags	Saw Dust
2	Bags	Granules
		BOX 3 (CATWALK)
3	Pcs	Compressed air breathing apparatus
1	Pc	Chemical suit (gas tight)
2	Pairs	Rubber boots
2	Pcs	Safety lamp
2	Pcs	Face mask
3	Pcs	Safety goggles
2	Pcs	Rubber gloves
3	Pcs	CHEMTEX chemical clothing
		BOX 4 (CATWALK)
2	Pcs	Sorbent blanket
2	Bags	Sorbent boom
25	Ltr.	Oil spill dispersant (SEACARE)
1	Pc	Pressure sprayer
1	Pc	Non sparking shovel
2	Pcs	Safety goggles
2	Pairs	Rubber gloves
2	Pairs	Rubber boots
2	Pcs	Plastic scoop
2	Pcs	Galvanized scoop
2	Pcs	Rain suit
		BOX 5 (BLOWER EXHAUST)
2	Bags	Saw dust
2	Bags	Granules
		BOX 6 (ACCOMMODATION)
2	Pcs	Compressed air breathing apparatus
2	Pcs	Chemical suit (gas tight)
2	Pcs	Safety helmet
2	Pcs	Safety lamp
1	Pc	Air drill
2	Pcs	Safety goggles
2	Pairs	Gloves
2	Pairs	Rubber boots
		SAFETY LOCKER #415
7	Pcs	Foam spray (Montage Schaum)
		FORECASTLE
4	Bags	Saw dust
		AFT WET LOCKER
14	Bags	Saw dust
5	Bags	Granules

****TO BE CHECKED MONTHLY AND DATE OF INSPECTION RECORDED****

APPENDIX II

Appendix C

Shipping Company certificate of entry and acceptance boats
Communication protocol
Safety management system for entry into confined water
Safety management system for monthly safety meeting

STEAMSHIP MUTUAL

CERTIFICATE OF ENTRY AND ACCEPTANCE

This is to certify that the ship below has been entered for insurance in
The Steamship Mutual Underwriting Association (Bermuda) Limited
for

Class 1 - Protection and Indemnity

With effect from

Noon G.M.T 20/02/2013 to Noon G.M.T 20/02/2014

until sold, lost, withdrawn or the entry is terminated in accordance with the Rules, to the extent specified and in accordance with the Act, Bye-Laws and the Rules from time to time in force and the special terms specified overleaf.

For the account of:

Coastal Shipping Ltd (Owner)

and Joint Members, if any, under Rule 9 (i) as listed overleaf

whose names have been entered in the Register of Members of the Club as a Member.

Vessel Name:	**"DORSCH"**		
Gross Tonnage:	**6,729**	Built:	**1980**
Class:	**GL**	IMO no:	**8007195**
Port of Registry:	**ST. JOHN`S, NFL.**		

THIS CERTIFICATE OF ENTRY IS EVIDENCE ONLY OF THE CONTRACT OF INDEMNITY INSURANCE BETWEEN THE ABOVE NAMED MEMBER(S) AND THE ASSOCIATION AND SHALL NOT BE CONSTRUED AS EVIDENCE OF ANY UNDERTAKING, FINANCIAL OR OTHERWISE, ON THE PART OF THE ASSOCIATION TO ANY OTHER PARTY.
IN THE EVENT THAT A MEMBER TENDERS THIS CERTIFICATE AS EVIDENCE OF INSURANCE UNDER ANY APPLICABLE LAW RELATING TO FINANCIAL RESPONSIBILITY, OR OTHERWISE SHOWS OR OFFERS IT TO ANY OTHER PARTY AS EVIDENCE OF INSURANCE, SUCH USE OF THIS CERTIFICATE BY THE MEMBER IS NOT TO BE TAKEN AS ANY INDICATION THAT THE ASSOCIATION THEREBY CONSENTS TO ACT AS GUARANTOR OR TO BE SUED DIRECTLY IN ANY JURISDICTION WHATSOEVER. THE ASSOCIATION DOES NOT SO CONSENT.

NOTES

1. REFERENCE IS REQUESTED TO THE RULES AS TO THE CIRCUMSTANCES OF ENTRY BEING CANCELLED AND AS TO THE CIRCUMSTANCES OF AN ALTERATION IN THE RULES OR BYE-LAWS.

2. THE RULES ARE PRINTED ANNUALLY IN BOOK FORM, INCORPORATING ALL PREVIOUS ALTERATIONS AND A COPY IS SENT TO EACH MEMBER. ALTERATIONS CAN BE MADE BY ORDINARY RESOLUTION FOLLOWING A GENERAL MEETING NOTIFIED TO ALL MEMBERS.

3. THIS CERTIFICATE OF ENTRY SUPERSEDES ANY PREVIOUS CERTIFICATE OF ENTRY IN RESPECT OF THESE RISKS AND ENTERED SHIP(S). SAVE AS OTHERWISE EXPRESSLY PROVIDED HEREIN ANY SUCH PREVIOUS CERTIFICATE OF ENTRY SHALL REMAIN IN FULL FORCE AND EFFECT UP TO THE DATE OF THIS CERTIFICATE OF ENTRY.

STEAMSHIP MUTUAL MANAGEMENT (BERMUDA) LTD.
MANAGERS

Hamilton, Bermuda - 07/02/2013

Certificate Number - 43113/ 1

Heather J. Cooper

Limit of Liability

Cover hereunder for all claims in respect of Oil Pollution shall be limited to US$ 1,000,000,000 each vessel any one accident or occurrence.

Inclusions of Cover

Cover as per Rules including but not limited to:

Liabilities in respect of Cargo in accordance with Rule 25 xiii and/save as may be more particularly set out in this Certificate of Entry.

Liability to Persons including Crew for illness, injury or death in accordance with Rule 25 i-iii, and/save as may be more particularly set out in this Certificate of Entry.

Liability for Loss of or Damage to Fixed and Floating Objects (including docks, jetties etc.) in accordance with rule 25 vii and/save as may be more particularly set out in this Certificate of Entry.

Liabilities in respect of Pollution in accordance with Rule 25 vi and/save as may be more particularly set out in this Certificate of Entry.

Liabilities in respect of Wreck Removal in accordance with Rule 25 xi and/save as may be more particularly set out in this Certificate of Entry.

Subject to the Rules and the Member's terms of entry this vessel is covered for trading to Arctic Waters.

Warranties

Vessel carrying non-persistent oil cargoes only, or held covered at terms and conditions to be agreed.

Trading between 15th June and 30th November annually, and to be laid-up at a safe port with less than 1/4 crew onboard for the remainder of the time

Trading Canadian waters only

Deductibles

US$5,235 - from all other cargo claims, each single voyage.

US$4,000 - from all other claims, any one accident or occurrence.

Other Conditions

Sanctions Clause

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It is a condition of this insurance that no coverage will be provided and no entries will be accepted in respect of:

1. Vessels owned, managed, operated or chartered by a party (who need not be a Member or prospective Member of the Club); and/or

2. Vessels;

designated under any legislation, regulation or order of any State or International Organisation which howsoever exposes those vessels and/or the Club and/or the Member entering such vessels and/or any other Member of the Club to the risk of being or becoming subject to any sanction, prohibition or adverse action whatsoever.

If, notwithstanding this condition,

(a) a vessel, in relation to which cover has been provided, or the entry of which has been accepted by the Club (whether or not a certificate of entry has been issued) ; or

(b) such vessel's owner, manager, operator or charterer, (whether or not a Member of the Club)

is or becomes so designated, the entry of that vessel and/or the coverage provided to the Member, shall cease forthwith and no claims, liabilities, costs or expenses shall be paid by or recoverable from the Club in relation thereto.

In the event that any vessel entered (whether or not a certificate of entry has been issued), or a vessel in relation to which cover has been provided, is employed on any voyage, in any trade, or for the carriage of cargo in breach of any legislation, regulation or order of any State or International Organisation which howsoever exposes the Club to the risk of being or becoming subject to any sanction, prohibition or adverse action whatsoever, the insurance of that vessel and/or the coverage provided to the Member shall cease forthwith and no claims, liabilities, costs or expenses in relation thereto, and arising after the date of such cessation, shall be recoverable hereunder. Save that at any time after such cessation, if the Directors in their absolute discretion so determine, that vessel's entry in the Club or the coverage in relation to that vessel, may be reinstated on such terms and conditions and from such date and time as the Directors or the Managers direct.

Crew Clauses

CANADIAN COMPENSATION EXCLUSION CLAUSE

Excluding any and all liability to crew and/or others employed on or about the vessel under any and all Workmens' Compensation Acts or equivalent legislation applicable under Canadian Federal or Provincial Law

Premium

Cancelling Returns only.

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Additional Parties

Joint Members

The cover afforded to:

1. Woodwards Oil Ltd (Other)
2. Labrador Leasing Ltd (Operator)
3. Labrador Motors Ltd (Operator)
4. Woodwards Ltd (Other)
5. Arctic Services Ltd (Other)

as Joint Member shall extend only to risks, liabilities, costs and expenses arising out of operations and/or activities customarily carried on by or at the risk and responsibility of shipowners and which are within the scope of the cover provided under the terms, conditions and exceptions provided by the Rules and by this Certificate of Entry.

The conduct of any one Joint Member which is sufficient to bar that Joint Member's right of recovery under the terms, conditions and exceptions provided by the Rules and by this Certificate of Entry shall bar absolutely the rights of recovery of all Joint Members thereunder.

All Joint Members shall be jointly and severally liable to pay contributions due to the Club in respect of this entry, and the receipt by any one Joint Member of any sums payable by the Club in respect of this entry shall be sufficient discharge of the Club for the same.

There shall be no recovery out of the funds of the Club in respect of any liability, costs and expenses arising out of or as a result of any claim, dispute or difference between any Joint Members, affiliates and/or any others insured to any extent under one entry.

Loss Payable Clause

Payment of any recovery the Owner is entitled to receive out of the funds of the Association in respect of any liability, costs or expenses incurred by him shall be made to the Owner or to his order unless and until the Association receives notice from:

The Royal Bank of Canada

that the Owner is in default under the Mortgage, in which event all recoveries shall thereafter be paid to:

The Royal Bank of Canada

or their order; provided always that no liability whatsoever shall attach to the Association, its Managers or their Agents for failure to comply with the latter obligation until after the expiry of two clear business days from the receipt of such notice. The Association shall, unless it receives from the Mortgagee notice to the contrary, be at liberty at the request of the Owner to provide bail or other security to prevent the arrest or obtain the release of the vessel, without liability to the Mortgagee.

Affiliated Companies Clause
It is noted that cover has been extended as follows, subject to the terms of Rule 9 (ii):

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Should a claim in respect whereof a Member named in this Certificate of Entry is insured by the Association be made or enforced through an Affiliated, Associated or Subsidiary Company of such Member, the Association shall if so requested by the Member indemnify such Company against any loss which as a consequence thereof such Company shall have incurred in that capacity provided always that nothing herein contained shall be construed as extending to any amount which would not have been recoverable from the Association by the Member had such claim been made or enforced against him. Once the Association has made such indemnification it shall not be under any further liability and shall not make any further payment to any person or Company whatsoever, including the Member, in respect of that claim.

Conduct of any one of the parties insured under this entry which is sufficient to bar the insured's rights hereunder shall bar the rights of recovery of all the said insured.

Addenda

War Risk Extension Clause

1) Cover excluded under Rule 21 is hereby reinstated subject to the terms set out in this Certificate of Entry and any Endorsement thereto, and to the following conditions.

2) This special cover shall be subject to an excess of either:

a) the "proper value" of the entered ship as defined in the Note to Rule 25 xv, (which, for the purpose of this War Risk Extension only, shall be deemed not to exceed US$100 million), or
b) the amount recoverable in respect of the claim under any other policy of insurance, whether of war risks or otherwise,

whichever shall be the greater, save that such excess shall not apply where the entry of the ship is solely in the name of or on behalf of a Charterer other than a Charterer by Demise or Bareboat Charterer, provided that the Directors may authorise the payment, in whole or in part, of any claim or part of a claim which falls within such excess, if in their discretion and without having to give any reasons for their decision they decide that the Owner should recover from the Club.

3) Subject to the exception set out below, the limit applying to this special cover shall be US$500 million, any one event each vessel or any limit set out elsewhere in this Certificate, whichever shall be the lesser.

4) All perils included in the special cover shall be subject to the following:

Chemical, Biological, Bio-chemical, Electromagnetic Weapons and Computer Virus Clause:

In no case shall this insurance cover loss damage liability or expense directly or indirectly caused by or contributed to by or arising from
a) any chemical, biological, bio-chemical or electromagnetic weapon;
b) the use or operation, as a means for inflicting harm, of any computer virus.

5) At any time or times before, or at the commencement of, or during the currency of any Policy Year of the Club, the Directors may in their discretion determine that any ports, places, countries, zones or areas (whether of land or sea) be excluded from the insurance provided by this P&I war risks cover. Save as otherwise provided by the Directors, this P&I war risks cover shall cease in

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respect of such ports, places, countries, zones or areas at midnight on the seventh day following the issue to the Members of notice of such determination in accordance with the terms of the cover provided pursuant to Rule 21 of the Club's Rules. Unless and to the extent that the Directors in their discretion otherwise decide there shall be no recovery from the Club under this P&I war risks cover in respect of any claim howsoever arising out of any event, accident or occurrence within the said area after such date.

6) Whether or not notice has been given under Clause (5) above, this P&I war risks cover shall terminate automatically:

i) upon the outbreak of war (whether there be a declaration of war or not) between any of the following countries:

United Kingdom, United States of America, France, the Russian Federation, the People's Republic of China and this insurance excludes loss, damage, liability or expense arising from such outbreak of war;

ii) in respect of any vessel, in connection with which cover is granted hereunder, in the event of such vessel being requisitioned either for title or use and this insurance excludes loss, damage, liability or expense arising from such requisition.

7) Notwithstanding any other term or condition of this insurance, the Directors may in their discretion cancel this special cover giving 7 days' notice to the Members (such cancellation becoming effective on the expiry of 7 days from midnight of the day on which notice of cancellation is issued by the Club and the Directors may at any time after the issue of notice of such cancellation resolve to reinstate special cover pursuant to the proviso to the terms of the cover issued pursuant to Rule 21 on such terms and conditions and subject to such limit as the Directors in their discretion may determine.

8) When either a Demise, Time, Voyage, Space or Slot Charterer and/or the Owner of the Entered Ship are separately insured for losses, liabilities, or the costs and expenses incidental thereto covered under Rule 21 of the Club and/or the equivalent Rule of any other Association which participates in the Pooling Agreement and General Excess Loss Reinsurance Contract, the aggregate of claims in respect of such losses, liabilities, or the costs and expenses incidental thereto covered under Rule 21 of the Club and/or the equivalent Rule of such other Association(s), shall be limited to the amount set out in the Certificate of Entry in respect of any one ship, any one incident or occurrence. If such claims exceed this limit, the liability of the Club in respect of each Certificate of Entry shall be limited to that proportion of the limit that claims recoverable from the Club under that Certificate bear to the aggregate of the said claims recoverable from the Club and from such other Association(s), if any.

9) Cover for acts of terrorism as defined in the U.S. Terrorism Risk Insurance Act of 2002 (TRIA) is included hereunder, subject to the conditions set out above, the estimated cost of this element of coverage being US0.25 cents per entered gross ton.

10) The Club shall not provide insurance hereunder for any losses, liabilities, costs or expenses if the provision of such insurance would create a liability for the (Insured Owner) under the Tanker Oil Pollution Indemnification Agreement 2006 to contribute to the IOPC Supplementary Fund.

11) Sanctions Clause - Excluding coverage for liabilities, costs and expenses to the extent that the payment of any claim or the provision of any benefit in respect of those

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liabilities, costs and expenses would expose the Club and/or their reinsurers hereunder to any sanction, prohibition or restriction under United Nations Resolutions or the trade or economic sanctions, laws or regulations of the European Union, United Kingdom or United States of America.

Bio-Chem Clause

1.1 Subject to the terms and conditions and exclusions set out herein, cover is extended to include the liability of the Member:
(a) To pay damages, compensation or expenses in consequence of the personal injury to or illness or death of any seaman (including diversion expenses, repatriation and substitute expense and shipwreck unemployment indemnity),
(b) For the legal costs and expenses incurred solely for the purpose of avoiding or minimising any liability or risk insured by an Association (other than under the Omnibus Rule)
1.2 Where such liability is not recoverable under either:
(a) cover provided by the Club for such liabilities, costs, losses and expenses as would be covered under the Rules but for the exclusion of war risks in Rule 21, or
(b) Any underlying war risk policies covering the same risks,
1.3 Solely by reason of the operation of an exclusion of liabilities, costs, losses and expenses directly or indirectly caused by or contributed to by or arising from :
(a) Any chemical, biological, bio-chemical or electromagnetic weapon
(b) the use or operation, as a means for inflicting harm, of any computer, computer system, computer software program, malicious code, computer virus or process or any other electronic system,
1.4 Other than liabilities, costs, losses and expenses arising from:
(i) Explosives or the methods of the detonation or attachment thereof
(ii) The use of the entered ship or its cargo as a means for inflicting harm, unless such cargo is a chemical or bio-chemical weapon.
(iii) the use of any computer, computer system or computer software program or any other electronic system in the launch and/or guidance system and/or firing mechanism of any weapon or missile.

2. Excluded Areas
2.1 The Directors may in their discretion decide that there shall be no recovery in respect of any liabilities, costs, losses and expenses directly or indirectly caused by or contributed to by or arising out of any event, accident or occurrence within such ports, places, zones or areas, or during such period as they may specify.
2.2 At any time or times before, or at the commencement of, or during the Policy Year, the Club may by notice to the Member change, vary, extend, add to or otherwise alter the ports, places, countries, zones and periods specified in Clause 2.1 from a date and time specified by the Club not being less than 24 hours from midnight on the day the notice is given to the Member.

3. Cancellation
Cover hereunder may by notice to the Member be cancelled by the Club from a date and time specified by the Club, not being less than 24 hours from midnight on the day notice of cancellation is given to the Member.

4. Limit of Liability
4.1 Subject to Clause 4.2 the limit of liability of the Club under this extension of cover in respect of all claims shall be in the aggregate US$30 million each ship any one accident or occurrence or series thereof arising from any one event.

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4.2 In the event that there is more than one entry by any person for Bio-Chem cover as provided herein in respect of the same ship with the Club and/or any other insurer which participates in the Pooling Agreement or General Excess Loss Reinsurance Contract, the aggregate recovery in respect of all liabilities, costs, losses and expenses arising under such entries shall not exceed the amount stipulated in Clause 4.1 and the liability of the Club under each such entry shall be limited to such proportion of that amount as the claims arising under that entry bear to the aggregate of all such claims recoverable from the Club and any such other insurer.

5. Deductible
The deductible shall be the deductible applicable to the relevant cover set out in the Certificate of Entry.

6. Law and Practice
This clause is subject to English law and practice.

Association:
The Steamship Mutual Underwriting Association (Bermuda) Limited
Washington Mall 1, PO Box HM 447, Hamilton HM BX, Bermuda
Tel: (441) 295-4502 Fax: (441) 292-8787

Managers:
Steamship Mutual Management (Bermuda) Limited
Washington Mall 1, PO Box HM 447, Hamilton HM BX, Bermuda
Tel: (441) 295 4502 Fax: (441) 292 8787

Managers' London Representative:
Steamship Insurance Management Services Limited
Authorised and Regulated by the United Kingdom Financial Services Authority
Aquatical House, 39 Bell Lane, London E1 7LU
Tel: 020 7247 5490 Website: www.simsl.com
Registered No: 3855693 England

Heather J. Cooper

STEAMSHIP MUTUAL

CERTIFICATE OF ENTRY AND ACCEPTANCE

This is to certify that the ship below has been entered for insurance in
The Steamship Mutual Underwriting Association (Bermuda) Limited
for

Class 1 - Protection and Indemnity

With effect from

Noon G.M.T 20/02/2013 to Noon G.M.T 20/02/2014

until sold, lost, withdrawn or the entry is terminated in accordance with the Rules, to the extent specified and in accordance with the Act, Bye-Laws and the Rules from time to time in force and the special terms specified overleaf.

For the account of:

Coastal Shipping Ltd (Owner)

and Joint Members, if any, under Rule 9 (i) as listed overleaf

whose names have been entered in the Register of Members of the Club as a Member.

Vessel Name:	**"NANNY"**		
Gross Tonnage:	**6,544**	Built:	**1993**
Class:	**DNV**	IMO no:	**9051399**
Port of Registry:	**ST. JOHN`S, NFL.**		

THIS CERTIFICATE OF ENTRY IS EVIDENCE ONLY OF THE CONTRACT OF INDEMNITY INSURANCE BETWEEN THE ABOVE NAMED MEMBER(S) AND THE ASSOCIATION AND SHALL NOT BE CONSTRUED AS EVIDENCE OF ANY UNDERTAKING, FINANCIAL OR OTHERWISE, ON THE PART OF THE ASSOCIATION TO ANY OTHER PARTY.
IN THE EVENT THAT A MEMBER TENDERS THIS CERTIFICATE AS EVIDENCE OF INSURANCE UNDER ANY APPLICABLE LAW RELATING TO FINANCIAL RESPONSIBILITY, OR OTHERWISE SHOWS OR OFFERS IT TO ANY OTHER PARTY AS EVIDENCE OF INSURANCE, SUCH USE OF THIS CERTIFICATE BY THE MEMBER IS NOT TO BE TAKEN AS ANY INDICATION THAT THE ASSOCIATION THEREBY CONSENTS TO ACT AS GUARANTOR OR TO BE SUED DIRECTLY IN ANY JURISDICTION WHATSOEVER. THE ASSOCIATION DOES NOT SO CONSENT.

NOTES

1. REFERENCE IS REQUESTED TO THE RULES AS TO THE CIRCUMSTANCES OF ENTRY BEING CANCELLED AND AS TO THE CIRCUMSTANCES OF AN ALTERATION IN THE RULES OR BYE-LAWS.

2. THE RULES ARE PRINTED ANNUALLY IN BOOK FORM, INCORPORATING ALL PREVIOUS ALTERATIONS AND A COPY IS SENT TO EACH MEMBER. ALTERATIONS CAN BE MADE BY ORDINARY RESOLUTION FOLLOWING A GENERAL MEETING NOTIFIED TO ALL MEMBERS.

3. THIS CERTIFICATE OF ENTRY SUPERSEDES ANY PREVIOUS CERTIFICATE OF ENTRY IN RESPECT OF THESE RISKS AND ENTERED SHIP(S). SAVE AS OTHERWISE EXPRESSLY PROVIDED HEREIN ANY SUCH PREVIOUS CERTIFICATE OF ENTRY SHALL REMAIN IN FULL FORCE AND EFFECT UP TO THE DATE OF THIS CERTIFICATE OF ENTRY.

STEAMSHIP MUTUAL MANAGEMENT (BERMUDA) LTD.
MANAGERS

Hamilton, Bermuda - 07/02/2013

Certificate Number - 43117/ 1

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Limit of Liability

Cover hereunder for all claims in respect of Oil Pollution shall be limited to US$ 1,000,000,000 each vessel any one accident or occurrence.

Inclusions of Cover

Cover as per Rules including but not limited to:

Liabilities in respect of Cargo in accordance with Rule 25 xiii and/save as may be more particularly set out in this Certificate of Entry.

Liability to Persons including Crew for illness, injury or death in accordance with Rule 25 i-iii, and/save as may be more particularly set out in this Certificate of Entry.

Liability for Loss of or Damage to Fixed and Floating Objects (including docks, jetties etc.) in accordance with rule 25 vii and/save as may be more particularly set out in this Certificate of Entry.

Liabilities in respect of Pollution in accordance with Rule 25 vi and/save as may be more particularly set out in this Certificate of Entry.

Liabilities in respect of Wreck Removal in accordance with Rule 25 xi and/save as may be more particularly set out in this Certificate of Entry.

Subject to the Rules and the Member's terms of entry this vessel is covered for trading to Arctic Waters.

Warranties

Vessel carrying non-persistent oil cargoes only, or held covered at terms and conditions to be agreed.

Trading between 15th June and 30th November annually, and to be laid-up at a safe port with less than 1/4 crew onboard for the remainder of the time

Trading Canadian waters only

Deductibles

US$5,235 - from all other cargo claims, each single voyage.

US$4,000 - from all other claims, any one accident or occurrence.

Other Conditions

Sanctions Clause

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It is a condition of this insurance that no coverage will be provided and no entries will be accepted in respect of:

1. Vessels owned, managed, operated or chartered by a party (who need not be a Member or prospective Member of the Club); and/or

2. Vessels;

designated under any legislation, regulation or order of any State or International Organisation which howsoever exposes those vessels and/or the Club and/or the Member entering such vessels and/or any other Member of the Club to the risk of being or becoming subject to any sanction, prohibition or adverse action whatsoever.

If, notwithstanding this condition,

(a) a vessel, in relation to which cover has been provided, or the entry of which has been accepted by the Club (whether or not a certificate of entry has been issued) ; or

(b) such vessel's owner, manager, operator or charterer, (whether or not a Member of the Club)

is or becomes so designated, the entry of that vessel and/or the coverage provided to the Member, shall cease forthwith and no claims, liabilities, costs or expenses shall be paid by or recoverable from the Club in relation thereto.

In the event that any vessel entered (whether or not a certificate of entry has been issued), or a vessel in relation to which cover has been provided, is employed on any voyage, in any trade, or for the carriage of cargo in breach of any legislation, regulation or order of any State or International Organisation which howsoever exposes the Club to the risk of being or becoming subject to any sanction, prohibition or adverse action whatsoever, the insurance of that vessel and/or the coverage provided to the Member shall cease forthwith and no claims, liabilities, costs or expenses in relation thereto, and arising after the date of such cessation, shall be recoverable hereunder. Save that at any time after such cessation, if the Directors in their absolute discretion so determine, that vessel's entry in the Club or the coverage in relation to that vessel, may be reinstated on such terms and conditions and from such date and time as the Directors or the Managers direct.

Crew Clauses

CANADIAN COMPENSATION EXCLUSION CLAUSE

Excluding any and all liability to crew and/or others employed on or about the vessel under any and all Workmens' Compensation Acts or equivalent legislation applicable under Canadian Federal or Provincial Law

Premium

Cancelling Returns only.

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Additional Parties

Joint Members

The cover afforded to:

1. Woodwards Oil Ltd (Other)
2. Labrador Leasing Ltd (Operator)
3. Labrador Motors Ltd (Operator)
4. Woodwards Ltd (Other)
5. Arctic Services Ltd (Other)

as Joint Member shall extend only to risks, liabilities, costs and expenses arising out of operations and/or activities customarily carried on by or at the risk and responsibility of shipowners and which are within the scope of the cover provided under the terms, conditions and exceptions provided by the Rules and by this Certificate of Entry.

The conduct of any one Joint Member which is sufficient to bar that Joint Member's right of recovery under the terms, conditions and exceptions provided by the Rules and by this Certificate of Entry shall bar absolutely the rights of recovery of all Joint Members thereunder.

All Joint Members shall be jointly and severally liable to pay contributions due to the Club in respect of this entry, and the receipt by any one Joint Member of any sums payable by the Club in respect of this entry shall be sufficient discharge of the Club for the same.

There shall be no recovery out of the funds of the Club in respect of any liability, costs and expenses arising out of or as a result of any claim, dispute or difference between any Joint Members, affiliates and/or any others insured to any extent under one entry.

Affiliated Companies Clause
It is noted that cover has been extended as follows, subject to the terms of Rule 9 (ii):

Should a claim in respect whereof a Member named in this Certificate of Entry is insured by the Association be made or enforced through an Affiliated, Associated or Subsidiary Company of such Member, the Association shall if so requested by the Member indemnify such Company against any loss which as a consequence thereof such Company shall have incurred in that capacity provided always that nothing herein contained shall be construed as extending to any amount which would not have been recoverable from the Association by the Member had such claim been made or enforced against him. Once the Association has made such indemnification it shall not be under any further liability and shall not make any further payment to any person or Company whatsoever, including the Member, in respect of that claim.

Conduct of any one of the parties insured under this entry which is sufficient to bar the insured's rights hereunder shall bar the rights of recovery of all the said insured.

Addenda

War Risk Extension Clause

1) Cover excluded under Rule 21 is hereby reinstated subject to the terms set out in this

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Certificate of Entry and any Endorsement thereto, and to the following conditions.

2) This special cover shall be subject to an excess of either:

a) the "proper value" of the entered ship as defined in the Note to Rule 25 xv, (which, for the purpose of this War Risk Extension only, shall be deemed not to exceed US$100 million), or
b) the amount recoverable in respect of the claim under any other policy of insurance, whether of war risks or otherwise,

whichever shall be the greater, save that such excess shall not apply where the entry of the ship is solely in the name of or on behalf of a Charterer other than a Charterer by Demise or Bareboat Charterer, provided that the Directors may authorise the payment, in whole or in part, of any claim or part of a claim which falls within such excess, if in their discretion and without having to give any reasons for their decision they decide that the Owner should recover from the Club.

3) Subject to the exception set out below, the limit applying to this special cover shall be US$500 million, any one event each vessel or any limit set out elsewhere in this Certificate, whichever shall be the lesser.

4) All perils included in the special cover shall be subject to the following:

Chemical, Biological, Bio-chemical, Electromagnetic Weapons and Computer Virus Clause:

In no case shall this insurance cover loss damage liability or expense directly or indirectly caused by or contributed to by or arising from
a) any chemical, biological, bio-chemical or electromagnetic weapon;
b) the use or operation, as a means for inflicting harm, of any computer virus.

5) At any time or times before, or at the commencement of, or during the currency of any Policy Year of the Club, the Directors may in their discretion determine that any ports, places, countries, zones or areas (whether of land or sea) be excluded from the insurance provided by this P&I war risks cover. Save as otherwise provided by the Directors, this P&I war risks cover shall cease in respect of such ports, places, countries, zones or areas at midnight on the seventh day following the issue to the Members of notice of such determination in accordance with the terms of the cover provided pursuant to Rule 21 of the Club's Rules. Unless and to the extent that the Directors in their discretion otherwise decide there shall be no recovery from the Club under this P&I war risks cover in respect of any claim howsoever arising out of any event, accident or occurrence within the said area after such date.

6) Whether or not notice has been given under Clause (5) above, this P&I war risks cover shall terminate automatically:

i) upon the outbreak of war (whether there be a declaration of war or not) between any of the following countries:

United Kingdom, United States of America, France, the Russian Federation, the People's Republic of China and this insurance excludes loss, damage, liability or expense arising from such outbreak of war;

ii) in respect of any vessel, in connection with which cover is granted hereunder, in the event of such vessel being requisitioned either for title or use and this insurance excludes loss, damage,

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liability or expense arising from such requisition.

7) Notwithstanding any other term or condition of this insurance, the Directors may in their discretion cancel this special cover giving 7 days' notice to the Members (such cancellation becoming effective on the expiry of 7 days from midnight of the day on which notice of cancellation is issued by the Club and the Directors may at any time after the issue of notice of such cancellation resolve to reinstate special cover pursuant to the proviso to the terms of the cover issued pursuant to Rule 21 on such terms and conditions and subject to such limit as the Directors in their discretion may determine.

8) When either a Demise, Time, Voyage, Space or Slot Charterer and/or the Owner of the Entered Ship are separately insured for losses, liabilities, or the costs and expenses incidental thereto covered under Rule 21 of the Club and/or the equivalent Rule of any other Association which participates in the Pooling Agreement and General Excess Loss Reinsurance Contract, the aggregate of claims in respect of such losses, liabilities, or the costs and expenses incidental thereto covered under Rule 21 of the Club and/or the equivalent Rule of such other Association(s), shall be limited to the amount set out in the Certificate of Entry in respect of any one ship, any one incident or occurrence. If such claims exceed this limit, the liability of the Club in respect of each Certificate of Entry shall be limited to that proportion of the limit that claims recoverable from the Club under that Certificate bear to the aggregate of the said claims recoverable from the Club and from such other Association(s), if any.

9) Cover for acts of terrorism as defined in the U.S. Terrorism Risk Insurance Act of 2002 (TRIA) is included hereunder, subject to the conditions set out above, the estimated cost of this element of coverage being US0.25 cents per entered gross ton.

10) The Club shall not provide insurance hereunder for any losses, liabilities, costs or expenses if the provision of such insurance would create a liability for the (Insured Owner) under the Tanker Oil Pollution Indemnification Agreement 2006 to contribute to the IOPC Supplementary Fund.

11) Sanctions Clause - Excluding coverage for liabilities, costs and expenses to the extent that the payment of any claim or the provision of any benefit in respect of those liabilities, costs and expenses would expose the Club and/or their reinsurers hereunder to any sanction, prohibition or restriction under United Nations Resolutions or the trade or economic sanctions, laws or regulations of the European Union, United Kingdom or United States of America.

Bio-Chem Clause

1.1 Subject to the terms and conditions and exclusions set out herein, cover is extended to include the liability of the Member:
(a) To pay damages, compensation or expenses in consequence of the personal injury to or illness or death of any seaman (including diversion expenses, repatriation and substitute expense and shipwreck unemployment indemnity),
(b) For the legal costs and expenses incurred solely for the purpose of avoiding or minimising any liability or risk insured by an Association (other than under the Omnibus Rule)
1.2 Where such liability is not recoverable under either:
(a) cover provided by the Club for such liabilities, costs, losses and expenses as would be covered under the Rules but for the exclusion of war risks in Rule 21, or
(b) Any underlying war risk policies covering the same risks,
1.3 Solely by reason of the operation of an exclusion of liabilities, costs, losses and expenses

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directly or indirectly caused by or contributed to by or arising from :
(a) Any chemical, biological, bio-chemical or electromagnetic weapon
(b) the use or operation, as a means for inflicting harm, of any computer, computer system, computer software program, malicious code, computer virus or process or any other electronic system,
1.4 Other than liabilities, costs, losses and expenses arising from:
(i) Explosives or the methods of the detonation or attachment thereof
(ii) The use of the entered ship or its cargo as a means for inflicting harm, unless such cargo is a chemical or bio-chemical weapon.
(iii) the use of any computer, computer system or computer software program or any other electronic system in the launch and/or guidance system and/or firing mechanism of any weapon or missile.

2. Excluded Areas
2.1 The Directors may in their discretion decide that there shall be no recovery in respect of any liabilities, costs, losses and expenses directly or indirectly caused by or contributed to by or arising out of any event, accident or occurrence within such ports, places, zones or areas, or during such period as they may specify.
2.2 At any time or times before, or at the commencement of, or during the Policy Year, the Club may by notice to the Member change, vary, extend, add to or otherwise alter the ports, places, countries, zones and periods specified in Clause 2.1 from a date and time specified by the Club not being less than 24 hours from midnight on the day the notice is given to the Member.

3. Cancellation
Cover hereunder may by notice to the Member be cancelled by the Club from a date and time specified by the Club, not being less than 24 hours from midnight on the day notice of cancellation is given to the Member.

4. Limit of Liability
4.1 Subject to Clause 4.2 the limit of liability of the Club under this extension of cover in respect of all claims shall be in the aggregate US$30 million each ship any one accident or occurrence or series thereof arising from any one event.
4.2 In the event that there is more than one entry by any person for Bio-Chem cover as provided herein in respect of the same ship with the Club and/or any other insurer which participates in the Pooling Agreement or General Excess Loss Reinsurance Contract, the aggregate recovery in respect of all liabilities, costs, losses and expenses arising under such entries shall not exceed the amount stipulated in Clause 4.1 and the liability of the Club under each such entry shall be limited to such proportion of that amount as the claims arising under that entry bear to the aggregate of all such claims recoverable from the Club and any such other insurer.

5. Deductible
The deductible shall be the deductible applicable to the relevant cover set out in the Certificate of Entry.

6. Law and Practice
This clause is subject to English law and practice.

Association:
The Steamship Mutual Underwriting Association (Bermuda) Limited
Washington Mall 1, PO Box HM 447, Hamilton HM BX, Bermuda
Tel: (441) 295-4502 Fax: (441) 292-8787

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Managers:
Steamship Mutual Management (Bermuda) Limited
Washington Mall 1, PO Box HM 447, Hamilton HM BX, Bermuda
Tel: (441) 295 4502 Fax: (441) 292 8787

Managers' London Representative:
Steamship Insurance Management Services Limited
Authorised and Regulated by the United Kingdom Financial Services Authority
Aquatical House, 39 Bell Lane, London E1 7LU
Tel: 020 7247 5490 Website: www.simsl.com
Registered No: 3855693 England

ATLANTIC TOWING

WOODWARD

BAKER LAKE AREA OPERATIONAL PROCESSES

To further support safe operations in the Baker Lake area between Woodward and Atlantic Towing, the following information and procedures will be adopted starting in the 2013 season.

1.0 COMMUNICATION PROTOCOL

Daily e-mail sent out by each vessel to all vessels by 8:00am. Distribution of e-mail would include all ATL, Woodward and Desgagnes vessels in the area.

E-mail to include:

- Current position
- ETA thru narrows
- Communication equipment status

Long Distance Communication

- Primary – satellite phone
- Secondary – Sat-C

Short Distance Communication

- VHF communication – channel 16

2.0 ATL COMMUNICATION INFORMATION

Atlantic Beech

- E-mail: 43252810@stratosmobile.net
- Cellular: (902) 229-3904
- Satellite: 011-8707-6481-1379

Atlantic Teak

- E-mail: 432521310@stratosmobile.net
- Cellular: (506) 343-4539
- Satellite: 011-8707-6487-5881

ATL VHF working channel is 69

WOODWARD COMMUNICATION INFORMATION

Dorsch

- E-mail: 431699913@stratosmobile.net
- Cellular: 1-709-727-6027
- Satellite: 1-613-980-6750

Nanny

- E-mail: 43169764@statosmobile.net
- Cellular: 1-709-690-4025
- Satellite: 1-613-855-6114

Alsterstern

- E-mail: 431605510@statosmobile.net
- Cellular: 1-709-541-0861
- Satellite: 1-613-855-4412

Havelstern

- E-mail: 431605711@statosmobile.net
- Cellular: 1-709-541-0083
- Satellite: 1-613-855-6115

Travestern

- E-mail: 431600532@statosmobile.net
- Cellular: 1-709-541-2029
- Satellite: 1-613-855-6121

WOODWARD VHF working channel is 10

DESGAGNES TRANSARCTIK INC.

Sedna Desgaganes

- E-mail: captain.sedna@desgagnes.com
- Cellular: (581) 998-3961
- Satellite: (418) 907-1134

Zelada Desgaganes

- E-mail: captain.zelada@desgagnes.com
- Cellular: (581) 998-6295
- Satellite: (418) 241-6175

Master Claude A. Desgagnes

- E-mail: captain.claudea@desgagnes.com
- Cellular: (418) 802-8596
- Satellite: (418) 907-8409

Master Rosaire A. Desgaganes

- E-mail: captain.rosairea@desgagnes.com
- Cellular: (418) 254-2355
- Satellite: (514) 907-5719

3.0 RULES OF THE WATER WAYS

Note: Outbound refers to Tanker and/ or Tug & Barge leaving Baker Lake for Helicopter Island
Inbound refers to Tanker and/or Tug & Barge leaving Helicopter Island for Baker Lake

Helicopter Island to Baker Lake

Inbound ATL Tug will contact outbound Woodward Tanker by e-mail to get its transit time thru the narrows . Tug and barge will depart Helicopter Island 3 and ½ hours prior to the transit time of the Tanker. It takes 3 hours for the Tug and Barge to reach the narrows from Helicopter Island. This allows plenty of time for all 4 vessels to transit the narrows. A couple of minutes before entering

Inbound ATL Tug and Barge **WILL ALWAYS** depart Helicopter Island prior to inbound Woodward Tanker. Inbound Woodward Tanker **WILL ALWAYS** follow inbound ATL Tug and Barge until to entrance of Baker Lake (no passing). Inbound ATL Tug and Barge and inbound Woodward Tanker will communicate on VHF channel 16 and should give a "security call" on channel 16 before entering the channel (satellite used as back up). All vessels (inbound and outbound) will use VHF channel 16 for communication (satellite used as back up).

Inbound ATL Tug and Barge will pass thru the narrows first, followed by the inbound Woodward Tanker. Outbound Woodward Tanker will pass thru the narrows next, followed by the outbound ATL Tug and Barge.

Baker Lake to Helicopter

Outbound Woodward Tanker will depart for the narrows. When reaching the narrows, outbound Woodward Tanker **WILL NEVER** proceed until inbound traffic has cleared the narrows. Outbound Woodward Tanker will hold position above the narrows just south of Bannerman Island.

Outbound ATL Tug and Barge will depart for the narrows. When reaching the narrows, outbound ATL Tug and Barge **WILL NEVER** proceed until inbound traffic has cleared the narrows. Outbound ATL Tug and Barge will hold position above the narrows just south of Bannerman Island.

Once inbound vessel traffic has cleared the narrows, the outbound Woodward Tanker will proceed thru the narrows first. The outbound ATL Tug and Barge **WILL ALWAYS** proceed thru the narrows after the outbound Woodward Tanker. All vessels (inbound and outbound) will use VHF channel 16 for communication (satellite used as back up).

FUEL HOSE POSITIONING

The fuel hose from the Woodward Tanker will be connected to the far side of the vessel away from the spud barge. The fuel hose will lay directly to shore, where a support structure will guide the fuel hose along the shore line until it mates with the shore manifold. This eliminates the risk of the ATL Tug and Barge coming into contact with the fuel hose while departing/ arriving at the spud barge. Also, a tender will be near the cargo hose with a line in order to move the hose away from the tug and barge.

In case of foul weather, where the tug and barge must cast off in a hurry, pumping operations will be suspended for a very short period of time, while the tug and barge depart.

Entry into Confined Waters

Vessel: _____
Channel/Pass/Port: _____
Date Completed: _____

Have the passage plan details been checked?

Item	Initials	Comments
Intended track verified for navigational hazards		
Paper chart track and ECS track are identical		
UKC maintained within Standing orders factoring in draft, squat and rise of tide. If this is not possible, prior clearance has been obtained from the Marine Superintendent in accordance with company policy.		
"No-Go" areas and abort positions are clearly marked on chart		
Index lines checked and characteristics of shoreline considered for radar errors		
Course alterations are within the maneuverability characteristics of the vessel including allowances for drift and wheel over delays		
The passage plan that includes this confined waters transit has been approved by the Master		

Prior to entering confined waters, have the following been prepared and checked?

Item	Initials	Comments
Call to E/R to confirm Engineer is on watch in the E/R and all systems are functioning normally		
Hand steering is engaged and both steering gear motors are running		
Thrusters are on, tested and control is on the bridge		
Primary pitch control is fully functional and on the bridge		
Sounder is switched on, recording, and the print out is signed by the OOW indicating the time, location and the direction of travel through the confined waters. If a printer is not fitted, a note to the same effect should be placed in the bell book.		
Speed log is switched on and functional		
Tide and current conditions have been checked and are suitable for the passage		
An up-to-date ice chart is available for the region and conditions are suitable for the passage		
Visibility conditions are suitable for the passage		
The Master has been informed of the upcoming passage and has assigned him/herself or the Chief Officer to the bridge during the passage		
A watchman has been placed on the bow and anchors have been prepared for immediate let-go. If not, Master must initial the line below, otherwise cross out the statement below.		
I do not feel a watchman on the bow is necessary for this passage. **Master's Initials:**		
If a watchman has been placed on the bow, a communication system has been established and tested.		
Immediately prior to entering the channel, a SECURITE call has been made to alert traffic in the vicinity.		

Notes, other precautions taken, or information about when precautions noted above must be enforced or may be relaxed

Signatures:

Watch Officer: _____ Signature: _____

Master or C/O: _____ Signature: _____

Monthly Safety Meeting Minutes

Date: _____
Time Started: _____
Vessel: _____

Purpose of Meeting

1. Review and discuss the response to the previous meetings and assign any action requested as part of a Corrective Action Plan.
2. Review and discuss any Memos, Classification Society Circulars, or amendments to the company's Safety Management System that have been implemented since the previous meeting.
3. Make general reminders and comments to the crew about safety and safety procedures on board. (ex: wear PPE, watch ice, snow on deck, reminder about crane safety)
4. Discuss incidents, injuries, accidents, and near-misses that have occurred since the previous meeting and propose corrective action to prevent reoccurrence.
5. Crew to raise and discuss new safety concerns onboard the vessel, keeping the focus on specific safety risks, potential hazards, and best safety practices, not general complaints.

Attendance (names)

Agenda

1. Minutes of previous meeting reviewed by vessel's crew.
2. Read and discuss company response to previous meeting.
3. Discuss outstanding items carried forward from previous meetings and safety items that have been resolved.
4. Review company memos, Class circulars, changes to Safety Management System, and make general safety reminders for crew.
5. Discuss risk assessments, injuries, accidents, near-misses and action to prevent reoccurrence.
6. Discuss new safety issues raised by vessel personnel.

Minutes of Previous Meeting

Minutes of previous meeting reviewed by vessel's crew.
Company response read and discussed.

Minutes of Current Meeting

Outstanding Safety Items From Previous Meetings

List items that were previously reported, but have not been closed yet. Indicate with a Yes or No if an additional response is requested from the office on the issue.

#	Safety Item	Latest Status	Response Requested? (Y/N)
1			
2			

Resolved Safety Items From Previous Meetings

List items that were previously reported, and have been resolved. Discuss the resolution and any changes in policy that have resulted.

#	Safety Item	Resolution
1		
2		

Review of Memos, Circulars, and SMS Amendments

List the item that is being discussed and any comments from the crew about how it applies to company vessels, changes to policy that may be needed to address the issue, or related concerns.

Item Discussed	Comments

Safety Reminders

List any reminders give to crew regarding safety onboard and applicable comments.

Item Discussed	Comments

Injuries, Accidents, Near-misses

List any incidents that have occurred since the previous meeting including a detailed description, and the findings of any follow-up investigation conducted. The office will follow-up on each item listed, so any suggested action to prevent reoccurrence would be helpful in improving safety policy. If the incident listed is an injury, accident or significant near-miss, please ensure the appropriate report paperwork has also been filed.

#	Incident Description	Investigation Findings	Suggested Action
1			
2			

New Safety Items Raised

List new safety items raised by the crew keeping the list focused on legitimate safety items. Non-safety related issues should be deferred to general discussion at the end of the meeting. The Master should comment on issues raised to determine if the issue can be resolved onboard. Indicate with a Yes or No if a response is requested from the office on the issue.

#	Safety Issue	Master's Comments	Response Requested? (Yes/No)
1			
2			
3			
4			

Other Comments

Meeting adjourned at:

Signatures

Safety Officer: _____ Master: _____

Appendix D

NWT/NU Spill Report Form

NT-NU SPILL REPORT

OIL, GASOLINE, CHEMICALS AND OTHER HAZARDOUS MATERIALS

NT-NU 24-HOUR SPILL REPORT LINE
TEL: (867) 920-8130
FAX: (867) 873-6924
EMAIL: spills@gov.nt.ca

REPORT LINE USE ONLY

A	REPORT DATE: MONTH – DAY – YEAR	REPORT TIME	☐ ORIGINAL SPILL REPORT, OR ☐ UPDATE # _____ TO THE ORIGINAL SPILL REPORT	REPORT NUMBER _____-_____
B	OCCURRENCE DATE: MONTH – DAY – YEAR	OCCURRENCE TIME		

C	LAND USE PERMIT NUMBER (IF APPLICABLE)	WATER LICENCE NUMBER (IF APPLICABLE)
D	GEOGRAPHIC PLACE NAME OR DISTANCE AND DIRECTION FROM NAMED LOCATION	REGION ☐ NWT ☐ NUNAVUT ☐ ADJACENT JURISDICTION OR OCEAN
E	LATITUDE DEGREES MINUTES SECONDS	LONGITUDE DEGREES MINUTES SECONDS

F	RESPONSIBLE PARTY OR VESSEL NAME	RESPONSIBLE PARTY ADDRESS OR OFFICE LOCATION	
G	ANY CONTRACTOR INVOLVED	CONTRACTOR ADDRESS OR OFFICE LOCATION	
H	PRODUCT SPILLED	QUANTITY IN LITRES, KILOGRAMS OR CUBIC METRES	U.N. NUMBER
	SECOND PRODUCT SPILLED (IF APPLICABLE)	QUANTITY IN LITRES, KILOGRAMS OR CUBIC METRES	U.N. NUMBER
I	SPILL SOURCE	SPILL CAUSE	AREA OF CONTAMINATION IN SQUARE METRES
J	FACTORS AFFECTING SPILL OR RECOVERY	DESCRIBE ANY ASSISTANCE REQUIRED	HAZARDS TO PERSONS, PROPERTY OR EQUIPMENT
K	ADDITIONAL INFORMATION, COMMENTS, ACTIONS PROPOSED OR TAKEN TO CONTAIN, RECOVER OR DISPOSE OF SPILLED PRODUCT AND CONTAMINATED MATERIALS		

L	REPORTED TO SPILL LINE BY	POSITION	EMPLOYER	LOCATION CALLING FROM	TELEPHONE
M	ANY ALTERNATE CONTACT	POSITION	EMPLOYER	ALTERNATE CONTACT LOCATION	ALTERNATE TELEPHONE

REPORT LINE USE ONLY

N	RECEIVED AT SPILL LINE BY	POSITION STATION OPERATOR	EMPLOYER	LOCATION CALLED YELLOWKNIFE, NT	REPORT LINE NUMBER (867) 920-8130

LEAD AGENCY ☐ EC ☐ CCG ☐ GNWT ☐ GN ☐ ILA ☐ INAC ☐ NEB ☐ TC

SIGNIFICANCE ☐ MINOR ☐ MAJOR ☐ UNKNOWN

FILE STATUS ☐ OPEN ☐ CLOSED

AGENCY	CONTACT NAME	CONTACT TIME	REMARKS
LEAD AGENCY			
FIRST SUPPORT AGENCY			
SECOND SUPPORT AGENCY			
THIRD SUPPORT AGENCY			

Appendix E

General Response Procedures for Spilled Chemical Substances

Explosives

E.1 Ammonium Nitrate
E.2 Ammonium Nitrate Fuel Oil (ANFO)

E.1 Ammonium Nitrate

AEM commits to review, modify and approve as required to establish this procedure as appropriate for use at the Meadowbank camp.

The first step against prevention of potential spills and association hazards is the application of proper storage procedures for bulk Ammonium Nitrate, including the following:

- Good housekeeping of the storage facility will prevent spilling and or contamination of materials;
- Ammonium nitrate should be stored away from combustible materials and fuels, as well as other blasting accessories (i.e. boosters, delays, detonating cords and detonators);
- The storage facility should be well ventilated;
- Proper signage restricting the use/exposure of ammonium nitrate to ignition sources should be posted (e.g. no hot work, smoking or vehicle maintenance); and
- The storage facility should be locked at all times with only authorized personnel allowed access.

The following is a general spill response procedure for ammonium nitrate. Consult the MSDS for the specific spilled compound to determine whether deviations from the general guidance are required. AEM commits to review and test, and if necessary, modify and update thus spill response procedure on an annual basis.

For an ammonium nitrate spill (solid):

1) Isolate and evacuate the spill area;

2) Contact your Supervisor who will then contact the On-Scene Coordinator and coordinate appropriate spill response materials outside the spill area. **Obtain and read the MSDS** for the substance to determine the chemical-specific hazards and to identify any special precautions that must be taken;

3) Put on appropriate personal protective equipment. For an ammonium nitrate spill this includes:

   a) Gloves **as recommended by the MSDS or glove manufacturer;**

   b) Protective eyeglasses or chemical safety goggles or face shield **as recommended by the MSDS;**

   c) Lab coat, coveralls or TyvekTM coveralls **as recommended by the MSDS; and**

   d) Half mask air-purifying respirator with cartridges and/filters **as recommended by the MSDS or respirator manufacturer;**

4) Ventilate (open windows/doors to outdoors) closed spaces before entering;

5) Remove all sources of heat and ignition (no smoking, flares, sparks or flames in immediate area) and remove uncontaminated combustible materials and organic compounds (wood, paper, oil, etc.,) from spill area;

6) For spills to land, protect the spill area from storm water runoff by constructing a ditch or dike using suitable absorbent materials, soil or other appropriate barrier;

7) Vacuum or sweep the spill residue using non-metal, non-sparking tools and place the residue in a labelled,

plastic, container (plastic pail with lid or double heavy duty plastic bags) for re-use or off-site disposal at a licensed disposal facility;

Note: Recovered solid, if generally free from impurities, may be suitable for its intended use. In this case, place solid in suitable container with lid, and ***clearly label the container per WHMIS Guidelines****.*

Note: Minimize dust generation during the operation.

8) Remove and bag personal protective equipment for cleaning and disposal at a licensed facility. Thoroughly wash potential skin contact locations after handling.

E.2 Ammonium Nitrate Fuel Oil (ANFO)

Currently no ANFO is stored at the site. ANFO is fabricated as required, with ammonium nitrate and fuel oil. In the event that ANFO would be stored at the camp, AEM commits to review, modify and approve as required to establish this procedure as appropriate for use at the Meadowbank Gold Project. Proper handling and disposal of ANFO is an important first step in mitigating against spills and associated hazards.

The proper storage procedures are as follows:

- ANFO should only be used under the supervision of authorized trained personnel;
- ANFO should be kept away from heat, sparks, and flames, as well as initiating explosives, oxidizing agents, combustibles, and other sources of heat;
- Containers should be protected from physical damage and in dry, well ventilated conditions;
- Transportation to the Mine site will be in accordance with Section 14 of the *Mines Act* and Regulations and the *Transportation of Dangerous Goods Act*. Transport vehicles will be in sound mechanical condition and equipped with proper safety equipment. Loaded vehicles will not be left unattended and only authorized personnel will be responsible for the security of the explosives under their control; and
- Explosives that have been identified as deteriorated or damaged will need to be disposed of or destroyed. The appropriate method of disposal or destruction and subsequent course of action will be determined by authorized personnel or the explosive supplier.

The following is a general spill response procedure for ammonium nitrate fuel oil – ANFO. The following procedure does not apply to emulsions or other explosives. Consult the MSDS for the specific spilled compound to determine whether deviations from the general guidance are required. AEM commits to review and test, and if necessary, modify and update thus spill response procedure on an annual basis.

For an ANFO spill (solid):

1) Isolate and evacuate the spill area;

2) Immediately extinguish any open flames and remove ignition sources (no smoking, flares, sparks in immediate area) IF SAFE TO DO SO. **Fires involving large quantities of ANFO should not be fought;**

3) Contact the On-Scene Coordinator who will assemble ERT members and the appropriate spill response materials outside the spill area. **Obtain and read the MSDS** for the substance to determine the chemical-specific hazards and to identify any special precautions that must be taken;

4) Put on appropriate personal protective equipment. For an ANFO spill this includes:

   a): Gloves **as recommended by the MSDS or glove manufacturer;**

   b) Protective eyeglasses or chemical safety goggles or face shield **as recommended by the MSDS;**

   c) Lab coat, coveralls or TyvekTM coveralls **as recommended by the MSDS;**

   d) Shoe covers or rubber boots;

   e) Half mask air-purifying respirator with cartridges and/filters **as recommended by the MSDS or respirator manufacturer;**

5) If the spill has occurred outdoors, stay upwind and avoid low lying areas. Ventilate (open windows/doors to outdoors) closed spaces before entering. Ensure adequate explosion proof ventilation for clean-up;

6) Remove all sources of heat and ignition (no smoking, flares, sparks or flames in immediate area) and remove uncontaminated combustible materials and organic compounds (wood, paper, oil, etc.,) from spill area;

7) Do not operate radio transmitters within 100 m of electric detonators;

8) For spill on land, protect the spill area from storm water runoff by constructing a ditch or dike using suitable absorbent materials, soil or other appropriate barrier. For spill to water, utilize damming, and/or water diversion to minimize the spread of contamination;

9) Collect, sweep or shovel spilled material and the other contaminated material/soil using non- metallic, spark-proof tools and place residue into a labelled, plastic, waste container (plastic pail with lid or double heavy duty plastic bags) for off-site disposal at a licensed disposal facility;

Note: Recovered solid, if generally free from impurities, may be suitable for its intended use. In this case, place solid in suitable container with lid, and ***clearly label the container per WHMIS Guidelines.***

Note: The drums/containers/residues are to be stored in ventilated areas away from incompatible materials for eventual off-site disposal at a licensed disposal facility.

10) Remove and bag personal protective equipment for cleaning or disposal at a licensed disposal facility. Thoroughly wash with soap potential skin contact locations after handling. Properly dispose of contaminated leather articles including shoes that cannot be decontaminated.

Appendix F

General Response Procedures for Spilled Chemical Substances

F.1 Compressed Gases

F.1 Compressed Gases

AEM commits to review, modify and approve as required to establish this procedure as appropriate for Meadowbank Gold Project.

The following is a general spill response procedure for compressed gases. Consult the MSDS for the specific spilled compound to determine whether deviations from the general guidance are required. AEM commits to review and test, and if necessary, modify and update thus spill response procedure on an annual basis.

For a compressed (inert and flammable) gas leak:

1) IF SAFE TO DO SO and it will stop the gas leak, turn off cylinder valve;

2) If the leak cannot be stopped by closing the cylinder valve, and it is **an inert atmospheric gas** (e.g. nitrogen, carbon dioxide, etc.) isolate and evacuate the affected area. If the leak is a **flammable gas** and the leak is outside of a ventilated building enclosure that will contain the gas, immediately activate the fire alarm system and evacuate the area/building;

3) Contact the On-Scene Coordinator who will assemble spill response team members and the appropriate spill response materials outside the spill area. **Obtain and read the MSDS** for the substance to determine the chemical-specific hazards and to identify any special precautions that must be taken;

4) If possible and safety permits, adjust leaking cylinder so that gas escapes rather than liquid;

5) If possible and safety permits, eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area) and turn off electrical equipment;

6) If the spilled has occurred outdoors, stay upwind and avoid low lying areas. If the spill has occurred inside a building, prevent spread of vapour throughout the building by closing doors to other rooms and hallways. If the room's air exchange system distributes air throughout the building, then it may also be necessary to have it shut-down. Allow vapours to ventilate outdoors by opening windows and doors to the exterior; and

7) Isolate area until gas has dispersed. On-Scene Coordinator to verify safe conditions.

Appendix G

General Response Procedures for Spilled Chemical Substances

G.1 Flammable and Combustible Liquids

G.1 Flammable and Combustible Liquids

AEM commits to review, modify and approve as required to establish this procedure as appropriate for use at the Meadowbank Gold Project. The following is a general spill response procedure for flammable or combustible liquids, particularly petroleum hydrocarbon products. Consult the MSDS for the specific spilled compound to determine whether deviations from the general guidance are required.

AEM commits to review and test, and if necessary, modify and update thus spill response procedure on an annual basis.

For a spill of flammable or combustible petroleum hydrocarbon product (liquid):

1) Isolate and evacuate the spill area;

2) Immediately extinguish any open flames and remove ignition sources (no smoking, flares, sparks in immediate area) IF SAFE TO DO SO;

3) Stop leak and contain spill (**see Step 9**) IF SAFE TO DO SO;

4) Contact the On-Scene Coordinator who will assemble ERT members if required and the appropriate spill response materials outside the spill area. **Obtain and read the MSDS** for the substance to determine the chemical-specific hazards and to identify any special precautions that must be taken;

5) Put on appropriate personal protective equipment. Depending on the scale of the spill and properties of the spilled substance, this can include:

   a) Gloves **as recommended by the MSDS or glove manufacturer;**

   b) Splash goggles or face shield;

   c) Shoe covers or rubber boots;

   d). Lab coat or TyvekTM coveralls; and

   e) Half mask air-purifying respirator with **organic vapour or combination** cartridges, or **as otherwise recommended by the MSDS or respirator manufacturer**.

6) If the spilled has occurred outdoors, stay upwind and avoid low lying areas. If the spill has occurred inside a building, prevent spread of vapour throughout the building by closing doors to other rooms and hallways. If the room's air exchange system distributes air throughout the building, then it may also be necessary to have it shut-down;

7) Ventilate (open windows/doors to outdoors) closed spaces before entering. Ensure adequate explosion-proof ventilation for clean-up. A vapour suppressing foam or water spray may be used to reduce vapours;

8) Remove all sources of ignition (no smoking, flares, sparks or flames in immediate area) and combustible materials (wood, paper, oil, etc.) within the spilled area;

9) Contain spill by using spill absorbent, spill pads or pillows, soil or snow to construct a dike that limits flow and prevents entry to sewer, waterways or onto ice. For spills to land, excavation of trenches/pits to capture spill flow may also be appropriate. If possible, compact soil or snow dikes, and place plastic tarps over the dike and at its foot to allow the product to pool on the plastic for easy recovery;

   Note: Do not use paper towels to absorb spill as this increases the rate of evaporation and vapour

concentration in the air.

Note: Do not flush with water into drainage areas or ditches as this will spread spill.

Note: Snow works well as a natural absorbent to collect and contain spilled petroleum hydrocarbons. However, its use in containing a spill will result in a water-contaminant mixture that may be more difficult to manage. It is important to scrape up the contaminated snow and ice as soon as possible.

10) Carefully cover the spill area with spill absorbent, spill pads, soil or snow, starting at the outside and working inward. Do not touch or walk through spilled material;

11) Sweep up or shovel the residue using non-metallic, spark-proof tools and place the residue into a labelled, plastic, waste container (plastic pail with lid or double heavy duty plastic bags). For larger spills to land, excavate impacted absorbent material and soil, place in lined and bermed temporary storage area or directly into sealed drums/containers;

Note: The drums/containers/residues are to be stored in ventilated areas away from incompatible materials for eventual treatment at on-site landfarm or off-site disposal at a licensed disposal facility. Electrically ground all containers and transporting equipment.

Note: Larger pools of product may be pumped into empty storage tanks or drums.

12) If spill is indoors, mop the affected area using detergent and water. Dispose of this water to drums for eventual off-site disposal at a licensed disposal facility. Spills to land may require further excavation or remediation of contaminated soil until acceptable soil quality is achieved. The On- Scene Coordinator and/or Environmental Superintendent will assess this requirement;

13) For spills to water, immediately limit the area of the spill on water using absorbent pads and booms and similar materials to capture small spills on water. Deploy and slowly draw in absorbent booms to encircle and absorb the spilled product. Recover larger spills on water with floating skimmers and pumps, as required, and discharge recovered product to drums or tanks;

Note: Petroleum hydrocarbons are generally hydrophobic, and as such, do not readily dissolves in water. They typically tend to float on the water's surface. Absorbent booms are often relied on to recover hydrocarbons that escape land containment and enter water.

Note: Antifreeze sinks and mixes with water. If released to water, attempt to isolate/confine the spill by damming or diverting the spill. Pump contaminated water to tanks or drums.

14) Remove and bag personal protective equipment for cleaning, informing laundry personnel of contaminant hazards, or disposal at a licensed disposal facility. Thoroughly wash with soap potential skin contact locations after handling. Properly dispose of contaminated leather articles, (including shoes) that cannot be decontaminated.

Appendix H

General Response Procedures for Spilled Chemical Substances

Oxidizing Substances

H.1 Liquids
H.2 Solids

H.1 Liquids

AEM commits to review, modify and approve as required and to establish this procedure as appropriate for use at the Meadowbank Gold Project. The following is a general spill response procedure for liquid oxidizer compounds. Consult the MSDS for the specific spilled compound to determine whether deviations from the general guidance are required.

AEM commits to review and test, and if necessary, modify and update thus spill response procedure on an annual basis.

For a liquid oxidizer spill:

1) Isolate and evacuate the spill area;

2) Stop leak and contain spill (**see Step 8**) IF SAFE TO DO SO;

3) Contact the On-Scene Coordinator who will assemble ERT members if required and the appropriate spill response materials outside the spill area. **Obtain and read the MSDS** for the substance to determine the chemical-specific hazards and to identify any special precautions that must be taken;

4) Put on the appropriate personal protective equipment. Depending on the scale of the spill and properties of the spilled substance, this can include:

    a) Gloves **as recommended by the MSDS or glove manufacturer;**

    b) Splash goggles or face shield;

    c). Shoe covers or rubber boots;

    d) Lab coat, coveralls or TyvekTM coveralls **as recommended by the MSDS**; and

    e) Half mask air-purifying respirator with cartridges and/or filters **as recommended by the MSDS or respirator manufacturer**.

5) Ventilate closed spaces before entering. Ensure adequate explosion-proof ventilation for clean-up;

6) Remove and/or moisten with water any combustible material (wood, paper, oil, etc.) affected by the spill;

7) Use water spray to reduce vapours or divert vapour cloud drift, if required;

8) Contain spill by using non-combustible spill absorbent, soil or snow to construct a dike that limits flow and prevents entry to sewer, waterways or onto ice. For spills to land, excavation of trenches/pits to capture spill flow may also be appropriate;

    *Note: Flushing area with flooding quantities of water may also be appropriate assuming this does not make clean up and waste management more difficult– **refer to the MSDS**.*

9) Carefully cover the spill area with spill absorbent, soil or snow, starting at the outside and working inward. Use non-combustible absorbent. Do not touch or walk though spilled material.

10) Sweep up or shovel the spill residue using non-metal, non-sparking tools and place the residue into a labelled, plastic, waste container (plastic pail with lid or double heavy duty plastic bags) for off- site disposal at a licensed disposal facility;

11) For indoor spills, mop the affected area using detergent and water. Flushing area with flooding quantities of water may also be appropriate – **refer to the MSDS**. Dispose of this water to the sanitary sewer, process stream or waste drums as appropriate. Spills to land may require further excavation or remediation of contaminated soil until acceptable soil quality is achieved. The On- Scene Coordinator and/or Environmental Superintendent will assess this requirement; and

12) Remove and bag personal protective equipment for cleaning, informing laundry personnel of contaminant hazards, or disposal at a licensed disposal facility. Thoroughly wash with soap potential skin contact locations after handling. Properly dispose of contaminated clothing that cannot be decontaminated.

H.2 Solids

AEM commits to review, modify and approve as required to establish this procedure as appropriate for use at the Meadowbank Gold Project.

The following is a general spill response procedure for solid oxidizer compounds. Consult the MSDS for the specific spilled compound to determine whether deviations from the general guidance are required.

AEM commits to review and test, and if necessary, modify and update thus spill response procedure on an annual basis.

For a solid oxidizer spill:

1) Isolate and evacuate the spill area;

2) Contact the On-Scene Coordinator who will assemble ERT members if required and the appropriate spill response materials outside the spill area. **Obtain and read the MSDS** for the substance to determine the chemical-specific hazards and to identify any special precautions that must be taken;

3) Put on the appropriate personal protective equipment. Depending on the scale of the spill and properties of the spilled substance, this can include:

    a) Gloves **as recommended by the MSDS or glove manufacturer;**

    b) Safety glasses or goggles;

    c) Lab coat; and

    d) Half mask air-purifying respirator with **N95 or greater protection** particulate filter or **as recommended by the MSDS or respirator manufacturer**.

4) Remove all sources of heat and ignition (no smoking, flares, sparks or flames in immediate area) and remove uncontaminated combustible materials and organic compounds (wood, paper, oil, etc.,) from spill area;

5) For spills to land, protect the spill area from storm water runoff by constructing a ditch or dike using suitable non-combustible absorbent materials, soil or other appropriate barrier. For spill to water, utilize damming, and/or water diversion to minimize the spread of contamination;

6) Vacuum, sweep or shovel the spill residue using non-metal, non-sparking tools and place the residue into a labelled, plastic, container (plastic pail with lid or double heavy duty plastic bags) for re- use or off-site disposal at a licensed disposal facility;

    Note: Recovered solid, if generally free from impurities, may be suitable for its intended use. In this case, place solid in suitable container with lid, and ***clearly label the container per WHMIS Guidelines****.*

    Note: Minimize dust generation.

7) If there is still oxidizer residue left in the spill area, neutralize with appropriate agent **as recommended by the MSDS**, or for spills to land continue to excavate until no visible spilled solid remains. Use non-combustible spill absorbent or soil to absorb the neutralized residue. Place in suitable drums/containers for disposal to a licensed facility;

8) For indoor spills, mop the affected area using detergent and water. Dispose of this water to the sanitary

sewer, process stream or waste drums as appropriate; and

9) Remove and bag personal protective equipment for cleaning, informing laundry personnel of contaminant hazards, or disposal at a licensed disposal facility. Thoroughly wash with soap potential skin contact locations after handling. Properly dispose of contaminated clothing that cannot be decontaminated.

Appendix I

General Response Procedures for Spilled Chemical Substances

Poisonous and Toxic Substances

I.1 Sodium Cyanide

I.1 Sodium Cyanide

AEM commits to review, modify and approve as required to establish this procedure as appropriate for use at the Meadowbank Gold Project. The following is a general spill response procedure for solid Sodium Cyanide.

AEM commits to review and test, and if necessary, modify and update thus spill response procedure on an annual basis.

For a Sodium Cyanide (solid) spill:

1) Isolate and evacuate the spill area;

2) Contact the On-Scene Coordinator who will assemble ERT members and the appropriate spill response materials outside the spill area. **Obtain and read the MSDS** for the substance to determine the chemical-specific hazards and to identify any special precautions that must be taken;

3) Put on the appropriate personal protective equipment. Depending on the scale of the spill and properties of the spilled substance, this can include:

    a) Gloves **as recommended by the MSDS or glove manufacturer;**
    b) Safety glasses or goggles;
    c) Lab coat; and
    d) Half mask air-purifying respirator **as recommended by the MSDS or respirator manufacturer**.

    Note: For worker safety, maintain readily accessible supply of cyanide antidote kits on site.

4) Ventilate area of spill or leak;

5) Avoid exposure to acids, water or weak alkalis which can react to form toxic hydrogen cyanide (HCN) gas.

6) Contain spill to prevent release to sewer, waterway or onto ice. For spills to land, protect the spill area from storm water runoff by constructing a ditch or dike using absorbent materials, soil or other appropriate barrier. If raining, cover spill area with tarp or plastic to minimize contact with water and prevent subsequent runoff. For spill to water, utilize damming, and/or water diversion to minimize the spread of contamination;

7) Shovel the spilled material into labelled drums, containers or plastic bags for re-use or off-site disposal at a licensed disposal facility.

    *Note: Recovered solid, if generally free from impurities, may be suitable for its intended use. In this case, place solid in suitable container with lid, and **clearly label the container per WHMIS Guidelines**.*

    Note: Minimize dust generation.

8) If there is still spilled sodium cyanide residue left in the spill area, neutralize with appropriate agent **as recommended by the MSDS** (sodium or calcium hypochlorite solution), or for spills to land continue to excavate until no visible spilled solid remains. Use suitable spill absorbent or soil to absorb the neutralized residue. Place in suitable drums/containers for disposal to a licensed facility. Collect material and place in a closed container for recovery or disposal;

9) For indoor spills, mop the affected area using detergent and water. Dispose of this water to waste drums/containers for disposal to a licensed facility; and

10) Remove and bag personal protective equipment for disposal at a licensed disposal facility. Thoroughly wash with soap potential skin contact locations after handling. Properly dispose of contaminated clothing that cannot be decontaminated.

Appendix J

General Response Procedures for Spilled Chemical Substances

Corrosive Substances

J.1 Acids, Liquids
J.2 Acids, Solids
J.3 Bases/Alkali, Liquids
J.4 Bases/Alkali, Solids

J.1 Acids, Liquids

AEM commits to review, modify and approve as required to establish this procedure as appropriate for use at the Meadowbank Gold Project.

The following is a general spill response procedure for liquid acid compounds. Consult the MSDS for the specific spilled compound to determine whether deviations from the general guidance are required. AEM commits to review and test, and if necessary, modify and update thus spill response procedure on an annual basis.

For a liquid acid spill:

1) Isolate & evacuate the spill area;

2) Stop leak and contain spill (**see Step 8 below**) IF SAFE TO DO SO;

3) Contact the On-Scene Coordinator who will assemble ERT members if required and the appropriate spill response materials outside the spill area. **Obtain and read the MSDS** for the substance to determine the chemical-specific hazards and to identify any special precautions that must be taken;

4) Put on appropriate personal protective equipment. Depending on the scale of the spill and properties of the spilled substance, this can include:

    a) Gloves **as recommended by the MSDS or glove manufacturer;**

    b) Splash goggles or face shield;

    c) Shoe covers or rubber boots;

    d) Lab coat or TyvekTM coveralls; and

    e) Half mask air-purifying respirator with **acid gas or combination** cartridges, or **as otherwise recommended by the MSDS or respirator manufacturer**.

5) If the spill has occurred outdoors, stay upwind and stay out of low areas. If the spill has occurred inside a building, prevent spread of vapour throughout the building by closing doors to other rooms and hallways. If the room's air exchange system distributes air throughout the building, then it may also be necessary to have it shut-down;

6) Ventilate (open windows/doors to outdoors) closed spaces before entering;

7) Remove all sources of ignition (no smoking, flares, sparks or flames in immediate area);

8) Contain spill by using spill absorbent, spill pads or pillows, or dry soil to construct a dike that limits flow and prevents entry to sewer, waterways or onto ice. For spills to land, excavation of trenches/pits to capture spill flow may also be appropriate. Ideally, use spill absorbent that contains a mild neutralizing agent **as recommended by the MSDS;**

    *Note: Many acids, particularly concentrated acids react violently in the presence of water. Do not flush spill area with water unless the **MSDS** indicates acceptable.*

    Note: Nitric Acid reacts violently and explosively with organic chemicals and organic material such as wood, cotton and paper; therefore, do not use organic absorbent material on Nitric acid.

Note: Hydrofluoric acid will fume during neutralization. Provide adequate ventilation and approach from upwind. Neutralize carefully with sodium bicarbonate, soda ash or lime. Use water spray to disperse the gas/vapour if required. Remove all sources of ignition.

9) Carefully cover the spill area with spill absorbent, spill pads or dry soil, starting at the outside and working inward. If practical, neutralize spill using **MSDS-recommended** or commercially available neutralizers. Use pH indicator paper to determine if spill is neutralized (pH 7);

Note: Use caution as neutralization reactions generate heat.

10) Sweep or shovel the neutralized spill residue using non-metal, non-sparking tools and place the residue into a labelled, plastic, waste container (plastic pail with lid or double heavy duty plastic bags) for off-site disposal at a licensed disposal facility;

11) Check the pH of the spill area. If it is less than pH 6, then further neutralize with a dilute solution of a suitable reagent **as identified on the MSDS** or for spill to land continue to excavate contaminated soil;

12) For indoor spills, mop the affected area using detergent and water. Dispose of this water to the sanitary sewer, process stream or waste drums as appropriate;

13) Remove and bag personal protective equipment for cleaning, informing laundry personnel of contaminant hazards, or disposal at a licensed disposal facility. Thoroughly wash with soap potential skin contact locations after handling. Properly dispose of contaminated clothing that cannot be decontaminated; and

14) After the spill has been cleaned up, the area should be free of vapours. However, if personnel note odours or irritation, isolate the spill area; re-clean the area as per **Steps 11 and 12** or wait at least **1 hour** before re-entering or until considered safe by the On-Scene Coordinator or Environmental Superintendent.

J.2 Acids, Solids

AEM commits to review, modify and approve as required to establish this procedure as appropriate for use on the Meadowbank Gold Project.

The following is a general spill response procedure for solid acid compounds. Consult the MSDS for the specific spilled compound to determine whether deviations from the general guidance are required.

AEM commits to review and test, and if necessary, modify and update thus spill response procedure on an annual basis.

For a solid acid spill;

1) Isolate and evacuate the spill area;

2) Contact the On-Scene Coordinator who will assemble ERT members if required and the appropriate spill response materials outside the spill area. **Obtain and read the MSDS** for the substance to determine the chemical-specific hazards and to identify any special precautions that must be taken;

3) Put on the appropriate personal protective equipment. Depending on the scale of the spill and properties of the spilled substance, this can include:

    a) Gloves **as recommended by the MSDS or glove manufacturer;**

    b) Safety glasses or goggles;

    c) Lab coat; and

    d) Half mask air-purifying respirator with **N95 or greater protection** particulate filter, or **as otherwise recommended by the MSDS or respirator manufacturer**.

4) Contain spill to prevent release to sewer, waterway or onto ice. For spills to land, protect the spill area from storm water runoff by constructing a ditch or dike using absorbent materials, dry soil or other appropriate barrier. If raining, cover spill area with tarp or plastic to minimize contact with water and prevent reaction and/or subsequent runoff. For spill to water, utilize damming, and/or water diversion to minimize the spread of contamination;

5) If necessary to minimize dust production, slightly moisten the solid. Use water, or if the material is water reactive, another inert liquid **as recommended by the MSDS;**

6) Sweep up or shovel the residue using non-metallic, spark-proof tools and place the residue into a labelled, plastic, waste container (plastic pail with lid or double heavy duty plastic bags) for reuse or off-site disposal at a licensed disposal facility;

    *Note: Recovered solid, if generally free from impurities, may be suitable for its intended use. In this case, place solid in suitable container with lid, and **clearly label the container per WHMIS Guidelines**.*

7) Remaining solid acid residue may be neutralized using a dilute solution of appropriate agent **as recommended by the MSDS** (e.g. sodium bicarbonate - baking soda), or for spills to land continue to excavate until no visible spilled solid remains. Check the pH of the spill area; the final pH should be between pH 6 and 10. Use spill absorbent, spill pads or dry soil to absorb the neutralized residue;

    Note: Use caution as neutralization reactions generate heat.

8) For indoor spills, mop the affected area using detergent and water. Dispose of this water to the sanitary sewer, process stream or waste drums as appropriate; and

9) Remove and bag personal protective equipment for cleaning, informing laundry personnel of contaminant hazards, or disposal at a licensed disposal facility. Thoroughly wash with soap potential skin contact locations after handling. Properly dispose of contaminated clothing that cannot be decontaminated.

J.3 Bases/Alkali, Liquids

AEM commits to review, modify and approve as required to establish this procedure as appropriate for use at the Meadowbank exploration camp.

The following is a general spill response procedure for liquid alkali or base compounds. Consult the MSDS for the specific spilled compound to determine whether deviations from the general guidance are required.

AEM commits to review and test, and if necessary, modify and update thus spill response procedure on an annual basis.

For a liquid alkali or base spill:

1) Isolate & evacuate the spill area;

2) Stop leak and contain spill (**see Step 8**) IF SAFE TO DO SO;

3) Contact the On-Scene Coordinator who will assemble ERT members and the appropriate spill response materials outside the spill area. **Obtain and read the MSDS** for the substance to determine the chemical-specific hazards and to identify any special precautions that must be taken;

4) Put on the appropriate personal protective equipment. Depending on the scale of the spill and properties of the spilled substance, this can include:

    a) Gloves **as recommended by the MSDS or glove manufacturer;**

    b) Splash goggles or face shield;

    c) Shoe covers or rubber boots;

    d) Lab coat or TyvekTM coveralls; and

    e) Half mask air-purifying respirator with cartridges/filters **as recommended by the MSDS or respirator manufacturer**.

5) If the spill has occurred outdoors, stay upwind and stay out of low areas. If the spill has occurred inside a building, prevent spread of vapour throughout the building by closing doors to other rooms and hallways. If the room's air exchange system distributes air throughout the building, then it may also be necessary to have it shut-down;

6) Ventilate (open/windows to outdoors) closed spaces before entering;

7) Remove all sources of ignition (no smoking, flares, sparks or flames in immediate area) and combustible materials (wood, paper, oil, etc.);

8) Contain spill by using spill absorbent, spill pads or pillows, or dry soil to construct a dike that limits flow and prevents entry to sewer, waterways or onto ice. For spills to land, excavation of trenches/pits to capture spill flow may also be appropriate. Ideally, use spill absorbent that contains a mild neutralizing agent **as recommended by MSDS;**

    Note: Use caution as neutralization reactions generate heat.

9) Carefully cover the spill area with spill absorbent, spill pads or dry soil, starting at the outside and working inward. If practical, neutralize spill using MSDS-recommended or commercially available neutralizers. Use

pH indicator paper to determine if spill is neutralized (pH 7);

Note: Use caution as neutralization reactions generate heat.

10) Sweep or shovel the neutralized spill residue using non-metal, non-sparking tools and place the residue into a labelled, plastic, waste container (plastic pail with lid or double heavy duty plastic bags) for off-site disposal at a licensed disposal facility;

11) Check the pH of the spill area. If it is greater than pH 10, then further neutralize with a dilute solution of a suitable reagent **as identified on the MSDS**, or for spill to land continue to excavate contaminated soil;

12) For indoor spills, mop the affected area using detergent and water. Dispose of this water to the sanitary sewer, process stream or waste drums as appropriate;

13) Remove and bag personal protective equipment for cleaning, informing laundry personnel of contaminant hazards, or disposal at a licensed disposal facility. Thoroughly wash with soap potential skin contact locations after handling. Properly dispose of contaminated clothing that cannot be decontaminated; and

14) After the spill has been cleaned up, the area should be free of vapours. However, if personnel note odours or irritation, isolate the spill area; re-clean as per **Steps 11 and 12** or wait at least **1 hour** before re-entering or until it is considered to be safe by the On-Scene Coordinator or Environmental Superintendent.

J.4 Bases/Alkali, Solids

AEM commits to review, modify and approve as required to establish this procedure as appropriate for use at the Meadowbank Gold Project.

The following is a general spill response procedure for solid alkali or base compounds. Consult the MSDS for the specific spilled compound to determine whether deviations from the general guidance are required.

AEM commits to review and test, and if necessary, modify and update thus spill response procedure on an annual basis.

For a solid alkali or base spill;

1) Isolate and evacuate the spill area;

2) Contact the On-Scene Coordinator who will assemble ERT members if required and the appropriate spill response materials outside the spill area. **Obtain and read the MSDS** for the substance to determine the chemical-specific hazards and to identify any special precautions that must be taken;

3) Put on the appropriate personal protective equipment. Depending on the scale of the spill and properties of the spilled substance, this can include:

    a) Gloves **as recommended by the MSDS or glove manufacturer;**

    b) Safety glasses or goggles;

    c) Lab coat; and

    d) Half mask air-purifying respirator with **N95 or greater protection** particulate filter or **as recommended by the MSDS or respirator manufacturer**.

4) Contain spill to prevent release to sewer, waterway or onto ice. For spills to land, protect the spill area from storm water runoff by constructing a ditch or dike using absorbent materials, dry soil or other appropriate barrier. If raining, cover spill area with tarp or plastic to minimize contact with water and prevent reaction and/or subsequent runoff. For spill to water, utilize damming, and/or water diversion to minimize the spread of contamination;

5) If necessary to minimize dust production, slightly moisten the solid. Use water, or if the material is water reactive, another inert liquid **as recommended by the MSDS**;

    Note: Do not use water to flush bases in powdered form, such as calcium oxide (lime), as this material is not very soluble.

6) Sweep or shovel the residue using non-metallic, spark-proof tools and place the residue into a labelled, plastic, waste container (plastic pail with lid or double heavy duty plastic bags) for offsite disposal at a licensed disposal facility;

    *Note: Recovered solid, if generally free from impurities, may be suitable for its intended use. In this case, place solid in suitable container with lid, and **clearly label the container per WHMIS Guidelines**.*

7) Remaining solid alkali or base residue may be neutralized using a dilute solution of appropriate acid. Check the pH of the spill area; the final pH should be between pH 6 and 10. Use spill absorbent, spill pads or dry soil to absorb the neutralized residue;

8) For indoor spills, mop the affected area using detergent and water. Dispose of this water to the sanitary sewer, process stream or waste drums as appropriate; and

9) Remove and bag personal protective equipment for cleaning, informing laundry personnel of contaminant hazards, or disposal at a licensed disposal facility. Thoroughly wash with soap potential skin contact locations after handling. Properly dispose of contaminated clothing that cannot be decontaminated.

Appendix K

Agnico Eagle Spill Response Training Records

Group Training Report

Course Name: Emergency Planning and Spill Response Awareness

Trainer's Name: Trever Miller

Date: Jan. 15/2013

Agnico-Eagle Mines Ltd.
Meadowbank Division

M		Name	Company	Signature	Hours TRG.	Hours ASS.	Hours Total Hours	Code
	1	Jeffrey Pratt	AEM				10	
	2	Fanny Laporte	AEM				10	
	3	Richard Jackson	AEM				10	
	4	Tom Thomson	AEM				10	
	5	Maurice Barrieau	AEM				10	
	6	David Alexander	AEM				10	
	7	Martin Theriault	AEM				10	
	8							
	9							
	10							

COMMENTS:

Trainer's signature:

Date: January 15, 2013

Codes:	Assessment Codes:
1. AEM Permit	A+: Very Good
2. Restrictive Permit	A : Good
3. Temporary Permit	B : Average
4. Training Completed	C : Below Average
5. Training Not Completed	
6. Fail	

Tom Thomson

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

- **Incident** - 45 m^3 diesel spills/plus oil/acid – Originates on Land, flows into the River
- **Spill** - occurred 22:00 hrs on March 20, 2013
- **River** – water flow, 5 km/hr, braided channels; approx 15 km to Baker Lake
- **Lake** – winds from the North West at 20 km/hr. Tide is high.

Km 23 - Bridge 3

1. List the **issues** linked to this scenario:

Response Time + Moving Equipment / Resources to the Area
Light + Temperature
Fish Bearing Stream
Speed of Containment / Cut off Point
Vast Contaminated area - Type of Contaminate

* Safety of Personel, Communications, Environment, Equipment

2. What **resources** are required?

Baker Lake Contractor / Peters Exp.
Baker Lake Command Center, Camp, at Spill Location
Ert Personal + Relieve
Emergency Trailer - Environmental
Emergency C-Cans / Roll offs
Lighting / Generators
Transportation
Safety officer(s)
AEM Personal from Baker Lake
Mapping of Area

3. What are the **initial spill response steps and what does your ICS look like**?

3rd Control / Crisis Centre
On Site Commander
Baker Lake
Logistic, Planning, Finance

1) Review ERP + Spill Contingency Plan
Prepare J.H.A on Spill

Establish Safety Zones - Hot, Warm, Cold

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4. What is your oil spill containment and recovery **strategy**?

Shut off/Stop Spill - Identify Source
Contain Spill - Trench - Bell or (POE)
Maritime Booms & Absorbants
Estimate Direction of spill & find a cut off points
By Using 10-30-4 - Protect Shoreline and diverting flow

* Pre plan - Plan it now

5. What is your strategy for shoreline **cleanup** operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

Vacuum Pump, Absorbants, Oil/water Separater
- Excavate cont Soil
- Vegatated/Rocky Shorelines
-
- Sample & Monitored until we have clearances from DFO, ENV Canada

- Do a quick wash & leave it for Bio remediation

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6. What are some **safety** issues?

[redacted], Drinking Water - Baker Lake

Temperature + H2S of Response Team
LEL's
water + ice

7. How do you manage your **waste**?

Quatrex, 45 Gallons, oil/water separator

Contaminated Soil pad

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

Same as #3 - Notify Proper Personal / Authorities Additional
DFO, EC, Baker Lake Res.

SWAT Consulting Inc.

Fanny Laporde.

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

45 000 Litres KM 23

- **Incident -** 45 m^3 diesel spills/plus oil/acid – Originates on Land, flows into the River
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- **River** – water flow, 5 km/hr, braided channels; approx 15 km to Baker Lake
- **Lake** – winds from the North West at 20 km/hr. Tide is high.

KM 23.

1. List the **issues** linked to this scenario:

Communication issu

- Contamination Back to land / Water contamination / Wildlife. To White ~~Hills~~ lake. (Fishing major site for invit)
- Time of day and distance from Camp.
- March → Still snow – could be cold
- Accident → Health & Safety (Driver) and the Responder
- Acid → add another safety issue ↓ less.
- Baker Lake water intake
- Public relation case / inform the Lobby appropriate person Community

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2. What **resources** are required? * 60 people ✓

- Labour → with incident Command Plan / everybody has a task in the organization / ERT Team.
- Commandement Trailer & facilities close to site ✓
  ↳ could be a container, heated
- decontamination area.
- Machinery → loader → TRUCK → ~~shovel~~ shovel. ✓
- Disposal and containing material DRUMS/45gall (berm - secondary material) Vacum - emergency trailer with supply.
- Towerlight → because it is night ✓ zodiak empty tanker.
  helicopter for next morning.

3. What are the **initial spill response steps and what does your ICS look like**?

Command ICS:

INFO. ①
- MSDS Sheets - Planning - Logistic
- JHA
- S.R.P spill response plan. / ERP. / SRP /

② Find ressources / General Briefing.

③ Logistic and reassess at all change (F.L.R.A)
  ↳ operations.
  - Isolation
  - Contain
  - Recovery - Remediate
  - wild life
  - Waste management
  - Sampling.

Level 3 ~~SPILL~~ emergency

Because it is night and impact can be desastrous

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4. What is your oil spill containment and recovery **strategy**?

0A → Make the environment safe for me and my Team - Gaz det for - PPE

1 Stop the leak

3 2 dig a ~~ditch~~ trench to protect the water (shore)

3 evalwate where the contaminent are → wind → slope → current.

4 Instal maritime bariere to contain (or) the biggest part of the oil.

5 Snow barrier if needed.

2 6 cut all entries to other ponds and rivers

7 Vaccum the containment and dispose the waste adequatly.

8 transpos what is still in the taken to another contaiter

5. What is your strategy for shoreline **cleanup** operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

Tundra / Rock

→ Inspect the shore / contain with ~~snow~~ trenches / bell hole. Maritime barrier.

→ Monitoring often and sample

→ When melting / sample and Vaccum if needed Quick wash.

→ let nature take over.

→ if ~~too~~ too much → excavate the shore and remove contaminent. and dispose

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6. What are some **safety** issues? Under the ice. → leave it.

→ LEL / Fire / toxic Gazes.

→ Water / ice / cold for response team and equipment.

→ darkness → uneven Ground / strain ankle

7. How do you manage your **waste**? 45 Gall.

Used Fuel → sent back south to appropriate place

used absorbant supply → ship down south in Quadrex

material → Land farm brought to

Clean and rinse - PPE

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

see # 4 ~~Exercise~~ answer. ✓

→ cut the Hamlet Water intake. ✓

inform additional Authorities.

Skimmers Vessels

Boats. V V J

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Jeff Pratt

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

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- **Lake** – winds from the North West at 20 km/hr. Tide is high.

1. List the **issues** linked to this scenario:

- 90km From mine
- Dark out
- Very Cold
- Vacinity to lake
- low tide will suck out

2. What **resources** are required?

- Personnel
- Command center both on site & Baker Lake
- Lightening
- Amenities for personnel
- Spill Response Equipment
- Transportation

3. What are the **initial spill response steps and what does your ICS look like**?

- Alert ERT and immobilize
- Alert ICS

ICS - Review of Spill Contingency - Planning for mobilization

- ERT Captain would assess situation and report incident command

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4. What is your oil spill containment and recovery **strategy**?

~~Goal~~

- Stop the release - Plug hole or build berm.
- Contain release - Do Not Let Enter Lake
  - Place boom along ~~mouth~~ deltas From the tributaries.
  - Have to create ice road to down stream collection point.
  - ~~Use~~ Extract contaminent from down stream boom point*

5. What is your strategy for shoreline **cleanup** operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

- Create Hot, Warm, Cold Zones
- Rocky Sandy Substate
- Leave to summer Valatilize

6. What are some **safety** issues?

- No light
- Cold Weather
- PPE for Chemicals

7. How do you manage your **waste**?

- Quatrex bags
- Totes for liquid Contaminants

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

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M. Theriault

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

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- **Lake** – winds from the North West at 20 km/hr. Tide is high.

1. List the **issues** linked to this scenario:

- BL water intake
- impact to the land / to the water
- Going towards white hills lake (fishing lake)
- Distance from camp / time of event / Weather
- H/S for the driver and responder + possible acid reaction
- Spalding of cont.
- Wildlife (fish)
- Public relationship (Must have the appropriate person)
- Dispersion
- Communication, Road Access

2. What **resources** are required?

- Equipment : Boat, Maritime Barrier, Shovel, truck, Quadrex waste disposal, secondary containment, Spot (toward light) Vaccum (Emergency trailer)

Decontamination unit, Commandement unit

- Personnal : Labour, ERT, IC, public relationship

Helicopter

3. What are the **initial spill response steps and what does your ICS look like**?

Planning { MSDS sheet, JHA, ERP, SRP,

Logist. { General Briefing
Find ressource and equipment and make them available

Operation → Field Level Risk Assessment
↳ Isolation - contain - Recovery ~~ect~~. Wildlife - Waste Management
Sampling

Reassess between field and Management by IC.

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4. What is your oil spill containment and recovery **strategy**?

Make sure everything is safe, gaz detector, PPE ect.

Plug the hole / Stop the leak

Dig a ditch (trench) close to the shore

Evaluate the location of the contaminate in the watere

Install maritime barrier to enclose (isolate) the leaking shore

Cut all entries to other channels

Vaccum the accumulate diesel / transfert the diesel left in the tanker

Adequately dispose the waste

5. What is your strategy for shoreline **cleanup** operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

inspect the shore, keep the maritime barrier containing the fuel close to shore, monitore and sample if needed, vaccuum, let nature take over

WASH IT

If too much contaminant keep coming from the underground, dig everything

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6. What are some **safety** issues?

- LEL / fire / toxic gasses
- WATER / ICE
- cold weather
- Heavy equipment
- Uneven soil, darkness (strain ankle)

7. How do you manage your **waste**?

- used fuel send back south to appropriate location
- Absorbant stuff used (quadrex) burned or ship down south
- Contaminated soil send to landfarm
- Rinse all the PPE

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

See question #4

R-Jackson

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

23 24

- **Incident** - 45 m^3 diesel spills/plus oil/acid – Originates on Land, flows into the River
- **Spill** - occurred 22:00 hrs on March 20, 2013
- **River** – water flow, 5 km/hr, braided channels; approx 15 km to Baker Lake
- **Lake** – winds from the North West at 20 km/hr. Tide is high.

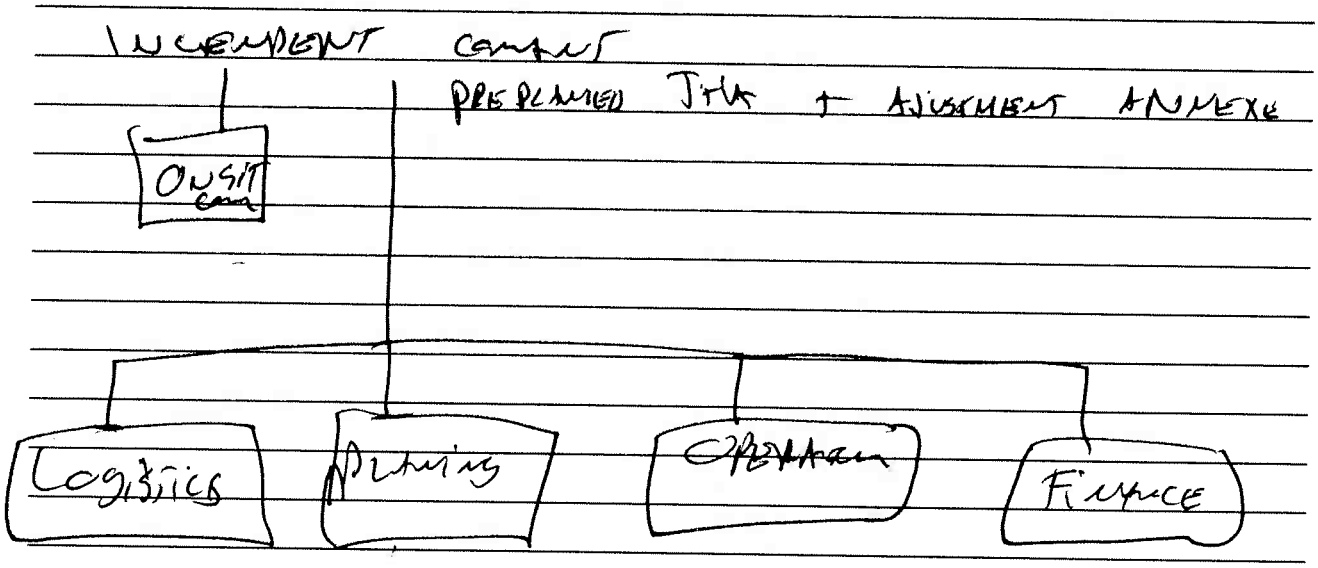
1. List the **issues** linked to this scenario:

- RESPONSE TIMES
- MOVING RESOURCES + EQUIP
- LIGHT FACTOR
- FISH BEARING
- SPEED OF CONTAINMENT
- VAST CONTAMINATED AREA
-

2. What **resources** are required?

- BLCS + PETER EXPEDITING HEAVY EQUIPMENT
- ERT PERSONEL + RELIEF PERSONEL
- COMMAND CENTER ON SITE + AT CAMP
- EMERGENCY SEAT CANS ROLLOFF BIN
- LIGHTING + GENERATORS
- INFORMATION + SAFETY OFFICER
- MAPPING OF THE AREA
-

3. What are the **initial spill response steps and what does your ICS look like**?



RL

SWAT Consulting Inc.

4. What is your oil spill containment and recovery **strategy**?

CONTAIN SPILL (STOP SPILL AT THE SOURCE
PREVENT FURTHER ENTRY/ TRENCH BELL HOLE
ESTIMATE DIRECTION OF SPILL MARITIME BOOMING
FIND CUT OFF POINTS
BY USING 10/30 @ 4 KNOTS DIRECT FLOW TO AND
PROTECT SHORE LINE

5. What is your strategy for shoreline **cleanup** operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

- VACU PUMP
- PADS
- SORBANTS
-

6. What are some **safety** issues?

LEL
COLD T°
~~SOUR~~ INHALATION
CONTAMINATION
FIRE
WATER OVER FLOW

7. How do you manage your **waste**?

QUANTUM TANKS
45 Gal DRUMS
OIL WAT SEPERATOR
CAN TRANSFER SAIC PUMP

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

SWAT Consulting Inc.

D. ALEXANDER

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

- **Incident -** 45 m^3 diesel spills/plus oil/acid – Originates on Land, flows into the River
- **Spill** - occurred 22:00 hrs on March 20, 2013
- **River** – water flow, 5 km/hr, braided channels; approx 15 km to Baker Lake
- **Lake** – winds from the North West at 20 km/hr. Tide is high.

1. List the **issues** linked to this scenario:

WATER INFILTRATION 90KM away
Sound alarm Pitch DARK
Extreme cold
Set-up block before RIVER ~~EMPTIES~~ EMPTIES INTO BAKER LAKE
Low tide when it comes will make it worse

2. What **resources** are required?

~~ERT RESPONSE~~ - ~~ALERT~~ BAKER LAKE FIRE DEPT.
COMMAND CENTRE AT MEADOW + BAKER
LIGHTING
WARM-UP ~~FOR~~ STAFF
SPILL RESPONSE EQUIP.
TRANSPORT FROM MINE
50-60 people fly/bus off at MB

3. What are the **initial spill response steps and what does your ICS look like**?

~~ALERT ERT~~ ALERT ERT, INCL. ENVIRO, MINE SUPER, ~~H+S~~ SUPER, SITE SERVICES HR
REVIEW CONTINGENCY PLAN, PLANNING FOR MOBILIZATION
ERT CAPTAIN - WITH ENVIRO, WOULD ASSES REPORT BACK TO the ICS

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4. What is your oil spill containment and recovery **strategy**?

STOP ~~CONTAIN~~ SPILL CONTAIN FROM entry into LAKE.
PLUG THE HOLE IN TRUCK OR BUILD BERM
↳ CREW ASSIGNED.
- INSTALL BOOM ALONG THE DELTA MOUTH OF THE RIVER JUST BEFORE IN ENTERS THE LAKE
- MAKE ICE ROAD TO DOWNSTREAM COLLECTION POINT
= WITH VACUUM TRUCK
-ESTABLISH ZONES

5. What is your strategy for shoreline **cleanup** operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

ROCKY, SANDY SUBSTRATE. WAIT TIL SUMMER
VALITISE.
ZONE OFF.

6. What are some **safety** issues?

PITCH DARK - NEED
Cold Weather
PROPER PPE

7. How do you manage your **waste**?

VACUUM TRUCK

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

CELLULOSE BOOMS

SWAT Consulting Inc.

M. BARIBEAU

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

- **Incident -** 45 m^3 diesel spills/plus oil/acid – Originates on Land, flows into the River
- **Spill** - occurred 22:00 hrs on March 20, 2013
- **River** – water flow, 5 km/hr, braided channels; approx 15 km to Baker Lake
- **Lake** – winds from the North West at 20 km/hr. Tide is high.

1. List the **issues** linked to this scenario:

- 90 kms From Site
- Patch dark, Very cold.
- Safety to Lake.
=> Set up on site operational Post.
=> Low tide will clean water away.
=>

SWAT Consulting Inc.

2. What **resources** are required?

=> Manpower - 6 ppl
=> Boat, Light Tower, ammunity.
=> Bobcat, Lake Fire flight.
=> Personnel transportation.
=> Mean of communication.
=> Small Loader, Vacuum Truck. -

3. What are the **initial spill response steps and what does your ICS look like**?

- Set up ICS
- H&S, Env/Regulat, HR, Site Service, General Service. spill.
- Review Emergency contingency Plan.
- Plan mobilization. => ERT Captain. assess situation and Report, =>

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4. What is your oil spill containment and recovery **strategy**?

Stop the Release, prevent further entry
- shut off flows, Build Berms,
→ Block off.

Make use Boat to collection Pond,

5. What is your strategy for shoreline **cleanup** operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

Rocky Sand wants clean till Summer.

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6. What are some **safety** issues?

- Measuring ice thickness
- Wear Proper PPE, ++
- Lighting
- cold weather
- acid
- 2 ashers Zones

7. How do you manage your **waste**?

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

Group Training Report

Course Name:

Trainer's Name:

Date: 2013-01-16

Agnico-Eagle Mines Ltd.
Meadowbank Division

M		Name	Company	Signature	Hours TRG.	Hours ASS.	Hours Total Hours	Code
	1	Jamie Kataluk	AEM				10	
	2	Robin Allard	AEM				10	
	3	Dave Holmston	AEM,					
	4	Alain Genesse	A-E-M					
	5	Stéphane Larose	AEM					
	6	Luc Blanchette	FGL					
	7							
	8							
	9							
	10							

COMMENTS:

Trainer's signature: _____

Date: _____

Codes:
1. AEM Permit
2. Restrictive Permit
3. Temporary Permit
4. Training Completed
5. Training Not Completed
6. Fail

Assessment Codes:
A+: Very Good
A : Good
B : Average
C : Below Average

STÉPHANE LACOSE

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

- **Incident** - 45 m^3 diesel spills/plus oil/acid – Originates on Land, flows into the River
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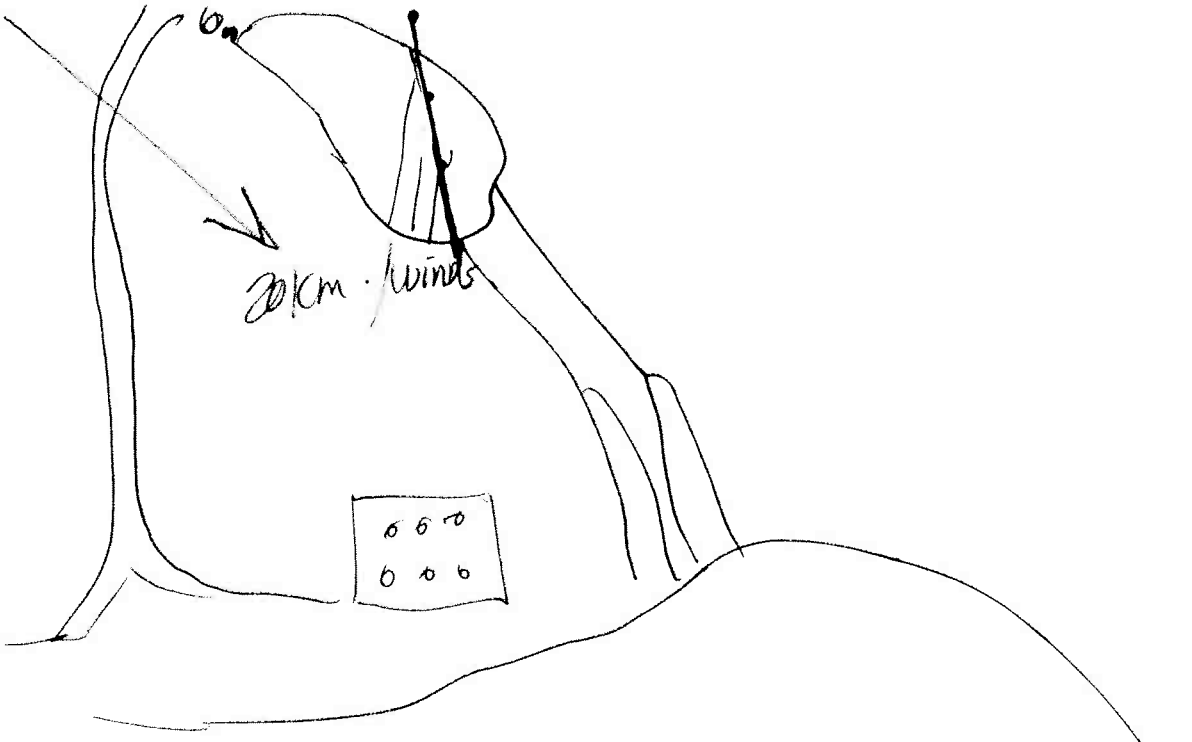

1. List the **issues** linked to this scenario:

→ 45 m^3 diesel / oil / acid flowing to the river heading to Baker lake. (15 km away)
→ Give less than 3 hours to react.
→ Contain the spill before the lake (Before to 2 rivers)
→ Secure and take care of the driver.

2. What **resources** are required?

- Helicopter to have look on the scene (Speed of the spill)
- 1 team at the scene (accident) to contained the spill at the source
- 1 team further down to stop the flow before the lake.
- Boats / maritime barrier / boom, etc... light plan
- ERT TEAM in case of fire.
- empty tanker to pump in.
- Good communication
- MSDS → Proper PPE

3. What are the **initial spill response steps and what does your ICS look like**?

- Scene survey (analyse) (inspection)
- Make the plan (planning)
- Decision (delegatee people)
- Execution
- Call proper authority

command

PLANNING OPERATION logistique cost

Safety first!!!

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4. What is your oil spill containment and recovery **strategy**?

→ Install barrier before the rivers (less contamination)
→ Recover the fuel/oil (Skimmer)

5. What is your strategy for shoreline **cleanup** operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

→ Assess the shoreline situation and ask trained people to evaluate if we need to clean and what we have to do.
→ Flush
→ Is it transferable?

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6. What are some **safety** issues?

- Risk of fire
- Falling into water / ice
- Poor visibility at night.
- Hypothermia
- Cold water.
- PPE (:

7. How do you manage your **waste**?

- Bring to the proper facility disposal (ENV. DEPT.) (QUATREX BAG)

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

- Protect the water intake of the town.
- Do whatever it takes at all cost.
- Inform community

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Dave Holmstrom.

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

- **Incident -** 45 m^3 diesel spills/plus oil/acid – Originates on Land, flows into the River
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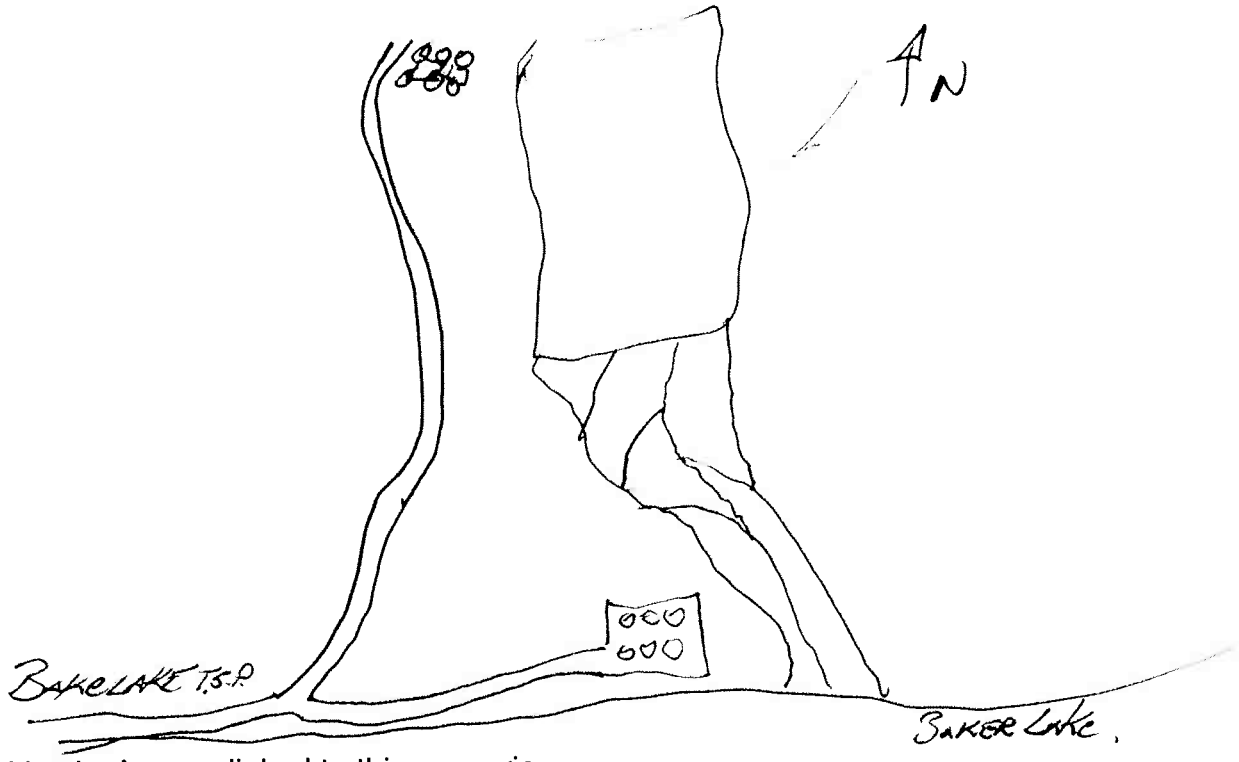


1. List the **issues** linked to this scenario:

- POTENTIAL RISK TO Baker Lake portable drinking water.
- FAST moving water (FRESHET). High travel rate / ICE,
- POTENTIAL Impact to spawning grounds.
- IS IT STOPPED? - Truck Rollover ??? Contained
- what are the sensitive areas.
- Time Frame / Braided channel extended shoreline
- LEL.
- Road traffic / Security

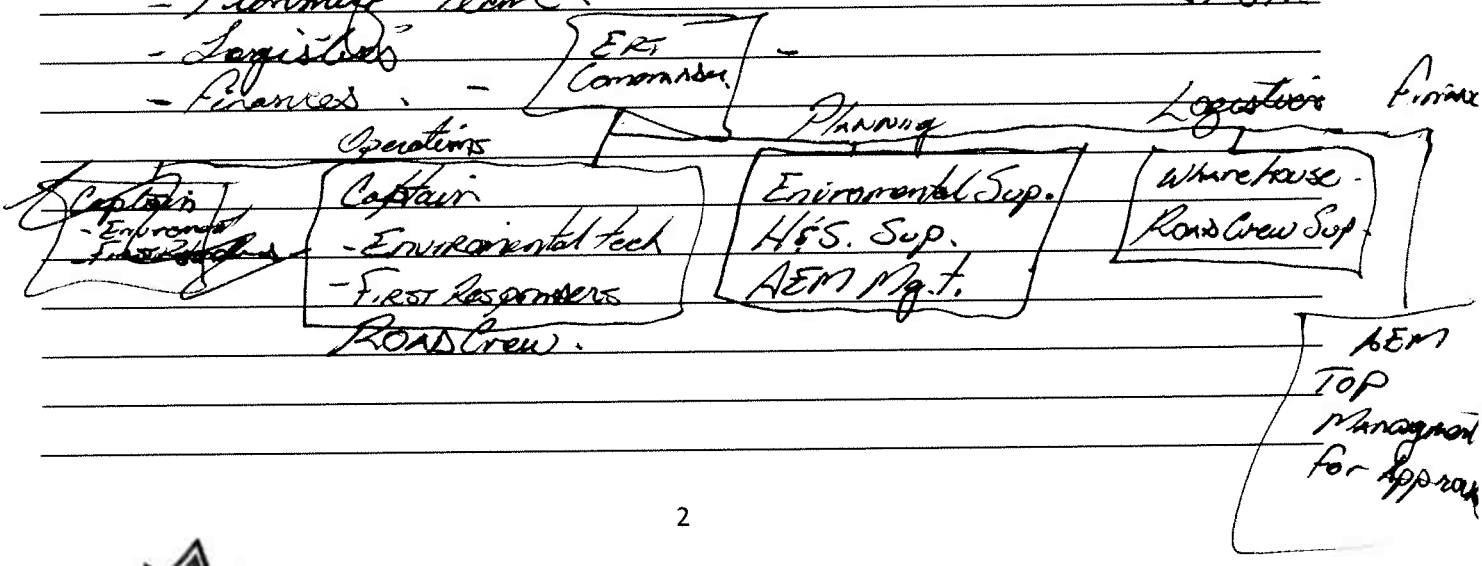
2. What **resources** are required?

- pump trucks - helicopter, - boat
- personal facilities - food, PPE, Bathroom - ~~B~~
- personal - clean up, communication, H&S, Environmental.
- ~~D~~ stop & containment resources - booms, pumps, coil
- ~~stop~~ - ~~stop pockets~~, C-Cuts for ~~Ditch~~, earth movers, storage -
- ERP, ~~Ed~~ Spill contingency Plan, OPEP, JHA.
- WHMIS,
- Level C, for first 6 hours. Level D After.
- TIER 3 response. initially

3. What are the **initial spill response steps and what does your ICS look like**?

- Call appropriate personal.
- Evaluate Spill - Immediate danger threat level.
- ~~Check~~ Identify Incident Command, team - with ERP
  - Operations personal.
  - Planning Team.
  - Logistics
  - Finances.

- Spill response plan
- JHSA



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4. What is your oil spill containment and recovery **strategy**?

- STOP Source.
- Based on Evaluation = ~~contain~~ Establish Booms for River Containment
  - Recover land based spills using
  - haul truck, Hoe, Loader. ~~Front~~
  - create ditch pump oil - from there.
  - Water containment - skimmer cleanup.
  - pump from bottom of V, U, J Boom.
  - Install booms at 30° of J.
  - Install ~~pumps~~ bell hole. pump from there.

5. What is your strategy for shoreline **cleanup** operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

~~Shoreline~~ Shoreline types.
- Rock
- Konsrd Organics.

Using SCAT.
Identified shoreline types - rock - nothing
- Tundra - Absorbants
+ and natural recovery.
- is it transferable.

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6. What are some **safety** issues?

- LEL, Benzine,
- Tired personel.
- recovery of truck
- water / ice operation - PPE's / Assesment.
- other road traffic.
- Possibility of Community water supplys
- Wild Animals.

7. How do you manage your **waste**?

Hazmat / Quadrex / Totes / Drums / Soil Pads.
Soil farms, Incinerate

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

- U-Boom
- V-Boom.
- 5-Boom.
- Corral it.
- Tostall Booms @ POE.

Robin Allard

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

- **Incident** - 45 m^3 diesel spills/plus oil/acid – Originates on Land, flows into the River
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- **Lake** – winds from the North West at 20 km/hr. Tide is high.

1. List the **issues** linked to this scenario:

Flow in River
→ close Baker Lake - Potential
→ Ice → Flow Forecast
→ Potential Impact to wildlife
Stop possible a spot
Sensitive area
TIME FRAME
+ Surface for Braided.
Road usus.

Safety Driver
LOL ISSUE.
High flow.

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2. What **resources** are required?

→ pump truck / Machinery
Personnal facilities . Food / PPE / Tent
HR
Spill - Stop / containment ressources / Lights
Helicopter
Communication
H/S
Environment Dept / Rep.
Documentation (ERP / Spill / OPEP) - JHA / BOAT
WHMIS

TIER III / →

3. What are the **initial spill response steps and what does your ICS look like**?

Evaluate / call
→ STOP if possible / Safety ERP / Spill RP /
Immediate Danger

→ ICS

C → ~~SIT~~ - OSC

O	P	L	F
Capt.	Env.	Wash	Management
Tech.	[illegible]	P/L	
Responders	H/S		
Saber			
Coad			

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4. What is your oil spill containment and recovery **strategy**?

→ Prevent from going to WATER.
→ Booms for containment.
→ Recover Truck / DITCH / VAC TRUCK
HOE - IF POSSIBLE

→ WATER CONTAINMENTS - Bottom/Bund.
→ Collect. Skimmer /

Protect Shoreline

5. What is your strategy for shoreline **cleanup** operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

SCAT
Rocks / Organic Matter -
↳ No SHEEN / Small minimal.

Tool - Hydro
Op → Shoreline / mm Natural

TRANSFERT

SWAT Consulting Inc.

6. What are some **safety** issues?

Tired
Recovery of fuel
ON WATER/ICE OPERATION / assistant.
to
FAST WATER.

DRINKING WATER.

7. How do you manage your **waste**?

HAZMAT / QUADREX / TOTES / DRUMS
65?

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

1 BOOM
1 BOOM
1 BOOM.

SWAT Consulting Inc.

LUC BLANCHETTE

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

- **Incident -** 45 m^3 diesel spills/plus oil/acid – Originates on Land, flows into the River
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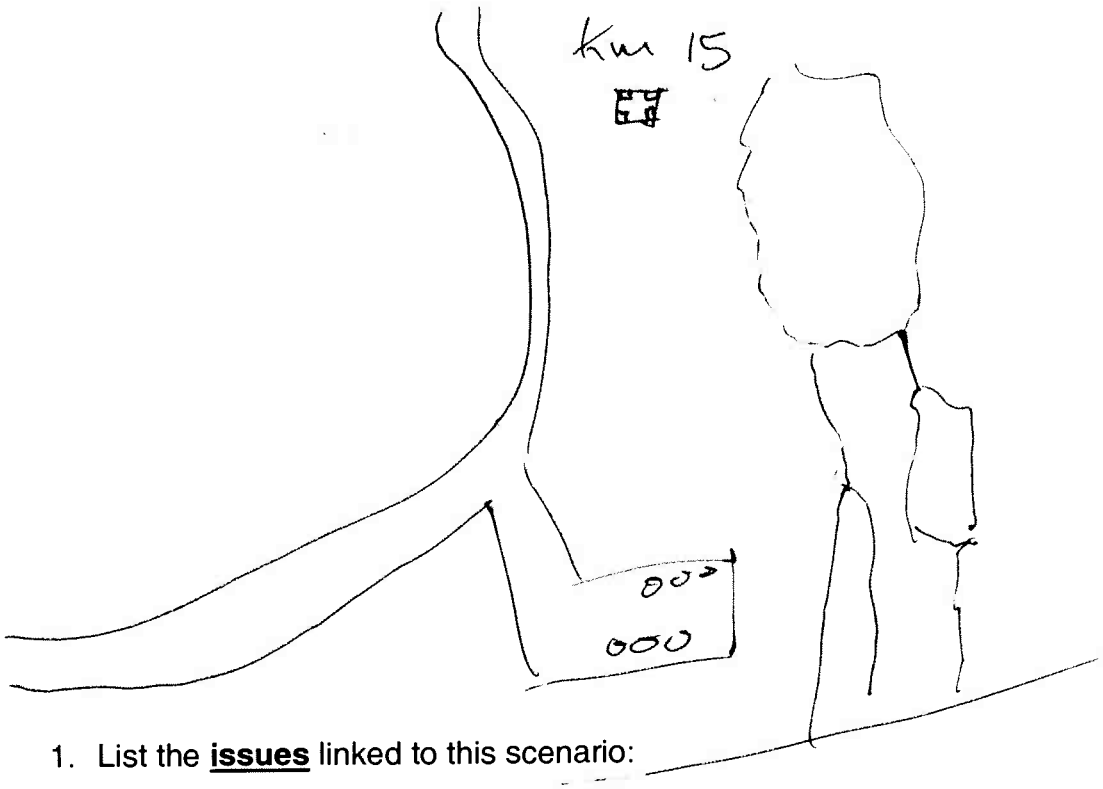

1. List the **issues** linked to this scenario:

- POSSIBLE CONTAMINATION OF COMMUNITIES WATER SUPPLY
- FRESHET WILL MAKE IT HARDER TO COLLECT CONTAMINANTS.
- BRAIDED CHANNELS INCREASE THE CHANCES OF MORE CONTAMINATED AREA
- MAY DISTURB SPAWNING AREAS → FISH
- TIDES WILL INCREASE THE CONTAMINATION OF SOIL.
- SHORT TIME FRAME
- SAFETY OF THE DRIVER
- LEL'S
- OTHER ROAD USERS.

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2. What **resources** are required?

- HEAVY EQUIPMENTS TO BUILD TRENCHES
- ENOUGH MATERIAL TO DO ENTIRE CLEANUP. (LAND & RIVER)
- PROPER PPE TO PROVIDE TO ALL PERSONEL
- ENOUGH MATERIAL TO DISPOSE CONTAMINATED MATERIAL (TOTES, SEALED DRUMS
- ADEQUATE MATERIAL TO BRING CONTAMINATED MATERIAL TO MINE SITE.
- SAFETY MONITORING DEVICE BEFORE STARTING ANY CLEANUP.
- PROPER COMMUNICATION.
- MSDS.
- MATERIAL TO MOVE THE TRUCK.
- H&S AND ENVIRONNEMENT PERSONNEL.
-

3. What are the **initial spill response steps and what does your ICS look like**?

- CODE 1 RADIO CALLED
- IC INFORMS TEAM OF SITUATION AND DOES HEADCOUNT BEFORE DEPLOYING TEAM
- COMMAND CENTRE SET UP - INCLUDE MANAGEMENT TO ASSISTS IN DECISION
- MONITOR AND DEVELOPPE A SAFETY ZONE IN THE SPILL AREA.
- IDENTIFY HAZARDS.
-

COMMAND

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4. What is your oil spill containment and recovery **strategy**?

- PREVENT FURTHER ENTRY.
- BUILD TRENCHES OF BARRIERS TO AVOID THE SPREADING OF THE SPILL.
- PLACE BOOMS INSIDE BARRIERS TO PICK UP CONTAMINANTS
- ONCE BOOMS ARE FULL - REPLACE WITH NEW ONES. PLACE CONTAMINATED BOOMS IN PROPER CONTAINERS.
- SEND QUADREX BAGS TO MINE SITE AND PLACED INSIDE SEACANS, PROPERLY LABELLED
- WATER → PLACE MARITIME BARRIER INSIDE LAKE. PLACE BOOMS OR ABSORBS ON SHORE TO PROTECT SOIL ALSO ALONG MARITIME BARRIERS.

5. What is your strategy for shoreline **cleanup** operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

- ASSES THE SHORELINE.
- FLUSH THE SHORELINE
- STOP THE CLEANING WHEN CONTAMINANTS IS NOT TRANSFERABLE.

6. What are some **safety** issues?

- TIRENESS OF THE CREW
- LELS
- REMOVAL OF THE TRUCK
- WORK ON ICE AND NEAR EAST WATER.
- WILDLIFE

7. How do you manage your **waste**?

- PUT IT INTO DRUMS OR TOTES TO BURN IT OR STORE IT → MINE SITE.
- ~~IF IT HITS THE WATER, SET UP A V, J OR U BOOM.~~

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

SET UP A V, J OR U BOOM.

SWAT Consulting Inc.

ALAIN GENESSE

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

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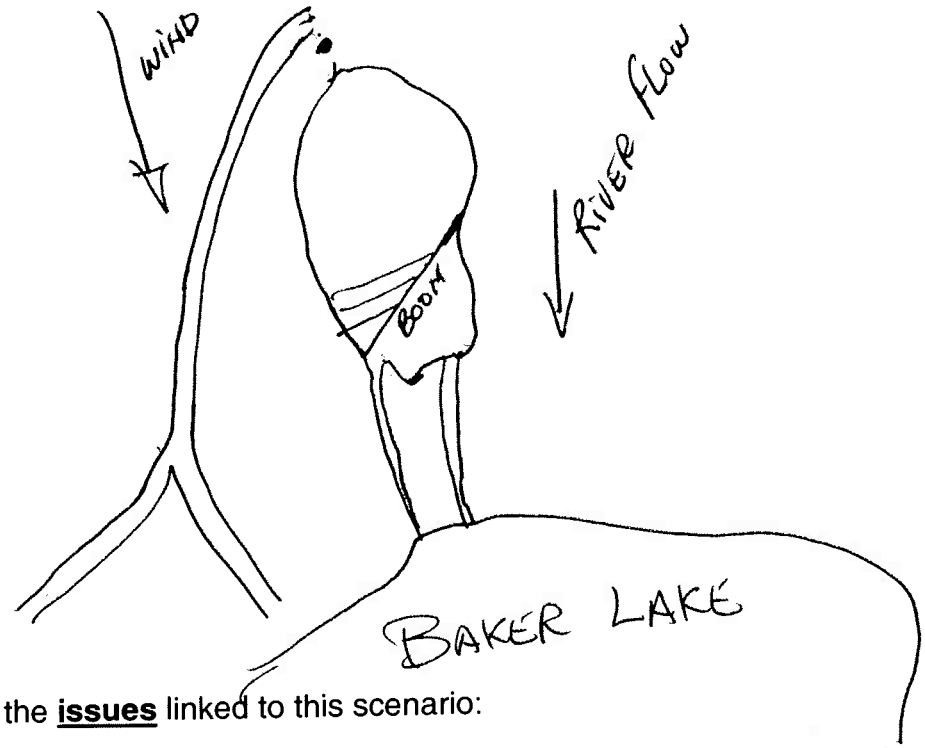


1. List the **issues** linked to this scenario:

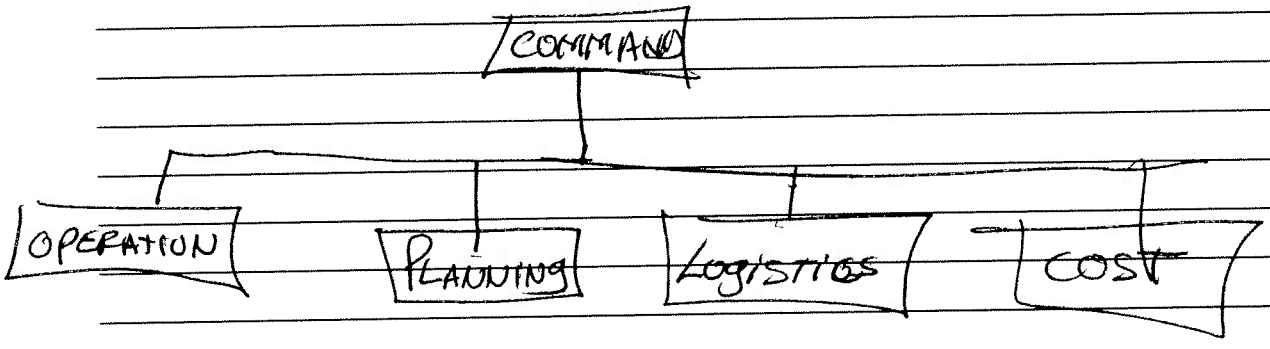
- DIESEL FLOWING INTO THE RIVER, HEADING TO BAKERLAKE (15 KM AWAY) GIVING US LESS THAN 3 HRS TO CONTAIN THE SPILL BEFORE IT GETS TO THE LAKE.
- ISOLATE THE VEHICULE.
- MAKE SURE THE DRIVER IS OK.

2. What **resources** are required?

- HELICOPTER TO ASSESS THE SPILL ON THE RIVER AND THE ACTUAL SPEED OF THE SPILL.
- A TEAM OF RESPONDERS AT THE ACCIDENT TO CONTAIND THE SPILL AT THE SOURCE.
- ANOTHER TEAM FURTHER DOWN STREAM BEFORE THE LAKE TO PREVENT ANY SPILL INTO THE LAKE
- NEED BOATS, MARITIME BARRIERS, SKIMERS, LIGHT PLANTS
- E.R.T. TEAM IN CASE OF FIRE
- M/T TANKER TRUCK TO PUMP THE REST OF THE LOAD
- M.S.D.S. - P.P.E.

3. What are the **initial spill response steps and what does your ICS look like**?

- ANALIZE THE SCENE, DELEGATE PEOPLE
- MAKE A PLAN, MAKE A DECISION, TAKE ACTION
- CALL PROPER AUTHORITY
- SAFETY



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4. What is your oil spill containment and recovery **strategy**?

- INSTALL BOOM ACROSS THE RIVER (POUND) BEFORE IT GETS INTO THE 2 RIVERS (CREEK) AND THE Big LAKE

FABRICATE A BERM

10-30-4 BARRIER

5. What is your strategy for shoreline **cleanup** operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

- ASSESS THE SHORELINE SITUATION, ASK TRAINNED PEOPLE TO EVALUATE IF WE NEED TO CLEAN, IF YES WHAT IS THE BEST WAY TO DO IT. (ANY FRAGILE SYSTEM)

- IS IT TRANSFERABLE? YES OR NO

6. What are some **safety** issues?

- RISK OF FIRE
- FALLING INTO WATER
- DEALING WITH POOR VISIBILITY (DARK AT NIGHT)
- WATER & ICE
- POTABILITY

7. How do you manage your **waste**?

- BRING TO THE PROPER DISPOSAL FACILITY.

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

- PROTECT THE WATER INTAKE FOR THE TOWN
- DO WHATEVER IT TAKES AT ALL COST.
- INFORM THE COMMUNITY.
- U-BOOM, V-BOOM, J-BOOM

Janie Katalnik

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover considered Tier 3 incident

- **Incident -** 45 m^3 diesel spills/plus oil/acid – Originates on Land, flows into the River
- **Spill** - occurred 22:00 hrs on ~~March~~ June 20, 2013
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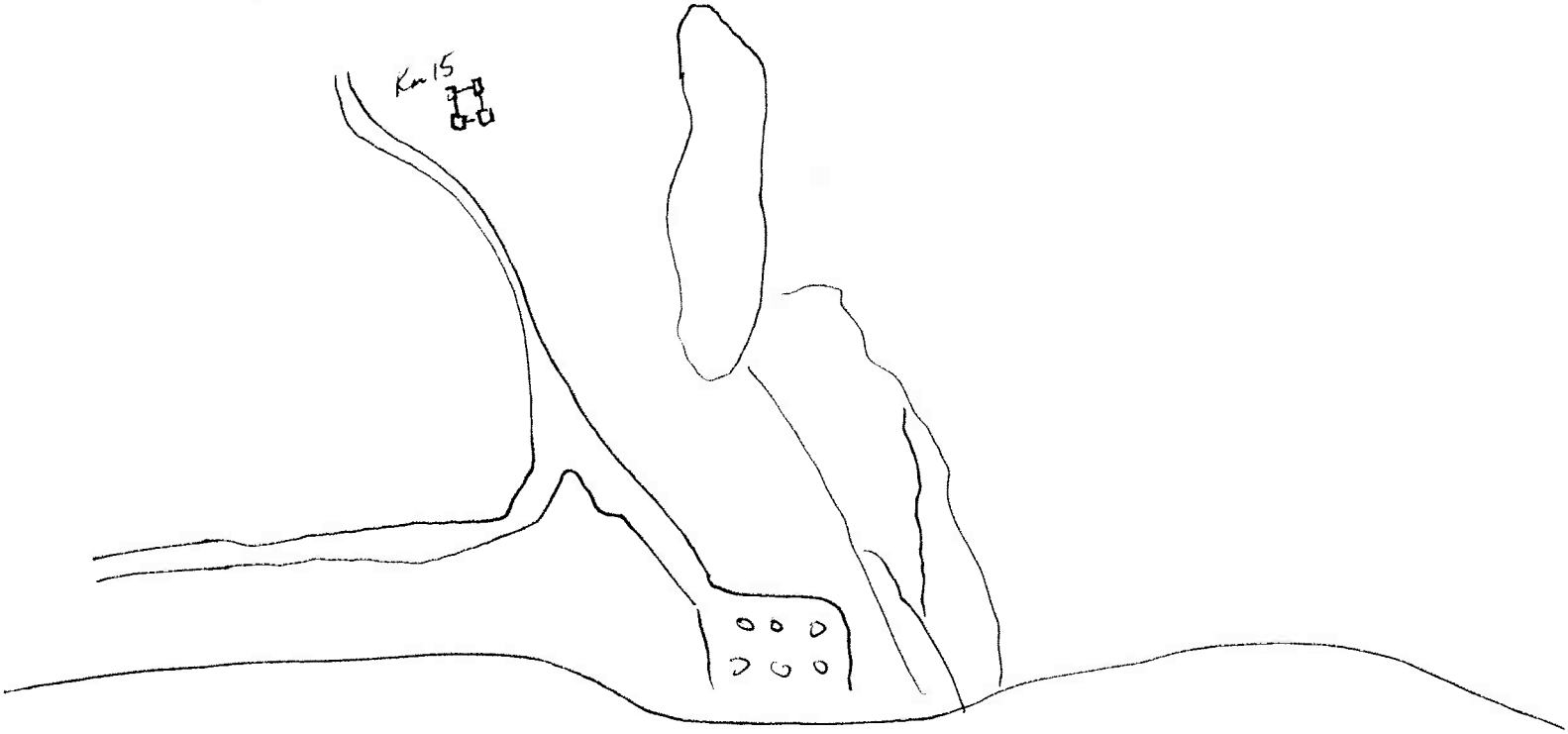

1. List the **issues** linked to this scenario:

possible contamination of communitys water supply
freshet will make it harder to collect contaminants
braided channels - increases chances of more contamination area
may disturb spawning areas - fish
tides will increase contamination of soil
response time
other road users

2. What **resources** are required?

heavy equipment to build trenches (COMMS) ERP
enough material to do entire clean up
proper PPE for all ~~personell~~ personnel
enough material to dispose contaminated material - totes, sealed drums
adequate equipment to bring contaminated material to mine site
safety monitoring devices before starting any clean up

3. What are the **initial spill response steps and what does your ICS look like**?

- Code 1 on radio called - safety
- IC informs team of situation and does a head count before deploying team
- command centre setup - include management to assist in decisions
- ~~location~~ develop a safety zone in spill area

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4. What is your oil spill containment and recovery **strategy**?

land - build bell holes or barriers to avoid spreading of contaminants
- place booms inside barriers to pick up contaminants
- once booms are full, replace with new ones - place contaminated booms into Quattrex bags
- send Quattrex bags to mine site and placed inside seacans - properly labelled

water - place maritime barrier inside lake
place booms along shore to protect soil - also along maritime barrier
collect

5. What is your strategy for shoreline **cleanup** operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

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6. What are some **safety** issues?

LEL
fatigue
water and ice
removal of truck
other road users
fast water
wildlife

7. How do you manage your **waste**?

place contaminated material - rags, booms - inside Quatrex bags
send bags to mine site - placed into seacans

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

Group Training Report

Course Name:

Trainer's Name: Robin Allard

Date: June 18, 2013

AGNICO-EAGLE

Agnico-Eagle Mines Ltd.
Meadowbank Division

M		Name	Company	Signature	Hours TRG.	Hours ASS.	Total Hours	Code
	1	JEAN-CLAUDE POITRAS	AEM		1.5		1.5	4
	2	Bernard Paradis	AEM		1.5		1.5	4
	3	MICHEL POITRAS	PRO-AB		1.5		1.5	4
	4	SERGE PARÉ	A.E.M		1.5		1.5	4
	5	RAY CARLSON	AEM		1.5		1.5	4
	6							
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	11							
	12							
	13							
	14							
	15							
	16							
	17							

Trainer's signature:

Date: 18 June, 2013

Induction Department Signatures:	
Human Resources:	
Camp:	
Nurse:	
Security:	
Health & Safety:	
Environment:	
Training:	

Comments:

Codes:	Assessment Codes:
1. AEM Permit	A+: Very Good
2. Restrictive Permit	A : Good
3. Temporary Permit	B : Average
4. Training Completed	C : Below Average
5. Training Not Completed	
6. Fail	

AGNICO EAGLE

MEADOWBANK GOLD MINE

Operational ARD/ML Testing and Sampling Plan

In Accordance with Water License 2AM-MEA0815

Prepared by:
Agnico Eagle Mines Limited – Meadowbank Division

Version 2
November 2013

EXECUTIVE SUMMARY

Agnico Eagle Mines Ltd. owns and operates the Meadowbank gold mine, which lies approximately 70 km north of Baker Lake, NU. Operation of this facility is subject to Water License 2AM-MEA0815/TR/B5 issued by the Nunavut Water Board (NWB) on June 9, 2008 and signed into effect by the Minister of Indian and Northern Affairs Canada (INAC) on July 10, 2008.

In accordance with this Water License, Agnico Eagle Mines Ltd. - Meadowbank Division maintains a detailed sampling, analysis and segregation plan to describe the management techniques used for the disposal of potentially acid-generating and/or potentially metal leaching waste rock and till.

This Operational ARD/ML Sampling and Testing Plan was initially developed in August, 2008 (Version 1) during the project development phase. This update/revision (Version 2) incorporates changes to procedures adopted as a result of testing prescribed in Version 1, as well as additional considerations based on feasibility of construction designs.

IMPLEMENTATION SCHEDULE

As required by Water License 2AM-MEA0815, Part B, Item 16, the proposed implementation schedule for this Plan is outlined below.

This Operational ARD/ML Sampling and Testing Plan is to be implemented by mine staff effective immediately.

DISTRIBUTION LIST

AEM - General Mine Manager

AEM - Mine Superintendent

AEM - Mine Engineer and the Mine Engineering Department

AEM - Chief Assayer

AEM - Environmental Superintendent and Environmental Department

DOCUMENT CONTROL

Version	Date (YMD)	Section	Page	Revision
1	08/08/08	All		Comprehensive plan for Meadowbank project
2	13/11/06	All		Updated plan for Meadowbank Mine

Prepared By: *Meadowbank Environment Department*

Approved by: _____
Bernard Waitzenegger
Meadowbank Geology Superintendent

_____
Kevin Buck
Meadowbank Environmental Superintendent

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2 WASTE ROCK MANAGEMENT **3**

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Appendix A: ARD/ML Potential of Meadowbank Mine Wastes – Summary

1 INTRODUCTION

The Meadowbank gold mine, owned and operated by Agnico Eagle Mines Ltd., is located 70 km north of the Hamlet of Baker Lake, NU. The mine consists of three main gold-bearing deposits (Portage, Goose Island and Vault; see Figure 1-1) that are being mined through a truck and shovel, open pit operation. The Portage and Goose Island deposits are adjacent to the main mine facilities, and the Vault deposit is located approximately 8 km to the north.

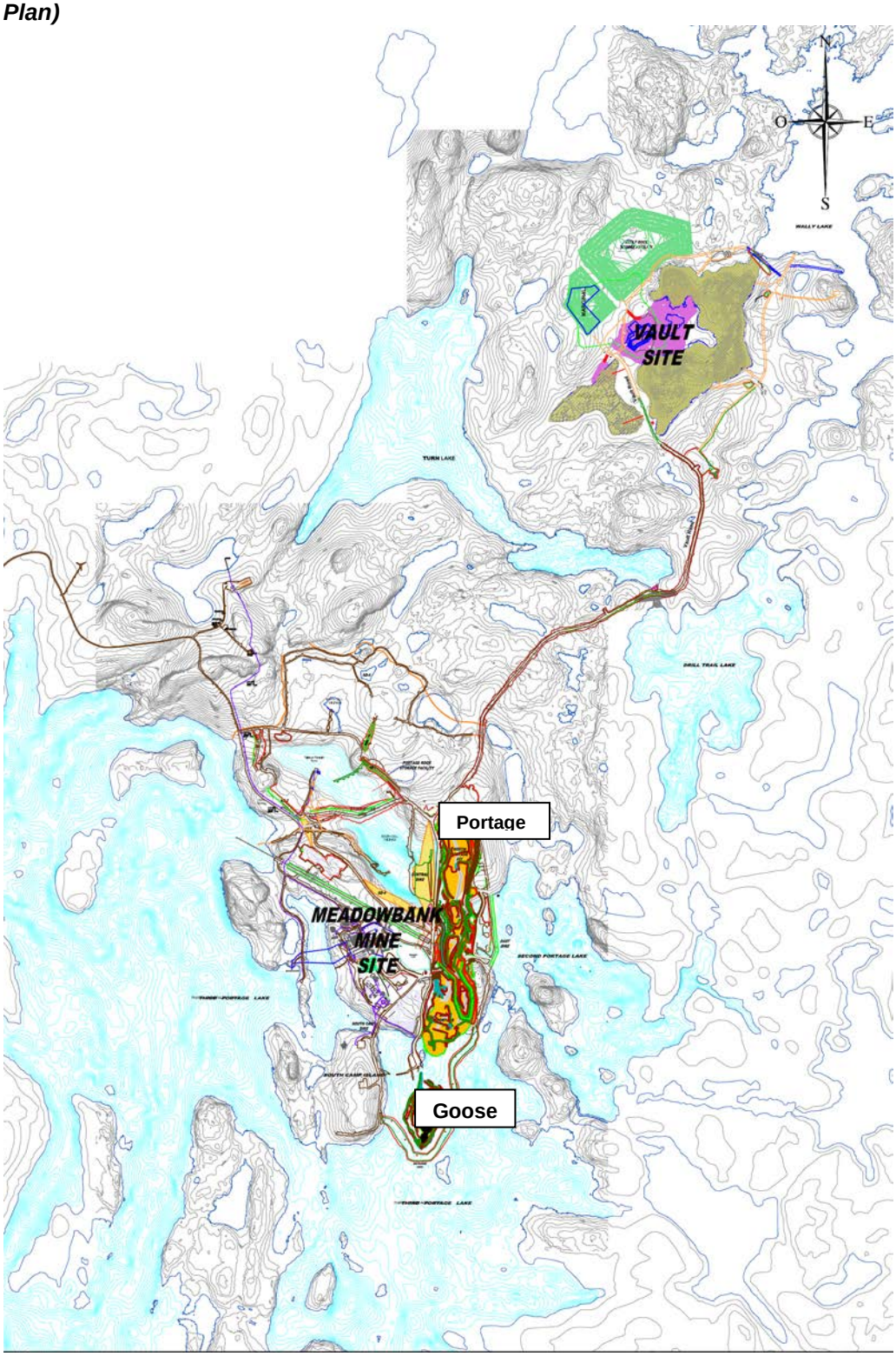
Operation of this facility is subject to Water License 2AM-MEA0815 issued by the Nunavut Water Board (NWB) on June 9, 2008. Under this license, AEM maintains an Operational ARD/ML Sampling and Testing Plan to reduce the potential for acid rock drainage (ARD) or metals leaching (ML) from waste rock to the receiving environment. The Plan was initially developed as required under Part I, Item 14 of AEM's Water License in August, 2008 (Version 1). The Plan is further updated/revised here (Version 2) to clarify current methods of sampling and analysis, which have been amended based on experience during the early stages of operation.

1.1 OBJECTIVES

The objectives of the Plan are to define the sampling, analysis and testing procedures that are to be implemented by staff at the Meadowbank mine to define the acid generating and metals leaching potential of waste rock. This characterization is to be used by mine staff to ensure that waste rock and till are identified, managed, segregated and disposed of in an environmentally appropriate manner, as designated in the Plan.

The Plan is closely associated with the Updated Mine Waste Rock and Tailings Management Plan (AEM, 2013a) and the Water Management Plan 2012 (SNC Lavelin, 2013).

FIGURE 1-1 – LOCATION OF THE PORTAGE, GOOSE AND VAULT DEPOSITS (General Site Plan)



2 WASTE ROCK MANAGEMENT

2.1 LITHOLOGIES

There are four major bedrock types (or lithologies) found at Meadowbank: intermediate volcanic (IV), iron formation (IF), ultramafic (UM), and quartzite (QZ). Each of these rock types is present in both the Portage and Goose Island Pits. The Vault Pit, however, consists almost exclusively of IV. With all deposits, a variable layer of overburden (OVB) is present.

During the early stages of the Project, the ARD and ML potential of each Meadowbank waste rock lithology was evaluated through both static and kinetic testing. Details on the test methods used and results obtained are provided in Golder, 2005a and 2005b (summarized in Appendix A). Anticipated ARD/ML potentials for each rock type based on exploration drill core tests are shown in Table 2-1.

Table 2-1 Anticipated ARD/ML potential of waste rock types at Meadowbank (Cumberland, 2005)

Pit	Waste Type	ARD Potential	ML Potential
All Pits	Till	None	Low
	Tailings	High	High
	Lake Sediment	Variable	High
Portage and Goose	UM	None	Low
	IV	Variable	Moderate
	IF	High	High under PAG, low when buffered
	QZ	High	Low
Vault	IV	Low	Variable

2.2 WASTE ROCK SEGREGATION

Under the life-of-mine (LOM) Plan (2012) approximately 193 million tonnes of waste rock and till will be generated from the Portage, Goose and Vault Pits. Till is used in site construction or placed in the RSF. Characterization of ARD/ML potential in the excavated waste rock is required in order to properly segregate it for use or disposal, as follows:

- **General Construction** - Only rock that has been certified as non-potentially acid generation (NPAG) can be used for site construction, including dewatering dikes. It is the responsibility of the Geology Superintendent to ensure that all waste rock being used for construction has been characterized and verified as being NPAG. The only exceptions are for select components of the tailing storage facility.

- **Pit Backfill** - Waste rock is currently being placed in pits, reducing the final depth of end pit lakes which act as fish habitat compensation (see AEM, 2012 - NNLP). Waste rock used as backfill in pits will be under water after flooding, thereby limiting air contact and reducing or eliminating further oxidation. Under the current mine plan, the central portion of the Portage Pit, and the Phaser portion of the Vault Pit (if constructed) will be partially backfilled with waste rock.

- **RSF** - All other waste rock will be placed within the Portage or Vault Rock Storage Facility (RSF) for permanent storage.

2.3 RSF DESIGN

The majority of waste rock generated at the Meadowbank site will be placed in the Portage or Vault Rock Storage Facility. The general locations of these RSFs have been previously selected based on environmental impacts, costs and operational constraints. Under the current plan, each RSF has an area of approximately 80 hectares.

RSFs are designed to minimize the potential for ARD and ML. The Portage RSF is constructed to encapsulate PAG waste rock inside a layer NPAG material as a control measure for ARD. The soluble NPAG rock that is placed on the top and sides of the storage pile is needed in the long term to host the thawed layer and prevent liquids from contacting the centre of the cell that contains the PAG waste rock. Presently it is estimated that at least 4 m of capping is required to ensure freezeback occurs. Based on the results of thermal modeling, it is expected that the material within the RSFs will freeze within two years of placement (BGC, 2004). Rock oxidation can still occur in frozen material but will likely proceed at a slower rate than predicted by laboratory testing because of the cold temperature prevalent for much of the year. Permafrost will retain water as ice, so it was predicted that contaminants will not be transported away from the RSF. Testing will be conducted to measure temperatures throughout the waste rock pile, and to measure the depth of the annual surface thaw (see Section 5.2.3). This information will be used to confirm the need for the 4m thickness of rock cover required to close out the Portage RSF. The Vault RSF is not expected to require capping, as the bulk of the material from this deposit is expected to be NPAG (Golder, 2005a). Further details of RSF design and management are provided in the Mine Waste Rock and Tailings Management Plan (AEM, 2013a).

3 ASSESSMENT OF ARD POTENTIAL

Sampling and testing of waste materials for ARD is conducted during mine operation in order to segregate PAG waste from NPAG waste, so that waste materials can be assigned to specific locations.

3.1 ACID BASE ACCOUNTING

The ARD potential of waste rock is traditionally characterized through acid-base accounting (ABA) analyses. ABA analysis involves a suite of analytical tests that include paste pH, total sulphur, sulfate sulphur, neutralization potential, and carbonate neutralization potential based on total inorganic carbon. As the name suggests, ABA accounts for both acid generation potential (assumed to be due to sulfide sulphur content, or total sulphur minus sulfate sulphur) as well as acid-buffering potential (referred to as neutralization potential). These factors are then used to determine the net potential ratio (NPR) of the rock sample.

3.1.1 Onsite Analyses

ABA analyses are relatively slow to complete (the average turn-around time at a commercial laboratory is approximately 2 to 4 weeks), and require several different types of equipment. In consideration of the mining rate at Meadowbank, alternate analytical methods were investigated.

The Draft Guidelines and Recommended Methods for the Prediction of Metal Leaching and Acid Rock Drainage at Mine sites in British Columbia (Price, 1997) provide factors for the conversion of total sulphur and total inorganic carbon to maximum potential acidity (MPA) and carbonate neutralization potential (NP), respectively, which are then used to classify material as PAG/NPAG (see Section 3.2). Since it was possible to equip Meadowbank's onsite assay lab with the equipment required for these analyses, their use as a surrogate for the complete suite involved in traditional ABA testing was assessed and confirmed using exploration drill cores (Golder, 2005a).

As a result of these analyses, the Meadowbank onsite assay lab has been equipped to analyze total sulphur and total inorganic carbon in waste rock, allowing for the characterization of acid generating potential onsite, with overnight turn-around times.

3.1.2 QA/QC

The onsite lab carries out a quality control quality assurance (QA/QC) program that includes the following elements:

- Use of certified reference materials to verify the precision of analytical methods; and
- Quarterly analysis of a minimum of 75 duplicate samples by an accredited external lab for full ABA to verify the onsite lab's accuracy with these determinations and confirm correlations.

This includes samples of IF, IV and UM rock types. This analysis is conducted by the Geology Department, and results are reported to the Geology and Environment Superintendents. Data is available for annual reporting, as required.

3.2 WASTE ROCK CHARACTERIZATION

The most conventional method of characterizing the acid generation potential of waste rock is to classify it as potentially acid generating (PAG), non-potentially acid generating (NPAG), or of uncertain acid generating potential (uncertain ARD potential) based on its Net Potential Ratio (NPR). The NPR of a material is calculated as the ratio of its measured carbonate neutralization potential (NP) to its calculated maximum potential acidity (MPA). Mine staffs apply the following procedures to characterize the waste rock at Meadowbank.

Samples of drill cuttings are analyzed on-site for total sulphur and total inorganic carbon. The results from these analyses are used to calculate the Net Potential Ratio which defines NPAG from PAG materials. The following steps lead to the calculation of the **NPR**:

i. Total sulphur is converted into a maximum potential acidity (**MPA**) value by multiplying the total S wt% by 31.25 which yields an MPA value in kg $CaCO_3$ equivalent.

ii. Total inorganic carbon is similarly converted into a carbonate neutralization potential (**NP**) by multiplying the total wt% inorganic carbon (reported as $\%CO_2$) by 83.34 which yields an NP value in kg $CaCO_3$ equivalent. NP = ((%C x 100.09)/12.01)x10.

iii. The Net Potential Ratio (**NPR**) for the blast hole drill cutting sample is then calculated as **NPR = NP/MPA**.

3.2.1 PAG/NPAG

The ARD potential of waste rock, till (overburden) and tailings materials from the Meadowbank mine were previously classified by Golder Associates (2005a) using the NPR-based guidelines published by Indian and Northern Affairs Canada (INAC, 1992), now known as Aboriginal Affairs and Northern Development Canada (AANDC), which are summarized in Table 3-1. The NPR guideline value to differentiate between uncertain and NPAG has been adjusted from 3 to 2 (Golder, 2006b) using the criteria described in the AANDC reference guide (knowledge of rock chemistry, mineralogy and reactivity of neutralizing minerals). For example, the use of carbonate NP as a surrogate for bulk NP was examined (Golder, 2006b) using data obtained from exploration drilling. Carbonate NP and bulk NP correlate well, which suggests that NPR values calculated using carbonate NP would be comparable to NPR values calculated using bulk NP. It also emphasizes that at Meadowbank measured NP is equal to carbonate NP and is thus fully available for neutralization of any acid generated (i.e., there does not appear to be any carbonate that is lost as iron carbonate or other mineral forms that cannot provide neutralization potential).

The NPR ratio adjustment was accepted during the NIRB environmental assessment process (Golder, 2006b).

Table 3-1 Summary of ARD guidelines used to classify Meadowbank waste rock and overburden (based on INAC, 1992).

Initial Screening Criteria	ARD Potential
NPR < 1	Likely acid generating (PAG)
1 < NPR < 2	Uncertain
2 > NPR	Non-potentially acid generating (NPAG)

3.3 FIELD METHODS

3.3.1 Waste Rock Sampling

Field sampling of rock material for use in NPR analyses proceeds according to the following guidelines:

- Drill holes are sampled in accordance with the frequency set out in writing by the Geology Superintendent. The default sampling frequency is the sampling of every fourth drill hole in each drill hole pattern. The Geology Superintendent will vary this frequency based on his knowledge from previous drilling and from visual inspections depending on where the drill pattern is situated.
    - For example, in the Goose Island Pit, data from the drill holes has been compiled for the first 4 benches and compared to the block model for each bench. The PAG/NPAG areas from blast holes consistently conform to the lithology (UM/quartzite and UM/IF) in the model. Thus, the area of UM waste rock on the western side of the pit will be treated as NPAG and sampling will be reduced in this area to every sixteenth drill hole. Sampling at the default frequency will continue for the Portage pit, and eastern side of Goose Island pit.
    - Alternatively, in areas where the Geology Superintendent has already characterized the rock as PAG and directed that this block be sent to segregation as PAG material no sampling at all may be required as the whole pattern has been classified as PAG and treated accordingly.
- Each sample should weigh no less that 1 kg.
- The sample is labeled using a convention that is readily traceable back to the production drill hole numbers.
- Composite samples are not to be used because they confuse the data and render it more difficult for use in model creation or comparison.

3.3.2 Waste Rock Delineation

Following laboratory analysis, geology staff will classify waste rock and overburden as NPAG if the NPR value is greater than 2; PAG if the NPR value is less than 1 and uncertain for NPR values between 1 and 2 (Table 3-1). These criteria can be re-evaluated when judged relevant by the Geology Superintendent in consultation with the Mine Engineer, as additional test data become available. ARD classifications of all samples are logged in Meadowbank's GEMCOM database, and are available as required for annual reports or upon request.

In some cases it may be appropriate to calculate a weighted bulk average NPR for the whole block of rock and use the blended NPR to classify the rock. In such cases the Geology Superintendent should be consulted and the calculation of the weighted average NPR documented. In these cases the blended material should only be classified as being NPAG with the written informed approval of the Geology Superintendent.

NPR values will be transferred to the mine plans for that specific blast. Once blasting is complete the mine surveyor will use NPAG and PAG outlines from the drill pattern to outline the respective dig limits in the open pit. Different material categories are separated into packets, identified in the field using stakes, wire flags and flagging tape so that each packet can be excavated and sent to the appropriate destination (see Section 2.2). Packets classified as NPAG should include no more than one acid-generating sample (NPR<1) for every 8 non-acid-generating samples (NPR>2). Neither should they include more than one sample of uncertain acid-generating potential (1<NPR<2) for every 4 non-acid-generating samples (NPR>2).

4 ASSESSMENT OF ML POTENTIAL

Waste rock and overburden materials can also potentially leach metals when they come into contact with water and air. This release of metals, otherwise referred to as metal leaching (ML) potential, can occur even if the materials are non-acid generating. The ML potential of all rock lithologies and overburden materials at the Meadowbank mine was initially evaluated by Golder Associates (Golder, 2006b) on samples taken from exploration drill cores. Four metals of potential concern were identified (As, Cu, Ni and Zn) but in general, ML at Meadowbank is low.

Standard techniques for analysis of ML potential include Shake Flask Extraction (SFE) and humidity cell tests. Both of these types of tests involve exposing the samples to water, and measuring the metal content of the water after a prescribed period of contact time (24 hours for SFE tests and weekly 24 hour trickle leaches over a minimum of 20 weeks for humidity cell tests), and are thus time-consuming by design. Consequently, it is not feasible to segregate waste materials based on measured ML potentials derived from either of these types of leaching tests. The turn-around time for analytical results is too long for either of these tests to be used as a decision making tool on a day-to-day basis as required during mine operations.

As a result, Version 1 of this plan indicated that ML potential would be determined through development of a predictive relationship between humidity cell leachate results, SFE leachate results and total metals concentrations in rock samples. Analyses for total metals would then occur onsite, and ML potential would be classified using the previously established relationship. However, a reliable model could not be developed. This is in accordance with Golder (2005), which indicated that for both arsenic and copper, the total concentration in the SFE test leachates was not proportional to the total arsenic and copper concentrations in the rock. For example, some waste rock from the Goose Island deposit contains relatively high total As concentrations but shows low As concentrations in the SFE test leachates. This indicates that As in this rock type is associated with relatively stable arsenopyrite and thus does not leach.

Consequently, ML potential is confirmed through quarterly analyses of SFE leachate on a minimum of 75 samples sent to an external accredited laboratory. This includes 25 samples each of IV, IF and UM rock types.

A surface runoff water monitoring program ensures rapid detection of ML in RSF and dike sumps (see Water Quality and Flow Monitoring Plan, 2009). In addition, all RSF sump water is transferred to the TSF, and is not released to the environment. Further details on this monitoring program are provided in Section 5.2.

5 PLAN REVIEW, PERFORMANCE MONITORING & REPORTING

5.1 PLAN REVIEW

The Mine Geology Superintendent is responsible for implementing the Operational ARD/ML Sampling and Testing Plan. The overall Plan is to be reviewed as required by the Geology Superintendent and updated if necessary to reflect any adaptive changes made in the operational sampling and testing procedures. The changes should be made in consultation with the mine engineer and chief assayer. Revised versions should be sent according to the Distribution List (pg. iii).

5.2 PERFORMANCE MONITORING

The Operational ARD/ML Sampling & Testing Plan is the primary tool to ensure that all overburden and waste rock generated on the Meadowbank site is appropriately characterized and segregated to prevent the future release of contaminants from the RSF and overburden stockpiles into the receiving environment.

In addition to the analytical QA/QC procedures outlined in Section 3, the following performance monitoring activities are conducted:

5.2.1 RSF Water Quality Monitoring

The water quality of the drainage from the RSFs and pits is sampled and monitored by the Meadowbank environmental team in accordance with the Meadowbank Type A water License (2AM MEA0815). Water quality predictions (Golder, 2005c) indicated that arsenic, copper, nickel, zinc, nitrate and ammonia may be found in the Portage RSF drainage, and that arsenic may be found in the Vault RSF drainage. The details of this monitoring program are described in the Meadowbank Gold Project Water Quality and Flow Monitoring Plan (2009). The data from this monitoring is provided to the Nunavut Water Board through annual reporting, as per the Type A Water License.

5.2.2 Dike Face Water Quality Monitoring

In order to ensure that waste rock used in the construction of in-water features (e.g. dewatering dikes) provides acceptable fish habitat, water quality of samples from interstitial spaces is analyzed as a component of Meadowbank's Habitat Compensation Monitoring Plan (AEM, 2013b). To date, sampling has been conducted along the East Dike in 2009 and 2011, and along the Bay-Goose Dike in 2011.

Water samples are collected from between the rocks of the dike face using a tube sampler and electronic pump, and analyzed for conventional parameters (hardness, conductivity, pH, and total dissolved and suspended solids), anions (alkalinity, chloride and sulphate), nutrients (ammonia, nitrate, nitrite, total Kjeldahl nitrogen, orthophosphate and total phosphate), organic parameters (chlorophyll-a, dissolved and total organic carbon) and total and dissolved metals at an accredited facility. In accordance with DFO authorizations, sampling and analysis of dike face interstitial water

will continue every 5 years until closure as part of the fish habitat compensation monitoring. Results from this program are provided to the Nunavut Water Board.

5.2.3 Permafrost Development

Thermistors have been installed within the RSF to determine if permafrost is forming as predicted. AEM will be installing additional thermistors in the RSF in late 2013 and 2014 to better define permafrost development. More information regarding the thermal monitoring plan is provided in the version 1 Mine Waste Rock and Tailings Management Plan (Section 8). Thermal monitoring results are provided in AEM's annual report submitted to the NWB.

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Appendix A

ARD/ML Potential of Meadowbank Mine Wastes – Summary

APPENDIX A

Summary of the ARD/ML Potential of Meadowbank Mine Wastes.

The acid rock drainage (ARD) and metal leaching (ML) potential of waste materials to be produced at Meadowbank has been evaluated through both static and kinetic testing (Golder, 2005a and Golder, 2005b). The static tests conducted for this purpose included the following:

- Mineralogy;
- Whole rock analysis;
- Elemental solid phase analysis (multi-acid digestion);
- Acid base accounting (ABA); and
- Shake flask extraction (SFE).

Test methods and results are provided in (Golder, 2005a).

Kinetic testing was conducted on representative samples of waste rock from each lithology using standard 1 kg humidity cell tests, 100 kg composite column tests, and approximately 250 kg composite field cells. Test methods and results are provided in (Golder, 2005b).

Table A.1 summarizes the ARD/ML potential of the till, lake sediments and pit rock, based on the results of static and kinetic testing (Golder, 2005a and 2005b). ARD potential was evaluated by comparing ABA results to the guidelines presented in INAC (1992). ML potential was evaluated based on exceedances of the Metal Mining Effluent Regulations (MMER, 2002) in kinetic test leachate.

TABLE A.1: Summary of ARD/ML Potentials of Meadowbank Waste Types

Deposit	Waste Type	ARD Potential			MMER Metal Exceedances in Kinetic Test Leachate
		% PAG	% Uncertain	% NPAG	
-	Till	9	-	91	N/A
-	Lake Sediments	73	-	27	N/A
Vault	IV	11	14	75	None[1]
Portage/Goose	IV	20	14	66	None[1]
	IF	67	13	20	Zn
	UM	2	2	96	As
	Q	86	-	14	N/A

Notes:

1. Based on the results corresponding to the 100 kg composite sample (Golder, 2005b).
PAG - potentially acid-generating
NPAG – not potentially acid-generating
N/A – not analyze

INAC (Indian and Northern Affairs Canada), 1992. Guidelines for ARD Prediction in the North – Northern Mine Environment Neutral Drainage Studies No. 1. Department of Indian Affairs and Northern Development, Ottawa, 1993.

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AGNICO EAGLE

MEADOWBANK GOLD PROJECT

Landfill Design and Management Plan

In Accordance with Water License 2AM-MEA0815

Prepared by:
Agnico Eagle Mines Limited – Meadowbank Division

Version 2
March 2013

EXECUTIVE SUMMARY

This Landfill Design and Management Plan outlines the design of the current operational and a conceptual closure industrial waste landfill as part of Agnico Eagle Mines Limited's (AEM) Meadowbank Gold Project in Nunavut.

The current landfill (Landfill #1) is required for the disposal of non-salvageable, non-hazardous solid wastes from mining activities that cannot be incinerated. It is located on the Portage Rock Storage Facility and will consist of several sub landfills that evolve with the placement of waste rock. All of the sub-landfills will be identified and mapped.

The leachate from the landfill is very weak (diluted) or simply no existent due to the controls on materials placed in the landfill, and therefore specific leachate management is not considered. Any leachate is naturally drained into the Tailing Storage Facility

At the end of mine life, the landfill waste will be covered by 0.3 to 1 m thickness of rock fill, with an additional 4 m of coarse Non-PAG waste rock material. The final landfill slopes will be up to 50%. Drainage water will be managed under the [1]Mine Waste and Water Management Plan (MMC, 2007a) and 2012 Meadowbank Site Water Management Plan, (SNC Lavalin, 2013).

To meet NWB guidelines, an environmental overview effects assessment was conducted to characterize environmental resources and determine the anticipated environmental effects of the landfills. The primary potential environmental effects from landfill activities included leachate generation, windblown debris and habitat (vegetation) loss. Operation of the landfill has not shown any such environmental effects.

A conceptual closure industrial waste landfill will be located near the top of the Portage RSF and would serve the mine for the last two years of the mine closure. Demolition waste from the plant site removal / reclamation will be disposed of in Landfill #2.

[1] – This plan will have a revision in early 2013

IMPLEMENTATION SCHEDULE

As required by Water License 2AM-MEA0815, Part B, Item 16, the proposed implementation schedule for this Plan is outlined below.

This plan will be immediately implemented (March 2013) subject to any modifications proposed by the NWB as a result of the review and approval process**.**

DISTRIBUTION LIST

AEM – General Mine Manager

AEM – Environment Superintendent

AEM – Environmental Coordinator

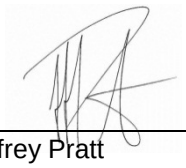
AEM – Engineering Superintendent

AEM – Mine Superintendent

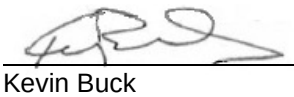
AEM – Site Services Superintendent

DOCUMENT CONTROL

Version	Date (YMD)	Section	Page	Revision
1	08/10/08			Amalgamation of original report and supplementary documents (Golder Associates, Doc 562 – *Landfill Design and Management Supplementary Information* and AEM document – *Meadowbank Type A Water License – Response to Pre-Hearing Commitments*, Appendix I)
		4	11	Addition of testing protocol and incinerator criteria; Incorporation of Government of Nunavut Environmental Guidelines
		5	14	Addition of protocols for material placement in the landfills; Confirmation that there are no planned design changes as of October 2008 to Landfill #1 or Landfill #2
2	12/12/18	ALL	ALL	Comprehensive update of entire plan

Prepared By: 

Jeffrey Pratt
Environmental Coordinator

Approved by: 

Kevin Buck
Environmental Superintendent

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Environmental Guideline for Ozone Depleting Substances
Disposal Guidelines for Fluorescent Lamp Tubes

SECTION 1 • INTRODUCTION

1.1 PROJECT OVERVIEW

This Landfill Design and Management Plan (Plan) outlines the design, operation and closure for two solid waste landfills as part of the Agnico Eagle Mines Limited (AEM) Meadowbank Gold Project.

The objectives of this Plan are summarized as follows:

1. To define the location, design and operating procedures to be used in the landfill disposal of non-hazardous solid waste generated at the Meadowbank Mine;

2. To define acceptable/non-acceptable types of solid waste to be placed in the Meadowbank landfill; and

3. To define operating and monitoring requirements for the landfill.

This updated version of the Landfill Design and Management Plan was developed by Agnico Eagle Mines Limited – Meadowbank Division staff in March 2013 in concordance with the water license requirement. This document will supersede all of the previous Landfill Design and Management Plans created by AEM.

The Meadowbank Project operates under Water License 2AM-MEA0815 issued by the Nunavut Water Board on June 09, 2008 and signed into effect by the Minister of Indian and Northern Affairs Canada (now Aboriginal Affairs and Northern Development Canada) on July 10, 2008. The landfills are required for the disposal of non-salvageable, non-hazardous industrial wastes from standard mining activities that cannot be incinerated. The Plan was developed in accordance with the AEM Type A Water License from the Nunavut Water Board (NWB) to operate the mine.

Hazardous wastes will not be placed in the landfills. Management procedures for hazardous wastes are provided under a separate report – Hazardous Materials Management
Meadowbank Mine Site Baker Lake Facilities (Ver.2, March 2012). All other materials considered unsuitable for landfill deposition are packaged for shipment and disposal off site at a licensed facility.

To meet NWB guidelines, an environmental overview effects assessment was conducted to characterize environmental resources and determine the anticipated environmental effects of the landfills. Other applicable regulatory guidelines and criteria were also incorporated into this Plan, as discussed in Section 2.0.

The overall Meadowbank Gold Project description, landfill siting options and descriptions, and corresponding environmental overview approach are described in the sections below. The Meadowbank Gold Project facility layout is shown in Figure 1.

At the Meadowbank site and Baker Lake Marshalling Area, hazardous waste materials are stored in secure facilities until they can be backhauled for off-site recycling or disposal in an approved facility. AEM has registered as a Hazardous Waste Storage Facility with the Government of Nunavut Department of Environment; the Meadowbank site waste generator number is **NUG 100031**.

1.2 LANDFILL SITING

The landfills were positioned considering the following criteria:

- Drainage – sites that drain into areas where water will be collected and monitored as part of the overall mine plan are preferred.
- Avoid Ice Rich Soil Excavation – sites where bedrock is at relatively shallow depth are preferred.
- Disturbed Areas – sites that will be within or near areas that will be disturbed as part of the overall mine plan are preferred.
- Access – sites that are located close to existing access roads are preferred.

The first three criteria are recommendations from the Mine Site Reclamation Guidelines for the Northwest Territories (INAC, 2006).

Based on the above criteria, a landfill is planned at each of the two following locations:

- Landfill #1 is developed in the Portage RSF (Figure 2); This landfill consist of multiple sub landfills that are built and buried according to the evolution of the RSF. As the RSF evolves, the elevation and location of the sub landfills change.

and

- Landfill #2 will be developed at the top of the Portage RSF.

While the preferred landfill location is the top of the Portage RSF (minimizing the disturbed area), such a landfill would hinder waste rock placement during mining activities. Thus Landfill #1 will be developed first and serve as the non-hazardous waste disposal site for the life of operation. For the closure of the mine, Landfill #2 will serve as the non-hazardous waste disposal site.

SECTION 2 • REGULATORY SETTING

Waste management in Nunavut is regulated under the *Nunavut Public Health Act*, the *Nunavut Environmental Protection Act* and the federal *Environmental Protection Act*. In addition to mandatory requirements, a number of waste management guidelines are commonly used in the NWT and Nunavut. The most recent of these was developed for municipal solid waste, and is titled "Guidelines for the Planning, Design, Operations and Maintenance of Modified Solid Waste Sites in the NWT" (Ferguson Simek Clark, April 2003, on behalf of the Department of Municipal and Community Affairs, Government of Northwest Territories). While not all of the recommendations provided in this guideline are appropriate for the management of industrial waste such as those generated at a gold mine, those principles that are considered applicable have been adopted in the Plan.

In addition, the NWB guidelines *Mine Site Reclamation Guidelines for the Northwest Territories* (INAC 2006) were followed in this current document regarding specific landfill design and mitigation for impacts pertaining to waste. The recommendations from *Implications of Global Warming and the Precautionary Principle in Northern Mine Design and Closure* (BGC 2003) were also incorporated into this document, where appropriate.

SECTION 3 • PLAN FOR THE ON-SITE DISPOSAL OF SOLID WASTE

3.1 APPROACH

The strategy for the disposal of solid waste is to first identify and segregate acceptable disposal items from non-acceptable items. Acceptable items that can be disposed of at the on-site facility are those that are non-hazardous, non-organic, with a low leachate and heat generation potential. All other materials are either incinerated or hauled offsite. This strategy for limiting the materials that can be placed in the landfills greatly reduces the potential for leachate.

All solid wastes that may contain food waste, food packaging waste or other organic waste that could attract wildlife are incinerated in the site's purpose built incinerator (see the Meadowbank Incinerator Management Plan - Ver.4, Nov. 2012 for more detail). This includes all garbage from the camp, camp kitchen, site lunchrooms and offices. The ash from the incinerator are placed in a container (yellow roll off) and disposed of at the landfill. Incinerator ash samples are collected and tested for metals according to the Government of Nunavut Environmental Guideline for Industrial Waste Discharges (D of SD, 2002). Ash that does not meet these guidelines will be buried within the TSF.

The second part of the strategy is to concentrate disposal of solid waste at two landfills, Landfill #1 and Landfill #2. Landfill #1 is located in the Portage RSF. It consists of multiple sub landfills that are built and buried according to the evolution of the RSF. As the RSF evolves, the elevation and location of the sub landfills change. It will serve the mine for the life of operation. Landfill #2 will be located near the top of the Portage RSF and would serve the mine for mine closure. Demolition waste from the plant site removal / reclamation will be disposed of in Landfill #2.

The development of the two landfills minimize the area disturbed and the re-handling of waste. Landfills at the selected locations allow any leachate that may be generated to be collected, monitored and managed with seepage and runoff water from the Portage RSF. The leachate from the landfills is very weak or simply absent due to the controls on materials placed in the landfill and thus site specific landfill leachate management is not considered to be required. Any leachate that may become present would runoff into the Tailings Storage Facility which will be capped at the end of mine life.

Based on the above strategy, a liner is not required for the landfills, nor is any special monitoring being completed or foreseen to be recommended in the future. However, the landfills conform to the Type A Water License requirements and closure plan for each landfill site for orderly landfill development and to reduce the potential for windblown debris.

The Type A Water License requires the following landfill related monitoring:

- Part I, Item 10 stipulates that the monthly runoff/seepage flow from both Landfill #1 and #2 in cubic meters must be measured, recorded and reported to the Water Board

- Part I, Item 12 stipulates that the annual geotechnical inspection to be carried out by a geotechnical engineer between the months of July and September should include all earth works including the two landfill sites with the results being included in the report to the Water Board

- Part I, Item 15 stipulates that seepage and runoff from the landfills is to be observed at a minimum of once per quarter with the observations reported to the Water Board in the Water License annual report

3.2 ACCEPTABLE WASTE FOR LANDFILLING

The following materials are acceptable for disposal at the landfills:

- Plastic (except expanded polystyrene);
- Steel, copper, aluminum, iron (most of this metal is recycled);
- Wood;
- Fiberglass insulation;
- Fiberglass;
- Roofing;
- Cardboard
- Concrete;
- Carpet;
- Bricks;
- Ceramics;
- Rubber
- Empty caulking tubes;
- Hardened caulk;
- Clothing;
- Glass
- Wire;
- Small appliances (with batteries removed);
- Gyproc;
- Ash provided it has cooled to 60ºC or less and follows procedures laid out in the Incinerator Management Plan; and
- Vehicles and machinery provided all liquids, grease, batteries, and electronics have been removed (see Section 3.3.2 for more details on ozone depleting substances).

3.3 UNACCEPTABLE WASTE FOR LANDFILLING

Materials that are not listed above are unacceptable for placement at the landfills, unless approved in writing by the Meadowbank Environment Superintendent. These materials include:

- Organic matter including food, septic tank pumpings or sludge from waste water treatment, dead animals, paper;
- Food containers and wrappings, unless cleaned;
- Whole tires;
- Hazardous waste including mercury, medical waste, batteries, solvents, glues, ethylene glycol antifreeze, adhesives (except empty caulking tubes);
- Electronics;
- Light bulbs or Fluorescent Lamp Tube
- Petroleum products, including materials contaminated with petroleum products; and
- Expanded polystyrene.

In particular, organic matter is not accepted in the landfill, thus eliminating the attraction to carnivores and/or raptors. This is accomplished by requiring all personnel to dispose domestic waste in designated receptacles and by sending all collected domestic waste (e.g. from kitchens and living quarters) to the site incinerator.

3.3.1 Fluorescent Lamp Tubes

Fluorescent tubes contain mercury phosphor powder and traces of lead and cadmium, which are considered environmental contaminants under the Nunavut *Environmental Protection Act* (EPA). The only disposal method for fluorescent tubes is through an approved hazardous waste recycling or disposal facility (Government of Nunavut, Environmental Protection Service, 2003). The *Disposal Guidelines for Fluorescent Lamp Tubes* are included in Appendix A.

3.3.2 Ozone Depleting Substances

Ozone depleting substances (ODSs) include chlorofluorocarbons (CFCs) or halons and common sources include refrigeration equipment, air conditioning equipment, motor vehicle air conditioners and fire extinguishing equipment (Government of Nunavut, Environmental Protection Service, 2002b). These materials are hazardous in nature; consequently, all disposal of ODS take place at an approved facility.

3.4 TOTAL VOLUME OF WASTE

An estimate of waste volume is required to estimate the approximate size of the landfills; however, an exact waste volume is not a critical parameter in the design because of the flexibility of design to accommodate extensions (larger to accept more waste) or contractions (smaller to accept less waste) of the landfill.

In 2011, the recorded amount of waste that went to the Landfill for disposal was 11, 185 m^3. For this reason we will assume that 78,295 m^3 will be required for the remaining 7 year life of the operating mine.

3.5 INCINERATOR ASH TESTING PROTOCOL

Please see the Incinerator Management Plan Ver.4 – 2012 for all information regarding the disposal of ash at the landfill.

SECTION 4 • LANDFILL LOCATION AND CONSTRUCTION

4.1 LANDFILL #1

The location of Landfill #1 is shown on Figure 2 in the northwest side of the Portage RSF. This landfill will serve as the solid waste disposal facility for the first 9 years of mine life. The design of Landfill #1 does not require imported materials or exacting survey data or measurement. This is due to the restriction on materials that can be landfilled and the location of the landfill within the catchment of the Portage RSF. These factors reduce the need for leachate collection or control or mitigation measures against vectors such as carnivores or raptors. Thus, the main environmental mitigation measure required is a wind screen to reduce windblown debris. As of March 2013, the Landfill #1 has evolved in sub landfills that are built and buried according to the evolution of the RSF. As the RSF evolves, the elevation and location of the sub landfills change.

The area to receive waste is bounded by a rock fill berm. The purpose of the rockfill berm is to act as a wind shield for the waste. The sub landfills have a rectangular shape with the length perpendicular to the prevailing wind direction so that much of the waste could be protected from wind by the rockfill berm.

Provided the materials that go into the incinerator are controlled to exclude all hazardous materials (*i.e.*, even small quantities of hazardous waste such as batteries are not disposed in the landfill), then the incinerator ash should be non-hazardous. As discussed in Section 3.5, an ash testing protocol has been implemented to ensure that the incinerator ash is suitable for disposal in the landfills.

4.1.1 Landfill #1 Protocol For Placement of Material

Wastes is disposed of directly on the ground and compacted with heavy equipment against the berm or existing row. When the sub landfill is either full of compacted waste or the RSF evolution causes the sub landfill to be moved, the waste is compacted and then covered with waste rock. A new sub landfill is then built including rockfill berm to act as a wind shield.

4.2 LANDFILL #2

Prior to the closure and covering of Landfill #1 by waste rock, Landfill #2 will be developed on top of the Portage RSF. Landfill #2 is currently estimated to be a 4 m deep depression in the top of the waste rock pile at the Portage RSF. The depression will be constructed by the waste rock trucks discharging their loads in a controlled manner such that the dimensions of the depression will be approximately as shown on Figure 3. The area to receive waste will be bounded on the northwest side by a 2 m high rockfill berm. The rockfill berm will act as a wind shield to reduce the amount of wind-blown debris, while providing material for intermediate cover of the landfill. Details and the exact location of Landfill #2 on top of the rock storage facility are not currently available because the Portage RSF will not reach a grade suitable for construction of the landfill until later in the mine life. The detailed design for Landfill #2 must be completed a minimum of one year prior to commissioning of the landfill. At that time, the required size of Landfill #2 will be calculated based on the actual rate of filling of Landfill #1 and the estimated amount of demolition material and decommissioned equipment that will need to be landfilled at the end of the mine life. As of March 2013, there are no planned changes to the general design of Landfill #2.

Waste will be placed to a maximum thickness of 4 m, after which it will be covered with a minimum of 0.3 m thickness of rock fill. This landfill should be provided with a capacity of 3,600 m^3, which is equivalent to 7 years of waste disposal at 500 m^3 / year, plus an allowance for waste from the demolition of the mine plant site. Thus, the base area of the depression is anticipated to measure about 30 m by 30 m.

4.2.1 Landfill #2 Protocol For Placement of Material

Materials destined for burial in the demolition landfill will be dismantled as safely and efficiently as possible, stacked in a stockpile and will then be cut by flame, hydraulic shears or saw, into manageable sizes for safe transport and placement in the demolition landfill. The demolition debris will be placed in compacted layers and then buried. Once compacted, waste rock will be placed on the debris to infill voids. Once a continuous layer of waste rock has covered the compacted debris then a final cover of a minimum of 4 m of Non Acid Generating Rock will be placed over the entire landfill area.

4.3 LEACHATE MANAGEMENT

The leachate from the landfills has a very low strength (dilute) or is simply absent due to controls on materials placed in the landfills, and thus site-specific landfill leachate management is not required. Any leachate generated by the landfill will naturally be directed to the Tailing Storage Facility. Due to the fact that the Portage RSF will cover Landfill #1 and #2, it is not proposed to have a separate water quality monitoring point for leachate.

4.4 LANDFILL ENCAPSULATION WITHIN THE PORTAGE RSF

The Portage Rock Storage Facility contains surplus quantities of waste rock from the Portage and Goose Island pits. A classification system is use to identify the use and storage for all mine rock[1]. Specifically, this system identify potentially acid generating (PAG) or non-acid generating (NPAG) rock types, as well as those with the potential to leach metals.

The Portage RSF is constructed as a cell, or series of cells, such that the interior of each cell is composed of PAG and/or ML waste rock, and the exterior of each cell is composed of NPAG waste rock. Thus, PAG and/or ML waste rock within the RSF is encapsulated within NPAG waste rock, thereby limiting its exposure to oxidizing agents such as air and water, and providing a buffer for any drainage from the interiors of the cells. The material within the Portage RSF freezes, which limits internal drainage as infiltrating water becomes frozen. As a further ARD control measure, the Portage RSF will be capped with a minimum 4 m thick layer of coarse acid-buffering ultramafic rock at closure.

Owing to their placement within the Portage RSF, the landfills are/will also become encapsulated within waste rock. Specifically,the slopes of the sub landfills are covered with an advancing waste rock layer during operations such that the sub landfills are covered by a minimum 0.3 to 1 m thickness of waste rock by the end of each sub landfill operations. AEM plans to use NPAG waste rock to surround and cover the landfills wherever practical. As noted above, a minimum 4 m thick layer of coarse acid-buffering ultramafic rock would also be placed over the landfill cover as part of planned closure activities for the Portage RSF.

[1] See Operational ARD/ML Testing and Sampling Plan

SECTION 5 • LANDFILL OPERATION

5.1 CONCEPTUAL OPERATIONS PLAN

The following is a conceptual plan for operating the landfills:

a) Materials Acceptable for Disposal

See Section 3.2.

b) Materials Not Acceptable for Disposal

See Section 3.3.

d) Site Development and Landfilling Method

The sub landfills are filled progressively in an orderly manner. Specifically, waste is placed at one end of the sub landfill at full height and then the active waste area progressively advances. Areas where the waste has been placed to full height and leveled are progressively covered by placement of a minimum 0.3 m thickness of rock fill on top of the waste.

e) Staffing and Equipment

The landfills do not require a full-time attendant. Roll off trucks haul waste to the landfills and a dozer is used to spread and level the waste.

f) Leachate Management

The leachate from the landfills is very weak (dilute) or simply absent due to the controls on materials placed in the landfills. Therefore, specific leachate management is not required.

g) Surface Water and Erosion Control

The slopes of the landfills are covered with rockfill, thus protecting them from erosion. Any water that may runoff from the RSF will flow to the TSF.

h) Inspections

The environmental department is conducting periodic inspections to ensure compliance with the permit and operation plan..

5.2 CONCEPTUAL CLOSURE PLAN

The following is a conceptual plan for closing the landfills:

a) Estimate of Total Waste Volumes, Tonnage and Life of Landfills

Upon closure, it is estimated that the landfills will have the volumes as described in Sections 4.1 and 4.2.

b) Final Cover Design

- The waste in the landfills will be covered by 0.3 to 1 m thickness of rockfill, covered with an additional 4 m thickness of coarse acid-buffering ultramafic waste rock material;
- The final landfill slopes will be up to 50%; and
- Drainage water, if present will be naturally directed to the Tailing

Storage Facility.

c) End use of Landfill After Closure

There is no planned end use of the landfills post-closure. They will become part of the waste rock storage facility.

d) Water Management

Contact water from the landfills in closure will continue to be managed under the Water Management Plan (SNC-Lavalin, 2013).

SECTION 6 • POTENTIAL ENVIRONMENTAL EFFECTS

The landfills are designed and built as part of the Portage RSF. The access road to the Rock Storage Facility is used to access the sub landfills considered as Landfill #1.. Access to Landfill #2 will also be by the access road to the Portage RSF.

Landfill activities that were identified to have potential effects on VECs include site preparation and construction, operations and closure.

Potential effects from the landfills on VECs were assessed as follows:

- Degradation of permafrost;
- Change in surface water and groundwater drainage patterns due to proposed landfill footprint (altered landscape);
- Change in groundwater and surface water quality from leachate percolation, leading to degradation of aquatic habitat;
- Change in air quality from dust and windblown debris;
- Loss of vegetation cover and terrestrial mammal habitat due to proposed landfill footprint;
- Attraction of predatory and small mammals to waste; and
- Loss of sites of heritage significance or traditional ways of life.

A number of mitigative measures, including management and monitoring plans, were implemented as part of the overall Meadowbank Gold Project and are also incorporated into landfill construction, operations and closure. The plans that set out detailed site-specific protection measures and procedures that serve to protect the VECs include:

- Water Management Plan (SNC Lavalin, 2013);
- Air Quality and Noise Management (Cumberland, 2005i) to be amended in 2013;
- Terrestrial Ecosystem Management (Cumberland, 2005);
- Hazardous Materials Management (AEM, 2012);
- Preliminary Closure and Reclamation Plan (AEM, 2008); and
- Water Quality and Flow Monitoring Plan (AEM, 2009) to be amended in 2013.

6.1 EFFECTS SUMMARY

The primary potential environmental effects from landfill activities included leachate generation, windblown debris and habitat (vegetation) loss. Given the effective implementation of mitigation plans, no residual environmental effects to VECs from construction, operation or closure of the landfills are anticipated. See summary below:

- The leachate that will be generated by the landfills is of very low strength (dilute) or simply absent due to restrictions on the materials that is placed in the landfills. Water drainage from the landfill area would naturally be directed to the Tailing Storage Facility and would be managed under the Water Quality and Flow Monitoring Plan (MMC, 2007b) during operations and closure.

- Rockfill berm act as a wind shield to reduce amount of windblown debris.

- Habitat loss is minimized because the landfills is designed and built within the footprint of the Portage RSF. With the implementation of terrestrial habitat reclamation strategies, the final surfaces of the landfills is graded to blend into the existing topography and enhance conditions for wildlife. Terrestrial habitat reclamation strategies will be incorporated as part of the Preliminary Closure and Reclamation Plan (MMC, 2007d), which include encouraging the regrowth of natural vegetation or revegetation to enhance re- establishment of vegetation communities, where warranted.

SECTION 7 • PLAN REVIEW AND CONTINUAL IMPROVEMENT

The Landfill Design and Management Plan will be reviewed annually by the Meadowbank Environmental Department in consultation with the engineering department, and updated every two years of operation. Improvements suggested through these reviews would be implemented in consultation with the Nunavut Water Board.

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FIGURE 1 – OVERALL SITE PLAN

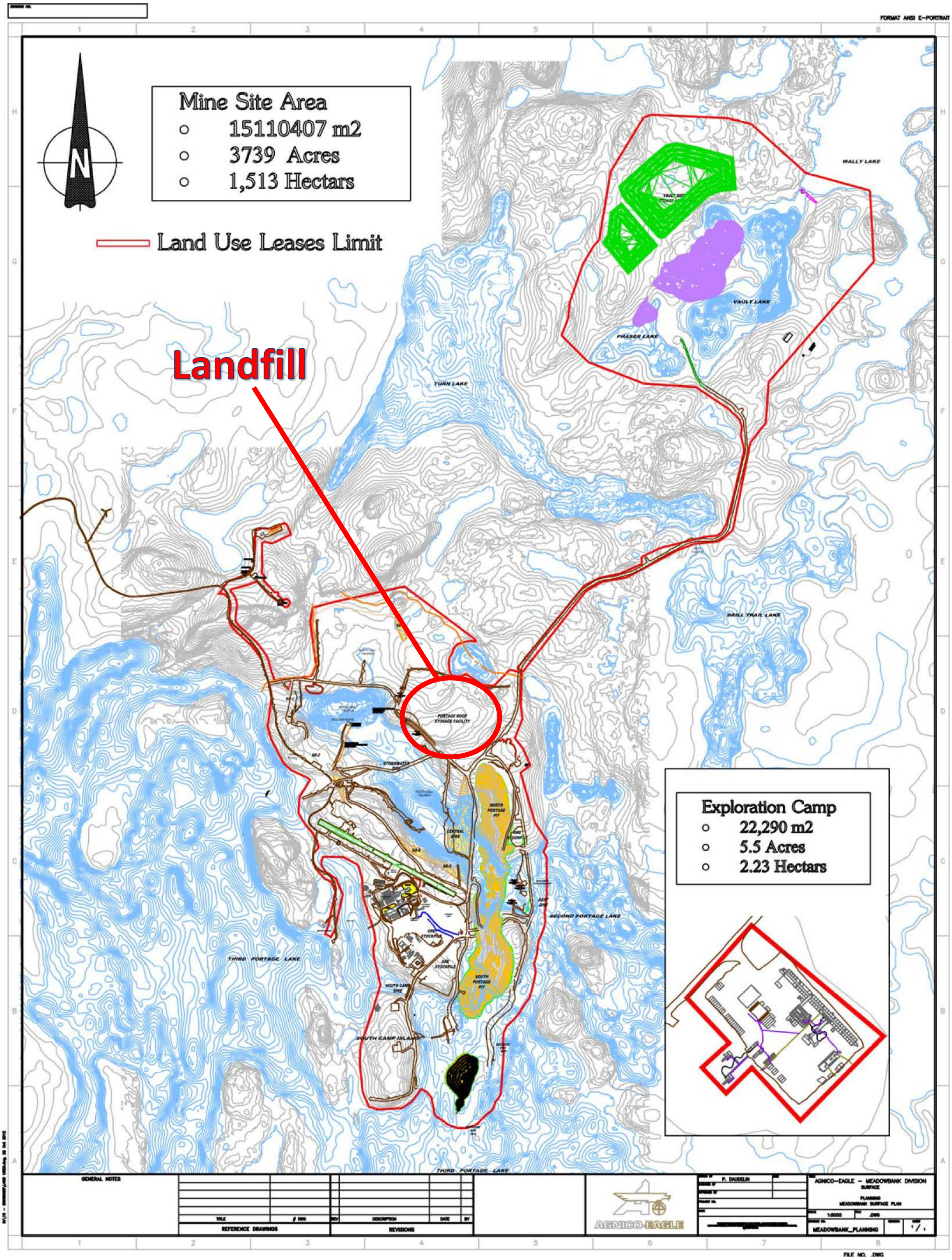
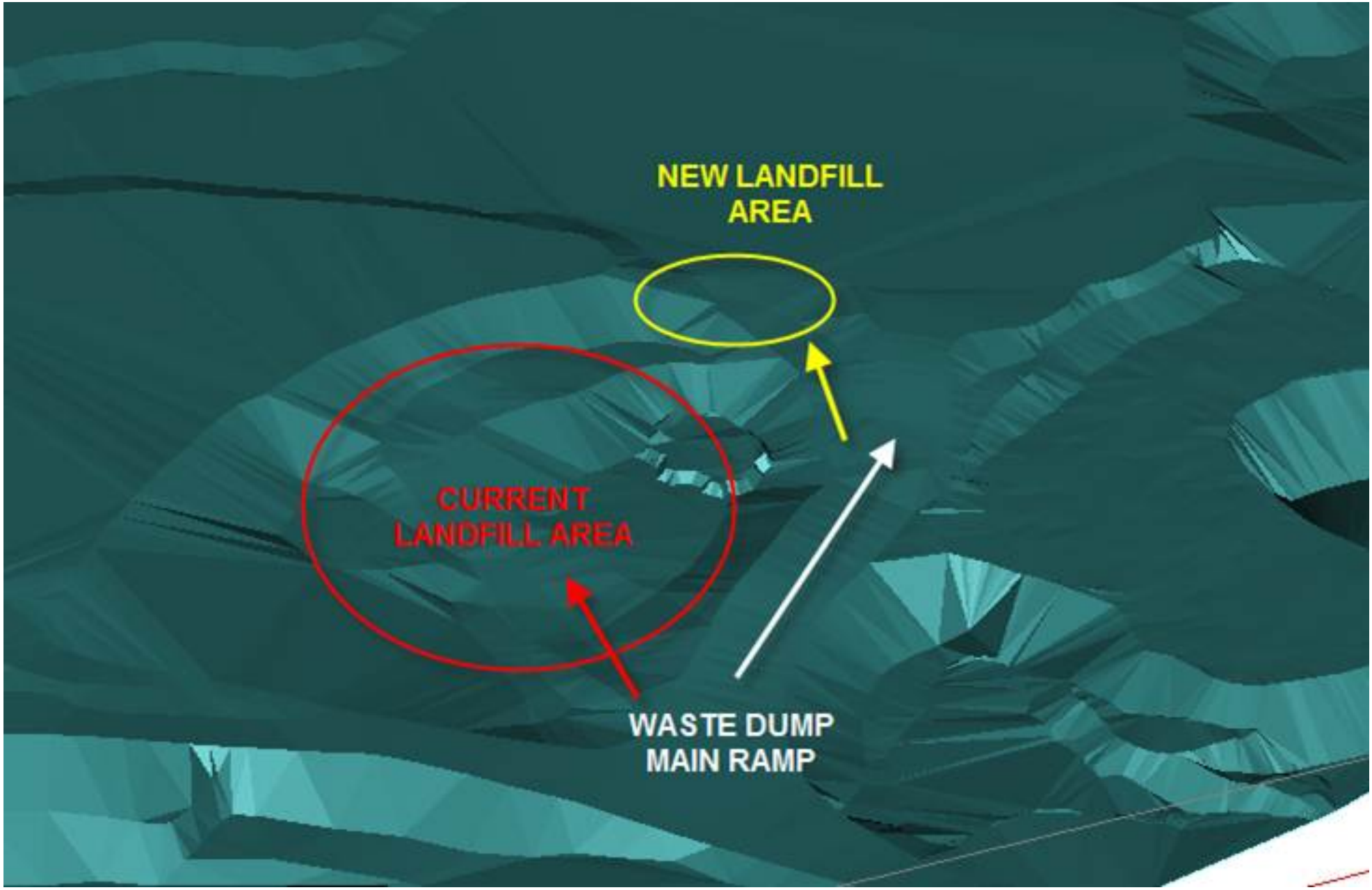


FIGURE 2 – LANDFILL #1 Location Plan



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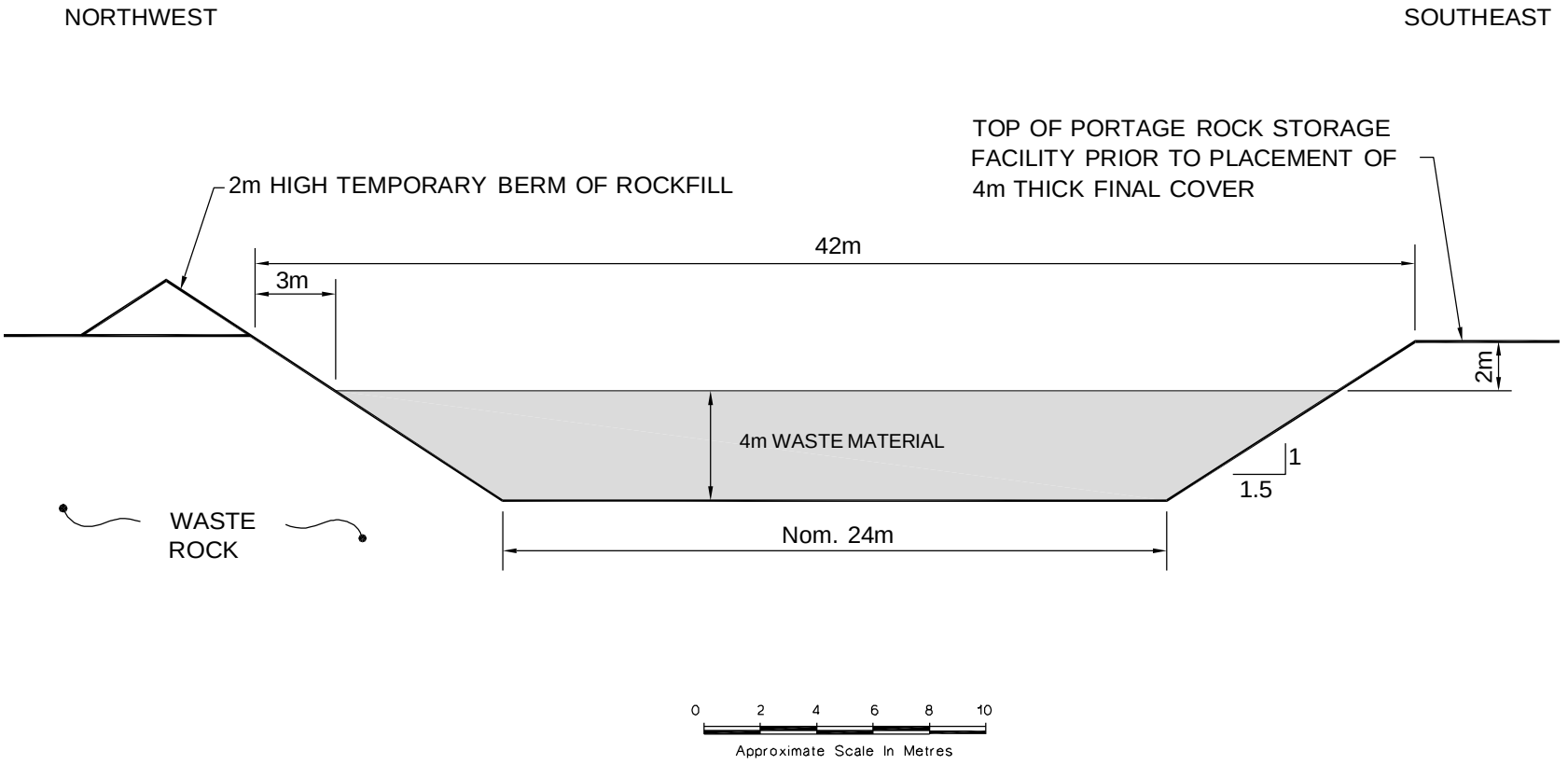


NOT FOR CONSTRUCTION

PROJECT

MEADOWBANK

MINING CORPORATIOND

TITLE

CONCEPTUAL CROSS SECTION OF LANDFILL #2 PRIOR TO PLACEMENT OF COVER

Golder Associates

PROJECT No. 06-1413-089			FILE No. 061413089-1400-FIG_4	
DESIGN	CW	23MAR07	SCALE AS SHOWN	REV. –
CADD	AS	15AUG07		
CHECK				
REVIEW				

FIGURE 3

Appendix A

Government of Nunavut Environmental Guidelines

Environmental Guideline for Ozone Depleting Substances

ENVIRONMENTAL GUIDELINE FOR Waste asbestos

Department of Sustainable Development
Environmental Protection Service

Nunavut

GUIDELINE: MANAGEMENT OF WASTE ASBESTOS

AS AMENDED BY:

USE OF GUIDELINE

A guideline is not law and is therefore not enforceable. It does however, assist an inspector to determine what action(s) may be required of him or her. Paragraph 2.2(c) of the *Environmental Protection Act* allows the Minister to "develop, co-ordinate and administer" guidelines. The Act [subsection 5(1)] makes it an offence to discharge a contaminant into the environment, subject to some exceptions [subsection 5(3)]. When a discharge occurs and it is inconsistent with the guidelines, the discharge is considered an unacceptable risk. The inspector may then consider issuing an order or laying an information.

A guideline allows for some leniency in applying the law. A court would probably be inclined to consider the application of a guideline favorably because the public is aware of the standards they are expected to meet.

This Guideline is not law.
It is prepared by Environmental Protection Service,
Department of Sustainable Development
Government of the Nunavut

January, 2002

Guideline for the Management of Waste Asbestos

1 Introduction
1.1 Definitions
1.2 Characteristics
1.3 Potential Effects

2 Roles and Responsibilities
2.1 Environmental Protection Service
2.2 Occupational Health and Safety
2.3 Generators of Waste Asbestos
2.4 Contractors

3 Waste Management
3.1 Pollution Prevention
3.2 Storage
3.3 Transportation
3.4 Asbestos Abatement
3.5 Disposal

4 Conclusion

Contact List

January, 2002

GUIDELINE FOR THE MANAGEMENT OF WASTE ASBESTOS

1 Introduction

This guideline provides general information on the proper management of waste asbestos. Waste asbestos is a contaminant under the *Environmental Protection Act* (EPA) and must be managed as a hazardous waste.

Asbestos is a cancer causing substance. The public, workers, and the environment must be protected from any air-borne exposure to this material.

This guideline is specific to the management of waste asbestos and should be read in conjunction with the Guideline for the General Management of Hazardous Waste In Nunavut (referred to as the General Guideline). Section 2.2 of the EPA gives the Minister of Sustainable Development the authority to develop, coordinate and administer these guidelines.

1.1 Definitions

Asbestos — Magnesium silicate minerals that occur naturally in fibrous forms. The regulated (TDGR) asbestos types include: chrysotile, actinolite, anthopkyllite, tremolite (white), crocidolite (blue), amosite, mysorite (brown).

Friable waste material — A material which when dry can be crumbled, pulverized or reduced to powder by hand pressure.

Generator — The owner or person in charge, management or control of a hazardous waste at the time it is generated, or a facility that generates hazardous waste.

Transport authority — The regulations controlling the management of hazardous waste under that mode of transport. These include:

Road and rail - *Transportation of Dangerous Goods Act* (TDGA) *and Regulations* (TDGR)

Air - *International Civil Aviation Organization Technical Instruction* (ICAO)

Marine - *International Maritime Dangerous Goods Code* (IMDG).

Waste Asbestos — Asbestos which is no longer useable for its intended purpose and is intended for storage, recycling or disposal. It includes any type of material with greater than 1% asbestos by weight but not asbestos that is immersed or fixed in a natural or artificial binder or in included in a manufactured product.

1.2 Characteristics

Asbestos is a silicate mineral which is strong, flexible and resistant to heat and chemicals. Asbestos was used in a variety of materials including: fireproof fabrics, gaskets, electrical and heat insulation, chemical filters, brake lining, siding and concrete reinforcement.

1.3 Potential Effects

Respiratory exposure to asbestos particles and fibers causes cancer.

The fibrous nature of asbestos is a health concern. Friable asbestos readily floats in air and is easily inhaled. Due to the mineral nature it is not readily dissolved and may not be excreted from the body. If enough asbestos particles are taken into the respiratory tract cancer may develop.

Environmental and occupational exposure to asbestos is primarily from air-borne sources. This includes weathered or poorly maintained asbestos materials and particles from asbestos abatement (removal) projects. Natural exposures of asbestos (rock outcrops) and dust from vehicle brake pad wear are beyond the scope of this guideline.

2 Roles and Responsibilities

2.1 Environmental Protection Service

The Environmental Protection Service (EPS) of the Department of Sustainable Development is the Government of Nunavut's (GN) agency responsible for initiatives which control the discharge of contaminants and their impact on the environment. EPS is responsible for ensuring that environmentally acceptable management procedures, emission levels and disposal methods are maintained. EPS programs are applied primarily to Commissioner's Land, lands administered by municipal governments or GN undertakings. Legislative authority is provided by the *Environmental Protection Act* and *Pesticide Act.* Contact EPS for a listing of relevant regulations and guidelines.

2.2 Occupational Health and Safety

Worker protection from air-borne asbestos particles is regulated by the Prevention Services Division, Workers Compensation Board. The *Asbestos Safety Regulations,* under the *Safety Act,* require that employee exposure to hazardous air-borne asbestos be maintained below specified levels. The exposure levels correspond to the type of asbestos and the friability of the material. Contact the Prevention Services Division of the Worker's Compensation Board for the regulations and procedures required for the containment of asbestos dusts and worker protection.

2.3 Generators of Waste Asbestos

The responsibility for proper waste management rests with the generator and should be considered as part of the cost of doing business.

Waste asbestos is a hazardous waste. The owner (generator) of the asbestos is responsible for ensuring the waste asbestos is properly managed from the time it is generated to final disposal. Waste asbestos must be safely removed, handled, packaged, stored, transported, treated and/or disposed in accordance with this guideline and all applicable Acts and regulations.

2.4 Contractors

Contractors can manage waste asbestos on behalf of a generator. However, the generator is responsible for insuring that the waste management method complies with this guideline, the General Guideline and the requirements of other legislative authorities. (Including the *Asbestos Safety Regulations* under the *Safety Act* and the *Transportation of Dangerous Goods Act and Regulations* (TDGR) or other transport authority).

3 Waste Management

> **Minimizing or avoiding the creation of pollutants and wastes can be more effective in protecting the environment than treating them, or cleaning them up after they have been created.**
>
> **Canadian Council of Ministers of the Environment**

3.1 Pollution Prevention

Pollution prevention methods reduce or eliminate the creation of waste. Pollution control practices treat waste after it has been created. Pollution prevention opportunities for asbestos include the following:

Reduce

- Consider using less hazardous materials i.e.: fiberglass, metals, wherever possible. In some applications there is no replacement for asbestos.

Reuse

- Encapsulation of the existing asbestos by sealing with paint or an epoxy product, covering with paneling or other non-asbestos materials may be considered. The Prevention Services Division, Workers Compensation Board must be consulted prior to sealing areas that contain asbestos.

- Non-friable asbestos materials can be re-used (i.e.: fire-break asbestos cementous boards), to reduce replacement costs and extend the life of the product.

3.2 Storage

Waste storage is not a long term solution.

Store waste asbestos according to the following:

- Store in sealed, airtight containers and labeled "Asbestos" as directed by the *Asbestos Safety Regulations.*
- Use containers that are sound, sealable and not damaged or leaking.
- Label containers according to the requirements of the Work Site Hazardous Materials Information System (WHMIS) of the *Safety Act* or the relevant Transport Authority if transport to a disposal location is planned. (see Section 3.3 Transportation).
- Protect containers from the weather and physical damage.
- Storage should be in a secure area with controlled access.
- Train personnel in the safe use, storage and shipping procedures for waste asbestos. Only trained persons should have access to the storage area.

The short term storage of waste asbestos is only acceptable as an interim measure to permit time for the collection of sufficient volumes for cost effective transport to a disposal facility.

Storage of waste asbestos in quantities greater than 1000 kilograms for a period greater than 180 days requires the site to be a registered hazardous waste storage facility. Consult the General Guideline or contact EPS for application procedures.

3.3 Transportation

The transport of waste asbestos requires proper classification, packaging, labeling and documentation as required by the transport authority (air, marine, rail, road). Requirements for waste generators and carriers are detailed in the General Guideline.

Special Provisions 37 and 44 of TDGR are two exemptions for road transport of waste asbestos. These provisions allow for the substitution of a shipping document for the hazardous waste manifest, and, provided the shipping name and product identification number appear on the outer package or small container, labels are not required.

The shipping document must include the following information and should be mailed or sent by facsimile to EPS:

- Date of consignment
- Consignor identification, mark or signature
- Shipping name
- Product Identification Number
- Quantity

For road transportation purposes, waste asbestos can be classified in the following ways, depending on the type of asbestos.

Shipping Name: **Waste White Asbestos**
P. 1. N.: UN 2590
Classification: 9.1
Packing Group: 111
Special provisions: 37,44

Shipping Name: **Waste Blue Asbestos**
P.I.N.: UN 2212
Classification: 9.1
Packing Group: 111
Special provisions: 37,44

Shipping Name: **Waste Brown Asbestos**
P.I.N.: UN 2212
Classification: 9.1
Packing Group: 111
Special provisions: 37,44

Further consultation with the transport authority is recommended.

Generator numbers, waste manifests and registered hazardous waste carrier lists are available from the Environmental Protection Service.

3.4 Asbestos Abatement

Prevention of asbestos fibre release into the air is the primary objective of all asbestos abatement projects.

The removal of asbestos materials requires a thorough understanding of the potential hazards and knowledge of measures available to prevent worker, public and environmental exposure to asbestos fibers.

The *Asbestos Safety Regulations* require that employers conducting an asbestos removal project provide the following training to workers who are likely to come in contact with asbestos:

(a) demonstration and instruction in the use of all protective equipment;
(b) the safe handling and disposal of waste asbestos;
(c) health education including information relating to pneumoconiosis, lung cancer and the effects of smoking; and,
(d) any other information a safety officer considers necessary.

Other requirements, such as soaking the asbestos with water through its entire thickness prior to disturbing are designed for safety purposes.

Materials containing non-friable asbestos, such as asbestos cementous board (used as building siding), ceiling tiles, linoleum, tar papers, are generally non-hazardous if they remain intact. However, if these are broken or shredded, asbestos fibers may be released into the air. Minimal safety apparel is required when proper handling procedures are exercised. Contact the Prevention Services Division, Workers Compensation Board, for more information on worker protection or to obtain a copy of the regulations.

The names and location of asbestos training centers are available by contacting the waste management associations listed in Appendix B of the General Guideline.

3.5 Disposal

Two options are available for the disposal of waste asbestos.

Burial at the local landfill. Approval for local landfill disposal must be obtained from the municipal authority. Acceptance of the asbestos materials by the local authority must be confirmed to EPS by telephone or in writing. This ensures that the municipality is registered as a receiver of waste asbestos.

At the landfill, the waste asbestos shall be immediately buried and covered with one half meter of cover material (two feet). Cover materials can be locally available soils, refuse or other materials provided the asbestos containment is not ruptured. If a landfill practices open burning, waste asbestos should be placed in a dedicated trench isolated from the burning. The excavated soils from the trench should then be used to cover the asbestos to the required depth.

In addition:

-the excavation must be isolated from future burning activities.
-the asbestos waste should be buried where it will not be disturbed.
-the location of the asbestos should be maintained on a map or diagram of the property by the municipal authority for future reference.

The second disposal option for asbestos is to contract a registered waste management company. These companies can be contacted through their associations listed in Appendix II of the General Guideline.

Consideration will be given to proposals for alternate disposal methods that provide a level of environmental protection equivalent to complying with this guideline. The Environmental Protection Service may approve the method, subject to conditions.

4 Conclusion

This guideline presents a brief introduction into the management of waste asbestos. It is intended as a source of basic information and should be read in conjunction with the Guideline for the General Management of Hazardous Waste in Nunavut.

For more information contact:

1) Environmental Protection Service
   Department of Sustainable Development
   P.O. Box 1000, Station 1195
   Iqaluit, Nunavut, X0A 0H0
   Phone: (867) 975-5900; Fax (867) 975-5990

2) Motor Vehicle Division
   Department of Community Government and Transportation
   P.O. Box 207
   Gjoa Haven, Nunavut, X0E 1J0
   Phone (867) 360-4614 Fax (867) 360-4619

3) Prevention Services Division
   Workers' Compensation Board
   P.O. Box 669
   Iqaluit, Nunavut, X0A 0H0
   Phone: (867) 979-8500; Fax: (867) 979-8501
   (867) 873-7468 (accident report); Fax: (867) 873-0262
   1-800-661-0792

If you would like to be placed on a mailing list to receive guideline amendments or for public consultation on Environmental Protection Service legislation please fill this out and mail or fax to:

Environmental Protection Service
Department of Sustainable Development
P.O. Box 1000, Station 1195
Iqaluit, Nunavut, X0A 0H0
Fax: (867) 979-5990

Users of this guide are encouraged to report any errors, misspellings, etc. contained within, to EPS at the above address

Mailing List for Environmental Protection Service Information

Name: _____

Title: _____

Address: _____

_____

Phone / Fax Number: _____

Disposal Guidelines for Fluorescent Lamp Tubes

Fluorescent tubes contain mercury phosphor powder and traces of lead and cadmium. These chemicals are environmental contaminants under the Nunavut *Environmental Protection Act* (EPA).

The only disposal method for fluorescent tubes is through an approved hazardous waste recycling or disposal company. The *Guideline for Industrial Waste Discharges* prohibits landfill disposal if mercury is present in excess of 0.2 mg/Litre (parts per million) based on leachate quality test results.

Provided the fluorescent tubes are not broken and are packaged in their original shipping box, no special requirements are needed for transport purposes; transport, as a hazardous waste is not necessary. Nevertheless, if the fluorescent tubes are broken, compliance with the *Guideline for the General Management of Hazardous Waste* and *Transportation of Dangerous Goods Regulations* is required. Also, special handling and safety procedures are required to prevent worker exposure to mercury. The Nunavut *Safety Act* and *General Safety Regulations* is the legislative authority. To ensure worker safety when handling mercury, contact a Safety Officer at the Prevention Services Division.

Recycling and Disposal Services:

- Sorci Industries, Langly BC; tel: (604) 857-5588, fax: (604) 857-5775
- RFL, Coteau-du Lac, PQ; tel: 1-800-567-8027 or (514) 345-0066, fax: (514) 763-0072
- Electro Waste 2002Ltd., Gloucester, ON, tel: (613) 744-6659, fax (613) 744-5981
- Environmental Services Association of Alberta, tel: 1-800-661-9278 or (403) 439-6363, fax: (403) 439-4249

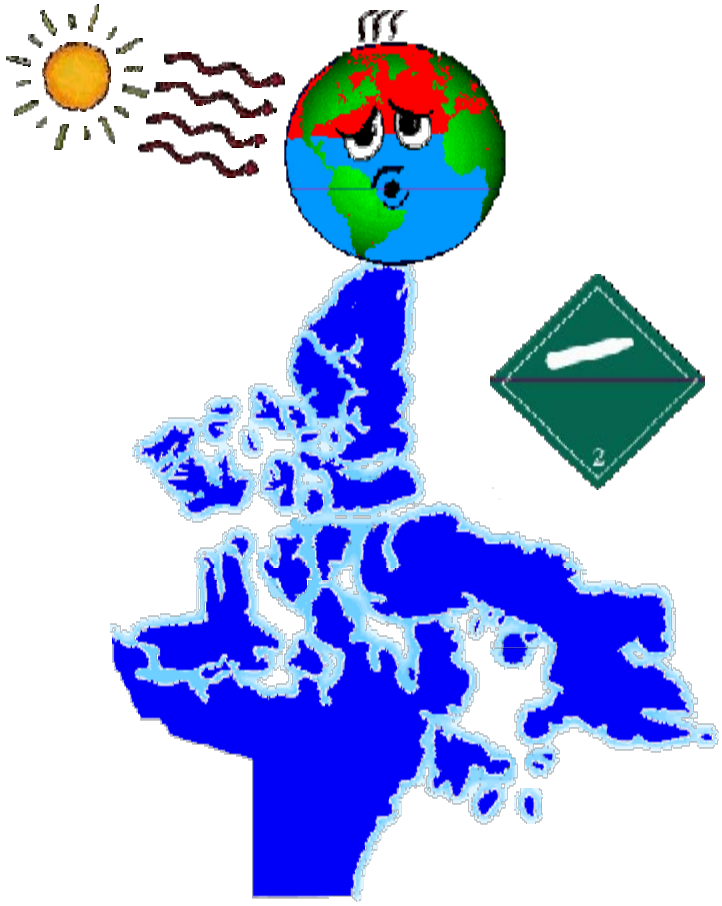
For more information contact:

1) Environmental Protection Service
   Department of Sustainable Development
   Government of Nunavut,
   P.O. Box 1000, Station 1195, 3rd Floor W. Brown Building,
   Iqaluit, NU X0A 0H0, Telephone (867) 975-5900 or Fax (867) 975-5990

2) Motor Vehicle Division
   Department of Transportation
   P.O. Box 1000, Station 775, Iqaluit, NU X0A 0H0,
   Telephone: (867) 975-5380 or Fax: (867) 975-5385

3) Prevention Services Division
   Workers Compensation Board
   P.O. Box 669, Iqaluit, NU X0A 0H0,
   Tel: (867) 979-8500 or 1-877-404-4407 or Fax:.(867) 979-8501

ENVI RONMENTAL GUIDELINE
FOR
OZONE DEPLETI NG SUBSTANCES



Department of Sustainable Development
Environmental Protection Service

Nunavut

GUIDELINE: MANAGEMENT OF OZONE DEPLETING SUBSTANCES

AS AMENDED BY:

USE OF GUIDELINE

A guideline is not law and is therefore not enforceable. It does however, assist an inspector to determine what action(s) may be required of him. Paragraph 2.2(c) of the Environmental Protection Act allows the Minister to develop, co-ordinate and administer guidelines. The Act [subsection 5(1)] makes it an offence to discharge a contaminant into the environment, subject to some exceptions [subsection 5(3)]. When a discharge occurs and it is inconsistent with the guidelines, the discharge is considered an unacceptable risk. The inspector may then consider issuing an order or laying an information.

A guideline allows for some leniency in applying the law. A court would probably be inclined to consider the application of guideline favourably because the public is aware of the standards they are expected to meet.

This Guideline is not law.
It is prepared by Environmental Protection Service,
Department of Sustainable Development
Government of the Nunavut

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January, 2002

Guideline for Ozone Depleting Substances (ODSs)

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2 Roles and Responsibilities
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January, 2002

GUIDELINE FOR OZONE DEPLETING SUBSTANCES (ODSs)

1 Introduction

The stratospheric ozone layer helps filter the sun's harmful ultraviolet (UV) radiation from the earth. Increased UV radiation harms human health and damages animal and plant life. Evidence shows that the main causes of ozone depletion are the releases of manufactured chlorofluorocarbons (CFC's), halons and a few other chemicals into the atmosphere. Hence, these materials are known as ozone depleting substances (ODSs). As one of 134 nations ratifying the Montreal Protocol, an international agreement to protect the ozone layer, Canada is committed to eliminating releases of ODSs.

The intent of this guideline is to assist in the management of ozone depleting substances in Nunavut. This guideline provides requirements and direction regarding the release, servicing, training, record keeping, labelling and disposal of equipment containing ODSs. For the purposes of this guideline, ozone depleting substances include certain air conditioning and refrigerant agents as well as substances contained in certain fire extinguishing equipment. The guideline targets commercial applications which account for 78% of the total sum of stored, leaked and consumed ozone depleting substances in the NWT and Nunavut. The total quantity of ODSs in the NWT and Nunavut amounts to over 65 tonnes.

The *Guideline for Ozone Depleting Substances* does not cover the production, importing or exporting of new, unused ODSs. These activities are controlled under federal regulations by Environment Canada.

This publication is a general guideline affecting the use of ozone depleting substances in Nunavut. Section 2.2 of the *Environmental Protection Act* (EPA) gives the Minister of Sustainable Development the authority to develop, coordinate and administer guidelines. This guideline complements existing acts and regulations that should be consulted for interpretation and application.

1.1 Definitions

Air conditioning or Refrigeration equipment	Heat pump, air conditioning, or refrigeration equipment including any motor vehicle air conditioners which contain an ozone depleting substance.
Certified service technician	A technician who is otherwise qualified to service ODS containing equipment and has successfully completed an environmental awareness course for ozone depleting substances certified by Environment Canada.
Code of Practice	The Environment Canada publication entitled *Code of Practice for the Reduction of Chloroflurocarbon Emissions from Refrigeration and Air Conditioning Systems* (EPS/1/RA/1 March 1991, original date) and subsequent updates.
Fire extinguishing equipment	A portable or fixed unit or system used to extinguish fire, that contains an ozone depleting substance.

Motor vehicle air conditioner	An air conditioning system on a motor vehicle which is a mechanical vapour compression refrigerant system that provides cooling for the passenger compartment of the vehicle and contains an ozone depleting substance as a refrigerant.
Ozone depleting substance (ODS)	A chlorofluorocarbon, halon or any other substance listed in Schedule I of this guideline that has the potential to destroy ozone in the stratosphere.
Portable fire extinguisher	A hand-held or wheeled fire extinguisher containing an ozone depleting substance.
Recover	Collecting an ozone depleting substance in a container which is not regularly a component of the system from which the ODS was removed.
Recycle	Restoring a recovered ozone depleting substance to acceptable purity levels by filtering, drying or distilling.
Servicing	The act of repairing, maintaining or adjusting a component of fire extinguishing, air conditioning, or refrigeration equipment, where the component contains an ozone depleting substance.

2 Roles & Responsibilities

2.1 Environmental Protection Service

The Department of Sustainable Development, Environmental Protection Service (EPS) is responsible for initiatives which control the discharge of contaminants and reduce the impact on the natural environment. EPS is responsible for ensuring that waste management procedures, emission levels and environmentally acceptable disposal methods are maintained. Contact EPS for a listing of relevant regulations and guidelines.

A waste manifest form must accompany ODSs recovered from commercial equipment if moved off site for storage, recycling or disposal. For further information on hazardous waste manifesting please refer to the *Guideline for the General Management of Hazardous Waste in Nunavut* or contact EPS. Registration numbers and waste manifest forms are available by contacting EPS.

2.2 Other Regulatory Agencies

Environment Canada under the Canadian Environmental Protection Act's *Chlorofluorocarbon Regulations* (SOR/90-127), *Ozone-depleting Substances Regulations* (SOR/94-408) and *Ozone-depleting Substances Products Regulations* (SOR/90-584) control the import, manufacture, use, sale

and export of bulk chlorofluorocarbons, hydrobromofluorocarbons, halons, carbon tetrachloride and methyl chloroform. These regulations reflect Canada's international commitments under the Montreal Protocol to eliminate production and consumption of ozone depleting substances.

The Nunavut Department of Community Government and Transportation, through the Office of the Fire Marshal is involved with ODSs because several types of fire extinguishing equipment contain halons.

2.3 Owners

Building/facility owners may be affected by phase-outs of ozone depleting substances. ODSs are most often found in air conditioning or refrigeration equipment or as halons in fire extinguishing systems. Owners have the responsibility to prevent releases of ODS from equipment.

Automobile owners must not ignore leaky air conditioning equipment containing ODS.

Owners of fire extinguishing equipment containing a halon should be aware of the presence of an ODS in the equipment. Replacement halons are no longer being manufactured or imported into Canada. As a result, these owners should consider plans to phase out the use of halon containing fire extinguishing equipment.

2.4 Service Technicians

Certified service technicians should be hired to repair leaks or damages to equipment containing the ODS as quickly as possible. Service technicians should not fill leaking equipment. Technicians must use proper recovery/recycling equipment and methods to prevent the release of the ODS into the environment. Section 3.5 of this guideline provides additional information on servicing. The technician should inform the building owner when they become aware of leaking equipment.

Automobile service technicians have similar responsibilities to those described above. Only certified technicians should repair leaks to automobile air conditioning equipment.

2.5 Vendors of ODSs

Vendors who sell ODSs other than as part of equipment also have a role in the management of these materials. Vendors are responsible for selling ODSs to only certified technicians. Vendors are encouraged to ensure industry stewardship of ODS refrigerants and fire extinguishing equipment.

3 Standards

The following sections outline the requirements for managing ODSs substances in Nunavut.

3.1 Release of ODS

ODS releases should not be allowed. The following are the major sources of ODSs in Nunavut;

- refrigeration equipment, including some indoor ice making equipment
- air conditioning equipment
- motor vehicle air conditioners
- fire extinguishing equipment

- equipment used in the recovery, recycling or storage of an ODS

Careful attention should be paid when handling these pieces of equipment. Any leaks in equipment should be repaired before adding an ODS. When servicing, testing or discarding fire extinguishing, air conditioning or refrigeration equipment the certified technician should recover the ODS for reuse or recycling.

Small communities where certified service technicians are not generally available may contact EPS for assistance on developing a plan to properly handle ODS containing equipment including discarded refrigerators and freezers.

3.1.1 Reported Release

The following release limits are in accordance with the *Environmental Protection Act's Spill Contingency Planning and Reporting Regulations*.

Any release of an ODS listed in Schedule I of this guideline, and classified as a class 2 (compressed gas), under *Transportation of Dangerous Goods Regulations* (TDGR) from containers with a capacity greater than 100L, must be reported immediately to the 24 Hour Spill Report Line by calling (867) 920-8130.

Similarly, a release of 5L or greater of an ODS listed in Schedule I of this guideline, and classified as a class 6 (poisonous substance), under TDGR, must be reported immediately to the 24 Hour Spill Report Line by calling (867) 920-8130.

3.2 Servicing Certification

Only certified technicians should service air conditioning, fire extinguishing, refrigeration or motor vehicle air conditioner equipment. To become certified, a service technician shall successfully complete an environmental awareness course for ozone depleting substances certified by Environment Canada[1]. Only a certified technician may purchase or possess an ozone depleting substance for the purpose of servicing equipment containing an ODS. Companies employing service technicians will maintain records indicating which employees are certified to service ODS containing equipment.

3.3 Sales Record

If a certified technician purchases an ODS other than as a component in another product, the vendor will require the certified technician to sign an acknowledgement of receipt of the ODS. The vendor should keep a sales record indicating the type of ODS, the date of sale, as well as the name and company of the certified technician.

3.4 Record Keeping and Labelling

All persons who service refrigeration, fire extinguishing or air conditioning equipment with an ozone

[1] For environmental awareness certification in NWT and Nunavut contact Aurora College, Thebacha campus. Contact the Environmental Protection Service for a listing of courses elsewhere.

depleting substance should keep an accurate log of the particulars of the event including quantities, date, name of business and certified technician involved. The record should be tabled chronologically and be made available for inspection by an inspector under the *Environmental Protection Act*. All information and records referred to in this guideline should be maintained for a period of two years.

All new equipment imported into, installed or sold in Nunavut that contains an ODS should be clearly labelled with the quantity and type of ODS contained in the equipment.

All vendors and service companies who are required to maintain records are requested to initially provide the Environmental Protection Service (EPS) in writing, the name and mailing address of the company as well as a contact name.

3.5 Servicing

Any technician who services refrigeration, fire extinguishing or air conditioning equipment should do so in accordance with the Code of Practice and this guideline. An ozone depleting substance should never be used for the purposes of leak testing refrigeration or air conditioning equipment. Technicians servicing air conditioning or refrigeration equipment should use equipment that can recover and contain an ODS. Recovery and recycling equipment should meet or exceed minimum performance standards set out in Schedule II.

3.6 Disposal of Refrigeration Equipment

Any equipment that contains an ozone depleting substance should be serviced by a certified technician, and the CFCs or HCFCs removed prior to disposal. Technicians should place a notice on the piece of equipment stating; the date of the service, the certified technician and company name as well as an indication that the equipment no longer contains refrigerant.

Household refrigeration equipment delivered to a municipal solid waste landfill is exempt from requiring removal of ODSs providing the landfill has a separate area identified and prepared for storage of this equipment. Municipalities are encouraged to bring in certified technicians to remove ODSs from stored equipment when quantities warrant. Remote, isolated, small communities where certified service technicians are not generally available may contact EPS for assistance on developing a plan to properly manage ODS containing equipment including discarded refrigerators and freezers.

3.7 Motor Vehicle Air Conditioners

Servicing a motor vehicle air conditioner requires the technician to follow the methods set out in the *Code of Practice and the Society of Automotive Engineers (SAE) Standard J-1989*. A motor vehicle cannot be discarded unless the ozone depleting substance used as a refrigerant in the air conditioner is recovered. Any motor vehicle delivered to a municipal solid waste landfill is exempted from requiring removal of ODSs providing the landfill has a separate area identified and prepared for storage of this equipment. Municipalities are encouraged to bring in certified technicians to remove ODSs from stored equipment when quantities warrant.

3.8 Fire Extinguishing Equipment

Fire extinguishing equipment cannot be disposed of unless the ODS is recovered. Recovered halons

can be used to provide recharge quantities to existing systems. The Underwriters' Laboratories of Canada (ULC) has published two standards that address halon recycling; *Servicing of Halon Extinguishing Systems* and *Halon Recovery and Re-conditioning Equipment*.

It is recommended that a person who owns fire extinguishing equipment that contains more than 40 kgs of an ODS should evaluate alternatives. They should prepare a management plan to eliminate the use of halons. Environment Canada's *Environmental Code of Practice on Halons* can be used as a guide in developing a halon management plan.

The Montreal Protocol required a phase-out of halon production and consumption by January 1,1994. However, the Montreal Protocol allows the continued trade of recycled halons, i.e. those produced before January 1,1994.

Owners of portable fire extinguishers, including marine and household systems, containing an ODS are encouraged to be to be taken out of service and sales stopped by December 31,1996.

4 Conclusion

This document is intended as a source of basic information about the issues involved in the management of ozone depleting substances. It does not replace the existing legislation which is referenced in the guideline. If you have any questions or concerns please contact the appropriate agency before proceeding.

1. Environmental Protection Service
   Department of Sustainable Development
   P.O. Box 1000, Station 1195
   Iqaluit, Nunavut, X0A 0H0
   Phone: (867) 975-5900; Fax: (867) 975-5990

2. Office of the Fire Marshal
   Department of Community Government and Transportation
   P.O. Box 1000, Station 700
   Iqaluit, Nunavut, X0A 0H0
   Phone (867) 975-5316; Fax (867) 979-4221

3. Environmental Protection Branch
   Environment Canada
   P.O. Box 1870
   Iqaluit, Nunavut, X0A 0H0
   Phone: (867) 979-3660; Fax: (867) 975-4645

4. Commercial Chemicals Evaluation Branch
   Environment Canada
   351 St. Joseph Blvd.
   Hull, PQ, K1A 0H3
   Phone (819) 953-1675; Fax (819) 953-4936

5. The Heating, Refrigerating and Air Institute of Canada (HRAI)
   5045 Orbiter Drive, Bldg. 11, Suite 300
   Mississauga, ON, L4W 4Y4
   Phone: 1-800-661-3369

6. Manitoba Ozone Protection Industry Association Inc. (MOPIA)
19-1110 Henderson Highway
Winnipeg, MB, R2G 1L1
Phone (204) 338-0804; Fax (204) 338-0810

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Society of Automotive Engineers (SAE), *Standard J-1989.*

Underwriters Laboratories of Canada (ULC), *Halon Recovery and Reconditioning Equipment*, ULC/0RD-C1058.5-1993.

Underwriters Laboratories of Canada (ULC), *The Servicing of Halon Extinguishing Systems* , ULC/ORD-C1058.18-1993.

Appendix A

SCHEDULE I

OZONE DEPLETING SUBSTANCES

1. Chlorofluorocarbons (CFC's)

a)	CFC-11	trichlorofluoromethane	Not restricted under TDG
	CFC-12	dichlorofluoromethane	TDG class 2.2 Non-flammable gas
	CFC-113	trichlorotrifluoroethane	Not restricted under TDG
	CFC-114	dichlorotetrafluoroethane	TDG class 2.2 Non-flammable gas
	CFC-115	chloropentafluoroethane	TDG class 2.2 Non-flammable gas

b) All other CFC's. Consult TDGA for classification.

c) All isomers and mixtures containing any of the above.

2. Hydrochlorofluorocarbons (HCFC's)

a)	HCFC-22	chlorodifluoromethane	TDG class 2.2 Non-flammable gas
	HCFC-123	dichlorotrifluoroethane	Not restricted under TDG
	HCFC-124	chlorotetrafluoroetane	TDG class 2.2 Non-flammable gas

b) All other HCFC's not specifically listed. Consult TDGA for classification.

c) All isomers and mixtures containing any if the above.

3. Bromofluorocarbons (Halons)

a)	Halon-1211	bromochlorodifluoromethane	Not restricted under TDG
	Halon-1301	bromotrifluoromethane	TDG class 2.2 Non-flammable gas
	Halon-2402	dibromotetrafluoroethane	Not restricted under TDG

b) All other halons not specifically listed. Consult TDGA for classification.

c) All isomers and mixtures containing any of the above.

4. Chlorocarbons

a)	Trichloroethane or methyl chloroform	TDG class 6.1 Poison
	Carbon tetrachloride	TDG class 6.1 Poison

b) All isomers and mixtures containing any of the above.

Appendix B

SCHEDULE II

PERFORMANCE STANDARDS FOR ODS RECYCLING OR RECOVERY AND RECYCLING DEVICES

1. Devices for the recovery and recycling of an ozone depleting substance designed to be used with the type of air conditioning or refrigeration equipment listed in Column I of Table 1 must, during normal operation, be capable of ensuring removal of the refrigerant from the equipment being serviced by reducing the system pressure, below atmosphere, to the level listed in Column II of Table 1 opposite the type of equipment.

Table 1

COLUMN I		COLUMN II
	INCHES OF MERCURY (VACUUM)	MICROMETERS OF MERCURY (ABSOLUTE PRESSURE)
Very high pressure equipment	0	760000
High pressure equipment with a charge of 23 kg or less	10	506000
High pressure equipment with a charge of more than 23 kgs	20	252000
Intermediate pressure equipment	25	125000
Low pressure equipment	29	23000

2. Devices for recovery or recovery and recycling intended for use with small appliances that contain an ozone depleting substance in their cooling system such as household refrigerants, or household freezers must recover a minimum of 90 % of the refrigerant in the cooling system of the appliance. Devices for recovery and recycling intended for use with small appliances that do not have an operational compressor must recover a minimum of 80% of the refrigerant in the cooling system of the appliance.

If you would like to be placed on a mailing list to receive guideline amendments or for public consultation on Environmental Protection Service legislation please fill this out and mail or fax to:

Environmental Protection Service
Department of Sustainable Development
P.O. Box 1000, Station 1195
Iqaluit, Nunavut, X0A 0H0
Fax: (867) 975-5990

Users of this guide are encouraged to report any errors, misspellings, etc. contained within, to EPS at the above address.

Mailing List for Environmental Protection Service Information

Name: _____

Title: _____

Address : _____

_____

Phone / Fax Number: _____

AGNICO EAGLE

MEADOWBANK DIVISION

WILDLIFE PROTECTION AND RESPONSE PLAN

Prepared by:

Agnico Eagle Mines Limited – Meadowbank Division

Version 3
November 2013

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DOCUMENT CONTROL

Version	Date (YMD)	Section	Page	Revision
1	3/2011			Wildlife Protection and Response Plan
2	08/2012			Update Plan to include recommendations from GN
3	11/2013			Updated Wildlife Protection and Response Plan

Table 1 - Document Control

Version 3:

Prepared By: _____

Jeffrey Pratt
Environment Coordinator

Approved By: _____

Kevin Buck
Environmental Superintendent

SECTION 1 – INTRODUCTION

As part of the Terrestrial Ecosystem Management Plan (2006), mitigation measures and monitoring initiatives have been proposed to lessen the likelihood that wildlife will become habituated to the Meadowbank Mine Site (the 'mine site') and its infrastructure. The TEMP identified measures to deter wildlife from obtaining food rewards, finding shelter around the mine site, gaining access to harmful substances present on the project site, being injured as a result of vehicle collisions, and damaging mine property.

Despite these mitigation measures, personnel may occasionally come into contact with wildlife that inhabits the Meadowbank area. To manage these incidents, a specific Wildlife Protection and Response Plan (WPRP) has been developed. Incidents must be managed to keep both humans and wildlife safe, using only humane control methods.

Furthermore, all staff must be familiar with the standard operating procedures and best practices aimed at ensuring human-wildlife conflicts are minimized during the life of the project. All personnel, including contractors, on site have a role to play in ensuring human safety, conservation of wildlife and documenting wildlife activities in the mine area.

The following WPRP provides information on general human-wildlife conflicts policies and regulations, species-specific response plans for ungulates and predatory mammals, and wildlife awareness.

SECTION 2 – HUMAN-WILDLIFE CONFLICTS

2.1 Overview

Wildlife encounters can take many forms. A conflict occurs when either human or wildlife health, and/or safety are put at risk. Human health and safety can be affected by contact or conflict with wildlife in several ways, including direct or indirect physical injury, and exposure to animal diseases that can infect humans (i.e., known as zoonotic diseases).

The most common conflict faced by wildlife is the increased risk of mortality from human encounters, which most often occurs when wildlife become habituated to human activity and lose their natural fear of people. The most serious form of habituation is directly correlated to the animal obtaining food, which is known as food conditioning. Food-conditioned animals become dependent on humans as sources of food. Because these human-induced habits become engrained in the animal, attempts to deter the habituated behavior generally fail with the end result usually the death of the animal. Loss of habitat effectiveness (how the animal uses its available habitat), and effects to wildlife movement (how the animal travels through its available habitat) can also result from wildlife in conflict with human development. Ultimately, this will affect both the health and safety of the wildlife species involved. While it is impossible to remove all risk to both human and wildlife health and safety, approaches to minimize the risk do exist. Reactive measures do have their place in stopping the conflicts when they occur, but proactive strategies are the most effective means of preventing potential conflicts.

2.2 Mine Policies and Regulations

The following summarizes the general rules regarding wildlife on the site and will form the basis of the Wildlife Awareness Orientation and Courses (see below).

Employees and contractors are advised to report all incidents of unauthorized activities on or in the vicinity of the mine site to the Environmental Department.

2.2.1 General Restrictions for Wildlife Protection

The following are general restrictions for mine site workers and contractors, intended to minimize the potential for negative project-related effects (e.g., increased mortality risk) on wildlife in and around the mine site.

- Wildlife shall have the right-of-way except where it is judged to be unsafe to do so. All species of wildlife (i.e., from small mammals to large carnivores, songbirds to raptors) when encountered by personnel on foot or in vehicles will be given the right-of way.

- Non-mine-registered firearms are not permitted on site,(i.e. carrying of firearms in private vehicles to and from the project site on workdays).

- Feeding wildlife is prohibited at all times on or in the vicinity of the mine site, including during travel to and from the mine site.

- Harassment (defined as to kill, injure, seize, capture or trap, pursue and includes to stalk, track, search

for, lie in wait for, or shoot at - for any of those purposes not authorized by the Environmental Department) of wildlife is prohibited at all times on or in the vicinity of the mine site, including during travel to and from the site.

- The deliberate destruction or disruption of wildlife nests, eggs, dens, burrows, and the like, is prohibited at all times on or in the vicinity of the mine site, including during travel to and from the site.

- Hunting and fishing is prohibited at all times on or in the vicinity of the mine site, including during travel to and from the site on workdays.

- Pets are prohibited at all times on or in the vicinity of the mine site, including during travel to and from the site on workdays.

- Maximum speed limit on all access roads is 50 km/h (30 mph).

- Traffic (including ATVs and snowmobiles) is restricted to designated access roads and trails.

The mine site refers to any mine facility present during the operations phase of the project, including but not limited to, outbuildings (e.g., machine shop, offices), pits, parking areas, tailings storage facilities and waste piles.

2.2.2 Wildlife Attractants

A list of potential wildlife attractants is provided below. The list is intended as a general summary of attractants but may not be comprehensive of all potential attractants.

- Food wastes and garbage;

- Chemicals (e.g., road salt) and their refuse (e.g., empty fuel containers);

- Wildlife carcasses (e.g., road kills, hunter kills);

- Movement and human activity (e.g., movement of people and equipment outdoors); and

- Roads, which may create preferential travel corridors for wildlife, can lead to vehicle collisions and increased exposure to wildlife encounters at the mine site.

General recommendations directed at minimizing wildlife concerns related to food wastes and garbage is presented under Section 2.2.3 (Garbage Management).

Protocols for dealing with chemical storage, disposal and spills are presented in Meadowbank's Hazardous Materials Management Plan and Spill Contingency Plan. These protocols will minimize the potential for adverse wildlife effects, and are referenced under Section 2.2.3 (Garbage Management) and Section 2.2.4 (Wildlife Health).

Requirements related to the reporting and removal of wildlife carcasses are presented under Section 2.2.6 (Reporting Wildlife Observations and Incidents).

2.2.3 Garbage Management

General recommendations directed at minimizing wildlife concerns related to food wastes and garbage is provided below.

- Littering is prohibited on and in the vicinity of the mine site and along access roads. All garbage (e.g., lunch bags) must be returned to temporary storage containers. Note: organic wastes (e.g., orange peels, apple cores) are included.
- Food related waste (including packaging) will be incinerated on a daily basis and general waste will be sent to the landfill and then buried.
- Wastes associated with mechanical maintenance and repairs (e.g., motor oil and antifreeze) will be disposed of as per the Hazardous Materials Management Plan.
- All temporary (small) storage containers for food waste garbage (yellow bin) will be wildlife protective (i.e. have bear proof lids).
- No open top buckets or anything similar will be tolerated outside buildings.
- Feeding wildlife is prohibited at all times on or in the vicinity of the mine site, including during travel to and from the site on workdays.
- Wildlife incidents related to garbage or human food attractants will be reported as soon as possible. See Section 2.2.6 (Reporting Wildlife Observations and Incidents) for more information.
- Improperly disposed of garbage, particularly food wastes will be reported as soon as possible.

See Section 2.2.6 (Reporting Wildlife Observations and Incidents) for more information.

While arctic fox tend to be the greatest concern with respect to access to garbage, other animals (e.g., wolverines, wolves and grizzly bears) may be attracted to uncontained garbage sources. Problem wildlife data at the Meadowbank mine to date indicate that Arctic fox and wolves are the most likely species to be attracted to the site

2.2.4 Wildlife Health

The following recommendations are intended to reduce potential mine-related effects on wildlife health (including non-vehicle related accidents and consumption of toxic substances).

- Feeding wildlife is prohibited at all times on or in the vicinity of the mine site, including during travel to and from the site. If caught feeding wildlife, an employee can be suspended and/or dismissed.
- Company procedures on the safe and prompt clean-up of any chemical spills will be followed. See Meadowbank's Spill Contingency Plan for a more detailed protocol.
- Any observations of wildlife in and around potential sources of contaminants (e.g., fuelling sites) will be reported. See Section 2.2.6 (Reporting Wildlife Observations and Incidents) for details.

2.2.5 Wildlife and Vehicles

The following recommendations are intended to reduce the incidence of wildlife-vehicle collisions and near misses.

- Wildlife has the right-of-way except where it is judged to be unsafe to do so.
- Obey all traffics signs.
- Maximum speed limit on all access roads is 50 km/h (30 mph).
- Verbally report wildlife carcasses observed on and in the vicinity of the mine site, and along access roads, as soon as possible. See Section 2.2.6 (Reporting Wildlife Observations and Incidents) for more information.
- Restrict traffic (including ATVs and snowmobiles) to designated access roads and trails.
- Push the snow with a dozer when clearing the road to avoid build-up snow banks on the side of the road.
- Report all wildlife-vehicle collisions that results in the death or injury of wildlife as soon as possible. See Section 2.2.6 (Reporting Wildlife Observations and Incidents) for details.
- A near miss between a vehicle and an animal should be reported as a wildlife 'incident'. See Section 2.2.6 (Reporting Wildlife Observations and Incidents) for details.

2.2.6 Wildlife and Buildings

The following recommendations are intended to reduce the risk of close encountering situations between wildlife and people

- Skirting will be add around the building to avoid having wildlife under the buildings
- Under building access ways must be closed at all time
- Keep c-can doors close at all time to avoid wildlife using them as shelter
- Open top bins and containers for food waste will not be permitted outside buildings. If needs be, a bear-resistant container shall be used.

2.2.7 Reporting Wildlife Observations and Incidents

2.2.7.1 Reporting Requirements of Project Workers and Contractors

Project workers and contractors are required to verbally notify the Environmental Department of the following wildlife observations or incidents as soon as possible.

- Signs of animal presence (e.g., tracks, scat, nests, burrows) in close proximity (visible to the eye from

within the mine site footprint to site facilities, vehicles, equipment, or areas frequented by workers.

- Sightings of animals in close proximity (visible to the eye from within the mine site footprint to site facilities, vehicles, equipment, or areas frequented by workers.)
  - Aggressive or unusual wildlife behavior in and around site facilities.
  - Instances of workers feeding wildlife.
  - Instances of improper disposal of garbage or other waste materials.
- Observed maintenance issues (e.g., improper placement or maintenance of garbage containers).
- Instances of workers not following vehicle use guidelines (e.g. speed limits).
- Vehicle collisions with wildlife or near misses.
- Observations and locations of dead (e.g., road kill) or injured animals.

Following the verbal report of a wildlife incident or observation, completion of a Wildlife Incident Report form may be requested at the discretion of the Environmental Coordinator or designate (s).

2.2.7.2 Reporting Requirements of Wildlife Occurrences

Wildlife Incident Reports provide essential information that may identify: 1) potentially dangerous situations requiring intervention (e.g., problem wildlife); 2) situations that require notification of the Nunavut Department of Environment; 3) weaknesses in garbage-handling and problem wildlife prevention measures; and 4) areas that may require warning signs (e.g., poor visibility road corners). The Environmental Coordinator or designate(s) should ensure that records of wildlife observations and incidents are thoroughly documented. Reports should attempt to include the following information wherever possible:

- Identification and number of wildlife observed;
- Specific timing and location of the observation(s);
- Details regarding the animal behavior, including direction of approach and departure, what it was doing, any aggressive behavior, etc.
- Assessment of local attractants, such as garbage, odors, movement of people, other wildlife, etc;
- If local attractants are identified as a factor, determination of what steps were or will be taken to address/remove potential attractants;
- Identification of any potential mitigation measures available to deter wildlife or limit access and how they will be implemented (refer to Section 2.2.7 for additional information on dealing with problem wildlife); and
- If an animal is destroyed, a description of the lethal measures deployed (e.g., rifle), statement of the rationale for use of lethal measures (e.g., proximity to workers, repeated incidents, observed condition

of the animal, etc.), and indication of what previous non-lethal measures were employed (e.g., deterrents, hazing, trapping and relocating (with permission from GN) etc.).

2.2.8 Protocols for Dealing with Problem Wildlife

A problem wildlife situation may arise where animal acts in an aggressive manner and/or is a repetitive nuisance or threat to worker safety. The following protocols should be used to deal with problem wildlife:

- Immediately notify the Environmental Coordinator or designate(s) of any problem wildlife issue. Reporting wildlife incidents as they occur will ensure that proactive rather than reactive measures can be taken to prevent a serious outcome (e.g., human injury, destruction of the problem animal). See Section 2.2.6 (Reporting Wildlife Observations and Incidents) for details.

- If deemed necessary by the Environmental Coordinator, notify the Conservation Officer in the Hamlet of Baker Lake or other designated Government of Nunavut representative, inform them of the problem wildlife encountered on site, discuss appropriate aversive and mitigation actions, and determine timing when lethal methods should be implemented, if necessary.

- The Environmental Coordinator or designate(s) will initiate the appropriate actions in response to a problem wildlife issue, Recommended actions include:

  - Assess potential local attractants and address or remove all those identified, where practical;

  - Utilize non-lethal deterrents (e.g., aversive conditioning, hazing, trapping and relocating), projectiles (e.g., rubber bullets) or consider trapping and relocation of animals (e.g. arctic fox), where it is considered appropriate and safe to do so (refer to Sections 3 and 4 for species-specific deterrents); and

  - Use lethal measures. Lethal measures should only be considered as a last resort in the event of aggressive animal behavior and/or repeated nuisance animals that pose a threat to worker safety and/or site facilities.

- Only authorized personnel (Environment Department) are permitted to use lethal and non-lethal projectiles (e.g., rubber bullets) or deploy traps for problem wildlife interventions.

- Do not attempt to deal with a problem wildlife issue on your own. Problem wildlife can be dangerous.

  Conform to recommendations regarding predator safety. All staff should have received a predatory mammal (i.e., grizzly bear, wolverine, wolf and fox) awareness training orientation. See Section 5.

SECTION 3 – SPECIES-SPECIFIC RESPONSE PLANS

3.1 Purpose

Response plans specific to species groups (i.e., ungulates and predatory mammals) are required to ensure that all personnel at the Meadowbank Division are provided guidance on how to respond in a manner that is safe to both humans and wildlife should they encounter wildlife on or around the project site.

3.2 Species Groups Addressed

Ungulates (caribou and muskoxen) and predatory mammals (grizzly bear, wolverine, wolf and Arctic fox) have the highest potential for interactions with humans during the life of the mine, and thus require specific response plans. If other wildlife are encountered, adaptive management strategies will be implemented if mitigation techniques and the mine policies and regulations mentioned in this document are not effective for these species. The proposed wildlife monitoring program will be the preferred measure of identifying potential areas in need of new mitigation strategies, or changes in policies or regulations.

For each of the species groups described below, the seasonal activity in the project area is discussed, as well as the protocol in the event of an encounter.

3.2.1 Ungulates

3.2.1.1 Seasonal Activity in the Project Area

Results from baseline surveys indicate that caribou and muskoxen are present in the Meadowbank area in all four seasons, but are observed in greatest abundance in the fall (e.g., October) when 1,000's of animals may be present in the vicinity of the mine and access road, and in lowest abundance in the summer (see the 'Terrestrial Ecosystem Baseline Report' for more details). Calving or post-calving aggregations or movements of caribou have not been observed within the mine study areas since baseline studies were initiated in 1999.

3.2.1.2 Response to Encounters

Caribou

It is extremely rare for humans to have physical altercations with caribou. Caribou do rut in the fall when they are at relatively high numbers on the project site and the levels of aggression displayed, particularly by males, increases substantially. There is some anecdotal information suggesting that a bull caribou may attack a person or vehicle during the rut. Therefore, a close encounter with caribou (during the fall) or muskoxen could be dangerous.

If you encounter a single or herds of caribou, the following actions should be taken:

- Back away slowly;
- Ensure animal(s) have an escape route;
- Do not make sudden movements;

- Do not make loud noises or attempt to scare the animal(s);
- Use radio/satellite phone to report presence of the animal(s) to the Environmental Department;
- Stay in radio/phone contact until the animal(s) moves away or you have returned to a safe area (e.g. inside vehicle or building); and
- Wait for the animal(s) to pass before continuing work in the area

Muskox

Although considered rare, muskoxen will charge humans if they are threatened (especially lone bulls). Being a sedentary species, the muskoxen will have the tendency to stand their ground when threatened, defending their territory or their young

If you encounter a single or herds of muskoxen the following actions should be taken:

- Back away slowly;
- Ensure animal(s) have an escape route;
- Do not make sudden movements;
- Do not make loud noises or attempt to scare the animal(s);
- Use radio/satellite phone to report presence of the animal(s) to the Environmental Department;
- Stay in radio/phone contact until the animal(s) moves away or you have returned to a safe area (e.g. inside vehicle or building); and
- Leave the area and wait for the animal(s) to go away before continuing work in the area

3.2.2 Predatory Mammals

3.2.2.1 Seasonal Activity in the Project Area

Grizzly Bear

Baseline surveys indicated limited use of the Meadowbank study area by grizzly bears, which are consistent with what would be expected for grizzly bears in the north, given their wide-ranging habits and low densities. In the fall, when caribou (a prey item) are more abundant, the Meadowbank area may have higher value for grizzly bears (see the 'Terrestrial Ecosystem Baseline Report' for more details). Furthermore, increasing hunting and food caches along the Meadowbank access road in all seasons may also attract grizzly bears to the area.

Wolverine

Wolverines occur in the project area on a year-round basis. Records of wolverine sightings or their sign were infrequent in the Meadowbank area during baseline studies beginning in 1999. Similar to grizzly

bears, the limited evidence for wolverine in the area is not surprising given their wide-ranging movements and characteristically low population densities (see the 'Terrestrial Ecosystem Baseline Report' for more details). Only one occurrence (i.e., in 2011) of a habituated wolverine has reported at the Meadowbank site since baseline studies began in 1999.

Wolf

Although they do occur year round in the project area, wolves were observed infrequently throughout the project area during all survey sessions, but were most common in the fall, perhaps in response to the increased caribou abundance at that time of the year (see the 'Terrestrial Ecosystem Baseline Report' for more details). Wolves have been one of the most frequent problem wildlife species encountered since the Meadowbank mine became operational in 2009. The majority of problem wolves were single and emaciated.

Arctic Fox

Camp personnel have regularly observed Arctic foxes close to camp and in and around camp buildings during most months of operation, including winter (see the 'Terrestrial Ecosystem Baseline Report' for more details). Arctic foxes are the most common predatory mammal species to be encountered at the Meadowbank mine.

3.2.2.2 Response to Encounters

Predatory mammals (such as wolves, wolverine, arctic fox and bears) rarely attack people; however, they are extremely strong and vicious, and should be given respect. Members of the dog family (such as wolves and foxes) are more at risk of carrying rabies, and other zoonotic diseases, and therefore should be avoided. Arctic fox in particular is easily tamed, quickly losing their fear of humans and often approaching very close. Sick or injured animals may no longer be able to feed themselves, and could be in a state of starvation. Often they show few physical signs that something may be wrong, but typically act more aggressively or even 'friendly' towards humans. Therefore, a close encounter with a predatory mammal could be dangerous. All bites and scratches from wildlife should be reported immediately to Health & Safety department since animals can be vectors for rabies.

If you encounter a predatory mammal, the following actions should be taken:

- Immediately inform Environmental department of situation using a radio/phone
- Back away slowly and do not turn your back on the animal;
- Do not make sudden movements;
- Do not make loud noises or attempt to scare the animal if it is simply traveling through the area;
- Use radio/satellite phone to report the presence of the animal to the Environmental department;
- Stay in radio/phone contact until the animal moves away or you have returned to a safe area. (e.g. inside vehicle or building); and
- Wait for the animal to pass before continuing work in the area.

If the predatory mammal does not back away, or shows interest in you:

- Continue to back away slowly and ensure a 10 m distance between yourself and the animal;
- Make sure the animal has a safe route of escape;
- Make noise to alert the animal of your presence or to scare it off;
- Avoid provoking it;
- Return to a safe area as soon as possible (e.g. inside a building or vehicle); and
- Keeps the Environmental department informed of situation using the radio/phone.

If the predatory mammal still does not back away, call for deterrent action by the Environment Department

The Environment Department is to treat all predatory mammals that are threatening or aggressive as they would treat a grizzly bear, which is perceived to be most dangerous. All predatory mammals that are showing interest in a person or mine site facilities must be aggressively deterred to prevent habituation to the mine site. Detailed response recommendations are provided in Section 3.2.2.3 below. If an animal is not of an immediate safety concern, the Wildlife Response team should discuss options to deter or remove the animal with Government of Nunavut conservation personnel.

3.2.2.3 Environment Department Protocols for Managing Problem Predatory Mammals

As part of the detailed response plan, the Environment Department will follow the procedures included here when responding to predatory mammal sightings and encounters. It is assumed that the reporting person(s) has followed procedures for predatory mammal incidents, and has requested the Environment Department to be dispatched due to the failure of human presence to deter the predatory mammal. If an animal is not of an immediate safety concern, the Environment Department should discuss options to deter or remove the animal with Government of Nunavut conservation personnel. All wildlife problems are to be recorded in the wildlife database.

The Environment Department will:

- Collect all deterrent equipment and receive briefing from the Environmental Coordinator or delegate (s) on location and circumstances of the call.
- When firearms are to be used there will always be two individuals, one person with a firearm (12 gauge) for deterrent use, the other as back up with lethal force. No lethal force will be taken without consent from the Environmental Superintendent / Coordinator in conjunction with the consultation of the Government of Nunavut Wildlife Officer unless the situation is deemed to be life threatening.
- The appropriate less than lethal deterrent will be chosen and used in an effort to scare the predatory mammal away.
- If the deterrent is successful, the incident will be recorded in the Wildlife database and should detail

the type and level of deterrent used, information on the predatory mammal involved, and all information on the circumstances leading up to the incident.

If the deterrent is not effective and the predatory mammal continues to approach or doesn't move away from the area of human activity or project footprint.

- Increase deterrent efforts to less than lethal projectile (rubber bullet) if not already being employed.
- Ensure the animal has an open escape route.
- Continue aggressive use of less than lethal projectile deterrents to try and chase the animal away.

All but the most aggressive animals should have been deterred at this point. The situation is now extremely dangerous and the Environment Department must be ready to use lethal force.

The risk to human life or property is imminent since the predatory mammal has not responded to non-lethal deterrent options and the safety of the team or mine property is now compromised.

- Shoot with the intention of stopping the threat, using the buckshot or 1-ounce lead slugs, as appropriate, to kill the animal.
- Shots should be aimed at the chest area, not the head or hind quarters
- If lethal force has been used, the Environment Department must complete a full report detailing the event immediately.
- The GN conservation officers will be notified by phone. Direction will then be given to properly dispose of the carcass.
- Any wildlife showing signs of rabies will be killed (never shot in the head) and reported.

SECTION 4 – WILDLIFE AWARENESS INFORMATION AND ENCOUNTER STRATEGIES

This section deals with general predatory mammal (i.e. Wolves, wolverines and grizzly bears) awareness information and encounter strategies. It does not replace the need for all personnel to take a recognized wildlife awareness course.

4.1 Factors that Influence a Predatory Mammal's Reaction

Wolverines, wolves and grizzly bears will react differently to chance encounters with humans, depending upon many factors, including each animal's past experience with humans. Their reaction is difficult to predict because of the variability of factors with each encounter.

- Female mammals may aggressively defend her young ones (for example: Female bears with cubs are more likely to attack than to flee).

- Wolverines or bears may defend a food cache (for example: a bear's main objective is to eat from the time it leaves its den to the time it returns to a winter den. Hunting bears will cache food after eating part of it by covering the food with dirt, branches or leaves. They will often establish a daybed nearby and return later for another meal). Animals will aggressively defend their food cache.

- Individual Space: All predatory mammals have a minimum distance surrounding them within which any intrusion is considered a threat. A cornered or surprised predatory mammal may be dangerous. If there is no cover to retreat to, their usual response to danger is to attack or to stand its ground.

- Old, wounded or predatory mammals with teeth malformations can be dangerous because they are very hungry or starving (e.g. Wolves observed on-site in 2009)

- Wolverines, wolves, artic fox and bears are easily attracted to human food sources and may become aggressive to obtain it. Predatory mammals that have obtained food from humans become "human food habituated." These mammals are accustomed to humans and link people as sources for obtaining food.

- Young animals which are inexperienced hunters and/or recently weaned are also at a greater risk to take advantage of human food source opportunities.

4.2 Animal Encounters

Most of animal safety is prevention – avoiding an encounter is the best way to stay safe while working in the home ranges of artic fox, wolverines, wolves, and grizzly bears.

4.3. How to React to Animal Encounters

Your reaction should depend on circumstances and the behavior of the mammal.

1) Stop and assess the situation before you act.

2) Does the wolverine, wolf or bear know you are there?

3) How is the animal reacting to the nearby activity?

4) Remain calm.

5) Do not turn your back on the animal.

DO NOT RUN – You will trigger the animal's natural response to chase you. Wolverines, wolves and bears are extremely fast and you cannot outrun them.

Some Simple Rules:

- Respect them – they can kill you
- Be alert at all times
- Watch for sign
- Make noise – don't surprise animals
- Travel in groups when possible
- Be cautious in noisy areas (streams)
- Know the types of areas animals use during the year
- Do not approach them
- Never feed them
- Get trained and carry deterrents
- Remember carcass equals danger – look for ravens, strong odours
- Mentally rehearse encounters

4.3.1 Specific situations: Animal Encounters

Wolverine, wolf, or bear is not aware of you:

- Leave the area quietly in the same direction that you came from.
- Move while the predatory mammal is not aware of you and stop moving when the mammal lifts its head to check its surroundings.
- Stay downwind so the wolverine, wolf or bear will not pick up your scent.
- When you have moved a safe distance away and preferably to your truck or shop where you can watch and wait until the predatory mammal leaves.
- Report event to Environmental department immediately

If the wolverine, wolf or bear is unaware of you and approaching:

- Allow the mammal the right of way. Make sure there is a safe escape route and that you are not in the way.
- Return to vehicle or building when available or allow animal a wide birth.
- Report event to Environmental department immediately

If you cannot leave undetected:

- Move upwind so animal can pick up your scent; this will help them identify you as human.
- If it is possible, try to keep the predatory mammal in your sight.
- Watch to see if the predatory mammal leaves when it smells that a person is nearby.
- Report event to Environmental department immediately

If the wolverine, wolf or bear is aware of you but in the distance:

- Continue walking at the same general pace and towards a safe area (vehicle or building)
- ☐ DO NOT RUN.

The wolverine, wolf or bear is aware of you and close:

- A predatory mammal will feel threatened in a close confrontation. Generally their natural tendency will be to reduce or to remove the threat. Assist the wolverine, wolf or bear by acting as non- threatening as possible.
- Do not make direct eye contact.
- Do not make any sudden moves.
- Do not run.
- In the case of a bear, they need to identify you as a person, so talk in low tones and slowly wave your arms over your head.
- Attempt to give the wolverine, wolf or bear an opportunity to leave. Be sure they have an open escape route.
- Try to back away slowly.
    - If the mammal begins to follow you, drop your jacket, or pack or some other article (not food) to distract the wolverine, wolf or bear. This may distract the bear long enough for you to escape.

- Report to Environmental department immediately

The wolverine, wolf or bear is close and threatening:

- If you have a deterrent such as a bear banger or bear spray be prepared to use it depending on how close the predatory mammal is.
- If you do not have a deterrent, or if using the deterrent is not successful, act as non-threatening as possible.
- Talk to the predatory mammal in a calm authoritative tone of voice.
- Do not startle or provoke the predatory mammal by making sudden moves.
- Back slowly away from the wolverine, wolf or bear and drop a pack, jacket, or some other article in order to distract the mammal momentarily.
- Remember that the wolverine, wolf or bear may be defending their cubs that you have not yet seen or they may have a food cache nearby. Attempt to look as non-threatening as possible.
- Report to Environmental department immediately

The wolverine, wolf or bear is very close and approaching:

A distance of less than 50 meters in an open area is considered very close.

- If the predatory mammal continues to approach use your deterrent when in range.
- If the predatory mammal does not respond to the deterrent you must now STAND YOUR GROUND!
- Report to Environmental department immediately

The wolverine, wolf or bear charges:

In the case that you have done something that has provoked the wolverine, wolf or bear into showing signs of aggression towards you. It is often not clear to the person what they have done to provoke the mammal until after the attack. It is important that you act passively, humble your posture and do not look directly at the wolverine, wolf or bear. Always keep the mammal in sight.

- Never yell or throw things as these are obvious signs of aggression

When faced with a charging wolverine, wolf or bear:

1) First use your deterrent, either a banger or pepper spray. If authorized (only Environment Department representatives or local security personnel) to carry a firearm, shoot the predatory.

2) **DO NOT PLAY DEAD IF THE PREDATORY MAMMAL CONSIDERS YOU FOOD**.

3) You must defend yourself with whatever means are available, act aggressively towards the bear.

4) Stand up on something high and try to make yourself look bigger. Try to appear dominant. Try to frighten it. Yell, scream, shout and wave your arms. Jump up and down and fight back.

5) Hold your jacket or backpack over your head to make yourself look bigger

6) If being aggressively attacked in a predatory attack, fight back. Concentrate your efforts on the face, eyes and nose of the bear. Use whatever means you have, rocks, sticks, tools, hardhat, or simply kick and punch with all the strength you can muster.

7) Report to Environmental department immediately

***There are two types of bear attacks*.**

Provoked Attacks:

- You have done something that has provoked the bear into showing signs of aggression towards you. It is often not clear to the person what they have done to provoke the bear until after the attack.
- It is important that you act passively, humble your posture and do not look directly at the bear. Always keep the bear in sight.
- Lie down on the ground in the prone position (i.e. play dead as this is a sign of submission to the bear and shows the bear that you are no longer a threat to them).
- Never yell at the bear or throw things at the bear, these are obvious signs of aggression towards the bear.
- Report to Environmental department immediately

Predatory Attacks:

- The bear is hunting or stalking you! You are being treated as potential food. DO NOT PLAY DEAD IF THE BEAR CONSIDERS YOU FOOD
- You must defend yourself with whatever means are available, act aggressively towards the bear. Stand up on something high and try to make yourself look bigger.
- Try to appear dominant. Try to frighten the bear. Yell, scream, shout and wave your arms. Jump up and down and fight back. Hold your jacket or backpack over your head to make yourself look bigger.
- Use your deterrent; either a banger or pepper spray. If authorized to carry a firearm, shoot the bear.
- Report to Environmental department immediately

4.4 Wildlife Deterrents

4.4.1 Noise

- Pencil Flare Guns are highly portable but many people have received injuries from this type of deterrent as the pen explodes while they are holding it. This deterrent is still sold and is not recommended. Canadian Conservation Officers no longer using pencil flares.
- Pyrotechnics, including bangers, screamers, whistlers and flares. Requires a magazine launcher. These launchers look like a small handgun. There are different types available, some carry only a single shot, and some will carry multiple cartridges. The bangers, screamers and whistlers are charges that will explode and emit a variety of different noises. The name of the device indicates the noise it will make.

4.4.2 Wildlife chemical Deterrents

Bear Sprays are highly effective but they must be used correctly to be effective. As with all deterrents they have their good points and their bad points.

- The main ingredient in bear spray is “Capsicum” an extract from hot peppers.
- Capsicum needs to strike the eyes, nose or mouth of the mammal, (open membranes) to be effective.
- These sprays can only be used at very close range, 3 to 8 m or 10 to 25 ft.
- You cannot discharge the bear spray too early – or it will be completely ineffective.
- If the predatory mammal comes within the range of the bear spray – aim directly into their face and spray.
- You must be aware of the wind direction. If you the wind is blowing towards you, the spray will be carried by the wind into your face.
- Bear spray may not be effective in sub-zero weather. (Spray cans do not fire well in very cold temperatures.) In colder weather you need to keep the can of bear spray warm in order for it to fire effectively.
- Bear spray will not be effective in the rain. When you fire a can of bear spray, the spray will create a billowing cloud of capsicum and propellant. Rain can/will wash the spray right out of the air before it strikes the bear in the face.

- If you have used your can of bear spray to deter a mammal, wash the nozzle off with soap and water to remove the scent. Replace your can of spray as soon as possible. You do not want to have another bear encounter with a half a can of spray left.

- Bear sprays have a shelf life. Always replace your bear spray when you are nearing the end of the shelf life. The Capsicum does not deteriorate over time; it is the canister seals that deteriorate over time.

- Do not test your can of spray before going out into the field. You need to take a full can of spray into the field, not a partially used one.

- Wildlife chemical deterrents are only to be used for the purpose they are intended for. Misuse of wildlife deterrents such as chemical sprays, bangers, and pyrotechnics is considered a criminal offence.

SECTION 5 – TRAINING PROTOCOL

5.1 Scope

The Wildlife Training Protocol outlines recommended levels of training that specific groups of people at the Meadowbank division site should receive. It is important that human activity at the site does not result in wildlife encounters that put people or wildlife at risk. All personnel on site have a role to play in ensuring human safety, conservation of wildlife, and documenting wildlife activities in the project area.

5.2 Assumptions and Key Considerations

Meadowbank must assign overall accountability, recording and reporting responsibility to the Environmental Coordinator or designate(s) if the various wildlife response plans and training initiatives are to be effective.

The Environmental Coordinator or designates (s) will be responsible for ensuring that all employees, contractors and visitors at the Meadowbank Division receive wildlife training appropriate to their roles and responsibilities.

The Environment Department will be responsible for all deterrent action whenever it is necessary to deter wildlife from mine infrastructure or personnel. All members of the Environment Department will receive specialized training in various levels of deterrent use. Security personnel and the Environment Department will be the only onsite personnel to have access to a firearm.

5.3 Training

Mandatory wildlife awareness orientation for all staff will include the following:

5.3.1 Wildlife-Human Conflict

- General restrictions for wildlife protection
- Wildlife Attractants
- Garbage Management
- Wildlife Health
- Wildlife and Vehicles
- Preventing Problem Wildlife
- Dealing with Problem Wildlife
- Reporting Wildlife Observations and Incidents

5.3.2 Wildlife Awareness Training

This orientation will be aimed at providing awareness of potential wildlife encounters that may occur at the Meadowbank Mine. The course should review:

- Wildlife that commonly occur near the mine site

- Behavior of wildlife that may be encountered near the mine site
- Wildlife encounters
- Wildlife Deterrents

5.3.3 Environment Department

In addition to the required mine site orientation the Environment Department may require additional training. The following training is recommended, especially for those without experience in situations where wildlife occurrences are common.

Bear Safety Training
Provided by qualified contractor or Territorial, Provincial or Federal Wildlife Officer, this course will provide:

- Instruction on the use of lethal and non-lethal deterrents for emergency response to bear incidents;
- Techniques for euthanizing bears during an emergency response;
- Other types of deterrent options available in non-emergency situations;
- In depth aversive conditioning techniques;
- Live trapping techniques and protocols;
- Necropsy techniques, and biological sampling; and
- Practicum.

Carnivore Safety Training
Provided by qualified contractor or Territorial, Provincial or Federal Wildlife Officer to include:

- Biology, ecology and behavior of wolverine, wolf, Arctic fox;
- Rabies and other zoonotic diseases;
- Detailed deterrent and aversive conditioning techniques;
- Live trapping techniques;
- Instruction on the use of lethal and non-lethal deterrents for emergency response to incidents involving large carnivores;
- Necropsy techniques and biological sampling; and
- ☐ Practicum.

Appendix A

Peregrine Falcon Management and Protection Plan on the Meadowbank Gold Project Site

APPENDIX C

AMMONIA MANAGEMENT PLAN

Title of document: **Ammonia Management Plan**

Client : **AGNICO-EAGLE MINES**

Project : **Meadowbank Gold Project**

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1.0 INTRODUCTION

The previous version of the Water Management Plan (WMP) for the Mine was presented in 2009 (Doc. 833), updating the first edition of the WMP, support document (Doc. 500) to the Type-A Water License Application for the Mine. The WMP was then updated in 2011 (Doc. 1270). This technical note was produced as an appendix to the 2012 WMP update and covers the ammonia management plan for the mine site.

This technical note provides guidance for monitoring ammonia levels at the mine site, as part of the conditions applying to waste disposal and management listed in the water license (NWB 2008) for this water quality parameter.

Ammonia is a naturally occurring nitrogen compound found in the environment. However, there are two sources at the mine site that can contribute to the mobilization of ammonia in the groundwater or surface runoff:

1. Blasting of ammonium-nitrate (AN) explosives is typically the primary source of ammonia in areas of mining operations. AN readily absorbs water and dissolves easily, thereby mobilizing ammonia in either groundwater or surface runoff.
2. In gold mine operations using a cyanidation process to extract the gold from the ore, the cyanide in solution is oxidized to cyanate (CNO^-) using a sulfur dioxide (SO_2)-air process before discharge to the Tailings Storage Facility. The cyanate can then hydrolyze to ammonia in the Tailings Storage Facility reclaim pond.

Ammonia dissolved in water exists in equilibrium of interchanging un-ionized (NH_3) and ionized (NH_4^+) forms. The equilibrium is influenced by pH, temperature, and ionic strength (salinity) where the amount of un-ionized ammonia is favoured as the pH becomes more basic or as the water temperature or salinity increases. Un-ionized ammonia can readily pass across the gill surface and enter into the bloodstream of fish, while ionized ammonia passes with greater difficulty. Once inside the fish, both forms of ammonia can cause toxic effects (CCME, 2010). Furthermore, it should be noted that ammonia oxidizes to nitrite (NO_2) and nitrate (NO_3), the former being particularly toxic to fish and humans. Both nitrite and nitrate are regulated by the CMME for the Protection of Aquatic Life.

This ammonia management plan (AMP) proposes monitoring of blasting practices for the assessment of explosive quantity used and blast performance, and monitoring of water quality to determine ammonia levels in waters within the mine site. The monitoring results can be used to review and adjust blasting practices or water management if ammonia levels need to be reduced.

In addition to ammonia, monitoring of nitrate and nitrite is also considered in the AMP, as both water quality parameters are signature compounds of AN explosives. NO_3 is listed with a discharge level threshold in the conditions applying to waste disposal and management in the water license (NWB 2008).

2.0 EXPLOSIVE MANAGEMENT AND BLASTING PRACTICES

2.1 SITE DESCRIPTION

2.1.1 Explosive Storage

Storage of explosive products will be located at the mine site emulsion plant area. The explosive products arrive by barge at the Baker Lake marshalling area. They are then transported by ground to the emulsion plant located at the Meadowbank mine site.

The emulsion plant area is located approximately four kilometers north of the mine plant and camp site, and is accessible from the All Weather Private Access Road (AWPAR). This area consists of an emulsion plant for the preparation of bulk emulsion explosives, two buildings for the storage of AN, and four explosive magazines along the access road to the plant.

Explosive products at the storage facilities are packed in sea containers, which limit the possibility of spillage. The products are only removed from these containers at the mine site emulsion plant area. Surface areas are graded to collect water runoff within the storage facilities.

2.1.2 Roads

The AWPAR is a restricted access road constructed and operated by AEM for ground transportation between the Meadowbank mine site and Baker Lake. This road is used to transport explosive products from the Baker Lake site facilities to the emulsion plant area at the mine site. In preparation for blasting operations, explosive products are transported from the emulsion plant area to the appropriate blasting locations via local site roads and the Vault Haul Road (when completed).

Spillage control protocols, procedures and handling of spilled material, and explosive management for both storage and transport have been established by Dyno Nobel Inc. (Dyno) and are provided in Appendix C2.

2.1.3 Pits

The development sequence of the mine site is provided in Table 2-1 of the Water Management Plan 2012 report (610756-0000-40ER-0001). Explosives are used for the excavation of waste rock and mining of the ore at the Portage, Goose pits and eventually the Vault open pit.

2.2 AMMONIA PATHWAYS

Ammonia not fully detonated within the in-pit blasting operations mobilizes through several pathways on the mine site. Water from drainage runoff is the primary mechanism of mobilization for ammonia residuals remaining within the pits. This water is collected at pit sumps and then pumped to the Portage Attenuation Pond, until it becomes the TSF Reclaim Pond (March 2015), after that it will be pumped to the South Cell TSF (former Attenuation

Pond). Blasting residuals are also expected to be attached to waste rock and ore materials, which are transported from the open pits to their respective storage and processing facilities. Residuals from waste rock may be washed off by precipitation and be ultimately conveyed to the Portage Attenuation Pond or the future South Cell TSF (former Attenuation Pond), or the Vault Attenuation Pond. Residuals from the ore may eventually be carried in the tailings to the Tailings Storage Facility.

2.3 EXPLOSIVES AND BLASTING

Based on experience at other open pit mines in the Canadian Arctic, the largest potential source of ammonia in mine water will be from explosive residue from blasting. Depending on the wetness of the site, water may leach explosives from blastholes prior to the blast. Other forms of ammonia released from AN are explosives flowing into cracks and fissures in the rock and not detonating, or leading to an incomplete detonation of the explosive column and misfired blastholes. An AN based emulsion is used as a blasting agent at the Meadowbank site. This material is designed to repel water thus minimizing the potential for ammonia to impact mine water.

Blasting operations on site include monitoring of explosive quantities and blast design, procedures and practices. Combined with water monitoring, the compilation of these data is used to assess blasting performance. The results of this assessment are used to adjust blasting practices as needed to:

a) Optimize the use of explosives

b) Increase the completion and efficiency of explosive detonations

Any modifications to blast design are intended to decrease the amount of ammonia that may become available for mobilization in mine water.

This section summarizes the explosive products and blasting design parameters, procedures and practices employed at Meadowbank. Associated monitoring is also discussed.

2.3.1 Explosive Products

Explosive products used at the mine site include bulk explosives (bulk emulsion), packaged explosives, cast boosters, detonating cords, non-electric delay detonators and non-electric lead lines. The material safety data sheets (MSDS) for these products are provided in Appendix C4. Of these products, the greatest potential for water contamination comes from the bulk explosives. Presently, Meadowbank uses emulsion as the primary bulk explosive for its blasting operations.

Bulk emulsions typically contain some or all of the following components:

- Ammonium, sodium and/or calcium nitrate
- Fuel and/or mineral oil

- Methylamine nitrate
- Emulsifiers
- Ethylene glycol

Although bulk emulsions are water resistant, contaminants can be leached from the product if it is left in contact with standing or flowing water for extended periods of time. The performance of the explosive, and hence the potential for post-blast contaminations, deteriorates with the length of time that the emulsion remains in the blasthole after it has been loaded (i.e., sleep time). Blast procedures currently in use are designed to minimize sleep time so that standing or flowing water is not in contact with the bulk emulsion for extended periods of time.

2.3.2 Procedures and Practices

Quality control procedures are in place to verify AN content in bulk explosives. Quality control procedures for the emulsion occur at the plant and density tests are done at the blast site (on the trucks). Loading procedures specify that blastholes be loaded with emulsion from the bottom of the blastholes to provide a continuous explosive column. Details on the explosive quality control and loading procedures have been established by Dyno and are provided in Appendix C2.

The primary factors that may reduce the amount of ammonia available for mobilization in mine water are:

- Explosives handling
- Completeness of detonation

Bulk emulsion spillage during blasthole loading could (as bulk emulsion is resistant to water) be a source of ammonia that could be carried by water collected in the pits. Spillage control protocols, procedures and handling of spilled material, and explosive management for storage and transport, as well as the emergency response plan, have been established by Dyno and are provided in Appendix C2 and C3.

Incomplete detonation results in higher ammonia residue on the blasted rock. Evidence of incomplete detonation is often observed as an orange fume after a blast and sometimes an orange pigment on the blasted rock. Explosives that have failed to detonate may be observed in the muckpile. Muckpiles are routinely inspected by Meadowbank staff for signs of incomplete detonation.

2.4 MONITORING

Monitoring of explosive handling and blasting is as follows:

a) Explosive quantities: Records of explosive quantities used for in-pit blasting are kept for each blasting event and will be conserved throughout the mine life. Furthermore, a record of blast location (i.e., pit and elevation), blast date, and bulk explosive type and name used (emulsion, with the corresponding ratio of AN over emulsion) is kept for all events.

b) Design parameters: Blast design parameters, as well as changes in the blast design parameters from the standard are recorded and dated.

c) Loading instructions: Loading instruction forms are completed for each blast event and provide a record of the as-loaded parameters for all blastholes in the blast pattern including:

- Hole depth
- Collar height
- Priming (single or double)
- Other observations made by the blast crew (e.g., wetness of holes, use of liners, collapsing holes or difficulty loading)

d) Video footage: Videos are taken of each blast. This practice provides a visual, qualitative record of the results of each blast and provides insight into potential problems such as incomplete detonation (e.g. orange fumes) and misfires, as well as areas of poor muckpile heave and forward movement.

e) Blast audits: Blast audits are conducted on a monthly basis to ensure that best practices are being followed in the field (audits may be adjusted to a lesser frequency if low ammonia levels are consistently observed, or conversely may be adjusted to a higher frequency if high ammonia levels are consistently observed).

An additional monitoring technique commonly used is the measurement of the Velocity of Detonation (VOD), which has been shown to be directly related to the volumetric fraction of the explosive that has been consumed. This technique will be implemented if poor or incomplete detonation is consistently suspected.

3.0 MILL EFFLUENT

3.1 SITE DESCRIPTION

The mill effluent consists of tailings produced at the mill that is pumped as slurry and deposited in the Tailings Storage Facility (TSF) where the tailings particles are allowed to settle and consolidate. The reclaim water is pumped back to the mill for re-use.

Prior to discharge of the mill effluent to the TSF, the effluent is sent to the cyanide destruction process. The cyanide destruction process at Meadowbank uses the sulfur dioxide (SO_2) and air process to oxidize weak acid dissociable cyanide (CN-WAD) to a less toxic form: cyanate (CNO^-) based on the following reactions:

$$SO_2 + O_2 + H_2O + \text{CN-WAD} \rightarrow CNO^- + H_2SO_4$$

The process can also use sodium metabisulfite ($Na_2S_2O_5$) instead of sulfur dioxide in case there are operating issues with the dosing of sulfur dioxide gas in the process. This ensures that chemicals required for the cyanide destruction process (either SO_2 or $Na_2S_2O_5$) are always available.

3.2 AMMONIA PATHWAY

Cyanate produced from the oxidation of CN-WAD can readily hydrolyze to ammonia (NH_3) and carbon dioxide (CO_2) based on the following reaction:

$$CNO^- + H^+ + H_2O \rightarrow NH_3 + CO_2$$

Thus, the mill effluent provides an ammonia loading to the TSF reclaim water.

During the operation of the TSF, the reclaim water will be pumped to the mill for re-use in a closed loop system. Consequently, there will be no discharge of reclaim water to the environment during this period. Furthermore, it is expected that the ammonia concentration will gradually increase in the TSF reclaim pond over time, even though (1) there may be some slight attenuation of ammonia due to microbial/algae activity in the summer and (2) ammonia may oxidize to nitrite and nitrate, particularly near the top of the pond where oxygen is most present.

The Water Quality Forecasting for the Portage Area 2012-2025 Report (610756-0000-40ER-0002) provides a forecast of the concentration for ammonia in the TSF reclaim pond during the life of the mine. Furthermore, the report provides a forecast of the ammonia concentration in the Portage and Goose Island Pit once flooding activities has started.

3.3 MONITORING

Concentrations of ammonia, nitrate and nitrite are parameters that are monitored on a monthly basis as part of this sampling campaign of the TSF reclaim water at station ST-21.

In the Water Quality Forecasting for the Portage Area 2012-2025 Report (610756-0000-40ER-0002), a maximum ammonia concentration in the TSF reclaim water is evaluated in order to meet the CCME guidelines for the Protection of Aquatic Life in the Portage and Goose Island Pits once flooding activities are completed. If this concentration is exceeded before the end of the flooding operation, measures could be undertaken to lower the ammonia concentration, as well as nitrate and nitrite if required, in the TSF reclaim pond prior to the transfer of TSF reclaim water to the pits.

Ammonia treatment technologies that could be further investigated, if the need arises, include:

i) Biological nitrification / denitrification during the summer months.

ii) In-situ volatilization of ammonia during the summer months.

iii) Ammonia removal by snow making.

4.0 WATER MANAGEMENT

Water quantity and quality monitoring assist in the monitoring of ammonia loadings from explosive residuals, as well as ammonia concentration found in the Tailings Storage Facility reclaim pond. The Meadowbank water quality and flow monitoring plan (AEM 2009) and water license (NWB 2008) includes monitoring stations that are used for the monitoring of ammonia loadings. The stations that specifically monitor for ammonia are listed in Table 1 and are shown in the Figures in Appendix C1.

Table 1: Water Monitoring Station Included Under the Meadowbank Water License

Station	Description	Phase	Parameters [(c)]	Frequency
ST-9	Portage Attenuation Pond prior to discharge through Third Portage Lake outfall diffuser	Early operation	Ammonia, nitrate, nitrite	Prior to discharge and weekly during discharge
			Water volume	Daily during period of discharge
ST-10 (Location not available until 2014)	Vault Attenuation Pond prior to discharge through Wally Lake outfall diffuser	Late operation	Ammonia, nitrate, nitrite	Prior to discharge and weekly during discharge
			Water volume	Daily during period of discharge
ST-16	Portage Rock Storage Facility	Early operation	Ammonia, nitrate, nitrite	Bi-annually during open water
		Late operation	Ammonia	Monthly during open water
		Closure	Ammonia, nitrate, nitrite	Bi-annually during open water
ST-17 [(a)]	North Portage Pit Sump	Early operation	Ammonia	Monthly and bi-annually during open water
			Nitrate, nitrite	Bi-annually during open water
			Water volume	Daily during period of discharge
	Portage Pit Lake	Late operation	Ammonia, nitrate, nitrite	Monthly during open water
		Closure	Ammonia, nitrate, nitrite	Bi-annually during open water
ST-18	Portage Attenuation Pond	Early operation	Ammonia	Monthly and bi-annually during open water
			Nitrate, nitrite	Bi-annually during open water
ST-19 [(a)]	Third Portage Pit Sump	Early operation	Ammonia	Monthly and bi-annually during open water
			Nitrate, nitrite	Bi-annually during open water
			Water volume	Daily during period of discharge
	Third Portage Pit Lake	Late operation	Ammonia, nitrate, nitrite	Monthly during open water
ST-20	Goose Island Pit Sump	Early operation	Ammonia	Monthly and bi-annually during open water
			Nitrate, nitrite	Bi-annually during open water

Station	Description	Phase	Parameters [c]	Frequency
			Water volume	Daily during period of discharge
	Goose Island Pit Lake	Late operation	Ammonia, nitrate, nitrite	Monthly during open water
		Closure	Ammonia, nitrate, nitrite	Bi-annually during open water
ST-21	Tailings Reclaim Pond	Early (South Cell) and late (North Cell) operation	Ammonia, nitrate, nitrite	Monthly during open water
ST-23 (Location not available until 2014)	Vault Pit Sump	Late operation	Ammonia	Monthly and bi-annually during open water
			Nitrate, nitrite	Bi-annually during open water
			Water volume	Daily during period of discharge
ST-24 [b] (Location not available until 2014)	Vault Rock Storage Facility	Late operation	Ammonia	Monthly and bi-annually during open water
			Nitrate, nitrite	Bi-annually during open water
		Closure	Ammonia, nitrate, nitrite	Monthly during open water
ST-25 (Location not available until 2014)	Vault Attenuation Pond	Late operation	Ammonia	Monthly and bi-annually during open water
			Nitrate, nitrite	Bi-annually during open water

(a) ST-17 and ST-19 become one sampling point at closure.

(b) Two monitoring points will be assigned to the Vault Storage Facility (ST-24) during closure.

(c) Parameters listed are only those required for the AMP. The complete suite of parameters analyzed for each station is provided in AEM (2009b) and NWB (2008).

In addition to the monitoring listed in Table 1, the following actions are undertaken as part of the AMP:

- If runoff or seepage is detected at the rock storage facility, water samples collected at the Portage Rock Storage Facility during late operation will also be analyzed for nitrate and nitrite to complete the suite of signature compounds found in explosive residuals.
- Tailings slurry volumes and density from the mill pumping facility to the TSF are recorded on a monthly basis.
- The records of water volumes pumped from the Portage Pit sumps include the destination: Portage Attenuation Pond or the future South Cell TSF (former Attenuation Pond).
- The records of water volumes pumped from the Portage Attenuation Pond will include the destination: Third Portage Lake or other future destination.

Sampling frequency at the pit sump will also be increased if high variability is identified in observed constituent concentrations as a result of the blasting schedule.

5.0 REPORTING

Reporting of ammonia concentrations at the sampling stations listed in Table 1 is included as part of the requirement of the water license (NWB 2008). The reporting frequency is provided in AEM (2009b), and includes:

- Brief monthly reports of the compiled water quality monitoring results, sent to the Nunavut Water Board (NWB), the AANDC Water License Inspector and to the Kivalliq Inuit Association (KIA); and
- An annual report submitted to the NWB, KIA, Aboriginal Affairs and Northern Development Canada, Nunavut Impact Review Board, Government of Nunavut, and other interested parties. This report summarizes monitoring results for each sampling station, annual seep water chemistry results, annual groundwater monitoring results, receiving water monitoring results, spills and any accidental releases, measured flow volumes, effluent volumes and loadings, and results of QA/QC analytical data.

Mine operation personnel reviews on a monthly basis the data gathered from the sampling stations in Table 1 and from the monitoring action proposed under the AMP. If the data indicates that further studies and/or significant changes to the water management infrastructure are required to assess or control ammonia concentrations, AEM will notify the Nunavut Water Board as early as practical. Results of these further studies and/or changes to the AMP monitoring actions will be transmitted to the Nunavut Water Board for review.

6.0 REVIEW OF AMMONIA MANAGEMENT PLAN

Review of the results of the site water quality and AMP monitoring during the year may provide new information, and/or indications that changes to the AMP are necessary. When revisions are warranted, an updated AMP will be submitted to the Nunavut Water Board for review.

7.0 REFERENCES

CCME (2010), Canadian Water Quality Guidelines for the Protection of Aquatic Life, Ammonia.

Golder (2009). Updated Water Management Plan. Agnico-Eagle Mines. July 2009

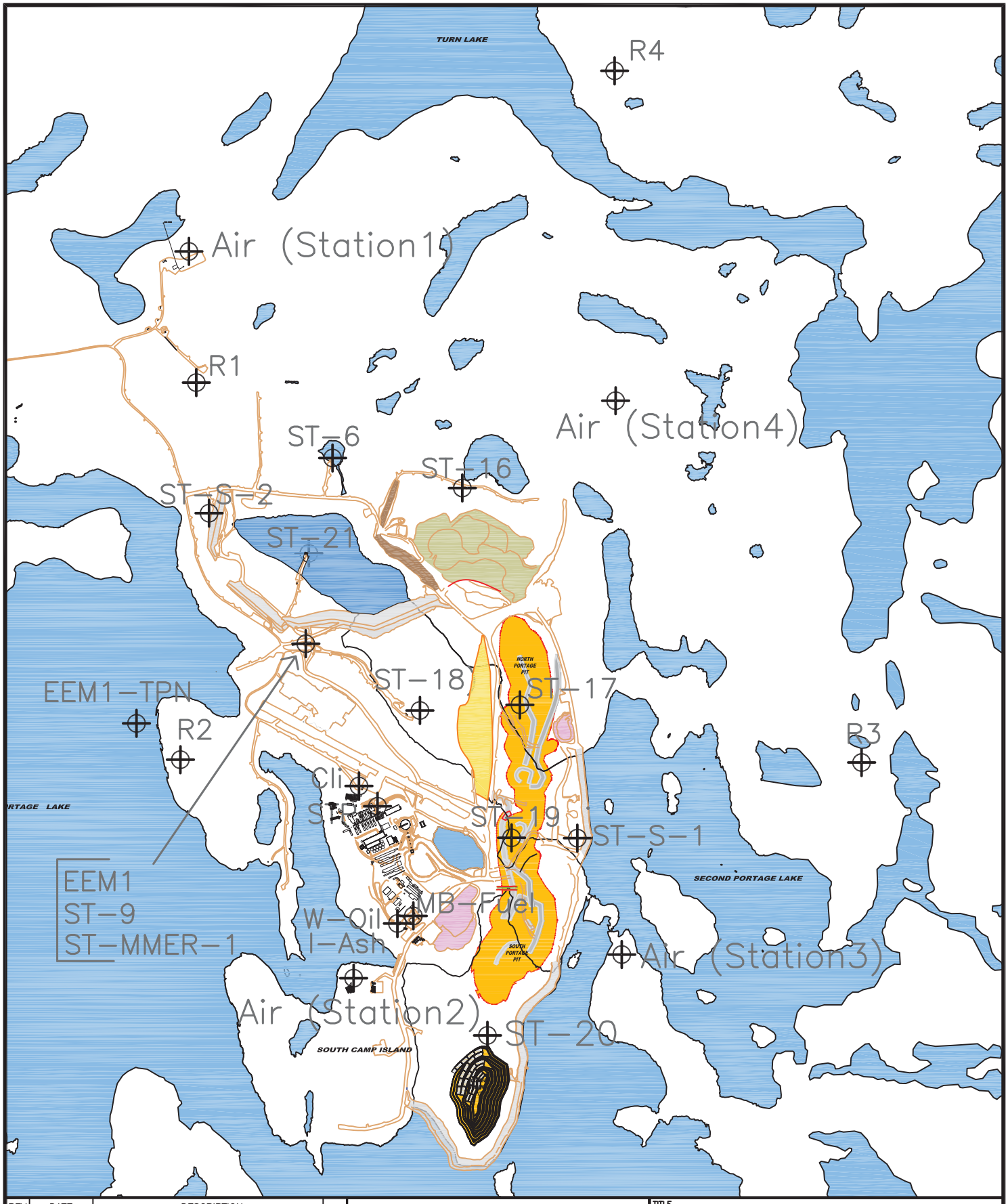
Golder (2011), Updated Water Management Plan, Agnico-Eagle Mines, July 2011

NWB (Nunavut Water Board License) (2008). Water License No: 2AM-MEA0815. Agnico-Eagle Mines Ltd. June 2008.

SLI (2012). Water Management Plan 2012. Agnico-Eagle Mines. Document No. 610756-0000-40ER-0001, Rev. 02. March 2013.

SLI (2012). Water Quality Forecasting for the Portage Area 2012-2025. Agnico-Eagle Mines. Document No. 610756-0000-40ER-0002, Rev. 01. March 2013

APPENDIX C1
ENVIRONMENT FIELD STATIONS – MINE SITE VIEW



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REVISIONS

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TITLE

Environment Field Stations

AGNICO–EAGLE – MEADOWBANK DIVISION

SCALE	DATE 2012-08-01	
DRAWN BY S. Gaudreault		SHEET 1 / 1
APPROVED BY		
DRAWING NO.		REVISION

C:\Users\sgaudreault\Desktop\2012-02 Environment Field Stations_2.dwg, 02 Aoû 2012

FILE NO.

APPENDIX C2
SPILL CONTROL AND LOADING PROCEDURE PLAN

Dyno Spill Control and Loading Procedure Plan

1) All trucks are washed inside shop to contain any residue that may have contacted trucks. The water from the washing of the trucks and or the shop floors themselves is then picked up by the AEM e vacuum and disposed of in the onsite Stormwater Management Pond.

2) A.N. Prill is brought to the Emulsion Plant site in 20 ft Seacans and is stored in the Seacans on the A.N. Pad for the site till it is needed. It is then taken out of the Seacan /s and brought into the Plant for use. Sometimes enough product for the next batch is stored outside to speed up Batching time when it is necessary. A.N. Prill is not left outside if weather looks like it is going to be damp or raining to prevent the leaching of Prill through the Tote bags and on to the ground surface.

3) Any A.N. spills that occur are promptly cleaned up and disposed of in 1 of 2 ways:
    i. Any contaminated prill is put into containment barrels or buckets inside Plant, depending on amount, and put into the next Ansol batch to be made.
    ii. Any contaminated Prill is put in Barrels or Buckets (depending on amount) and then transferred from barrels to buckets for the Emulsion Truck Operators to take to the Blast Pattern and placed into the boreholes after they have been loaded (disposal via blast).

   Any spills that are too difficult (some of our drummed Products) to take care of in this manner are placed in Metal Drums or HAZMAT bins etc. with absorbing materials, sealed and sent to AEM HAZMAT AREA (for shipment south).

4) Emulsion waste (with contaminants) is also either contained in drums or bins until it can be transferred into buckets and taken to Blast patterns and placed into boreholes for disposal (disposal via blasting).
   Any non contaminated Emulsion is put back through the system and on to Trucks.
   When Trucks need to be de-contaminated or process lines of trucks or plant need to be cleaned out, the excess water is strained through a Sack (this allows the water to go through, but contains the Emulsion) to minimize nitrites in our plant sump containment.

5) When an Emulsion Truck has completed loading on a blast pattern the remaining emulsion is flushed out of the loading hose by running water through the hose (water holding tank on trucks) until water discharges out the end of the hose into the borehole.
   This does not completely remove all of the Emulsion out of the Hose; there is still a residue amount left in the hose. Thus, when the Truck operator starts up on the next blast pattern, the hose is put into the borehole and the Operator primes the hose and all the residue Emulsion is contained in borehole and disposed of when hole/s are blasted.

APPENDIX C3

DYNO NOBEL EMERGENCY RESPONSE PLAN – MAGAZINE, PLANT AND WORK SITE

EMERGENCY RESPONSE PLAN

QAAQTUQ

Agnico Eagle Meadowbank (Baker Lake)
Nunavut

For Dyno Nobel Canada Inc.

Magazine, Plant and Work Sites

This Emergency Response Plan (ERP) addresses incidents and potential incidents involving the manufacturing, handling and storage of explosives and related products in Dyno Nobel Canada Inc.' magazines, plants and worksites. This ERP has been developed for Dyno Nobel Canada Inc. and all of it's wholly-owned subsidiaries (DNX Drilling). Actions detailed within this plan are compulsory, under the approval and authorization of DNCI's Regional Operations Managers.

"This document, as presented on Dyno Nobel's database, is a controlled document and represents the version currently in effect. All printed copies are uncontrolled documents and may not be current".

Note: Information provided within this document may be privileged and is not intended for general distribution.

Original Date of Publication: 15 October 2003, as amended site specific, December 19, 2011

Publication/ Amendment Date	Changes To Prior Edition	Pg.
15 Oct 03	**New document**	All
26 Apr 04	**Amendment # 1**	
	Renumbering of Appendices 6 – 13	App. 7 – 14
	Miscellaneous Typos & Amendment Dates	All
17 March 08	**Amendment #2**	
	Updated Contact information	
	Addition of definitions	
	Included Calling and responding emergency procedures	
	Addition Duties of Key personnel	
	Addition of response to Natural disasters	
	Addition of visitor and contractors access control -	
	Replaced the Appendices and renumbering	
	Included a Emergency Report form	
	Addition of Nitric acid, Aluminum and Diethylene glycol and CFE	
	Addition of alternate methods of communication	
	Addition of Reportable Substance list	
	Miscellaneous Typos & Amendment Dates	All
August 18, 2010	**Amendment #3**	
	Updated Scope and ERP Outline	
	Added Sign-off sheet for Annual Fire Department Review	
	Added Appendix for Employee Training sign-off	
	Updated Reporting Incidents Flowchart	
	Updated procedure for Raw Material Truck Spills	
	Updated Bomb Threat Checklist	
September 29, 2011	Amendment #4	
	Updated contacts and phone numbers	
November 15, 2011	Amendment #5	
	Amended Appendix 8	
	Addition of Appendix 10	

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Appendix 6 Bomb Threat Checklist

Appendix 7 New/Transferred Employee or Annual Refresher Form
Appendix 8 Annual Fire Department Review Form / Debrief Form
Appendix 9 TDG Regualtion Class Quantity Emission Limit

1.0 SCOPE

This document provides a Work Site Emergency Response Plan covering fire/explosion, spills, security breach, bomb threat, evacuation and prescribed actions that employees must take to ensure employee and public safety in the event of an emergency. The general reference to DNCI's "Work Sites" throughout this document includes magazines, plants and miscellaneous work locations.

The Emergency Response Plan appearing on Dyno Nobel Canada Inc.' database is a controlled document. Uncontrolled copies of this ERP are provided to customers and associates who own the land on which DNCI's worksite is located, plus applicable municipal and regulatory authorities. As well, uncontrolled copies are issued to all Company employees and are placed in all central offices and Company delivery vehicles.

2.0 RELATED DOCUMENTS

The following documents also relate to emergency situations that can arise and should be held at each Work Site:

- Federal, Provincial and Municipal regulations, standards and guidelines
- Corporate Policies plus MSA Standards & Procedures
- Standard Operating Procedures (SOP's)
- Dyno Nobel General and Specialized Work Rules
- Material Safety Data Sheets
- Prime Contractor's / Customer's ERP
- Transportation ERAP #2-1037
- Crisis Communication Plan

3.0 ERP OUTLINE

3.1 The following materials are covered by this ERP:
Fuel Oil
ATF Hydraulic Fluid
Ammonium Nitrate Prills and Solution
Sodium Nitrite
Sodium Thiocyanate
ANFO
Emulsion

Packaged Explosives
Detonators
Acetic acid
Diethylene glycol
Aluminum
Enviro CFE

3.2 The following situations are addressed in this ERP:

- Fire / Explosion
- Storage Tank Failure
- Spills from Product Delivery Trucks
- Spills from Raw Material Delivery Trucks
- Process Spills
- Shut down due to weather, floods, lightning, fires, explosions and other threats to the security and operation of DNCI's facilities, equipment and material.
- Bomb Threats
- Quantities of spills and reportable to Dyno Nobel and authorities

3.3 This ERP covers:

Preparation	Reporting
Training	Waste Disposal Permits
Lines of Authority	Containment
Notification	Inspection
Decontamination	Maintenance

3.4 The following definitions apply to this plan:

DNCI Corporate contact : A DNCI corporate employee who is assigned to receive Emergency Calls at all times from the answering service.

ER Advisor: Emergency Response Advisor (ERA), who will normally be the applicable General Manager, Area Manager, or Technical Advisor who will liaise with First Responders.

OSC: (DNCI) On Scene Coordinator, the Senior DNCI employee at an incident site who manages and controls DNCI resources in support of First Responders and incident recovery.

ERT: Emergency Response Team, DNCI personnel dispatched to an incident site to assist First Responders and conduct incident recovery under the direction of the OSC.

4.0 PREPARATION AND PLANNING

4.1 In order to provide competent emergency response at Dyno Nobel Canada Inc.' magazines, plants and worksites, first responders (local fire departments and mine rescue personnel) must be thoroughly briefed on an annual basis of the potential hazards involved in a Dyno Nobel Canada Inc. worksite fire. To this end, Work Site Supervisors must take fire department plus mine safety and security representatives on an annual magazine / plant tour to view:

Explosives Storage Areas	Evacuation (Meeting) Area
Bulk Emulsion Equipment	Communications Equipment
ANFO Blending Area	Facility Layout
Fire Fighting Equipment Sites	(Waste) Burn Facilities

A record of each explosives worksite tour and the names of the first responder representatives attending are to be documented and kept on file.

Annual Fire Department Review Form (Appendix 9)

4.2 All DNCI employees shall review this ERP on an annual basis and participate in ERP drills / exercises when scheduled.

4.3 All worksite accidents involving fire, explosion, reportable spills/emissions, breaches of security and bomb threats are to be reported to applicable authorities and senior management. As per incident reporting procedure

4. 4 Spill procedures for each of the materials listed in section 3.1 are outlined in Table 6-3. All procedures specify: Method of Cleanup, Method of Disposal and Protective Clothing. Based on the procedures presented in Table 6-3, worksite supervisors must ensure that adequate clean-up equipment and materials are readily available and in good condition.

4.5 Worksite information for each of DNCI's facilities is contained in the attached appendices. The ERP is revised whenever significant changes are made.

4.6 Current Material Safety Data Sheets (MSDS) are to be kept at each Work Site for all hazardous materials that are stored and handled at the Work Site. Copies of current product MSDS' are also made available to customers and landowners. Obsolete MSDS' will be replaced as new ones are issued.

4.7 Each Work Site will hold and maintain in good repair, appropriate fire fighting and spill control equipment for potential emergencies. Fire extinguishers, hoses and other fire fighting equipment are to be visually inspected on a monthly basis to ensure Magazine, Plant, Work Site and delivery vehicle readiness.

5.0 TRAINING

5.1 All employees will complete training on the contents of this Plan during their "new hire" orientation and review the plan annually.

5.2 A trained person is considered to have reviewed all related documents (Section 2.0), to have been instructed on the use of related equipment and procedures, and to have discussed with their Supervisor or trainer, questions and issues of concern.

5.3 Training records, including certificates for training completed, are to be kept onsite in the Employee's Training Record.

5.4 The Magazine, Plant or Work Site Supervisor/Manager will certify their employees as having received training by signing the training form. In signing the training form, the Supervisor / Manager will have satisfied themselves that trained employees are able to:

- Recognize fire and explosive hazards for the materials and processes to which they are exposed /involved with;
- Competently use Fire Fighting / Fire Protection Equipment (Note: employees should receive refresher training in the use of fire extinguishers at least every three years)
- Competently use applicable personal protective equipment (PPE) when handling hazardous substances;
- Recognize and be familiar with substances which become hazardous wastes when spilled; and

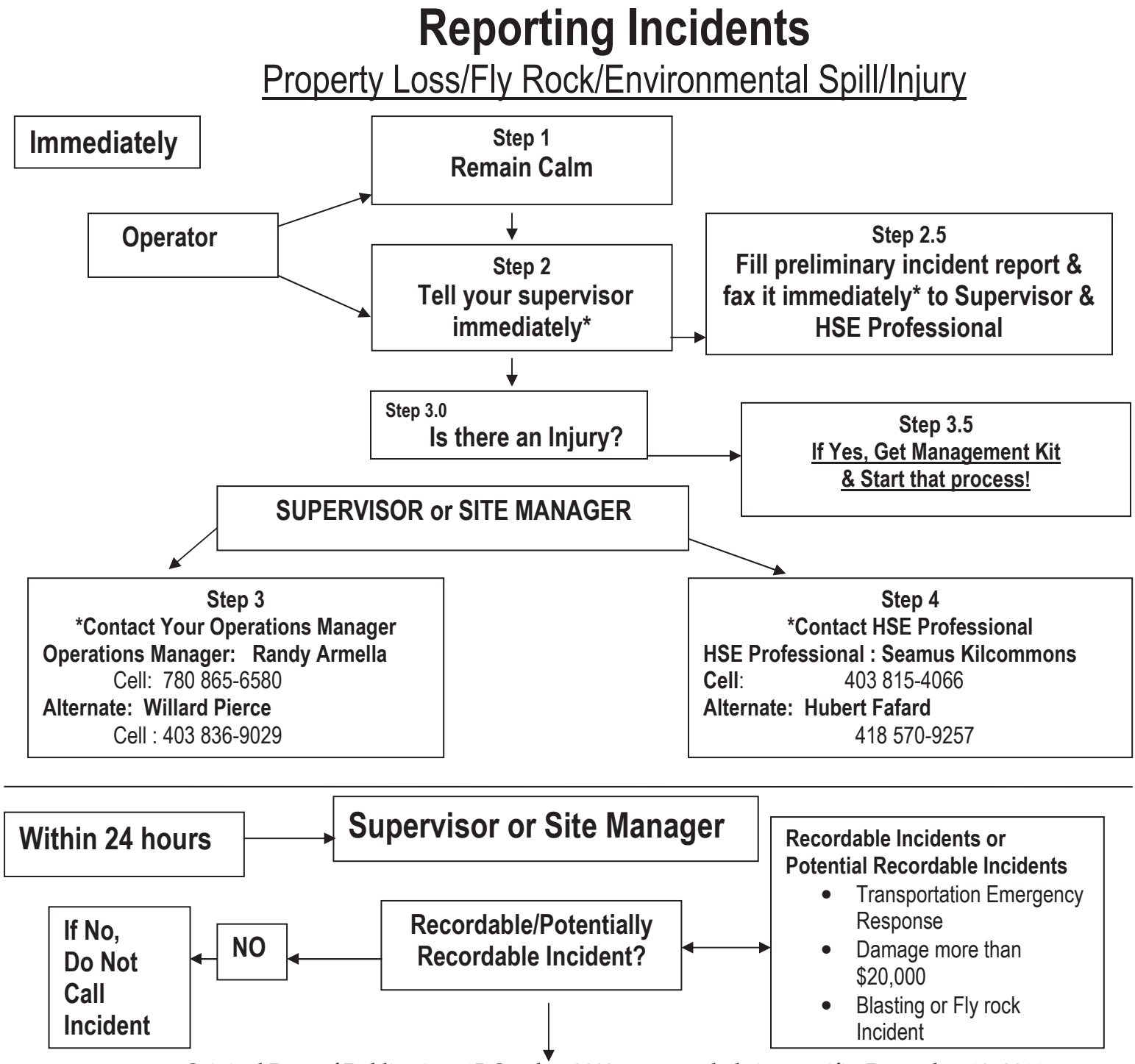
- Follow SOP's and use established work practices to minimize the potential for fires, explosions, environmental releases and other accidents.
- Worksite Managers / Supervisors will ensure that all contractors receive a worksite orientation before commencing work or being left unaccompanied in the worksite. Following the orientation process, the contractors will be required to sign off on the Contractor Checklist acknowledging training in the applicable areas including the site emergency response plan.
- All Plant & Magazine sites will have in place, a continuous (24 hour) access control system to control the entrance, presence and exit of visitor and contractors and their equipment and materials
- Employees must be trained on Reportable Quantities to the Government in the unlikely event of a spill.
- All employees are aware of evacuation routes, muster point location, and all-clear notice procedure.
- New/Transferred employee or Annual Refresher sign-off form located in Appendix 8

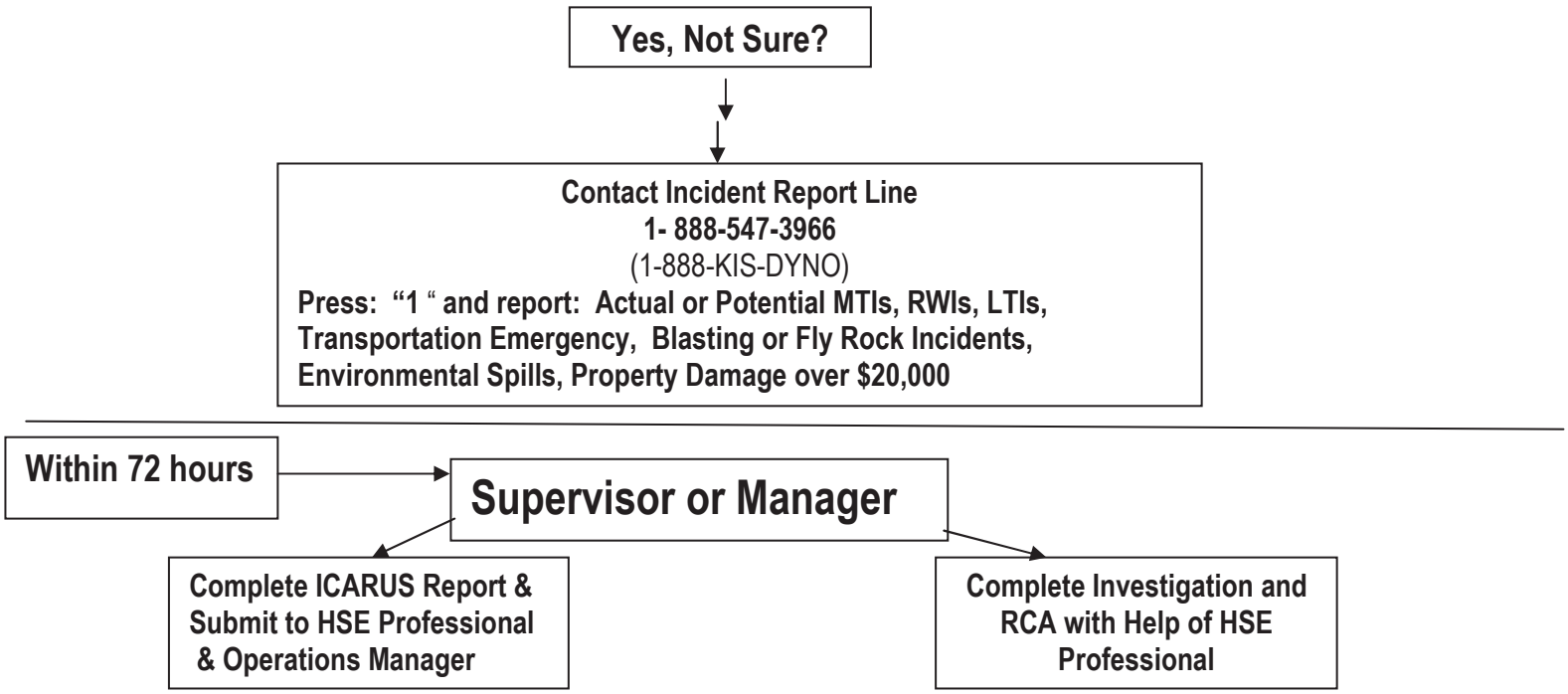
6.0 EMERGENCY PROCEDURES AND LINES OF AUTHORITY

6.1 GENERAL

Reporting Incidents Flow Chart (continued on next page)

Table 6-1
Emergency Response Flow Chart





SITE SUPERVISOR/DELAGATE
EXPERIENCING EMERGENCY / POTENTIAL EMERGENCY

- **CALL FOR EMERGENCY ASSISTANCE**
  In the event of an emergency, accidental release or imminent accidental release involving explosives, eliminate potential sources of detonation where possible (eg. turn off the ignition of a vehicle), call **911** (or the local police number) for immediate assistance, **call the site Supervisor/ Area Manager** and initiate the site's Emergency Response Plan. If normal phone systems are down other methods of communication can include two way radios, satellite phones, pager, e mail and vehicle satellite tracking systems.

- **WARN PUBLIC WITHIN EVACUATION DISTANCES IF RISK OF DETONATION**
  Should there be explosive detonations, or the risk of detonations due to the presence of fire or other detonating factors, advise the First Responders (or anyone within the immediate vicinity if First Responders are not at the scene) of the risk and applicable safety distances per Table 6-4, page 17 (liaise with Emergency Response Advisor (ERA) if time permits). Help organize perimeter guards to prevent people from entering the evacuation zone.
  Note: See ERP, page 17 Table 6-4 for Evacuation Procedures.

- **ASSIST LOCAL AUTHORITIES**
  Assist First Responders and Local Authorities in eliminating the emergency situation, and liaise with DNCI's On-Call Employee / ERA until relieved by the Company's Emergency Response Team (ERT).

TO RESPOND TO AN EMERGENCY CALL

DNCI Corporate contact instructions:

Upon receiving a call for emergency response assistance, keep a log of all subsequent communications and actions, and do the following:

1. Immediately obtain the name and callback number of the caller, in case the telephone line is lost.

2. Obtain information as fully and accurately as possible following the emergency report form (see appendix 1).

3. Call an ER Advisor for the applicable Region (see appendix 2) and report the emergency situation. In turn, the ER Advisor will phone the emergency scene caller, establish ongoing contact, assess the emergency, determine what Company resources and/or contracted emergency response services are required and organize an Emergency Response Team – ERT to proceed to the emergency scene if required.

4. Assist the Emergency Response Advisor (ERA).

5. Liaise with Company Executive / Senior Managers.

Emergency Response Advisor (ERA) instructions:

1.Call the Branch/Plant Supervisor nearest the emergency scene plus provincial & federal authorities (see applicable appendix to Annex D) to advise them of the situation and the need for an emergency response.

2. Designate, assemble and dispatch an Emergency Response Team (ERT), made up of Groups 1 & 2 personnel (see ERAP pg. 16 and Annex D) under the leadership of an On Scene Coordinator (OSC), if required.

3. Authorize the dispatching of additional resources, communications, transportation and contracted services as necessary.

4. Contact and instruct the designated Emergency Response Team (ERT) to proceed to the emergency scene with the required vehicles and equipment.

5. Liaise with the Person in Charge of the Emergency) and/or Local Authorities to obtain a situation update.

6.Advise Local Authorities as appropriate, regarding the properties, hazards and handling procedures for the explosives involved in the emergency. In particular, advise the Local Authorities of appropriate evacuation distances per Table 6-4 pg. 17.

7. Continue to consult with the Local Authorities as appropriate, plus the Company's On-Scene Coordinator (OSC), to stabilize and eliminate the emergency.

8. Refer to **Regional Manager** *Tom Medak or Cory Redwood .(see appendix2))* for any media requests in accordance to the Crisis Communication Plan (CCP). Media contacts shall be through Regional Manager designated for the area.

9. Contact the explosives supplier and / or transporter (if other than DNCI) to advise them of the emergency and to request their assistance if/as required.

ON-SCENE CO-ORDINATOR (OSC)

- The On-Scene Coordinator (OSC) is the Company's representative and local authority in charge of all company actions and resources at the emergency scene. Once the OSC arrives at the emergency scene, the ERA will transfer communication with First Responders/Local Authorities to the OSC. In turn, the OSC will liaise with the ER Advisor as required. Throughout the Company's emergency response, the OSC will ensure that First Responders and Company personnel (employees and contractors) observe all safety and regulatory standards and procedures.
- The OSC may revise / adjust the composition of the Emergency Response Team (ERT) and supporting resources as required. The OSC may, in consultation with the ER Advisor, contract commercial services to assist in addressing and resolving the emergency situation.

- The OSC will oversee the Company's local involvement with emergency services, government (municipal & provincial) and public interests until the emergency is fully resolved. Post-emergency activities (clean-up, restoration, etc.) under the direction of the Environment Manager may be delegated to an appropriate Branch, Plant or Area Manager. **EMERGENCY RESPONSE TEAM (ERT)**

- Selected emergency response personnel will take their direction to assemble and proceed to the emergency scene from the ERA or their representative. Team members will immediately report to the On-Scene-Coordinator.

- The primary role of the ERT is to provide a competent and trained / certified workforce plus specialized equipment and material to assist First Responders / Local Authorities in the stabilizing and elimination of an 'explosives emergency', and to retrieve / recover, repackage and remove to safe and secure storage, non-detonated explosives.

- While at the emergency scene, ERT members will take their direction from the Company's OSC and remain available until released by the OSC.

NOTE:

ONLY INDIVIDUALS WHO HAVE RECEIVED TRAINING AS REQUIRED UNDER THE TRANSPORTATION OF DANGEROUS GOODS (CLEAR LANGUAGE) REGULATIONS, OR WHO ARE WORKING UNDER THE DIRECT AND CONTINUOUS SUPERVISION OF AN EMPLOYEE WHO HAS BEEN TRAINED FOR CLASS 1 DANGEROUS GOODS UNDER TDG, MAY PARTICIPATE IN SITE CLEAN-UP ACTIVITIES SUCH AS PICKING UP, REPACKAGING AND TRANSPORTING EXPLOSIVE MATERIAL.

6.1.1 In any emergency the Work Site Supervisor/Manager or their delegate must take certain actions, including the following:

- Call local fire/emergency authorities (at mine sites, also call Mine Fire, Safety and Security if different and give relevant information).
- Account for all employees and visitors. Arrange for Rescue of anyone who may be trapped, without endangering oneself or others.
- Notify Dyno Nobel Canada Inc. ERA's so that necessary arrangements can be made for technical / administrative support, including accident reporting and investigation plus continued/alternate production. The following information should be provided and refer to appendix 1:

What Occurred	Time of Occurrence
Action Taken	People Contacted
Status of Situation	Anticipated Follow-up

6.2 FIRE & EXPLOSIVES

6.2.1. There are three categories of fire that may involve explosives:

I. Fires Directly Involving Class 1 Explosives and Blasting Agents

- **DO NOT FIGHT THE FIRE.** Instruct all fire fighters on the scene not to fight fire with explosives.

- Shut off power at main breakers if possible. At mine sites, call Mine Security or Fire/Rescue. At all other DNCI locations call local Fire/Rescue personnel.
- Evacuate all personnel from the Work Site to the safe meeting place as outlined in the Work Site Appendix.
- Set up a communications base at the meeting place and guard
- against anyone entering the area.

II. **<u>Fires Involving Components For Manufacture of Blasting Agents</u>**

Bulk blasting agents may be in the form of emulsion or ANFO. ANFO is a mixture of prilled ammonium nitrate and fuel oil.

Under conditions of large mass, intense heat, confined dust / vapor buildup, and the right mixture combination of the basic ingredients, emulsion and ANFO will explode. The probability of explosion with ammonium nitrate (AN) alone is very small, but increases when under intense heat and confinement. Table 6-1 includes recommended fire fighting procedures for each of these substances.

III. **<u>Fires Involving Dyno Nobel Canada Inc. Trucks</u>**

In cases where the Dyno Nobel Canada Inc. delivery trucks are in a building that is on fire, if there is no explosives and safe to do so, may be moved provided access to the truck and exit from the building is not barred by flames or smoke, with available fire extinguishers with caution only if the fire is small and not in the storage compartment.

Fires on re-pump or other bulk explosive delivery vehicles shall not be fought if the fire involves the explosives compartment. Fire fighting measures should be taken immediately to prevent any fire such as a tire, electrical or cab fire from reaching the explosives compartment.

Fires on other transport vehicles may be fought with caution. Fires that cannot be controlled sufficiently to avoid involvement of the vehicle's fuel compartment shall be left and personnel evacuated to a safe distance.

6.2.2. When a fire is small and does not involve any explosive agents, it may be fought with plant extinguishing equipment. If the fire is widespread and intense, all

personnel, including visitors and contractors should be evacuated to the meeting area outside the main gate.

Table 6 - 2
FIRE FIGHTING INFORMATION

MATERIAL	RECOMMENDED FIRE-FIGHTING METHODS	SPECIAL CONSIDERATION
Ammonium Nitrate Prill – Odorless white to light tan crystaline solid	Use flooding amounts of water in early stages of fire. Keep upwind. AN is an oxidizing agent which supports combustion and is an explosive hazard if heated under confinement that allows high-pressure buildup. Ensure good ventilation and remove combustible materials if it can be safely done. Evacuate to designated area if fire cannot be controlled.	Toxic oxides of nitrogen are given off during combustion. Fire fighters require self-contained positive pressure breathing apparatus. Avoid contaminating with organic materials. Many powdered metals such as Al, Sb, Si, Cd, Cr, Co, Cu, Fe, Pb, Mg, Mn, Ni, Sn, Zn and brass react violently and explosively with fused AN below 200˚C Sensitivity to detonation increases when heated.
Ammonium Nitrate Solution- Colorless/Odourless Liquid – white paste like solid when cooled	Use flooding amounts of water in early stages of fire. Cool containing vellels with with flooding quantities of water until after fire is out	Material will not burn, but thermal decomposition may result in flammable/toxic gases being formed. These products are nitrogen oxides and ammonia. (NO,NO_2 NH_3). Product may form explosive mixtures when contaminated and comes in contact with organic materials. Explosive when exposed to heat or flame under confinement. Avoid temperatures over 210°C (410°F) A self contained breathing apparatus should be used to avoid inhalation of toxic fumes
Acetic Acid – Colourless liquid with a pungent odour	Use dry chemicals, CO_2, Alcohol foam or water spray	Isolate and restrict area access, stay upwind. Water run-off and vapour cloud may be corrosive.
Sodium Thiocyanate – White solid - odourless	Use extinguishing media most appropriate for the surrounding fire	Wear self contained breathing apparatus – MSHA/NIOSH approved or equivalent, and full protective gear. During a fire, irritating or highly toxic gases may be generated by thermal decomposition or combustion.
Sodium Nitrite – Oxydizing agent - white to light yellow crystals- faint odour	Flammability class – not regulated. Flood with water only – Isolate materials not involved in the fire and cool containers with flooding quantities of water until well after the fire is out.	Self contained apparatus should be worn in a fire involving Sodium Nitite.Thermal decomposition will cause reddish brown nitrogen oxides to be released.
Fuel Oil (No. 2 diesel) Dyed or pale yellow liquid with petroleum odor; and/or ATF Fluid	Use water spray to cool fire-exposed surfaces and to protect personnel. Shut off fuel from fire. Use foam, dry chemical or water spray to extinguish fire. Avoid spraying water directly into storage container due to danger of boil-over.	Avoid strong oxidizing agents.

Explosive emulsions, ANFO, packaged explosives and firing devices.	**Fire involving explosive materials must never be fought. Evacuate the incident scene. Do not confine (ventilate to prevent / reduce pressure build-up if safe to do so).**	Explosion hazard.
Enviro CFE	Dry chemical, foam, water spray (fog). Use water spray to cool exposed surfaces and containers	OIL FLOATS ON WATER. Do not use direct or heavy water stream to fight fire. Use organic vapour respirator or self-contained breathing apparatus to fight fire.

Table 6 - 3
CONTROL MEASURES FOR FIRE

MATERIAL	RECOMMENDED FIRE-FIGHTING METHODS	SPECIAL CONSIDERATION
Acetic acid	Small fire: type ABC dry chemical or CO_2 fire extinguisher. Large fire: water fog or foam.	May react violently with oxidizers and nitric acid. May react with aluminum powder and give off highly flammable hydrogen gas.
Aluminum	Small fire: type D fire extinguisher, dry sand. **Never use water**.	May react with oxidizers (nitrate and perchlorate) and acids. Avoid contact with water. Highly flammable hydrogen gas may be released.
Diethylene glycol	Small fire: type ABC dry chemical or CO_2 fire extinguisher. Large fire: water fog.	Keep away from oxidizers (nitrates and perchlorate). Explosion hazard if heated under confinement.

EVACUATION PROCEDURES

Advise the first emergency responders at the scene (police or fire) of the need to evacuate using the guidance in the Emergency Response Plan. Employees at the scene should assist local emergency services to the best of their ability to accomplish this. For incidents within a worksite such as a mine, quarry or construction operation, in most cases access is radio controlled. The quickest way of alerting people, therefore, is by site radio. Clearly state your location, situation and call for assistance in evacuating the area.

DO NOT FIGHT EXPLOSIVES FIRES. EVACUATE THE AREA AND LET THE FIRE BURN ITSELF OUT.

THE MINIMUM EVACUATION DISTANCE IS AS OUTLINED IN TABLE 6-4 (Pg. 17) FOR ALL DIRECTIONS (which is based on a higher traffic / risk / population density within the area, without benefit of protective features such as berms and hills. (**Transport Canada requires 1,600 meters for situations that involve high-risk surroundings**) upon determining actual quantity of explosives refer to Table 6-4 as per ERD quantity of distances.

Table 6 - 4
EVACUATION DISTANCES
Based On Amount of Explosives Present

Explosive Quantity		**Metric Distance**		**English Distance**
250 kg		70 Meters		230 Feet
500 kg		100 Meters		320 Feet
1,000 kg		150 Meters		500 Feet
2,000 kg		240 Meters		800 Feet
5,000 kg		400 Meters		1,300 Feet
7,000 kg		450 Meters		1,450 Feet
10,000 kg		480 Meters		1,550 Feet
20,000 kg		700 Meters		2,300 Feet
40,000 kg		800 Meters		2,640 Feet
60,000 kg		870 Meters		2,860 Feet
80,000 kg		960 Meters		3,150 Feet
100,000 kg		1040 Meters		3,420 Feet
120,000 kg		1100 Meters		3,610 Feet
>120,000 kg		1600 Meters		5,250 Feet

6.3 ENVIRONMENTAL RELEASES

6.3.1 Procedure For Fuel Oil Storage Tank Failure

- Assess the magnitude of the leak.
- If the leak is slow and the source can be determined, take the appropriate action to prevent further leakage.
- Transfer fuel from storage tank into drums if necessary.
- Collect spilled material, including contaminated soil, with absorbent pads or inert solid absorbent and store in drums labeled for disposal.
- If the leak is large and further leakage cannot be prevented, allow the dyke to fill. Transfer to drums, label for reuse or disposal, and store.
- Inspect empty tank to identify failure/cause of leak and repair tank.

6.3.2 Procedure For Raw Material Truck Spills

- Identify the material involved, assess the magnitude of the spill or leak and assist the driver to take appropriate action to stop the leak, taking care to prevent run off and/or entry into any water course or drainage system near the spill site.
- For AN prill, shovel spilled material into drums, label for reuse or disposal, and store. Use a non-sparking shovel to transfer spilled material into lined drums.
- For spilled fuel, contain by dyking with earth. Collect spilled fuel with absorbent pads or solid inert absorbent, transfer into drums, label and store for disposal.
- Remove contaminated soil for disposal in conformance with Environment Canada standards.

6.3.3 Procedure For Process Spills

- Identify the material involved and assess the magnitude of the spill or leak, taking care to prevent run off and/or entry into any watercourse or drainage system near the spill site.
- For AN prill, shovel spilled material into drums, label for reuse or disposal, and store.
- For spilled fuel, contain by dyking with earth. Collect with absorbent pads or solid inert absorbent, transfer into drums, label, and store for disposal.
- In the case of leaking bags of ANFO, sweep or shovel the spilled material into a clean drum or other suitable container, label for reuse or disposal, and store.
- Remove contaminated soil for disposal in conformance with Environment Canada standards.

- Have any process equipment (pumps, process lines, parts, gauges, etc.) involved in a leak or spill inspected and repaired or replaced. Re-inspect and test if necessary after repair is affected.

6.3.4 **Procedure For Emulsion Tank Failure**

- Assess the magnitude of the leak.
- If the leak is slow and the source can be determined, take the appropriate action to prevent further leakage.
- Transfer remaining emulsion from leaking storage tank into another storage tank, a tanker trailer if available, or into drums as necessary.
- Collect spilled material using double diaphragm pump(s) and store in labeled drums for reuse or disposal at the mine.
- If the leak is large and further leakage cannot be prevented, allow the room to fill. Transfer to drums, label for reuse or disposal, and store.
- Inspect empty tank to identify failure/cause of leak and repair or replace the tank

6.3.5 **Procedure For Fire**

- In the event of a raw material or product fire, take care to protect all persons from exposure to smoke and gaseous emissions from the fire.
- Potential toxic gaseous emissions from fires involving explosive materials include:

  Oxides of Nitrogen
  Carbon Monoxide
  Cyanide Gas

- All fires must be reported to local authorities and Mine Site Security as soon as possible.
- Self contained breathing apparatus is required for fighting a fire in the plant.
- Follow procedures outlined above for any spills and leaks resulting from fire when it is safe to do so

Table 6 – 5
ENVIRONMENTAL RELEASE PROCEDURES

MATERIAL	SPILL AND LEAK PROCEDURES	WASTE DISPOSAL
Ammonium Nitrate Prill (odorless white to light tan crystalline solid)	Remove source of heat and ignition. Sweep or shovel spill into a clean, non-combustible container. Wash remaining trace residues with water. Wear rubber gloves and safety glasses to minimize contact with skin and eyes.	Re-use if possible or give it to a farmer as a fertilizer. If not possible, dispose of as-is in approved. Remove as much as possible the spilled material as a solid.
Ammonium Nitrate Solution-Colorless/Odourless Liquid – white paste like solid when cooled	Small spill - Dike and contain spilled material. Ensure spilled material does not enter sewers, wells or water courses. Allow to solidify. Use appropriate tools to place in container for disposal. Larger spill - Dike and contain spilled material. Ensure spilled material does not enter sewers, wells or water courses. Notify downstream water users. Allow to solidify. Use appropriate tools to place in container for disposal.	Call for assistance for disposal. Ensure disposal complies with regulatory requirements and regulations.
Fuel Oil (dyed or pale yellow liquid with petroleum odor)	Eliminate any source of ignition. Prevent spills from entering watercourses or drainage systems. Contain with sand or earth. Recover with pump or inert absorbent material into clean container. Wear safety glasses and rubber gloves to prevent contact with the eyes and skin.	Dispose of recovered material in approved landfill or other waste disposal facility.
ANFO (Ammonium Nitrate Fuel Oil)	This material is an explosive. Remove all sources of heat and ignition. Transfer into clean plastic container with a plastic shovel. Label drums. Wear rubber gloves.	Recycle product, if possible. If not practical, explode it inside a borehole or burn it in an authorized burning ground.
Emulsion	This product is a blasting agent. Remove all sources of heat and ignition. Prevent spills from entering watercourses or drainage systems. If large amount of emulsion is involved, contain spill with earth or sand found locally. Recover spilled material with a diaphragm pump. Use of a diaphragm pump also requires an air compressor. Limitation of the pump suction is approximately 2.5 meters, pump discharge is approximately 8 meters. Use a screening device on pump suction hose. Out of area spills will require taking two pumps and extra hose. Transfer the product into a tanker trailer or clean 200 liter drums. If small amount of emulsion is involved, transfer material into a clean plastic container with a plastic shovel. Label tanker trailer or drums. Wear rubber gloves and rubber boots.	Recycle product, if possible. If not practical, explode it inside a borehole or if large amount is involved, demulsify it with liquid detergent.

Enviro CFE	Eliminate any source of ignition. Prevent spills from entering watercourses or drainage systems. Contain with sand or earth. Recover with pump or inert absorbent material into clean container. Wear safety glasses and rubber gloves to prevent contact with the eyes and skin.	Dispose of recovered material in approved landfill or other waste disposal facility.
Sodium Thiocyanate – White solid - odourless	Ensure adequate ventilation whe handling Sodium Thiocyanate. Keep containers closed when not in use. Wear appropriate PPE – eye protection, gloves and appropriate clothing to prevent skin exposure.	Vacuum or sweep up material and place into a suitable disposal container. Avoid run off into storm sewers and ditches which lead to waterways. Not regulated as a hazardous material. Chemical waste generators must consult appropriate hazardous waste regulations to ensure complete and accurate classification.
Sodium Nitrite – Oxydizing agent - white to light yellow crystals- faint odour	In the event of a spill or leak, contact the vendor (403-263-8660) for advice. Wear respirator, protective clothing and gloves. Vacuuming is the recommended method to clean up spills. Do **not** sweep or use compressed air for clean up. Recover spilled material on non-combustible material, such as vermiculite. Use non-sparking tools and place in covered containers for disposal. Any recovered material mau be used for it's intended purpose , depending on contamination.	Dispose of the waste material at an approved hazardous waste treatment/disposal facility.
Acetic Acid – Colourless liquid with a pungent odour	Wear appropriate PPE – evacuate downind areas as required to prevent exposure and to allow fumes and vapours to dissipate. Prevent entry into sewers or streams. Dike if needed. Eliminate all sources of ignition. Neutralize the residue with sodium carbonate or crushed limestone. Absorb win an inert dry material and place in an appropriate container for disposal. Flush area with water to remove trace residue.	Waste disposal must be done in accordance with provincial and federal regulations. Empty containers must be recycled or disposed of through an approved waste management facility.

6.4 SECURITY

6.4.1. In the event of a breach of security at a Dyno Nobel Canada Inc. Work Site, a call is to be made to the RCMP / local Police Department at the discretion of the Supervisor/Manager, or their delegate. In the case of a breach of security, Dyno Nobel Canada Inc.' HSE, Regulatory Affairs and Executive / Senior Management shall also be informed immediately and provided with the same information as outlined in Section 6.1

6.4.2. Any person(s) apprehended during the course of a serious security breach shall be detained until the Police arrive (note: employees are not to put themselves at undue risk by attempting to apprehend or restrain a potentially violent person).

6.5 BOMB THREAT

6.5.1. The safety of employees and the public is of primary concern. A person receiving a bomb threat over the telephone should attempt to remain calm and keep the caller talking by asking the questions listed in Table 6-6 (ERP pg. 20). Recording (writing) as much information about the caller and their comments is also very important for future reference. If possible, alert a co-worker to the situation while talking to the caller.

6.5.2. The police / mine security should be advised of the bomb threat as soon as possible. Unless there is good reason to the contrary, all personnel should evacuate the Work Site and await the arrival of the police / first responders at the designated meeting area. Suspicious objects should be reported but not tampered with and other people should be prevented from entering the Work Site until the local authority has authorized a return to the Work Site. Employees should be prepared to assist local authorities in their search / inspection of the Work Site as necessary.

Table 6 - 6
CONVERSATION GUIDELINES IN THE EVENT OF RECEIVING A BOMB THREAT

See Appendix 7

6.6 LINES OF AUTHORITY

6.6.1 Based upon the information available at the time of the incident, the Work Site Supervisor/Manager, in consultation with others (such as DNCI Senior Management, Mine/local authorities and/or Dyno Nobel advisors), will evaluate the incident and proceed with appropriate steps to implement this ERP. A decision on when to return to the scene of a serious incident will be made in like fashion, subject to approval by public authorities overseeing the incident.

6.6.2 The Work Site Supervisor/Manager will have overall responsibility for the implementation of this ERP and the supervision of all Company activities. Public authorities and the site owner have ultimate authority regarding the resumption of normal production activities.

7.0 NOTIFICATION AND REPORTING

7.1 Any incident that activates this ERP shall be documented on the DYNO Incident (Cintellate) Report. The Corporate Emergency Response Advisor must also be notified and in turn will advise the:

HSE Manager Vice President Operations
Area Manager

It is the responsibility of the HSE Manager or his delegate to report the incident to DYNO's HSE Management Team. A major incident involving a fire with emissions and/or a hazardous material spill shall be reported to a provincial Environment Officer under the direction of the Environmental Manager. Major incidents shall also be reported to the Chief Inspector, Explosives Branch, Natural Resources Canada; a Provincial/Territorial Safety Officer; and as applicable, an Emergency Measures Official.

Any incident which involves a spill at a Mine Site shall be immediately reported to the Mine Site Environmental Representative, and followed up with a copy of the incident report when complete.

7.2 Spills and Releases – Reportable and Significant Classifications

1) Determine if the spill/release is reportable
All environmental incidents are to be input into Cintellate. Reportable spills/releases are not only input into Cintellate, but the investigation and corrective action sections of Cintellate must be completed. To assist in determining if a spill/release is reportable, a listing of common materials with assigned reportable quantities is referenced (see Appendix 5, Reportable Substance List). The reportable quantities utilize the most stringent "reportable quantity" in Canada. Even if the spill/released material is recovered, the media impacted by the spill/release may be reportable to authorities (e.g., a portion of a spill reaching a source of drinking water or wetland). In addition, a spill/release is reportable if the amount equals or exceeds the Dyno Nobel Default Threshold.

2) Determine if the spill/release is significant

- Significant spills/releases are disclosed in the company's annual report. Significant spills/releases trigger time-critical internal actions as required by the company's procedures (crisis communication, internal investigation, etc)

The following table is provided to assist in making these determinations:

Reporting of Environmental Spills

Is the spill reportable?

- Yes if above a Reportable Quantity
- Yes if oil sheen is visible or sludge/emulsion is deposited beneath water surface
- Yes if water quality standards are exceeded
- Yes if from a UST exceeding 25 gallons or result in a sheen

Is the spill significant?

- Yes if authorities implement a national contingency plan
- Yes if "sensitive" environmental features have been impacted
- Yes if neighbors are evacuated
- Yes if authorities and/or neighbors file complaints and/or demand response activities
- Yes if financial impact is >US$100K
- Yes if media coverage is adverse.

7.3 Internal investigation reports will include:

- Name, work address, and phone number of the investigating (reporting) individual
- Identification and quantity of the released substance
- Time, duration, and location of the release
- Nature and quantity of injuries, property damage, production loss, administrative penalty and/or legal liability
- Precautions taken during the incident
- Relevant environmental conditions
- Corrective actions taken at the time of the incident
- Recommended corrective actions to prevent future occurrence

7.4 Senior Management shall be immediately informed by telephone of any major incident that requires Government notification as per Dyno Nobel's reporting procedures.

7.5 Major incidents involving explosive material shall also be reported to the Chief Inspector, Explosives Branch, and Natural Resources Canada by the applicable Regulatory Affairs Coordinator.

Table 7 – 1
REPORTABLE SUBSTANCE QUANTITY LIST

Material Released	Reportable to Authorities		Dyno Nobel Default Threshold (Proposed)
	If Recovered	If Unrecoverable/ Abandoned / Disposed	
AN Solution	Not Reportable if it can be used as a product	45 Kg (100 lbs) as released oxidizer (not media specific)	225 Kg (500 lbs)
	44 Kg (100 lbs) for ammonia if released into water	45 Kg (100 lbs) for ammonia if released into water	
	Report if released to Drinking Water (DW std at 10mg/L-N)	Report if released to Drinking Water (DW std at 10mg/L-N)	
	Report if released to aquatic ecosystem (NH3 toxic to fish)	Report if released to aquatic ecosystem (NH3 toxic to fish)	
AN Prill	Not Reportable if it can be used as a product	45 Kg (100 lbs) as released oxidizer (not media specific)	225 Kg (500 lbs)
	45 Kg (100 lbs) for ammonia if released into water	45 Kg (100 lbs) for ammonia if released into water	
	Report if released to Drinking Water (DW std at 10mg/L-N)	Report if released to Drinking Water (DW std at 10mg/L-N)	
	Report if released to aquatic ecosystem (NH3 toxic to fish)	Report if released to aquatic ecosystem (NH3 toxic to fish)	
SN Prill	Not Reportable if it can be used as a product	45 Kg (100 lbs) as released oxidizer (not media specific)	225 Kg (500 lbs)
	Report if released to Drinking Water (DW std at 10mg/L-N)	Report if released to Drinking Water (DW std at 10mg/L-N)	
Acetic Acid	453 Kg (1,000 lbs)	454 Kg (1,000 lbs)	225 Kg (500 lbs)
	Report if released to Drinking Water (DW std at 10mg/L-N)	Report if released to Drinking Water (DW std at 10mg/L-N)	
Sodium Nitrite	45 Kg (100 lbs)	45 Kg (100 lbs)	225 Kg (500 lbs)
	Report if released to Drinking Water (DW std at 1mg/L-N)	Report if released to Drinking Water (DW std at 1mg/L-N)	
Fuel Oil	Reportable if sheen on surface of pond, stream, etc. or sludge within such	Reportable if sheen on surface of pond, stream, etc. or sludge within such	225 Kg (500 lbs); 261 L (69 gallons)
	State Regulations - Varies from Any Amount to specific Trigger Amounts	State Regulations - Varies from All Spills to specific Trigger Amounts	
	95 L (25 gallons) from UST	96 L (25 gallons) from UST	
Mineral Oil	Reportable if sheen on surface of pond, stream, etc. or sludge within such	Reportable if sheen on surface of pond, stream, etc. or sludge within such	225 Kg (500 lbs); 261 L (69 gallons)

	State Regulations - Varies from Any Amount to specific Trigger Amounts	State Regulations - Varies from All Spills to specific Trigger Amounts	
	95 L (25 gallons) from UST	96 L (25 gallons) from UST	
Emulsifier Agents	Reportable if sheen on surface of pond, stream, etc. or sludge within such	Reportable if sheen on surface of pond, stream, etc. or sludge within such	225 Kg (500 lbs); 261 L (69 gallons)
	State Regulations - Varies from Any Amount to specific Trigger Amounts	State Regulations - Varies from All Spills to specific Trigger Amounts	
Granular Aluminum	Not Reportable	Not Reportable	225 Kg (500 lbs)
ANFO	Not Reportable if it can be used as a product	45 Kg (100 lbs) as released oxidizer (not media specific)	225 Kg (500 lbs)
	45 Kg (100 lbs) for ammonia if released into water	45 Kg (100 lbs) for ammonia if released into water	
	Report if released to Drinking Water (DW std at 10mg/L-N)	Report if released to Drinking Water (DW std at 10mg/L-N)	
	Report if released to aquatic ecosystem (NH3 toxic to fish)	Report if released to aquatic ecosystem (NH3 toxic to fish)	
	Reportable if sheen on surface of pond, stream, etc.	Reportable if sheen on surface of pond, stream, etc.	
Emulsion	Not Reportable if it can be used as a product	45 Kg (100 lbs) as released oxidizer (not media specific)	225 Kg (500 lbs)
	44 Kg (100 lbs) for ammonia if released into water	45 Kg (100 lbs) for ammonia if released into water	
	Report if released to Drinking Water (DW std at 10mg/L-N)	Report if released to Drinking Water (DW std at 10mg/L-N)	
	Report if released to aquatic ecosystem (NH3 toxic to fish)	Report if released to aquatic ecosystem (NH3 toxic to fish)	
	Reportable if sheen on surface of pond, stream, etc. or sludge within such	Reportable if sheen on surface of pond, stream, etc. or sludge within such	
Ethylene Glycol	2250 Kg (5000 lbs)	2250 Kg (5000 lbs)	225 Kg (500 lbs)
Sodium Thiocyanate	45 Kg (100 lbs)	45 Kg (100 lbs)	225 Kg (500 lbs)
	Report if released to Drinking Water (DW std at 1mg/L-N)	Report if released to Drinking Water (DW std at 1mg/L-N)	

8.0 DECONTAMINATION

8.1 DNCI's Standard Operating Procedures and safety rules establish work practices that minimize employees' direct and indirect contact with hazardous substances.

8.2 Equipment, rubber boots, gloves and clothes that have been contaminated can be washed with soap and water. Wash water should be collected and disposed of in an approved manner with other contaminated material.

9.0 WORKSITE CLOSURE / SHUT DOWN

9.1 **Plant Shutdown (use appropriate lock-out/tag-out procedures)**

- In the event that a plant is shut down due to weather, flood, or other adverse situation, the Plant Manager / Supervisor or his delegate will ensure that all non-essential power is shut off. The Plant Manager / Supervisor will secure all valves and flow devices so as to prevent accidental opening.
- The Plant Manager / Supervisor shall determine if any raw material or raw material storage will be contaminated or at risk of fire/explosion, and take steps to move the material or isolate it from the contamination / hazard source.
- If the power and/or gas will create a dangerous situation the Plant Manager / Supervisor will cut the outside supply of power, thereby isolating all plant equipment.
- The Plant Manager /Supervisor will advise local Mine authorities of the plant shutdown and preventative actions taken.
- All sensitive documents must be secured.

9.2 **Magazine Closure (use appropriate lock-out/tag-out procedures)**

- In the event that a magazine is closed due to weather, flood, or other adverse situation, the Supervisor/Manager or his delegate will ensure that all non-essential power is shut off. Also, the Supervisor/Manager will ensure that all magazines and compound gates are locked before leaving the site.
- The Supervisor/Manager shall determine if any products or raw materials will be contaminated and take steps to move the material or isolate it from the contamination source.
- If power and/or gas will create a dangerous situation the Supervisor/Manager will cut the outside supply of power, thereby isolating all magazine equipment.

10. RESPONSE TO NATURAL DISASTER

Hurricanes, tornadoes, floods, slides, forest fires, and earthquakes, have the ability to damage or destroy everything in their path. Yet much of the damage or destruction associated with such phenomena is the result of some secondary event, e.g. fallen power lines, ruptured tanks valves, pipes etc. If reasonable warning of an approaching disaster is received, efforts can be made to minimize damage by taking specific preventative measures. These measures are outlined in the following procedures.

1.Consult the Site Supervisor for guidance and proceed according to his direction. **SEE SITE SPECIFIC POTENTIAL HAZARDS APPENDIX 10**
2. If so directed, notify key personnel regarding the action being taken.
3. Collect important files, records and papers for safekeeping.
4. Open main electrical breaker to cut off all power to the site. (The main breaker is marked for easy identification).
5. Secure all buildings and equipment and lock the site gate.
6. Evacuate the site taking mobile equipment to safety.
7. Post Guards on site access routes to monitor the activities of unauthorized personnel.
8. A report of the incident must be submitted to the Area Manager within 24 hours.

10.1 PREVENTIVE MEASURES

10.2 Waste Disposal Permits

If nitrate waste is generated, a disposal permit must be obtained and kept up to date if the product will be disposed of off-site, or in mine tailings. Permits to dispose of other collected waste in the event of spills or leaks (such as described in Section 6.3) must also be obtained in consultation with mine / provincial environmental representatives

10.3 Liquid Containment

All fuel / oil storage tanks must be dyked according to the provisions of Federal and/or Provincial regulations (eg. National Fire Code, Environmental Protection Act), or have a double-walled tank.

A plan must be in place and materials on hand to create a dyke in the event of a large fuel or solution leak or spill or other emergency spill situation.

10.4 Inspection

All site emergency storage areas and equipment must be inspected monthly by qualified personnel, monthly for physical condition and serviceability,

and the results recorded according to quality and safety standard operating procedures.

All recommendations/orders made by NRC Explosives Branch inspectors, Fire Marshals and insurance inspectors must be responded to and acted upon accordingly. Copies of their reports are to be forwarded to DNCI's HSE representative for the region.

10.5 **Maintenance**
All preventive and breakdown maintenance must be carried out and recorded in accordance with standard operating procedures.

11.0 WORK SITE START UP (Restoration of Business)

11.1 Before startup, the condition prompting the shutdown / closure must be over / corrected (i.e. flood, fire, explosion or blizzard).

11.2 All decontamination procedures must be followed and the site cleared and cleaned of any environmental waste hazards.

11.3 All repairs to plant equipment involving safety shutdowns and essential operating machinery must be completed.

11.4 All electrical circuits, plumbing and piping must be tested.

11.5 The Work Site Supervisor / Manager will ensure that all lockout and tag-out procedures have been followed and signed off.

11.6 The Work Site Supervisor / Manager will start up the facility by turning on individual switches to the components that have been shutdown.

11.7 Operational checks will be done to ensure that all equipment is functioning at safe working pressures and voltage.

11.8 The Work Site Supervisor / Manager will give the verbal "all clear" before workers will be allowed to return to work.

11.9 The Work Site Supervisor / Manager or one of their delegates will cancel / remove all roadblocks, terminate evacuation activities, and notify employees to return to normal activities.

APPENDIX 1

Basic Investigation Report

(Factual Report not prepared Under Legal Professional Privilege)

Incident Title	

Incident No.	
Incident Date	
Site	
Department / Location	
Report Author	
Report Date	
Investigation Manager	
Investigation Team Members	
Report Distribution	

Who was involved? **name, job, title**
When did it happen? **date & exact time**
Where did it happen? **The exact location**
What was the person doing at the time? **What product or equipment was involved**
What went wrong? **Not your opinion, only factual information. Eg: an operator fell off a ladder, the hose broke; spill / quantity**
What happened? **Describe the sequence and timing of events**
Immediate Control Actions **What first aid treatment was given and or actions taken (valve turned off, electricity isolated) immediately after the incident to make the situation safe**
Interim Control Action **The interim corrective actions to prevent re-occurrence**
5-Why Analysis - Consolidate the information above into a flow chart Double click on chart to enter visio and update as required

Contributing factors **What factors combined to make the situation unsafe – in descending order of importance**
Root Cause **What were the root causes identified in the 5Why analysis – in descending order of importance**

Corrective Action	**Who**	Due Date

Comments

APPENDIX 2

DNCI Corporate contact

Name	Position	Cell number
Benoit Choquette	Environmental Manager - Canada	(514) 246-6285
Seamus Kilcommons	H&S Manager Western Canada	(403) 815-4066
Tim Marles	H&S Advisor Artic	(403) 723-7540
Willard Pierce	Regional Manager West/ Central Canada	(403) 836-9029
Hubert Fafard	H&S Manager Eastern Canada	(418) 570-9257
Greg Brown	Sales Manager Western	(403) 512-5127
Ralph Olson	Operations Manager of Western Canada	(250) 713-8720
Randy Armella	Bulk Operations Manager	(780) 865-6580
Rick Chopp	H&S Manager – Central Canada	(705) 498-2855
Pierre St Georges	Regulatory Affairs Coordinator	(613) 677-1051
Cory Redwood	General Manager Western Canada	(867) 444-8533

APPENDIX 3

DNCI Emergency Response Advisors (ERA) per area

Name	Position	Cell number	Area (West, Central or East)
Tom Medak	Mgr, Bulk operations	(403) 818-4434	West / Arctic
Dennis Wall & Doug Robertson	Meadowbank Operations Supervisors	(867) 793-4610 opt 2 ext 6804 Cell (867) 222-3930	Arctic
Seamus Kilcommons	H&S Manager Western Canda	(403) 815-4066	West
Tim Marles	H&S Advisor Arctic	(403) 723-7540 office	Artic
Tyrone McClean	Operations manager, Manitoba and Saskatchewan	(204) 687-0046	Central
Corey Rachuk	Plant Supervisor – Flin Flon	(204) 687-0028	Central
Joss Forget	Operations Manager Northern Ontario	(705) 471- 8745	East
David Roy	Manager Plant operations	(418) 570-5604	East
Francois Lambert	Operations Manager	(514) 212-3490	East
Daniel Roy	Dyno Consult , Ste-Sophie	(514) 213-5889	East

APPENDIX 4
SITE: QAAQTUQ / Meadowbank Operations

MANAGEMENT AND WORK SITE CONTACT LIST

NAME	TITLE	BUSINESS PHONE	2 WAY RADIO	CELL PHONE
Dennis Wall	Site Supervisor	(867)793-4610 opt#2 ext 6804		(867) 222-3930
Doug Robertson	Site Supervisor	((867)793-4610 opt#2 ext 6804		(867) 222-3930
Tom Medak	Bulk Manager	(403) 236-9160		(403) 818-4434
Tim Marles	H&S Advisor Arctic	403 723-7540		TBA
Seamus Kilcommons	H&S Manager	(403) 236-9160		(403) 815-4066
Benoit Choquette	Environmental Manager	(450) 818-7176		(514) 249-6285
Pierre St George	Regulatory Affairs Coordinator	(613) 632-5844		(613) 677-1051

Agnico-Eagle Mines Ltd. – Meadowbank WORK SITE CONTACT LIST

NAME	TITLE	BUSINESS PHONE	2 WAY RADIO	CELL PHONE
Meadowbank Mine		(867)793-4610		
Julie Belanger	Agnico-Eagle	(867)793-4610 ext 6721		

EXTERNAL CONTACT NUMBERS

ORGANIZATION/CONTACT	LOCATION	PHONE NUMBER
NT Oil & Chemical Spills	Iqaluit, NU	(867) 979-8130
Environment Canada, NT	Yellowknife, NT	(867) 669-4700
NRC / Explosives Branch	Ottawa	(613) 995-5555
RCMP	Baker Lake, NU	(867) 793-1111 or (867)-793-0123
RCMP 'G' Division	Yellowknife, NT	(867)669-5100

APPENDIX 5

Area Office Address:
Agnico-Eagle Mines Ltd. - Meadowbank
PO BOX 540
Baker Lake, Nunavut
X0C 0A0

Type of Facility:
Bulk Explosives Site

Customer/Client Information:
Customer: Agnico-Eagle
Contact:
Title:

Evacuation and Emergency Meeting Place Upon Evacuation:
As identified on site orientation forms (Designated Muster Points)

Emergency Shutdown switch location:

"ONLY A CERTIFIED PERSONELLE ARE TO ACTIVATE THIS SWITCH"

Magazine and Plant Site Address:

Agnico-Eagle Meadowbank Mine

NRC License:

Site Plan and Evacuation Route:
Posted in site offices – site specific orientations required

Site Rescue Plans:
Site Supervisor or designate to conduct review of attendance sheet. If employees, visitors or contractors are unaccounted for, Site Supervisor will advise mine LPO of unaccounted persons and last known location. Site Supervisor shall attend last known location with mine rescue team and jointly determine potential hazards of re-entering area to locate unaccounted for persons. Site Supervisor and Rescue team entering the evacuated area must don all required PPE due to unknown potential dangers that may have come about. Proper fire retardant suits, SCBA and/or other PPE as determine by the site to protect rescuers from becoming overcome by physical, chemical or other hazards. If determined safe to enter site and/ or buildings, a counter clockwise sweep of the area is to be conducted.

Medical Emergencies: In the unlikely event of a medical emergency, the site shall ensure that it is compliant to OH&S Code. As per legislation requirements, the site shall have adequate first aiders and equipment to attend to individuals as required.

All incidents, first aid/ medical treatment/property damage/near miss or other, shall be in compliance with HSE MS Standard 9.2, which meets or exceeds legislative requirments.

Site First Aiders:	LOCATION	PHONE NUMBER
TBA		
Security (Mine Emergency Services –fire, EMS)		

Emergency Equipment On Hand:
Fire Extinguishers, Spill Kits, First Aid Kits, non-sparking shovels as outlined in site plan.

Delivery Vehicles:			Carrying
		(EVC/ETP)	Capacity
Unit #	Vehicle	TC Permit #	(80% of Max.)

APPENDIX 6
BOMB THREAT CHECKLIST

Exact time of call:
Exact words of caller:
QUESTIONS TO ASK
1- When is bomb going to explode?
2- Where is the bomb?
3- What does it look like?
4- What kind of bomb is it?
5-What will cause it to explode?
6- Did you place the bomb?
7- Why?
8- Where are you calling from?
9- What is your address?
10- What is your name?
CALLER'S VOICE (circle) 1- Calm Slow Crying Slurred 2- Stutter Deep Loud Broken 3- Giggling Accent Angry Rapid 4- Stressed Nasal Lisp Excited 5- Disguised Sincere Squeaky Normal
If voice is familiar, whom did it sound like?
Were there any background noises?
Remarks:

Person receiving call:	Telephone number call received at:
Date:	Report call immediately to:

APPENDIX 7

Dyno Nobel Inc.

JOB-SPECIFIC ORIENTATION CHECKLIST

(Modify as needed to meet site-specific needs)

Employee Name: Job Title:

Location: Hire Date:

CHECK COMPLETED ITEMS. FOR ALL ITEMS THAT ARE NOT APPLICABLE, ENTER "NA" ON THE LINE RETURN COMPLETED AND SIGNED CHECKLIST TO APPROPRIATE HR REPRESENTATIVE

1. JOB SPECIFIC ORIENTATION TO DNA WORK SITE(S)

a. ____ DN Safety & Quality Policy
b. ____ General Safety Rules
c. ____ Site Specific Safety Rules and Instructions
d. ____ Products and Services
e. ____ Tour of Site
f. ____ Rest Rooms, Lockers, Eating Areas
g. ____ Dress and Uniform Standards
h. ____ Personal Protective Equipment
i. ____ First Aid Procedures
j. ____ How to Report Near-Misses and Accidents
k. ____ Workers' Compensation and Return to Work
l. ____ Smoking Policy and Designated Areas
m. ____ Drug and Alcohol Policy
n. ____ Site Emergency and Evacuation Plans
o. ____ Fire Extinguishers
p. ____ DN Crisis Communication Plan
q. ____ Parking and Traffic Plan
r. ____ Security Issues
s. ____ Electrical Hazards
t. ____ Review Job Description
u. ____ Take 5 Program
v. ____ Site Specific SOPs

2. OCCUPATIONAL HEALTH AND SAFETY ACT - REGULATION (OHSA)

a. ____ Mobile Equipment (Forklifts/Bobcats)
b. ____ Review Site MSDS
c. ____ Confined Spaces
d. ____ Lockout/Tagout
e. ____ DNA Hearing Conservation
f. ____ Bloodborne Pathogens
g. ____ Worker's Rights

3. ENVIRONMENT CANADA

a. ____ Spill/Release Reporting
b. ____ Proper disposal of Waste
c. ____ Waste Minimization/Pollution Prevention
d. ____ Used Oil Management
e. ____ Drum/Container Management

4. TRANSPORTATION CANADA (TDG)

a. ____ Road Test
b. ____ TDG Transportation
c. ____ TDG Hours of Service Policy
d. ____ Pre and Post Inspections

5. NATURAL RESOURCES CANADA, EXPLOSIVES SAFETY AND SECURITY BRANCH

a. ____ Site Security Plans / Key Policy
c. ____ Inventory Accuracy
b. ____ Magazine Rules
d. ____ Guidelines for bulk explosive facilities

6. QUESTIONS AND SUMMARY

_
__
_ Ask employee if there are any questions or areas of employment not clearly understood. Advise employee what's next.
Comments
: _____

_____ _____ _____ _____ Employee
Signature Date Trainer/Supervisor Signature Date

Job Specific Orientation Page 1 of 1 Canadian Standard Revised 12/17/09

APPENDIX 8

ANNUAL FIRE DEPARTMENT REVIEW FORM

Information to be released to Emergency Services

From: Local Emergency Services

Subject: Emergency Response Plan for _____.

The following is a copy of the Emergency Response Plan that has been prepared by Dyno Nobel Inc. Has been received from _____ operations. The ERP has been discussed and being kept on file for future reference. If questions arise, we have been given the contact information for the _____ operations staff.

Signed:_____

Position:_____

Date:_____

EMERGENCY RESPONSE REPORT/DEBRIEF TEMPLATE (found in NEXUS Std 9.1)

Site:..... **Date**: ..... **Drill or Actual Event** (circle)

Emergency Call placed with: Mine Emergency ☐ 911 ☐

Supervisor/Manager Advised: ☐

Incident Details:

Sequence of Events

Time	Activity	By

Gaps Identified:

	Details of Gaps Identified	*Action Required
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		

A report should be raised in SHAERS/ICARUS listing all gaps identified and action required.

Fax completed form to Health & Safety Advisor for your site

APPENDIX 9
Transportation of Dangerous Goods Regulation
Class Quantity Emission Limit

1	Any quantity that could pose a danger to public safety or 50 kg
2	Any quantity that could pose a danger to public safety or any sustained release of 10 minutes or more
3	200 L
4	25 kg
5.1	50 kg or 50 L
5.2	1 kg or 1 L
6.1	5 kg or 5 L
6.2	Any quantity that could pose a danger to public safety or 1 kg or 1 L
7	Any quantity that could pose a danger to public safety. An emission level greater than the level established in section 20 of the *Packaging and Transport of Nuclear Substances Regulations*
8	5 kg or 5 L
9	25 kg or 25 L

Table identified in Section 8.1(1) of Part 8 of the Transportation of Dangerous Goods Regulation Class Quantity Emission Limit

APPENDIX 10

Emergency Risk Assessment

Site Emergency Response Plan should be based upon a risk assessment of all types of probable emergencies and regulatory impact (as found in NEXUS Std 9.1)

Location Date Analysis Completed Completed by:

Emergency Type	Scenario(s)	Safeguards	Historical Frequency	Future Risk Potential	Loss Severity Rate	Probable Emergency 8+ to be in plan	Regulatory Notifications	Actions / Remarks
Bomb Threat								
Chemical Spill/Release								
Security								
Explosion								
Fire								
Loss/Theft of Explosives								
Equipment								
Process Loss/Interruption								
Catastrophic Injury/Illness								
Trespassing/Vandalism								
Extreme Temperatures								
Earthquake								
Hurricane								
Tornado								
Severe Flooding								
OFF SITE								
Blast Site Incident								
Fire (Forest/Brush)								
Neighboring Facility Incident								
Transportation Vehicle Accident								
Transportation Fire/Explosion Incident								
Transportation Chemical Spill								
Transportation Vehicle Breakdown								

Emergency Assessment Score Information **- Use to evaluate Emergency Type level of risk**

Historical Frequency	Score	Future Risk Potential	Score	Loss Severity Rate	Score	Probability Total A & B (8+) to be in plan
Several Time per Year	5	Several Time per Year	5	Catastrophic	5	
One Time per Year	4	One Time per Year	4	Major/Critical	4	12 or higher
Once Every 3-5 Years	3	Once Every 3-5 Years	3	Serious	3	8-11
Less than Once Every 10 Yrs	2	Less than Once Every 10 Yrs	2	Negligible- No Loss	2	Less and 8
Very Unlikely to Happen Ever	1	Very Unlikely to Happen Ever	1	No Loss Occurrence	1	

APPENDIX C4
MSDS FOR BULK EMULATION AND PRESPLIT

1. MSDS – Dyno Gold Lite Bulk Emulsion
2. MSDS – Detagel Presplit

Material Safety Data Sheet

Dyno Nobel Inc.
2650 Decker Lake Boulevard, Suite 300
Salt Lake City, Utah 84119
Phone: 801-364-4800 Fax: 801-321-6703
E-Mail: dnna.hse@am.dynonobel.com
FOR 24 HOUR EMERGENCY, CALL CHEMTREC (USA) 800-424-9300
CANUTEC (CANADA) 613-996-6666

MSDS # 1052
Date [redacted]

Supercedes
MSDS # 1052 03/21/05
Added Dyno® RG3

SECTION I - PRODUCT IDENTIFICATION

Trade Name(s): DYNO GOLD® C, DYNOGOLD® C EXTRA
DYNO GOLD® C LITE, DYNO GOLD® C LITE SUPER
DYNO GOLD® CS LITE
DYNO GOLD®, DYNO GOLD® LITE
DYNO GOLD® B, DYNO GOLD® B LITE
HD
1116, 1126P, 1136P, 1146P
IREMEX 362, IREMEX 562, IREMEX 762, IREMEX 764
RJ5
RG1-A
RUG-1 (Canada Only)
DX 5007; DX 5010
DX 5013; DX 5013G; DX 5013 PB
TITAN®XL1000
TITAN® 1000, TITAN® 1000 G, TITAN® PB 1000
DYNO® RG3

Product Class: Bulk Emulsion

Product Appearance & Odor: Translucent to opaque, viscous liquid. May be silvery in color. May have fuel odor.

DOT Hazard Shipping Description: As Transported:
Oxidizing Liquid, n.o.s. (Ammonium Nitrate) 5.1 UN3139 II
After Blending with Density Control Agent On-site:
Explosive, Blasting, Type E 1.5D UN0332 II

NFPA Hazard Classification: Not Applicable (See Section IV - Special Fire Fighting Procedures)

SECTION II - HAZARDOUS INGREDIENTS

Ingredients:	CAS#	% (Range)	ACGIH TLV-TWA
Ammonium Nitrate	6484-52-2	30-80	No Value Established
Sodium Nitrate[1*]	7631-99-4	0-15	No Value Established
Calcium Nitrate	10124-37-5	0-35	No Value Established
Fuel Oil	68476-34-6	0-10	100 ppm
Mineral Oil	64742-35-4	0-7	5 mg/m^3
Aluminum *	7429-90-5	0-5	10 mg/m^3

DYNO
Dyno Nobel

[1] Our source of Sodium Nitrate (Chilean) may contain perchlorate ion, which occurs naturally. Although Dyno Nobel does not analyze for the presence of perchlorate anion, based on published studies, the products listed above may contain between 0 and 300 ppm perchlorate.

* The hazardous ingredients marked with an asterisk are not found in the majority of listed products.

Ingredients, other than those mentioned above, as used in this product are not hazardous as defined under current Department of Labor regulations, or are present in deminimus concentrations (less than 0.1% for carcinogens, less than 1.0% for other hazardous materials).

SECTION III - PHYSICAL DATA

Boiling Point: Not Applicable
Vapor Density: (Air = 1) Not Applicable
Percent Volatile by Volume: <30

Evaporation Rate (Butyl Acetate = 1): <1

Vapor Pressure: Not Applicable
Density: 0.8 - 1.5 g/cc
Solubility in Water: Nitrate salts are completely soluble, but emulsion dissolution is very slow.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: Not Applicable
Flammable Limits: Not Applicable
Extinguishing Media: (See Special Fire Fighting Procedures Section)
Special Fire Fighting Procedures: Do not attempt to fight fires involving explosive materials or emulsion explosive precursors. Evacuate all personnel to a predetermined safe location, no less than 2,500 feet in all directions.
Unusual Fire and Explosion Hazards: May explode or detonate under fire conditions. Burning material may produce toxic vapors.

SECTION V - HEALTH HAZARD DATA

Effects of Overexposure

Eyes: Can cause irritation, redness and tearing.
Skin: Prolonged contact may cause irritation.
Ingestion: Large amounts may be harmful if swallowed.
Inhalation: May cause dizziness, nausea or intestinal upset.
Systemic or Other Effects: *Perchlorate*: Perchlorate can potentially inhibit iodide uptake by the thyroid and result in a decrease in thyroid hormone. The National Academy of Sciences (NAS) has reviewed the toxicity of perchlorate and has concluded that even the most sensitive populations could ingest up to 0.7 microgram perchlorate per kilogram of body weight per day without adversely affecting health. The USEPA must establish a maximum contaminant level (MCL) for perchlorate in drinking water by 2007, and this study by NAS may result in a recommendation of about 20 ppb for the MCL.

Emergency and First Aid Procedures

Eyes: Irrigate with running water for at least fifteen minutes. If irritation persists, seek medical attention.
Skin: Remove contaminated clothing. Wash with soap and water.
Ingestion: Seek medical attention.
Inhalation: Remove to fresh air. If irritation persists, seek medical attention.
Special Considerations: None.

SECTION VI - REACTIVITY DATA

Stability: Stable under normal conditions. May explode when subjected to fire, supersonic shock or high-energy projectile impact, especially when confined or in large quantities.
Conditions to Avoid: Keep away from heat, flame, ignition sources and strong shock.
Materials to Avoid (Incompatibility): Corrosives (strong acids and strong bases or alkalis).
Hazardous Decomposition Products: Nitrogen Oxides (NO_x), Carbon Monoxide (CO)
Hazardous Polymerization: Will not occur.

SECTION VII - SPILL OR LEAK PROCEDURES

Steps to be taken In Case Material is Released or Spilled: Protect from all ignition sources. In case of fire evacuate area not less than 2,500 feet in all directions. Notify authorities in accordance with emergency response procedures. Only personnel trained in emergency response should respond. If no fire danger is present, and product is undamaged and/or uncontaminated, repackage product in original packaging or other clean DOT approved container. Ensure that a complete account of product has been made and is verified. Follow applicable Federal, State and local spill reporting requirements.
Waste Disposal Method: Disposal must comply with Federal, State and local regulations. If product becomes a waste, it is potentially regulated as a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR, part 261. Review disposal requirements with a person knowledgeable with applicable environmental law (RCRA) before disposing of any explosive material.

SECTION VIII - SPECIAL PROTECTION INFORMATION

Ventilation: Not required for normal handling.
Respiratory Protection: None normally required.
Protective Clothing: Gloves and work clothing that reduce skin contact are suggested.
Eye Protection: Safety glasses are recommended.
Other Precautions Required: None.

SECTION IX - SPECIAL PRECAUTIONS

Precautions to be taken in handling and storage: Store in cool, dry, well-ventilated location. Store in compliance with Federal, State and local regulations. Keep away from heat, flame, ignition sources and strong shock.
Precautions to be taken during use: Avoid breathing the fumes or gases from detonation of explosives. Use accepted safe industry practices when using explosive materials. Unintended detonation of explosives or explosive devices can cause serious injury or death.
Other Precautions: It is recommended that users of explosives material be familiar with the Institute of Makers of Explosives Safety Library publications.

SECTION X - SPECIAL INFORMATION

The reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR 372 may become applicable if the physical state of this product is changed to an aqueous solution. If an aqueous solution of this product is manufactured, processed, or otherwise used, the nitrate compounds category and ammonia listings of the previously referenced regulation should be reviewed.

Material Safety Data Sheet

Disclaimer

Dyno Nobel Inc. and its subsidiaries disclaim any warranties with respect to this product, the safety or suitability thereof, the information contained herein, or the results to be obtained, whether express or implied, INCLUDING WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE AND/OR OTHER WARRANTY. The information contained herein is provided for reference purposes only and is intended only for persons having relevant technical skills. Because conditions and manner of use are outside of our control, the user is responsible for determining the conditions of safe use of the product. Buyers and users assume all risk, responsibility and liability whatsoever from any and all injuries (including death), losses, or damages to persons or property arising from the use of this product or information. Under no circumstances shall either Dyno Nobel Inc. or any of its subsidiaries be liable for special, consequential or incidental damages or for anticipated loss of profits.

Detagel Presplit

Material Safety Data Sheet

5700 N. Portland, Suite 301 / Oklahoma City, OK 73112 / Phone: (405) 947-0765 / Fax: (405) 947-0768

SECTION 1 - PRODUCT INFORMATION

TRADE NAME:	Presplit
SYNONYM:	NA
CHEMICAL FAMILY:	Watergel Slurry High Explosive
FORMULA:	Mixture
CAS NUMBER:	None
UN/NA NUMBER:	UN0241
DOT HAZARD CLASS:	Explosive, Blasting, Type E, Class 1.1 D

SECTION 2 - HEALTH ALERT

DANGER - If misused or disposed of improperly, material could explode and cause death or serious injury.
DO NOT HANDLE WHEN IN DOUBT!!
See section VIII - Personal Protection
CHEM-TEL, INC. (800) 255-3924.

SECTION 3 - HEALTH HAZARD INFORMATION

EYE: May cause moderate irritation.
SKIN: May cause moderate irritation characterized my redness and/or rash.
INHALATION: Inhalation of decomposed products may irritate the respiratory tract. Prolonged exposure to these fumes may result in respiratory difficulties (shortness of breath, etc.) and possibly more severe toxic effects.
INGESTION: Swallowing large quantities may cause toxicity characterized by dizziness, bluish skin coloration, methemoglobinemia, unconsciousness, abdominal spasms, nausea, and pain.

SECTION 4 - EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT: Flush with large amounts of water. Seek medical aid.
SKIN CONTACT :Remove contaminated clothing. Wash skin thoroughly with soap and water.
INHALATION: Remove from exposure. If breathing stops or is difficult, administer artificial respiration or oxygen. Seek medical aid.
INGESTION: Give 8-16 oz. of milk or water. Induce vomiting. Seek medical aid.

SECTION 5 - RECOMMENDED OCCUPATIONAL EXPOSURE LIMIT/ HAZARDOUS INGREDIENTS

EXPOSURE LIMIT (PRODUCT): None required for product. *React to form Hexaminedinitrate

HAZARDOUS INGREDIENTS:	PERCENT	EXPOSURE LIMIT	PPM	MG/M3
Ammonium Nitrate	<65%	NONE		
Sodium Nitrate	<20%	NONE		
Sodium Perchlorate	<7%	NONE		
Nitric Acid*	<5%	ACGIH - TLV	2	5
Hexamine*	<15%	NONE		
Aluminum	<7%	ACGIH - TLV		
Pentaerythritol Tetranitrate	<2%	NONE		

NOTE: All ingredients are present in a gelled slurry matrix and individual hazard may not be present in this formulation.

SECTION 6 - REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY: Heat (confinement); Stacking (burning).
INCOMPATIBILITY: Can react violently or explode, with reducing agents and organic materials. Avoid amines, strong alkalies & acids. ***HAZARDOUS REACTION / DECOMPOSITION PRODUCTS:*** At high temperatures, especially >374 F, may emit severe toxic fumes of nitrogen oxides. ***CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION:*** Not applicable.

SECTION 7 - FIRE AND EXPLOSION HAZARD INFORMATION

FLASH POINT & METHOD: NA ***AUTO IGNITION TEMPERATURE:*** Explodes ***FLAMMABLE LIMITS (% BY VOLUME/AIR): LOWER:*** NA ***UPPER:*** NA ***EXTINGUISHING MEDIA:*** Water ***FIRE-FIGHTING PROCEDURES:*** When explosive is burning, ***EVACUATE AREA.*** Avoid breathing vapor. Don't disturb fire, as dusty cloud containing aluminum may form explosive mixture with air. ***FIRE & EXPLOSION HAZARDS:*** Dangerous when exposed to heat or flame. Can support combustion of other materials involved in a fire and is capable of undergoing detonation if heated to high temperatures, especially under confinement including being piled on itself in a burning fire. When heated to decomposition, highly toxic fumes may be emitted. Do not return to area of explosion until smoke and fumes have dissipated. Dry alkali or amine salts are explosive.

Detagel Presplit

Material Safety Data Sheet

SECTION 7 - FIRE AND EXPLOSION HAZARD INFORMATION (con't.)

Internally, product contains detonating cord, consisting of flexible cord with and explosive core of PETN (pentaerythritol tetranitrate) within a textile casing covered by a seamless polyethylene jacket. This portion, if removed from the cartridge, may explode when subjected to fire or shock. PETN crystals, if separated or spilled, are substantially more sensitive to initiation by impact and friction than other components of the product, and care should be taken to avoid shock, friction, and excessive heat.

SECTION 8 - PERSONAL PROTECTION INFORMATION

EYE PROTECTION: Safety goggles approved for the handling of explosives materials.
SKIN PROTECTION: Neoprene, natural rubber, polyethylene or polyvinyl chloride gloves. Use barrier creams, hand protection and protective clothing. ***RESPIRATORY PROTECTION:*** Not normally required. Mechanical filter or supplied air type respirator as required for concentrations exceeding the occupational exposure limit.
VENTILATION: Maintain adequate ventilation. Use local exhaust if needed.

SECTION 9 - PERSONAL HANDLING INSTRUCTIONS

HANDLING: Explosives should not be abandoned at any location for any reason. Do not handle during electrical storms.
STORAGE: Store in a cool, dry, well-ventilated area remote from operations. Storage area should be of non-combustible construction and in accordance with appropriate BATF regulations. Organic materials, flammable substances and finely divided metals should be stored separately. Flames, smoking and unauthorized personnel are prohibited where this product is used or stored. Protect against physical damage, static electricity and lightning.
WARNING: Use of this product by persons lacking adequate training, experience and supervision may result in death or serious injury. Obey all Federal, State, and local laws / regulations applicable to transportation, storage, handling, and use of explosives.
DISTANCE: Always stay from area of explosion or disposal sites. Stay behind suitable barriers.

SECTION 10 - SPILL & LEAK PROCEDURES

PROCEDURES IF MATERIAL IS RELEASED OR SPILLED (IN ADDITION, SEE SECTION 8): Isolate area. Eliminate ALL sources of ignition. Avoid skin contact. Scrape up. Remove soiled clothing.
WASTE DISPOSAL - USE APPROPRIATE METHOD(S): Disposal of unexploded or deteriorated explosives material can be hazardous. Expert assistance is positively recommended in destroying explosives. Accidents can be prevented by thorough planning and handling in accordance with approved methods. Consult your supervisor, or the nearest SEC Regional Office for assistance. If improperly disposed of, material could explode and cause death or serious injury.

In all cases, follow facility emergency response procedures. Contact Facility Environmental Manager for assistance. Report any discharge of oil or hazardous substance that may enter surface waters to the National Response Center (800) 424 - 8802.

Observe all applicable local, state, and federal environmental spill and water quality regulations.

SECTION 11 - PHYSICAL DATA

BOILING POINT: NA ***BULK DENSITY:*** 1.25 g/cc ***MELTING POINT:*** NA ***%VOLATILE BY VOLUME:*** NA
VAPOR PRESSURE: NA ***EVAPORATION RATE (ETHER=1):*** NA ***SOLUBILITY IN WATER:*** Negligible with short term exposure
APPEARANCE/ ODOR: Odorless ,gray/white gel packaged in polyethylene cartridges ***DECOMPOSITION POINT:*** 200 C

SECTION 12 - COMMENTS

This product is classified as a Class 1.1D High Explosive and must be stored in a high explosive magazine. Storage should be in a well constructed, well ventilated, dry structure located to conform with local, state, and federal regulations. The area surrounding an explosive magazine must be kept clear of combustible materials for a distance of 50 feet. Magazine floors and containers must be properly cleaned. Normal operating conditions are assumed unless otherwise stated. If any given information is not clear or does not apply to your situation, STOP, store the material suitably, and seek correct help from your supervisors, Institute of Makers of Explosives or Slurry Explosive Corporation.

Disposal sites must be clear of people at the time of disposal.

NOTICE: The data and recommendations presented herein are based upon data which are considered to be accurate. However, SEC makes no guarantee or warranty, either expressed or implied, of the accuracy or completeness of these data and recommendations. For more detailed information on the hazards of this product, contact the Regulatory Compliance Department at the address below:

Slurry Explosive Corporation
P. O. Box 348
Columbus, Kansas 66725
(620) 597-2552

Revised 6-2001

MEADOWBANK GOLD PROJECT

Operation & Maintenance Manual
Sewage Treatment Plant

In Accordance with Water License 2AM-MEA0815 & 8BC-TEH0809

Prepared by:
Agnico Eagle Mines Limited – Meadowbank Division

Version 4
April 2013

EXECUTIVE SUMMARY

The Nunavut Water Board (NWB) has issued Type A Water License 2AM-MEA0815 to Agnico Eagle Mines Limited (AEM) for the Meadowbank Gold Project site authorizing the use of water and the disposal of waste required by mining and milling and associated uses.

AEM has prepared the following document which summarizes the operational and maintenance procedures to be followed at the sewage treatment plant.

This report documents the stand alone Operation & Maintenance Manual – Sewage Treatment Plant, as specified under Water License 2AM-MEA0815 Part D, Item 19 and includes the following requirements:

- The manual was prepared in accordance with the "Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories, 1996", and adapted for the use of a mechanical sewage treatment facility;
- The manual includes contingency measures in the event of a plant malfunction;
- The manual includes sludge management procedures; and
- The manual incorporates the Operation and Maintenance Manual requirements of 8BC-TEH0809, Part D, Item 10.

IMPLEMENTATION SCHEDULE

As required by Water License 2AM-MEA0815, Part B, Item 16, the proposed implementation schedule for this Plan is outlined below.

This Plan will be immediately implemented (April 2012) subject to any modifications proposed by the NWB as a result of the review and approval process**.**

DISTRIBUTION LIST

AEM Internal:

- Site Services Superintendent
- Site Services General Foreman
- Environmental Superintendent
- Environmental Coordinator
- STP Operator

DOCUMENT CONTROL

Version	Date (YMD)	Section	Page	Revision
1	08/11/07			Operation and Maintenance manual
2	July 2012			Complete review of Operation and Maintenance Manual
3	February 2013			Complete review of Operation and Maintenance Manual
4	April 2013			Change in sampling frequency and parameters of analysis

Prepared By: _____
Environmental Department

Approved by: _____
Kevin Buck Environment Superintendent

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1. INTRODUCTION

1.1 PURPOSE

This sewage treatment plant (STP) operation and maintenance (O&M) manual for the Meadowbank Gold Project has been prepared in accordance with the Nunavut Water Board Type A Water License 2AM-MEA0815, Part D, Item 19, and is based on the "*Guidelines for the Preparation of an Operation and Maintenance Manual for Sewage and Solid Waste Disposal Facilities in the Northwest Territories, 1996, prepared by the Department of Municipal and Community Affairs, NWT*". The manual has been adapted for the use of a mechanical sewage treatment facility.

This manual is a component of the Meadowbank Environmental Management System. The objectives of this plan are summarized as follows:

1. To define the location, design and operating procedures to be used in the treatment of sewage generated at the Meadowbank Mine; and
2. To provide monitoring requirements for the STP.

1.2 BRIEF DESCRIPTION OF THE PROJECT

The Meadowbank Gold Project, operated by Agnico Eagle Mines Ltd. (AEM), is located approximately 70 kilometres north of the Hamlet of Baker Lake, in the Kivalliq Region of Nunavut. The center of operations is situated at 65^{o} 01' 9.12''N latitude and 96^{o} 04' 1.91''W longitude on NTS map sheet 66H/1. The site has been actively mining since March 2010.

Gold will be extracted using traditional open pit mining methods during the roughly five year remaining mine life (2018). Access to the site is via an airstrip at Meadowbank and via an all-weather access road from the Hamlet of Baker Lake. On-site facilities will include a mill, power plant, maintenance facilities, tank farm for fuel storage, water treatment plant, sewage treatment plant, and accommodation and kitchen facilities for 550 people.

1.3 CONTACT INFORMATION

The individuals responsible for the operation of the sewage treatment plant for the Meadowbank Gold Project are the following:

Site services Superintendent	867-796-4610 ext 6724
STP Operator	867-796-4610 ext 6758
Environmental coordinator	867-796-4610 ext 6728

2. BACKGROUND AND DESCRIPTION

2.1 HISTORY OF SEWAGE TREATMENT AT MEADOWBANK

The sewage treatment plant (STP) at Meadowbank first went into operation on May 15, 2008. It is located on the northern end of the mine site in a prefabricated structure adjacent to the accommodations camp. The proximity of the system to the camp optimizes the wastewater inputs. The treated wastewater is discharged into a small attenuation pond (formerly known as Teardrop Lake – now as the Stormwater Management Pond). It is less than 2m deep, and fishless. This water body is located between the plant site and Portage Pit, within the mine footprint, and is also used as a storm water management pond for the Meadowbank site. This wastewater is pumped periodically (when near capacity of the pond) with mill tailings or directly to the Tailings Storage Facility (TSF). There is no discharge of treatment effluent to the natural environment.

2.2 DESCRIPTION OF TREATMENT PLANT

A Rotary Biological Contactor (RBC) sewage treatment system has been installed at Meadowbank. Four RBC units are installed at site; the Seprotech L333 Rotordisk model, and three Biodisk LJ100 units. These units are designed to remove solids, organic material a limited amount of nutrients from the wastewater (sewage and grey water).

The main unit, the Seprotech L333, and two (plus one backup) Biodisk LJ100 units, run in a parallel series. An 80 m^3 capacity equalization tank is utilized prior to the treatment units and serves as an equalization tank to manage peak flows of influent (morning and evenings). The treated effluent from both systems passes through a U.V. disinfection system and flows to a common lift station (station 3) prior to discharge.

The operation of the RBC system is based on a continuous flow of wastewater through a series of stages. As wastewater flows through the RBC system, each successive RBC stage receives influent with lower contaminant concentrations than the previous. In general, treatment of wastewater by an RBC system includes the following processes:

- Aeration and mixing via rotating disks;
- Biological reactions on disk surfaces; and
- Sloughing of solids from rotating disks.

Prior to entering the RBC, untreated wastewater, as a pretreatment, passes through a screen system to provide for course solids removal prior to primary clarification. Wastewater can then flow into the RBC units, where it comes in contact with disks attached to a rotating shaft. The disks can be configured and corrugated in various patterns to provide increased surface area and enhanced structural stability as they rotate through the wastewater. Aeration and mixing occurs as the shaft and associated disks rotate through the wastewater. The disks provide surfaces on which microorganisms can react with ambient air and wastewater to convert ammonia to nitrate (termed nitrification) and reduce the Biological Oxygen Demand (BOD). As wastewater flows through the disks, sloughing of solids accumulated on the disks occurs by displacement and gravity. After the treatment process within the RBC is complete, the resulting wastewater is directed to settling tanks. These tanks are

necessary for secondary clarification. The settled solids remaining after secondary clarification is termed sewage sludge.

The Meadowbank RBC units are housed within an insulated tank with an insulated cover and are equipped with immersion heaters to ensure efficient operation under Northern adverse weather conditions. See below for Photographs of the system and Figure 1 for a flow diagram of the system.

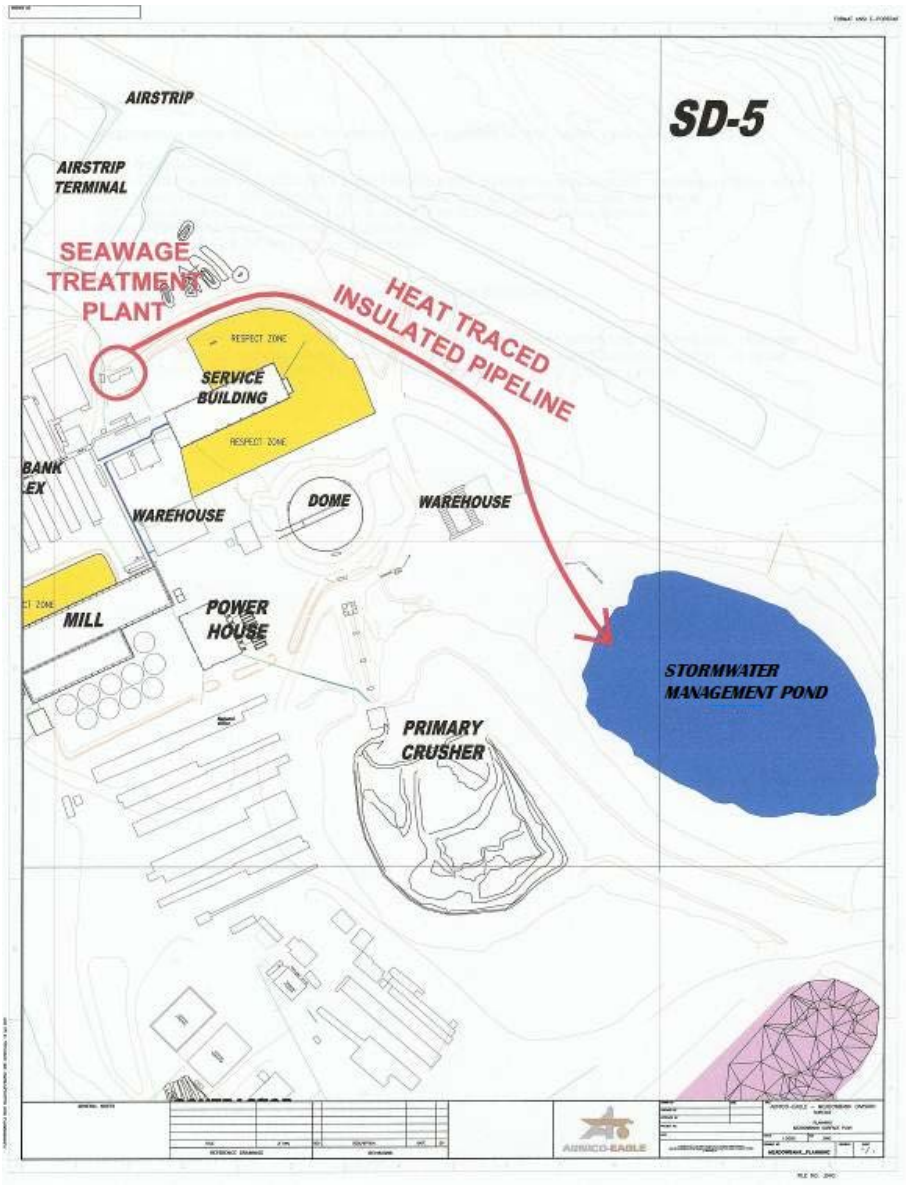

Figure 1 – Flow Diagram

2.3 SEWAGE GENERATION AND COMPOSITION

The STP at Meadowbank is capable of handling 188 m^3 per day. With a biological oxygen demand (BOD) of approximately 350 mg/L, the L333 has a capacity up to 105 m^3, and the two Biodisks, operating in a series, another 27.5 m^3 each. These units provide primary and secondary treatment.

On average between 100 m^3 and 120 m^3 of sewage and grey water is generated at site each day. Daily records are maintained of the amount of sewage and grey water generated.

The composition of the sewage and grey water entering the plant and the composition water exiting the units are monitored monthly (to determine plant efficiencies). Initially, STP Operations and Maintenance Manual stated that samples were taken weekly to make sure the units are operating correctly. In February 2013, AEM reduced sampling frequency to once every two weeks and to once per month in May 2013. The reasons for this sampling frequency reduction are;

- Sampling data from the last three years certainly indicates that units are operating as designed and show little variability in the results;
- Raw sewage stream basically doesn't change;
- Operators do daily operational inspection and perform weekly maintenance and repairs, if necessary. The daily operational inspections identify problems efficiently and quickly and have proven to be as effective as sampling;
- If there is major problem or failure in the RBC it would be most likely due to changes in the influent (raw sewage) ie high strength sewage (BOD high) killing bacteria in the RBC. In this case, there would be visible effluent problems (part of daily operational checks), low dissolved Oxygen (part of daily operational checks) and increased odours that the operator would note. If this occurs, a sample will be taken to try to determine the source of the problem;
- RBC effluent is not discharged to the environment;
- Sampling weekly or bi-weekly at this point is not necessarily and does not provide any more useful data than a monthly sampling and the daily operational checks provide.

Average results for 2012 are presented in Table 1 to provide an example of the characteristics of the raw sewage (influent) and the effluent discharged from the RBC treatment units. Sludge generated as a result of the treatment process is collected and disposed of with mill tailings in the TSF. All monitoring results are contained in AEM's Annual Reports submitted to the Nunavut Impact Review Board and the Nunavut Water Board.

Table 1: Untreated and treated Water Quality from the STP (Influent and Effluent) – average for 2012

Parameter	Units	STP-IN (Influent)	STP-LJMIX (Effluent from combined LJ)	STP-SEP (Effluent from Seprotech)
BOD-5	mg/L	230	18	11
COD	mg/L	500	80	71
TSS	mg/L	161	27	21
Nitrate	mg N/L	0.02	24.17	22.12
Nitrite	mg N/L	0.01	1.29	0.45
pH		7.72	5.65	5.07
Total Phosphorus	mg/L	11.6	10.6	10.8
Ammonia	mg N/L	93	13.9	8.2
NTK	mg N/L	112	19.36	12.16
Fecal Coliforms	cfu/100 ml	4 846 666	721	84
Total Coliforms	cfu/100 ml	15 875 000	2458	1236

3. OPERATION AND MAINTENANCE

3.1 WASTEWATER COLLECTION

All sewage and grey water generated at Meadowbank is drained by gravity pipelines to a specific lifting station, then pumped through a heat traced insulated pipeline to the STP equalization tank. The number of lifting stations, and the building they service, is provided below.

- Lifting station 1 services the grey water generated from the kitchen grease trap, laundry room; this is strictly a grey water line that connects to lifting station 3
- Lifting station 2 services the dormitory accommodations in trailer units # 1 to 11; this is the main sewage line
- Lifting station 3 services the discharge line to the storm water management pond
- Lifting station 4 services the service building; this line connects to the main line
- Lifting station 5 services the mine operation office; this line connects to the main line
- Lifting station 6 services the power plant; this line connects to the main line
- Lifting station 7 services the mill; this line connects to the main line
- Lifting station 8 services the assay laboratory; this line connects to the main line
- Lifting station 9 services the dormitory accommodation in trailer unit # 12 and Site services building; this line connects to the main line
- Lifting station 10 services the nova camp sewage
- Lifting station 11 services the nova camp grey water
- Lifting station 12 services the gym and construction/training area

In addition to the sewage generated from the buildings above, a sewage holding truck picks up sewage three times per week from storage tanks at the Exploration Camp, the Emulsion Plant, the old Nahanni lunch room, the north gate washroom, the primary crusher washroom, and the airport washroom. This material is deposited into Lift Station # 2 which flows to the treatment plant.

3.2 SLUDGE MANAGEMENT

Sludge from the STP treatment units is pumped and transferred to the TSF as required. Sludge and other settled solids is also removed from Lifting Station # 2 and deposited at the TSF as required.

3.3 STORMWATER MANAGEMENT POND

AEM has built up the depth of this pond through construction of low permeability roadways around the perimeter of the pond. These roadways operate as dikes to increase capacity of the pond to better manage storm water and STP discharge flows. The treated sewage from the STP is pumped through a heat traced insulated pipeline to lifting station # 3 and then into the storm water management pond. When full the storm water pond is pumped to the TSF.

3.4 NORMAL OPERATIONAL AND MAINTENANCE PROCEDURES

The sections below outline the general operational and maintenance procedures at the plant; further details are available in the manufacturers' operating manuals in Appendix A (Seprotech), Appendix B (Biodisk) and in the Site Services protocols and Procedures - Appendix D.

AEM recognizes that in order to keep a properly functioning STP, certain material must be kept out of the influent raw sewage. These items are,

- Food and other kitchen grease are removed from the sewage in the kitchen via a grease trap. The grease trap is manually cleaned to keep this material out of the sewage treatment plant influent and the recovered grease co-disposed with the mill tailings (TSF) or placed in the camp incinerator.
- Camp rules and purchasing practices prohibit anti-bacterial soap products from being used on site to protect the biological activity in the RBC units.

3.4.1 Chemicals used in the Treatment Process

The dry bacteria product, BEC105, is used in the treatment process to stimulate biological activity when needed.

3.4.2 General Operation & Maintenance and Sampling Procedures and Frequency

The STP at Meadowbank went into operation in May 2008. The following are the general Operation & Maintenance and sampling procedures that have been employed since the plant's start up. Further details of Operation & Maintenance procedures are provided in the equipment operating manuals and in Site Services Protocols and Procedures (Appendix A, B, and D).

Daily

A daily inspection of the sewage collection system, heat traced pipelines, and treatment plant is conducted to ensure there are no spills or incidents to report.

Inspection and sampling sheets are completed every second day for each of the RBC units; these forms include:

- Daily weather observations;
- Discharge volumes;
- Turbidity;
- Dissolved Oxygen and pH measurements in the final discharge of the treatment units;
- Visual observations of the final discharge.

Example daily/monthly record sheets are provided in Appendix C.

Weekly

Maintenance inspections and repairs, if necessary, of bearings, pumps and hoses in the STP are conducted weekly.

Monthly

Influent (sewage and grey water) and effluent sampling of the final discharge from the Seprotech and Biodisk RBC units is conducted monthly. Parameters include:

- Ammonia
- Ammonia-nitrogen
- Total Kjeldahl Nitrogen
- Biological Oxygen Demand (BOD_5)
- COD
- Nitrate
- Nitrite
- Faecal Coliforms
- Total Coliforms
- pH
- Total Suspended Solids
- Total Phosphorus

Sample monitoring for Phosphorus in the treated effluent has been discontinued because the units do not have Phosphorus removal capability. AEM will continue to monitor Phosphorus in the influent sewage.

Every 6 Months

An inspection of the chain linkage in the RBC units will be conducted every 6 months and the gear oil is changed.

Annually

On an annual basis, each of the tanks will be pumped out for maintenance and cleaning purposes. Depending on the accumulation of sludge in the tanks it may be done more often or as required.

3.5 RECORD KEEPING

Records of the operational and maintenance and sampling procedures are kept daily in order to assist in the evaluation of the effectiveness of the sewage treatment plant.

The following is recorded on a daily basis,

- Volume of any effluent discharged to environment;
- Sewage volume collected;
- Details of any maintenance undertaken at site.

The record sheets are kept in the Sewage Treatment Plant office.

3.6 SAFETY PROCEDURES FOR OPERATORS

Employees working in the STP facility must be trained prior to commencement of work so that they are aware of the health and safety risks as well as the operational procedures associated with the STP. The following are two very important safety rules:

- No person shall drink the water in the plant or the water that is discharged from it; and
- Working with sewage requires adequate protection for operators. This includes wearing steel toed boots, hard hat, safety vest, protective glasses and protective gloves;
- All authorized personnel working in the STP must have received Hepatitis A and B vaccine.

Eye and hand wash are located in the plant for use in the event of accidental contact with unprotected hands or face due to splashing or other causes.

3.7 CONTROLLING ACCESS TO STP

Access to the STP at Meadowbank is restricted to authorized personnel only. All doors to the plant are locked, with only authorized persons having keys. Signs are posted on the STP entrance doors notifying all people that the entrance to the STP is for authorized personnel only.

No fencing is used to control access to the STP. Due to the remote nature of Meadowbank, there is no concern of non-mine personnel attempting to access the site.

4. EMERGENCY RESPONSE

4.1 FIRE

In case of fire at the STP, the on-site emergency response team would be notified as per AEM protocol. Instructions from the on-site emergency response team would be followed by all personnel at the STP. Further details of fire response are provided in the "*Emergency Response Plan*" prepared by AEM in October 2008 and revised in March 2012.

4.2 SPILL

In the event of a spill at the STP, the on-site emergency response team would be notified as per AEM protocol. Instructions from the on-site emergency response team would be followed by all personnel at the STP. Further details of spill response are provided in the "*Spill Contingency Plan*" prepared by AEM in August 2008 and revised in December 2011.

4.3 PLANT MALFUNCTION

In the event of a failure of one of the three operating RBC's (ie Seprotech and 2 LJ100's) there is a backup LJ100 unit available at all times.

The following other contingent measures can be applied by AEM in the event of an RBC malfunction at the Meadowbank Sewage Treatment Plant for more than 24 hours:

- Cut back on allowable camp water until the malfunction is corrected and use the equalization tank to retard the peak flow to the remaining RBC unit;
- Shut down the malfunctioning RBC unit until the malfunction is repaired and use only one of the two parallel units until repairs are completed; and
- Shut down all water use in the camp until the repairs are complete;
- Bypassing untreated STP influent around the malfunctioning RBC unit and holding this untreated influent in a holding tank or lined pond on site until the repairs are complete is another contingent measure that could be applied. The untreated sewage would then be pumped back to the STP when the unit is repaired. This will require the coincidental restriction of water use to minimize the volume of untreated influent being bypassed.

Appendix A : Seprotech Operation and Maintenance Manual

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INSTALLATION, OPERATION AND MAINTENANCE MANUAL

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IMPORTANT: READ THIS INSTALLATION PROCEDURE PRIOR TO START-UP.

1.0 SITE INSTALLATION OF ROTORDISK® SEWAGE TREATMENT PLANTS:

IMPORTANT: READ THIS INSTALLATION PROCEDURE PRIOR TO START-UP.

1.1 - Concrete Tankage for ROTORDISK®

If the ROTORDISK® unit supplied is to be encased in concrete tankage, the site preparation is as follows:

The unit is lowered into the concrete tankage, the pipe at the end of the unit is placed into the opening of the intermediate wall between the primary and final settlement chambers and lowered onto the anchor bolts (contractors supply).

Unit is to be lifted only at lifting points by use of hooks and spreader bars.

All anchor bolts (contractors supply) should be correctly located in concrete in a vertical position. In addition, all bolts should include a levelling nut.

All anchoring and levelling of ROTORDISK® unit on site is to be done by customer/contractor. When the unit is set onto the anchor bolts in the concrete tank, it must be levelled to a slope of no more than 3/4" in 20' along the length. The unit is then centred in the tank and completely bolted down.

After the unit has been bolted down, check alignment of shaft and sprockets and clearances of couplings where applicable prior to start-up, failure to do so may void manufacturer's warranty. Refer to this ROTORDISK® manual for details. If required, the contractor must perform levelling.

All hydraulic piping, to and from the unit, is to be supplied and installed by customer/contractor.

All input electric and hydro hook-ups to be done by customer/contractor to local governing regulations and a signed approval sent to SEPROTECH SYSTEMS INCORPORATED. Under no circumstances must electrical connections, junction boxes or equipment pertaining to the electrical function of the unit be installed in the ROTORDISK® tank.

SEPROTECH SYSTEMS INCORPORATED will supply a man on-site to assist customer/contractor at a specified rate and at customer/contractor discretion.

If unit is not shipped completely assembled assembly instructions and drawings will be supplied. (As shown)

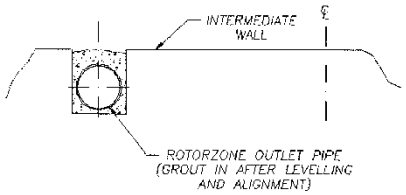


Figure a - **ROTORDISK®** tank outlet through intermediate wall between settlement tank chambers.

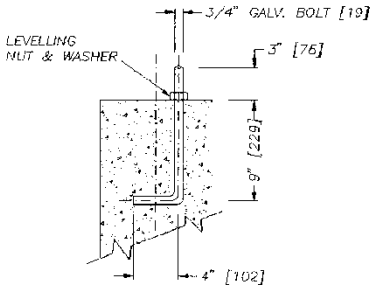
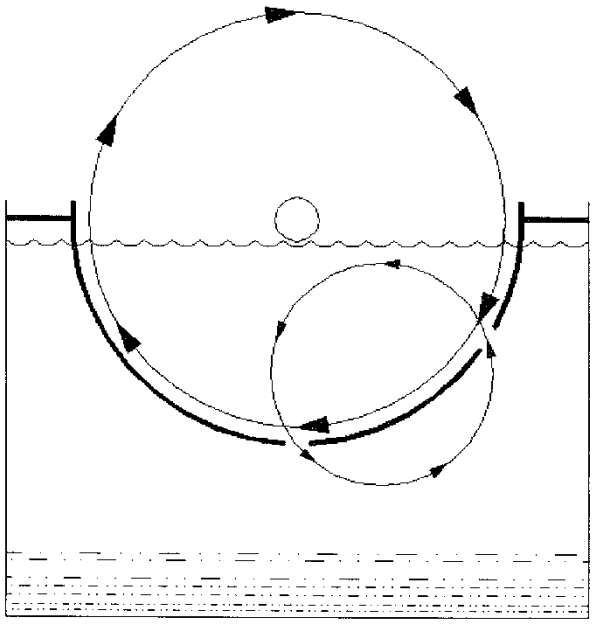


Figure b - anchor bolt detail for **ROTORDISK®** tank.

1.2 - DIRECTION OF SHAFT ROTATION



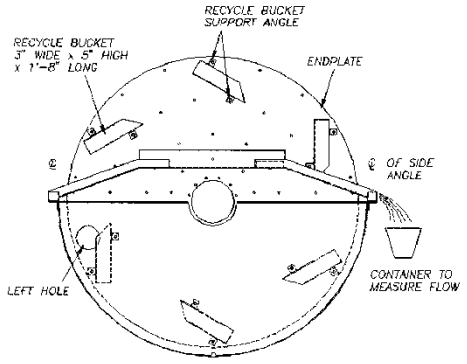
The direction of shaft rotation should be such that disks mounted on shaft will enter water on the side where inlet to "Rotorzone" is located. The electric motor driving the shaft should be wired accordingly.

1.3 - RECYCLE for ROTORDISK®

1.4.1 Recycle buckets are mounted on the last stage of the ROTORDISK®. These buckets rotate at the same speed as the disks. See the attached elevation view of the recycle buckets and trough on the Rotorzone tank.

1.4.2 As the disks rotate, the buckets scoop-up treated wastewater. As this wastewater falls into the recycle trough, it is exposed to the atmosphere, where it absorbs fresh oxygen. The wastewater then cascades on one side of the trough through a narrow steel channel and mixes back with the contents of the Primary Clarifier, thereby introducing fresh dissolved oxygen in the Primary Clarifier. See the section of diskbank assembly showing buckets and recycle trough.

1.4.3 The set-up described above is comprised of the recycle buckets and recycle trough, is what we term as our D.O. re-circulation device. This is especially advantageous to preventing septic conditions from occurring in the Primary Clarifier in small flow or low flow situations.



SECTION OF DISKBANK ASSEMBLY SHOWING 6 BUCKETS AND RECYCLE TROUGH

1.4 - SUMMARY OF OPERATION

(ROTORDISK® systems designed for BOD/SS/Ammonia/Nitrate removal)

The sewage plant (as supplied by SEPROTECH SYSTEMS INCORPORATED) is comprised of three (3) main components: the primary settling tank, the RBC tank, and the secondary settling tank.

Raw sewage is pumped and/or gravity flows into the primary settling tank (PST). When the sewage is pumped into the plant, pumping must simulate conditions encountered in gravity fed systems. Indeed, over a 24-hour period, the plant is designed to handle a flow rate corresponding to the Average Daily Flow (ADF) and can accommodate for two Peak Daily Flow (PDF) periods of two (2) hours per day. Each PDF event can be at a maximum of three times ADF.

In the PST, sedimentation separates heavy solids from the bulk of the liquid and the supernatant enters the aerobic section through the inlet slot located at the front section of the RBC tank.

The aerobic section is made up of four stages. The 1st stage is mounted on one common shaft. This 1st stage is comprised of one (1) to three (3) disk banks. The normal colour of the bacteria in the 1st stage is dark brown. This is the stage where most of the BOD removal by biological oxidation occurs. The succeeding 2nd, 3rd, and 4th stages are mounted on the rest of the shaft or another common shaft. Each stage has one (1) to three (3) disk banks. It is in the 2nd stage that further BOD is removed, and if the BOD is removed to approximately 30 mg/l, nitrification will follow. As such, in the 3rd stage, nitrifying bacteria (those which convert ammonia (NH_3) in the form of ammonium ions (NH_4^+) into nitrite (NO_2^-) and, ultimately, nitrate (NO_3^-) predominate in the 3rd and 4th stages. The 4th and last aerobic stage has recycle buckets that introduce both fresh dissolved oxygen into the primary settling tank and nitrifying bacteria present in the recycled water.

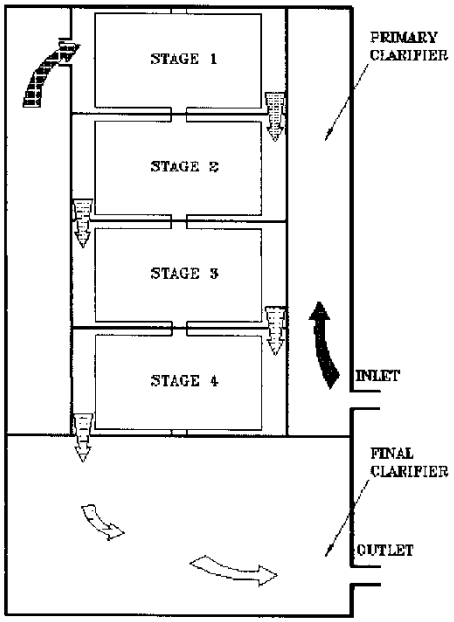
The rotation of the disks in and out of the water provides a mean of air and heat transfer from the ambient air to the water. The transfer of air to the water is important for aerobic bacteria to remove BOD and ammonia. The transfer of heat to the water is important to maintain the water at an optimum temperature of 15 °C and above such that BOD and ammonia removal rates by the bacteria are maximized (removal rates are a function of the water temperature). Because maintaining a temperature that provides acceptable removal rates is important to the process, RBC's are installed indoors and ambient air is maintained at 15 °C and above.

In the secondary settling tank, remaining suspended solids as well as sloughed off biomass from the disks settles and is pumped to the primary settling tank via sludge return pumps.

Chemical dosing of alum facilitates the coagulation and flocculation of aluminium phosphate resulting in the removal of phosphorus. Sodium bicarbonate can be used to maintain the pH balance throughout the process.

2.0 - ROUTINE VISUAL CHECKS ON PHYSICAL AND BIOLOGICAL FUNCTIONING OF ROTORDISK® & DESCRIPTION OF TREATMENT PROCESS

ROTORDISK® sewage treatment plants have three major steps in the purification process. In the primary settling tank, gross solids separate from the flow by either sinking or floating. In the Rotorzone, dissolved pollutants are broken down to simple, non-pollutant compounds by the bacteria ("biomass"), which grows on the rotating disks. The final settling tank permits gravity separation of spent biological growth, which continually sloughs off the disks in the Rotorzone preceding it.



2.1 - PRIMARY SETTLING TANK (PST OR PRIMARY "CLARIFIER")

The accumulation of floating scum on the surface of the primary clarifier is normal. It is proportional to the accumulation of settleable solids at the bottom of the tank. Periodic (9-12 months) removal of sludge at the bottom of the tank is required for proper operation of the Unit.

If no sludge, measuring device is available; the accumulation of 9"-12" depth of scum on the surface is a good indication that it is time to remove the accumulated deposits of sludge from the bottom of the tank(s).

2.2 - ROTORZONE

The Rotorzone is subdivided into four sections, with disk banks in each. The wastewater first enters the Rotorzone in the section marked "1" in the sketch (furthest away from the inlet to the plant). The flow then proceeds through sections 2, 3, and 4 before entering the final settling tank.

The accumulation of biological growth will be greatest in section 1, and gradually decrease through subsequent sections. Generally, the growth will be thick, and often filamentous ("stringy"), in section 1, becoming thinner and more compact through sections 2-4.

The colour of the growth will typically be dark brown to black in Section 1. Some grey growth may also be noticed, depending on the relative load and type of wastewater being treated. Growth in sections 2-4 will typically vary from medium brown to a light brown or tan growth in section 4.

In a well-functioning unit with the appropriate feed of wastewater, there will be an earthy, humus-like ("musty") smell inside the unit. A substantial sour, "sewage" smell may be an indication of sub-optimal conditions in the treatment process.

2.3 - 'BATHTUB RING'

The wastewater flows by gravity within a ROTORDISK® Plant thus the water level is relatively constant. Changes in water level of 1" to 2" are not unusual due to surge flows entering the unit. The evidence of this is a 'bathtub ring' 1" - 2" above the normal level. A 'bathtub ring' higher than this, suggests partial or complete flooding of the unit has occurred since the last check. If so, the (gravity or pump) discharge system should be checked for blockages or mechanical malfunction. Another condition, which can lead to the level of water rising to levels greater than 1" – 2"; is if the plant is fed by pumps, which exceed, the design limits of the plant (i.e., ADF over a period of 24 hours including a maximum of two (2) PDF events no longer than 2 hours each).

2.4 - FINAL SETTLING TANK (FST OR FINAL "CLARIFIER")

The effluent near the outlet at the backside of the final clarifier should be relatively clear and colourless and relatively free of suspended matter. Clarity can best be judged by scooping a small volume of the final effluent into a clear glass container. This is particularly true of larger units where the depth and dark colour of the tank walls may make clarity hard to determine. (Note: Although the risk of infection is very small, the wearing of rubber gloves is a rational safety precaution when hand-scooping the effluent for a clarity check. This is particularly true if there are open cuts on the hands.)

Although the final effluent itself should be relatively clear, some floating matter may accumulate on the surface of the final clarifier. This is normal, and will typically be much less than the accumulation of floating scum in the primary clarifier.

2.5 - MONITORING OF DISCHARGE FLOW RATE

The plant is equipped with a flow meter located on the influent pipe. This instrument is equipped with a counter that allows tracking of the total volume of clean effluent discharged by the plant.

2.6 - OPERATING PARAMETERS ADJUSTABLE ON THE CONTROL PANEL

Sludge pumps should be set to operate for 15s every 3h. Making changes and adjustments to the default plant's operating parameters requires a good understanding of the wastewater treatment process and should therefore only be performed by qualified and trained staff. Please contact SEPROTECH SYSTEMS INCORPORATED if assistance is needed to optimise the operation of the plant.

2.7 - FREQUENCY OF INSPECTION

Visual checks every week should be sufficient. However, for better preventative maintenance of the wastewater treatment plant and thus the capital investment, a daily walk through is often the preferred frequency of visit. Many owners prefer the visual and audible (look and listen) walk through. A standard operator checklist should be prepared and used by the person responsible for periodic maintenance of the plant at every visit. SEPROTECH SYSTEMS INCORPORATED can assist in preparing such checklist upon request.

3.0 - STANDARD RECOMMENDATIONS AND PROCEDURES FOR SLUDGE REMOVAL

3.1 - STORAGE CAPACITIES

A design feature of ROTORDISK®, which contributes greatly to overall simplicity of the process, is the sizing of clarifiers to accommodate static internal sludge storage for extended periods. Depending on such factors as raw wastewater solids concentrations, and design organic loading in a given application, maximum sludge storage levels will typically be reached in 6-9 months of operation.

This period is based on calculated rates of initial decomposition of raw and biological solids, and, upon operating experience, indicating the degree of auto-digestion/compacting, which proceeds during the storage period. The 6-9 month period will be shortened to the extent that design hydraulic and waste loads are exceeded. It will be lengthened to the extent that flows and waste load are less than those designed for.

3.2 - DETERMINATION OF ACCUMULATED SLUDGE VOLUMES

The accumulation of maximum storage capacities can be indirectly monitored through visual observation of the thickness of the scum blanket on the surface of the primary clarifier. When the scum blanket has matured to a height of approximately 7"-10", this is a good indication that sludge accumulations at the bottom of both clarifiers are at or near maximum levels, and that sludge withdrawal is indicated.

A more accurate procedure of determining sludge levels is to directly measure actual accumulations, and compare these to the maximum storage capacities listed on the "Details" section of the general arrangement drawing for the ROTORDISK® model in question.

A variety of sludge measuring devices is commercially available. The two most common are the weighted hollow tube type, and, the (electronic) turbidity-change detector type. The former is less

costly, relatively easy to use, and more appropriate because of the low frequency with which measurements need to be made in a ROTORDISK® unit.

Whatever means of measuring the sludge may be selected; it must be kept in mind that the sludge is not a firm solids substance. Domestic wastewater sludge is mostly trapped water and other liquids. Only to determine sludge levels by "feeling" for a solid layer with a stick or pole. The settled sludge is far more liquid than the surface scum, which is perhaps 30-40% solids, by volume.

Irrespective of the type of device used, sludge levels should be measured at several locations in each settlement tank to ensure a reasonably accurate calculation of accumulated volumes. This is required since sludge accumulation levels are not uniform; being highest at the inlet ends of both clarifiers, and, below the slot at the bottom of the first section of the Rotorzone trough.

Once an average sludge height has been determined, multiply by the surface area of the clarifier in question to determine the existing volume of stored sludge. Compare to maximum design capacity listed on the general arrangement drawing. If the accumulated levels equal or exceed design values, it is time to remove the sludge from the unit.

3.3 - SLUDGE REMOVAL

A pump-out truck of the same type that pumps out septic tanks normally does the sludge removal. For smaller ROTORDISK® units, the entire liquid contents of the treatment plant can be withdrawn. For larger installations, the haulage contractor should be instructed to get the suction hose directly to the bottom of the tanks and withdraw the sludge only, while taking as little of the supernatant as possible. Once the primary sludge is withdrawn from the primary settlement tank, the supernatant of the secondary clarifier can be transferred to the primary settlement tank to expose the secondary sludge. The suction hose should be placed down at a multiple number of points to help ensure complete removal of accumulated sludge deposits. Floating surface scum should also be removed. Haulage contractors should be given a brief description of the unit and its operation if they are not already familiar with it. A particular point to emphasise is that the biological growth on the disks should not be washed off, but should be left in place. The exception to this is if the disks have accumulated excess biomass due to sludge pump out being delayed past the indicated intervals.

Sludge removed from the unit is normally hauled away by the pumping truck and disposed of at municipal facilities, or, by controlled spreading on farmland. On-site disposal in shallow trenches and/or some form of on-site volume reduction (prior to export) may be feasible or desirable depending on the specific opportunities and limitations afforded by the site of a given installation.

3.4 - POTENTIAL CONSEQUENCES OF OPERATING ROTORDISK® UNITS PAST DESIGNATED MAXIMUM SLUDGE STORAGE LEVELS

Sludge accumulations should be removed once they reach indicated maximum storage levels, because failure to do so could result in lowered treatment efficiency, and possibly cause serious damage to the structure of the Rotating Assembly and drive unit. The potential for problems is as described below and depicted in the attached sketches.

Figure (c) shows a unit operating with sludge build-ups at or near maximum storage levels. This will cause no problem since the storage heights are designated so that flows through the primary clarifier will not disturb the sludge layer. Characteristics of wastewater reaching the Rotorzone at this time (and since start-up) will be in the range of 180-200 mg BOD/l and 50-250 mg SS/l. The

supporting structure of the rotating assembly is over designed for the amount of biological build-up which will occur on the disks under this operating condition, and the shear force of the rotation through the trough water will limit the thickness of growth.

However, if sludge is allowed to accumulate past designated storage heights, flow through the primary clarifier will begin to disturb the sludge blanket, and thus carry loads of solids and dissolved organic matter into the Rotorzone which are not anticipated in the design of the unit (Figure d). The pollutant load reaching the biomass on the first stage of disks will overload that biomass (in terms of F:M ratio), and force a change in its activity and growth. The biomass becomes more gelatinous, and does not shear off as well with disk rotation. Additionally, the biomass will readily adsorb and entrap the extra solids with the sum effect being an increase in weight on the rotating assembly that considerably exceeds that which its design is based on.

This tendency reaches its extreme if sludge is allowed to accumulate to the point where it will be disturbed by-, and caught up in -, the re-circulation pattern created by the two slots in the trough on the first section of the Rotorzone (see Figure e).

The sludge will have characteristics in the order of 20,000 mg TSS/l and 10,000 mg BOD/l, so it is obvious that even a minor amount of this material caught up in the re-circulation flow will significantly increase the concentration of the waste stream entering the Rotorzone. If, for example, the sludge was caught up in the recycle flow at a ratio of as little as 1:10 or 1:15, the resulting concentration would be sufficient to produce a considerable first-stage overload on an amount of disk area selected based on normal concentrations.

The resulting build-up of poorly-shearing gelatinous biomass and trapped solids would pose a serious potential for strain on the drive unit, and for structural damage to disk bank assemblies and shaft, in spite of them being considerably over designed for loads anticipated in normal operation.

Clearly, these potential problems should be avoided by the removal of sludge once it reaches the level specified as maximum for the ROTORDISK® unit in question.

3.5 - FRONT VIEW SCHEMATIC OF ROTORDISK®

UNIT OPERATING AT-, AND ABOVE-,
RECOMMENDED MAXIMUM SLUDGE STORAGE LEVELS

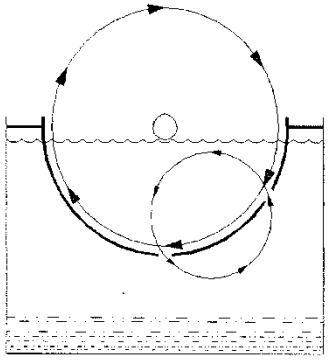


Figure c-unit operating at maximum sludge storage levels. Neither influent flows, nor re-circulating flows, disturb sludge blanket.

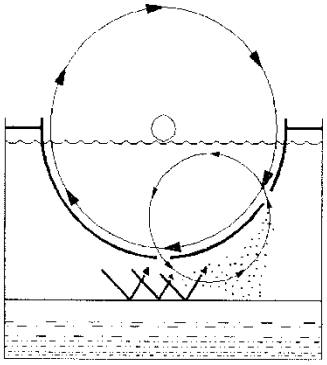


Figure d- unit operating with excess accumulations. Influent flows may disturb sludge blanket and increase BOD and solids loads to Rotorzone to levels above treatment design.

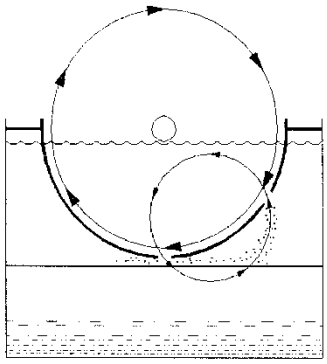


Figure e-Unit operating with excess sludge accumulated to base of Rotorzone. Both influent flows and re-circulation flows will disturb and carry sludge solids. Increase in BOD and solids loads entering Rotorzone will be substantially above design treatment levels, increase accumulated masses on rotating assembly, produce potential for damage to structure and drive unit.

3.6 - PUMPOUT PROCEDURES FOR ROTORDISK® TREATMENT SYSTEMS (summary)

Using suction hose, floating or surface scum should be removed first. Place the suction hose directly to the bottom of the tank and withdraw sludge only, while taking as little as possible of the volume of waste liquid above the sludge blanket (supernatant).

Move the hose at a multiple number of points along the bottom of the settlement tanks. Do not wash off biological growth (biomass) on the disks. The exception to this is excess accumulated biomass on the disks due to an overdue sludge pump-out. Excess accumulated biomass is when a disk bank is 100% fully covered with biomass and the colour is grey with a slight odour.

Keep a record of all pump-outs to arrive at an actual normal operating interval for sludge pump-outs. For systems with several flow meters, it is also beneficial to note the total flow generated between pump-outs.

3.7 - START-UP PROCEDURES OF ROTORDISK®

WARNING: A VALVE LOCATED AT THE BOTTOM OF THE DENITRIFICATION TANK AND EQUIPPED WITH A REMOTE ACTUATION MECHANISM WAS PROVIDED WITH YOUR UNIT. THIS VALVE:

- Needs to be OPEN: when the plant is first filled with water, during draining if the plant ever requires such operation and during subsequent refilling operations. FAILURE TO OPEN THIS VALVE DURING FILLING AND DRAINING WILL RESULT IN SERIOUS DAMAGE TO THE PLANT. This is because, during a filling operation, the water rising in the PST would push the denitrification tank upwards while it is empty (this tank wouldn't have had a chance to fill with water until the water level reaches the inlet slot between the PST and the aerobic ROTORDISK®. Th open valves provide a mean of filling the PST and the through (denitrification tank included) at the same time.

- Needs to be CLOSED: during normal operation of the plant. Indeed, the denitrification section contains water already partly treatment thus this water and that contained in the PST shouldn't mix. FAILURE TO CLOSING THIS VALVE DURING NORMAL OPERATION OF THE PLANT WILL RESULT IN A POOR QUALITY EFFLUENT.

The ROTORDISK® sewage treatment plant is based on a fixed film treatment process referred to as the Rotating Biological Contactor (RBC). In this process, micro-organisms or bugs are attached and grown on the surface of a media, the quantity of bugs being directly proportional to the amount of food in the wastewater. When starting up a new system, it will normally take about two weeks to get organic removal from the wastewater and three to four weeks to establish the nitrification process at normal domestic sewage temperatures. The method of and effluent discharge during system start-up should be discussed and thoroughly communicated with the environmental authority. The primary sedimentation tank and RBC of the system should, preferably, be filled with fresh water before admitting wastewater to the system. A flow less than design is not a problem. The biomass will develop themselves on the media. If there is a small flow only a portion of the disk will have biomass. As the flow increases the amount of biomass will increase.

Seeding a ROTORDISK® with activated sludge, although not required, can be accomplished. The activated sludge should be at the same temperature as the influent. Sudden changes in wastewater temperature cause biomass sloughing. In most cases, the use of domestic waste as a seed culture has provided the required biomass for continuous operation. When seeding the ROTORDISK® with activated sludge is decided, the primary sedimentation tank and RBC of the system should first be filled with fresh water (preferably) and the activated sludge added to the RBC. The RBC should be rotating at all times. The wastewater introduced to the tank needs to have only 20% of the disks covered with waste. This can already provide the needed wetting and still provide some time to reach normal operating levels when source flow is introduced. The final clarifier does not need to be filled with anything.

Alternately, seeding can be accomplished using dry bacteria and a source of organic carbon such as raw molasses or sugar. This can be done, for example, in situations where wastewater or activated sludge are not available and the plant needs to be ready to treat wastewater very shortly after it begins receiving it. By simulating the conditions encountered in wastewater (where large amounts of organic carbon and bacteria are present), biomass will establish on the ROTORDISK® and the plant can thus be prepared to work under actual conditions before these are actually encountered. SEPROTECH SYSTEMS INCORPORATED can help find appropriate supplies of both dry bacteria and raw molasses.

The preferred start up is the introduction of source wastewater at design or less than design loading. The disks need to be rotating at all times. When the disks are rotating and wastewater is introduced the biomass will develop and the pollutants will be removed.

The practice of starting up a sewage plant with a charge of septage or activated sludge may be appropriate for suspended growth systems where sludge return is an essential and necessary part of the process. However, start-up with septage is not an appropriate practice for fixed film systems such as the Rotating Biological Contactor process and is not recommended. This is especially true of the ROTORDISK® process and its static, internal storage of sludge.

Studies have shown that the natural start-up time for a ROTORDISK® is 2 1/2 – 3 weeks (normal temperatures and BOD reduction only), and that it has already developed sufficient biomass for 50% removals in only 1 week. These are time frames significantly shorter than respective ones for suspended growth systems. Thus there is little rationale for "pre-starting" a ROTORDISK® unit with septage.

Further, septage contains solids that are already well digested, and therefore not subject to further digestion-compaction in the storage zones. This contrasts to the fresh solids, which will undergo considerable digestion-compaction in the 6 – 9 months after initial settlement. Therefore, a charge of septage would contribute disproportionately to the accumulation of sludge levels, and necessitate a shorter interval to the first pump-out of the unit.

The ROTORDISK® concept of static sludge storage contributes greatly to its overall operation and maintenance simplicity. Following the above guidelines and recommendations will help ensure that the trouble-free simplicity of ROTORDISK® is maintained.

4.0 - STORAGE OF ROTORDISK® SEWAGE TREATMENT EQUIPMENT

If the unit is not to be operated for an extended period, then the motor-reducer assembly (drive unit) should be removed from its mound and stored at room temperature in a reasonably dry area (unless the whole unit is being stored in such an area).

Additionally:

1. Reducer: The input shaft should be given several turns once a month to re-lubricate the upper bearings.

NOTE: Some reducers are shipped to site filled with synthetic lubrication. Otherwise, fill the reducer with the lubricant (see reducer section of installation & maintenance instructions).

2. Motor: The motor has a tendency to take on moisture when not in operation. It requires no attention during storage, but before it goes into operation the insulation should be measured using a Meger. It should be at least 1.0 mega-ohm. If below 1.0 mega-ohm, it has taken on excessive condensation, and must be dried out before being operated. (Note: any electrical contractor or repair shop commonly understands these terms and procedures).

3. Support bearings on main ROTORDISK® shaft(s) should be re-lubricated prior to start-up.

4. The system should not be installed and operated in water. In the absence of sewage inputs and normal biological activity, freezing and consequent mechanical damage would be a distinct possibility. Water level in the primary settlement tank to be dropped to below the bottom of the Rotorzone tank level, if freezing of the tank contents is possible.

5.0 - ASSEMBLY PROCEDURE OF ROTORDISK® COMPONENTS SUPPLIED BY SEPROTECH SYSTEMS INCORPORATED

1. Upon receipt of mechanical components:

   a. Check packing list for any missing items on delivery.

   b. Motor/Reducer is shipped loose, for assembly on the reducer flange. The reducer is shipped completely filled with synthetic lubricant.

   c. Bearing components are shipped as a set. Open only when ready for assembly to avoid moisture contamination.

   d. Chain and sprockets are shipped as a set. Check for the following:

   -Large sprocket bushing (O.D.) fits into the large sprocket bore.
   -Large sprocket bushing bore (I.D.) fits the Rotordisk® shaft drive end.
   -Small sprocket bore (I.D.) fits on the reducer output shaft.
   -Cottered chain fits or matches the teeth on the sprockets.

   e. Coupling (applicable only to split-shaft ROTORDISK® is shipped as a set. Check the coupling hubs to ensure they fit the center stub ends of the ROTORDISK®shafts.

f. Disk banks are shipped pre-assembled on the shaft by SEPROTECH SYSTEMS INCORPORATED and are shipped on A-frames. Handle with care, as the Fiberglass of the disk banks is brittle.

g. Hardware (bolts, nuts, washers) for mounting the following items are provided:

-Bearings
-Reducer
-Recycle trough

2. If, for any reason, the diskbanks must be removed from the shaft, the procedure for remounting them is as follows:

If disk banks are 5 ft. in diameter or larger (supplied in semicircular sections)

Mount them on shaft(s) as shown on Dwg.# GL-28D, with 1/2-20NFX1-1/2 Bolts. Connect two half sections with two connecting plates (see sketch of typical mounting details) Remove outer nuts on required tie rods, fit connecting plate on tie rods over the end plates, then fasten them together with nuts and washers.

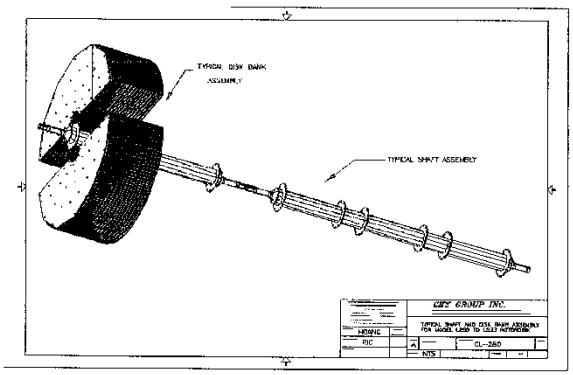


Figure f - typical mounting of disk banks on the shaft(s).

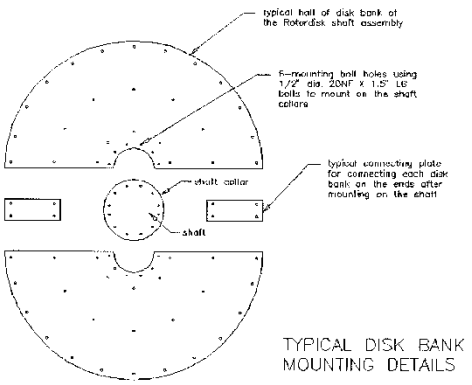


Figure g - exploded view of disk bank mounting parts.

3. Mount Bearings on Shaft(s).

   a) Bearing should be mounted at the centre of stub end. Follow bearing manufacturer's installation instructions.
   b) Use of the bearing fixing rings: one bearing of each pair is "fixed", the other "floating". Install the fixed bearing on the drive end of the shaft and the floating bearing on the non-drive end.

NOTE: All bearings mounted on tapered sleeves have to be driven up the taper to the tolerances given in the manual, using a bearing locking tool or equal. See installation, operation and maintenance instructions section of this manual regarding bearings.

4. Mount coupling hubs on their respective shafts (if applicable) so that hub face is flush with the end of its shaft (for direct drive and 'L' models). See installation, operation and maintenance instructions section of this manual regarding couplings.

5. Install shaft(s) in ROTORDISK® tank.

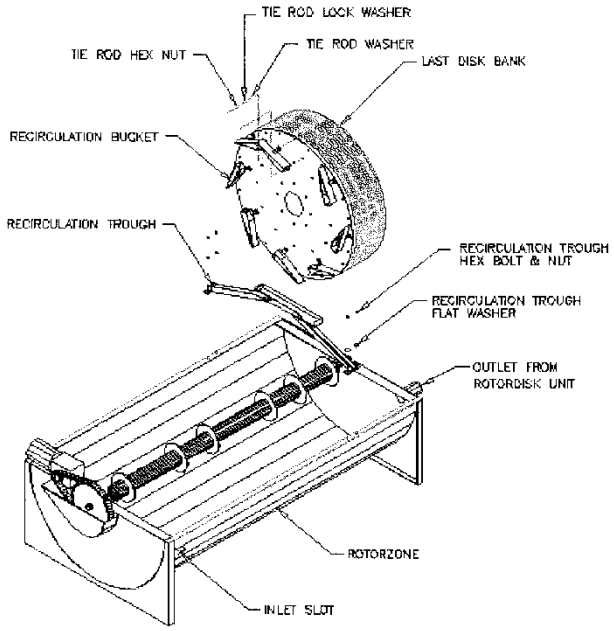
6. Mount small sprocket/coupling hubs on reducer output shaft (whichever is applicable).

7. Install Reducer-Motor Assembly in place. The reducer comes completely filled with synthetic lubricant. Ensure that the breather plug (mounted on top of one of the reducer oil intake ports) is installed on the reducer, after it is mounted on the ROTORDISK®. It is recommended that the motor be mounted into the reducer prior to assembly into the ROTORDISK® tank. Allow for some play in the reducer mounting bolt tightness so the chain tightness can be adjusted later.

8. Connect sprockets with chain. Check the axial alignment of the sprockets while tightening the chain. Tighten the previously loosened reducer mounting bolts after the sprockets are aligned and set in place. See installation, operation and maintenance instructions section of this manual regarding roller chain drives.

9. Connect two coupling hubs, grease, and fit coupling cover (if applicable). Before mounting, check bore on both hubs to match the shaft diameter. See installation, operation and maintenance instructions section of this manual regarding couplings.

10. Mount the stainless steel recycle trough on the ROTORDISK® tank with the bucket opening points to the proper rotation of the shaft.



NOTES:

1. Follow manufacturers instructions in the "Installation, Operation & Maintenance Manuals" included by SEPROTECH SYSTEMS INCORPORATED for mounting bearings, couplings (if applicable), reducer, sprockets and chain (if applicable).

2. Make sure all setscrews on sprockets and coupling hubs; bolts on reducer and bearings, are all well tightened before machine goes into operation.

6.0 - ROUTINE MECHANICAL MAINTENANCE OF ROTORDISK® SEWAGE TREATMENT PLANTS

6.1 - MOTOR:

If motor is equipped with grease fittings and relief plugs, it should be re-lubricated using a low-pressure gun once a year with Shell Alvenia R2" grease (DO NOT OVER-LUBRICATE). There is no lubrication required for motors without grease fittings and relief plugs

6.2 - REDUCER:

Reduction gear on ROTORDISK® units is filled with synthetic long life lubricant. No inspection or maintenance outside of periodic visual inspection is normally required. If there are no evidence of oil leaks on the seals, the synthetic lubricant must be changed every five (5) years for ROTORDISK® units running 24 hours a day.

Reduction Gear on medium and large ROTORDISK® size units are filled with Shell Tivela 75 oil and does not require oil changes (permanent lubrication). Periodic visual inspection is required. Check oil level and top up to required level with same oil, if necessary.

6.3 - BEARINGS:

Lubricant will deteriorate in time and rate of deterioration is a function of the operating conditions encountered. Lubrication cycle can be determined by analysing the samples taken near the bearing. See bearing manufacturer's maintenance instructions.

6.4 - SPROCKETS AND CHAIN:

(Applicable to non-direct drive ROTORDISK® units)

Chain drive should be inspected every six- (6) months for following points:
- If Chain is covered with grit or chips, it should be cleaned in kerosene and re-lubricated.
- Inspect oil for contamination, such as chips, dirt or grit. Replace oil if necessary (Oil with viscosity of SAE30 at ambient temperature 40° to 100° F is recommended).
- Milky white colour of the oil is indicative of flooding. Replace oil and determine the cause of the flood.
-Check Chain tension and adjust if required.

6.5 - COUPLING:

(Applicable for direct drive ROTORDISK®)

Coupling should be checked for lubricant level. Lubricant is to be added if required. Re-lubrication with NLGI#2 or LTG Grease once a year is usually adequate.

7.0 - TROUBLE SHOOTING

7.1 - MECHANICAL HARDWARE

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Noisy chain	1. Loose chain 2. Faulty lubrication 3. Misalignment 4. Worn Parts 5. Moving parts rubbing stationary parts	1. Tighten chain 2. Lubricate properly 3. Correct sprocket alignment 4. Replace worn chain 5. Align & tighten chain to clear oil bath
Rapid wear on chain	1. Faulty lubrication 2. Loose or misalign parts	1. Lubricate properly 2. Align & tighten entire drive
Chain climbing sprockets	1. Worn out chain and sprockets 2. Loose chain	1. Replace worn out parts 2. Tighten chain
Stiff chain	1. Misalignment 2. Worn out chain or sprockets 3. Faulty lubrication 4. Rust corrosion	1. Correct alignment 2. Replace worn out parts 3. Lubricate properly 4. Clean and lubricate
Noisy Bearing	Rollers or bearings damaged	Replace bearing cartridge
Bearing grease discoloured or mixed with water	Insufficient grease in the bearings	Purge bearing with grease and increase lubrication interval
Hot bearing	1. Improper lubrication 2. Rollers or bearing race damaged	1. Purge bearing with grease and decrease lubrication interval 2. Replace bearing cartridge
Reducer temperature rises above 200 degrees Fahrenheit.	Oil level too high or too low	Maintain proper oil level
Oil leakage from reducer	1. Oil seals need to be replaced 2. Ventilators/breather plugged causing pressure build-up inside the reducer. 3. Oil level too high	1. Replace oil seals 2. Clean Ventilators 3. Correct oil level
Noisy reducer	1. Bearing failure 2. Misalignment in worm gear inside 3. Coupling between motor and reducer worn out and misalign	1. Check bearings and replace if necessary 2. Align worm gear shafts. 3. Replace coupling between motor and reducer. Align coupling hub vertically
Noisy Motor	Bearing damage	Replace damaged bearings
Motor overheating	1. Reducer overheating 2. Cooling fins on motor are clogged 3. Overload 4. Rotor rubbing on stator 5. Over greasing or lubrication	1. Check reducer 2. Clean fins 3. Check for excess friction or imbalance 4. Replace bearings 5. Avoid packing grease too tightly
Motor won't start	1. Power trouble 2. Single phasing at station 3. Fuse blown	1. Check source of power supply 2. Do not try to make it go and "fry" motor. Check starter windings 3. Replace fuse
Knocking/rumbling on motor bearings	1. Bearing worn due to lack of lubrication or excessive mechanical overload 2. Bearings slack in housing	1. Replace bearing and put new grease of recommended grade. 2. Fit new end shields
Rotordisk® shaft doesn't turn	1. Power failure 2. Motor failure 3. Reducer failure 4. Chain drive failure	1. Check power supply 2. Check and replace motor and bearings. 3. Check teeth worn gears and bearings. Replace necessary parts 4. Replace chain

7.2 - ROTORDISK® PROCESS

ROTORDISK® TROUBLESHOOTING GUIDE

Problem	Cause	Corrective Action
1. Slime on media appears shaggy with a brown colour	PROPER OPERATION	NO PROBLEM. NORMAL CONDITION
2. Black slime growing on disks	Solids and/or BOD overloading	a. Pre-aerate RBC influent b. For severe organic overloads, increase recycle rate c. De-sludge unit d. Place another RBC unit in parallel
3. Rotten egg or other obnoxious odors	Solids or BOD overloading	See Problem 2, solutions a, b, c and d, above
4. Development of odors and white biomass over most of the media surface	1. Septic influent wastewater or high hydrogen sulfide or sulfate concentration	a. Determine the cause of the problem and correct it at source. For example, aerate equalization tank b. Pre-aerate influent wastewater c. Determine the cause of the problem, possibly with the addition of chlorine or hydrogen peroxide; potassium permanganate has also been used
	2. Overload first stage	a. Check dissolved oxygen levels to confirm overload problem b. Increase number of recycle buckets
5. White slime	1. Bacteria that feed on sulfur compounds. Also, industrial discharges containing sulfur compounds may cause an overload	▪ See Problem 2, solutions a and b above
	2. Grease on the disks	a. Remove grease at source b. Install grease traps
6. Sloughing or loss of slime (biomass)	1. Toxic or inhibitory substances in influent, including abrupt pH changes	a. Eliminate source of toxic or inhibitory substances b. Reduce peaks of toxic or inhibitory substances by carefully regulating inflow to plant c. Dilute influent using plant effluent or any other source of water d. See Problem 7.4
	2. Variation in flow or organic loading	a. During low flow or loading periods, pump from secondary clarifier or 4th stage RBC unit effluent to recycle water with food and dissolved oxygen through the RBC unit b. During high flow or loading conditions, attempt to throttle plant inflow during peak periods c. For severe organic under loads, add a cheap source of soluble carbon in the PST such as molasses

ROTORDISK® TROUBLESHOOTING GUIDE

Problem	Cause	Corrective Action
7. Decrease in process efficiency	1. Reduced wastewater temperature	a. Decrease air opening in RBC building b. Heat air inside RBC unit cover or building
	2. Unusual variations in flow or organic loading	▪ See Problem 6, cause 2, solutions a and b above
	3. Sustained flows or loads above design levels	▪ Install additional treatment units
	4. High or low pH values	▪ Adjust pH to near neutral
	5. Improper rotation of media	▪ Inspect chain tension and adjust
8. Accumulation of solids and clogging in the RBC system	Solids removal in pre-treatment steps is not adequate	a. Improve pre-treatment efficiencies b. Provide supplemental aeration to help prevent solids from settling c. De-sludge primary tank
9. Floating or rising sludge in the secondary clarifier	Removal of sludge from the clarifier is inadequate	a. Increase the duration of pumping sludge from the clarifier b. Remove sludge from the clarifier more often
10. Excess shaft weight or biomass thickness	1. Organic loading too high	▪ Decrease organic loading
	2. Stage loading too high	a. Increase number of recycle buckets
	3. Inorganic solids accumulation because of inadequate pre-treatment	▪ Check primary treatment and grit removal equipment for proper operation
	4. Accumulation of minerals	▪ Use chemical pre-treatment to eliminate minerals
	5. Digester supernatant adding excessive BOD or sulfides	▪ Modify supernatant pumping frequency
11. Shaft rotation non-uniform or "jerky"	1. Normal variations in balance	▪ Time rotation by quarters. A difference of less than 3 seconds in quarter rotation time is normal
	2. Uneven biomass weight due to power outage	a. If severe, shut unit down and wash down disks b. Turn off the unit temporarily and rotate manually to uniformly wet biomass growth before restarting c. Decrease or stop flow of wastewater to affected units d. Contact manufacturer for assistance

ROTORDISK® TROUBLESHOOTING GUIDE

Problem	Cause	Corrective Action
12. Effluent quality apparently below requirements	1. Organic loading too high	a. Add additional operating RBC's b. Identify cause of additional loading and eliminate at source c. Add supplemental air to RBC trough
	2. Sampling or testing procedures inaccurate	a. If nitrification is occurring, analyze for carbon BOD only by using nitrification inhibitor b. Check for contaminated dilution water, sampler lines, or improper sampling storage
	3. Inadequate secondary clarifier operation	a. Clean and de-sludge clarifier b. Modify sludge removal procedures to eliminate BOD kickback c. Install filters after clarifier d. Increase alum dose to enhance flocculation
	4. Anaerobic solids in the RBC tanks producing BOD kickback	▪ Flush or drain tanks
13. Snails or other nuisance organisms in RBC tanks	Nutritional and conducive environment for reproduction of hard-bodied shell snails ($^1/_8$" - $^1/_2$" in size)	a. Addition of controlled dosages of chlorine. Physical removal may be required with taking units out of service temporarily b. Contact manufacturer

Contact SEPROTECH SYSTEMS INCORPORATED for advice on how to resolve problems related to the process before making changes to the process or equipment.

Adapted from Water Pollution Control Federation "Manual of Practice OM-10", 1988.

8.0 - MAINTENANCE PROGRAM – Do's and Don'ts

8.1 - DO'S

1. Do use biodegradable soap if at all possible. The system will, however, handle a certain amount of normal soap. When laundering clothes, please follow manufacturer's instructions regarding quantity of detergent. Excessive use of detergent can cause odour in the system.

2. Do put large amounts of grease in a container and dump in garbage. The system will handle a certain amount of fat and grease. If a tile bed is used and if fats and grease get into it, they may plug the pores of the soil and seal up the bed. Never put large amounts of grease (i.e. old grease from deep fryer) into the sewer lines.

3. Have your system pumped out a minimum of once a year to remove sludge and scum to maintain top operating treatment in your system and filter bed.

4. For small systems equipped with a service hatch, keep the service hatch above the ground. Do not let run-off water enter system, as this will cause hydraulic overload.

5. If a tile bed is used, do keep traffic such as cars, snowmobiles, etc., away from the system bed areas as they will break pipes and seal the soil over the bed.

6. If a tile bed is used, do leave the raised filter in place without disturbing it. The filter is specifically designed to provide maximum dispersal of the water. Altering it by adding fill, covering it up or changing in any way may destroy its water dispersal characteristics and result in bed failure.

7. If a tile bed is used, do encourage a growth of ground cover over the filter bed as it helps disperse water by evaporation and transpiration.

8.2 - DON'Ts

1. Do not put non-biodegradable materials downs the drain, put them in the garbage, these include any plastics, rubber, disposable diapers, sanitary napkins, rubber goods, cigarettes, children's toys, cellophane, etc. They will plug the system, and a pump out will be needed.

2. Do not put harsh chemicals down the drain. They will kill the bacteria necessary for efficient treatment. These include acid or caustic cleaners, gasoline, oil, turpentine, photographic chemicals, etc. Disinfectant and chlorine bleaches should be kept to domestic uses.

3. Do not leave taps running or faulty toilets. The excess water may overload the system and, if used, tile field causing breakout and poor treatment.

4. If you do not have access to workers with appropriate training, do not attempt to fix the mechanical parts yourself. Your dealer is trained to repair your plant and work safely with electrical and mechanical components. Call him if you have a problem or concerns.

5. Do not connect any other electrical load to the fuse or breaker feeding the plant as it will cause damage to the controls.

6. Never put large amounts of grease (i.e. old grease from deep fryer) into the sewer lines.

YOUR CO-OPERATION WITH RESPECT TO THE ABOVE POINTS SHOULD ENSURE TROUBLE-FREE OPERATION OF YOUR TREATMENT PLANT AND WILL BE GREATLY APPRECIATED.

9.0 - INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS FOR VARIOUS MECHANICAL PARTS OF THE ROTORDISK® AND OTHER EQUIPMENT SUPPLIED

9.1 - INSTALLATION & MAINTENANCE DETAILS FOR ROLLER CHAIN DRIVES

CHAIN TENSIONING:
The proper fit of a chain may be obtained by adjusting the sprocket centres. When a chain is correctly tensioned, the total mid-span movement (double amplitude) in the slack span should be 4-6% of the span length for normal drives.

Where there is no adjustment means, adjustment may be made by removing links to compensate for elongation due to wear (Drives with fixed centres). Proper lubrication and proper drive maintenance may minimize chain wear.

LUBRICATION:
Although many slow-speed drives operate successfully with little or no lubrication beyond the initial factory lubrication, proper lubrication will greatly extend the useful life of every chain drive.

A good grade of clean petroleum oil without additives, free from flowing at the prevailing temperatures should be used.

Chain drives should be protected from abrasive and corrosive conditions, and the oil supply kept free of contamination. Periodic oil change is desirable. The lubricant viscosity recommended for ambient temperature 40° - 100°F is SAE 30.

OIL BATH:
With bath lubrication, the lower strand of chain runs through a sump of oil in the drive housing. The oil level should reach the pitch line of the chain at its lowest point while operating. Only a short length of chain should run through oil.

INSTALLATION RECOMMENDATIONS:
Shafting, bearings and foundations should be supported rigidly to maintain the initial alignment. Roller chain should be free of grit and dirt. Wash the chain in kerosene when required. Re-lubricate!

Misalignment results in uneven loading across the width of the chain and may cause roller link-plate and sprocket tooth wear. Drive alignment involves two things:

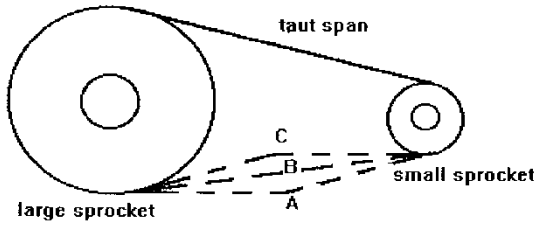
a) Parallel shaft alignment: Shafts should be parallel and level.
b) Axial sprocket alignment: Sprocket axial alignment can be checked with a straight edge, which will extend across the finished sides of the two sprockets.

Normally, it is good practice to align sprockets as close to the shaft bearings as possible.

Installing the Chain: Recheck all preceding adjustments for alignment and make sure all setscrews, bolts and nuts are tight. Fit chain around both sprockets and bring free ends together around one sprocket for connection.

Chain Tension: Check chain tension to be sure that the slack span has 4-6% mid-span movement in horizontal drives.

Recommended Possible Mid-Span Movement AC									
Drive	Tangent Length Between Sprockets								
Center-Line									
	5"	10"	15"	20"	30"	40"	60"	80"	100"
Horizontal to 45	.25"	.5"	.75"	1"	1.5"	2"	3"	4"	5"
Vertical to 45	.12"	.25"	.38"	.5"	.75"	1"	1.5"	2"	2.5"



AC = Total Possible Mid-Span Movement
Depth of Free Sag = .866 AB, approximately

MAINTENANCE RECOMMENDATIONS:

Regular maintenance schedules should be followed for all chain drives. Each drive should be inspected every six months. At each inspection period the following points should be checked:

a) Check Lubrication: If chain is covered with grit or chips, it should be cleaned in kerosene and re-lubricated before reinstalling. With bath lubrication, oil should be maintained at the proper level, as shown in lubrication instructions. Add oil if necessary. At each inspection, oil should be checked for contamination, such as chips, dirt or grit.

b) Check sprocket alignment: If the chain is properly aligned, no wear will show on the inner surfaces of the chain roller link-plates. If wear is apparent, this is evidence that sprockets are misalign and should be realigned as outlined in the installation instructions to prevent further chain and sprocket wear.

c) Check sprocket tooth wear: If sprocket shows evidence of wear high on the sprocket teeth, this is evidence of excessive wear in the chain and the chain should be replaced. If the sprocket teeth are severely worn, the sprocket should be replaced. Do not run new chain on worn sprockets.

d) Check chain tension: At each inspection period, the chain tension should be adjusted. If excessive slack has accumulated which cannot be removed by available shaft centre adjustment (i.e. by moving reducer away from large sprocket using chain tensioning bolts), two or more pitches of chain should be removed and chain reconnected.

9.2 - PROCEDURE FOR ASSEMBLING BEARINGS AND PILLOW BLOCKS

Shaft Preparation
Clean shaft and remove any burrs or sharp edges. Check the shaft diameter to given specifications.

Seal Installation
Place seal, which consists of: Double lip 'G' type seal

9.2.1 - MOUNTING OF BEARING ON SHAFT

Adapter Sleeve Mounting
Position adapter sleeve on the shaft to correct location with respect to required bearing centerline. A smear of lubricating oil (SAE 10 or 20) applied to the sleeve outside diameter surface results in easier bearing mounting and removal. (For pillow blocks mounted close to a pulley hub or similar obstruction, mount the adapter sleeve with threads inboard for easy removal. Remember to slide lock-nut, lock-washer and bearing onto the shaft before positioning the sleeve.)

NOTE: All bearings mounted on tapered sleeves have to be driven up the taper to the tolerances given in SKF tables, to ensure correct fits. Spherical roller bearings can be measured between the unloaded rollers and the outer ring sphere surface.

Un-mounted Clearance, Spherical Roller Bearings
Measure the un-mounted internal clearance in the bearing by inserting and sliding progressively larger feeler blades the full length of the roller between the most vertical unloaded rollers and the outer ring sphere. Never run the rollers over the feeler blade, as the wrong value will be obtained. Record the measurement of the largest size blade that will slide through. This is the un-mounted internal clearance.

Bearing
Mount the bearing hand tight on the adapter sleeve. Be sure the large end of the bore of the inner ring matches the taper of the adapter. To avoid damage to the bearing it is most important during this and subsequent operation that the shaft is blocked up so the bearing is unloaded. Do not apply lock-washer. Drive up procedure may damage it.

Bearing Drive Up, Spherical Roller Bearings
Lubricate the face and thread of the lock nut and apply to sleeve with chamfered face toward the bearing. Tighten the lock nut. Do not attempt to tighten the lock nut with a hammer and drift (use proper wrenches), the lock nut can be damaged and chips can enter the bearing. Further tighten the lock nut and measure the internal clearance until the internal clearance is less than the un-mounted clearance figure by the amount shown in the attached table (see last page). Finally, remove lock nut, position lock washer with outer tangs facing away from the bearing, and inner tang properly seated in the slot provided in the adapter. Replace lock nut and tighten until firmly seated.

9.2.2 - PREPARATION OF PILLOW BLOCK HOUSING

Check to be sure all pillow block parts are free of burrs and are completely clean. Internal surfaces should be removed. Apply a thin coat of grease to the bearing seat in the base. Fit the bearing and seal inserts into the pillow block base, being careful not to damage to O-rings. For assembling larger sizes where hoists must be used, it may be convenient to seat both bearings into their housing bases simultaneously.

FIXING RINGS

On each shaft one bearing is generally "Held" and other bearings are "Free", to permit shaft expansion. For "Held" bearing housings, use two fixing rings. Place one on each side of bearing.

CAPPING THE PILLOW BLOCK

Place the cap on the base so that the dowel pins in the base align with the holes in the cap, being careful not to damage the O-rings. Caps and bases are not manufactured for interchangeable assembly. They must be kept together. Install cap-bolts with lock washers and tighten securely.

GREASE LUBRICATED BLOCKS

Lubrication Notes

Grease Lubrication

If grease is used as a lubricant, it should be smeared between the rolling elements and worked in. The lower half of the housing should be packaged $^{1}/_{2}$ to $^{3}/_{4}$ full.

9.2.3 - PROCEDURE FOR APPLYING LUBRICANT TO BEARINGS AND PILLOW BLOCKS

Pack each bearing as completely full of the specified grease as possible by swiveling the outer ring open and rotating it as necessary to inject the grease. Then, swivel the outer ring closed being careful not to use force in the event a roller end catch the corner of the outer ring sphere.

B) Before assembling the pillow block cap to the base, and after completing bearing and base assembly, fill $^{1}/_{2}$ to $^{3}/_{4}$ of the pillow block base with the same lubricant that was used to pack the bearing.

9.2.3.1 - LUBRICATION PROCEDURE TO BE USED AT START-UP

A) All pillow block assemblies that have not been prepared for stage are ready for use, assuming the installation procedures have been correctly followed.

B) While shaft is rotating, lubricate each seal through the outside lubricant fittings until grease is seen emerging from the labyrinth areas. Make sure the outside of the lubricant fitting is clean before applying grease.

9.2.3.2 - RE LUBRICATION

Lubricants deteriorate in time, and the rate of deterioration is a function of the lubricant used at the operating conditions encountered. Determining the re-lubrication cycle depends on sampling the grease and analysis of the samples. Provisions must be made to adequately evaluate the contamination by solids. Samples for grease evaluation should be taken from near the bearing, and evaluation of the samples should dictate the re-lubrication cycle.

Remove caps once a-year and re-apply new grease.

Each seal assembly should be lubricated once a month, while the bearing is rotating, with the same grease that is used in the bearing.

9.3 - GREASE CLASSIFICATION

		Oil Viscosity Saybolt Second (approx. SSU)		
Class	Type of Base (1)	@ 100 F	@ 210 F	NLGI (2) Grade
A	Lithium or Equal	200 - 500	48 – 55	0
B	Lithium or Equal	400 - 600	58 – 68	1
C	Lithium or Equal	800 - 1,000	75 – 82	1
D	Lithium only	800 - 1,000	75 – 82	2

	Grease requirement from above			
Operating temperature of bearing (4)	Low (5)	Medium	High	Suggested Re-lube cycle
0 – 70	A or B			6 – 12 months
70 – 120	B or C			6 – 12 months
120 – 160	B or C	C or D (6)	D (7)	2 - 3 weeks
160 – 200	C	C or D (6)	D (7)	1 - 4 weeks

1) Calcium Complex Greases NOT recommended for spherical roller bearings.

2) National Lubricating Grease Institute Consistency Code.

3) Definition of speed categories:
Low: up to 1/4 of catalog speed limit for static oil lubrication.
Medium: 1/4 to 1/2 catalog speed limit for static oil lubrication.
High: 1/2 to full catalog speed limit for static oil lubrication.

4) Consult SKF Engineering if temperature is below 0° or above 200°F.

5) Extremely slow speed will require special consideration if loads are high.

* Under all conditions, application should be checked using the SKF lubricant film parameter found in the Engineer Data Catalog.

6) Use type "C" where load is heavy, 15,000 hours-rating life or less and/or speed are less than RPM.

7) Consult SKF Engineering - Grease lube not normally recommended under this combination of operating conditions.

8) Dry clean applications only. For moderate conditions of dirt and/or moisture, use cycle of 1 to 2 months. For extreme conditions of dirt and/or moisture, use cycle of 1 week. Vertical applications normally require shorter than normal re-lube cycle.

9) Never mix greases with unlike bases.

10) Remove old grease at least once a year.

10 - LIMITED WARRANTY

SEPROTECH SYSTEMS INCORPORATED warrants the parts in each treatment plant to be free from defects in material and workmanship; for a period of 15 months from shipment or 12 months from start-up, whichever occurs first, in the treatment of domestic wastewater. Sole obligation under this warranty is as follows:

SEPROTECH SYSTEMS INCORPORATED shall fulfil this warranty by repairing or exchanging any component part, F.O.B. our factory, that in SEPROTECH SYSTEMS' judgement, shows evidence of defects, provided said component part has been paid for and is returned through an authorized dealer, transportation prepaid. The warranty must also specify the nature of the defect to the manufacturer. New placed parts are under warranty for one year.

The warranty does not cover treatment plants that have been flooded, by external means, or that have been disassembled by unauthorized persons, improperly installed, subjected to external damage or damage due to altered or improper wiring or overload protection.

This warranty applies only to the treatment plant and does not include any other electrical wiring, plumbing, drainage, or disposal system. SEPROTECH SYSTEMS INCORPORATED is not responsible for any delay or damages caused by defective components or material, or for loss incurred because of interruption of service, or for any other special or consequential damages or incidental expenses arising from the manufacture, sale, or use of this plant.

SEPROTECH SYSTEMS INCORPORATED reserves the right to revise, change, or modify the construction and design of the treatment plant for domestic wastewater or any component part or parts thereof without incurring any obligation to make such changes for modifications in previously sold equipment. SEPROTECH SYSTEMS INCORPORATED also reserves the right, in making replacements of component parts under this warranty, to furnish a component part, which, in its judgement is equivalent to the Company part replaced.

Under no circumstance will SEPROTECH SYSTEMS INCORPORATED, be responsible to the warrantee for any other direct or consequential damages. Including but not limited to; lost profits, lost income, labour charges, delays in production, and/or idle production, which damages are caused by a defect in material and/or workmanship in its parts.

This warranty is expressly in lieu of any other expressed or implied warranty, excluding any warranty of merchantability or fitness, and of any other obligation on the part of SEPROTECH SYSTEMS INCORPORATED.

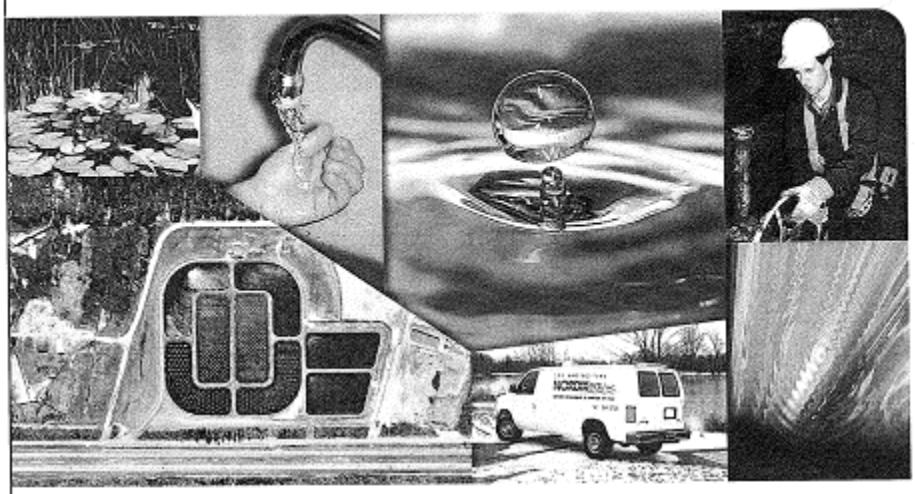
Appendix B : NORDIKeau Technical Support Manual

ORIGINAL

AEM

Agnico-Eagle Mines

TECHNICAL SUPPORT
SECTION 2



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50255 / JUNE 2010

ORIGINAL

AEM

Agnico-Eagle Mines

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5025S / JUNE 2010

AGNICO EAGLE

TECHNICAL SUPPORT
SECTION 2

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June 30th, 2010
(N/Réf. : 50255)

NORDIKeau INC.
EXPERTS TECHNIQUES EN GESTION DE L'EAU

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Appendix G HACH – SENSION 6 DISSOLVED OXYGEN METER

NORDIKeau INC.
EXPERTS TECHNIQUES EN GESTION DE L'EAU

1. INTRODUCTION

The operations manual is a practical guide for the operation and maintenance of the wastewater treatment system, Rotating Biological Contactors type, installed on the Meadowbank mine site to treat domestic effluents from the Main Camp and Nova Camp.

This manual is intended both to the operator and technical supervisor. It aims to collect and condense specific data of works in place. Whenever possible, information available on previous works has also been collected and grouped together to present the most coherent overall.

Typically the operations manual contains the main works components, and described its function, its characteristics and its operation. The equipments mechanical maintenance is briefly discussed, most often in reference with documents provided by the supplier. Finally, it also includes a method and tools to follow and document the works' functioning, including information that must appear in the Daily Operation Logbook.

The operations manual has been prepared assuming that the staff assigned to the building installations has a basic knowledge in wastewater treatment and possesses the necessary qualities and skills to plan and carry out all operating tasks, process control, and maintenance grouped in this manual.

The operator plays a key role and represents a factor in:

- The quality of treated water, in connection with the disposal requirements to be met, among others;
- the optimization of the operation that can significantly reduce costs (electricity, chemicals);
- the quality of equipment maintenance which, in turn, directly affects both short-term costs (repairs) and the medium and long term (parts or equipment replacement).

2. PROCESS DESCRIPTION & DESIGN CHARACTERISTICS

2.1 Process description

Rotating biological contactors (RBC) were originally developed in Europe and recently accepted by America and Asia. The process system is primarily a fixed-film biological reactor consisting of a synthetic medium mounted on a horizontal shaft and place in a contour-bottomed tank. The general concept of rotating biological contactors is to let wastewater flow through the tank, and to rotate the medium in the wastewater to be treated, alternatively exposing the medium (and the attached biological growth) to air and the wastewater. The slowly rotated media are 40% immersed in the wastewater for aerobic removal of organic waste by the biological film developing on the media. The lattice-structured medium, and to a lesser extent the disc structure, is fragile and should be protected from direct exposure to wind, sun, and weather fluctuation. Therefore, the media are usually enclosed in a superstructure or individual shaft covers.

Media rotation can be provided by either mechanical drives or air-motivated rotation. Rotation not only results in exposure of the film to the atmosphere as a means of aeration, but also provides rotational shear forces for stripping off the excess biomass on the medium. The stripped biological solids are maintained in suspension by the mechanical mixing action of the rotation medium or by supplemental diffused air, depending on the driving force of rotation. The air-driven system, in rotating the media by diffused air generated near the thank bottom, alleviates the development of undesirable anaerobic conditions, and also reduces the oxygen limitation, which often is the limiting factor in biological oxidation.

The most important factor affecting performance of the rotating biological contactors is the biological slime of those microorganisms that grow on a series of thin media, such as disc, mounted side by side on a shaft. When the process is first started, the microorganisms in the wastewater begin to stick to the medium surfaces and grow there until all the media are covered with a 1/16 to 1/8 in layer of biological slime. The attached biomass is similar to the biofilm in a trickling filter, except that the microorganisms are passed through the wastewater rather than the wastewater being passed over the microorganisms. As with all biological units, alkalinity, pH, nutrients, temperature, oxygen, biomass population balance, concentrations of pollutants, and so on, must be acceptable for efficient operation.

Most organisms cannot tolerate pH levels above 9.5 or below 4.0. In general, the optimum pH for biological growth lies between 6.5 and 7.8 for carbonaceous oxidation, between 8.2 and 8.6 for nitrification (12), and between 7.2 and 7.8 for denitrification. An alkalinity deficit can result from nitrification; thus a supplemental alkalinity source may be required. The inorganic nutrients normally present in domestic wastewater are sufficient to assure maximum biological growth, provided that all other environmental conditions are optimum. The nutrient needs should be checked when there is a significant industrial waste contribution. A suggested ratio of BOD_5:N:P is 100:5:1. Wastewater temperatures between 13 and 32 °C have no significant effect on process performance. The treatment efficiency, however, decreases with decreasing wastewater temperature below 13 °C. For year-round operation in warm climates, a simple sun roof is sufficient protection; whereas for year-round operation in cold climates, rotating biological contactor plants should be weatherproofed.

To achieve high treatment efficiency, the wastewater should be maintained under aerobic conditions throughout the entire treatment system for carbonaceous and nitrification. It is suggested that a minimum of 1 to 2 mg/L of dissolved residual oxygen be maintained in the tank to prevent oxygen deficiencies from limiting the substrate removal rate.

Each shaft of medium operates as completely mixed, fixed-film reactor, I which the biological growth rate and the excess biomass stripping rate are at dynamic equilibrium. As the treated wastewater and the stripped biomass pass from stage to stage, the wastewater undergoes a progressively increased degree of treatment by the specific biomass found in each stage, which in turn adapt to the changing wastewater. Microorganisms in the initial stages of a medium, which receive the highest concentration of organic wastes, are mainly ordinary bacteria responsible for carbonaceous oxidation. Higher life forms, such as nitrifying bacteria, protozoa, rotifers, and other predators, begin to appear in subsequent stages, where the concentration of organic substances gradually decreases form stage to stage.

2.2 Design characteristics

The sewage treatment plant (STP) has been designed to meet environmental requirements and site conditions.

The STP design includes two (2) parallel biodisks units and has been based on the following characteristics:

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DESCRIPTION	L 333	LJ 100	Total
Number of unit	1	3	4
Average Daily Flow	105 m³/d	3 x 27,5 m³/d	188 m³/d
Peak Hour Flow	4 x design	4 x design	4 x design
Influent BOD_5			250 mg/L
Total Suspended Solids (TSS)			250 mg/L
Total Ammonia			35 mg/L
Outdoor temperature			-40 to +40 °C
Indoor temperature			10 to 25 °C
Operating			24 hr / 365 day
Process details			
Hydraulic loading	105 m³/d	3 x 22,62 m³/d	173 m³/d
Bio support media area	3390 m²	3 x 487 m²	4851 m²
Bio support media diameter	2,44 m	1,63 m	
Primary clarifier capacity	73,09 m³	3 x 6,82 m³	93,55 m³
Final clarifier capacity	24,72 m³	3 x 3,88 m³	36,36 m³
Biozone capacity	18,12 m³	3 x 3,43 m³	28,41 m³

2.3 Effluent characteristics and performance guarantee

The STP has been designed to meet the effluent characteristics shown in table 2.1 below.

Prior to the construction of the Tailing Storage Facility, the License shall direct the effluent from Stormwater Management Pound to the monitoring station ST-35, to the northwest arm of Second Portage Lake and not exceed the government quality limits shown in table 2.1.

TABLE 2.1 EFFLUENT CHARACTERISTICS AND PERFORMANCE GUARANTEE

PARAMETER	STP Design	Government effluent quality limits	
	Monthly average	Monthly average	Grab sample
BOD_5	15 mg/L	25 mg/L	50 mg/L
TSS	15 mg/L	25 mg/L	50 mg/L
Fecal Coliforms	200 / 100 mL	1000 / 100 mL	2000 / 100 mL
Temperature	10 °C		
pH		6,0 to 9,5	6,0 to 9,5

3. DESCRIPTION AND OPERATION OF THE SEWAGE TREATMENT

3.1 Basic description of the sewage treatment plant

The sewage treatment plant has been designed to treat domestic wastewaters coming from the Main Camp and Nova Camp. As shown in Figure 1, treatment works include the following components:

- **Lifting station n° 1**

  Pumping station n° 1 is adjacent to the Main Camp. It receives grey waters coming from the kitchens and the laundry. A screen basket is installed in front of the inlet pipe to hold the unrefined wastes. These waters are currently pumped downstream to the STP, directly in pumping station n° 3 (LS-3), which insures the pumping of all effluent (treated or not) toward the Tailing Storage Facility.

- **Lifting station n° 2**

  Pumping station no 2 (LS-2) is adjacent to the STP. It receives sanitary wastewaters (washbasins, toilets, showers) coming from dormitories of Main Camp and, still to confirm, Nova Camp. These waters are pumped in the Equalization Tank (EQT) to be processed.

- **Equalization tank**

  The equalization tank (EQT) allows lopping flow peaks of the day. Wastewaters accumulated in this tank are pumped in constant flow towards the rotating biological contactors (RBC). The EQT is currently equipped with four (4) pumps. Pumps P-1 and P-2 send wastewaters towards LJ-1 and LJ-2 RBC, while pumps n° 5 and n° 6 are pumping wastewaters toward RBC L333.

- **Rotating biological contactors (RBC)**

  The RBC secondary treatment system is a fixed culture treatment process. The biological contactor (Rotorzone) is made of several thin plastic disks assembled around a horizontal axis. Microorganisms responsible for the degradation are naturally fixed to the disks and form a biofilm of about 1 to 4 mm of thickness. Approximately 40% of the disks surface is immersed. The disks' rotary movement around the axis alternately exposes the biomass to the atmosphere and the wastewaters, allowing the aeration and wastewaters mixing. The shearing forces created by the rotary movement limit the biofilm's thickness and lead to a

detachment of the excess biomass, which is then separated from the effluent with the help of a secondary settling tank (*final clarifier*).

A primary treatment system composed of a settling tank (*Primary tank*) is located under the biological contactor to hold fibrous solids, greases, scum, and other unwanted waste subjected to hang on to the disks.

The treatment system is composed of four (4) biodisks:

- One (1) unit SEPROTECH L333 designed to treat a 105 m^3/d daily flow.
- Three (3) units LJ-100 (one is not started yet) designed to treat an 83 m^3/d daily flow (27, 5 m^3/d per unit).

- **UV disinfection**

The wastewaters disinfection by ultraviolet radiation is the last stage of treatment before the treated waters is discharged towards the Tailing Storage Facility. It consists of sending wastewaters through a reactor composed of mercury vapor lamps emitting UV radiations. The radiations have the characteristic to inactivate the microorganisms.

The treatment system is composed of three (3) UV lamps:

- One (1) unit TROJAN, UV3000 PTP model, installed at the exit of biodisk L333
- Two (2) units SEVERN TRENT, ULTRADYNAMICS model, currently installed at the outlet of biodisks LJ-1 and LJ-2. Currently, these units are not in service.

- **Lifting station n° 3**

Pumping station n° 3 is located inside the WTS. It currently receives the final effluent of the STP and untreated grey waters from Main Camp and Nova Camp. Two (2) submersible pumps assure the pumping of these waters towards the Tailing Storage Facility.

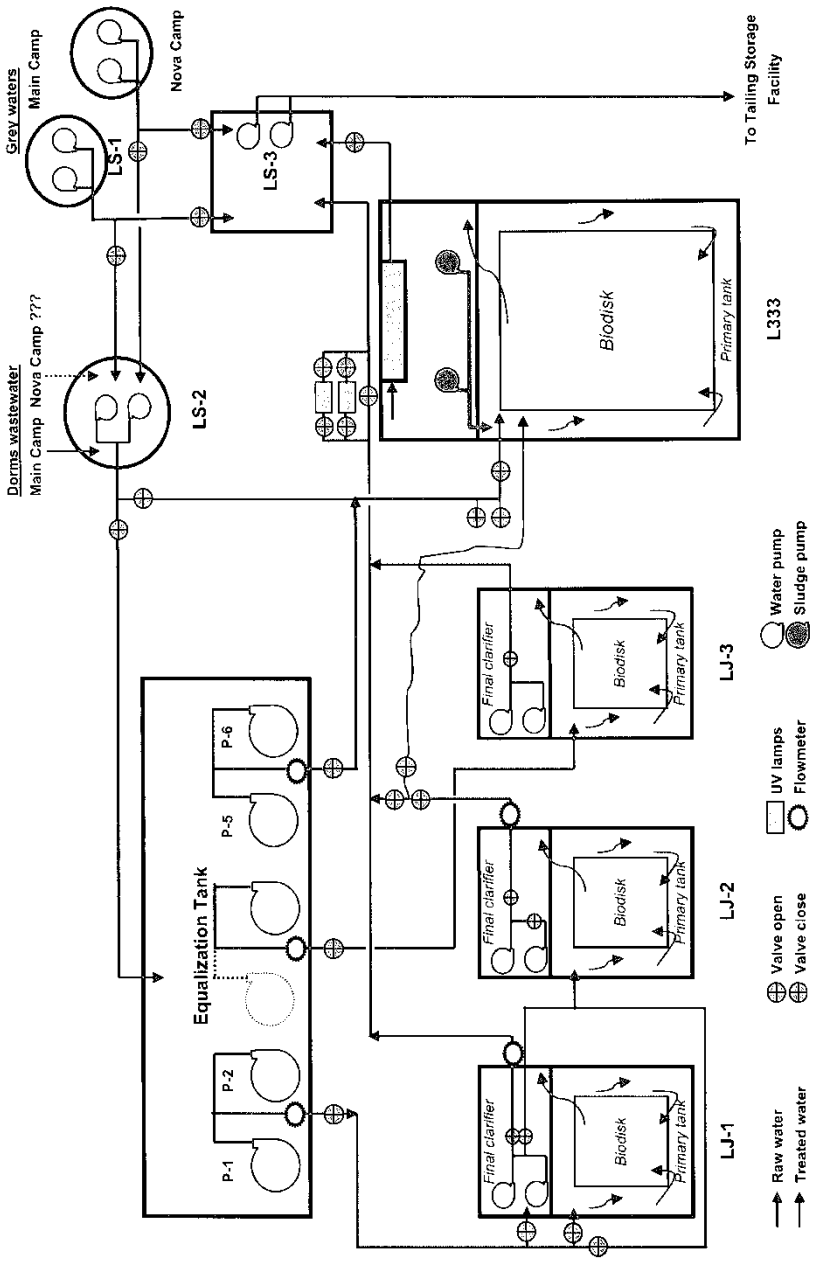


FIGURE 3.1: FLOWSHEET

3.2 Operation procedure

3.2.1 Lifting station n° 1

Pumping station n° 1 is adjacent to the Main Camp. It receives grey waters coming from the kitchens and the laundry. A screen basket is installed in front of the inlet pipe to hold the unrefined wastes. These waters are currently pumped downstream to the STP, directly in pumping station n° 3 (LS-3), which insures the pumping of all effluent (treated or not) toward the Tailing Storage Facility.

The lifting station is equipped with two (2) MYERS submersible pumps. There are level floats to control stop, and start cycles of pumps. Each pump has a check valve on their discharge pipe.

Starts and stops levels of the pumps are voluntarily set-up at close intervals to avoid prolonged operations, which could lead to an overflow of pumping station LS-3. It is also for this reason that the ball valve on the pumps' force main (just before LS-3) is maintained partially closed.

The cleaning operation of the screen basket, which requires the presence of two employees, is required approximately once a week.

No overflow pipe is present. In case of defaults of the pumping station, overflowing of the station and sewer system can occur.

3.2.2 Lifting station n° 2

Pumping station LS-2 receives wastewaters (washbasins, showers and toilets), of Main Camp dormitories and, still to confirm, Nova Camp. Pumping station n° 2 (LS-2) is adjacent to the STP. It receives sanitary wastewaters (washbasins, toilets, showers) coming from dormitories of Main Camp and, still to confirm, Nova Camp. These waters are pumped in the equalization tank (EQT).

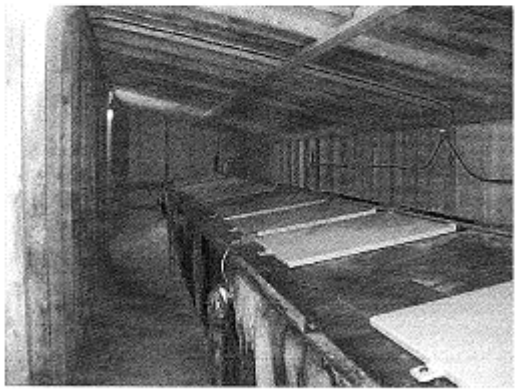
This station is equipped with two (2) MYERS submersible pumps that discharge the wastewater in the EQT. There are level floats to control stop, and start cycles of pumps. Each pump has a check valve on their discharge pipe.

3.2.3 Equalization tank

The equalization tank (EQT) allows lopping flow peaks of the day. Wastewaters accumulated in this tank are pumped in constant flow towards the rotating biological contactors (RBC). The EQT is currently (May 2010) equipped with four (4) pumps, but two (2) more pumps will be installed soon to feed the LJ-3 biodisk:

- Pumps P-1 and P-2 are pumping wastewaters towards LJ-1 and LJ-2;
- Pumps P-3 and P-4 (future) will pump wastewaters towards LJ-3;
- Pumps no. 5 and no. 6 are pumping wastewaters toward L333.

Each pair of pumps are equipped with a Doppler Flowmeter *GREYLINE*, model DFM 4.0. The sensor is fixed to the pipe with coupling material between the sensor face and the pipe. Sensor installation with excessive coupling compound can result in gaps or voids in the coupling and cause errors or signal loss. Insufficient coupling compound will create similar conditions. Over time, temporary coupling compounds (e.g. Petroleum Gel) may gradually sag away from the sensor resulting in reduced signal strength and, finally, complete loss of signal. Warm temperatures, moisture and vibration will accelerate this process. Dow Corning Silicone Compound # 4, as supplied with the DFM 4.0 (and available from Greyline Instruments) is recommended for semi-permanent installations. For more information, refer to the GREYLINE instruction manual.



The equalization tank (EQT) has the following dimensions, approximately: 14,3 m x 2,3m x 2,5 m, for a total volume of 80 m^3. The stabilization of the flow is done with the help of five (5) liquid level floats switches.

Four (4) 10 kW heating elements are installed at the bottom of the EQT to heat wastewater if required. The number of heating elements to put in service must be set to maintain a temperature between 20 and 25 °C. Temperature below 15 °C will probably cause a decrease in microbiological growth on biodisk media and reduce efficiency of the biological process. Temperature over 30 °C increases the nitrification reactions and the anaerobic fermentation which can lead to an important pH and alkalinity decrease and also can, under certain conditions, increase the formation of H_2S gas.

A control unit allow to adjust the running pumps cycles for pumps n° 1 and n° 2 (towards LJ-100), and for pumps n° 5 and n° 6 (towards L333).

The current position of the level floats and pumps on/off cycles' settings ensures an appropriate storage capacity of about 50 m^3.

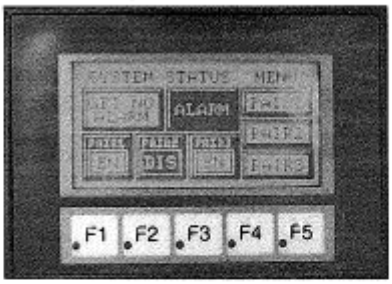
In automatic mode, the control sequence is currently the following:

Float 1 (low level):	low level alarm
Float 2 (stop):	stop pumping
Float 3 (start):	Pumps 1 and 2 (54 sec ON, 306 sec OFF) Pumps 5 and 6 (95 sec ON, 265 sec OFF)
Float 4 (high flow):	Pumps 1 and 2 (162 sec ON, 198 sec OFF) Pumps 5 and 6 (285 sec ON, 75 sec OFF)
Float 5 (high level):	High level alarm and simultaneous start of the four (4) pumps as long as the float stays in horizontal position.

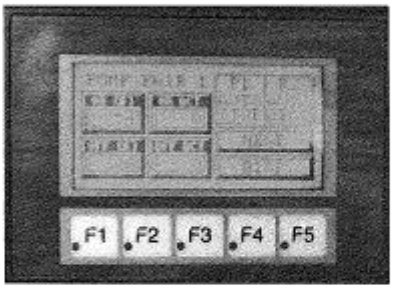
If the water level in the EQT remains low, it indicates that the current controls of the pumps operating time are too high and, consequently, the tank's equalization function is useless.

If the water level in the EQT remains very high, it indicates that the current controls of the pumps operating time are too low and, consequently, the tank's equalization can reach the level 4 «High Flow» which, obviously, would cause overflowing of station LS-3.

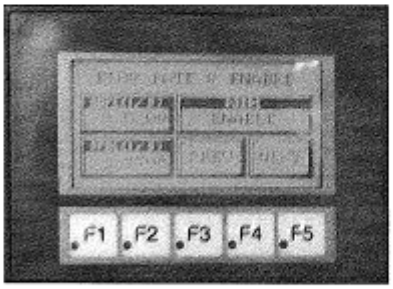
To change the ON/OFF setting cycles of each pair of pumps, you need to follow the step below. The example is for pumps 1 and 2.



Press on **PAIR 1**. A new screen (below) will appear.



Press on **NEXT**. A new screen (below) will appear



Press on **ADF1 (l/s).** Increase or decrease the value in the pop-menu to increase or decrease the running time of the pumps (in seconds) during the 360 seconds ON/OFF cycles.

The five (5) floats level switches must be inspected periodically (once a month). It is very important to keep the floats as clean as possible. Grease can potentially accumulate around the floats and impede operation.

In order to reduce deposits accumulation in the EQT, the level float n° 2 (stop pump) must be kept approximately at mid-level of the motor's pumps.

The depth of solids at the bottom of the EQT must be monitored once a month with the *RAVEN* slude interface detector.

It is possible to bypass the EQT for cleaning, maintenance, or repairs by closing valve V-__ and opening valve V-__. In this situation, Lifting Station n° 2 wastewaters will be all pumped in unit L333. A decreasing of the final effluent quality could be observed.

3.2.4 Rotating biological contactors (RBC)

The treatment system is composed of four (4) biodisks:

- One (1) SEPROTECH L333 UNIT
- Three (3) LJ-100 units

3.2.4.1 Operation summary

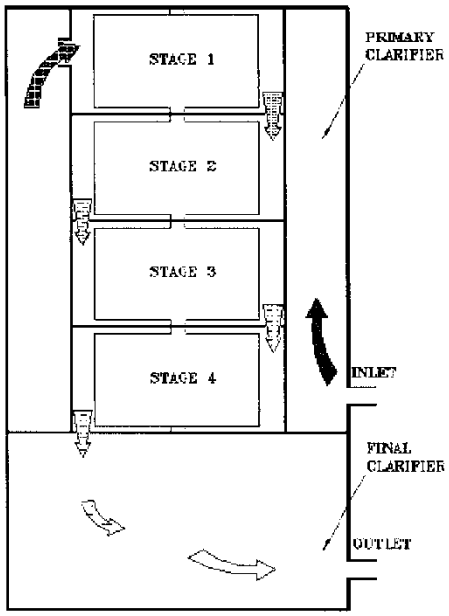
Rotating Biological Contactors (RBC) is a secondary treatment plant designed to remove organic material. It is composed of the primary settling tank (PST), the Biozone tank, and the final clarifier.

Raw sewage is pumped into the PST. Fats, oils and greases (FOG) will float to the top of the PST. The Biozone location concentrates the scum in the area along the side walls of the tank. Settling separates the heavy solids. The clarified water enters the Biozone tank section through the inlet slot located at the bottom of the non-drive end section of the Biozone.

This is the first section of four stages in the RBC aeration process. The normal color of the bacteria in the first stage is dark brown. This is the stage where most of the BOD reduction occurs. The succeeding stages are mounted on the same shaft. The fourth disk bank has recycle buckets that introduce both fresh dissolved oxygen into the PST and nitrifying bacteria present in the recycled water.

Partially treated water from the RBC now enters the final clarifier which allows gravity separation of spent biological growth. Spent biomass settles in this chamber. Sludge is

pumped to the primary clarifier and the supernatant (final effluent) is evacuated to the Lifting Station n° 3.



3.2.4.2 Biodisk LJ-100

A) Equipment characteristics

Supplier		:	Biodisk Corporation
Capacity (each unit)		:	27 500 L/d at a strength of 250 mg/L BOD Effluent BOD and TSS 20 mg/L
Drive motor and gear		:	Nord Gear Limited SK9043.1-80LH/4 Helical Bevel Gear Motor 208 volts, 1 ph, 60 Hz, 1 HP Rotation speed of the shaft is 4,8 rpm
Bearings	(fixed)	:	SKF SNL22518/3.3/16 TG
	(free)	:	SKF22518/3,3/16 THL Bearings are permanently lubricated

Effluent (2) and sludge (1) pumps	:	MYERS, Model ME50S-53 0,5 HP, 575 V, 3ph, 60 Hz
Flowmeter (LJ-1 and LJ-2 only)	:	ENDRESS & HAUSER, Promag 10W
Recorder (LJ-1, LJ-2 and LJ-3)	:	ENDRESS & HAUSER, Echograph RSG 30

B) Electrical controls

The detailed wiring diagram is provided on the inside of the panel and in the operation manual. All of the electrical power requirements pass through the panel. The panel has been designed for a 600/120v, 60 HZ.

The panel has a 200 watt forced air panel heater.

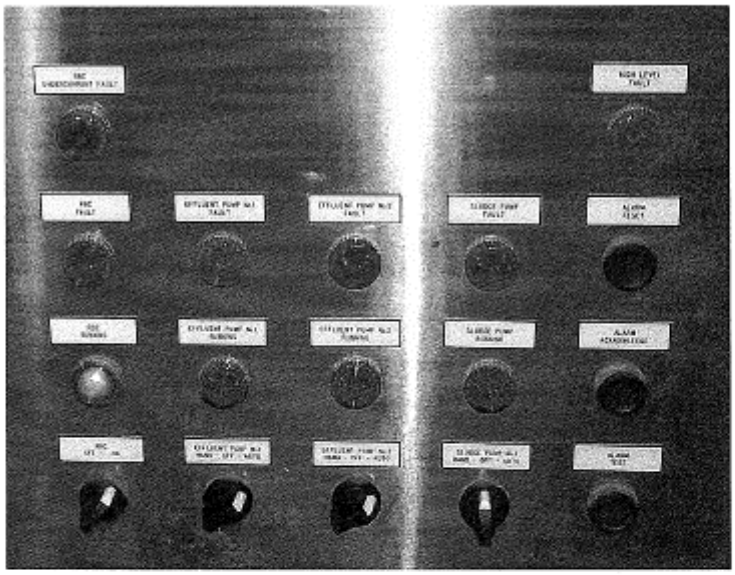
Breaker protection has been provided for all components.

The panel lights will show which equipment is running. Pumps and heaters are normally left in the AUTO position and the RBC runs 24h/365d in the ON position.

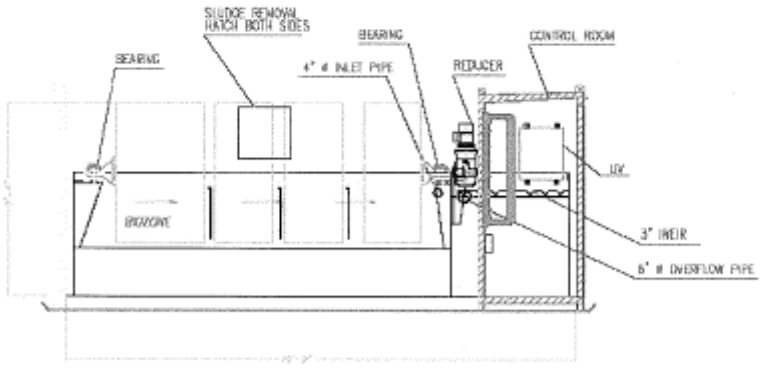
Duplex alternating effluent pump controls are provided with HAND-OFF-AUTO switches and high water alarm. The floats in the final clarifier start and stop the pumps. The fourth and highest float allows two pumps to operate at the same time for high flows. This feature will also start the stand by pump when the primary pump failed. The third float is for a high water level alarm.

A flashing red light mounted on the top of the control panel is activated by the RBC drive motor when the motor amps are too high or too low, or high water and effluent pump malfunction. The control panel lights will indicate the component that triggered the alarm.

The tank is heat traced. One additional heat tracing contact has been provided.

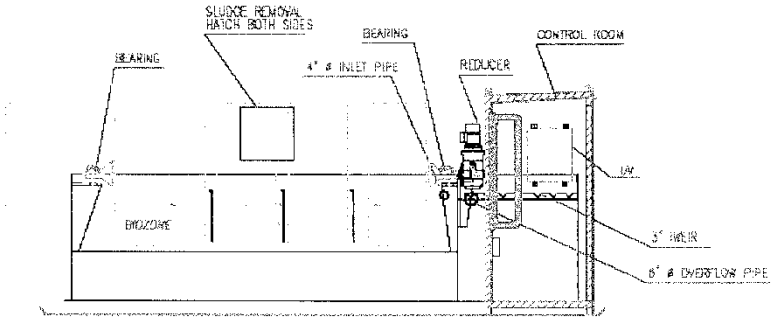


LJ-100 Electrical Panel

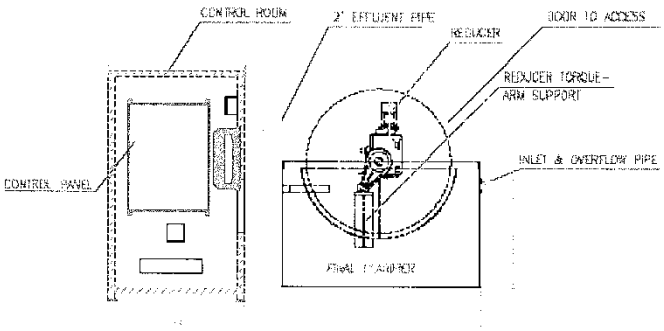


SECTION VIEW

NORDIKeau INC.
EXPERTS TECHNIQUES EN GESTION DE L'EAU

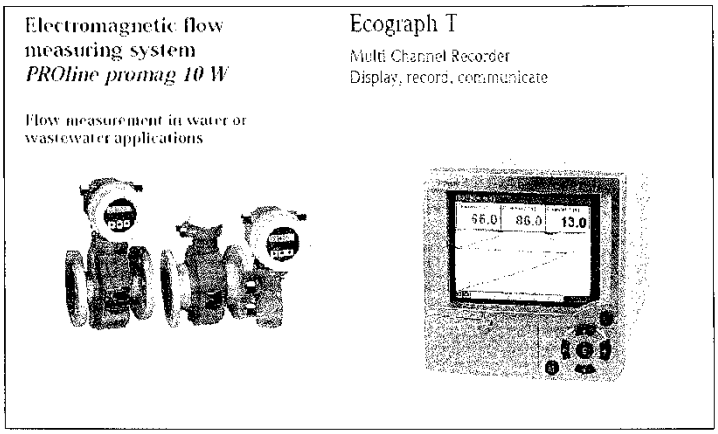


SECTION VIEW



END VIEW

NORDIKeau INC.
EXPERTS TECHNIQUES EN GESTION DE L'EAU



3.2.4.3 Rotordisk L333

A) Equipment characteristics

Supplier		:	Seprotech Systems inc.
Capacity (each unit)		:	105 000 L/d at a strength of 250 mg/L BOD Effluent BOD and TSS 20 mg/L
Drive motor and gear		:	Nord Gear Limited SK9062185TC Motor TEFC 185 TC Frame 575 volts, 3 ph, 60 Hz, 3 HP
Bearings	(2)	:	SKF SNH22524, 4 3/16 inches diameter
	(2)	:	SKF SNH 22526 4 7/16 inches diameter
Coupling	(1)	:	
Sludge pumps	(2)	:	MYERS, Model

B) Electrical controls

Refer to section 10 of the *« Seprotech L33 Installation, operation and maintenance manual »* for the detailed wiring diagram. All of the electrical power requirements pass through the panel. The panel has been designed for a 600/120v, 60 HZ.

Breaker protection has been provided for all components.

The panel lights will show which equipment is running. Pumps, heaters are normally left in the AUTO position and the RBC runs 24h/365d in the ON position.

Duplex alternating sludge pump controls are provided with HAND-OFF-AUTO switches. In automatic mode, pumps are controlled by an « ON-OFF » timer located inside the panel. Sludge pumps have been initially set to operate for 15 sec every 3 hours.

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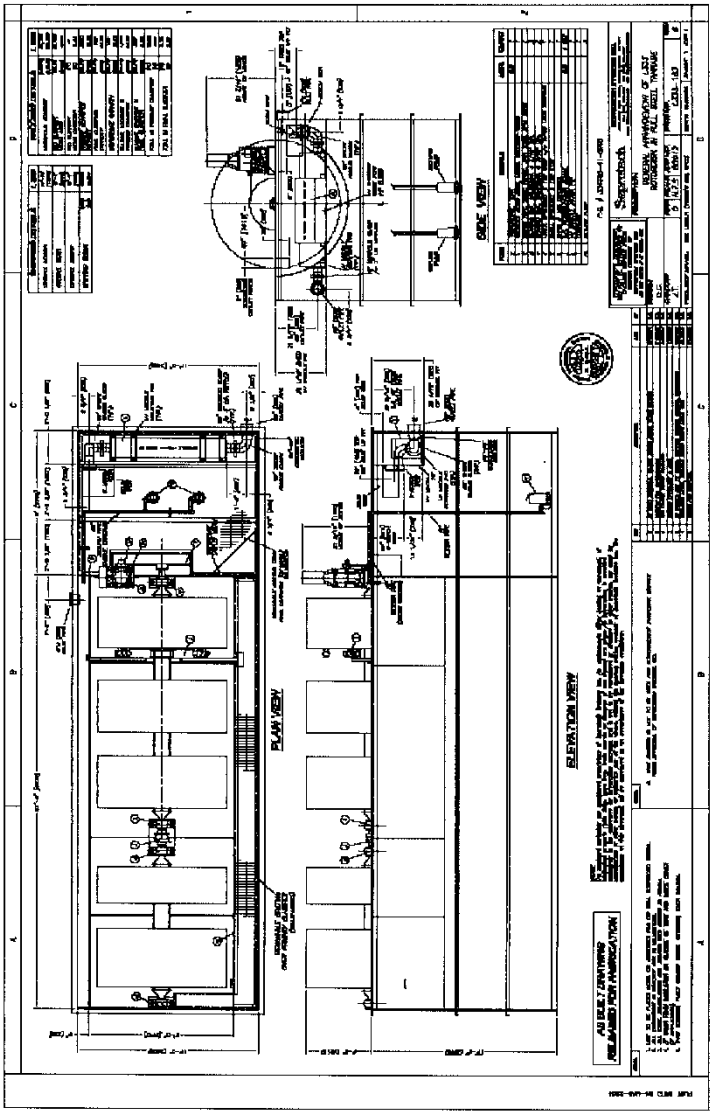
EXPERTS TECHNIQUES EN GESTION DE L'EAU



C) What to check

✓ **Abnormal Noise (1 / day)**

The Biodisk does not have any noisy components. Check valves are the only noisy (clunk) component. The splash of the disk going through the water is as constant as the humming of the motor is. Noises should be at a low level and constant. There are three sources of noise to listen for: the drive, the bearings and the rotating assembly. The drive motor makes a constant humming. High speed noises are generally associated with motor bearings or reducer input bearings. Low speed noises are reducer output noises.

Bearing noises are often cyclical. The rotation speed of the shaft is 4.8 rpm. Bearing can also squeak continuously. This type of noise needs to be investigated.

The rotating assembly consists of the shaft and the disk banks. The disk banks are bolted to the shaft. Lock Tight is used on the disk collar bolts. Movement in the collar bolts will loosen the disk bank and allow it to move. This movement will be evident on every revolution and may be accompanied by a thud. If left unattended, the loose components will eventual break down. Tighten all components that have any movement.

✓ **Visual inspection (1 / day)**

An experienced operator can tell if the Biodisk is working properly by looking at the process. The amount of scum, biomass thickness, coverage, texture, colour, odour, final clarifier scum and time are visual indicators of process efficiency.

Scum will float in the primary clarifier. Scum formation is normal. Fats, oils and grease (FOG) are not beneficial to biological growth and needs to be removed from the wastewater flow before the RBC process. The removal happens in the primary clarifier of the Biodisk. When the scum blanket completely covers the primary tank and has a depth of about 8", the primary tank may need pumping.

The amount of **scum in the final clarifier is an indicator**. A small amount of scum is an indicator that nitrogen gas has being released. Nitrogen gas is liberated in anoxic environments when a carbon source and nitrates are present. This process is called denitrification. When more than 50% of the final clarifier is covered with scum, it is an indicator that the Biodisk may need to have the biosolids and scum removed.

Sludge storage time is directly related to the organic load per day. Lightly loaded systems have long term sludge storage. Scum, biomass thickness, coverage, texture, colour, odour and time are all indicators to tell the sludge's thickness. The removal of

biosolids needs to be addressed. A pump-out truck normally does the sludge removal. A particular point to emphasize is that the biological growth (biomass) on the disks should **not** be washed off.

The thickness and distribution of the biomass is an indicator of plant capacity. When the flow is close to or at design, the biomass will be 1/8" in the first stage and progressively less on the following stages. When the treatment is at capacity, biomass will be evident on the last stage. As the flow is reduced, the amount of biomass on the disks will be proportional to the loading. At 50% of design, the organic removal biomass will occupy 50% of the shaft's length. Light brown nitrification bacteria on the last stage are a good sign. Nitrification does not occur in the Biodisk until the BOD is less than 30 mg/L. If the last stage is without obvious biomass, it is a good indicator of complete nitrification.

Biomass colour is a process indicator to the operator. The biomass in the lead stages will be a medium brown colour. In the lag stages, the disks will be lighter brown when the system is lightly loaded and heavier colour shows when designed for nitrification. Colorless or no biomass is a sign of an under loaded system. The appearance of black and grey patches biomass is not good. Black and grey biomass is an indicator of organic overload and or excessive FOG. This will appear first on the lead stage. It may be time to have the system pumped out.

Often, black and grey spots are accompanied by gelatinous material. These unhealthy bacteria hang on the ends of the tie rods. This is also a sign of organic over load, FOG and excessive use of detergents or cleaners.

The **effluent** near the outlet at the backside of the final clarifier should be relatively clear, colourless and relatively free of suspended solids. Clarity can test rapidly by performing turbidity analysis.

The bearing, gear box and motor have been lubricated with long life synthetic lubricants. **Look for oil and grease leaks.**

✓ **Odour (1 / day)**

Odour is evident when dissolved oxygen (DO) levels are low in the RBC. Low DO in the first stage is an indicator of organic overload. If the problem causing the black, grey and gelatinous biomass is not addressed, it will lead to increased odour and process breakdown. The indicators will appear on the first stage and eventually progress down the full shaft.

Odour under the RBC cover is normally not offensive. A healthy biomass smells like rich earth or loam. In some application, the RBC has been used as an odour eater. If the RBC is producing odour, it is an indicator of poor effluent, organic overload or excessive FOG.

✓ **Water sampling and on site analysis (1 / day)**

Dissolved Oxygen (D.O), pH, and temperature analysis must be performed in the first and last stage of the Biodisk.

The same analysis must be performed on the effluent of the final clarifier. Alkalinity analysis must also be performed, if required.

For more information regarding procedures and interpretations analysis, please refer to Section 4 Control Process.

✓ **Monitoring the flow rate (1 / day)**

The plant is equipped with three Doppler (3) flowmeters located on the force main of the EQT pumps. There is also two (2) magnetic flowmeters install on the force main of the effluent pumps of LJ-1 and LJ-2 units.

These instruments are equipped with a counter that allows tracking of the total volume (m^3) and pumps flowrate (m^3/h).

✓ **Determination of accumulated sludge blanket (periodically)**

The sludge blanket in the PST and in the final clarifier must be measure periodically with the « Sludge Interface Detector ». The sludge accumulation must be compare to the maximum storage capacities listed on the "Details" section of the general arrangement drawing for the Biodisk model in question.

Sludge levels should be measured at several locations in each settlement tank to ensure a reasonably accurate calculation of accumulated volumes. This is required since sludge accumulation levels are not uniform; being highest at the inlet ends of both clarifiers, and, below the slot at the bottom of the first section of the Rotorzone. Once an average sludge height has been determined, multiply it by the surface area of the clarifier in question to determine the existing volume of stored sludge. Compare to maximum design capacity listed on the general arrangement drawing. If the accumulated levels equal or exceed design values, it is time to remove the sludge from the unit.

Sludge accumulations in PST should be removed once they reach indicated maximum storage levels, because failure to do so could result in lowered treatment efficiency, and possibly cause serious damage to the structure of the Rotating Assembly and drive unit. If sludge is allowed to accumulate past storage heights, flow through the primary clarifier will begin to disturb the sludge blanket, and thus carry loads of solids and dissolved organic matter into the Rotorzone, which are not anticipated in the design of the unit.

✓ **Sludge removal (periodically)**

L333

A pump-out truck (same type that pumps out septic tanks) normally does the sludge removal. For the L333 primary settling tank, it is preferable to connect the suction hose directly to the three (3) PVC pipes connected to the bottom of the tanks and withdraw the sludge only, while taking as little of the supernatant as possible.

Once the primary sludge is withdrawn from the primary settlement tank, the supernatant of the secondary clarifier can be transferred to the primary settlement tank, to expose the secondary sludge. The suction hose should be placed down at a multiple number of points of the final clarifier (particularly in the corners) to help ensure complete removal of accumulated sludge deposits. Floating surface scum should also be removed.

LJ-100

Before withdrawing the sludge of the LJ-100 primary settling tank, it is recommended to transfer the supernatant at the inlet of other LJ-100 units before connecting the suction hose directly to the bottom of the tanks and withdraw the sludge only.

The same operation is recommended for the LJ-100 final clarifier.

3.2.5 U.V. Disinfection system

3.2.5.1 Summary

Another step in the STP process is to disinfect the wastewater. This ensures that any harmful bacteria are destroyed before wastewater is released from the plant. The most common method for disinfecting treated wastewater for small treatment plants is to use ultraviolet (UV) disinfection. UV disinfection relies on the high energy contained in UV light to destroy the ability of bacteria and other microorganisms to reproduce, thereby,

effectively killing them. In wastewater treatment, UV lamps are typically installed in a shallow contact channel, so as the wastewater passes through the channel, UV light is shone through the water. The UV lamps are submerged in the wastewater. When submerged UV lamps are used, they must be encased in quartz tubes to prevent excessive cooling and protected from breakage by a metal grid.

UV disinfection has been proven to be very effective in destroying bacteria in drinking water and some wastewaters. However, because the UV light must reach the bacteria in wastewater in order to be effective, wastewater must be relatively clear and free of turbidity (have few suspended solid particles that give the wastewater a cloudy appearance). In turbid or very cloudy wastewater, the suspended solid particles will reflect and scatter much of the UV light, shielding some bacteria in the wastewater from the light and leaving them unharmed. This will result in inadequate disinfection. For this reason, UV light should not be used as the sole disinfectant on wastewaters with high suspended solids concentrations. It should also be noted that, unlike chlorination, UV disinfection provides no residual disinfection of wastewater. Since wastewater can easily be contaminated again, it should not be stored for a significant length of time before its release back into receiving waters from the treatment facility.

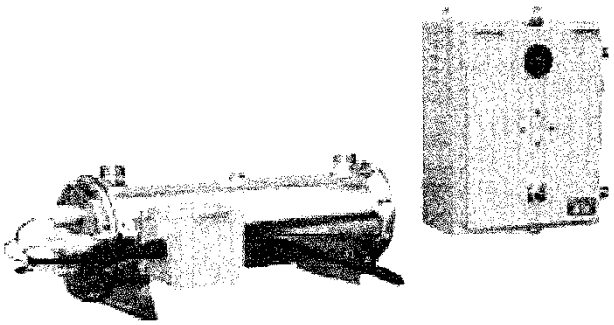
The UV disinfection system must not exceed the following effluent quality limits:

- Fecal Coliforms : 1000 CFU / 100 mL (monthly average)
  2000 CFU / 100 mL (grab sample)

The treatment system is composed of three (3) UV lamps:

- One (1) unit TROJAN, UV3000 PTP model, installed at the outlet of biodisk L333
- Two (2) units SEVERN TRENT, ULTRADYNAMICS model, currently installed at the outlet of LJ-1 and LJ-2 biodisks. Currently, these units are not in service.

3.2.5.2 Ultradynamics UV system



A) Equipment characteristics

Supplier	:	SEVERN TRENT SERVICES
Model – UV Intensity Monitor	:	8102-DM
Model – UV Reaction Chamber	:	8102-HO-60
Number of lamps	:	6
UV lamps rate	:	9000 hours or 1 year
Capacity	:	30 m³/h (clear wastewater, 65 % T)
Maximum operating pressure	:	150 psi
Power requirements	:	240 V, 1,3 kW, 5,6 amps
Maximum water temperature	:	38° C
Ambient temperature	:	2 to 43° C
Maximum start/stop cycles	:	4 per 24 hours
Minimum flowrate (to avoid heat)	:	0,7 m³/h (3 us gal/min)

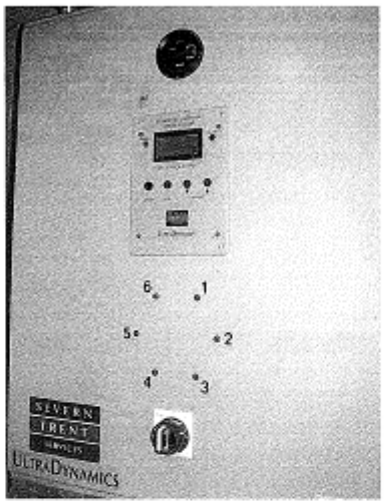
B) Equipment description

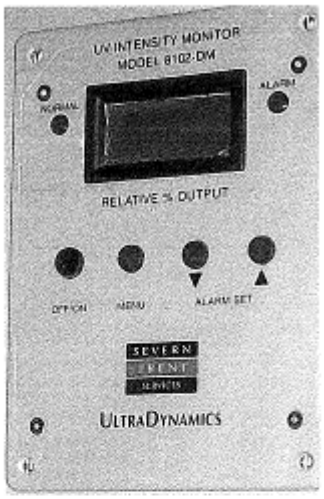
Ultraviolet disinfection performance is monitored with the UV Intensity Monitoring System. The Ultraviolet Intensity Monitoring System includes a monitor with digital display and indicator alarms mounted in a remote cabinet and a sensor assembly located at the lamp source.

Ultraviolet light intensity is monitored with a submersible UV Sensor designed for reliability in a water environment. The sensor transmits an electrical signal proportional to the UV intensity in the channel to the UV intensity monitor. The system is set to accurately indicate relative UV light intensity on a scale of 0 to 100%, with 100% representing the UV intensity in normal process effluent with clean quartz sleeves and new lamps in the UV system. Indicator lights and alarms on the UV intensity monitor keep the operator informed of UV system performance. The sensor is positioned in a UV reactor to measure the relative UV energy. Since the rate of quartz sleeve fouling and the water quality are consistent within the reactor, the readings from the UV intensity monitor are a good indication of performance.

UV Intensity Monitoring Systems measure relative UV intensity, not actual UV intensity. A reading of 100% represents the UV intensity registered with clean quartz sleeves, new lamps and normal water quality. Reductions in UV intensity are due to lamp aging, fouling of quartz sleeves, fouling of the diffuser on the sensor, and/or changes in water quality (suspended solids and percent transmission).

When cleaning the UV system quartz sleeve, it is also necessary to clean the UV sensor probe. Shut off water, relieve the system pressure and/or isolate (valve out) the UV chamber. Remove the monitor by unscrewing the white retaining nut and sliding the probe out of the sensor port. Deposits on the sensor probe are mostly caused by suspended and dissolved solids and minerals naturally occurring in the water. This coating can be easily removed by applying a small amount of lemon juice on a soft dry cloth and gently rubbing the sensor probe until clean, rinsing with hot water.





Ultraviolet lamps must be replaced every 10 to 12 months of continuous use, after every two (2) years of intermittent use, or when the monitor reads 60% of the new lamp output. **DO NOT WAIT** for the monitor to cut-off. Always stock spare lamps.

C) Operation and maintenance

Inspecting the Quartz Jackets:

As water passes through the UV unit, minerals, debris and other matter in the water will settle and deposit onto the quartz jackets. This will impair the ability of the UV rays to penetrate into the water. Therefore, it is necessary to determine a cleaning schedule for the quartz jackets, and the frequency will depend on the specific type of water used at your facility.

If the water has been processed through deionization, reverse osmosis, or distillation, the cleaning frequency can be set at once a year. If clear, fresh water is used, the probable cleaning frequency will be anywhere from once every thirty (30) days to once every six (6) months. You can determine the cleaning frequency by visually inspecting any quartz jacket to see if any debris or film has settled on the outside of the quartz jacket.

Severn Trent Services suggest to initially scheduling your first inspection after thirty (30) days of use and after the first month. If the quartz jacket is noticeably dirty, your cleaning frequency should be shortened; if the jacket is clean, the frequency can be lengthened.

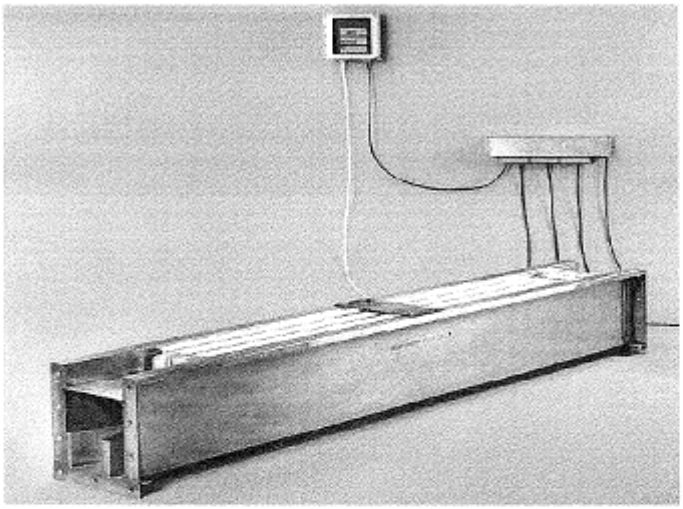
Cleaning the Quartz Jacket:

To clean the quartz jackets, first turn off the water, disconnect the electrical service and drain the UV chamber. Next, remove the UV lamps. Then loosen the compression nut and carefully remove the quartz jackets. The quartz jackets may be washed with a mild soap and hot water and rinsed clean with hot water. Should this be insufficient to clean the quartz jackets, use a mild abrasive cleaning agent. Be careful when cleaning the quartz jacket. It is fragile. Should a quartz jacket be damaged, it must be replaced.

Other Periodic Maintenance :

- ✓ Operate the quartz jacket wiper system regularly on manual models (push/pull stroke). You cannot overclean the quartz jacket(s).
- ✓ The exterior surfaces of the UV unit should be kept clean as part of routine maintenance. Use a soft cloth and water or any commercial stainless steel cleaner.
- ✓ Inspect for overhead piping leaks and correct as necessary to protect UV equipment.
- ✓ Measure the performance of the UV unit at sufficient intervals to ensure the effluent meets your requirements.

3.2.5.3 Trojan UV system



A) Equipment characteristics

Supplier	:	TROJAN TECHNOLOGIES
Model	:	UV3000 PTP
Model – UV Reaction Chamber	:	8102-HO-60
Number of lamps	:	
Number of module	:	
UV lamps rate	:	8 760 hours (1 year)
Capacity	:	
Power requirements	:	
Maximum water temperature	:	
Ambient temperature	:	
Maximum start/stop cycles	:	
Minimum flowrate (to avoid heat)	:	

B) Equipment description

The Trojan UV3000TMPTP is made of several components (some of which are optional):

- UV Module
- UV Lamps
- Quartz Sleeves, Springs, Spacers
- Lamp Holder Seal Assembly
- Effluent Channel
- Transition Boxes
- Power Distribution Receptacle
- Monitoring System UV Sensor
- Level Control Weir
- UV Module rack

UV Module

The UV module is the basic unit of the flowthrough UV bank. A bank is made up of UV modules placed in parallel within a single channel.

UV Lamps

Trojan supplied __ inch long UV lamps. The UV output after one year of use is approximately 80% of the output after the 100 - hour burn-in period. It should also be noted that frequent cycling shortens the life of the lamps.

Quartz Sleeves, Springs, Spacers

The quartz sleeves are made of Type 214 clear fused quartz circular tubing. They are rated 89% for UV transmittance and are not subject to solarisation. The sleeves protect the lamps from breakage and in conjunction with the spacer rings, they provide insulation. This assures minimum lamp temperature variations, which could affect the lamps performance.

Lamp Holder Seal Assembly

The open end of the lamp sleeve is sealed with a type 316 stainless steel sleeve nut which threads onto a sleeve cup and compresses the sleeve o-ring. The knurled surface of the sleeve nut allows a positive handgrip for tightening; it does not require any tools for removal. The lamp is held in place with a moulded lamp holder, which incorporates a triple seal. The lamp holder seals against the inside of the quartz sleeve to act as a second seal in series with the external o-ring seals.

Another seal on the lamp holder isolates and seals the lamp from the module frame and all other lamps in the module. If a quartz sleeve fracture happens, the seals of the lamp holder prevent moisture from entering the lamp module frame and the electrical connections to the other lamps in the module.

Effluent Channel (Type K)

The effluent channel is typically made of 14 Type 304 stainless steel gauges, and comes complete with drain, UV module support rack and downstream serpentine weir.

Transition Boxes (optional)

Transition boxes are conceived to provide transition between the UV channel and flanged inlet and outlet pipes. The inlet transition box helps to ensure a plug flow condition that is conducive to more efficient disinfections.

Power Distribution Receptacle

The PDR consists of duplex ground fault interrupter receptacle that can be mounted in a location which allows convenient hook-up of UV Modules. The PDR is provided with a weatherproof cover. However, direct water sprays should be avoided.

Monitoring System UV Sensor

The submersible UV Sensor measures the UV intensity within each bank of UV lamp modules. The UV Sensor is mounted on a representative UV lamp module. The UV Sensor is calibrated in the factory and should not be altered, or its calibration changed. The monitoring system offers the main following features:

- A UV Sensor that continuously monitors the UV intensity produced in each bank of UV lamp modules.
- A 3 character display that indicates UV intensity in milliwatt per square centimeter (mW/cm2). This display will flash when the intensity drops below the Low UV Intensity Alarm setpoint.
- A 5 character display that indicates elapsed time in hours. The Elapsed Time display will flash when lamps will need to be changed in a near future.

Level Control Weir (optional)

A water level control weir controls the effluent level within the UV channel.

UV Module Rack

The UV Module Rack is a stainless steel support frame, which supports each bank of UV modules.

D) Operation and maintenance

To ensure maximum performance, it is essential that the quartz sleeves containing the UV lamps are kept clean. If coating is to building up on the sleeves, the amount of UV light transmitted to water is reduced. The cleaning interval for the UV modules depends on the effluent quality. Often, a hosing off of foreign matter clinging to the unit may be all that is required. Over a period of time, however, a coating will build up on the quartz sleeves and it will be necessary to clean them thoroughly.

Always clean quartz sleeves when intensity falls below 2,8 mW/cm2. Clean the UV Sensor at the same time.

CAUTION : ***Wear cotton gloves when handling quartz sleeves and lamps.***

The Trojan UV3000TMPTP sleeves' cleaning method is to manually hand wipe the quartz sleeves using a Trojan approved cleaning agent. The cleaning agent is applied using a cleaning cloth or sprayed on the quartz sleeves, then wiped off. See the Trojan Instruction Manual for the complete maintenance procedure.

The crest of the Level Control Weir and the channel must be clean periodically.

Lamps must be typically replaced every 8760 hours of operation (1 year), although the actual time varies according to the following factors: effluent temperature, power levels of lamps, and frequency of switching lamps ON and OFF. To ensure lamps are replaces at the proper time, it is best to replace all lamps in a scheduled operation, and to maintain a record of lamp replacement dates and elapsed timing on all lamps.

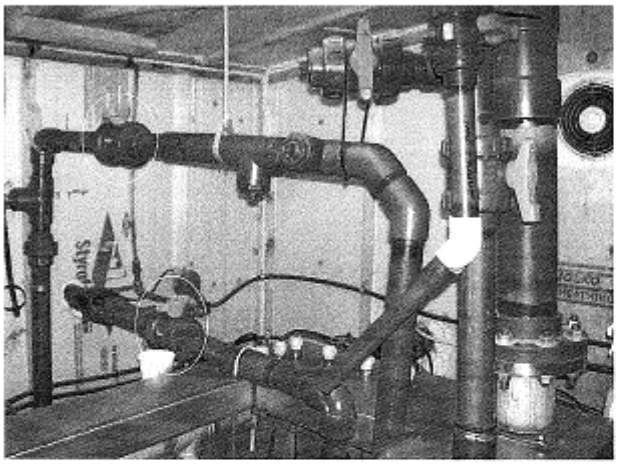
3.2.6 Lifting station n° 3

Pumping station LS-3 received the final effluent of the STP and grey waters (untreated) of Main Camp and Nova Camp wastewaters.

This station is equipped with two (2) MYERS submersible pumps and forces back waters towards the Tailing Storage Facility. Pumps control is ensured by four (4) level switch floats. Both pumps run simultaneously when the water level in the station reaches the level switch n° 3. Timers for the pumps' running time figured on the control panel.

The dimensions of the wet well are very limited (1,20 m x 0,9 m x 0,9 m), as well as the pumping flowrate capacity of the station. **No overflow pipe is present.** Overflowing can

thus occur, particularly when pumps upstream are manually started for more than a few minutes. For that reason, the ball valves installed on both grey waters 2 inches inlet pipes must be maintained partially closed (see photo below). Furthermore, Nova Camp's grey waters are pumped during the night, a low flow period.



4. PROCESS CONTROL

4.1 Summary

Operation of the RBC system is more than "just turning it on and letting run itself". The operator has a number of options even in plants with limited flexibility if he is willing to use his ingenuity.

Certain visual indicators, such as the appearance of different biomass colors, presence of odours and amounts of solids in the effluent of clarifiers and RBC overflow points, give and indication of how the process is working. These have been described in the lesson; however, they have to be related to the individual plant before they have true significance to the operator. They are valuable and should not be overlooked or discounted.

Additionally, certain lab tests are also described to tell whether the first stage is overloaded, whether nitrification might be expected in later stages, whether nitrification is occurring and reducing pH, how much DO is present, etc. Test results should be used to

make process control decisions, not simply to satisfy some regulatory requirement. Use of this information has been described.

Maintenance must be performed routinely and preventive steps taken to keep the process healthy. Lubrification of bearings, maintenance of other moving parts such as shafts, belts, chains, and media are all part of standard operation duties. The importance of this has been mentioned above.

Finally, the RBC units are depending on the correct functioning of the other processes. When all the parts of the process reviewed as tools needed to produce the final products, namely disposable solids and acceptable effluent, the operator can be proud of his job.

4.2 Sampling procedures

The analytical results of a sample are only as accurate as the quality of the sample taken. If your technique for collecting the samples is poor, then no matter how accurate your lab procedures are, the results will be poor. Buy sampling according to set procedures, you reduce the chance of error and increase the accuracy of your samples results.

Wastewater sampling is generally performed by one of two methods:

- grab sampling
- composite sampling

Grab sampling is just what it sounds like; all of the test material is collected at one time. As such, a grab sample reflects performance only at the point in time when the sample was collected, and only if the sample was properly collected.

Composite sampling consists of a collection of numerous individual discrete samples taken at regular intervals over a period of time, usually 24 hours. The material being sampled is collected in a common container over the sampling period. The analysis of this material, collected over a period of time, will therefore represent the average performance of a wastewater treatment plant during the collection period.

Numerous industry references list various parameters for wastewater testing and whether samples should be collected using grab sampling or composite sampling methods. For example, grab sampling allows the analysis of specific types of unstable parameters such as pH, dissolved oxygen, chlorine residual, and temperature.

However, the most widely used indicators of treatment plant performance, including BOD_5 (biochemical oxygen demand), TSS (total suspended solids) normally require the use of a 24 hours composite sampling techniques because routine variations in the volume and

strength characteristics of incoming wastewater create fluctuations in the quality of treatment plant effluent. Therefore, an effluent grab sample taken at one specific time throughout the daily flow pattern will not be representative of the system performance over the entire day.

In the absence of an automatic composite sampler on Meadowbank site, all the water samples collected to control and monitor the process are taken using grab samples.

Once a sample is taken, the constituents of the sample should be maintained in the same condition as when collected. When it is not possible to analyze collected samples immediately, samples should be preserved properly. Biological activity such as microbial respiration, chemical activity such as precipitation or pH change, and physical activity such as aeration or high temperature must be kept to a minimum. Methods of preservation include cooling, pH control, and chemical addition. Freezing is usually not recommended. The length of time that a constituent in wastewater will remain stable is related to the character of the constituent and the preservation method used.

4.3 Sampling points location

In order to make appropriate adjustments to the treatment plant, the operator should be able to take representative water sample at the following location of the STP as shown on Table 4.1.

Table 4.1 Sampling points location

Sampling point	Location	Test to perform		Comments
		On site by operator (each day)	Independant laboratory (each week)	
STP Influent		pH temperature	BOD5 COD TSS NH3-NH4 P tot	
Biodisks (First stage)		pH Temperature D.O. Media observation		
Biodisks (Last stage)		pH Temperature D.O. Media observation		
STP Effluent		pH Temperature D.O. Turbidity	BOD5 COD TSS NH3-NH4 P tot NO2-NO3 Fecal coliform	

4.4 Analysis results interpretation

There are a number of parameters and analyses that should be tested and tracked, beyond those required by the Government. This chapter is intended to introduce the reader to laboratory tests interpretation.

4.4.1 Independent laboratory analysis results

Biochemical Oxygen Demand (BOD) is the rate at which micro-organisms use the dissolved oxygen in the wastewater while stabilizing or breaking down decomposable organic matter. In decomposition, the organic matter serves as food for the bacteria.

The BOD is an index of the amount of oxygen that will be consumed by the decomposition of the organic matter in a wastewater.

The analysis consists of measuring the initial dissolved oxygen concentration in a water sample, and measuring the final dissolved oxygen after incubation for five (5) days (BOD_5) at 20 °C.

The STP has been designed to reduce total BOD of the effluent to approximately 15 mg/L.

The organic loading apply on a RBC must generally not exceed 5 g BOD / m² of Bio support media / day.

An increase of BOD on the effluent treated water is a sign of deterioration of the treatment process.

Chemical Oxygen Demand (COD) is a measure of the water capacity to consume oxygen during the decomposition of organic matter and the oxidation of inorganic chemicals such as ammonia and nitrite. Chemical Oxygen Demand is measured as a standardized laboratory assay in which a closed water sample is incubated with a strong chemical oxidant under specific temperature conditions and for a particular period of time. A commonly used oxidant in COD assays is potassium dichromate ($K_2Cr_2O_7$) which is used in combination with boiling sulfuric acid (H_2SO_4). Because this chemical oxidant is not specific to oxygen-consuming chemicals that are organic or inorganic, both of these sources of oxygen demand are measured in a COD assay.

Generally, COD is preferred to BOD in process control applications because results are more reproducible and are available in just a few hours rather than five (5) days.

The COD test is not a direct substitute for the BOD test; however, a ratio usually can be correlated between the two (2) tests. This requires COD versus BOD testing over a specified period of time.

On typical domestic wastewater, a ratio COD/BOD between 2 and 3 is usual. On treated effluent a ratio COD/BOD between 4 and 6 is usual.

Total Suspended Solids (TSS) are the particles which are either suspended in solution or slowly settled to the bottom. Wastewater treatment plants are designed to remove TSS from wastewater.

TSS of a water sample is determined by pouring a carefully measured volume of water through a pre-weighed filter of a specified pore size, then weighing the filter again after drying to remove all water. The gain in weight is a dry weight measure of the particulates

present in the water sample expressed in units derived or calculated from the volume of water filtered (typically milligrams per litre or mg/L).

Although turbidity purpose is to measure approximately the same water quality property as TSS, the latter is more useful because it provides an actual weight of the particulate material present in the sample. In water quality monitoring situations, a series of more labor intensive TSS measurements will be paired with relatively quick and easy turbidity measurements to develop a site-specific correlation.

The STP has been designed to reduce TSS of the effluent to approximately 15 mg/L.

An increase of TSS on the effluent treated water is probably a sign of insufficient sludge extraction in the biodisks's final clarifier.

Ammonia nitrogen (NH_3 and NH_4^+) is a form of nitrogen, which is a nutrient necessary for both plant and animal life. The Nitrogen Cycle is the natural conversion of nitrogen from one form to another through various biological processes. Wastewater treatment plants are generally designed to remove NH_3 from wastewater.

Large concentrations of ammonia create a large oxygen demand due to the conversion of ammonia to nitrate (NO_3) by nitrifying bacteria. Approximately 4.3 mg O_2 are consumed for every mg of ammonia-nitrogen oxidised to nitrate-nitrogen.

Nitrification is possible if sufficient detention time is created. There are two (2) bacterial species involved. *Nitrosomonas sp.* bacteria which oxidize ammonia to nitrite, while Nitrobacter bacteria convert nitrite to nitrate, with both species utilising the energy released by the reactions.

Between 7 to 8 mg of alkalinity in the form of HCO_3^- are consumed per mg of ammonia-nitrogen oxidised. This is quite a substantial amount of alkalinity and it will over a period of time dramatically change the character of the water during the treatment process, affecting pH stability. Nitrification process is the main reason of the pH water drop during the RBC treatment process.

The increase of nitrites (NO_2) and nitrates (NO_3) during the treatment process, and the decrease of ammonia nitrogen (NH_3 and NH_4^+) and pH is also an indication of the rate of nitrification during the treatment process.

Even if the STP system has been designed for ammonia/nitrate removal, there is no Government effluent quality limits for these parameters.

Controlling **phosphorus** discharged from municipal wastewater treatment plants is a key factor in preventing eutrophication of surface waters. The overall total phosphorus

removal obtained in a conventional biological wastewater treatment like the Meadowbank STP is generally very low, less than 20%.

4.4.2 On site analysis results

Temperature is an important factor for the treatment process. Settling properties are more effective at higher temperatures whereas colder conditions reduce the biological activity and organic removal efficiency decreases at wastewater temperatures below 15 °C.

Water will hold more dissolved oxygen at colder temperatures as compared to warmer temperatures. Water in the winter can hold almost twice as much Dissolved Oxygen (DO) as in the summer.

Biological activity and nitrification process decreases, however, as temperature decreases.

Covers on RBC provide protection against drop of water temperature and protect equipment and media from freezing during winter.

The term **pH** is a measure of the acidity or alkalinity of a liquid. The pH scale ranges from 0 to 14, with the acceptable range for wastewater typically being 6.0 to 8.5.

The microbiological organisms begin to become stressed at higher and lower pH which in turn results in lower treatment efficiencies.

Turbidity is the cloudiness or haziness of a fluid caused by individual particles (suspended solids) that are generally invisible to the naked eye, similar to smoke in the air. The measurement of turbidity is a key test of water quality.

A property of the particles —they will scatter a light beam focused on them — is considered a more meaningful measure of turbidity in water. Turbidity measured this way uses an instrument called a nephelometer with the detector setup to the side of the light beam. More light reaches the detector if there are lots of small particles scattering the source beam than if there are few. The units of turbidity from a calibrated nephelometer are called Nephelometric Turbidity Units (**NTU**). To some extent, how much light reflects for a given amount of particulates depends on properties of the particles like their shape, color, and reflectivity.

For this reason (and that heavier particles settle quickly and do not contribute to a turbidity reading), a correlation between turbidity and total suspended solids (TSS) is somewhat unique for each location or situation.

Dissolved Oxygen (DO)

In an aerobic RBC system, a biofilm is allowed to form on the medium, which is partly submerged in the wastewater and partly exposed to the air. The rotation alternately exposes this biofilm to atmospheric oxygen and wastewater. Oxygen transfers from the air to the RBC unit in three (3) ways: by oxygen absorption of the liquid film over the biofilm surface when the biofilm is in the air; by direct oxygen transfer to the air-water interface; and by direct oxygen absorption by the microorganisms during the air exposures.

Usually, as a consequence of an active respiration in the initial stages, the oxygen concentration reaches minimal levels, increasing along the reactor where substrate concentration is low.

During operation oxygen levels must be properly controlled and, to prevent from becoming a limiting factor, initial stages should have at least 1 mg/L of D.O.

Oxygen demand is the amount of DO required by bacteria and microorganisms to oxidize the influent organic waste. It is directly proportional to the organic strength of the influent waste. Therefore, oxygen requirements are dependent on BOD loading as well as the degree of treatment.

Alkalinity

Alkalinity is an indication of the acid neutralizing wastewater capacity. It is a measure of wastewater's resistance to changes in pH. The major components of alkalinity are carbonate (CO_3) and bicarbonate (HCO_3) species.

BOD removal causes a slight decrease in alkalinity. Ammonia (NH_3) removal, also known as nitrification, causes a significant decrease in alkalinity. During nitrification, NH_3 is converted to NO_3. Theoretically, 7.14 mg of alkalinity is consumed during the oxidation of 1 mg of NH_3.

When DO is not available, nitrate (NO_3) is used as an oxygen source. NO_3 removal, also known as denitrification, causes a slight increase in alkalinity. NO_3 is converted to N2 gas. Theoretically, 3.57 mg of alkalinity is created during the reduction of 1.0 mg of NO3.

When DO and NO_3 are not available, sulfate (SO_4) is used as an oxygen source. Organic nitrogen is used as a food source, which causes a significant increase in alkalinity. This leads to the generation of ammonia (NH_3).

4.5 Other process interpretations

4.5.1 Observing the media

Rotating biological contactors use bacteria and other living organisms growing on the media to treat waste. Because of this, you can use your senses of sight and smell to identify problems. The slime growth or biomass should have a brown to gray color, no algae present, a shaggy appearance with a fairly uniform coverage, and very few or no bare spots. The odour should not be offensive, and certainly there should be no sulfide (rotten egg) smells.

During operation, observations of the RBC movement, slime color and appearance are helpful in determining system performance; that is, they can indicate process conditions. If the unit is covered, observations are usually limited to that portion of the media that can be viewed through the access door.

A gray, shaggy appearing biological slime is indicative of a system designed strictly for BOD removal. A brown, thinner, less shaggy biological slime is indicative of a nitrifying system.

The Rotorzone is subdivided into four (4) sections, with disk banks in each. The wastewater first enters the Rotorzone in the section marked "1" in the sketch (furthest away from the inlet to the plant). The flow then proceeds through sections 2, 3, and 4 before entering the final settling tank.

The accumulation of biological growth will be greatest in section 1, and gradually decrease through subsequent sections. Generally, the growth will be thick, and often filamentous ("stringy"), in section 1, becoming thinner and more compact through sections 2-4.

The colour of the growth will typically be dark brown to black in Section 1. Some grey growth may also be noticed, depending on the relative load and type of wastewater being treated. Growth in sections 2-4 will typically vary from medium brown to a light brown or tan growth in section 4.

Black appearance

If the appearance becomes black and odours, which are not normal to occur, then this could be an indication of solids or BOD overloading. These conditions would probably be accompanied by low DO in the plant effluent. Compare previous influent suspended solids and BOD values with current test results to determine if there is an increase. To solve this problem, place another rotating biological contactor unit in service, if possible,

or try to pre-aerate the influent to the RBC unit. Also review the operation of the primary clarifiers and sludge digesters to be sure they are not the source of the overload.

White appearance

A white appearance on the disc surface also might be present during high loading conditions. This might be due to a type of bacteria which feeds itself on sulfur compounds. The overloading could result from industrial discharges containing sulfur compounds upon which certain sulfur loving bacteria thrive and produce a white slime biomass. Corrective action consists of placing another RBC unit in service or trying to pre-aerate the influent to the unit. During periods of severe organic or sulfur overloading, remove the bulkhead or baffle between stages one and two.

Another cause of overloading may be sludge deposits that have been accumulating in the bottom of the bays. To remove these deposits, drain the bays, wash the sludge deposits out and return the unit to service. Be sure the orifices in the baffles between the bays are clear.

Sloughing

Sloughing is the term used to refer to the process in which excess microbrial growth separates from the media and is washed to the secondary clarifiers with the treated wastewater. The excess slime will settle out in the secondary clarifiers and be removed from the system. Natural biological sloughing will occur from any fixed film reactor. It is a normal consequence of media growth.

If severe sloughing or low growth of biomass occurs after the start-up period and process difficulty arises, the causes may be due to the influent wastewater containing toxic or inhibitory substances that kill the organisms in the biomass or restrict their ability to treat wastes. To solve this problem, steps must be taken to eliminate the toxic substance even though this may be very difficult and costly. Biological processes will never operate properly as long as they attempt to treat toxic wastes. Until the toxic substance can be located and eliminated, loading peaks should be dampened (reduced) and a diluted uniform concentration of the toxic substance allowed reaching the media in order to minimize harm to the biological culture.

Another problem which could cause low biomass growth is an unusual variation in flow and/or organic loading. In small communities, one cause may be high flow during the day and near zero flow at night. During the day, the biomass is receiving food and oxygen and starts growing; then the night flow drops to near zero, available food is reduced and nearly stops. The biomass starts sloughing off again due to lack of food. Considering the presence of the Equalization tank, this problem should not occur.

4.5.2 Smell

In a well-functioning unit with the appropriate feed of wastewater, there will be an earthy, humus-like ("musty") smell inside the Biodisks. A substantial sour, "sewage" smell may be an indication of sub-optimal conditions in the treatment process.

When undesirable septic conditions appear, a classic "rotten egg" odour is noticeable. It results from the bacterial breakdown of organic matter in the absence of oxygen (anaerobic digestion). Remember that Hydrogen sulfide is a toxic gas.

4.5.3 Observing the clarifiers and final effluent

Clarification in the secondary clarifier is another major factor that affects performance. For example, shallow clarifier, as installed in Meadowbank, normally have difficulty containing the typically low density sludges. Low density sludge blanket are also easily disturbed by hydraulic (flow) fluctuations, and such disturbances can cause the loss of sludge particles (TSS) in the final effluent.

Rising sludge ('pop-ups') are particles or chunks of sludge floating to the surface of the clarifier. The sludge can be carried over the effluent weir, which results in elevated effluent TSS levels. The sludge is carried to the surface by bubbles of gas formed in the sludge blanket at the bottom of the clarifier or from sludge hung up on the walls of the clarifier. The gas may be either nitrogen or hydrogen sulfide gas (H_2S) formed from the biological decomposition of the sludge.

Some differences of the gas can be used to determine if the sludge is denitrifying or going septic at the bottom of the tank. Pop-ups caused by nitrogen are usually light brown to brown in color, and have no odour when broken up by a hose or cleaning brush. When pop-ups are caused by septic conditions, a classic "rotten egg" odour is noticeable when the sludge is hosed down or otherwise broken up, due to release of the hydrogen sulfide gas. The pop-ups are usually dark brown to black.

If sludge extraction frequency is too low, sludge can accumulate and be washed into the effluent or the sludge may remain in the clarifier but have no DO, causing the higher microorganisms to die or the bacteria to denitrify or go anaerobic and cause gas bubbles and rising sludge.

The effluent near the outlet at the backside of the final clarifier should be relatively clear and colourless and relatively free of suspended matter. The turbidity measurement of the final effluent is a quick and easy method of checking the operation and performance of the RBC process. An increasing effluent turbidity indicates an unfavourable trend in process operation which should be promptly investigated and corrected.

Turbidity in the final effluent is chiefly due to biological floc that has carried out over in the clarifier effluent. Monitoring the sludge blanket in the clarifier is the most direct method available for determining when sludge extraction must be done.

4.5.4 Determination of the sludge blanket

The sludge levels accumulation can be directly measure with the Sludge Interface Detector supplied on site. The Raven SID-10200 utilizes the infrared light dispersion technology sensor probe to accurately determines the sludge blanket solid/liquid interface depth in primary tanks and clarifiers.

Sludge levels should be measured at several locations in each settlement tank to ensure a reasonably accurate calculation of accumulated volumes. This is required since sludge accumulation levels are not uniform; being highest at the inlet ends of both clarifiers, and, below the slot at the bottom of the first section of the Rotorzone.

If the accumulated levels equal or exceed design values, it is time to remove the sludge from the unit.

4.6 Process parameters

4.6.1 Percent Removal Calculations

BOD, TSS, and NH_3 are all pollutants, which are present in large concentrations in the influent wastewater coming into a treatment plant. Through the treatment process, the concentrations of BOD, TSS and NH_3 are reduced.

The Percent Removal Calculation is used to determine the percentage of the incoming concentration of a particular pollutant (BOD, TSS or NH_3) that was removed through the treatment process. It is calculated as follows:

$$\text{Percent Removal (\%)} = \frac{\text{(Influent Concentration, mg/L) – (Effluent Concentration, mg/L)}}{\text{(Influent Concentration, mg/L)}} \times 100$$

Example

Influent BOD = 250 mg/L
Effluent BOD = 15 mg/L

$$\text{Percent Removal (\%)} = \frac{\text{(Influent Concentration, mg/L) – (Effluent Concentration, mg/L)}}{\text{(Influent Concentration, mg/L)}} \times 100$$

$$\text{Percent Removal (\%)} = \frac{\text{(250 mg/L) – (15 mg/L)}}{\text{250 mg/L}} \times 100$$

Percent Removal (%) = 94%

4.6.2 Organic loading

Organic loading is defined as the grams of Biochemical Oxygen Demand (BOD) introduced into the RBC basin per square meter of media surface area per day. The design of the media optimizes its available surface with the use of ridges and void spaces. Consequently, the media surface can not be accurately calculated by an operator and is provided by the manufacturer. See table in section 2.2.

Typical organic loading of a RBC is 4 to 6 grams BOD/day/m².

Increased organic loadings lead to increased biological slime thickness where dissolved oxygen becomes depleted. With higher organic loadings sulfur reducing filamentous bacteria (*Beggiatoa*) become abundant due to DO deficient conditions. This phenomenon is indicated by a white/gray colored biomass

Organic Load is calculated as follows:

$$\text{Organic Load (g BOD/day/m}^2\text{)} = \frac{\text{(BOD, mg/L) x (Flow, m}^3\text{/d)}}{\text{(Area, ft2)}}$$

Example 1

Calculate the organic loading on L333 Biodisks if the operation data are the following:

- Media Surface Area of L333 = 3390 m² (see table on Section 2.2)
- Influent Flow = 55 m³/d (flowmeter on P5 and P6 pumps of the EQT)
- Influent BOD = 240 mg/L (last result from independant laboratory)

$$\text{Organic Load} = \frac{\text{(240 mg/L) x (55 m}^3\text{/d)}}{\text{(3390 m}^2\text{)}}$$

$$\text{Organic Load} = 3{,}9 \text{ g BOD/day/m}^2$$

Example 2

Calculate the organic loading on the four (4) Biodisks if the operation data are the following:

- Media Surface Area of L333 = 3390 m² (see table on Section 2.2)
- Media Surface Area of each LJ-100 = 487 m² (see table on Section 2.2)
- Influent Flow = 78 m³/d (flowmeter on P5 and P6 pumps of the EQT)
- Influent BOD = 280 mg/L (last result from independent laboratory)

$$\text{Organic Load} = \frac{\text{(280 mg/L) x (78 m}^3\text{/d)}}{\text{(4851m}^2\text{)}}$$

$$\text{Organic Load} = 4{,}5 \text{ g BOD/day/m}^2$$

4.7 Process troubleshooting guide

This section of the manual presents troubleshooting procedures for solving common operating problems experienced in the Rotating Biological Contactors (RBC) process.

With each problem or observation, a list is included for the probable causes, checks to determine the cause, and the suggested corrective measures. You, the operator, must determine and select one or more of the corrective measures that will restore the process to its full efficiency with the least adverse effect on the final effluent quality.

There are different problems presented that frequently occur in operating the RBC process. In all of the guides presented, the probable cause given for the observation should be looked at concurrently because many times one problem may have several causes.

Table 7.3 – Troubleshooting Guide — Rotating Biological Contactors

(Adapted from *PERFORMANCE EVALUATION AND TROUBLESHOOTING AT MUNICIPAL WASTEWATER TREATMENT FACILITIES*, Office of Water Program Operations, US EPA, Washington, DC.)

INDICATOR/OBSERVATION	PROBABLE CAUSE	CHECK OR MONITOR	SOLUTION
1. Decreased treatment efficiency.	1a. Organic overload.	1a. Check peak organic loads — BOD, SS, DO, pH, temperature.	1a. 1. Improve pretreatment of plant. 2. Place another RBC in service if available. 3. Remove bulkhead between stages 1 and 2 for larger first stage. 4. Recycle effluent as a possible short-term solution.
	1b. Hydraulic overload.	1b. Check peak hydraulic loads — if less than twice the daily average, should not be the cause.	1b. 1. Flow equalization; eliminate source of excessive flow. 2. Balance flows between reactors. 3. Store peak flows in collection system, monitor possible overflows of collection system.
	1c. pH too high or too low.	1c. Desired range is 6.5 - 8.5 for secondary treatment; 8 - 8.5 for nitrification.	1c. 1. Eliminate source of undesirable pH or add acid or base to adjust pH. When nitrifying, maintain alkalinity at 7 times the influent NH_3 concentration. 2. Sodium bicarbonate can be used to increase both pH and alkalinity.
	1d. Low wastewater temperatures.	1d. Temperatures less than 55°F will reduce efficiency.	1d. 1. Cover RBC to contain heat of wastewater. 2. Heat influent to unit or building.
2. Excessive sloughing of biomass from discs.	2a. Toxic materials in influent.	2a. Determine material and its source.	2a. 1. Eliminate toxic material if possible — if not, use flow equalization to reduce variations in concentration so biomass can acclimate. 2. Recycle effluent for dilution.
	2b. Excessive pH variations.	2b. pH below 5 or above 10 can cause sloughing.	2b. Eliminate source of pH variations or maintain control of influent pH.
	2c. Unusual variation in flow and/or organic loading.	2c. Influent flow rate(s) and organic strength.	2c. Eliminate/reduce variations by throttling peak conditions and recycling from the secondary clarifier or RBC effluent during low flows. 2d. Monitor industrial contributors for flow variations.
3. Development of white biomass over most of disc area.	3a. Septic influent or high H_2S concentrations.	3a. Influent odor.	3a. Pre-aerate wastewater or add sodium nitrate or hydrogen peroxide or place another RBC unit in service. Prechlorination of influent will also control sulfur-loving bacteria.
	3b. First stage is overloaded organically.	3b. Organic loading on first stage.	3b. 1. Improve pretreatment of plant. 2. Place another RBC in service, if available. 3. Adjust baffles between first and second stages to increase total surface area in first stage.
4. Solids accumulating in reactors.	4a. Inadequate pretreatment.	4a. Determine if solids are grit or organic.	4a. Remove solids from reactors and provide improved grit removal or primary settling.

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ACTIVATED SLUDGE PROCESS
SECONDARY CLARIFIER

TROUBLESHOOTING GUIDE NO. 3 — SOLIDS WASHOUT/BILLOWING SOLIDS

OBSERVATION	PROBABLE CAUSE	NECESSARY CHECK	REMEDIES	REFERENCES
1. Localized clouds of homogenous sludge solids rising in certain areas of the clarifier. Mixed liquor in settleability test settles fairly well with a clear supernatant.	A. Equipment malfunction.	1. Refer to Troubleshooting Guide No. 1, Observations 1-A, 2-A, and 2-B. 2. Check the following equipment for abnormal operation. a. Calibration of flow meters. b. Plugged or partially plugged RAS or WAS pumps and transfer lines. c. Sludge collection mechanisms, such as broken or worn out flights, chains, sprockets, squeegees, plugged sludge withdrawal tubes. 3. Check sludge removal rate and sludge blanket depth in clarifier.	2) Repair or replace abnormal operating equipment. 3) Adjust RAS rates and sludge collector mechanism speed to maintain sludge blanket depth at 1 to 3 feet from clarifier floor.	pg II-77 pg II-28

ACTIVATED SLUDGE PROCESS
SECONDARY CLARIFIER

TROUBLESHOOTING GUIDE NO. 3 — SOLIDS WASHOUT/BILLOWING SOLIDS (continued)

OBSERVATION	PROBABLE CAUSE	NECESSARY CHECK	REMEDIES	REFERENCES
	B. Air or gas entrapment in sludge floc or denitrification occurring.	1. Perform sludge settleability test and gently stir sludge when settling to see if bubbles are released.	1) If the process is not nitrifying, refer to Probable Cause A above, and Troubleshooting Guide No. 7, Observation 2.	pg II-90
		2. If bubbles are released, check nitrate mg/l in secondary effluent to see if the process is nitrifying.	2) If the process is nitrifying, refer to Troubleshooting Guide No. 5, Probable Cause A.	
	C. Temperature currents.	1. Perform temperature and D.O. profiles in clarifier.	1) If temperatures exceed 1 to 2 degrees between top and bottom of clarifier, use an additional aeration tank and clarifier if possible.	pg II-81
		2. Check inlet and outlet baffling for proper solids distribution in clarifier.	2) Modify or install additional baffling in clarifiers.	pg II-81
			3) Refer to Probable Cause A-1, and A-2 above.	
	D. Solids washout due to hydraulic overloading.	1. Check hydraulic detention time in aeration tank and clarifier, and surface overflow rate in clarifier.	1) If hydraulic loadings exceed design capability, use additional aeration tanks and clarifiers if possible.	pg II-78
			2) Reduce RAS rate to maintain high sludge blanket depth in clarifier.	pg II-29
			3) If possible, change process operation to sludge reaeration or contact stabilization mode.	pg III-15
			4) Refer to Probable Causes B-1, B-2, and C-2 above.	

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ACTIVATED SLUDGE PROCESS
SECONDARY CLARIFIER

TROUBLESHOOTING GUIDE NO. 3 — SOLIDS WASHOUT/BILLOWING SOLIDS (continued)

OBSERVATION	PROBABLE CAUSE	NECESSARY CHECK	REMEDIES	REFERENCES
2. Localized clouds of fluffy homogenous sludge rising in certain areas of the clarifier. Mixed liquor in settleability test settles slowly, leaving stragglers in supernatant.	A. Overloaded aeration tank (low MLSS) resulting in a young, low density sludge.	1. Check and monitor trend changes which occur in the following: a. Decrease in MLVSS, mg/l. b. Decrease in MCRT, Gould Sludge Age. c. Increase in F/M ratio. d. Lower air SCFM rate to maintain D.O. level.	1) Decrease WAS rates by not more than 10% per day to bring process back to optimum parameters.	pg II-87 & II-36

ACTIVATED SLUDGE PROCESS
SECONDARY CLARIFIER

TROUBLESHOOTING GUIDE NO. 5 — SLUDGE CLUMPING

OBSERVATION	PROBABLE CAUSE	NECESSARY CHECK	REMEDIES	REFERENCES
1. Sludge clumps (from size of a golf ball to as large as a basketball) rising to and dispersing on clarifier surface. Bubbles noticed on clarifier surface. Mixed liquor in settleability test settles fairly well, however a portion of and /or all of the settled sludge rises to the surface within four hours after test is started.	A. Denitrification in clarifier.	1. Check for increase in secondary effluent nitrate level. 2. Check loading parameters. 3. Check D.O. and temperature levels in the aeration tank. 4. Check RAS rates and sludge blanket depth in clarifier.	1) Increase WAS rate by not more than 10% per day to reduce or eliminate level of nitrification. If nitrification is required, reduce to allowable minimum. 2) Maintain WAS rates to keep process within proper MCRT, Gould Sludge Age, and F/M ratio. 3) Maintain D.O. at minimum level (1.0 mg/l). Be sure adequate mixing is provided in the aeration tank. 4) Adjust RAS rate to maintain sludge blanket depth of 1 to 3 feet in clarifier.	pg II-30 & II-36 pg II-35 pg II-24 pg II-29
	B. Septicity occurring in clarifier.	1. Refer to Troubleshooting Guide No. 1, Observation No. 2. 2. See 3 and 4 above.		

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ACTIVATED SLUDGE PROCESS
SECONDARY CLARIFIER

TROUBLESHOOTING GUIDE NO. 8 — CLOUDY SECONDARY EFFLUENT

OBSERVATION	PROBABLE CAUSE	NECESSARY CHECK	REMEDIES	REFERENCES
1. Secondary effluent from clarifier is cloudy and contains suspended matter. Mixed liquor in settleability test settles poorly, leaving a cloudy supernatant.	A. MLSS in aeration tank low due to process start-up.	1. Refer to Troubleshooting Guide No. 2, Observation No. 1.		
	B. Increase in organic loading.	1. Perform microscopic examination on mixed liquor and return sludge. Check for presence of protozoa.	1) If no protozoa are present, possible shock organic loading has occurred.	pg II-93 & IV-18
		2. Check organic loading on process.	2) Reduce WAS rate by not more than 10% per day to bring process back to proper loading parameters and increase RAS rates to maintain 1 to 3 foot sludge blanket in clarifier.	pg II-42 & II-36
		3. Check D.O. level in aeration tank.	3) Adjust air SCFM rate to maintain D.O. level within 1.0 to 3.0 mg/l.	pg II-24
	C. Toxic shock loading.	1. Perform microscopic examination on mixed liquor and return sludge. Check for presence of inactive protozoa.	1) If protozoa are inactive, possibility of recent toxic load on process.	pg II-93
			2) Refer to Troubleshooting Guide No. 2, Observation No. 1-C.	

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ACTIVATED SLUDGE PROCESS
SECONDARY CLARIFIER

TROUBLESHOOTING GUIDE NO. 6 — CLOUDY SECONDARY EFFLUENT (continued)

OBSERVATION	PROBABLE CAUSE	NECESSARY CHECK	REMEDIES	REFERENCES
	D. Overaeration causing mixed liquor floc to shear.	1. Perform microscopic examination on mixed liquor. Check for dispersed or fragmented floc and presence of active protozoa.	1) Refer to Troubleshooting Guide No. 1, Observation No. 1-A.	pg IV-18
	E. Improper D.O. levels maintained in aeration tank.	1. Refer to Troubleshooting Guide No. 1, Observation No. 2.		

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5. TROUBLESHOOTING GUIDES

This section presents a summary of Troubleshooting Guides gathered in the available Operation and Maintenance Manuals.

The Troubleshooting Guide in this section only applies to trouble, probable cause, and corrective solution that can occur on mechanical equipment. The problems and solutions related to the process are in Section 4.

For more information, refer to Operation and Maintenance Manual before working on equipment.

5.1 MOTOR AND GEARBOX – BIODISK L333

See appendix A

5.2 TROJAN UV 3000 – BIODISK L333

See appendix B

5.3 PYROTENAX INDUSTRIAL HEAT TRACING – BIODISK LJ-100

See appendix C

5.4 SEVERN TRENT ULTRADYNAMIC UV SYSTEM – BIODISK LJ-100

See appendix D

5.5 GREY LINE FLOWMETER DFM 4.0 - EQT

See appendix E

5.6 YSI ENVIRONMENTAL – YSI 550A DISSOLVED OXYGEN METER

See appendix F

5.7 HACH – SENSION 6 DISSOLVED OXYGEN METER

See appendix G

6. RECORD KEEPING

The operators of the Sewage Treatment Plant (STP) are important players behind any effluent treatment successful story. In successful organizations, the operators are typically tasked with specific responsibilities that include daily chores such as general daily inspection of the STP to ensure that there is no effluent pipe leakages or equipment breakdown, preventive maintenance and performance monitoring, sampling, record keeping, etc. These activities need to be conducted in a coordinated manner to ensure proper functioning of all the STP components.

Monitoring, recording, and reporting of the STP performance are required to demonstrate that the treatment system is functioning correctly and the effluent standards are being complied with.

A successful effluent treatment depends on all components of the STP being operational and in optimal condition. Problems with any system components will affect the overall efficiency of the STP, resulting in poor effluent quality. To ensure a successful treatment and regulatory compliance, each of the treatment processes (unit processes and unit operations) needs close monitoring on a regular basis.

It is recommended to maintain the performance monitoring data and corrective actions taken record to address problems encountered in the STP daily operation. The tables recommended to use are shown in the next pages. The record should be kept in a log or in a file and should be available on demand.

SECTION 7 TROUBLESHOOTING

7.1 Error Codes

Error codes inform the user of an out-of-range value or meter problem. *Table 6* outlines the operator assistance codes available in the meter series.

Table 6

Error Code	Error Type	Possible Remedy
E-1	Data error in the non-volatile memory.	Turn off the meter, then turn it on again.
E-3	Failure to correctly store a reading.	Call Service. Meter cannot store data in at least one location, but is otherwise functional.
E-9	Failure to correctly retrieve a reading that was stored earlier.	Call Service.
E-10	Sample temperature is out of range (0 to 50 °C).	

Note: *To display the electric current coming from the dissolved oxygen electrode, press the* **READ** *and* **CONC** *% keys simultaneously.*

Appendix A

MOTOR AND GEARBOX – BIODISK L333

7.0 - TROUBLE SHOOTING

7.1 - MECHANICAL HARDWARE

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Noisy chain	1. Loose chain 2. Faulty lubrication 3. Misalignment 4. Worn Parts 5. Moving parts rubbing stationary parts	1. Tighten chain 2. Lubricate properly 3. Correct sprocket alignment 4. Replace worn chain 5. Align & tighten chain to clear oil bath
Rapid wear on chain	1. Faulty lubrication 2. Loose or misalign parts	1. Lubricate properly 2. Align & tighten entire drive
Chain climbing sprockets	1. Worn out chain and sprockets 2. Loose chain	1. Replace worn out parts 2. Tighten chain
Stiff chain	1. Misalignment 2. Worn out chain or sprockets 3. Faulty lubrication 4. Rust corrosion	1. Correct alignment 2. Replace worn out parts 3. Lubricate properly 4. Clean and lubricate
Noisy Bearing	Rollers or bearings damaged	Replace bearing cartridge
Bearing grease discoloured or mixed with water	Insufficient grease in the bearings	Purge bearing with grease and increase lubrication interval
Hot bearing	1. Improper lubrication 2. Rollers or bearing race damaged	1. Purge bearing with grease and decrease lubrication interval 2. Replace bearing cartridge
Reducer temperature rises above 200 degrees Fahrenheit.	Oil level too high or too low	Maintain proper oil level
Oil leakage from reducer	1. Oil seals need to be replaced 2. Ventilators/breather plugged causing pressure build-up inside the reducer. 3. Oil level too high	1. Replace oil seals 2. Clean Ventilators 3. Correct oil level
Noisy reducer	1. Bearing failure 2. Misalignment in worm gear inside 3. Coupling between motor and reducer worn out and misalign	1. Check bearings and replace if necessary 2. Align worm gear shafts. 3. Replace coupling between motor and reducer. Align coupling hub vertically
Noisy Motor	Bearing damage	Replace damaged bearings
Motor overheating	1. Reducer overheating 2. Cooling fins on motor are clogged 3. Overload 4. Rotor rubbing on stator 5. Over greasing or lubrication	1. Check reducer 2. Clean fins 3. Check for excess friction or imbalance 4. Replace bearings 5. Avoid packing grease too tightly
Motor won't start	1. Power trouble 2. Single phasing at station 3. Fuse blown	1. Check source of power supply 2. Do not try to make it go and "fry" motor. Check starter windings 3. Replace fuse
Knocking/rumbling on motor bearings	1. Bearing worn due to lack of lubrication or excessive mechanical overload 2. Bearings slack in housing	1. Replace bearing and put new grease of recommended grade. 2. Fir new end shields
Rotordisk® shaft doesn't turn	1. Power failure 2. Motor failure 3. Reducer failure 4. Chain drive failure	1. Check power supply 2. Check and replace motor and bearings. 3. Check teeth worn gears and bearings. Replace necessary parts 4. Replace chain

Motor Trouble Shooting Chart

Problem	Likely Causes	What To Do
Motor fails to start upon initial installation.	Motor miswired.	Verify motor is wired correctly.
	Motor damaged and rotor is striking stator.	May be able to reassemble; otherwise, motor should be replaced.
	Fan guard bent and contacting fan.	Replace fan guard.
Excessive humming	High voltage.	Check input line connections
Motor had been running, then fails to start.	Fuse or circuit breaker tripped.	Replace fuse or reset breaker.
	Stator is shorted or went to ground. Motor will make a humming noise and the circuit breaker or fuse will trip.	Contact NORD for assistance
	Motor overloaded or load jammed.	Inspect to see that the load is free. Verify amp draw of motor versus nameplate rating.
Motor runs but dies down.	Voltage drop.	If voltage is less than 10% of the motor's rating contact power company or check if some other equipment is taking power away from the motor.
	Load increased.	Verify the load has not changed. Verify equipment hasn't got tighter. If fan application verify the airflow hasn't changed.
	Bad bearings.	Noisy or rough feeling bearings should be replaced.
	Voltage too low.	Make sure that the voltage is within 10% of the motor's nameplate rating. If not, contact power company or check if some other equipment is taking power away from the motor.
Motor runs in the wrong rotation.	Incorrect wiring.	Disconnect from power source and interchange any two of the three line leads from the three-phase motor.
Vibration	Rubbing between rotating parts and stationary parts.	Isolate and eliminate cause of rubbing.
	Resonance.	Tune system or contact NORD for assistance.
Motor overload protector continually trips.	Load too high.	Verify that the load is not jammed. If motor is a replacement, verify that the rating is the same as the old motor. If previous motor was a special design, a stock motor may not be able to duplicate the performance. Remove the load from the motor and inspect the amp draw of the motor unloaded. It should be less than the full load rating stamped on the nameplate.
	Ambient temperature too high.	Verify that the motor is getting enough air for proper cooling. Most motors are designed to run in an ambient temperature of less than 40° C. (Note: A properly operating motor may be hot to the touch.)
	Winding shorted or grounded.	Inspect stator for defects, or loose, cut wires that may cause it to go to ground.

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TROUBLE SHOOTING

PROBLEM WITH THE REDUCER		POSSIBLE CAUSES	SUGGESTED REMEDY
Runs Hot	Overloading	Load exceeds the capacity of the reducer	Check rated capacity of reducer, replace with unit of sufficient capacity or reduce load
	Improper lubrication	Insufficient lubrication	Check lubricant level and adjust up to recommended levels
		Excessive lubrication	Check lubricant level and adjust down to recommended levels
		Wrong lubrication	Flush out and refill with correct lubricant as recommended
Runs Noisy	Loose foundation bolts	Weak mounting structure	Inspect mounting of reducer. Tighten loose bolts and/ or reinforce mounting and structure
		Loose hold down bolts	Tighten bolts
	Worn RV Disc	Overloading unit may result in damage to disc	Disassemble and replace disc. Recheck rated capacity of reducer.
	Failure of Bearings	May be due to lack of lubricant	Replace bearing. Clean and flush reducer and fill with recommended lubricant.
		Overload	Check rated capacity of reducer.
	Insufficient Lubricant	Level of lubricant in the reducer not properly maintained.	Check lubricant level and adjust to factory recommended level.
Output Shaft Does Not Turn	Internal parts are broken	Overloading of reducer can cause damage.	Replace broken parts. Check rated capacity of reducer.
		Key missing or sheared off on input shaft.	Replace key.
		Coupling loose or disconnected.	Properly align reducer and coupling. Tighten coupling.
Oil Leakage	Worn Seals	Caused by dirt or grit entering seal.	Replace seals. Autovent may be clogged. Replace or clean.
		Overfilled reducer.	Check lubricant level and adjust to recommended level.
		Autovent clogged.	Clean or replace, being sure to prevent any dirt from falling into the reducer.
		Improper mounting position, such as wall or ceiling mount of horizontal reducer.	Check mounting position. Name tag & verify with mounting chart in manual.

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Appendix B

TROJAN UV 3000 – BIODISK L333

13.1 Basic System Troubleshooting

UV module (UVM) troubleshooting

Condition	***Symptom***	***Possible Cause***	***Solution***
1. One UV lamp status LED is off	Corresponding lamp is off	Lamp failure	Replace lamp
		Lamp holder / wiring	Inspect lamp holder and wiring and replace as necessary
		Water intrusion	Inspect and replace lamp, sleeve and o-ring as necessary
	Corresponding lamp is on	Module Board (MCB)	Replace module board
2. Two UV lamp status LEDs are off (lamps 1&2 or lamps 3&4)	Corresponding lamps are off	Lamp failure	Replace lamps
		Lamp holder / wiring	Inspect lamp holder and wiring and replace as necessary
		Water intrusion	Inspect and replace lamp, sleeve and o-ring as necessary
		Ballast failure	Replace ballast
	Both LEDs are off in a two-lamp module	No power to the module	Inspect module power cable – is it plugged-in or damaged? Reset ground fault of PDR or reset PDR supply breaker
	Corresponding lamps are on	Module Board (MCB)	Replace module board
3. All UV lamp status LEDs are off	All lamps are off	Lamp failure	Replace lamps
		Lamp holder / wiring	Inspect lamp holder and wiring and replace as necessary
		Water intrusion	Inspect and replace lamp, sleeve and o-ring as necessary
		Ballast failure	Replace ballast
	All lamps are on	Module Board (MCB)	Replace module board
IF YOU HAVE CHECKED ALL POSSIBLE CAUSES, PLEASE CALL TROJAN TECHNOLOGIES FOR TECHNICAL ASSISTANCE AT 1-800-666-9459			

Power Distribution Receptacle (PDR) Troubleshooting

Condition	***Symptom***	***Possible Cause***	***Solution***
1. Ground Fault (GFI) trips	GFI trips for a specific module only	Cracked sleeve causing water intrusion	Replace sleeve
		Faulty o-ring causing water intrusion	Replace o-ring
		End-cap assembly causing water intrusion	Inspect and repair or replace end-cap assembly
		Faulty or cut wiring	Inspect and repair or replace faulty wiring
	GFI trips for any module	Faulty wiring at GFI	Inspect and repair or replace wiring as necessary
		Faulty GFI receptacle	Replace GFI receptacle
IF YOU HAVE CHECKED ALL POSSIBLE CAUSES, PLEASE CALL TROJAN TECHNOLOGIES FOR TECHNICAL ASSISTANCE AT 1-800-666-9459			

Monitoring System Troubleshooting

Condition	***Symptom***	***Possible Cause***	***Solution***
1. Elapsed Time display flashing		Elapsed time displays 9500-10,000, 19,500-20,000… hours	Replace lamps. Display will stop flashing after 10,000, 20,000… hours
2. UV intensity display is flashing and displaying 0.0mW/cm^2		Sensor cable is not connected to monitoring system	Reconnect UV sensor to monitoring system
		Fouled sleeve and/or sensor	Clean sleeve and sensor as required
		Loose or no connection at TB5 terminal in monitoring system enclosure	Tighten or reconnect wiring at terminal
3. UV intensity display is flashing and displaying value less than alarm set point (1.6 mW/cm^2)		Fouled sleeve and/or sensor	Clean sleeve and sensor as required
IF YOU HAVE CHECKED ALL POSSIBLE CAUSES, PLEASE CALL TROJAN TECHNOLOGIES FOR TECHNICAL ASSISTANCE AT 1-800-666-9459			

Appendix C

PYROTENAX INDUSTRIAL HEAT TRACING
BIODISK LJ-100

10 Troubleshooting Guide

Symptom	Probable Causes	Corrective Action
Insulation resistance less than expected	1. Rainy or high humidity.	(1) Dry tails and face of seal.
	2. Nicks or cuts in heating cable sheath, with moisture present.	(2, 3, 4) Visually inspect cable for damage, especially at elbows, flanges, and around valves. If damaged, repair or replace heating cable. Inspect power connection box for moisture or signs or tracking. Dry out connections and retest.
	3. Kinked or crushed heating cable.	
	4. Arcing created by damage to the heating cable.	
	5. Physical damage to heating cable is causing a direct short.	(5) Check for visual indications of damage around the valves, pump, and any area where there may have been maintenance work. Look for crushed or damaged insulation along the pipe. Replace damaged sections of heating cable.
	6. Presence of moisture in terminations or connections.	(6) Dry out cold lead and/or connections and replace termination if necessary.
	7. Damaged termination.	(7) Replace termination

Symptom	Probable Causes	Corrective Action
Circuit breaker trips	1. Circuit breaker undersized.	(1) Recalculate circuit load current. Resize breaker as required.
	2. Defective circuit breaker.	(2) Repair or replace breaker.
	3. Short circuit in electrical connections.	(3, 4) Eliminate short circuit. Thoroughly dry connections. Install conduit drains as required.
	4. Excessive moisture in connection boxes.	(5, 6) Repair damaged section or replace heating cable.
	5. Nicks or cuts in heating cable sheath, moisture present.	(7) Replace undersized GFPD with 30mA GFPD. Check the GFPD wiring instructions.
	6. Kinked or crushed heating cable.	
	7. Ground-fault protection device (GFPD) is undersized (5mA used instead of 30mA) or miswired.	

Note: *If the corrective actions above do not resolve the problem, verify that the installation is as per design.*

10 Troubleshooting Guide

Symptom	Probable Causes	Corrective Action
Power output appears correct but pipe temperature is below design maintain temperature.	1. Wet or missing insulation.	(1) Remove wet insulation and replace with dry insulation and secure it with proper weather-proofing.
	2. Insufficient heating cable on valves, flanges, supports, pumps, and other heat sinks.	(2) Confirm compliance with system design. (If valve, flange, and pipe support types and quantities have changed, additional heating cable may be required.)
	3. Temperature controller set incorrectly.	(3) Reset temperature controller.
	4. Improper thermal design used.	(4) Contact your Tyco Thermal Controls representative to confirm the design and modify as recommended.
	5. Temperature sensor in wrong location.	(5) Confirm that sensor is in the correct location.
	6. Low fluid temperature entering pipe.	(6) Verify temperature of fluid entering pipe.

Symptom	Probable Causes	Corrective Action
Power output is zero or incorrect	1. No input voltage.	(1) Repair electrical supply lines and equipment.
	2. Temperature controller wired in the normally open (N.O) position.	(2) Confirm wiring using the normally closed (N.C.) terminals so that contacts close with falling temperature.
	3. Broken or damaged heating element, hot-cold joint, end cap, or broken tail.	(3) Repair or replace heating cable.
	4. Wrong cable used.	(4) Verify installation as per design and replace cable if necessary.
	5. Improper voltage used.	(5) Verify voltage and connect to proper voltage if necessary.

Note: *If the corrective actions above do not resolve the problem, verify that the installation is as per design.*

Appendix D

SEVERN TRENT ULTRADYNAMIC UV SYSTEM – BIODISK LJ-100

6 TROUBLESHOOTING CHART

Trouble	Probable Cause	Corrective Action
1. Low UV Output	a. Dirty quartz jacket b.Old or broken quartz jacket c.Old Uv lamps d.Water or condensation inside quartz jacket	a.Remove and clean quartz jacket b.Replace quartz jacket c.Replace UV Lamps d.Remove jacket and dry internal quartz
2.Low voltage output	a.Bad regulator	a.Replace regulator
3.Lamp out	a.Bad lamp b.Bad ballast	a.Replace lamp b.Replace ballast
4.Low UV transmission	a.dirty, cloudy or high mineral count	a.Install pre-filter or de-mineralizer
5.Sensor inoperative	a.Dirty sensor lens	a.Remove and clean lens
6.Sensor malfunctioning	a.Water or condensation inside sensor b.Sensor calbe not connected	a.Remove and dry inside sensor b.Verify that the sensor cable is connected to the monitor
7.Monitor not operating	a.Sensor cable not connected b.Monitor switch in the OFF position c.No power to monitor d.Incorrect power supply to monitor.	a.Verify that the sensor cable is connected to the monitor b.Verify that the monitor switch is in the ON position c.Verify power to monitor. d.Verify power supply voltage to monitor, either 120 Vac or 240 Vac.

Design improvements may be made without notice.
Represented by:

SEVERN TRENT SERVICES

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Web: www.severntrentservices.com
E-mail: marketing@severntrentservices.com

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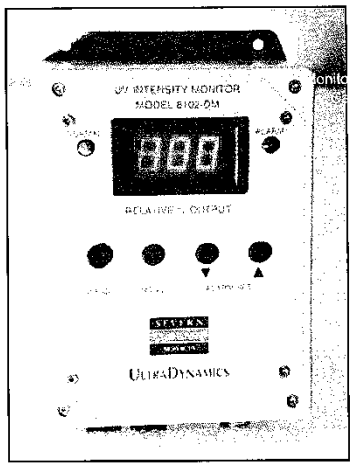
Maintenance:

(Reference Figure 1 & 3)
Listed in the below table are possible causes for a reduced reading of UV intensity.

Indication	Cause	Corrective Action
Gradual loss of UV intensity over several weeks or months	Fouled quartz sleeve	Follow UV System instruction manual for quartz sleeve cleaning procedure
Gradual loss of UV intensity over a 1 year period	Lamp degradation	Replace UV lamp - lamps last for 1 year Refer to UV system instruction manual
Total loss of UV intensity Check lamp status alarm	Lamp failure	Replace UV lamp Refer to UV system instruction manual
Gradual or total loss of intensity after the above have been ruled out	Change in water quality	Increase in suspended or dissolved solids may require installation of pre-filter

When cleaning the UV system quartz sleeve it is also necessary to clean the UV sensor probe. Shut off water, relieve the system pressure and/or isolate (valve out) the UV chamber. Remove the monitor by unscrewing the white retaining nut and sliding the probe out of the sensor port.

Deposits on the sensor probe are mostly caused by suspended and dissolved solids and minerals naturally occurring in the water. This coating can be easily removed by applying a small amount of lemon juice to a soft dry cloth and gently rubbing the sensor probe until clean, rinsing with hot water.



Detailed Menu Level Description

L01 Press the menu key once. L01 will be displayed. Press the menu key again. The preset alarm level will be displayed. Use the up and down keys to select the new alarm level. Press the menu key return to return to the Relative % Output display. The new alarm level will be set. If the up or down keys are not activated for longer then two seconds, the unit will default to the Relative % Output display.

L02 This function is not used on the Series 8102–DM /P. Changing this value will have no affect on the unit's operation.

L03 Press the menu key once. Press the up key twice to display L03. Press the menu key once. The absolute detector current will be displayed in milliamperes. Press the menu key again to return to the Relative % Output display.

L04 Press the menu key once. Press the up key three times to display L04. Press the menu key once. The absolute detector voltage will be displayed in Volts. Press the menu key again to return to the Relative % Output display

L05 Consult Factory, not for customer use.

Appendix E

GREYLINE FLOWMETER DFM 4.0 EQT

FIELD TROUBLESHOOTING

Possible Causes:	*Corrective Action:*
METER READING LOWER THAN EXPECTED	
Calibration Error	• Review UNITS/MODE menu and Pipe ID
Lower flow rate than expected	• Investigate pump/valves. Compare velocity with alternate instrument
Signal not penetrating far enough into the flow stream	• Relocate sensor closer to elbows or flow disturbances
Improper mounting of sensor	• Reinstall Sensor with careful application of Coupling Compound
Pipe is not full	• Remount Sensor on vertical pipe
METER READING WHEN THERE IS NO FLOW	
Vibration on pipe	• Install in another location
Local electrical noise	• Ensure all Flowmeter wiring is in METAL conduit and sensor shield is properly grounded. • Ensure correct power input Ground connection (<1 ohm resistance). • Ensure 4-20mA Shield connected to Instrument Ground stud.
Cross talk between two or more DFM 4.0 flowmeters on same pipe	• Turn OFF one flowmeter or relocate the second flowmeter at a greater distance.
Variable Speed Drive interference	• Follow Drive manufacturers wiring and Grounding instructions • Relocate Flowmeter electronics, Sensor and wiring away from VSD
Valve leak or Reverse flow	• Test Valve. Relocate Sensor farther from valve • Use Backflow Rejection
Sensor connections incorrect	• Refer to Connections diagram

Possible Causes:	*Corrective Action:*
METER READING ERRATIC	
Sensor mounted too close to valve, pump or elbow	• Change sensor placement. Recommended 6-10 diameters from elbows, and 30 diameters from pumps, controlling valves, orifice plates, nozzles or open pipe discharge
NO FLOW INDICATION	
Not enough suspended particles or gases in the fluid	• Relocate sensor in more turbulent pipe section. Mount sensor at 12 o'clock position on horizontal pipe
Coupling compound washed out, or sensor loose on pipe	• Remount sensor • Use Dow Corning Silicone #4
`Slave` selected in `SPECIAL FUNCTIONS` menu with no Synchronization input from Master.	• Select `Master` in `SPECIAL FUNCTIONS` menu.
Power interruption. No flow.	• Check fuse/breaker. Confirm flow
METER READING TOO HIGH	
Calibration error	• Review UNITS/MODE menu and Pipe ID
Vibration or noise on the pipeline	• Install in another location.
Pipe is not full	• Remount Sensor on vertical pipe
Nearby velocity increasing device (pump, valve, orifice plate)	• Relocate sensor >30 pipe diameters from velocity increasing device
Local electrical noise	• Ensure all Flowmeter wiring is in METAL conduit and sensor cable shield is connected to Ground stud
Variable Speed Drive interference	• Follow Drive manufacturers wiring and Grounding instructions • Relocate Flowmeter electronics, Sensor and wiring away from VSD

Possible Causes:	*Corrective Action:*
METER READING DOES NOT TRACK FLOW	
Sensor and GND wires reversed or not properly connected	• Check Sensor connections
Improper AC power input Ground	• Use direct connection with 12 AWG wire to nearest Ground pole (<1 ohm resistance).

Appendix F

YSI ENVIRONMENTAL – YSI 550A DISSOLVED OXYGEN METER

TROUBLESHOOTING

NOTE: An error displayed briefly during the first few seconds after turning the instrument on does NOT indicate a problem.

SYMPTOM	POSSIBLE SOLUTION
1. Instrument will not turn on, LCD displays "LO BAT", or Main display flashes "OFF"	A. Low battery voltage, replace batteries B. Batteries installed incorrectly, check battery polarity C. Return system for service
2. Instrument will not calibrate.	A. Replace membrane and electrolyte B. Clean probe electrodes C. Return system for service
3. Instrument "locks up".	A. Remove batteries, wait 15 seconds for reset, replace batteries B. Replace batteries C. Return system for service
4. Instrument readings are inaccurate.	A. Verify calibration altitude and salinity settings are correct and recalibrate. B. Probe may not have been in 100% water saturated air during calibration procedure. Moisten sponge in calibration chamber and recalibrate. C. Replace membrane and electrolyte. Recalibrate. D. Clean probe electrodes. E. Return system for service.
5. Main display reads "Over" or "Undr".	A. Sample O_2 concentration is more than 60 mg/L or 500%, or less than –0.02 mg/L or -0.3%. B. Verify calibration altitude and salinity settings are correct and recalibrate. C. Replace membrane and electrolyte. Recalibrate. D. Clean probe electrodes. E. Return system for service.
6. Main display reads "Over" or "Undr" during calibration.	A. Replace membrane and electrolyte. Recalibrate. B. Clean probe electrodes. C. Return system for service.
7. Secondary display reads "Ovr" or "Undr".	A. Sample temperature is less than -5° C (23°F) or more than +45°C (122°F). Increase or decrease the sample temperature to bring within the allowable range. B. Return system for service.

Appendix C: STP Sample Sheets, April 2011

MEADOWBANK STP - MONTHLY REPORT

Month: **February 2010** **Average flow:**

PARAMETER	INFLUENT	EFFLUENT	EFFICIENCY	COMMENTS
Independant laboratory				
BOD (mg/L)				
COD (mg/L)				
TSS				
TKN				
NH3-NH4				
NO2-NO3				
P tot				
Fecal Coliform				
On site				
pH				
Alkalinity				
D.O.				
Turbidity				
Temperature		22		

Sludge extractions (m^3)	Primary tanks	Final Clarifier	Comments
LJ-1			
LJ-2			
LJ-3			
L-333			
Total			

MEADOWBANK STP - WEEKLY ANALYSIS

Month: _____

DATE:						Average
STP - INFLUENT						
BOD_5 (mg O_2/L)						
COD (mg O_2/L)						
TSS (mg/L)						
TKN (mg N/L)						
NH_3-NH_4 (mg N/L)						
P tot (mg/L-P)						
STP - FINAL EFFLUENT						
BOD_5 (mg O_2/L)						
COD (mg O_2/L)						
TSS (mg/L)						
TKN (mg N/L)						
NH_3-NH_4 (mg N/L)						
NO_2-NO_3 (mg N/L)						
P tot (mg/L-P)						
Fecal Coliform (UFC/100 mL)						

Comments :

MEADOWBANK MINE - SEWAGE TREATMENT PLANT

Month: _____ **201** ____

Date	Time	Operator	Concentration of gaz at L-333				COMMENTS
			CO Level (ppm)	O_2 Level (%)	Comb/Ex	H_2S (ppm)	
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
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31							

MEADOWBANK MINE - SEWAGE TREATMENT PLANT

Month: _____ **201** ____

Date	Time	Operator	LJ -1				LJ -2				L 333				FINAL EFFLUENT				Grey Water LS-3	
			D.O		pH	Temp	D.O		pH	Temp	D.O	pH	Temp		D.O	pH	Temp.	Colour	pH	Temp
			In (mg/L)	Out (mg/L)	Out	Out (°C)	In (mg/L)	Out (mg/L)	Out	Out (°C)	Out (mg/L)	Out	Out (°C)		(mg/L)		(°C)			(°C)
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Appendix D : Site Services Protocols and Procedures

Changing the length of time the pumps will pump from the EQ tank into the Bio-Disks

PROCEDURE NUMBER:			MBK-SIT-0025
People concerned	**Site Services**	**Prepared by**	Services Department
		Approved by	Alain Hamel Services General Superintendent
Issuing date :	2012-04-11		
This procedure corresponds to the required minimum standard. Each and every one also has to comply with the rules and regulations of the Nunavut Government in terms of health and safety at work.			

Objective:

To

Concerned departments:

Site services

Required employee preparation:

- Every person is required to have Hepatitis A & B and Tetanus shots before doing any work at the STP that will bring them in contact with contaminants i.e. sewage, sludge, effluent, influent, etc.

✓

Impacts			
Health & Safety	Process/Quality	Costs	Environment

Changing the length of time the pumps will pump from the EQ tank into the Bio-Disks

Procedure	Risks/ Impacts
The screen in the top left corner of the panel is what is used for controlling the pumps	
1. Start at the screen "SYSTEM STATUS MENU"	Prevent incident and /or accident; health issues
2. If the screen is not at "SYSTEM STATUS MENU" press "DISP" (DISPLAY)	Prevent incident and /or accident; health issues
3. If the "DISP" is not showing but a "PREV" is, press the "PREV" until you come to "DISP"	
4. Press the "DISP" key and that will take you to the "SYSTEM STATUS MENU"	
5. For pumps 1 & 2 which currently feed LJ #1 press PAIR 1 , "ON & OFF SCREEN"	
6. For pumps 3 & 4 which currently feed LJ #3 press PAIR 2 , "ON & OFF SCREEN"	
7. For pumps 5 & 6 which currently feed L333 press PAIR 3 , "ON & OFF SCREEN"	

Changing the length of time the pumps will pump from the EQ tank into the Bio-Disks

8. After pressing the pair of pumps you want to change press NEXT (middle right)	
9. You will see the "PUMP PAIR " screen	
10. Press Next	
11. You will now be at the "FLOW RATE & ENABLE " screen	
12. Press ADFI(l/s) (top left corner)	
13. Curser will be flashing on the last number on right	
14. Using the BS (Back space key) press until you are at the number you would like to change	
15. i.e. +0.4500 on the screen presently	
16. Each time you press the BS key you will remove a number from the left	

Changing the length of time the pumps will pump from the EQ tank into the Bio-Disks

17. Pressing BS 4 times will bring you to +0	
18. If you want to change it to +0.5150 , press the 5 , then the 1 , and the 5, not necessary to press 0	
19. After you have done this press "ENT" (bottom left)	
20. The ADF(Average Daily Flow) on the pump has now been changed	
21. To get back to the main menu	
22. Press "PREV"(bottom middle)	
23. Then press "DISP"	
24. You are now back to the main menu	
25. The above instructions are for pairs #1 & #3	

Changing the length of time the pumps will pump from the EQ tank into the Bio-Disks

26. **Pair # 2 is a little different**	
27. **You will notice that in pairs #1 & #3 the number you have programmed into the" ADFl (l/s)" screen of the "FLOW RATE & ENABLE" screen is the same as in the "PUMP PAIR " screen**	
28. **Pump #2 will have a lower number in the "FLOW RATE & ENABLE" screen than in the "PUMP PAIR" screen *(It is just the way it has been programmed)***	
29. **i.e. in order to get 45 seconds on the "PUMP PAIR " screen you have to enter +0.2800 in the ADFl(l/s) screen of the "FLOW RATE & ENABLE" screen**	
30. **The ADFl(l/s) number is approx. 63% of the seconds (not including the decimal point)**	
31. **You will just need to play with it a bit to get the number you want**	
32. **Important:** If you happen to press "ENABLE" in the "FLOW RATE & ENABLE" screen by mistake and it is now at "DISABLE" just press the "DISABLE" and it will go back to "ENABLE"	
33. **When you are at the first menu ("SYSTEM STATUS MENU") ensure that the pairs 1 , 2 & 3 all have an "EN" displayed if all pumps are being used**	
34. If not , go to the pair that has a "DIS" on it , press that pair	

Changing the length of time the pumps will pump from the EQ tank into the Bio-Disks

35. Press "NEXT" to get to the "FLOW RATE & ENABLE" screen	
36. Press on "DISABLE" to change it back to "ENABLE"	
37. Press "PREV"	
38. Press DISP"	
39. You should be back at the Main Menu	

Personal Hygiene at STP

Personal Hygiene Protocol to follow when working at the Sewage Treatment Plant and Lift Stations

Daily Inspection and readings

Lab coat

Boot covers

Nitrile gloves

Safety glasses

- Shower not required
- Thorough washing and disinfection of hands before leaving decontamination unit

Testing - every second day

Lab coat

Boot covers

Nitrile gloves

Safety glasses

- Shower not required
- Thorough washing and disinfection of hands before leaving decontamination unit

Cleaning Lift Station #3

Tyvek suit

Boot covers

Nitrile gloves

Safety glasses

- Shower not required
- Thorough washing and disinfection of hands before leaving decontamination unit

Cleaning/Changing U.V. lamps - Little Johns/L333

Tyvek suit

Boot covers

Nitrile gloves

Safety glasses

- Shower not required
- Thorough washing and disinfection of hands before leaving decontamination unit

Personal Hygiene Protocol to follow when working at the Sewage Treatment Plant and Lift Stations

Sludge measurement

Tyvek suit

Boot covers

Nitrile gloves inside rubber gloves

Safety glasses

- Shower not required
- Thorough washing and disinfection of hands before leaving decontamination unit

Sludge removal

Tyvek suit

Boot covers

Nitrile gloves inside rubber gloves

Safety glasses with full face shield/full face respirator

- Shower required

Changing Pumps in influent lift stations/working on pipes - raw sewage (plumbers?)

Tyvek suit

Boot covers

Nitrile gloves inside rubber gloves

Safety glasses

- Shower required

Changing Pumps in effluent lift stations/working on pipes (plumbers?)

Tyvek suit

Boot covers

Nitrile gloves - rubber gloves if required

Safety glasses

- Shower required

SAMPLING AND TESTING

TARGET ANALYSIS RESULTS

	TARGET	ACCEPTABLE
pH	6.5 - 8.0	6.0 - 8.5
D.O. in	> 1.0 ppm	> .3 ppm
D.O. out	> 4.0 ppm	> 2.0 ppm
Temperature	20 - 25 C	15 - 30 C
Turbidity	< 20 NTU	< 40 NTU

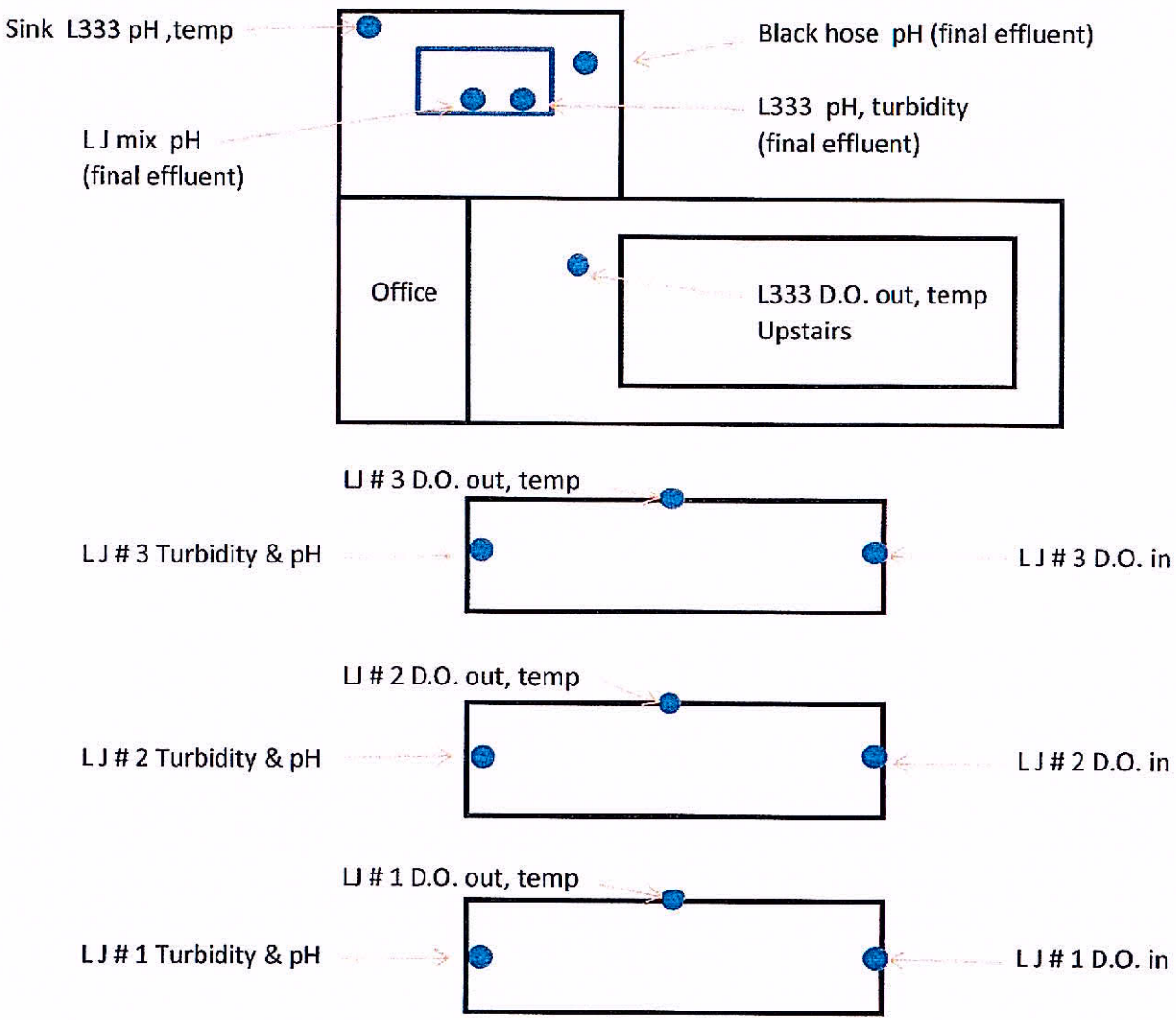
L J = Little Joh. S = Lift Station

STP SAMPLING POINTS

Location	Sampling Points	Frequency	Parameters	pH for Environment
Lift station #3 room	STP IN (Sink close to LS #3)	Every second day	pH temperature	Every Monday or whenever requested by environment department
L J back door	L J # 1 & # 3 IN	Every second day	D.O.	
L J side door	L J # 1 & # 3 OUT	Every second day	D.O. temperature	
L J double doors	L J #1 & # 3 FINAL EFFLUENT (Sample line in LJ close to the flowmeter above the clarifier)	Every second day	pH turbidity	Every Monday or whenever requested by environment department
L333 upstairs	L333 OUT (D.O. is marked on sample point)	Every second day	D.O. temperature	
Lift station #3 room	L333 FINAL EFFLUENT (3/8 " sample line above LS #3)	Every second day	pH turbidity	Every Monday or whenever requested by environment department
Lift station #3 room	L J MIX FINAL EFFLUENT (1" sample line above LS #3)		pH	Every Monday or whenever requested by environment department
Lift station #3 room	FINAL EFFLUENT (black hose from pipe beside flowmeter at LS #3)		pH	Every Monday or whenever requested by environment department

Note: Mondays pH tests done for the Environment Dept must be given to them that day

Sample points at the STP



L J = Little John L333 = Big Bertha

Calibration of pH meter

PROCEDURE NUMBER:			MBK-SIT-0023
People concerned	**Site Services**	**Prepared by**	Services Department
		Approved by	Alain Hamel Services General Superintendent
Issuing date :	2012-04-11		
This procedure corresponds to the required minimum standard. Each and every one also has to comply with the rules and regulations of the Nunavut Government in terms of health and safety at work.			

Objective:

To

Concerned departments:	Required equipment
Site services	

Impacts			
Health & Safety	Process/Quality	Costs	Environment

Calibration of pH meter

Procedure	Risks/ Impacts
For better accuracy, frequent calibration of the instrument is recommended	Prevent incident and /or accident; health issues
Calibrate once a week and record on calibration report	Prevent incident and /or accident; health issues
1. From the normal measuring mode, **press and hold** the MODE button until OFF and until the secondary LCD is replaced by CAL	
2. Release the button. The LCD enters the calibration mode displaying "pH 7.01 USE"	
3. After 1 second the meter activates the automatic buffer recognition feature	
4. For a two point calibration, place the electrode in pH 7.01 buffer solution. After the first calibration point has been accepted, the "pH 4.01 USE" message appears	
5. If no valid buffer is recognized, then the "WRNG" message is shown. It may be time to change the buffer solutions	
6. If a valid buffer (4.01) is detected, then the meter completes the calibration procedure	

Calibration of pH meter

7. When the buffer is accepted, the LCD shows the accepted value with the "OK 2" message and then the meter returns to the normal measuring procedure mode	
8. ***THE ELECTRODE MUST STAY WET DURING STORAGE. ENSURE THAT THERE IS ALWAYS WATER IN THE STORAGE CAPSULE***	
9. ***Taking pH Measurements***	
10. **Submerge** the electrode **in the solution** to be tested while **stirring it gently**	
11. The **measurement** should be **taken when** the stability symbol **(clock)** on the top left of LCD **disappears**	

Testing at the STP

PROCEDURE NUMBER:		MBK-SIT-0022	
People concerned	**Site Services**	**Prepared by**	Services Department
		Approved by	Alain Hamel Services General Superintendent
Issuing date :	2012-04-11		
This procedure corresponds to the required minimum standard. Each and every one also has to comply with the rules and regulations of the Nunavut Government in terms of health and safety at work.			

Objective:

To

Concerned departments:

Site services

Required employee preparation:

- Every person is required to have Hepatitis A & B and Tetanus shots before doing any work at the STP that will bring them in contact with contaminants i.e. sewage, sludge, effluent, influent, etc.

Required equipment

- ✓ PPE : Safety glasses , hard hat, nitrile gloves, gas detector

Impacts			
Health & Safety	Process/Quality	Costs	Environment

Testing at the STP

Procedure	Risks/ Impacts
1. Turn on the D.O and calibrate before testing	Prevent incident and /or accident; health issues
2. Turn on the pH meter and calibrate if necessary(once a week)	Prevent incident and /or accident; health issues
3. Turn on the turbidity meter and calibrate if necessary(once a month)	
4. Check the chart on the wall for schedule and locations of sampling points	
5. Procedures for each sampling point are posted at each location	
6. Record all test results and enter into computer	

Procedures For Little John's

Procedures for Changing U.V. Lamps and

Changing/Cleaning Tubes in Little John U.V. Lamp Units

Every person is required to have Hepatitis A & B and Tetanus shots before doing any work at the STP that will bring them in contact with contaminants i.e. sewage, sludge, effluent, influent, etc.

✓ **Warning : Do not look at the U.V. lamps when they are on**

There are 2 sealed U.V. lamp units , both have 6 U.V. lamps inside each unit

✓ **PPE: Tyvek suit, boot covers, nitrile gloves, safety glasses, hard hat, locks for locking out electrical panel**

1) Check for gases with gas detector before entering the U.V. lamp area
2) Shut off and lock out one of the U.V. lamps units
3) Using a step ladder close the valves on both sides of the unit being cleaned
4) Place a pail under the drain hose and open the valve
5) Crack the outlet valve a bit to allow the unit to drain
6) Once the unit has been drained remove the sensor
7) The sensor is located on the side of each unit and is threaded in
8) With the 50% Lime Away solution spray bottle clean the sensor by spraying it and then wiping it down with a soft paper towel/kleenex
9) Take another dry paper towel/kleenex and wipe the sensor dry
10) Take the water hose and spray water into the sensor hole and let it drain to remove some of the dirt inside the unit
11) Thread sensor unit back into chamber
12) Close the valve on the drain hose
13) Remove the wiring harness from the U.V. lamps
14) Remove the U.V. lamps being very careful not to break them
15) Some end caps may need to be removed to get the lamps out(very tight spot)
16) These will need to be disposed of as HAZMAT
17) Remove the threaded end caps from the unit if removing the tubes
18) If the tubes are not being taken out the end caps do not need to be removed
19) If the tubes are being cleaned or replaced remove them as well by pulling them out
20) Be careful not to lose the o rings and stainless steel washers
21) Clean the tubes with Lime away if they are going to be cleaned
22) Install cleaned or new tubes

23) Install the U.V. lamps being careful not to get them dirty
24) Thread the end caps back into place
25) Put the wiring back on the lamps taking note that the wires are numbered to match with the unit
26) Unlock the Unit
27) Turn the unit back on for approximately 2 minutes
28) Open up the inlet and outlet valves
29) Wait for a few minutes to ensure that the lamps are working properly by checking the reading on the monitor.
30) The unit will now need to be calibrated
31) See the manual for calibrating
32) After calibrating the unit % will be at 100
33) The % will fluctuate at times as the effluent flows and particles of dirt get on the sensor
34) Enter the date the U.V lamps/tubes were changed in the back of the daily log book

Procedures for Cleaning Little John U.V. Lamp Sensor (downstairs)

Every person is required to have Hepatitis A & B and Tetanus shots before doing any work at the STP that will bring them in contact with contaminants i.e. sewage, sludge, effluent, influent, etc.

✓ **Warning : Do not look at the U.V. lamps when they are on**

There are 2 sealed U.V. lamp units , both have 6 U.V. lamps inside each unit

✓ **PPE: Tyvek suit, boot covers, nitrile gloves, safety glasses, hard hat, locks for locking out electrical panel**

1) Check for gases with gas detector before entering the U.V. lamp area
2) Shut off and lock out the U.V. lamp unit that is being cleaned
3) Using a step ladder close the valves on both sides of the unit being cleaned
4) Place a pail under the drain hose and open the valve
5) Crack the outlet valve a bit to allow the unit to drain
6) Once the unit has been drained remove the sensor
7) The sensor is located on the side of each unit and is threaded in
8) With the 50% Lime Away solution spray bottle clean the sensor by spraying it and then wiping it down with a soft paper towel/kleenex
9) Take another dry paper towel/kleenex and wipe the sensor dry
10) Take the water hose and spray water into the sensor hole and let it drain to remove some of the dirt inside the unit
11) Thread sensor unit back into chamber
12) Close the valve on the drain hose
13) Unlock the Unit
14) Turn the unit back on for approximately 2 minutes
15) Open up the inlet and outlet valves
16) Wait for a few minutes to ensure that the lamps are working properly by checking the reading on the monitor.
17) When all is working well the number should be around 100% after a cleaning
18) The % will fluctuate at times as the effluent flows and particles of dirt get on the sensor
19) Record the date the sensor was cleaned in the daily log book

Procedures for dumping sewage into and removing solids/sludge from lift station #2 at the STP

Workers are required to have Hepatitis A & B and Tetanus shots before doing any work that will bring them in contact with contaminants i.e. sludge, effluent, influent,sewage etc.

All sewage from bathroom facilities around the Meadowbank site including the Exploration and Emulsion plants must be dumped into lift station #2 at the Sewage Treatment Plant.

All other liquids including the liquids from the grease traps should be off loaded at the tailings pond.

Twice a week, Wednesdays and Sundays 1 load of solids should be removed from lift station #2 and unloaded at the tailings pond.

If other jobs or poor weather come up and the solids cannot be done during these days removing solids can be done on other days.

There is a sheet at the STP just inside the door of the decontamination unit which is to be filled out by the vacuum truck operator.

The operator will fill in the date, initials of driver of vacuum truck, size of sewage load in or size of solids load out. This size of the load will be entered in the appropriate column , example *¾ S or 75% S.*
(S for small truck, B for big truck)

Also on this sheet under comments enter why the solids were not able to be done if it happens example, " *blizzard , truck broke* down, *too busy*" or any other information the driver may need to enter example "*broken paddle needs to be repaired*"

Occasionally the STP operator will also ask for the sludge to be removed from the bottom of lift station #2 but this will come as a formal request.

Measuring Sludge in the Little Johns

	PROCEDURE NUMBER:		**MBK-SIT-0004**
People concerned	**Site Services**	**Prepared by**	Site Services
		Approved by	Roger Sauvé Services General Supervisor
Issuing date :	2012-04-11		
This procedure corresponds to the required minimum standard. Each and everyone also have to comply with the rules and regulations of the Nunavut Government in terms of health and safety at work.			

Objective:

Sludge is required to be measured every 2 weeks in the primary and clarifier tanks(final stage)

Concerned departments:

Site services

Required employee preparation:

- Every person is required to have Hepatitis A & B and Tetanus shots before doing any work at the STP that will bring them in contact with contaminants i.e. sewage, sludge, effluent, influent, etc.

Required equipment

- Gas detector , safety glasses ,hard hat, Tyvek suit and boot covers, nitrile/rubber gloves, locks for locking out bio-disk

Impacts				Location	
Health & Safety	Process/Quality	Costs	Environment	Control Room	Field

Measuring Sludge in the Little Johns

Procedure	Risks/ Impacts
1. Ensure proper PPE is worn	Prevent incident and /or accident; health issues
2. Two (2) people to be present when measuring sludge	
3. Shut off and lock out the bio-disk	
4. Keep gas tester on person or close at hand	
5. Little Johns primary tank measurement : side door/opening on the left side when facing the Little Johns from the big double doors – 1 measurement	
6. Turn the sludge meter on	
7. Turn the alarm on the sludge meter	
8. Slowly drop the sensor into the effluent allowing in to go to the bottom	

Measuring Sludge in the Little Johns

9. The alarm will sound as it starts to hit the sludge	
10. Take note of the depth of the tank by reading the numbers on the cord (measured in 6" intervals)	
11. Slowly lift the sensor/cord until the alarm goes off	
12. Record the difference on the cord from when the alarm is on at the bottom to when the alarm goes off	
13. This difference is the depth of the sludge	
14. Follow the same procedures in the Little Johns clarifier tank	
15. Little Johns clarifier tank measurement : open double doors and take measurements on both sides of the tank	
16. Once the sludge measurements have been taken and recorded, the bio-disk can be unlocked and restarted	
17. Clean up tools and put things away where they belong	

AGNICO EAGLE

MEADOWBANK GOLD PROJECT

TAILINGS STORAGE FACILITY

Operation, Maintenance and Surveillance Manual

Prepared by:
Agnico Eagle Mines Limited – Meadowbank Division

Version 3
September 2013

TAILINGS STORAGE FACILITY

OPERATION, MAINTENANCE AND

SURVEILLANCE MANUAL

MEADOWBANK GOLD PROJECT

AGNICO EAGLE MINES LIMITED

This Operation, Maintenance and Surveillance Manual has been prepared by Agnico Eagle Mines Limited and is to be used for the operation, maintenance and surveillance of the Tailings Storage Facility at the Meadowbank Gold Project. All Registered Manual Holders are responsible for ensuring that they are using the most recent revision of this document. This Operation, Maintenance and Surveillance Manual, may not be copied in whole or in part without the written consent of Agnico Eagle Mines Limited.

IMPLEMENTATION SCHEDULE

This Plan is immediately implemented.

DISTRIBUTION LIST

AEM - General Manager Meadowbank

AEM- Environment Superintendent

AEM- Mine Operations Superintendent

AEM- Engineering Superintendent

AEM- General Services Manager

AEM- Corporate Environment Director

Golder- Dike Design Engineer

SNC- Dike Design Engineer

DOCUMENT CONTROL

Version	Date (YMD)	Section	Page	Revision
(first revision)	February 2012	All	All	
V2	August 27, 2013	All	All	
V3	September 15, 2013	All	All	Updated items mentioned by MDRB and the Mine Inspector in the Annual Geotechnical Inspection in September 2013

Approved by: _____
Julie Belanger
Engineering Superintendent

_____
Kevin Buck
Environment Superintendent

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LIST OF ACRONYMS AND ABBREVIATIONS

%	Percent
°C	Degrees Celsius
1:100	1 in 100 years (return period)
2H:1V	Slope of 2 horizontal units to 1 vertical unit
AEM	Agnico Eagle Mines Limited
CDA	Canadian Dam Association
Elev.	Elevation
EPP	Emergency Preparedness Plan
ERP	Emergency Response Plan
g	Gravitational acceleration constant (9.80 m/s^2)
Golder	Golder Associates Ltd.
m	Metre
M	Million
MAC	Mining Association of Canada
OMS	Operation, maintenance and surveillance
SD1	Saddle Dam 1
SWD	Stormwater Dike
TSF	Tailings Storage Facility
tpd	Tonnes per day

LIST OF DEFINITIONS

Active Layer: Ground above the top of permafrost. This layer freezes and thaws seasonally.

Permafrost: Bedrock or soil at a temperature at or below 0 ^oC for a continuous period of two or more years. It is important to note that permafrost is not permanent. It is also important to note that the term permafrost does not imply the presence or absence of ice in the bedrock or soil.

SECTION 1 • INTRODUCTION

1.1 PURPOSE

This operation, maintenance and surveillance (OMS) manual provides a reference document to be used by the personnel responsible for the operation, maintenance and surveillance of the Tailings Storage Facility (TSF) at the Meadowbank Gold Project that is owned and operated by Agnico Eagle Mines Limited (AEM).

The TSF is the permanent surface storage facility for tailings produced during the operation of the mine. Refer to Section 3.0 for description details of the TSF.

Qualified personnel shall be used for the operation, maintenance and surveillance of the TSF and adequate records shall be maintained for regulatory, general and reference purposes. As the management structure changes, the OMS manual should be revised and distributed accordingly. A primary objective during the early phases of operation and development of the TSF, especially during that of the North Cell, is to optimize these activities for use during subsequent development phases.

This OMS manual addresses the operational issues of the TSF. It does not examine design, construction or closure issues in detail. Details of the design and construction requirements for the TSF are presented in the references provided later in this document. Details on closure are included in the Closure Plan.

1.2 REGISTERED MANUAL HOLDERS AND REVISIONS

Each copy of this OMS manual is assigned a unique identification number.

The AEM Environment Superintendent is responsible for maintaining an up-to-date list of the registered holders of this OMS manual in Table 1-1.

The AEM Environment Superintendent is also responsible for the issue of all revisions and addenda to all Registered Manual Holders of this OMS manual. Revisions will be made, as and when required, by re-issuing a complete section, table and/or appendix so that the superseded section, table and/or appendix can be removed and replaced. All Registered Manual Holders are responsible for placing the revisions and addenda in their copy of the OMS manual and for recording receipt of the same in Table 1-2.

1.3 REGULATORY, CDA AND MAC GUIDELINE REQUIREMENTS

This OMS manual sets out procedures to ensure compliance with the AEM regulatory requirements which are summarized in Table 1-3.

The Canadian Dam Association (CDA) Dam Safety Guidelines (CDA 2007) states “Dam operation, maintenance and surveillance encompass a number of activities and constraints defined to ensure that the dam is managed with appropriate regard for safety.” The preparation and use of this OMS manual achieves this requirement. Reference to CDA (2007) was made in the preparation of this OMS manual.

The Mining Association of Canada (MAC) has prepared two reference documents for management of tailings facilities: "A Guide to the Management of Tailings Facilities" (MAC 2008) and "Developing an Operation, Maintenance and Surveillance Manual for Tailings and Water Management Facilities" (MAC 2005). Both of these documents were used in preparation of this OMS manual.

1.4 DAM CLASSIFICATION

Table 1-4 presents the classification information and the following is noted for the perimeter containment structures of the TSF (i.e. Saddle Dams 1 to 6, inclusive, the Stormwater Dike and the Central Dike):

- Loss of life: the embankment is classified as "high" due to the limited number of workers in the Portage and Goose Pits downstream of the Central Dike coupled with AEM's procedures for pit evacuation in the event of an emergency;
- Environmental and Culture Values: the embankment is classified as "high" due to the water licence requirements and environmental permitting considerations;
- Infrastructure and Economic Losses (third parties): the embankment is classified as "high" due to the water licence requirements and environmental permitting considerations; and
- The dam classification for the TSF perimeter containment structures is determined by the highest of the three ratings above; therefore, these structures are classified as "high" consequence structures.

1.5 ANNUAL REVIEW OF MANUAL

This OMS manual will be reviewed by AEM on an annual basis and revised as necessary to accommodate changes in the condition and operation of the TSF. The Registered Manual Holders of the OMS manual are encouraged to provide comments and suggestions for improvement of the OMS manual and the procedures specified in it to the AEM Engineering Superintendent. The comments and suggestions communicated will be considered in the annual review.

1.6 REFERENCE DOCUMENTS AND DRAWINGS

A summary of the documentation prepared for the TSF, including design reporting, as-built reporting, technical specifications, construction drawings, instrumentation installation reporting and deposition planning, is presented in Table 1-5. The most current technical specifications and construction drawings referenced in Table 1-5 are presented in Table 1-6 to Table 1-8, inclusive. All design and as-built documents can be found in hard copy onsite in the engineering department, as well as in electronic copies on the dikes server.

Table 1-1 List of Registered OMS Manual Holders

Name / Position / Address or Location	OMS Manual Copy No.
General Manager Meadowbank / Jean Beliveau, Alexandre Proulx (ass.) / OFFICE	1
Environment Superintendent / Kevin Buck / OFFICE	2
Mine Operations Superintendent /Martin Beausejour, Brock Johnston (ass.) / OFFICE	3
Engineering Superintendent / Julie Belanger / OFFICE	4
Site Services Superintendent / Eric Trudel/ OFFICE	5
Dike Design Engineer / Golder Associates Ltd./ 500 – 4260 Still Creek Drive, Burnaby, BC, V5C 6C6	6
Dike Design Engineer / SNC-Lavalin Inc./ 5500, Boulevard des Galeries, Bureau 200, Quebec, Quebec, G2K 2E2	7
Update as Required	

Table 1-2 Record of OMS Manual Revisions and Addenda

Revision No.	Section	Table	Appendix	Addenda No.	Date of Revision
1	All	All	All	-	February 2012
2	All	All	All	-	August 2013
3	All	All	All	-	September 2013

Table 1-3 Regulatory Requirements

Document	Document Reference and/or No.	Review Date
Territorial Lands Act – Land Lease	Production Lease KVPL08D280	Expires December 27, 2027
Environmental Impact Assessment	NIRB Project Certificate No. 004	Only required if substantial modifications to original application are to be carried out
Water License Type “A”	Nunavut Water Board Water Licence 2AM-MEA0815	Expires May 31, 2015

Table 1-4 Classification of Dams in Terms of Consequences of Failure (after CDA 2007)

Dam Class	Population at Risk [Note 1]	Incremental losses		
		Loss of Life [Note 2]	**Environmental and Cultural Values**	**Infrastructure and Economics**
Low	None	0	Minimal short-term loss No long-term loss	Low economic losses; area contains limited infrastructure or services
Significant	Temporary only	Unspecified	No significant loss or deterioration of fish or wildlife habitat Loss of marginal habitat only Restoration or compensation in kind highly possible	Losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes
High	**Permanent**	**10 or fewer**	**Significant loss or deterioration of *important* fish or wildlife habitat Restoration or compensation in kind highly possible**	**High economic losses affecting infrastructure, public transportation, and commercial facilities**
Very high	Permanent	100 or fewer	Significant loss or deterioration of *critical* fish or wildlife habitat Restoration or compensation in kind possible but impractical	Very high economic losses affection important infrastructure or services *(e.g., highway, industrial facility, storage facilities for dangerous substances)*
Extreme	Permanent	More than 100	Major loss of *critical* fish or wildlife habitat Restoration or compensation in kind impossible	Extreme losses affecting critical infrastructure or services *(e.g., hospital, major industrial complex, major storage facilities for dangerous substances)*

Note 1. Definitions for population risk:

None – There is no identifiable population at risk, so there is no possibility of loss of life other than through unforeseeable misadventure.

Temporary – People are only temporarily in the dam-breach inundation zone *(e.g., seasonal cottage use, passing through on transportation routes, participating in recreational activities).*

Permanent – The population at risk is ordinarily located in the dam-breach inundation zone *(e.g., as permanent residents)*; three consequence classes (high, very high, extreme) are proposed to allow for more detailed estimates of potential loss of life (to assist in decision-making if the appropriate analysis is carried out).

Note 2. Implications for loss of life:

Unspecified – The appropriate level of safety required at a dam where people are temporarily at risk depends on the number of people, the exposure time, the nature of their activity, and other conditions. A higher class could be appropriate, depending on the requirements. However, the design flood requirement, for example, might not be higher if the temporary population is not likely to be present during the flood season.

Table 1-5 Tailings Storage Facility Documentation Summary

Item	Description	Reference
TSF Design Basis	Report	Golder (2008)
Stormwater Dike and Saddle Dam 1 Geomembranes	Technical Memorandum	Golder (2009)
Revised configuration for Saddle Dam 1	E-Mail	Golder (2009; no formal document issued)
Deposition Plan (North Cell)	Report	Golder (2011, 2012)
Deposition Plan (North Cell)	Presentation	AEM (September 2013)
Construction Report TSF	Report	AEM (June 2013)
North Cell Diversion Ditches	Report	AEM (July 2013)
Update as Required		

Table 1-6 Listing of Specifications for Tailings Storage Facility

Item (Prepared By)	Specification No. and Title	Revision No. and Title	Date of Revision
Golder	Specification-TSF Dike Construction	Doc. 795 Rev. 0	October 16, 2009
Update as Required			

Table 1-7 List of Construction Drawings for Embankment Structures

Drawing No. (Prepared by)	Title	Revision No.	Date of Revision
4100 -30 to 4100-39 (Golder)	Tailings Storage Facility – Stormwater Dike	0	July 10, 2009
4100-50 to 4100-60 (Golder)	Tailings Storage Facility – Saddle Dam 1	0	July 10, 2009
SD2-SD3-01 to SD2-SD3-13 (Golder)	Tailings Storage Facility –Saddle Dam 2 and Saddle Dam 3	A	August 25, 2010
SD6-01 to SD6-11 (Golder)	Tailings Storage Facility – Saddle Dam 6	A	September 13, 2010
Figure 1—Supersedes Drawing Nos. 4100-30, 4100-31, and 4100-32 (Golder)	Agnico-Eagle Mines Limited, Meadowbank Gold Project Nunavut, Stormwater Dike Staged Layout Plan	N/A	August 5, 2009
Figure 2—Supersedes Drawing Nos. 4100-33, Detail 3 on 4100-34 (Golder)	Tailings Storage Facility Typical Cross-Section and Details	N/A	August 5, 2009
Figure 1—Supersedes Drawing Nos. 4100-51, 4100-52, 4100-53, and 4100-58 (Golder)	Tailings Storage Facility Saddle Dam 1 Rockfill Plan and Liner Details	N/A	August 17, 2009
All drawings in the Construction Report TSF (AEM)	Construction Report Tailings Storage Facility	N/A	June 15, 2013
Update as Required			

Table 1-8 List of Construction Drawings for Infrastructure and Piping

Drawing No. (Prepared by)	Title	Revision No. and Title	Date of Revision
All Booster Pump Design Drawings	Booster Pump Design Drawings, MEAD-360	N/A	June 26, 2012
Weekly Update Geotech Planning – Tailing Deposition (AEM)	North Cell Tailings Storage Facility Tailings Deposition Plan	Updated Weekly	N/A
All drawings in the Construction Summary Report North Cell Diversion Ditches (AEM)	Construction Summary Report North Cell Diversion Ditches	N/A	July 27, 2013
Update as Required			

SECTION 2 • ROLES AND RESPONSIBILITIES

There are several AEM department teams involved in the operation, maintenance and surveillance of the TSF:

The Engineering Department has a team of people that:

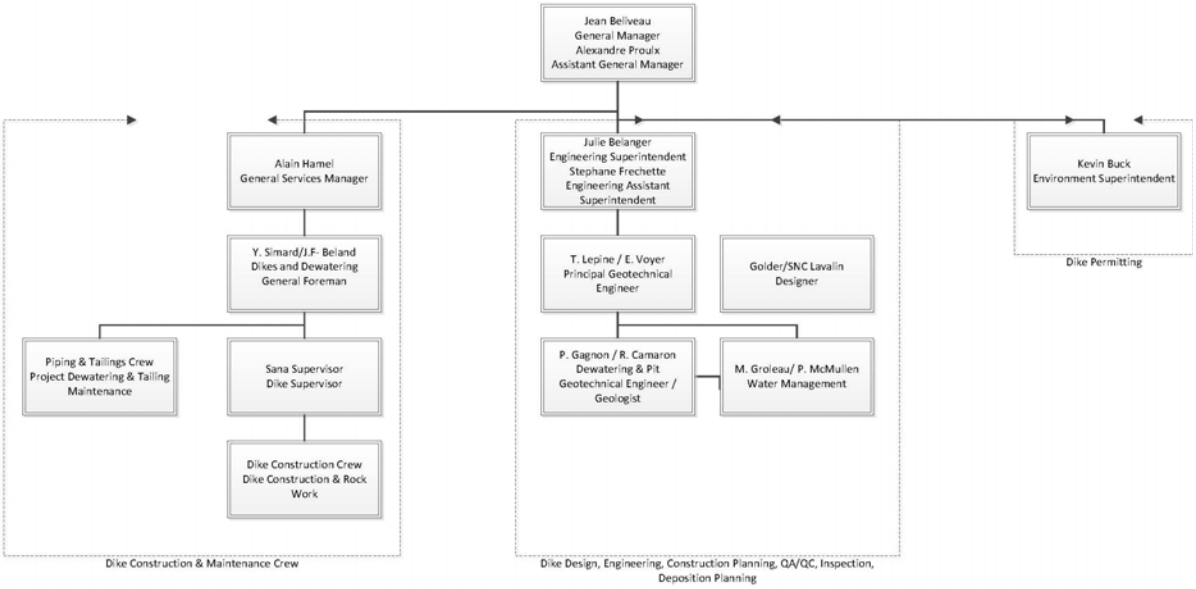
- Plan and oversee the construction of the embankments of the TSF;
- Provides the overall management of the TSF;
- Oversees the design, development, construction and deposition activities of the TSF;
- Monitors the thermistor instrumentation of the TSF;
- Monitors quantity and manages the water of the TSF, including the perimeter water control structures;
- Carries out operation, maintenance and surveillance of the tailings distribution system;
- Conducts visual inspections of the TSF, including the perimeter water control structures;
- Monitors the water level elevations of the perimeter sumps and the embankment slope monitoring points; and
- Coordinates activities and ensure compliance with the regulatory requirements of the TSF.

The Environment Department has a team of people that:

- Monitors the water quality from the sumps of the TSF; and
- Coordinates activities and ensure compliance with the regulatory requirements of the TSF.

The organizational chart of the current management team is shown on Figure 1. This chart shall be updated to reflect changes in management and/or changes in operational criteria in accordance with AEM's overall management and operational requirements.

Figure 1 AEM Tailings Storage Facility Management Structure



Note: To be updated as required

2.1 ROLES, RESPONSIBILITIES AND AUTHORITY

The roles and responsibilities for each AEM position and the authority during the operational cycle of the TSF are listed in Table 2-1. The roles and responsibilities of each position should be updated to reflect changes to the overall management structure.

All site personnel are responsible for informing their Superintendent of any indications of abnormal situations that may be observed.

2.2 REQUIRED LEVELS OF KNOWLEDGE

The recommended minimum levels of knowledge by the various positions are as summarized in Table 2-2. Training of personnel shall be carried out to ensure the minimum levels of knowledge set out in Table 2-2 are attained by all personnel and positions involved in the operation of the facility. AEM's training department, with support from relevant personnel, shall carry out all training. Training shall be logged and registered according to the department protocols.

Table 2-1 Roles and Responsibilities

Position	Role	Responsibility
General Mine Manager	Oversees mine development and planning, operations and permitting	Initiate and oversee emergency or contingency protocols during emergency events. Oversight of Mine, Engineering, and Environment Superintendents tasks and responsibilities as laid out in the OMS Manual. Ensures that proper planning is carried out and that required resources are made available. Oversees and provides input in all matters arising in the operation and management of the mine including the TSF.
Engineering Superintendent /Principal Geotechnical Engineer	Overall TSF management	Coordinates all TSF management related activities. Coordinates with Environmental Superintendent on environmental issues. Ensures Mining Association of Canada (MAC) compliance. Ensures Canadian Dam Association (CDA) compliance. Ensures monitoring is carried out in accordance with the TSF monitoring program, other applicable programs, approved protocols and frequency. Reviews existing and assesses future monitoring requirements. Reviews construction designs and schedules. Reviews the QA/QC system to meet construction design. Reviews TSF operating and training manuals – assists in completion of manuals. Ensures documentation and records related to TSF development, construction and operations are kept and are up-to-date. Authorizes emergency work in the event of non-compliance or emergency operational requirement. Reports operational issues to the Mine Superintendent. Ensures all systems are properly maintained. Prepares TSF development, construction, QC and activity reports. Coordinates and reviews regular facility inspections by AEM staff.
Dike and Dewatering Foreman	Oversees TSF development and maintenance	Maintains access to the TSF, road surface repairs, dust control and snow removal. Oversees and provides input in construction of the TSF matters. In charge of earthwork construction and piping installation and maintenance.

Position	Role	Responsibility
		Supervises Contractor(s).
Environment Superintendent	Oversees environmental data collection and processing	Liaise with external stakeholders including NIRB, Nunavut Water Board and government agencies Assesses current and future monitoring requirements. Reviews government permits and recommends monitoring for compliance Reviews TSF development and deposition plans Prepares TSF water management reports. Oversees TSF water, collection pond and groundwater sampling in accordance with approved protocols. Interprets environmental (facility water quality) data Monitors compliance with water quality and quality from the TSF, and reports non-compliance events and/or trends to Operations Manager. Supervises Environmental Coordinator. Indicates water quality sampling locations, sample collection protocols and analytical parameters in coordination with the Environmental Consultant. Senior TSF environmental oversight. Acts as AEM's contact for governmental oversight of TSF. Reports environmental issues to the General Manager and Operations Manager. Ensures with Engineering Superintendent TSF instrumentation data collection, processing and reporting. Reviews government permits and recommends monitoring for compliance. Assesses future monitoring requirements. Ensures compliance with regulatory requirements. Validates laboratory test results. Processes laboratory data and prepares summary reports. Ensures compliance with water management protocols. Develops and maintain site wide and TSF water balance. Supervises Environmental Technician.
Geotechnical Engineering Consultant	TSF annual inspections	Provides construction-level design, reports, drawings and technical specifications. Provides deposition planning design and reporting. Communicates through Engineering Superintendent and Environment Superintendent. Performs regularly scheduled Third Party Inspections.

Position	Role	Responsibility
		Performs Special Inspections, as required. Reviews as-built and monitoring reporting. Reviews field quality assurance (QA) and quality control (QC) programs. Reviews geotechnical designs relative to actual field conditions.

Table 2-2 Recommended Minimum Knowledge of OMS Manual

Position	Recommended Minimum Knowledge
General Mine Manager / Assistant Mine Manager	Review of the OMS Manual with an understanding of the operational requirements. Detailed knowledge of emergency response procedures.
Mine Operations Superintendent	Basic knowledge of the OMS Manual, with an understanding of the design and operational requirements. Detailed knowledge of emergency response procedures.
Engineering Superintendent/ Principal Geotechnical Engineer	Detailed understanding of the OMS Manual, with a complete understanding of the design and operational requirements. Detailed and ongoing review of all monitoring, inspections and embankment safety reviews. Complete understanding of all related technical documents for design, operation, risk assessment and emergency response. Review of the operations manuals on an annual basis. Detailed knowledge of emergency response procedures.
Environment Superintendent	Detailed understanding of the OMS Manual, with an understanding of the design and operational requirements set out in this OMS Manual. Detailed understanding of all operational elements within the facility and their operational and maintenance requirements. Detailed knowledge of emergency preparedness and emergency response procedures.
Environmental Coordinator	Detailed understanding of the OMS Manual, with a complete understanding of the design and operational requirements. Detailed and ongoing review of all monitoring, inspections and embankment safety reviews. Complete understanding of all related technical documents for design, operation, risk assessment and emergency response. Review of the operations manuals on an annual basis. Detailed knowledge of emergency preparedness and emergency response procedures
Process Plan Superintendent	Basic knowledge of the OMS Manual, with an understanding of the design requirements. Detailed knowledge of emergency response procedures.
External Personnel (Consultants and Contractors)	Varied levels of knowledge and understanding depending on involvement. Detailed knowledge of emergency preparedness plan.

SECTION 3 • FACILITY DESCRIPTION

3.1 BACKGROUND

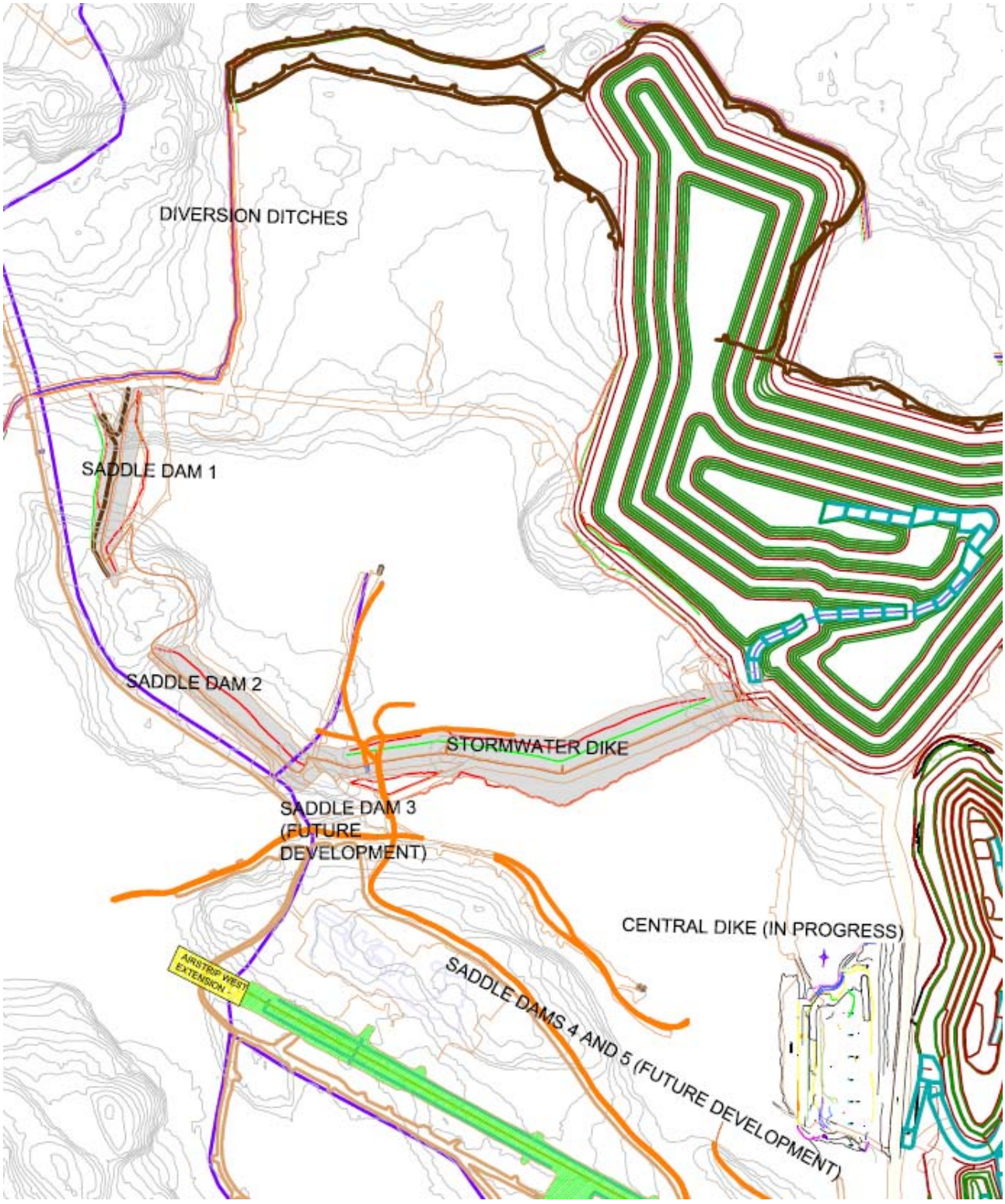
The TSF is the permanent surface storage facility for tailings produced during the operation of the mine. The TSF is located north of the Plant Site, as presented on Figure 2, and will be developed in two cells in the following order:

1. North Cell; and
2. South Cell.

The main components of the TSF are:

- Perimeter containment structures (Saddle Dams 1 to 6, inclusive, and the Central Dike);
- Seepage and run-off perimeter water control structures;
- Internal deposition structure (Stormwater Dike);
- Deposition infrastructure;
- Dewatering infrastructure;
- Instrumentation; and
- Reclaim water system: supernatant pond and water treatment facility.

Figure 2 Plan of Tailings Storage Facility



3.2 DESIGN AND OPERATIONAL CRITERIA

The main design and operational criteria for the TSF are summarized in Table 3-1.

3.3 FACILITY COMPONENTS

3.3.1 Perimeter Containment Structures

A series of containment structures comprising Saddle Dam 1 (SD1), to SD5, inclusive, and the Central Dike form the perimeter of the TSF. These structures are shown on Figure 2.

3.3.2 Internal Deposition Structures

To facilitate deposition within the TSF, the Stormwater Dike (SWD) is located within the facility (refer to Figure 2). This structure divides the North Cell and the South Cell.

3.3.3 Perimeter Water Control Structures

The design objective of the perimeter water control structures, comprising ditches and sumps, is to collect surface water runoff and seepage from the TSF for pumping to the water treatment plant. The purpose of controlling the runoff and seepage from the TSF is to prevent it from reporting to the downstream environment. The perimeter water control structures will be used throughout the operating life of the TSF. These will continue to be used into the post-closure of the project until both the TSF and adjacent ground returns to pre-development permafrost conditions or the surface runoff and seepage waters are of acceptable quality to be discharged directly to the environment.

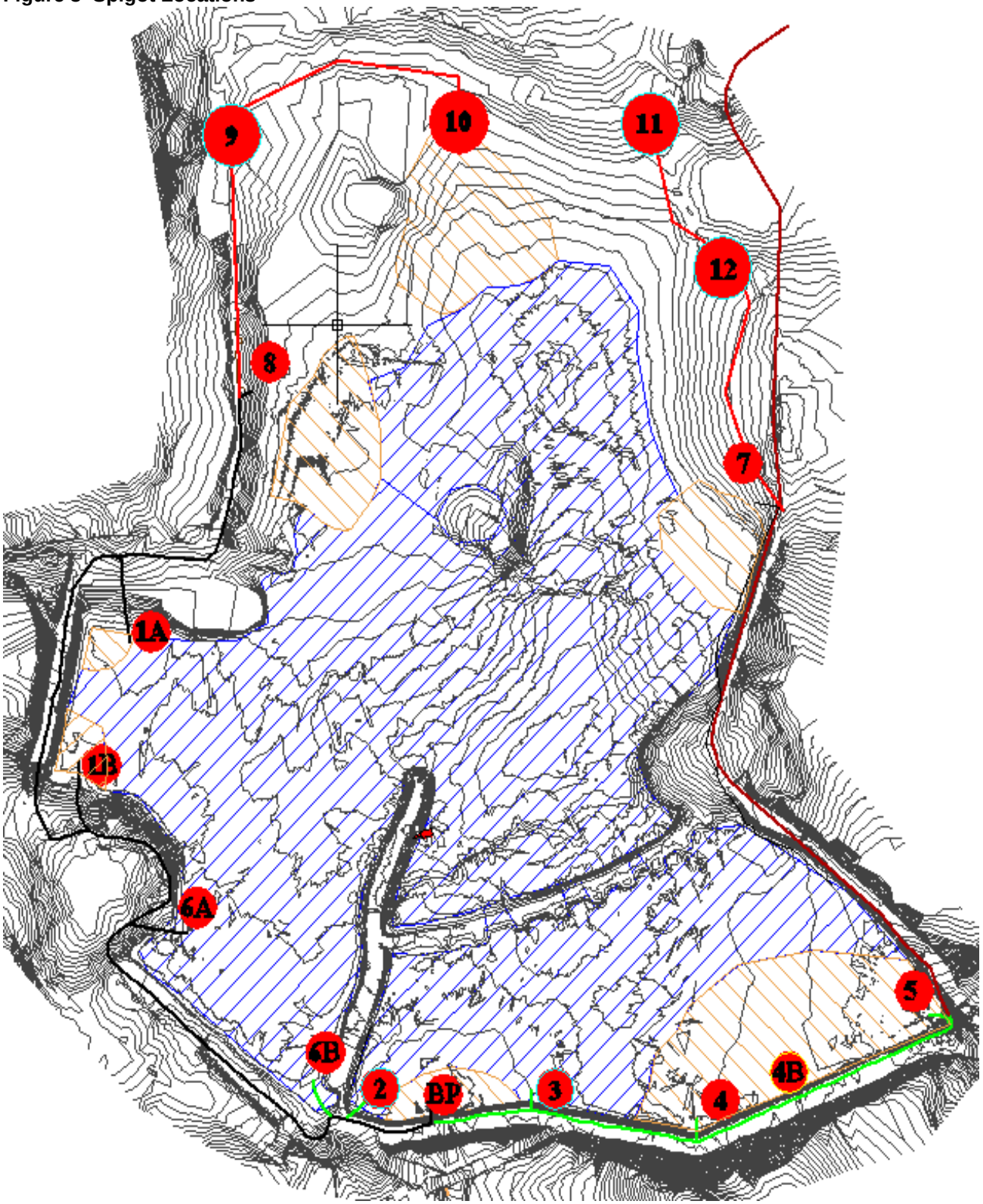
The ditches surrounding the TSF are designed to capture seepage and surface runoff water and provide gravity flow of the water into the sumps.

The sumps are collection points for flows from the ditches and the TSF to enable pumping of water to the water treatment plant.

3.4 TAILINGS DISTRIBUTION SYSTEM

The tailings distribution piping system for transporting slurry from the Process Plant to and for deposition into the TSF is presented on Figure 3.

Figure 3 Spigot Locations



3.5 WATER MANAGEMENT SYSTEM AND PIPING

Water is pumped from the supernatant pond to the Mill Plant for recirculation. Water collected from the non-contact perimeter ditches and sumps is generally directed by the diversion ditched or pumped into the environment if the limits are respected. Water collected form the Saddle Dams seepage collection systems are sent directly to the TSF.

3.6 FACILITY CLOSURE

A cover of non-acid generating waste rock will be placed over the TSF to promote drainage from the surface; no pond will be maintained within the facility. The tailings will begin freezing during operations and remain fully frozen into the post-closure period. Additional details are provided in the closure plan.

3.7 INSTRUMENTATION

The perimeter containment structures of the TSF are instrumented with geotechnical instrumentation and monitored during operations. Monitoring will continue during post-closure. Monitoring is performed to confirm performance of the structures relative to the design.

3.8 PUBLIC SAFETY

Public access to the mine site is restricted by security gates and on-site security upon exiting aircraft and vehicles.

Table 3-1 Design and Operational Criteria

Component	Item	Criteria	Source/Comment
Perimeter Containment Structure Design	Life of mine Storage Capacity	24.5 m^3	calculated
	Life of mine total ore	31.8Mt	AEM
	Life of Mine	8 years	AEM
	Canadian Dam Association hazard classification	High	CDA (2007)
	Seismicity for this site: Peak horizontal acceleration based factored 1 in 10,000 year event	0.04 g	Golder (2007)
	Stability: Minimum factor of safety for static load conditions	1.3	Golder (2007)
	Stability: Minimum factor of safety for pseudostatic load conditions	1.1	Golder (2007)
	Embankment crest width	10.0 m (nominal)	Refer to drawings
	Perimeter containment structure downstream side slope*:	1.5H:1V for rock fill	Refer to drawings

Component	Item	Criteria	Source/Comment
	Perimeter embankment upstream side slope*:	3H:1V	Refer to drawings
	Interior embankments downstream side slope*:	1.5H:1V for rock fill	Refer to drawings
	Interior embankments upstream side slopes*:	3H:1V	Refer to drawings
Perimeter Water Control Structure Design	Design Event Storage Capacity: Temporary sumps : Perimeter sumps:	1:10 year freshet runoff event 1 :100 year freshet runoff event	Refer to drawings
	Ditch Gradient	Minimum 0.3%	Refer to drawings
Process Plant Rate	Nominal daily processing rate	11,000-12,000 tpd	AEM
Operation	Tailings discharge solids content	52%	AEM
Operation	Average deposited slurry dry density	1.21 t/m^3	Assumed value pending field trials.
Operation	Deposition slope angle for slurry	0.5% to 4.0%	Assumed value pending survey.
Ice	Ice entrapment (by volume)	40% (allowance)	Assumed value pending field investigations.
Operation	Specific Gravity for tailings solids	1.6	AEM
Operation: Water Control Structures	Perimeter sump recommended Freeboard	Minimum 1.5 m	Refer to drawings
Operation: Water Control Structures	Design Pump Capacity	Sufficient to dewater a sump for the 1:100 design event in a 2 week period.	

*Note: *Fill placement to be in accordance with the relevant specification*.

SECTION 4 • OPERATIONS

Operation of the TSF requires the management of tailings deposition and storage using inputs from the deposition plan and management of water within the facility.

4.1 OPERATIONAL PHILOSOPHY

Tailings are pumped from the process plant and deposited in the TSF as slurry according to the deposition plan. The objectives of the deposition plan are to:

- Develop long tailings beaches upstream of the perimeter structures;
- Maintain the supernatant pond away from the upstream faces of the perimeter structures;
- Receive tailings from the process plant at all times;
- Limit ice entrapment within the deposited tailings; and
- Provide a flexible plan with the realization that the tailings will be variable in properties (e.g. solids content) and having a variable schedule depending on the processing schedule.

The perimeter ditches of the TSF will intercept and route surface water runoff and seepage from the TSF to the sumps. The sumps are to provide short-term water storage prior to pumping to the tailing pond. A practical minimum level of water should be maintained during operations.

4.2 DEPOSITION PLANNING CRITERIA AND CONSTRAINTS

The following constraints were identified as being desirable inputs into the deposition planning work:

- During winter months, deposition would use a “pull back”;
- Limit switching between tailings deposition lines so to reduce line flushing requirements;
- Changing between deposition points on a given line will, in general, consist of stopping the flow of tailings in the line (during planned process plant shut-downs), flushing the line with water for cleaning and the relocation of the deposition point followed by the reinstatement of tailings flow through the deposition line; and
- All pipelines should be flushed of tailings and fully dewatered prior to periods of non-use to reduce the likelihood of materials and/or water freezing within the pipelines.

Operating Criteria and constraints should be reviewed periodically and updated in the OMS Manual as required (Table 3-1).

4.3 WATER MANAGEMENT

The perimeter ditches will intercept and route runoff and seepage from the TSF to the sumps. The diversion ditches redirect runoff water away from the TSF to the environment. The sumps will provide short-term storage prior to the pumping of the water to the tailing pond. A practical minimum level of water within the sump should be maintained during operations. The maximum operating water level for a given sump is 1.5 m below the sump rim.

SECTION 5 • MAINTENANCE

Maintenance at the TSF is important for safe, continuous operation, and integrity of the facility.

The objectives of the maintenance program are to review and identify maintenance requirements, executing corrective measures and timely repairs of the containment structures, perimeter water control structures, facility access, and infrastructure.

5.1 CONTAINMENT STRUCTURES

Erosion of the rock fill embankments is not expected. However, it is expected that periodic maintenance and re-sloping especially following thawing at the start of each summer may be required at times during operations.

The SWD, as it is an internal structure, is tolerant to settlement. Maintenance during the summer is expected once the frozen materials thaw. Grading, reshaping and nominally compacting additional material should be expected.

The exposed liner should be inspected during the summer season. Repairs shall be done for any damage during that season.

5.2 DITCHES AND SUMPS

Flows may erode the ditches and/or sumps. Sediment, snow and/or ice may accumulate in the ditches and sumps and will require removal to maintain operational functionality and provide storage capacity. Removal of excessive material deposits from the ditches and sumps should be performed. The ditches and sumps will require routine monitoring for signs of deterioration and to address any cleaning and maintenance that is required.

Pumps located at the temporary and perimeter sumps will require maintenance based on Manufacturer's specifications and recommendations.

5.3 INSTRUMENTATION

The instrumentation of the TSF shall be maintained to enable collection of the data. Repair, replacement and installation of additional instrumentation should be expected during the development of the TSF.

5.4 PIPELINES AND PUMPS

Maintenance on pumps and tailing pipes should be performed during Mill Plan scheduled shut-down periods or when they are not in operation. General inspection of the pipes should be performed on a regular basis. The heat tracing of the tailings distribution and dewatering pipelines will require maintenance. After each change of deposition point, the pipeline is cleaned and drained with a pig. The pipes are inspected after the cleaning.

SECTION 6 • SURVEILLANCE

The principal objective of the TSF surveillance program is to identify conditions that would compromise the integrity of the facility well in advance of problems occurring and adjusting the design and/or operation to reduce risk. The TSF surveillance program focuses on four areas of interest:

1. Stability and deformation of the perimeter containment structures;
2. The thermal conditions beneath and within the TSF;
3. The quantity and quality of seepage from the TSF; and
4. Material movement and placement (locations and quantities of all material types being deposited, disposed and placed) in the TSF.

Table 6-1 (see Section 6.2) was developed to determine the items which will be monitored, the monitoring frequency and the responsible party. The items should be monitored at a frequency such that project commitments and/or requirements are satisfied and such that trends may be developed for optimization of the operation of the TSF. Table 6-1 should be reviewed and updated as required while maintaining the project commitments.

6.1 INSPECTIONS

A series of regularly scheduled inspections is required to ensure that the TSF facility is performing as intended and to identify problems and issues so that necessary corrective actions may be implemented in a timely manner. Surveillance tasks include visual inspections, monitoring of instrumentation and water levels and preparation of written and photographic documentation.

The main types of inspections are as follows:

- Routine inspections – performed by AEM geotechnical team;
- Monthly or Bi-Monthly Inspection – performed by AEM geotechnical team;
- Special Inspections – performed by AEM and the Geotechnical Engineering Consultant depending on the event; and
- Annual Inspection – performed by a Geotechnical Engineering Consultant familiar with the design and operation of the facility.

6.1.1 Routine Inspections

Routine visual inspections are to be carried out by AEM personnel at the TSF to assess operational status of various elements of the facility. The frequencies for these inspections are as follows:

- In areas of active deposition: daily; and

- In areas without deposition: monthly.

Inspections of the TSF perimeter containment structures and water control structures are to be conducted and documented. Inspection forms used to conduct and document these inspections are included in Appendix II.

The following is a list of general information which should be recorded during each inspection:

❖ Water Control Structures (by Engineering department)::

- Sump water elevation (staff gauge readings) noted and reviewed to ensure normal freeboard;
- General dewatering pipeline condition, signs of leaks or abnormal conditions; and
- Depth of flow in ditches, inspection of ditches and downstream berm condition, signs of potential seepage.

❖ Perimeter Containment Structures (by Engineering department):

- Inspection of the general condition of interior and perimeter embankment crest, toe, and slopes, looking for: settlement, erosion, seepage, cracking, liner deterioration, animal burrows or other abnormal conditions;
- Description and status of embankment construction activities; and
- Inspection of embankment slopes for any signs of instability.

❖ Tailings Distribution System (by Engineering department and Dikes and Dewatering General Foremen):

- General pipeline condition, signs of leaks or abnormal conditions;
- Deposition location point and beach elevation relative to spigot elevation;
- Length of beach; and
- Pipeline flow, slurry density, pipeline pressure.

Documentation of the routine inspections of the TSF perimeter containment structures should be submitted to the principal geotechnical engineer following each inspection.

The completed Perimeter Containment Structures and Water Control Structures inspection forms are stored in an electronic data base system for the TSF. Hard copies of the inspection forms are catalogued and stored on site.

6.1.2 Special Inspections

Special inspections may be required in addition to the routine inspections such as during, or at the time of: unusual climate events such as heavy rain, rapid snowmelt, anomalous instrumentation readings or significant seismic events. The Geotechnical Engineer or Geotechnical Technician shall perform the special inspection immediately at the time of the event and shall notify the Geotechnical Engineering Consultant.

6.1.3 Annual Inspection

Annual inspections shall be carried out by a qualified Geotechnical Engineering Consultant who is familiar with the design and on-going operation of the TSF. The objective of the inspections is to carry out a detailed review of the conditions of the facilities and facility operation during the spring freshet and prior to freeze up.

The Geotechnical Engineering Consultant issues an inspection report to AEM containing observations and recommendations. This report provides information to be used to revise the operation, maintenance and surveillance programs as necessary and to assist in planning for future operation of the facility.

6.2 INSTRUMENTATION AND SURVEY

Instrumentation is installed to monitor the stability and deformation of the perimeter containment structures, ground temperature, seepage, water quality and to monitor operational performance. Instrumentation is to be maintained, replaced, added, extended and relocated during the development of the TSF; therefore this section should be updated regularly. The current instrumentation locations are shown on Figure 4. Current instrumentation for the TSF includes thermistors. Piezometers are installed at Central Dike. Survey of the water and tailing elevation are also taken at different location in the TSF.

The instrumentation and survey level are to be read and recorded at the frequencies shown in Table 6-1.

Table 6-1 Surveillance Items and Frequencies

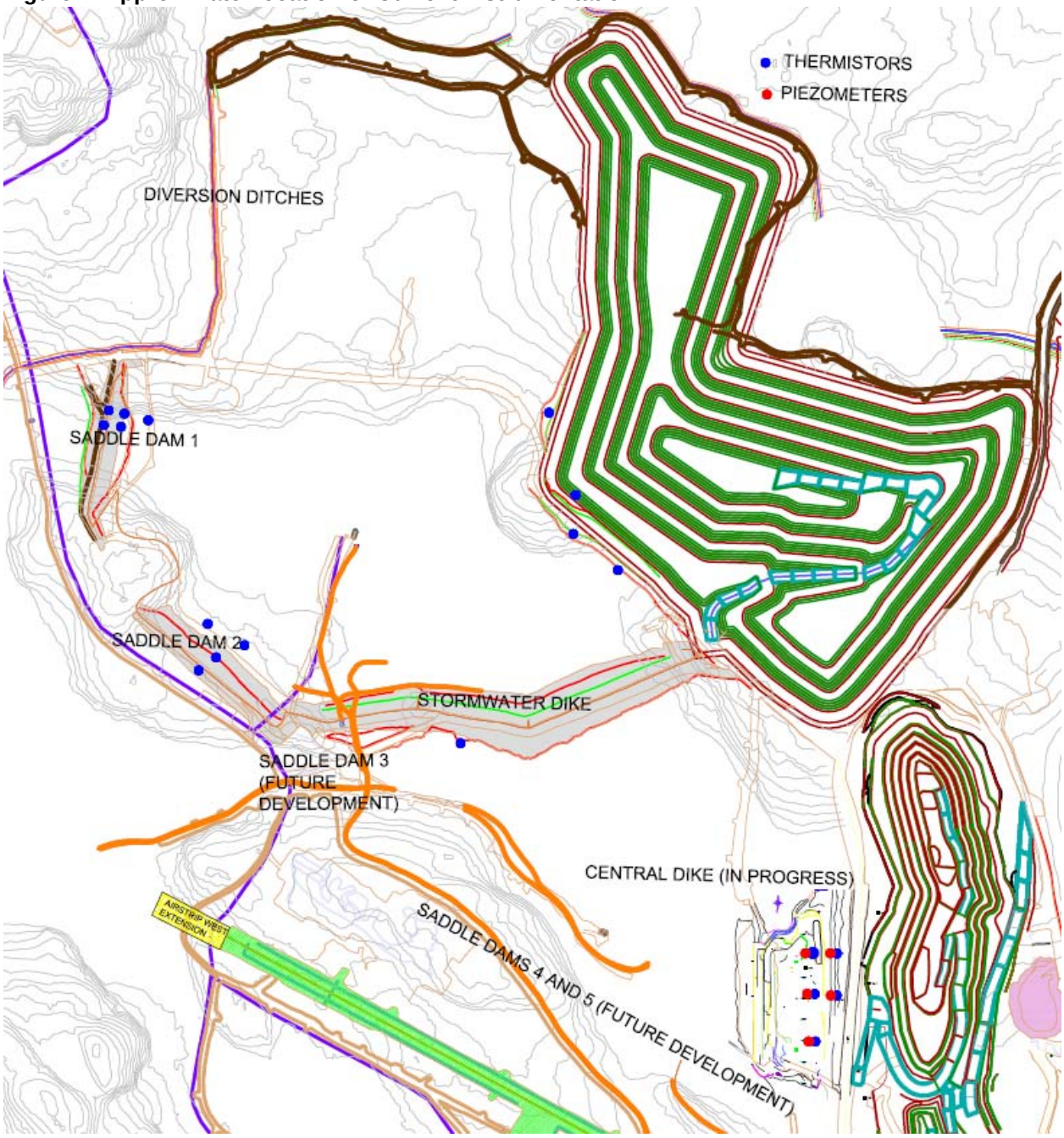
Instrumentation	*Monitored By*	*Reported To*	*Frequency*
Thermistors and Piezometers	• Manually by Engineering and Environment Personnel	Engineering and Environment Superintendent Principal Geotechnical Engineer	Weekly during winter and every three (3) days during the summer
Survey	• Manually by Engineering Personnel	Engineering and Environment Superintendent Principal Geotechnical Engineer	Daily during freshet; and Monthly during non-freshet period

The instrumentation is to be monitored by the responsible party and at the frequency shown on Table 6-1 and at any other periods of extended rainfall or run-off. Immediate readings of all instrumentation shall be carried out following a significant seismic or climatic event.

The instrumentation data shall be analyzed and summarized by the engineering and environmental department.

The instrumentation readings are to be reviewed by the Geotechnical Engineering Consultant performing the third party inspections.

Figure 4 Approximate Location of Current Instrumentation



6.2.1 Ground Temperature and Piezometric Level Monitoring

Thermistors have been installed in the area of the TSF to measure ground temperatures. Piezometers have been installed at Central Dike to measure the piezometric level in the ground. Additional thermistors and piezometers will be installed in the future during operations and closure.

Maintenance and calibration of the instruments and extensions should be carried out according the Manufacturer's recommendations.

Data presented for the thermistors and piezometers should include:

- Time plots (presenting all thermistor nodes on each string); and
- Temperature vs. depth/elevation plots over time.

The plots shall indicate the instruments reference number, date of measurements, elevation, and depth.

6.2.2 Anomalous Measurements

Anomalous instrumentation data includes the following:

- Thermistors:
    - Increase or decrease in measurements (over two or more readings) that cannot be explained by seasonal temperature variations or instrument malfunction.
- Piezometers:
    - Sudden increase or decrease in measurements (over two or more readings) that cannot be explained by normal variation of the piezometric level or instrument malfunction.

If anomalous readings are observed, the following actions should be taken:

1. Inspect the embankment where possible and appropriate;
2. Check data, reductions and calculations for accuracy and correctness;
3. Re-read to verify the reading;
4. Check readout equipment to verify that it is functioning correctly;
5. Verify calibration;
6. If instrument has stopped functioning, notify the Engineering Superintendent immediately. If considered critical, a replacement instrument should be installed;

7. If the anomalous reading is confirmed, a detailed review of the effects of the reading should be carried out based on the specific inspection and design or remedial actions should be implemented if determined necessary by the Engineering Superintendent; and
8. Increase monitoring frequency to assess progression of anomaly.

6.2.3 Seepage Monitoring

The seepage monitoring performed for the TSF comprises visual inspections of the perimeter water control structures, the quantity tracking of water pumped to and from the TSF, rate of seepage and water quality of seepage through the embankment, and testing water samples collected from the perimeter sumps.

Visual inspections should document sediment, ice and snow deposits in the ditches and sumps.

Anomalous measurements of the seepage may occur and include the following:

- Increase or decrease in pump rates that are inconsistent with rainfall or runoff events;
- Sediments present in the seepage water; and
- Changes in seepage location, flow and quality.

If anomalous readings are observed, the following action should be taken:

1. Inspect the water control structure area;
2. Check data, reductions, and calculations for accuracy and correctness;
3. Re-read;
4. Check readout equipment to verify that it is functioning correctly;
5. Verify calibration;
6. If the anomalous seepage measurement is confirmed, a detailed review of the effects of the increased seepage should be carried out based on the specific inspection and design or remedial actions should be implemented if determined necessary by the Engineering Superintendent; and
7. Increase monitoring frequency to assess progression of anomaly.

6.3 WATER QUALITY

The quality of water collected in the sumps and sampled from the water sampling locations is to be monitored. The monitoring plan available in Appendix I elaborated by AEM summarizes water quality and water flow monitoring to be conducted for the Meadowbank gold project.

SECTION 7 • REPORTING AND DATA MANAGEMENT

7.1 REPORTING

7.1.1 Inspection Documents

All inspection documents and reviews shall be submitted to the Engineering Superintendent and the Principal Geotechnical Engineer and accessible to all in the local network.

7.1.2 Instrumentation Measurements

Instrumentation measurements (thermistors and piezometers) and water quality results collected shall be reported to the Engineering Superintendent and the Principal Geotechnical Engineer. Pumping rates during dewatering and operation shall be reported to the Engineering Superintendent and the Principal Geotechnical Engineer.

7.1.3 Emergencies

All documents regarding instrumentation and inspection during an emergency situation and prior to the emergency shall be made available to all parties involved including the General Manager, Assistant General Manager, Environment Superintendent, Engineering Superintendent, Principal Geotechnical Engineer Process Superintendent, Mine Operations Superintendent, Maintenance Superintendent, and the Geotechnical Engineering Consultant.

7.2 DATA MANAGEMENT

All surveillance records including visual embankment inspections, instrumentation measurements, flow, and water quality results shall be stored in an electronic library or database system which is easily accessible to staff involved with the TSF. Hard copies shall be catalogued and stored on site. Examples of surveillance data stored, but not limited to, are:

- Routine operation inspection reports, perimeter containment structures visual inspections, water control structure inspections and water management inspections,
- Special Inspections;
- Annual Inspections;
- Instrumentation Measurements;
    - Thermal- thermistor data;
    - Piezometers data; and

- Water quality testing results.

SECTION 8 • EMERGENCY PREPAREDNESS PLAN

The Dam Safety Guidelines prepared by the Canadian Dam Association (2007) states that “A dam which does not impose an unacceptable risk to people or property, and which meets safety criteria that are acceptable to the government, the engineering profession and the public is a safe dam”.

This guiding principle has been taken into account for the design of the TSF embankments and the emergency procedures.

The TSF perimeter containment structures are classified as a “High Consequence of Failure” (CDA 2007) as discussed in Section 1.4.

To respond to possible hazards and emergencies involving the TSF, emergency response plans have been designed. This section provides a summary of the actions, triggers and measures in the event of an emergency.

In case of an emergency, the documents listed in Table 9-1 shall be referenced. The Emergency Response Plan (ERP) shall also be referenced. The Dike Failure Scenario Appendices from the ERP are included in Appendix III.

8.1 EMERGENCY PROCEDURES

The purpose of the Emergency Preparedness Plan (EPP) is to present a basic procedure for responding to potential failure mechanisms. The procedure identifies various measurable or observable effects or causes of the failure mechanisms and identifies the appropriate people to notify. Potential failure mechanisms are summarized in Table 9-2 with potential measurable and observable causes and effects.

8.1.1 Operation

Table 9-3 summarizes the triggers for implementing the EPP with respect to the potential measurable and observable effects or causes of the various failure mechanisms during operations.

Table 9-4 indicates the chain of communication to follow so persons in charge are notified for different states of emergency.

Table 9-5 indicates the responsibilities of persons for each emergency level in terms of who performs the decision making, mobilization, and action to be taken.

Table 9-6 indicates the names and contact numbers of the persons in charge during an emergency event.

8.2 EMERGENCY DETAILS

In the unlikely event of a catastrophic dike breach that could endanger workers the Code 1 procedure described in Section 8.2.4 would be followed to warn all workers of the situation. Then an evacuation of the affected areas and pits would be carried out and directed by the ERT Team in person and over the emergency channel. In the event of an embankment failure, the following information should be used during the emergency response:

Project Name: Meadowbank Gold Project

Perimeter Containment Structure Names: SD1, SD2, SD3, SD4, SD5, SD6, Central Dike

Owner's Name: Agnico Eagle Mines Limited (867) 793-4610

Site Location: Latitude: 65°01'07''N Longitude: 96°04'26''W

8.2.1 Access to the Project Site

- 80 km north of the Hamlet of Baker Lake;
- Site accessible by all-weather road from Baker Lake; and
- Site accessible by aircraft and helicopter.

	Name	Phone Number
Local Charter Company:	Calm Air International Ltd.	Baker Lake : (867) 793-2873
Local Helicopter Company:	Kitikmeot Helicopters Ltd	(867) 983-2544
Charter Aircraft Company:	Propair-Nolinor	(514)631-3000

8.2.2 Emergency Assessment

In case of an event, emergency assessment will be done first by AEM Geotechnical Engineering personnel and the Engineering Superintendent on site. Assessment will be done according the criteria stated in the Table 9-2 and 9-3.

8.2.3 Emergency Communication and Actions

In case of an event, after the emergency assessment, the persons involved in the emergency response need to be notified following the chain of command stated in Table 9-4. Contact details of each person are available in Table 9-6.

According to the state of the event, decision and action plan will be taken by the persons notified. Action plan will be defined according to the level of emergency and the cause of the event. Immediate action plan will be taken with material and equipment available on site, as listed in Section 8.4.

8.2.4 Site Emergency Procedure

As specified in the Emergency Response Plan, Ver. 6, Section 4:

In the event of an immediate emergency that is or could impact persons or equipment, the employee will have to follow our emergency procedure:

- Emergency is initiated - by calling **6911** on desk type phones, or calling on two-way radio on **"Working Channel" – Code 1 – Code 1 – Code 1.**
- All communication stops except for those involved with the Emergency – i.e.: First Aid Room attendants, Medics, ERT as required.
- All work stops in First Aid Room / Clinic – and in affected area – depending on seriousness of Emergency – the whole site.
- First Aid Room Attendant / Medic will answer the phone and/or radio.

  Note: if the First Aid Room Attendant / Medic do not answer, then Security Guard will answer and/or a Supervisor on radio will answer so that Emergency Response can be initiated.
- **Responder –** will ask where the medic is required.
- **Caller –** will give a brief description of the Emergency – name, location and what is wrong and/or required.
- **Responder –** will confirm location and details of incident and activate the **ERT** team. Security will be notified by responder and a page will be sent out to all **ERT** team members on site. (All **ERT** team members on site now carry pagers).
- The person at the casualty(s) will administer First Aid if trained to do so.
- Incident Commander Center will be immobilized as to ensure that communications, transportation, and effective deployment of **ERT** resources are conducted. It is mandatory that the Official In-Charge be notified immediately.
  - Transportation will be arranged to meet at the **ERT** hall by the two large doors for medical gear and **ERT** team members.

The **ERT** team (minimum of 6 team members) will assemble as quickly as possible. (Expectation – when the page goes off – all **ERT** team members will make their way expediently to the **ERT** hall.

8.2.5 Communication Equipment Location

Communication equipment can be found at the following locations (*to be updated if required*):

- 3 phone land lines are located in the main office;
- Base station radios are located in the main office;

- Drills will have either base station radios or handhelds—depending on their distance from camp and will have satellite phones available; and

- Emergency Communication Plans (including emergency contact numbers) are located adjacent to all phones and radios and in each drill.

8.3 MEDICAL AND FIRST AID SERVICES

In case of injury the medic and First Aid station are located in the Service Building. The first aid channel on the radio is 1.The nearest hospital is located in Baker Lake.

Health Center: Baker Lake Health Center *Phone #:* (867) 793-2816

8.4 ON SITE EQUIPMENT AND MATERIAL

8.4.1 Pumping Equipment

The following is a list of onsite pumping equipment available for use during an emergency event:

Unit Number	Description	Model
61PWA01	Dewatering pump #1	Godwin model HL250M
61PWA02	Dewatering pump #2	Godwin model HL250M
61PWA03	Dewatering pump #3	Godwin model HL250M
61PWA04	Dewatering pump #4	Godwin model HL250M
61PWA05	Dewatering pump #5	Godwin model HL250M
61PWA06	Dewatering pump #6	Godwin model HL250M
61PWA07	Pit Dewatering pump #7	Godwin model CD80M
61PWA08	Pit Dewatering pump #8	Godwin model CD80M
61PWA09	Dike Dewatering pump #9	Godwin model CD100M
61PWA10	Dike Dewatering pump #10	Godwin model CD103M
61PWA11	Dike Dewatering pump #11	Godwin model CD103M
61PWA12	Dike Dewatering pump #12	Godwin model CD103M
61PWA13	Pit Dewatering pump #13	Godwin model HL5MS
61PWA14	Pit Dewatering pump #14	Godwin model HL5MS
61PWA15	Bay-Goose Seepage dewatering pump #9	Godwin model CD103M
61PWA16	Bay-Goose Seepage dewatering pump #10	Godwin model CD103M

Note: To be updated as required

8.4.2 Mobile Equipment

The following are lists of onsite mobile equipment of AEM and FGL available for use during an emergency event:

AEM Mobile Equipment List (to be updated as required)

MODEL	EQUIP. #
LOADING	
RH 40	BAC01
345CL	BAC02
307	BAC03
345D	BAC05
385C	BAC06
345DL	BAC07
RH120	BAC10
RH120	BAC11
RH120	BAC12
IT14G	LOA02
992G	LOA03
992G	LOA04
980H	LOA12
DOZER	
D8T	DOZ01
D9T	DOZ02
D9T	DOZ05
D9T	DOZ06
D9T	DOZ07
834H	DOZ08
GRADER	
16M	GRA03
16M	GRA04
HAULING	
777F	HTR01
777F	HTR02
777F	HTR03
777F	HTR04
777F	HTR05
777F	HTR06
777F	HTR07
777F	HTR08
785B	HTR20
785B	HTR21
785B	HTR22
785D	HTR23
785D	HTR24
785D	HTR25
785C	HTR26
785C	HTR27
785C	HTR28
785D	HTR29
785D	HTR30
777B	HTR10
773E	HTR09
DRILL	
DM45E	RBD01
DM45E	RBD02
DM45E	RBD03
DM45E	RBD04
CM785	RBD05
DML	RBD06
DML	RBD07
DML	RBD08
HAMMER	
V56	HAM01
V56	HAM02
BUS	
H77 (SS)	BUS01
E-350	BUS02
E-350 (SS)	BUS03
VAN E350	BUS04
32006-S (SS)	BUS05
E-350	BUS06
S30	BUS07
3800	BUS08
3800	BUS09
SITE SERVICE	
330D	BAC04
DOZER	
D8R	DOZ03
D8T	DOZ09
GRADER	
16H	GRA01
160H	GRA02

MODEL	EQUIP. #
LOADER	
IT14G (SS)	LOA01
420E (SS)	LOA05
966H (SS)	LOA06
TC44H (SS)	LOA08
966H (SS)	LOA09
980H (SS)	LOA10
420E	LOA11
TRUCK	
T800	TRK01
KENWORTH	TRK02
KENWORTH	TRK03
KENWORTH	TRK04
TRUCK (SS)	TRK05
KENWORTH	TRK06
FRD WATER	TRK07
SEPTIC	TRK08
HIAB	TRK09
CEMENT	TRK10
CEMENT	TRK11
Truck	TRK12
KENWORTH	TRK14
KENWORTH	TRK15
TRUCK (SS)	TRK16
FUEL	TRK17
GARBAGE (SS)	TRK18
FIRE TRUCK	TRK19
FUEL	TRK21
S.Plow	TRK22
S.Plow	TRK23
STEAMER	TRK24
Fountaine T.	TRK28
LUB	TRK30
Service	TRK31
AIR PLANE FUEL TANKER	TRK32
LUB	TRK33
SHOP	TRK34
FUEL	TRK35
S.Plow	TRK36
Service Truck	TRK38
GENSET	
XQ2000	GEN01
XQ2000	GEN02
XQ2000	GEN03
3412	GEN05
XQ202	GEN06
XQ202	GEN07
3508	GEN08
C6T	GEN09
C6T	GEN10
DGHE	GEN11
DGCG	GEN12
D200P	GEN13
D100P4S	GEN14
D100P1SX	GEN15
D30-8	GEN16
D25-8S	GEN17
D25-8S	GEN18
D13-4S	GEN19
D13-4S	GEN20
QAS30	GEN21
QAS30	GEN22
DSFAE	GEN23
3412	GEN24
3412	GEN25
GEH220-2	GEN26
D200P3	GEN27
DSKAA	GEN28
DSKAA	GEN29
QAS30	GEN30
QAS38	GEN31
?	GEN32
D30-10 (SS)	GEN33
QAS 30	GEN34
QAS 30	GEN35
D30-10	GEN36
6081AF001	GEN37
D30-10	GEN38
D30-8	GEN39

MODEL	EQUIP. #
PICKUP	
F-350	PCK01
F-350 (SS)	PCK02
F-350	PCK03
F-350	PCK04
F-350	PCK05
F-350	PCK06
F-350	PCK07
F-350	PCK08
F-350	PCK09
F-350	PCK10
F-350	PCK11
F-350	PCK12
E-350	PCK13
F-350	PCK14
F-350	PCK15
F-350	PCK16
F-350	PCK17
F-350	PCK18
F-250	PCK19
F-250	PCK20
F-250	PCK21
F-350	PCK22
F-350	PCK23
F-250	PCK24
F-250	PCK25
F-250 (SS)	PCK26
F-250 (SS)	PCK27
F-250	PCK28
F-250	PCK29
F-250 (SS)	PCK30
F-250	PCK31
F-250	PCK32
F-250	PCK33
F-250	PCK34
F-250	PCK35
F-250	PCK36
F-250	PCK37
F-250	PCK38
E-350	PCK39
F-250	PCK40
F-250	PCK41
F-250	PCK42
F-350	PCK43
F-250	PCK44
F-350	PCK45
F-250	PCK46
F-250	PCK47
F-250	PCK48
F-250	PCK49
F-250	PCK50
F-250	PCK51
F-450 WH	PCK52
F-250	PCK53
F-250	PCK54
F-250	PCK55
F-250	PCK56
F-250	PCK57
F-250	PCK58
F-250	REN56
ATV	
	ATV02
	ATV03
	ATV05
BOAT ENGINE	
	ENG56
	ENG57
COMPACTOR	
	CPT01
	CPT02
EMERGENCY VEHICULE	
SNOWCAT	SNC01
FORK LIFT	
HYSTER RH35	FKL02
CAT (WH)	FKL03
RZ2	FKL04
CAT	FKL05
CAT (SHOP)	FKL06
740DR321T	FKL07
ETDR40TT	FKL08
HYSTER	FKL09

MODEL	EQUIP. #
FROST FIGHTER	
IDF-350	HEA01
IDF-350	HEA02
IDF-350	HEA03
IDF-350	HEA04
IDF-350	HEA05
IDF-350	HEA06
IDF-350	HEA07
IDF-350	HEA08
IDF-350	HEA09
IDF-350	HEA10
IDF-350	HEA11
IDF-350	HEA12
IDF-350	HEA13
IDF-350	HEA14
FROST FIGHTER	
MOBILE TANK	MFT01
GÉNIE	
GS3232	SCI05
S85	SCI06
Z-45/25	SCI07
Z-45/25	SCI08
S85	SCI11
S85	SCI12
S125	SCI13
S125	SCI14
S85	REN07
Crane	
120T (SS)	MCR01
80T (SS)	MCR02
35T (SS)	MCR03
90T (SS)	MCR04
25T (SS)	MCR05
200T	MCR06
LIGHT TOWER	
AL5080D	LGT01
L-20	LGT02
L-20	LGT03
L-20	LGT04
L-20	LGT05
L-20	LGT06
L-20	LGT07
L-20	LGT08
LTC4	LGT09
LTC4	LGT11
LTC4	LGT12
LT5000-4MH	LGT18
MECHANICAL SERVICE TRUCK	
SERVICE	WMM02
MULE	
OBSOLETE	VSE01
Mule	VSE02
Mule	VSE03
Mule	VSE04
Mule	VSE05
Mule	VSE06
Mule	VSE07
Kubota	VSE08
Kubota	VSE09
Kubota	VSE10
Mule	VSE11
SKID STEER	
262C	SKD01
753	SKD02
262C	SKD03
SNOW BLOWER	
SNOW BLOWER	SBL01
SNOW BLOWER	SBL02
HYSTER HANDLER	
GTH844	TPA01
GTH844	TPA02
HR45 (SS)	TPA03
PETER	TPA03P
1056C (SS)	TPA04
SPARE	TPA05
INGERSOLL RAN	REN15
COMPRESSOR	
	COM01
SULLAIR	COM02
SULLAIR	COM03

MODEL	EQUIP. #
TRAILER	
TANKER	TRL01
LOW BED	TRL04
LOW BED	TRL05
FUEL TANK	TRL06
FUEL TANK	TRL07
LOW BOY	TRL08
FIRE PUMP TRAILER	TRL09
WELDING MACHINE	
400D	SMD01
WITH AIR PACK	SMD02
500P WIT AIR	SMD03
WITH AIR PACK	SMD05
RH120 BUCKET	
Bucket 01	
Bucket 02	
Bucket 03	
Bucket 04	
345 BUCKET	
Bucket 01	
Bucket 02	
Bucket 03	
Bucket 04	
385 BUCKET	
Bucket 01	
Bucket 02	
992 BUCKET	
Bucket 01	
Bucket 02	
Bucket 03	
Bucket 04	
TRUCK BOX REPAIR	
TRUCK BOX	BOX01
TRUCK BOX	BOX02
TRUCK BOX	BOX03
TRUCK BOX	BOX04
TRUCK BOX	BOX05
TRUCK BOX	BOX06
TRUCK BOX	BOX07
TRUCK BOX	BOX08
TRUCK BOX	BOX09
TRUCK BOX	BOX10
TRUCK BOX	BOX11
TRUCK BOX	BOX12
TRUCK BOX	BOX13
TRUCK BOX	BOX14
TRUCK BOX	BOX15
TRUCK BOX	BOX16
TRUCK BOX	BOX17
TRUCK BOX	BOX18
TRUCK BOX	BOX19

FGL Mobile Equipment List (to be updated as required)

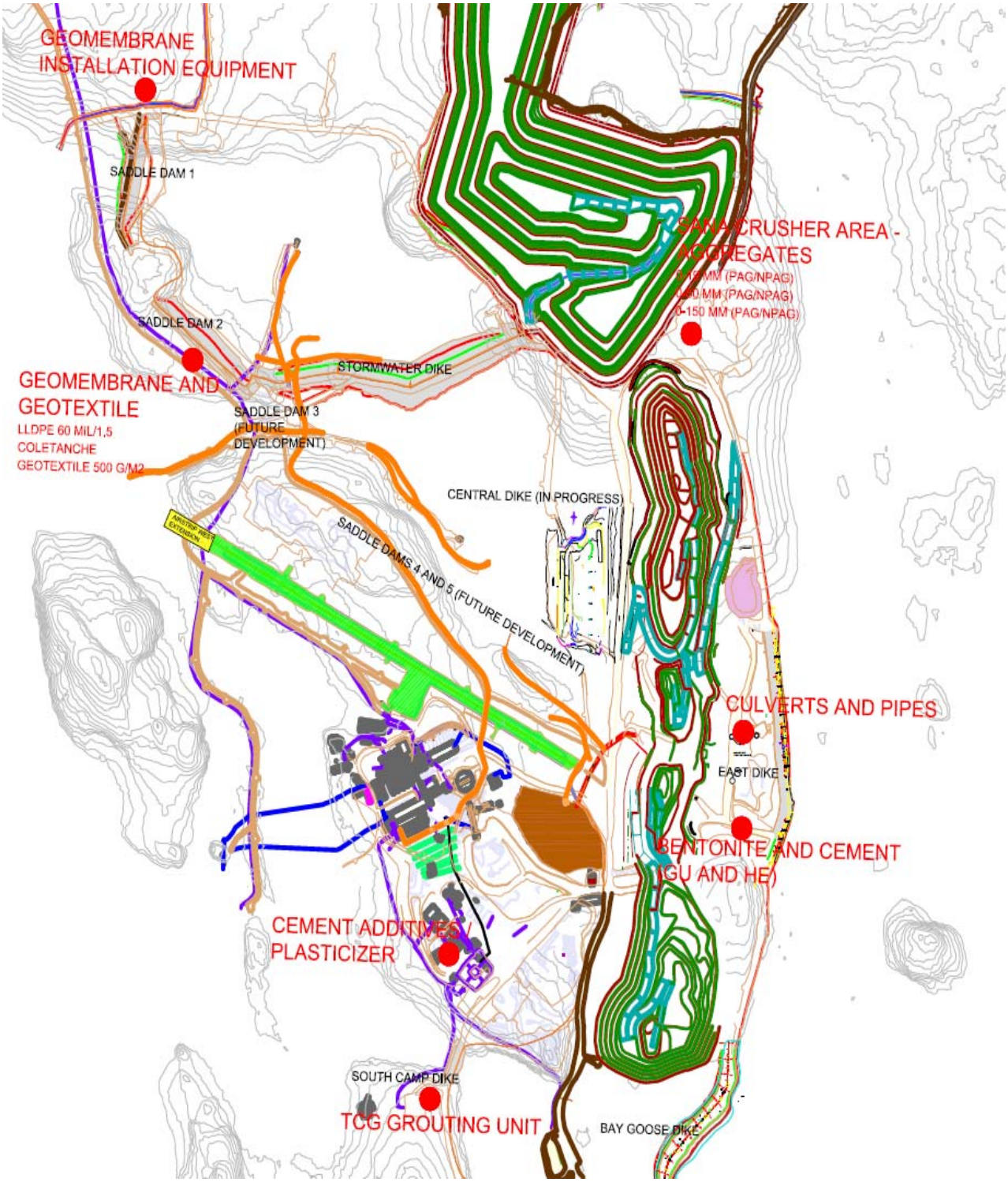
Qamanittuaq SANA FGL HEAVY EQUIPMENTS

SHOVELS		
TYPE	UNIT NUMBER	Models
PC 1250	11-0303	Komatsu
385	395	Caterpillar
385	1333	Caterpillar
365	1313	Caterpillar
345	11-0301	Caterpillar
345	393	Caterpillar
GRADER		
TYPE	UNIT NUMBER	OPERATOR NAME
14-M	513	Caterpillar
HAULING TRUCKS		
TYPE	UNIT NUMBER	OPERATOR NAME
773	1516	HTR 773F
773	1517	HTR 773F
773	1518	HTR 773F
773	1519	HTR 773F
773	1520	HTR 773F
773	1535	HTR 773F
773	1536	HTR 773F
740	1522	HTR 740
740	1530	HTR 740
100T	11-1001	TR 100
100T	11-1002	TR 100
100T	11-1003	TR 100
100T	11-1004	TR 100
DOZERS		
TYPE	UNIT NUMBER	OPERATOR NAME
D6	441	Caterpillar
D8T	438	Caterpillar
D8T	443	Caterpillar

8.4.3 Earthwork Material and Equipment

Figure 5 presents the earthwork material, including geomembrane and cement, available on site in case of an emergency.

Figure 5 Earthwork Material and Equipment Location



SECTION 9 • EMERGENCY RESPONSE REFERENCE DOCUMENTS

Table 9-1 Emergency Response Reference Documents

Document	Current Revision
Emergency Response Plan	Updated by AEM. Version 6, August 2013
Emergency Preparedness Plan	In TSF OMS Manual, Version 2, August 2013

Note: To be updated as required

Table 9-2 Potential Effects or Causes of Embankment Failure Mechanisms

Embankment Failure Mechanism	Potential Measurable and Observable	
	Causes	Effects
Overtopping	(1) Slurry/water level within the cell rises. (2) Embankment crest settlement	Increase of seepage leading to erosion of downstream foundation soils. Increase in seepage pumping rate during operations Increase in turbidity / suspended solids of seepage
Internal Erosion	(1) Loss of tailings water, erosion through embankments (2) Loss of mineral soil foundation at defect in embankment section.	Sinkhole observable at crest Increase in seepage pumping rate during operations Increase in turbidity / suspended solids of seepage
Slope Instability	(1) Ice or wave forces, or traffic on crest, seepage, weakness of foundation soils (2) Earthquake seismic event	Increase in settlement and/or settlement rate Increase in displacement and/or displacement rate of embankment toe Cracks along the embankment crest Sloughing of the face Bulging of embankment toe

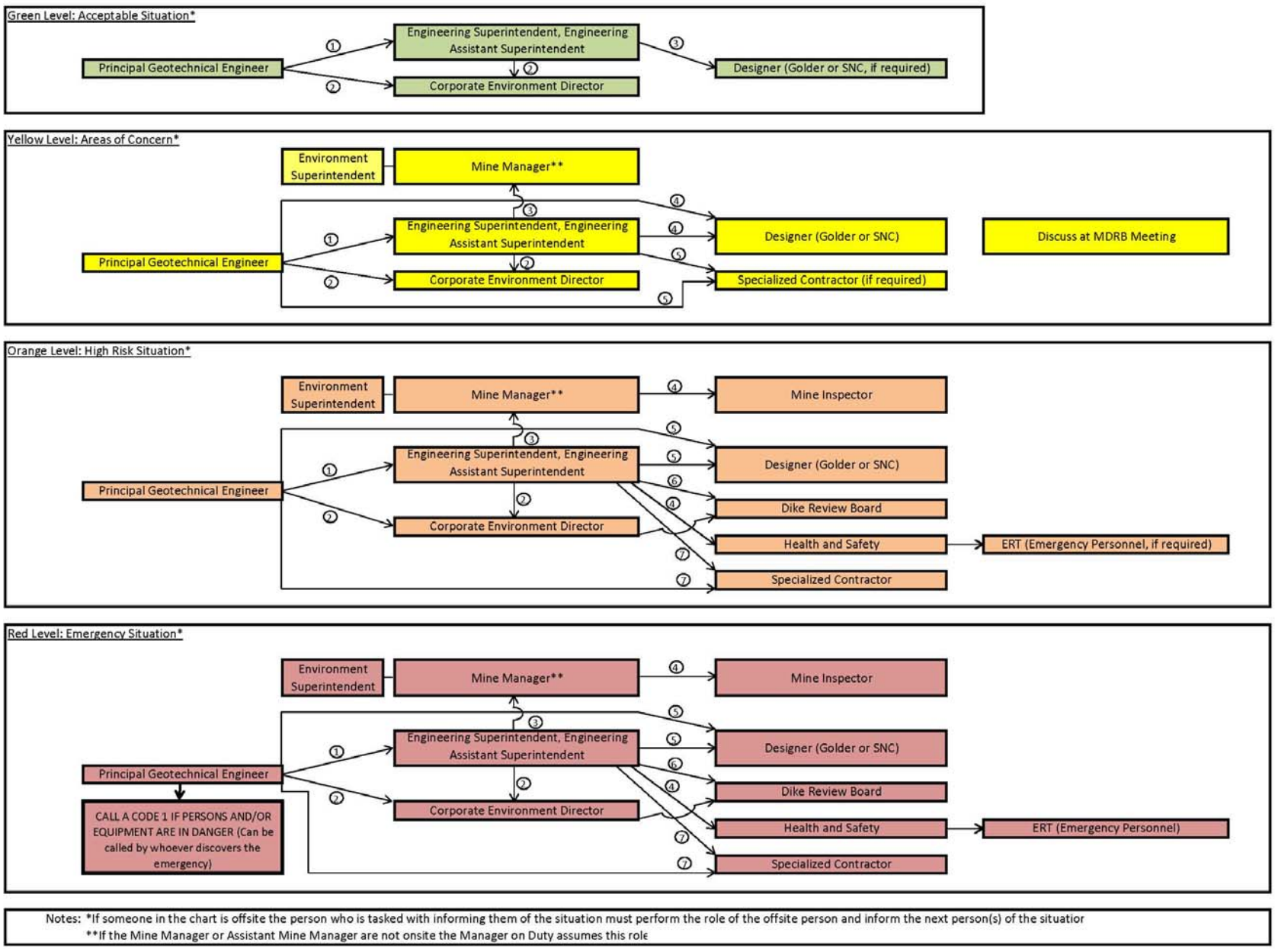
Embankment Failure Mechanism	Potential Measurable and Observable	
	Causes	**Effects**
	or blasting	
Unexpected settlements	Consolidation of foundation soils or embankment fills	Potential slurry/water overtopping the embankment leading to erosion of downstream foundation soils. Increase in seepage pumping rate during operations Increase in turbidity / suspended solids of seepage

Table 9-3 Threshold Criteria during Operation

		Threshold Criteria During Operation			
		Green **Acceptable Situation**	**Yellow** **Areas of Concern**	**Orange** **High Risk Situation**	**Red** **Emergency Situation**
Criteria	Cumulative crest settlement from operations start up	No settlement observed	< 0.2 m	> 0.2 m and < 1.0 m Increasing rate of settlement	> 1.0 m Increasing rate of settlement
	Downstream toe displacement	No displacement observed	Affecting seepage collection system	Loss of roadway	Loss of roadway
	Shear crack along rockfill embankment (differential settlement)	No shear crack observed	< 0.4 m deep	> 0.4 m and < 0.8 m deep	> 0.8 m deep
			< 5 m length along the dike	> 5 m and < 10 m length along the dike	> 10 m length along the dike
	Tension crack embankment alignment at crest	No tension crack observed	< 0.25 m deep	> 0.25 m and < 1 m deep	> 1 m deep
			< 0.10 m wide across the dike	> 0.10 m and < 0.20 m wide across the dike	> 0.20 m wide across the dike
			< 5 m length along the dike	> 5 m and < 10 m length along the dike	> 10 m length along the dike
	Sloughing along downstream rockfill embankment face	No sloughing observed	Observed	Observed and worsening from yellow situation	Observed and worsening from orange situation
	Embankment lateral cumulative deformation	No deformation observed	< 0.1 m	> 0.1 m and <0.25 m	> 0.25 m
	Seepage through embankment	No seepage observed	< 1/3 pumping rate capacity	> 1/3 and < 2/3 pumping rate capacity	> 2/3 pumping rate capacity
	Increase of seepage rate	No increase in seepage rate	< 5% per day over five consecutive days	> 5% < 10% per day over four consecutive days	> 10% per day over three consecutive days
	Turbidity of seepage water	No turbidity observed	Turbidity observed for first time	Turbidity observed and source of sediments matching cut-off wall or foundation till mineralogy	Turbidity observed and source of sediments matching cut-off wall or foundation till mineralogy
	Sinkhole on crest	No depressions or sinkholes on crest observed	Localized depression of embankment crest	Observed	Well developed
Action Required			Monitor as normal All cracks filled or repaired If cracks re open implement engineering review Identify source of turbidity	Implement engineering review Suspend activities on embankment crest at chainage of concern Intensify monitoring at chainage of concern	Remove personnel and equipment from pit and suspend activities
Personnel Notified		Principal Geotechnical Engineer, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC, if required).	Principal Geotechnical Engineer, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC), Specialized Contractor (if required), Mine Operations Manager, Environment Superintendent, Mine Manager, Discuss at MDRB Meeting.	Principal Geotechnical Engineer, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC), Specialized Contractor, Mine Operations Manager, Environment Superintendent, Mine Manager, Dike Review Board, Mine Inspector, Health and Safety, ERT (Emergency Personnel, if required).	Principal Geotechnical Engineer, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC), Specialized Contractor, Mine Operations Manager, Environment Superintendent, Mine Manager, Dike Review Board, Mine Inspector, Health and Safety, ERT (Emergency Personnel).

Table 9-4 Communication Charts for Each Emergency Level

Communications are rated to indicate in which order responsible persons should be notified in the case where a person needs to advise more than one persor



Notes: *If someone in the chart is offsite the person who is tasked with informing them of the situation must perform the role of the offsite person and inform the next person(s) of the situatior
**If the Mine Manager or Assistant Mine Manager are not onsite the Manager on Duty assumes this role

Table 9-5 Responsibilities of Persons for Each Emergency Level

	Decision Making	Mobilization	Performing the Action to be Taken
Green Acceptable Situation	Principal Geotechnical Engineer	Principal Geotechnical Engineer	Geotechnical Team*
Yellow Areas of Concern	Principal Geotechnical Engineer Engineering Superintendent Engineering Assistant Superintendent Designer (Golder or SNC)	Principal Geotechnical Engineer	Geotechnical Team* Specialized Contractor (if required)
Orange High Risk Situation	Principal Geotechnical Engineer Engineering Superintendent Engineering Assistant Superintendent Designer (Golder or SNC) Corporate Environment Director Dike Review Board Mine Manager Health and Safety (if required)	Principal Geotechnical Engineer Engineering Superintendent Engineering Assistant Superintendent	Geotechnical Team* Specialized Contractor ERT (if required)
Red Emergency Situation	Principal Geotechnical Engineer Engineering Superintendent Engineering Assistant Superintendent Designer (Golder or SNC) Corporate Environment Director Dike Review Board Mine Manager Health and Safety	Principal Geotechnical Engineer Engineering Superintendent Engineering Assistant Superintendent Mine Manager Health and Safety	Geotechnical Team* Specialized Contractor ERT

*The Geotechnical Team consists of the Principal Geotechnical Engineer, the Dewatering and Pit Geotechnical Engineer/Geologist, Water Management, and the Geotechnical Technician.

Table 9-6 Names and Contact Details (to be updated as required)

Internal Emergency Response Contact Information Chart		
Position	**Name/Location**	**24-Hour Contact #**
Principal Geotechnical Engineer	Erika Voyer	Ph: 867-793-4610 ext. 6837 cell: 581-982-7107
	Thomas Lepine	Ph: 867-793-4610 ext. 6837 cell: 418-473-8077
Engineering Superintendent	Julie Belanger	Ph: 867-793-4610 ext. 6721 cell: 819-856-1667
Engineering Assistant Superintendent	Stephane Frechette	Ph: 867-793-4610 ext. 6721 cell: 819-856-3152
Corporate Environment Director	Michel Julien	Ph: 416-947-1212 ext. 3738 cell: 514-244-5876
Designer (Golder or SNC)	Golder Burnaby: Dan Walker, Fiona Esford Golder Montreal: Yves Boulianne, Annie Beaulieu	Burnaby Office: 604-296-4200 Montreal Office: 514-383-0990
	SNC: Jean-Francois St-Laurent, Yohan Jalbert, Simon Beaulieu	Quebec City Office: 418-621-5500
Specialized Contractor	SANA (FGL Group)	Onsite Ph: 867-793-4610 ext. 6963 Ph: 418-615-0559
Environment Superintendent	Kevin Buck	Ph: 867-793-4610 ext 6838 Cell: 819-856-1956
Mine Manager	Jean Beliveau	Ph: 867-793-4610 ext. 6901 cell: 819-856-5605
	Alexandre Proulx (asst.)	Ph: 867-793-4610 ext. 6843 cell: 819-860-6389
Dike Review Board	Anthony Rattue Norbert Morgenstern Don Hayley	Anthony.Rattue@snclavalin.com norbertm@ualberta.ca dhayley@eba.ca
Mine Inspector	Martin VanRooy	Martin.vanRooy@wscc.nu.ca_contact1
Health and Safety	Normand Ladouceur	Ph: 867-793-4610 ext. 6720 cell: 819-860-6258
	Yves Levesque (asst.)	Ph: 867-793-4610 ext. 6720 cell: 819-856-9051
ERT (Emergency Personnel)	Emergency response personnel available on site to assist with spill and emergency response activities	Coordinated by the Emergency Measures Counsellor
Incident Commander	André Rouleau	Ph: 867-793-4610 ext. 6809 cell: 819-355-2191 Channel #1
	Normand Ladouceur	Ph: 867-793-4610 ext. 6720 cell: 819-860-6258 Channel #1

Emergency Measures Counsellor	André Rouleau	Ph: 867-793-4610 ext. 6809 cell: 819-355-2191
Health Professionals / Medical Clinic	Medical Clinic 1	Ph: 867-793-4610 ext. 6734
	Medical Clinic 2	Ph: 867-793-4610 ext. 6751
AEM Management Representative	Dominique Girard	Ph: 867-793-4610 ext. 6901 cell: 819-277-4080
Human Resource Superintendent	Krystel Mayrand	Ph: 867-793-4610 ext 6723 cell: 819-856-9556

SECTION 10 • REFERENCES

Canadian Dam Association (CDA) 2007. Dam Safety Guidelines.

Golder Associates Ltd. (Golder) 2008. Detailed Design of Tailings Storage Facility, Meadowbank Gold Project. December 17, 2008. Doc. 784 Ver. 0.

Golder 2009. Stormwater Dike and Saddle Dam 1 Geomembranes, Meadowbank Gold Project. July 20, 2009. Doc. 917 Ver. 0.

Golder 2011. 2011 Tailings Deposition Plan Update, Meadowbank Gold Project. July 18, 2011. Doc. 1272 Ver. 0.

Mining Associate of Canada (MAC) 2005 Developing an Operation, Maintenance and Surveillance Manual for Tailings and Water Management Facilities.

Mining Association of Canada (MAC) 2008. A Guide to the Management of Tailings Facilities. Second Edition.

AEM, Emergency Response Plan, Ver.6, August 2013

Appendix I

Water Quality and Flow Monitoring Plan

Appendix II
Tailings Storage Facility - Inspection Form

All parts of this inspection form should be completed. Adverse conditions should be described and location stated. Additional information and relevant photographs should be attached.

Inspecting Officer: *Report No.:* _____ *Inspection Date:* _____

DAM/DIKE INFORMATION:

Dam ☐ Dike ☐ _____ Crest Elevation: _____ Head Pond Elevation _____
Tailing elevation _____

DAM / BERM

A) Crest

cracking	☐ none	☐	
settlement	☐ none	☐	
erosion	☐ none	☐	
other movement	☐ none	☐	

B) Downstream Slope and Toe Area

erosion	☐ none	☐	
settlement	☐ none	☐	
bulging	☐ none	☐	
sloughing	☐ none	☐	
slope protection	☐ good	☐	
animal burrows	☐ none	☐	
seepage	☐ none	☐	location 1: _____
			rate: ☐ damp ☐ trickle ☐ steady ____ (L/s)
			clarity: ☐ clear ☐ muddy
			sample taken: ☐ yes ☐ no
			location 2: _____
			rate ☐ damp ☐ trickle ☐ steady ____ (L/s)
			clarity ☐ clear ☐ muddy
			sample taken ☐ yes ☐ no
			type: _____
sand boils	☐ none	☐	location(s) _____

C) Upstream Slope and Tailings Surface

erosion	☐ none	☐	wave induced		☐ surface runoff	
			location(s):			
			degree	☐ minor	☐ moderate	☐ severe
geomembrane	☐ none	☐				
settlement	☐ none	☐				
bulging	☐ none	☐				
sloughing	☐ none	☐				
slope protection	☐ good	☐				
slope vegetation	☐ none	☐				
animal burrows	☐ none	☐				
sinkholes	☐ none	☐				
tailings surface	☐ water covered	☐				

DAM / DIKE INSTRUMENTATION: (plot any newly installed instrumentation on relevant plans and cross-sections)

	Operational	Damaged	Measurement Taken
☐ none	☐	☐	☐
☐ piezometers	☐	☐	☐
☐ monitoring well	☐	☐	☐
☐ survey stakes	☐	☐	☐
☐ other Thermistors (4)	☐	☐	☐ every 3-4 days

COMMENTS AND RECOMMENDATIONS:

☐ Action Required: ☐ none ☐ further monitoring ☐ immediate remediation
☐ Plan or Sketch Attached _____
☐ Photographs (number) _____

Review Officer: _____ Review Agency: _____ Date Reviewed: _____
(DD/MM/YR)

REVIEW COMMENTS: ☐ ***none***

Appendix III
Dike Failure Scenario Appendices from the ERP

Dike Failure Scenarios

1. **Dewatering Dikes (removed)**
2. **Central Dike**
3. **Saddle Dams**
4. **Storm water Dike**

Appendix 2

Central Dike

Central Dike

The Central Dike system is comprised of a Central Dike, a series of perimeter dikes, and the natural basin of the northwest arm of Second Portage Lake, as shown on the general mine site plan provided at the beginning of this document. The Central Dike cross-section consists of:

- A rockfill embankment, constructed from run-of-mine waste rock, placed in lifts and compacted, with the upstream face designed at 3H:1V and 2H:1V and the downstream face designed at a 1.5H:1V slope;
- An upstream two zone granular filter and inverted granular filter along the foundation;
- A bituminous liner with appropriate cover on the upstream face and part of the foundation;

A central or upstream key trench; The Central Dike is a high consequence structure, based on Dam Safety Guidelines (CDA, 2007). Slope stability analyses show that the dike will meet or exceed design FoS for stability under static and pseudostatic earthquake load conditions. Consequently, the probability of failure of the Central Dike is considered to be very low.

For information on the consequences and monitoring/action for the various embankment failure modes possible at the Central Dike see Table 2.2 below.

Table 2.2: Meadowbank Tailings Storage Facility Summary of Consequences and Proposed Monitoring / Action for Rare Event Based On Water Retaining Embankment Failure Modes Identified in ICOLD Study (1995)

Failure Mode	Scenario	Consequence	Monitoring/Action
Overtopping	(1) Pond Level rises because of restricted outflow (excessive inflow is a far less likely scenario). Water will spill at the low point on the dike system, which will depend on the construction schedule.	Water spills over the crest but, as this crest is both wide and comprises coarse compacted rock fill, minimal damage to the dike is credible. There will be considerable warning time prior to overtopping given the design freeboard and the storage volume.	Adjust decant and/or deposition rate. Add spillway in Central Dike, Saddle Dam, or natural ground.
	(2) Dam crest settles more than available freeboard over a distance of (say) 50m or so. This scenario requires unexpected foundation condition, such as glacial lake clay deposit. Settlement would occur upon placement of rock fill during dike raise construction. Freeboard is greatest immediately after a raise and this scenario is therefore unlikely to occur.	Water and tailings spill over crest and if settlement was rapid might erode the crest. Travel of tailings will be dependent on volume of water available, and level of thaw. Tailings would only go to the pit, and not reach the lake.	The situation envisaged is unlikely. This scenario would develop slowly during construction of the dike. Crest settlement would be evident at least several weeks before an overtopping event occurred. Easily observed cracks should be evident during summer period, but could be hidden during the winter. Systematic crest settlement monitoring is appropriate, and included in the design. Production and addition of tailings to the Tailings Storage Facility could be stopped to maintain freeboard. A spillway could also be constructed. The tailings deposition plan maintains a long beach between the dike and the pond, which provides additional freeboard to overtopping of the dike by pond water.

Internal Erosion	(1) Dike Section: Upstream bituminous liner contains defects arising from undetected damage during installation. May lead to loss of water, but filter retains tailing.	Loss of water into the rock fill. This is not a catastrophic failure mode, because the rock fill of the dike will be stable, and at its worst, would lead to temporary suspension of mining. Plus the bituminous liner does not propagate a tear like a plastic liner, so undetected damage is typically small and does not grow. Also, the foundation slopes down towards the tailings, so seepage impounds in the rock fill and will tend to reduce further seepage	Not necessary to monitor directly. Will become evident as possible seepage at dike toe. QA/QC program during construction is the main defence against this scenario.
	(2) Dike Section: Upstream bituminous liner contains defects arising from undetected damage during installation. This defect occurs at the same location as a filter defect.	Loss of tailings and water into the rock fill. This is not a catastrophic failure mode, because the rock fill of the dike will be stable, and at its worst, would lead to temporary suspension of mining. Accumulation of ponded water within the rock fill would decrease the head difference driving flow, thereby limiting the potential for a catastrophic failure.	Not necessary to monitor directly. Will become evident as possible intensive seepage at dike toe, and potentially as tailings fines within seepage downstream of the toe. QA/QC program during construction is the main defence against this scenario.
Seepage within Embankment	Seepage on its own is not a credible failure scenario. The rock fill is pervious so seepage will daylight on the downstream face. Flow through the rock fill will not lead to instability. Any seepage related failures must include internal erosion, see above.	No credible consequences.	No scenario specific monitoring required.
Seepage within Foundation	If the till foundation had a zone of more pervious soil (e.g. gravel seams) and the more pervious zone was preferentially exposed to water pressure, then normal seepage would transmit an unexpectedly high fraction of the reservoir head into the downstream part of the dike foundation. This scenario requires construction defects in filters, liner, and cut off trench fill.	This failure mechanism has caused other embankment failures elsewhere because of straightforward pore pressure induced instability. However, it is unclear that it could cause failure of the Central Dike because of its large width compared to the retained water head. The most likely consequence is downstream toe slumping requiring a localized stabilizing berm.	If this mechanism arises it should show itself gradually as the tailings and water level increase in the basin by buildup of pore water pressures in the foundation. This would be detected during routine monitoring of piezometers installed in the foundation. Pressure relief wells could be installed in the foundation during operations. The tailings deposition plan maintains a long beach between the pond and the dike. This will reduce seepage gradients beneath the dike. In addition, the tailings act as an upstream blanket on the bottom of the TSF to limit seepage into the foundation.

Internal Conduit Rupture	There are no water off take works or other structures extending through the dikes.	Not applicable.	Not applicable.
Slope Instability	(1) Normal Operation: The rockfill has high frictional strength and the design widths make it conservative. Slope failure requires failure in the foundation, which would then extend into the overlying dike.	A foundation failure would cause a rotational slip or sliding failure until equilibrium was reached. This mechanism would limit access along the dike until repaired. Failure through the rock fill will not necessarily compromise the tailings or water retaining function of the dike.	Initial stages of failure should be observable as tension cracks in dike crest and movement at dike toe. Walk-over inspection of dikes by a trained inspector is an appropriate monitoring strategy. Survey of crest, face and toe is also appropriate. If movements associated with increases in foundation pore pressures are discovered, then construction could be stopped or staged to allow pore pressure dissipation. Placement of rockfill as a downstream toe berm could help prevent failure.
	(2) Earthquake Induced: Occurrence of an extreme earthquake, a very rare event.	The extreme earthquake loading for site is a low magnitude event. A large earthquake would not be expected to cause a catastrophic failure, rather the dike would settle. The Central Dike rock fill is placed in the dry and compacted, and will therefore have limited settlement. This would not be a failure situation. The crest is also erosion resistant for earthquake induced wave action in the impounded water.	No monitoring is necessary. Dike should be inspected following any earthquakes felt on site.
Liner Failure Due To Foundation Movement	Differential horizontal movement of the dike due to pit wall failure. Creates a breach in the liner and filter. Pit wall failure is unlikely based on assessments of pit wall stability and the setback between the pit and the toe of the dike. Also, the liner and rock fill can withstand significant deformation, making this an unlikely scenario.	Tailings and water escape into the dike rock fill, but pond there because the foundation slopes towards the dike, rather than the pit. It is noted that the tailings pond is operated approximately 500 metres away. Rapid escape of water will therefore be limited.	No enhanced monitoring. Prism monitoring program and visual inspection sufficient. Movement would be evident in setback area between dike and pit. Tailings at face of dike may be excavated to allow repair of liner, or placement of filter material. Other options include freezing tailings at face of dike.
Unexpected Settlements	The foundation till is expected to consolidate during construction and operations. There is no credible mechanism for a large degree of unexpected settlement following construction required to eliminate freeboard and release tailings/water.	A large settlement could lead to water flowing through the rock fill, but this would not cause failure of the rock fill. It could also be readily repaired by placing more end-dumped rock fill, and extending the liner, in a manner similar to the periodic raise.	No enhanced monitoring required, as excessive settlement would be apparent from prism monitoring data, and visual inspection.

2.1 Failure Scenario during Operations

In the case of failure of the Central Dike during operations, the 'worst-case' scenario would involve a flow of unfrozen water and tailings in association with a catastrophic failure of the dike in the later stages of mining when personnel and machinery are working in the open pit directly down-stream of the Tailings Storage Facility (TSF).

Potential Effect

The failure of the Central Dike could result in the sudden release of dike material and tailings from the TSF into that portion of the Portage Pit immediately adjacent to the dike. This could potentially result in loss of life. This would result in cessation of mining activities, either temporarily or permanently.

There would be no effect on the receiving environment water quality, fish or fish habitat because tailings would be contained within the pit and the dewatering dikes and the area would not yet be flooded.

Mitigation, Management and Monitoring

The calculated FoS for this failure mode, under static and pseudo-static conditions, are above design criteria in the Dam Safety Guidelines (CDA, 2007). Consequently, the probability of such a failure developing is low. Based on the tailings deposition plan, it is expected that the tailings pond will typically be 500 m or more from the face of the Central Dike. Furthermore, thermal modeling indicates the tailings and Central Dike will be frozen or partially frozen, and that the facility will tend to the frozen state in the long term. Therefore, a catastrophic failure of the Central Dike without some form of prior dam distress providing a warning of deteriorating conditions is not considered a credible catastrophic failure mode.

Mitigation against such a failure mode occurring will be to construct the Central Dike to design so that it is physically stable under all loading conditions. A comprehensive quality control and quality assurance program will be undertaken during dike construction to confirm foundation conditions, material type and quality, and to adjust designs as necessary to accommodate actual or unexpected conditions found at site.

- A management plan was developed for the operation of the tailings facility, and includes appropriate operational controls and monitoring activities. During operations, instrumentation will be installed to monitor not only the physical performance of the Central Dike itself, but also the performance of the TSF. The instrumentation installed and to be installed includes thermistors to monitor the thermal regime in the dike and foundations, and deposited tailings.

- Piezometers to measure pressure and to infer flow through the dike and foundation materials

- Prisms to monitor deformations within the dike.

If necessary, the stability of the foundation materials and of the dike during operations can be enhanced through the construction of a stabilizing toe berm or through freezing.

2.2 Failure Scenario during Closure

In the case of failure of the Central Dike during or following closure, the 'worst-case' scenario would involve a catastrophic failure of the dike and the release of tailings into the lake.

Potential Effect

Failure of the Central Dike during or following closure is not expected to result in loss of life, as mining operations will have finished.

Under this scenario, a catastrophic failure of the Central Dike could result in the sudden and unexpected release of dike material and tailings into the Portage Pit lake area. This could potentially produce a wave of sediment laden water that could over-top the East Dike.

Such a scenario would destroy fish habitat along the dike face and smother benthic habitat outwards from the failure area. Suspended solids and dissolved metals would increase in the water column and would cause displacement of fish and possible toxicity of some bottom sediments, depending on how much tailings material was lost. The new face would be subject to chronic erosion of fine tailings material until such time as a new, stable dike face could be established. Failure of the dike would not cause a change in water level. Impacts would be localized because the Central Dike is situated in the upper part of a blind arm of the lake with an extremely limited drainage area and low turnover. Consequently, transport of suspended sediment away from the area would be restricted and the area of impact would be relatively small.

Mitigation, Management, and Monitoring

The calculated FoS for the Central Dike design are greater than design criteria for post closure for static and pseudo-static (earthquake) conditions. Consequently, the likelihood of a failure occurring is low. Furthermore, thermal modeling indicates the tailings and Central Dike will progressively freeze, and that the facility will tend to the frozen state in the long term. Freezing will increase dike and tailings stability and decrease tailings mobility, and therefore this is not considered a credible catastrophic failure mode.

Mitigation against such a failure mode occurring will be to construct the Central Dike to the design so that it is physically stable under static and pseudo-static loading conditions, and to monitor during the mine life to assess the overall performance of the dike and the TSF. Data gathered during the operational period of the TSF can be used to re-evaluate the performance of the Central Dike structure in the context of longer term stability post closure.

Appendix 3

Saddle Dams

Saddle Dams

Five Saddle dams will be constructed around the limits of the tailings basin. Two Saddle Dams were built between 2009 and 2011, the three other Saddle Dams will be built later during the mine operation. The saddle dam locations are shown on the general mine site plan provided at the beginning of this document. The saddle dams will be constructed by dumping a rockfill berm with a crest width of 30 m to allow haul truck traffic. The Saddle Dams will be re-sloped, with a minimum 6 m crest width. The downstream face will be angle of repose, or 1.32H:1V (Horizontal:Vertical), and the upstream face will be 3H:1V. The Saddle Dams will have an upstream two-zone granular filter and a liner. There is a potential for release of attenuation water, reclaim water, or tailings to Third Portage Lake in the event of an overtopping or catastrophic failure.

For information on the consequences and monitoring/action for the various embankment failure modes possible at the Saddle Dams see Table 2.2 for the Central Dike.

3.1 Failure Scenario during Operation

Depending upon the phase of operations, breach or complete failure of a Saddle Dam could result in the uncontrolled release of Attenuation Pond water, Reclaim Pond water or tailings to Third Portage Lake. There is also the possibility of the Saddle Dams being overtopped through the formation of a wave resulting from a slope failure within the Portage Waste Rock Storage Facility and the sudden release of waste rock into the TSF.

A tailings beach will be formed on the toe of each Saddle Dam. As a result, the Reclaim Pond will be pushed away from the Saddle Dams. As the tailings and Saddle Dams are expected to freeze, and freezing will reduce the chance of tailings reaching Third Portage Lake, failure of the Saddle Dams with release of tailings to Third Portage Lake is not considered to be credible.

An overtopping or breach failure of the section of the Saddle Dams located just south of the intersection with the Stormwater Dike could potentially result in flow of Reclaim Pond water and/or tailings toward Third Portage Lake.

Potential Effect

Should an overtopping event or breach occur in a Saddle Dam, water flowing toward Third Portage Lake would consist of Reclaim Pond water which is predicted to exceed Metal Mining Effluent Regulations (MMER) guidelines for a number of constituents.

As a worst case of failure resulting in a dam breach, the total predicted Reclaim Pond volume of 0.75 Mm^3 could be released towards Third Portage Lake. The Saddle Dams would not be expected to fail due to overtopping. This failure mode is not expected to release a considerable volume of water to Third Portage Lake. Given the size of Third Portage Lake, the impacts to water quality and on fish from a release of Reclaim Pond water would likely be localized.

A worst case scenario would also involve the flow of non-frozen tailings into Third Portage Lake. The distance between the toe of the Saddle Dams and Third Portage Lake is on the order of 150 m to 300 m. Such a scenario would destroy fish habitat and smother benthic habitat outwards from the failure area. Suspended solids and dissolved metals would increase in the water column and would cause

displacement of fish and possible toxicity of some bottom sediments, depending on how much tailings material was lost.

Mitigation, Management, and Monitoring

The dams are designed according to Dam Safety Guidelines (CDA, 2007), and were and will be constructed under controlled conditions. A comprehensive quality control and quality assurance program was and will be undertaken during construction to confirm foundation conditions, material type and quality, and to adjust designs as necessary to reflect actual conditions found at site. The dams are predicted to eventually freeze, which will enhance stability. Therefore, failure of Saddle Dams by overtopping, full breaching or foundation and slope failure is not considered to be credible.

With respect to slope stability failure, the Saddle Dams are constructed of rockfill, which has high shear strength. Slope stability failures must therefore occur through foundation soils. The calculated FoS for slope stability failure modes through foundation soils are above the design criteria in the Dam Safety Guidelines (CDA, 2007) for static and pseudo-static conditions. Consequently, the probability of such a failure developing is low.

The tailings are expected to freeze, and freezing will reduce the chance of tailings reaching Third Portage Lake. The distance from Saddle Dam 1 to Third Portage Lake is about 300 m at its closest point. Leaks of supernatant water and or tailings from the South Saddle Dam would be most likely to occur during operations. Leaks would be visible, and could be mitigated during operations.

3.2 Failure Scenario during Closure

At closure Reclaim Pond water will be pumped to an Attenuation Pond, the basin behind the Saddle Dams will be drained and filled with run-of-mine, acid-buffering ultramafic waste rock (NPAG). The rock is expected to freeze over time. Failure of the Saddle Dams following closure is not considered to be credible. Further, the lack of water will reduce mobility of tailings if failure occurs.

Potential Effect

No effects to water quality, fish or fish habitat is expected.

Mitigation, Management, and Monitoring

As described previously, the dams were and will be designed to meet Dam Safety Guidelines (CDA, 2007). The dams were and will be constructed under controlled conditions. During the construction of the dams a comprehensive quality control and quality assurance program was and will be undertaken to confirm foundation conditions, material type and quality, and to adjust designs as necessary to reflect actual or unexpected conditions found at site. Monitoring during operations will ensure the Saddle Dams perform as intended. The dams will eventually freeze, which will enhance stability. Therefore, post-closure failure of the Saddle Dams by full breaching or foundation and slope failure is not considered to be credible.

Appendix 4

Stormwater Dike

Stormwater Dike

The Stormwater Dike is located at the northwest end of Second Portage Lake, within the TSF as shown on the general mine site plan provided at the beginning of this document. The location of the Stormwater Dike was selected to optimize the storage capacity of the main tailings basin, and of the Portage Attenuation Pond. The dike separates the tailings basin from the Attenuation Pond until approximately 2014 at which point the tailing deposition will start in the South tailing Cell. At the end of mine life, any remaining water will be treated within the TSF and released once discharge criteria are met.

The Stormwater Dike was constructed using rock fill, with a upstream slope of 3H: 1V and a downstream slope at angle of repose for rock fill. The minimum crest width is 6 m. Final crest is at elevation 150.0 m. The dike has a filter zone placed on the south face, underlying an impermeable element of bituminous geo-membrane. The maximum height of the dike is about 13 m. At the maximum cross section, the width of the base of the dike is approximately 95 m.

For information on the consequences and monitoring/action for the various embankment failure modes possible at Storm water Dike see Table 2.2.

4.1 Failure Scenario during Operation

If slope failure of the Stormwater Dike were to occur when tailings are at their maximum elevation in the main tailings basin, and if the tailings are not frozen, this could potentially result in the sudden flow of tailings into the Attenuation Pond area. This in turn could potentially result in the development of a wave which overtops the Saddle Dam at the northwest end, releasing tailings and reclaim water to Third Portage Lake.

Potential Effect

A breach or failure of the Stormwater Dike may cause a wave-induced overtopping of the Saddle Dam at the northwest end. The Saddle Dam would not be expected to fail due to a single overtopping wave event.

This failure mode is not expected to release water to Third Portage Lake. The distance between the toe of the Saddle Dam and Third Portage Lake is on the order of 150 m, so tailings would likely settle out. The potential impacts on Third Portage Lake water quality, fish and fish habitat would likely be minor, localized and short-lived.

Mitigation, Management, and Monitoring

The Stormwater Dike was designed to meet Dam Safety Guidelines (CDA, 1999). The upstream side slopes were designed to allow machine traffic, and are therefore highly conservative with respect to slope stability. The dike was constructed in the dry under controlled conditions. During the construction of the dike a comprehensive quality control and quality assurance program was undertaken to confirm foundation conditions, material type and quality, and to adjust designs as necessary to reflect actual conditions found at site. The dike will eventually freeze, which will enhance stability. Therefore, failure of the dike due to overtopping is not considered to be credible.

4.2 Failure Scenario during Closure

The Stormwater Dike will be covered by tailing on both upstream and downstream side, to equal out the different elevations. At closure Reclaim Pond water will be pumped to an Attenuation Pond, the basin behind the Saddle Dams and Stormwater Dike will be drained and filled with run-of-mine, acid-buffering ultramafic waste rock (NPAG). The rock is expected to freeze over time. Failure of the Stormwater Dike following closure is not considered to be credible. Further, the lack of water will reduce mobility of tailings if failure occurs.

Potential Effect

No effects to water quality, fish or fish habitat is expected.

Mitigation, Management, and Monitoring

The Stormwater Dike was designed to meet Dam Safety Guidelines (CDA, 1999). The dike was constructed under controlled conditions. During the construction of the dike a comprehensive quality control and quality assurance program was undertaken to confirm foundation conditions, material type and quality, and to adjust designs as necessary to reflect actual or unexpected conditions found at site. Monitoring during operations ensure the Stormwater Dike performs as intended. The dike will eventually freeze, which will enhance stability. Therefore, post-closure failure of the Stormwater Dike by full breaching or foundation and slope failure is not considered to be credible.

AGNICO EAGLE

MEADOWBANK GOLD PROJECT

DEWATERING DIKES

Operation, Maintenance and Surveillance Manual

Prepared by:
Agnico Eagle Mines Limited – Meadowbank Division

Version 3
September 2013

DEWATERING DIKES

OPERATION, MAINTENANCE AND

SURVEILLANCE MANUAL

MEADOWBANK GOLD PROJECT

AGNICO EAGLE MINES LIMITED

This Operation, Maintenance and Surveillance Manual has been prepared by Agnico Eagle Mines Limited and is to be used for the operation, maintenance and surveillance of the Dewatering Dikes at the Meadowbank Gold Project. All Registered Manual Holders are responsible for ensuring that they are using the most recent revision of this document. This Operation, Maintenance and Surveillance Manual, may not be copied in whole or in part without the written consent of Agnico Eagle Mines Limited.

IMPLEMENTATION SCHEDULE

This Plan is immediately implemented.

DISTRIBUTION LIST

AEM - General Manager Meadowbank

AEM- Environment Superintendent

AEM- Mine Operations Superintendent

AEM- Engineering Superintendent

AEM- General Services Manager

AEM- Corporate Environment Director

Golder- Dike Design Engineer

SNC- Dike Design Engineer

DOCUMENT CONTROL

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Approved by: _____
Julie Belanger
Engineering Superintendent

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SECTION 1 • INTRODUCTION

1.1 PURPOSE

This document includes procedures for the operation, maintenance and surveillance (OMS) of the Dewatering Dikes at the Meadowbank Gold Project, Nunavut, operated by Agnico Eagle Mines Limited (AEM), Meadowbank Division. The Dewatering Dikes are comprised of the following structures: East Dike, Bay-Goose Dike, South Camp Dike, and Vault Dike. The dewatering dikes isolate the open pit mining activities from Second Portage Lake and Third Portage Lake.

The responsibilities of AEM staff have been allocated based on the current management structure. As the management structure changes the OMS Manual should be revised and distributed accordingly.

This OMS Manual refers to the dewatering, operations, and decommissioning phases of the Dewatering Dikes.

1.2 REGULATORY REQUIREMENTS

This manual addresses specific requirements from regulatory agencies and provides procedures to maintain compliance. Regulatory requirements are presented in the documents summarized in Table 1.1.

Table 1.1 Regulatory Requirements

Document	Document Reference No.	Review Date
Territorial Lands Act - Land Lease	Production Lease KVPL08D280	Expires December 27, 2027
Environmental Impact Assessment	NIRB project certificate No. 004	n/a – Only if substantial modifications to original application are to be carried out
Water Licence Type A	Nunavut Water Board Water License 2AM-MEA0815	Expires May 31, 2015

The operating, maintenance, surveillance and emergency procedures recommended by the Canadian Dam Association (CDA) “Dam Safety Guidelines” (CDA 2007) and the Mining Association of Canada (MAC) “Developing an Operation, Maintenance and Surveillance Manual for Tailings and Water Management Facilities” (MAC, 2005) have been incorporated into this manual.

The CDA Dam Safety Guidelines (CDA, 2007) states: “dam operation, maintenance and surveillance shall be provided so that an acceptable level of dam safety is ensured.” This manual contains protocols and information that will assist AEM to operate, maintain, and monitor the Dewatering Dikes in a safe manner and identify early signs of distress. Qualified personnel shall operate, maintain and monitor the structures and adequate records shall be maintained for general and reference purposes.

1.3 CONSEQUENCES OF FAILURE

The Dewatering Dikes consequence of failure classification is based on the guidelines provided in the CDA Dam Safety Guidelines (CDA 2007) and is presented in Table 1.2. The East Dike and Bay-Goose Dike are rated as "High" consequence of failure structures based on the potential for loss of life and "High" economic loss. The South Camp Dike and Vault Dike are rated as a "Significant" consequence of failure structure based on a temporary risk to workers, and classified as "Low" due to economic loss.

No flooding or inundation mapping has been completed. It is assumed that failure of the East Dike could flood the Portage Pit, resulting in associated threat to the safety of mine personnel, equipment, and other workings within the dewatered area. Similarly, it is assumed that failure of the Bay-Goose Dike could flood the Goose Island Pit and Portage Pit, resulting in associated threat to the safety of mine personnel, equipment, and other workings within the dewatered area. Flooding would likely cause cessation of mining operations within one or both pits, either temporarily or permanently. It is assumed that failure of South Camp Dike could not flood the Bay-Goose Pit as the Third Portage Lake water level at South Camp Dike is too low. It is assumed that once the dewatering of Vault Lake will be complete, a failure of Vault Dike could flood Vault Pit resulting in associated threat to the safety of mine personnel, equipment, and other workings within the dewatered area. Flooding would likely cause cessation of mining operations within one or both pits, either temporarily or permanently.

Table 1.2 Classification of Dams in Terms of Consequences of Failure (CDA 2007)

Dam Class	Population at Risk [Note 1]	Incremental losses		
		Loss of Life [Note 2]	Environmental and Cultural Values	Infrastructure and Economics
Low	None	0	Minimal short-term loss No long-term loss	Low economic losses; area contains limited infrastructure or services
Significant	Temporary only	Unspecified	No significant loss or deterioration of fish or wildlife habitat Loss of marginal habitat only Restoration or compensation in kind highly possible	Losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes
High	Permanent	10 or fewer	Significant loss or deterioration of *important* fish or wildlife habitat Restoration or compensation in kind highly possible	High economic losses affecting infrastructure, public transportation, and commercial facilities
Very High	Permanent	100 or fewer	Significant loss or deterioration of *critical* fish or wildlife habitat Restoration or compensation in kind possible but impractical	Very high economic losses affection important infrastructure or services *(e.g., highway, industrial facility, storage facilities for dangerous substances)*
Extreme	Permanent	More than 100	Major loss of *critical* fish or wildlife habitat Restoration or compensation in kind impossible	Extreme losses affecting critical infrastructure or services *(e.g., hospital, major industrial complex, major storage facilities for dangerous substances)*

Note 1. *Definitions for population risk:*

None – *There is no identifiable population at risk, so there is no possibility of loss of life other than through unforeseeable misadventure.*

Temporary – *People are only temporarily in the dam-breach inundation zone (e.g., seasonal cottage use, passing through on transportation routes, participating in recreational activities).*

Permanent – *The population at risk is ordinarily located in the dam-breach inundation zone (e.g., as permanent residents); three consequence classes (high, very high, extreme) are proposed to allow for more detailed estimates of potential loss of life (to assist in decision-making if the appropriate analysis is carried out).*

Note 2. *Implications for loss of life:*

Unspecified – *The appropriate level of safety required at a dam where people are temporarily at risk depends on the number of people, the exposure time, the nature of their activity, and other conditions. A higher class could be appropriate, depending on the requirements. However, the design flood requirement, for example, might not be higher if the temporary population is not likely to be present during the flood season.*

1.4 REGISTERED MANUAL HOLDERS AND REVISIONS

The Engineering Superintendent is responsible for maintaining an up-to-date list of the registered holders of this OMS Manual in Table 1.3.

The Engineering Superintendent is also responsible for the issue of all revisions and addenda to the registered holders of this Manual. Revisions will be made, as and when required, by re-issuing a complete section, table or appendix so that the old section, table or appendix can be removed and replaced. Each registered holder is responsible for placing the revisions and addenda in his or her manual and for recording receipt of the same in Table 1.3.

Each copy of this manual is assigned a unique identification number.

Table 1.3 List of Registered OMS Manual Holders

Position / Name / Address or Location	OMS Manual Copy No.
General Manager Meadowbank / Jean Beliveau, Alexandre Proulx (ass.) / OFFICE	1
Environment Superintendent / Kevin Buck / OFFICE	2
Mine Operations Superintendent /Martin Beausejour, Brock Johnston (ass.) / OFFICE	3
Engineering Superintendent / Julie Belanger / OFFICE	4
Site Services Superintendent / Eric Trudel/ OFFICE	5
Dike Design Engineer / Golder Associates Ltd./ 500 – 4260 Still Creek Drive, Burnaby, BC, V5C 6C6	6
Dike Design Engineer / SNC-Lavalin Inc./ 5500, Boulevard des Galeries, Bureau 200, Quebec, Quebec, G2K 2E2	7
Update as Required	

Table 1.4 Record of Revisions/Addenda

Revision No.	Section	Table	Appendix	Addenda No.	Date of Revision
1	All	All	All	-	February 2012
2	All	All	All	-	August 2013
3	All	All	All	-	September 2013

1.5 ANNUAL REVIEW OF MANUAL

This manual will be reviewed by AEM on at least an annual basis and revised as necessary to accommodate changes in the condition and operation of the facilities. The registered users of the manual are encouraged to provide comments and suggestions for improvement of the manual and the procedures specified in it to the Engineering Superintendent. The comments and suggestions communicated will be considered in the subsequent review.

1.6 REFERENCE DOCUMENTS AND DRAWINGS

The following Table 1.5 is a summary of key reference documents for the Dewatering Dikes. All design and as-built documents can be found in hard copy onsite in the engineering department, as well as in electronic copies on the dikes server.

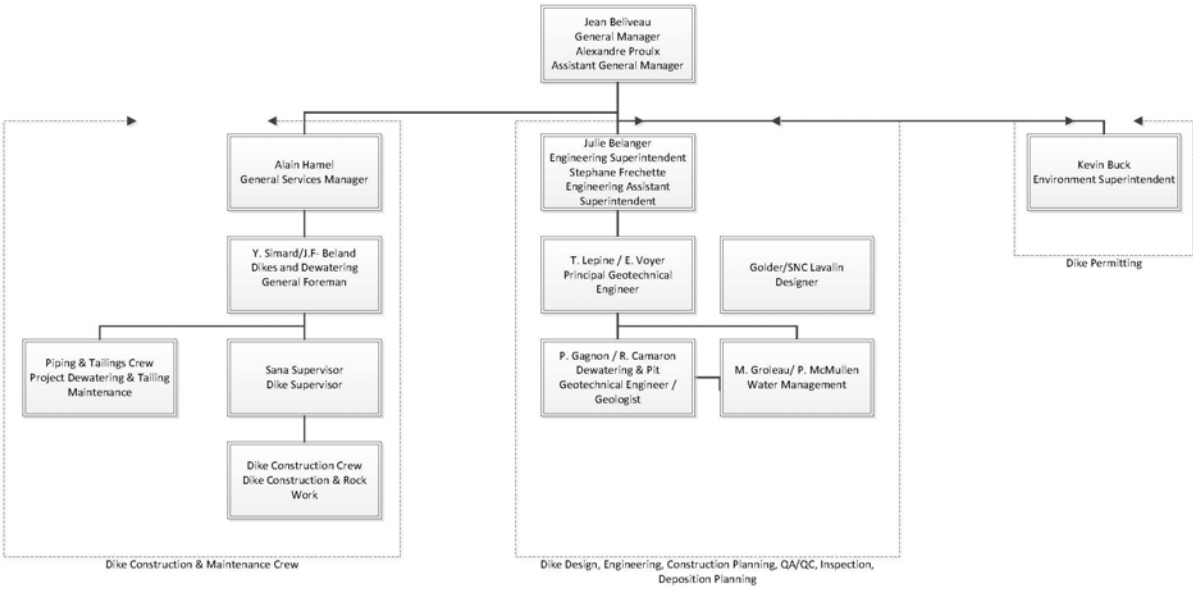
Table 1.5 Summary of key reference documents for the Dewatering Dikes

Dewatering Dike	Type of Information	Document Number	Document Title
East Dike	Design	Doc. 572	East Dike Design Meadowbank Gold Project (Golder 2008b)
	As-built	Doc. 900	East Dike Construction As-Built Report Meadowbank Gold Project (Golder 2009d)
	Remediation	Doc. 916	Meadowbank East Dike Grouting Response Plan (Golder 2009b)
		Doc. 953	East Dike CPT Investigation Meadowbank Gold Project" (Golder 2010b)
		Doc. 986	East Dike Sinkhole Investigation Program Meadowbank Gold Project (Golder 2010a)
Bay-Goose Dike	Design	Doc. 802	Bay-Goose Dike and South Camp Dike Designs (Golder 2009a)
	As-built	Doc. 1328	Bay Goose Dike Construction As-Built Report Meadowbank Gold Project (Golder 2013)
South Camp Dike	Design	Doc. 802	Bay-Goose Dike and South Camp Dike Designs (Golder 2009a)
	As-built	NA	South Camp Dike Construction Summary Report, Meadowbank Gold Project (AEM 2012)
Vault Dike	Design	610548-2020-4GER-0001	Detailed Engineering of Vault Dike (SNC, 2013a)
	Technical Specifications	610548-2020-4GEF-0001	Construction of Vault Dike – Technical Specifications (SNC, 2013b)
	As-built	NA	Construction Summary Report Vault Dike (AEM, 2013)

SECTION 2 • ROLES AND RESPONSIBILITIES

An organizational chart of the current management structure is shown in Figure 1. This chart shall be updated to reflect changes in management structure, as necessary, such that it is maintained up-to-date.

Figure 1 Organizational Structure



2.1 RESPONSIBILITIES

The responsibilities for each management position during dewatering and during operations of the Dewatering Dikes are shown in Table 2.1 and Table 2.2, respectively. For the purpose of this manual, dewatering is defined as completed, except for Vault Lake which began to be dewatered in June 27, 2013, and operation begins when the downstream toe of the dike is exposed.

Table 2.1 Responsibilities during Dewatering

Position	Responsibilities
Manager of Regulatory Affairs	Liaise with external stakeholders during an emergency event including NIRB, Nunavut Water Board, NGO's, government agencies.
General Manager Meadowbank	Initiate and oversee emergency or contingency protocols during emergency events.
	Liaise/direct/coordinate the Meadowbank Dike Review Board (MDRB).
	Oversight of Mine, Engineering, and Environment Superintendents tasks and responsibilities as laid out in the OMS Manual.
Assistant General Manager	Initiate and oversee emergency or contingency protocols during emergency events, if General Manager is not on site.
	Oversight of Mine, Engineering, and Environment Superintendents tasks and responsibilities as laid out in the OMS Manual.
Mine Superintendent	Maintain access to the Dewatering Dikes, including making road repairs, controlling dust and removing snow. Maintain stockpiles of construction material.
	Carry out field maintenance on the dikes as required, including material placement, electrical and mechanical repairs.
Engineering Superintendent/Principal Geotechnical Engineer	Construction of seepage collection works.
	Carry out inspections of the dikes as required in the OMS Manual.
	Monitor Dewatering Dike instrumentation as required in the OMS Manual.
	Monitor pumping rates for dewatering, upstream and downstream water levels, and freeboard.
	Liaise with Design Engineer during dewatering regarding dike performance, pumping rates, water quality, instrumentation measurements, etc.
	Review geotechnical and environmental monitoring data for compliance with Water License regulations and to evaluate dike performance with respect to design parameters.
	Prepare reports including description of activities on dikes, pumping rates, instrumentation readings, water quality data, dike performance, visual observations, etc. as required in the OMS Manual.
	Determine dewatering pumping schedule based on the water quality monitoring.
	Maintain instrumentation, readout units, data acquisition system and cabins.
	Coordinate work force as required for monitoring and maintenance.

Position	Responsibilities
	Coordinate equipment, labour, materials and maintenance activities required for pumps and pipelines during dewatering.
	Revise and update the OMS Manual to reflect as-built conditions and any other changes.
	Maintain up to date list of registered holders of the OMS Manual.
	Issue all revisions and addenda to registered OMS Manual holders.
	Carry out field operations including pumping.
Environment Superintendent	Monitor water quality.
	Monitor total suspended solids at pump intake.
	Review environmental monitoring data for compliance with Water License and regulations and to evaluate dike performance with respect to design parameters.
	Liaise with external stakeholders including NIRB, Nunavut Water Board, NGO's, government agencies.
Site Services Superintendent	Maintain and service pumps and pipelines for dewatering.
	Coordinate equipment, labour and materials for maintenance during dewatering.
	Carry out field maintenance on material placement, electrical and mechanical repairs.
	Coordinate labour as required for monitoring.
Design Engineer	Communicate with Engineering Superintendent/ Dike Advisor on frequent basis regarding performance of dewatering dikes.
	Review instrumentation package (to be provided by Engineering Superintendent/Dike Advisor) on a frequent basis.
Meadowbank Dike Review Board (MDRB)	Be updated on the performance of the dewatering dikes behaviour during their operation.
Emergency Response Team	Follow the guidance written in the Emergency Response Plan in an emergency situation

Table 2.2 Responsibilities during Operation

Position	Responsibilities
Manager of Regulatory Affairs	Liaise with external stakeholders during an emergency event including NIRB, Nunavut Water Board, NGO's, government agencies.
General Manager Meadowbank	Liaise with external stakeholders including NIRB, Nunavut Water Board, NGO's, government agencies.
	Liaise / coordinate / direct the MDRB.
	Initiate and oversee emergency or contingency protocols during emergency events.
	Oversight of Mine, Engineering, and Environment Superintendents tasks and responsibilities as laid out in the OMS Manual.
	Coordination of mine staff and equipment during an emergency.
Assistant General Manager	Oversight of Mine, Engineering, and Environment Superintendents tasks and responsibilities as laid out in the OMS Manual.
	Coordination of mine staff and equipment during an emergency if General Manager is not on site.
Mine Superintendent	Maintain access to the Dewatering Dikes and seepage collection systems, including making road repairs, controlling dust and removing snow.
	Carry out field maintenance on the dikes as required, including material placement, electrical and mechanical repairs.
Engineering Superintendent/Principal Geotechnical Engineer	Carry out inspections of the dikes, ditches and sumps as required in the OMS Manual.
	Monitor seepage pumping rates.
	Monitor Dewatering Dike instrumentation as required in the OMS Manual.
	Review geotechnical instrumentation and environmental monitoring data to evaluate dike performance with respect to design parameters and for compliance with Water License and regulations.
	Prepare reports including description of activities on dikes, pumping rates, instrumentation readings, water quality data, dike performance, visual observations, etc. as required in the OMS Manual.
	Liaise with Design Engineer regarding dike performance, pumping rates, water quality, instrumentation measurements, etc.
	Maintain instrumentation, readout units, data acquisition system and cabins.
	Coordinate work force as required for monitoring and maintenance.
	Coordinate equipment, labour, materials and maintenance activities required for pumps and pipelines associated with the seepage collection systems and any runoff diversions.
	Revise and update the OMS Manual to reflect as-built conditions of seepage collection system and future modifications.
	Maintain up to date list of registered holders of the OMS Manual.
	Issue all revisions and addenda to the registered OMS Manual holders.
	Liaise with MDRB as required.
	Carry out field operations.
Environment Superintendent	Monitor water quality of seepage and runoff collected in sumps and

Position	Responsibilities
	ditches.
	Review environmental monitoring data for compliance with Water License and regulations and to determine dike performance with respect to design parameters.
	Liaise with external stakeholders including NIRB, Nunavut Water Board, NGO's, government agencies.
Site Services Superintendent	Maintain and service pumps and pipelines for seepage and runoff.
	Coordinate equipment, labour and materials for maintenance during dewatering.
	Carry out field maintenance on material placement, electrical and mechanical repairs
	Coordinate labour as required for monitoring and maintenance.
	Purchase equipment as required.
Design Engineer	Communicate with Engineering Superintendent/ Dike Advisor on a frequent basis regarding performance of dewatering dikes. Frequency to be determined by Engineering Superintendent/ Dike Advisor.
	Review instrumentation package (to be provided by Superintendent/Dike Advisor) on a frequent basis, frequency to be determined by Engineering Superintendent/ Dike Advisor.
	Carry out annual inspection and reporting.
Meadowbank Dike Review Board (MDRB)	Be updated on the performance of the dewatering dikes behaviour during operation.
Emergency Response Team	Follow the guidance written in the Emergency Response Plan in an emergency situation

All site personnel are responsible for informing their Managers of any indications of abnormal situations or conditions that may be observed.

The responsibilities and authorities of each position in the OMS Manual should be updated to reflect any changes to the overall management structure as they occur.

2.2 REQUIRED LEVELS OF KNOWLEDGE

A minimum level of knowledge and training are required for personnel to adequately carry out their responsibilities and to appropriately realize their level of authority. Personnel should understand consequences of non-compliance for their area and have an understanding of emergency procedures. The recommended minimum levels of knowledge for the anticipated positions are as summarized in Table 2.3.

Table 2.3 Recommended Minimum Knowledge and Training Requirements

Position	Recommended Minimum Knowledge and Training
Manager of Regulatory Affairs	Review of the OMS Manual, with an understanding of the operational requirements.
	Detailed knowledge of emergency response procedures.
General Manager Meadowbank	Detailed understanding of the OMS Manual, with a complete understanding of the design, dewatering and operational requirements, particularly monitoring, inspection and dam safety review requirements.
	Complete understanding of environmental compliance issues and monitoring requirements.
	Understanding of all related technical documents for design and construction.
	Detailed knowledge of emergency response procedures.
Assistant General Manager	Detailed understanding of the OMS Manual, with a complete understanding of the design, dewatering and operational requirements, particularly monitoring, inspection and dam safety review requirements.
	Complete understanding of environmental compliance issues and monitoring requirements.
	Understanding of all related technical documents for design and construction.
	Detailed knowledge of emergency response procedures.
Environment Superintendent	Detailed understanding of the OMS Manual, with a complete understanding of the design, dewatering and operational requirements.
	Detailed and ongoing review of all monitoring, inspections and dam safety reviews.
	Complete understanding of environmental compliance issues and monitoring requirements.
	Knowledge of emergency response procedures.
Mine Operations Superintendent	Basic knowledge of the OMS Manual, with an understanding of the design requirements.
	Detailed knowledge of emergency response procedures.
Engineering Superintendent/Principal Geotechnical Engineer	Detailed understanding of the OMS Manual, with a complete understanding of the design, dewatering and operational requirements.
	Detailed knowledge of monitoring protocols and requirements.
	Detailed and ongoing review of all monitoring, inspections and dam safety reviews.
	Complete understanding of all related technical documents for design, dewatering, operation, risk assessment and emergency response.
	Detailed understanding of all operational elements within the facility and their operational and maintenance requirements.
	Detailed knowledge of emergency response procedures.
Environment Personnel	Knowledge of the OMS Manual, with an understanding of the dewatering and operational requirements set out in this OMS Manual.
	OMS Manual should be reviewed with the Environmental Superintendent.
	Detailed knowledge of environmental monitoring protocols and requirements.

Position	Recommended Minimum Knowledge and Training
	Knowledge of emergency procedures.
Mine Personnel	Knowledge of the OMS Manual, with an understanding of the dewatering and operational requirements set out in this OMS Manual.
	Knowledge of emergency response procedures.
Engineering Personnel	Knowledge of the OMS Manual, with an understanding of the design, dewatering, and operational requirements set out in this OMS Manual.
	Detailed knowledge of monitoring protocols and requirements.
	Knowledge of emergency procedures.
Site Services Superintendent	Basic understanding of the OMS Manual, including the design, dewatering and operational requirements set out in the OMS Manual.
	Detailed knowledge of all operational elements set out in the OMS and required for an event of emergency, such as available materials quantity and locations, equipment inventory and locations and available labour.
	Knowledge of emergency response procedures.
External Personnel (Design Engineer and MDRB)	Varied levels of knowledge and understanding depending on involvement.
	General Manager shall determine levels of knowledge and instruct personnel.
Emergency Response Team	Knowledge of emergency response procedures.

Training of personnel shall be carried out to ensure the minimum levels of knowledge set out in Table 2.3. Training shall be documented for each personnel in a staff database organized and maintained by AEM.

The OMS Manual should be updated to reflect any changes in responsibilities or management structure as they occur.

SECTION 3 • DESCRIPTION OF DEWATERING DIKES

The Meadowbank Gold Project site is located approximately 80 km north of Baker Lake, Nunavut. The gold ore deposits are situated adjacent to and beneath Second Portage Lake, Third Portage Lake and Vault Lake. The mine plan includes the construction and operation of a series of dewatering dikes to isolate the open pit mining activities from the lakes. Figure 2 presents the site plan. The Dewatering Dikes consist of the following structures:

- East Dike;
- Bay-Goose Dike;
- South Camp Dike; and
- Vault Dike.

A description of the physical conditions of the site, as well as a description of the climate, geological and geotechnical conditions can be found in various documents including the design documents for the East Dike and Bay-Goose Dike Doc. 572 Sections 3.0 and 4.0 (Golder 2008b) and Doc. 802 Section 2.0 (Golder 2009a), respectively.

In 2008 the East Dike and West Channel Dikes were constructed to isolate the northwest arm of Second Portage Lake to permit mining of Portage Pit and also to provide an area for the storage of tailings. Dewatering of the northwest arm of Second Portage Lake began in the spring of 2009 and was halted during the summer of 2009. Dewatering recommenced in the fall of 2009. The downstream toe of the East Dike has been exposed continuously since July 2010 although was mostly exposed by July 2009. Dewatering of the basin continued intermittently as other construction and site water was transferred to the basin as part of the operations.

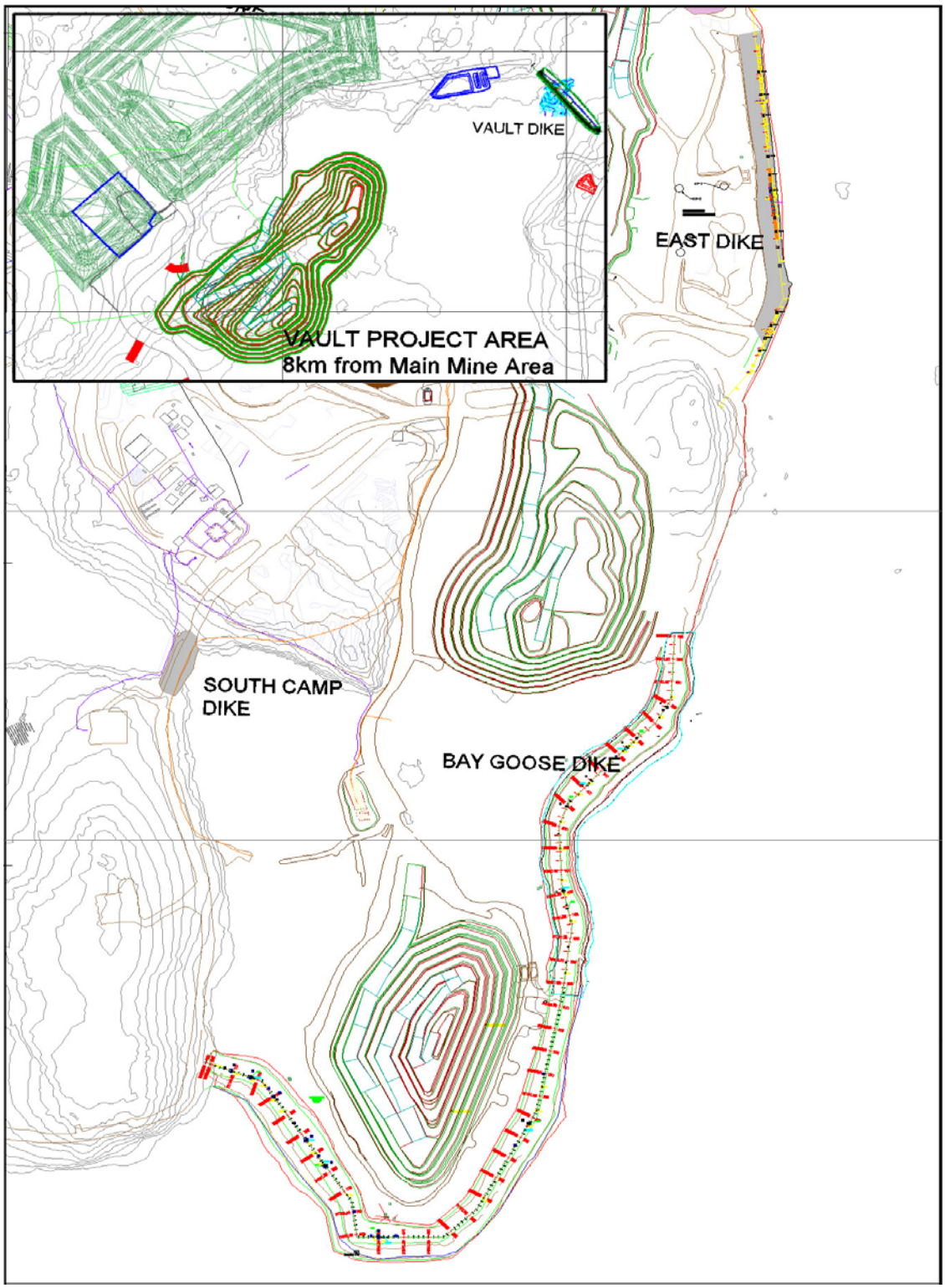
In 2009 the South Camp Dike was constructed. The earthworks component of the Bay-Goose Dike construction occurred over two summer construction seasons. The north portion of the Bay-Goose Dike was constructed in 2009 and the south portion in 2010. Grouting and jet grouting works commenced in 2010 and were completed by mid-July 2011.

Dewatering of the Bay-Goose Basin occurred between July 25 and November 14, 2011 following completion of the Bay-Goose Dike construction and instrumentation installation. In March 2012, the pre-stripping of Goose Pit started and it's now in the operation stage.

The construction of Vault Dike at Meadowbank was conducted from February 2013 to March 2013. Vault Dike is located across a shallow creek which connects Wally Lake and Vault Lake, at the Vault Pit area. Vault Dike is essential to allow the dewatering of Vault Lake and to isolate Vault Pit during mining activities from Wally Lake. The dewatering of Vault Lake has started on June 27th, 2013 and is scheduled to be complete at the end of November 2013.

The following subsections provide additional details for each of the Dewatering Dikes.

Figure 2 Site Plan



3.1 EAST DIKE

The East Dike together with the West Channel Dike isolates the northwest arm of Second Portage Lake. During the operational phase of the mine, the East Dike isolates the Portage Pit from Second Portage Lake. In closure, as the plan will include breaching of the Bay-Goose Dike thereby flooding both Goose and Portage Pits, then the East Dike will separate Third Portage Lake from Second Portage Lake. There are no spillways or water diversion works associated with the East Dike. The East Dike also used to serve as a haul road to connect the North Portage Pit to the ore stockpiles and to the crushing facility within the plant site. The West Channel Dike used to cover a narrow channel and prevent flow from Third Portage Lake to Second Portage Lake. The West Channel Dike together with the East Dike isolated the northwest arm of Second Portage Lake. The West Channel Dike purpose was no longer required and was removed as part of mining operations in the Portage Pit in 2012.

The East Dike was constructed in the summer of 2008 and grouting of the foundation and bedrock occurred in 2008 and during the first quarter of 2009. It is approximately 800 m in length, and was constructed within Second Portage Lake prior to dewatering. The dike consists of a wide rockfill shell, with downstream filters and a soil-bentonite cutoff wall that extends to bedrock. The cutoff wall extends up to 8 m below lake level.

3.1.1 East Dike - Design and Construction

The East Dike design is contained within Doc. 572 (Golder 2008b). A plan view and profile of the constructed dike is presented on Figure 3 and includes the locations of instrumentation installations used for monitoring. A typical cross section through the dike and is shown on Figure 4. Additional as-built information and as-built drawings for the East Dike are provided in Doc. 900 (Golder 2009e).

Dike construction occurred in the following general manner:

<u>Rockfill Embankment:</u>

- A rockfill platform approximately 50 m wide was advanced from the south abutment to the north. The rockfill platform provided construction access and support for the core materials.

- The width of the rockfill platform (embankment) was subsequently increased by placement of additional rockfill on the downstream side, to provide an adequate road width to accommodate two-way haul traffic.

<u>Initial Trench Excavation:</u>

- Rockfill and lakebed soils were excavated from the crest of the rockfill platform to expose bedrock along the cutoff centreline. Loose blocks or slabs from the bedrock surface were removed, as practical.

Backfilling of the Initial Trench:

- A coarse granular filter (150 mm minus) was placed using the bucket of the excavator on the downstream slope of excavation.

- Then the remaining portion of the excavation was backfilled with Core Backfill (19 mm minus) material in the central portion along the cutoff wall centreline and Coarse Filter (150 mm minus) material on the upstream and downstream sides of the Core Backfill. Backfilling of the trench with the Core Backfill and Coarse Filter materials was a simultaneous activity and occurred progressively as the initial trench was the excavation front advanced.

- At the bedrock surface, a minimum of 5 m of Core Backfill material was to be placed.

Compaction of Core Backfill:

- Core Backfill and Coarse Filter were placed to an elevation 2 m above the water level to form a platform from which densification could occur.

- The Core Backfill was densified using multiple passes of dynamic compaction. Craters produced by the dropped weight were backfilled to level the working platform between passes.

Cutoff:

- A 1 m wide trench was excavated through the Core Backfill material and extended to the bedrock surface along the cutoff wall centreline. Bentonite slurry was used to support the trench.

- The trench was backfilled with soil-bentonite.

Grouting:

- Grouting of the bedrock foundation and “contact area” identified as the zone between the base of the cutoff wall and bedrock surface was performed through the centerline of the cutoff wall.

Figure 3 East Dike Plan and Profile

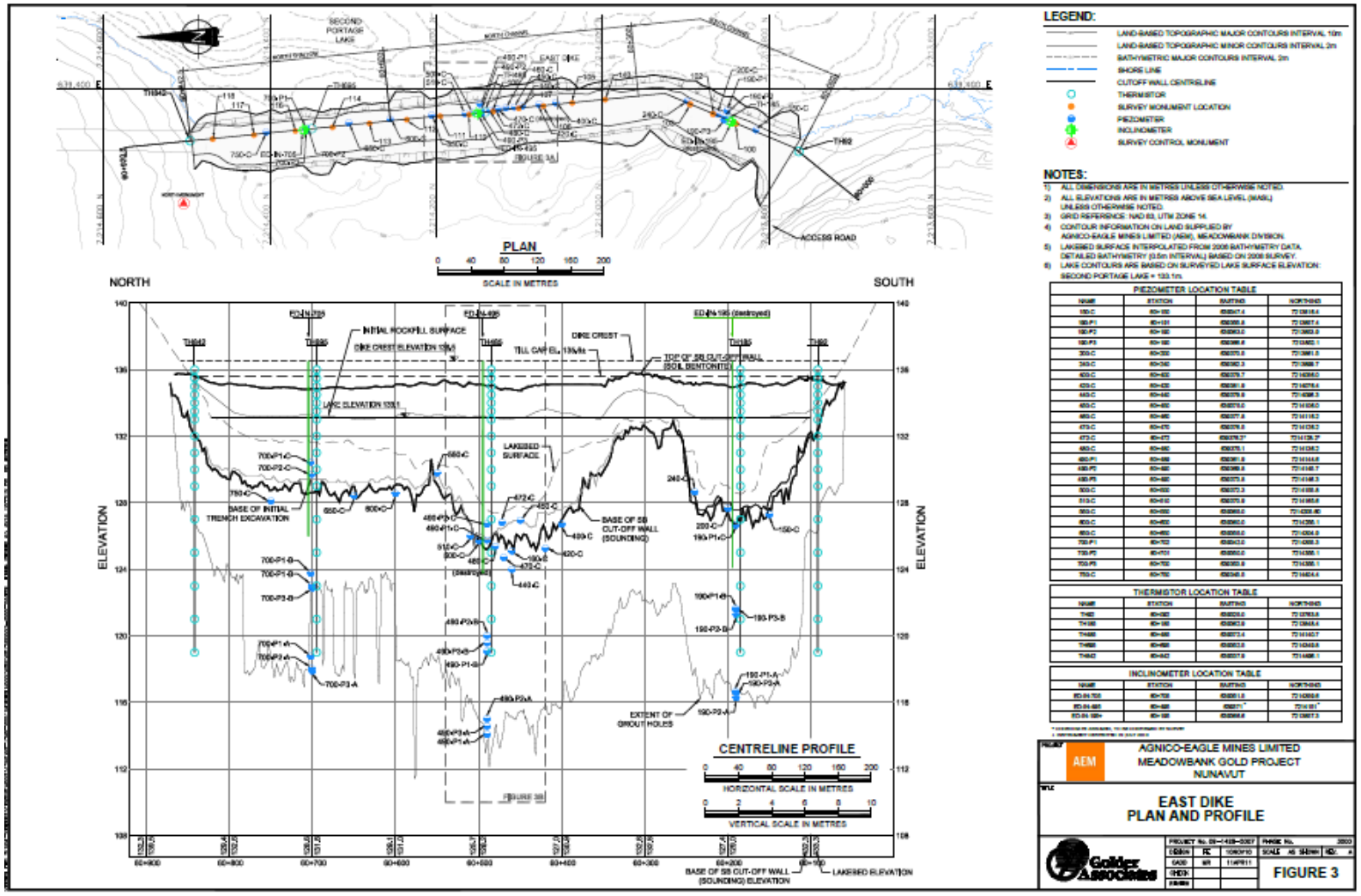


Figure 3A East Dike Plan view Thermistors between Sta. 60+440 to Sta.60+521

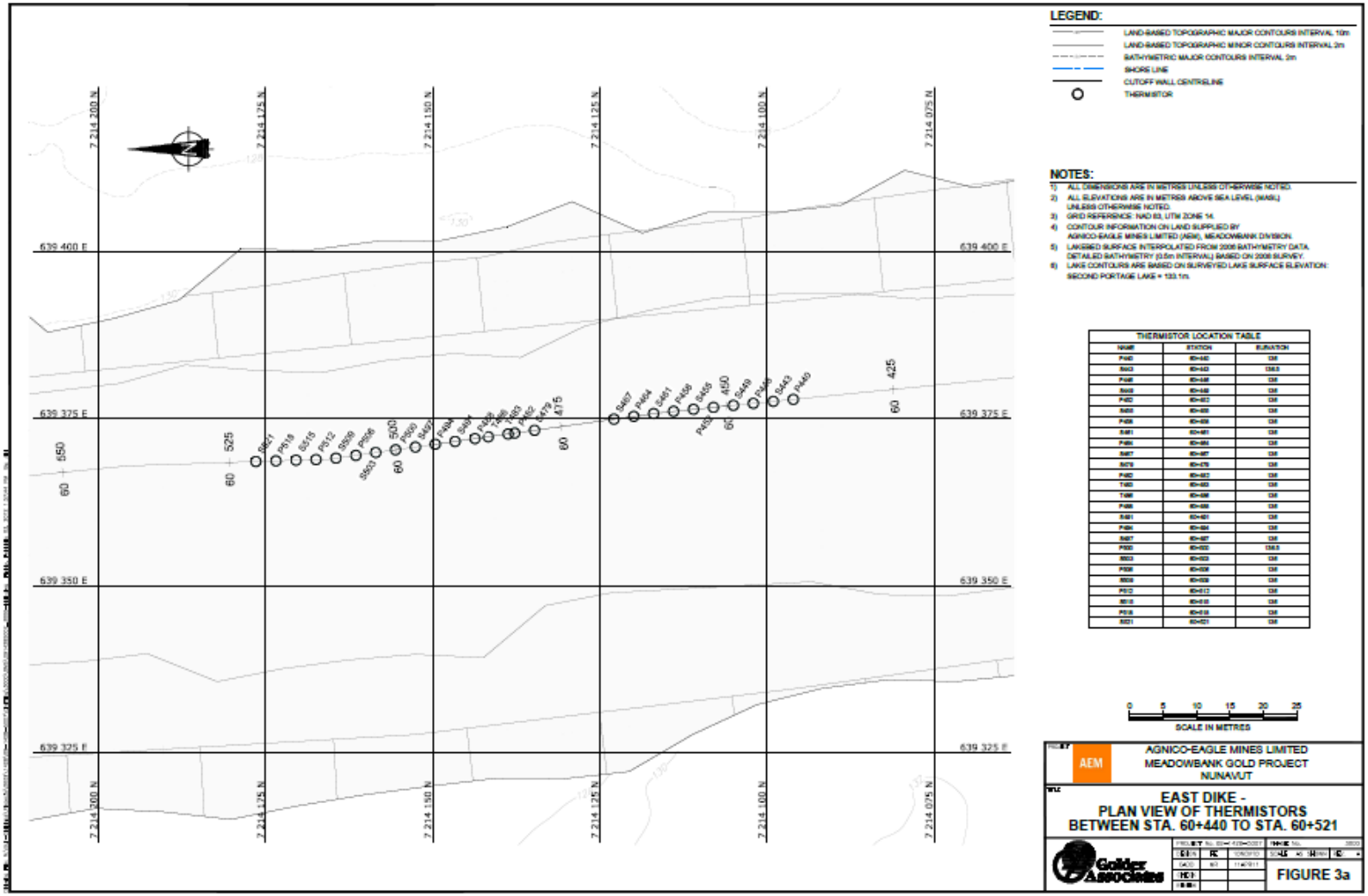


Figure 3B East Dike Profile view Thermistors between Sta. 60+440 to Sta.60+521

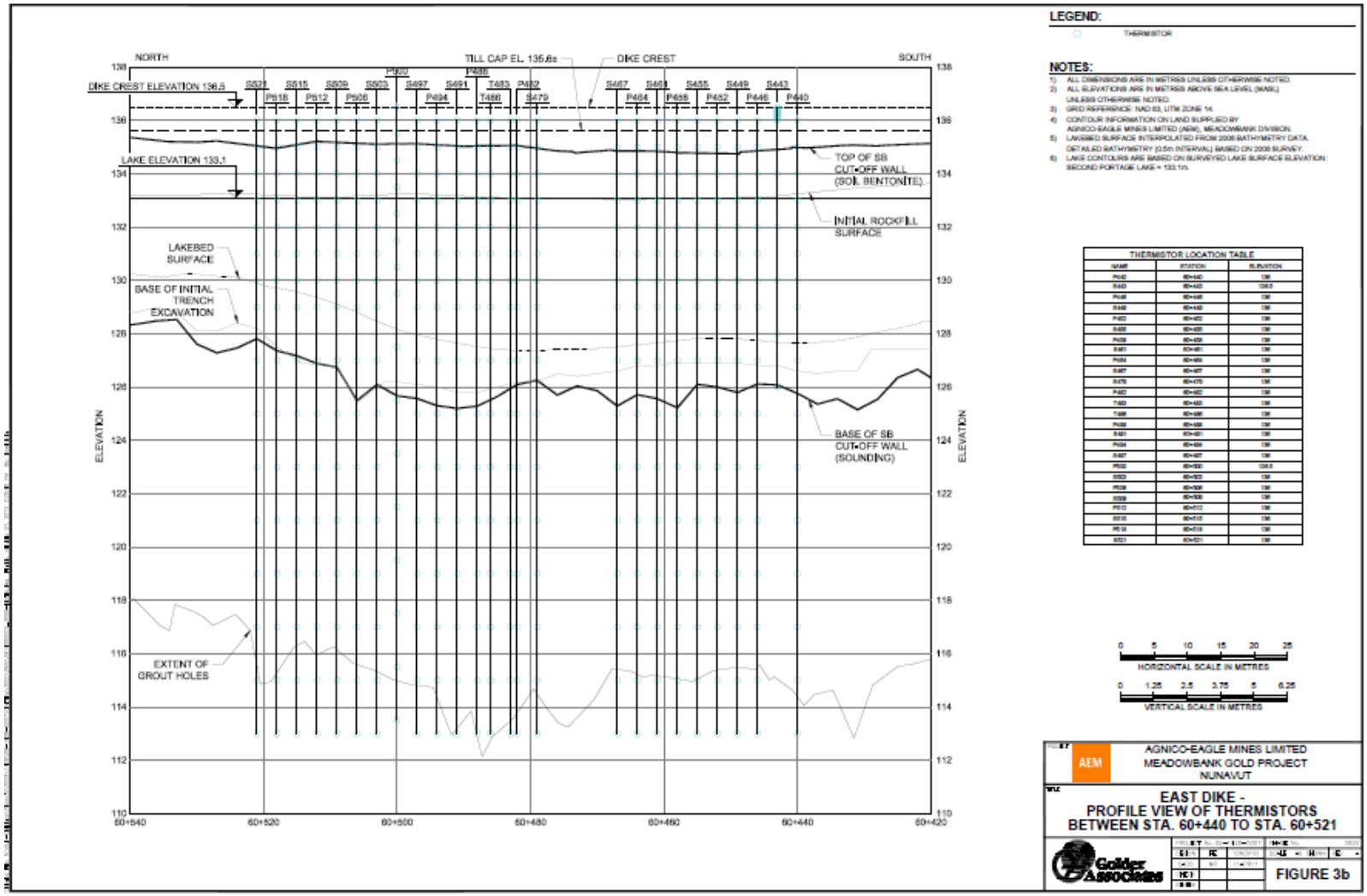


Figure 4 East Dike Typical Section

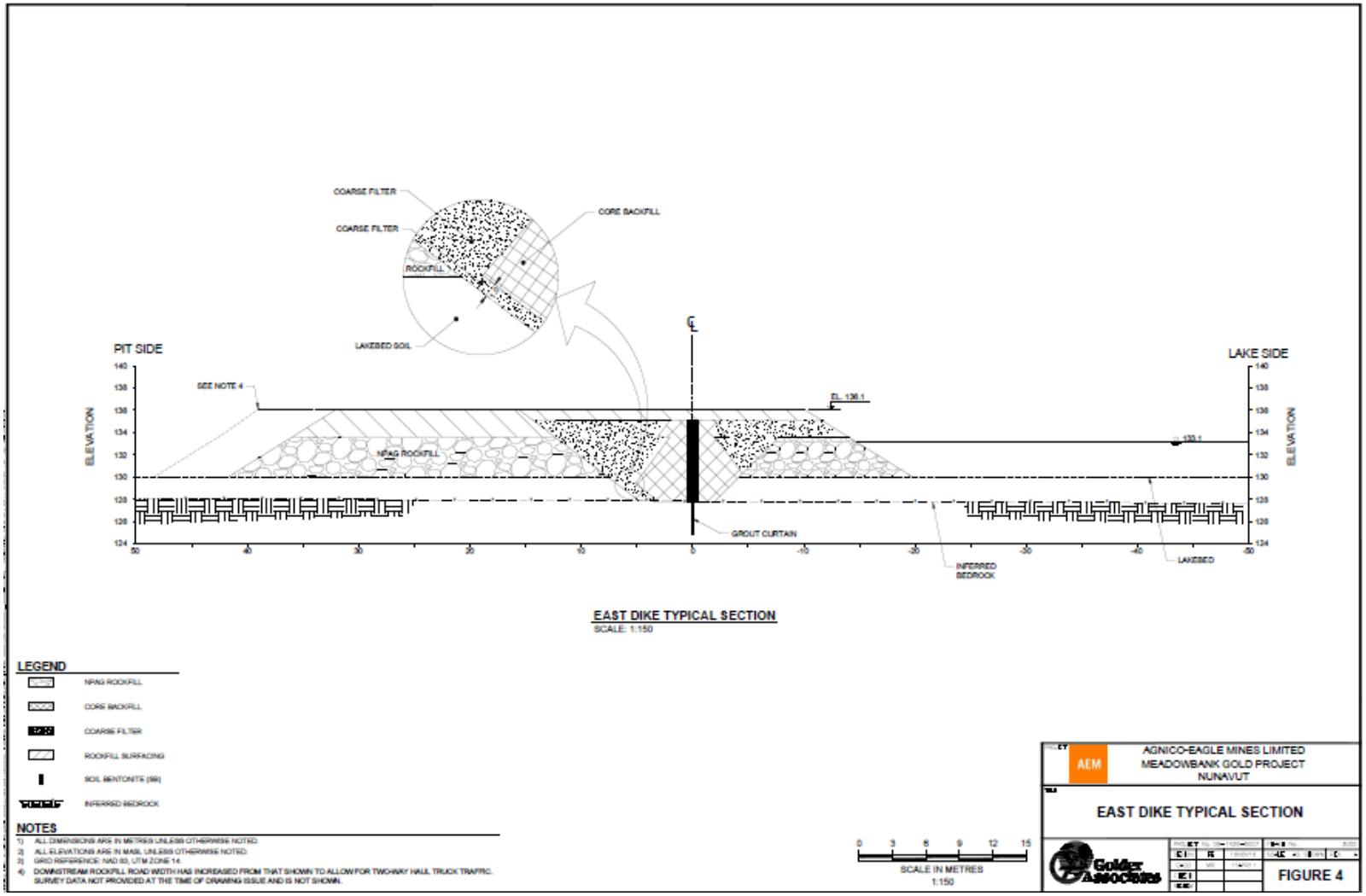
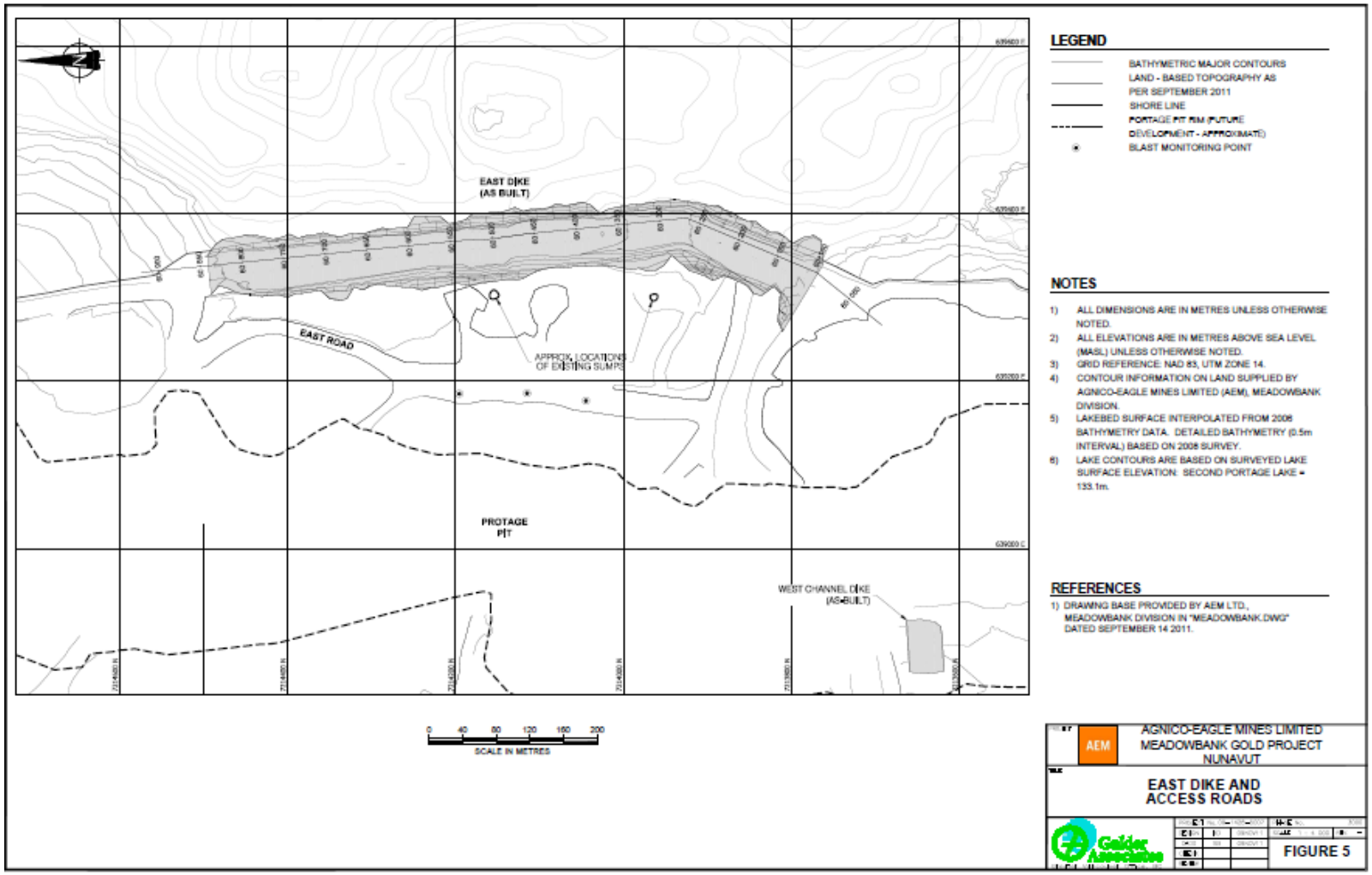


Figure 5 East Dike and Access Roads



3.1.2 East Dike - Instrumentation

Instrumentation was installed prior to dewatering to monitor the behaviour of the dike and dike foundation during dewatering and operation. Instrumentation consisted of:

- Single vibrating wire piezometers located downstream of the cutoff wall;
- Arrays of vibrating wire piezometers, installed at various levels, upstream, immediately downstream of the cutoff wall and further downstream;
- Thermistor strings installed through the centreline of the cutoff wall;
- Inclinometers installed through the centreline of the cutoff wall; and
- Survey monuments along the centreline of the cutoff wall.

The monitoring network was expanded through the installation of additional instruments. Table 3.1 summarizes existing instrumentation.

Table 3.1 Existing Instrumentation Summary

Instrumentation Type	Station Location	Label / Identification	Offset from Centreline + is d/s; - is u/s	Elevation (masl)	Details
Vibrating Wire Piezometer Array	60+190	190-P1-A	10	116.7	190-P1 Top of steel casing: El. 136.39
		190-P1-B	10	121.7	
		190-P1-C	10	126.7	
		190-P2-A	2	116.34	190-P2 Top of steel casing: El. 136.54
		190-P2-B	2	121.34	
		190-P2-C	2	126.34	
		190-P3-A	-2	116.63	190-P3 Top of steel casing: El. 136.54
		190-P3-B	-2	121.63	
Vibrating Wire Piezometer Array	60+490	490-P1-A	11	114.12	490-P1 Top of steel casing: El. 136.20
		490-P1-B	11	119.12	
		490-P1-C	11	125.81	
		490-P2-A	3.1	115.07	490-P2 Top of steel casing: El. 136.15
		490-P2-B	3.1	120.07	
		490-P2-C	3.1	126.76	
		490-P3-A	-0.9	114.62	490-P3 Top of steel casing: El. 136.02
		490-P3-B	-0.9	119.62	
Vibrating Wire Piezometer Array	60+700	700-P1-A	9.9	118.81	700-P1 Top of steel casing: El. 136.27
		700-P1-B	9.9	123.81	
		700-P1-C	9.9	130.5	
		700-P2-A	2	118.08	700-P2 Top of steel casing: El. 136.48
		700-P2-B	2	123.08	
		700-P2-C	2	129.77	
		700-P3-A	-1.9	117.93	700-P3 Top of steel casing: El. 136.40
		700-P3-B	-1.9	122.92	

Instrumentation Type	Station Location	Label / Identification	Offset from Centreline + is d/s; - is u/s	Elevation (masl)	Details
Individual Vibrating Wire Piezometers	60+150	150-C	2.1	127.35	Top of steel casing: El. 136.33
	60+200	200-C	2	127.71	Top of steel casing: El. 136.29
	60+240	240-C	2	128.71	Top of steel casing: El. 136.26
	60+400	400-C	2.2	126.76	Top of steel casing: El. 136.27
	60+420	420-C	2	125.32	Top of steel casing: El. 137.10
	60+440	440-C	2	124.66	Top of steel casing: El. 137.14
	60+450	450-C	1.9	127	Top of steel casing: El. 136.22
	60+460	460-C	2	125.15	Top of steel casing: El. 137.60
	60+470	470-C	2	124.76	Top of steel casing: El. 137.43
	60+480	480-C	2	125.44	Top of steel casing: El. 137.65
	60+500	500-C	2	125.78	Top of steel casing: El. 137.34
	60+510	510-C	2	126.06	Top of steel casing: El. 137.10
	60+550	500-C	2	129.85	Top of steel casing: El. 136.24
	60+600	600-C	1.9	128.6	Top of steel casing: El. 136.53
	60+650	650-C	2	128.48	Top of steel casing: El. 136.59
	60+750	750-C	1.5	128.16	Top of steel casing: El. 136.93

Instrumentation Type	Station Location	Label / Identification	Offset from Centreline + is d/s; - is u/s	Elevation (masl)	Details
Thermistor Strings	60+092	TH92	0	136 (1st Bead)	Beads at Elev. 136, 135.5, 135, 134.5, 134, 133.5, 133, 132, 131, 130, 129, 127, 125, 123, 121 and 119 masl.
	60+185	TH185	0	136 (1st Bead)	Beads at Elev. 136, 135.5, 135, 134.5, 134, 133.5, 133, 132, 131, 130, 129, 127, 125, 123, 121 and 119 masl.
	60+485	TH485	0	136 (1st Bead)	Beads at Elev. 136, 135.5, 135, 134.5, 134, 133.5, 133, 132, 131, 130, 129, 127, 125, 123, 121 and 119 masl.
	60+440	P440	0	136 (1stBead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+443	S443	0	136.5 (1stBead)	Beads at Elev. 136.50, 136.45, 136.40, 136.35, 136.30, 136.25, 136.20, 136.15, 136.10, 136.05, 136.00, 134.00, 132.00, 130.00, 128.00 and 126.00 masl.
	60+446	P446	0	136 (1stBead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+449	S449	0	136 (1stBead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+452	P452	0	136 (1stBead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+455	S455	0	136 (1stBead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.

Instrumentation Type	Station Location	Label / Identification	Offset from Centreline + is d/s; - is u/s	Elevation (masl)	Details
	60+458	P458	0	136 (1st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+461	S461	0	136 (1st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+464	P464	0	136 (1st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+467	S467	0	136 (1st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+479	S479	0	136 (1st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+482	P482	0	136 (1st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+483	T483	0	136 (1st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+486	T486	0	136 (1st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+488	P488	0	136 (1st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.

Instrumentation Type	Station Location	Label / Identification	Offset from Centreline + is d/s; - is u/s	Elevation (masl)	Details
	60+491	S491	0	136 (1st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+494	P494	0	136 (1st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+497	S497	0	136 (1st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+500	P500	0	136.5 (1st Bead)	Beads at Elev. 136.50, 136.25, 136.00, 135.00, 134.00, 133.00, 132.00, 131.00, 129.00, 127.00, 125.00, 123.00, 121.00, 119.00, 117.00 and 115.00 masl.
	60+503	S503	0	136 (1st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+506	P506	0	136 (1st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+509	S509	0	136 (1st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+512	P512	0	136 (1st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+515	S515	0	136 (1st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.

Instrumentation Type	Station Location	Label / Identification	Offset from Centreline + is d/s; - is u/s	Elevation (masl)	Details
	60+518	P518	0	136 (1st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+521	S521	0	136 (1st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+695	TH695	0	136 (1st Bead)	Beads at Elev. 136, 135.5, 135, 134.5, 134, 133.5, 133, 132, 131, 130, 129, 127, 125, 123, 121 and 119 masl.
	60+842	TH842	0	136 (1st Bead)	Beads at Elev. 136, 135.5, 135, 134.5, 134, 133.5, 133, 132, 131, 130, 129, 127, 125, 123, 121 and 119 masl.

Instrumentation Type	Station Location	Label / Identification	Offset from Centreline + is d/s; - is u/s	Elevation (masl)	Details
Inclinometer	60+195	ED-IN-195 (A and B Axis)	0.05	137.6 (Collar Elevation)	Azimuth 51.2 degree Destroyed in 2010
	60+495	ED-IN-495 (A and B Axis)	0.05	137.6 (Collar Elevation)	Azimuth 347.9
	60+705	ED-IN-705 (A and B Axis)	0.09	137.6 (Collar Elevation)	Azimuth 20.4 degree
Initial Crest Survey Monuments		100	0	136.9	Many have been destroyed since installation.
		101		136.8	
		102		136.7	
		103		136.6	
		104		136.9	
		105		136.8	
		106		136.9	
		107		136.7	
		108		136.6	
		109		136.5	
		110		136.6	
		111		136.3	
		112		136.5	
		113		136.7	
		114		136.8	
		115		136.7	
		116		136.8	
		117		136.7	
		118		136.7	

As installation of additional instrumentation occurs to broaden the existing monitoring network or to replace damaged instruments, the summary table and figures shall be updated.

Blast monitoring is carried out using portable blast monitoring seismographs that measure both blast induced velocities and accelerations at the point of monitoring (i.e. crest and/or the toe of the dike).

- Instrumentation locations are shown both in plan and profile on Figure 5.
- Records of all instrument installation details, data sheets, and calibration sheets shall be maintained and stored in a central location, such that they are readily available to AEM personnel and external reviewers.

3.1.3 East Dike - Dewatering

During dewatering of the northwest arm of Second Portage Lake, an apparent leak through the East Dike of up to 0.5 m^3/s occurred over several days near Sta. 60+490. The leak then appeared to self heal following drilling works for the additional grouting carried out in this sector. A sinkhole cavity of about 18 m^3 in the general vicinity of the leak (Sta. 60+472) also appeared in July 2009. The sinkhole was located immediately upstream of the cutoff wall and extended at least partially through the cutoff wall. A Technical Memorandum entitled "Meadowbank East Dike Grouting Response Plan – Completed Works" (Golder 2009b) provides additional information regarding the remedial grouting work and Golder Doc. No. 961 (Golder, 2009d) "East Dike Sinkhole Summary Report" provides more details about the sinkhole.

Following the appearance of the sinkhole, a cone penetration test (CPT) investigation was conducted, and three diamond drill holes and a surface geophysical survey were advanced in the area to obtain additional information. Based on the CPT results, there appeared to be a zone of coarser grained material (area with lower fines content) in the apparent leak area. The drilling investigation indicated that there may be soil between the base of the cut-off wall and underlying bedrock that was not completely excavated and/or grouted. An additional investigation of the sinkhole and apparent leakage area consisting of the temporary installation of thermistor strings and monitoring of the thermal condition was initially conducted in 2010 and repeated in 2011. Based on the thermal results, it appeared that a pervious zone existed within the cut-off wall and shallow bedrock between approximately Sta. 60+440 and 60+504. In the past, AEM considered potential mitigation options to reduce seepage through the dike and to provide contingency protection for the Portage Pit. Based on the stability of the dike and the seepage rate, remediation or implementation of contingency control measures is not considered necessary. The condition of the dike will continually be monitored and if the condition of the dike is judged to be deteriorating then remediation would be reassessed. Details regarding these investigations are provided in East Dike CPT Investigation Report (Golder, 2010b) and East Dike Sinkhole Investigation Program October-November 2009 (Golder 2010a).

The seepage is currently controlled by a seepage collection system and is not impacting the mining operation. The seepage is regularly monitored and appears to have stabilized and does not have a negative effect on the dike stability.

3.1.4 East Dike - Seepage Collection System

The purpose of the seepage collection system is to:

- Collect and convey seepage and runoff away from the downstream toe area; and
- Allow measurement of seepage through the dike.

The downstream toe of the East Dike was mostly exposed by July 2009 and then entirely by July 2010. Three seepage zones have been identified along the toe of the East Dike at approximately Sta. 60+480, Sta. 60+225 and Sta. 60+550. A temporary rectangular weir was installed in 2009 to monitor the seepage observed at approximately Sta. 60+480. Monitoring of the seepage from this location has occurred during the open water season (approximately mid-July through early October) in 2009 and 2010. During 2010, a temporary v-notch weir was installed to measure a second zone of

seepage exposed near Sta. 60+225 following dewatering. This portion of the dike was not exposed for visual inspection in 2009 due to the downstream water elevation. No monitoring system has been installed in the area around Sta. 60+550. Seepage flows have been measured to be between 7 L/s and 11 L/s at Sta. 60+480 and around 4 L/s at Sta. 60+225 and estimated to be about 1 L/s at Sta. 60+550.

The installation of a seepage collection system downstream of East Dike to capture and pump the seepage water started in September 2011 and was completed in 2012. After the system installation, 3 zones of seepage were identified near the downstream toe. The zones at about Sta. 60+247 and Sta. 60+498 each had a collection sump with pump connected to a year round pumping and piping system.

In 2011, the downstream seepage at Sta. 60+498 had been stable at a rate of about 864 m^3/day (10 L/s) with no visual signs of turbidity, which was consistent with rates recorded during previous years. In 2011, the seepage downstream at Sta.60+247 appeared stable at around 345.6 m^3/day (4L/s) with no visual signs of turbidity noted, which was consistent with previous rates. Since the installation of the seepage collection system, all seepage is being captured within the sumps and no sign of additional seepage on the ground surface or downstream in the Portage Pit was observed. No active monitoring of the seepage rate at these locations occurred in 2012 but AEM has been visually inspecting the flow in the sumps and no turbidity was noted. AEM performed a pump test after the installation of the sumps, it was noted that the measured flow were consistent with 2010 and 2011 data. Flow meters have been installed in 2013 at the exit of each pump. The flow is approximately 1000 m^3/day.

3.1.5 East Dike - Access

Access to the East Dike is from the north and south abutments, shown on Figure 2 and Figure 5. In 2010, the East Dike was used as a haul road connecting the North Portage Pit to the Plant Site. East Road was built downstream and used to function as haul road to get access from the east to Portage Pit. No haul trucks use the East Dike or East Road anymore during normal operations.

3.2 BAY-GOOSE DIKE

The Bay-Goose Dike together with the South Camp Dike isolates the Bay-Goose Basin from Third Portage Lake, which will permit mining of the Goose Pit and the southern portion of Portage Pit. No spillways or water diversion works are associated with the Bay-Goose Dike. Figure 2 shows the location of Bay-Goose Dike.

The Bay-Goose Dike is approximately 2,200 m in length and was constructed “in the wet”, prior to dewatering. The dike consists of a wide rockfill shell, with downstream filters and a cutoff wall constructed of a mixture of materials dependent on the location along the dike:

- Soil-bentontie (SB);
- Cement soil-bentonite (CSB);
- Jet grouted columns;

- A combination of soil-bentonite and cement soil-bentonite;
- A combination of soil-bentonite and/or cement soil-bentonite and jet grouted columns; and
- With the exception of the south abutment, the cutoff system (including the jet grouted columns) extends to bedrock and is up to 20 m below lake level.

The earthworks component of the Bay-Goose Dike construction occurred over two summer construction seasons. The north portion of the Bay-Goose Dike was constructed in 2009 and the south portion in 2010. Grouting and jet grouting works commenced in 2010 and were completed by mid-July 2011.

Dewatering of the Bay-Goose Basin occurred between July 25 and November 14, 2011 following completion of the Bay-Goose Dike construction and instrumentation installation. In March 2012, the pre-stripping of Goose Pit started and Goose Pit is now under operation stage.

Further details regarding the dike are provided in the following subsections.

3.2.1 Bay-Goose Dike – Design and Construction

The dike design is provided within Doc. 802 (Golder 2009a). A plan view of the dike along with the instrument locations is shown on Figure 6. Figure 7 provides the profile view along the cutoff wall centreline. Figure 8 provides the profile view of instrumentation details. Typical cross sections are shown on Figure 9. As-built drawings of the dike can be found in Golder 2009a.

Dike construction occurred in the following general manner:

<u>Rockfill Platform / Embankment:</u>

- A rockfill platform of varying width (approximately 60 to 90 m) was advanced from the north abutment to Goose Island, between July and September 2009 to an elevation of about 134 m.
- A rockfill causeway about 25 m wide was advanced from Goose Island to the south abutment between February and June 2010 while ice cover existed on Third Portage Lake. Ice was broken and removed, as practical, in front of the advancing rockfill platform.
- Following ice breakup from the lake in July 2010, additional rockfill was placed to widen the causeway to the full design width of the rockfill platform (approximately 55 to 100 m).
- The rockfill platforms surface elevation was about 134 m and was used to provide a working surface for the subsequent construction activities. The rockfill also provides lateral support for the granular core materials.

Initial Trench Excavation:

- Rockfill and lakebed soils were excavated from the rockfill platform surface to bedrock or competent lakebed soils along the cutoff centreline. As much as practical, loose blocks or slabs from the bedrock surface were removed.

- Ice rich soils beneath the cutoff wall were removed with the exception of at the south abutment where beyond Sta. 32+112 some ice-rich soils remain beneath the base of the initial trench excavation and cutoff wall.

- The required bottom width of the excavation varied based on its depth and varied between 8 and 11 m.

Backfilling of the Initial Trench:

North Portion of Dike

- A layer of Core Backfill (19 mm minus) material was placed along the downstream slope of the excavation such that Core Backfill material would be in contact with the lakebed soils.

- Then the remaining portion of the excavation was backfilled with Core Backfill (19 mm minus) material in the central portion along the cutoff wall centerline, with Coarse Filter (150 mm minus) material simultaneously placed on either side of the Core Backfill. Backfilling of the excavated trench occurred progressively as the excavation front advanced.

South Portion of Dike

- In very limited areas along the alignment, a layer of Core Backfill (19 mm minus) material was placed along the downstream slope of the excavation prior to the primary backfilling of the trench.

- The excavation was backfilled with Core Backfill (19 mm minus) material in the central portion along the cutoff wall centerline, with Coarse Filter (150 mm minus) material simultaneously placed on the downstream side of the Core Backfill and a “Fine Rockfill” material placed on the upstream side. Backfilling of the excavated trench occurred progressively as the excavation front advanced.

- In areas to be compacted using the vibratory-densification method, the width of Core Backfill material was required to be 8 m. Therefore, once the initial backfilling had been completed relatively small V-shaped excavations were made at the surface on either side of the initially placed Core Backfill. These excavations were then refilled with Core Backfill material to provide the required 8 m width of Core Backfill.

Compaction of Core Backfill:

- For all of the North Portion of the dike and a majority of the South Portion of the dike, a 2 m layer of Core Backfill, Coarse Filter, and Rockfill was placed to increase the elevation of the platform to provide a working surface for the dynamic compaction.

- The Core Backfill was densified using multiple passes of dynamic compaction. Craters produced by the dropped weight were backfilled to the level of the working platform between passes.

- For the South Portion of the dike, in zones where the initial excavation was not extended to bedrock, termed “partial cutoff” zones, compaction of the Core Backfill material was done using two methods: vibratory-densification and dynamic-compaction. Vibratory-densification of the Core Backfill material was conducted from the initial rockfill platform working surface (134 m). Vibro-densification was utilized to treat the Core Backfill material at the base of the excavation up to an elevation of about.128 m (i.e. 6 m below the water level). Then the 2 m of additional Core Backfill, Coarse Filter, and Rockfill materials were placed to increase the elevation of the platform to about 136 m creating the working surface for the dynamic compaction. The upper portion of the Core Backfill material was then treated using multiple passes of dynamic compaction. Craters produced by the dropped weight were backfilled to the level of the working platform between passes.

Cutoff:

- A 1 m wide trench was excavated through the Core Backfill material and extended to bedrock or competent till surface along the cutoff wall centreline. Bentonite slurry was used to support the trench.

- The trench was backfilled with:

    - Soil-bentonite (SB);

    - Cement Soil-bentonite (CSB); or

    - A combination of SB and CSB.

- Then a capping layer about 0.5 m thick of SB was placed above the trench to an approximate elevation of 136.5 m.

Jet Grouted Wall

- Jet grouting has been used to extend the low permeability element (cutoff wall) of the dike to the bedrock surface. A double jet system was used with a cement water ration of 1:1 to construct the jet grouted columns. Jet grouting was completed from a working platform elevation of approximately 137 m.

- Jet grouting beneath the cutoff wall to the bedrock surface was conducted in the “partial cutoff” areas where the cutoff wall was not excavated to bedrock. This occurred in Channel 1 (Sta. 32+007 to 32+110), Channel 2 (Sta. 31+820 to 31+928), and Channel 3 (Sta. 31+575 to 31+611). Jet grouted columns were constructed with a centre to centre spacing of 1.2 m with an overlap with the cutoff wall and extended into the bedrock surface. Columns were constructed in two passes, primary columns at a spacing of 2.4 m with secondary columns subsequently constructed between the primary columns.

- Jet grouting was also conducted in two additional areas of the dike where significant silt accumulated at the base of the initial excavation and prevented the cutoff wall from being successfully constructed to bedrock. These two areas the North Channel (Sta. 30+361 to 30+435) and between Channel 1 and Channel 2 (Sta. 31+928 to 32+007). Jet grouted columns were constructed with a centre to centre spacing generally of 1.5 m, with the exception of the portion between Sta. 31+928 and Sta. 31+966.4 where a spacing of 1.2 m was utilized, following a primary and secondary sequence for installation.

Grouting:

- The working platform along the cutoff wall centerline was raised with Coarse Filter material to an elevation of 137 m, from which grouting work was conducted.

- Grouting of the bedrock foundation and “contact area” identified as the zone between the base of the cutoff wall or jet grout columns and bedrock surface was performed through the centerline of the cutoff wall.

Figure 6 Bay-Goose Dike Instrumentation Plan

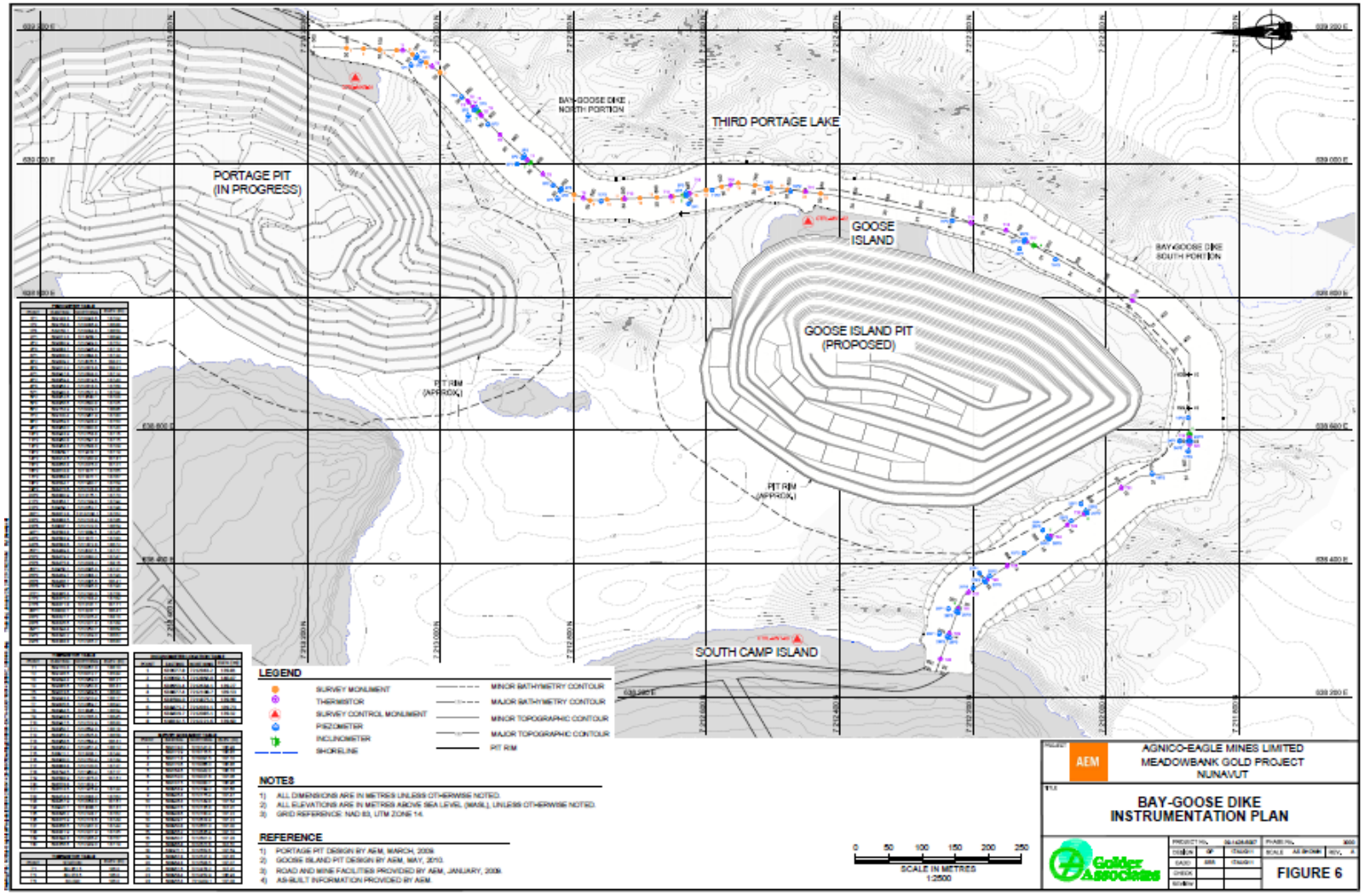


Figure 7 Bay-Goose Dike – Profile View of SB and CSB Placement Zones

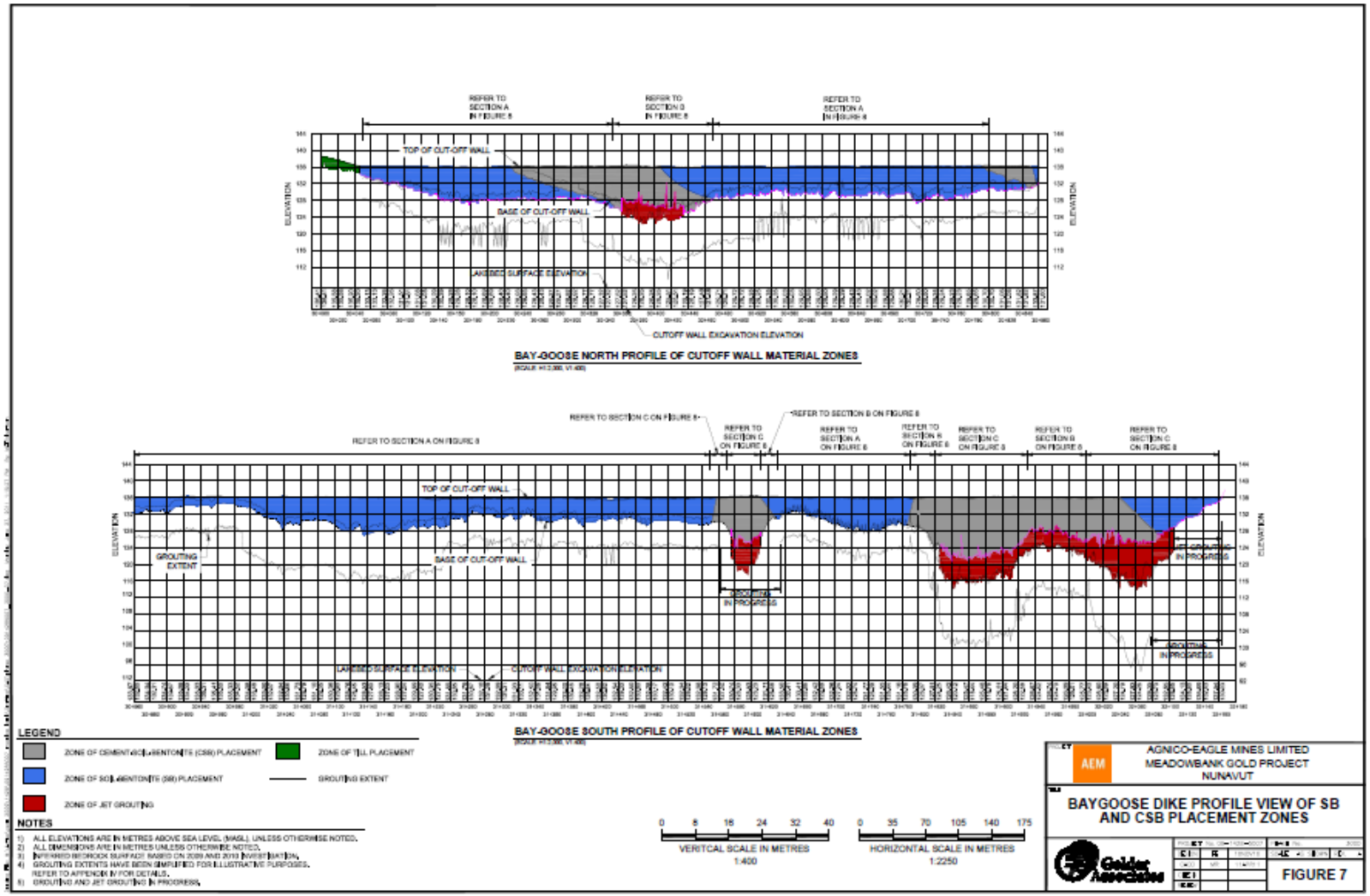


Figure 8 Bay-Goose Dike – Instrumentation Profile

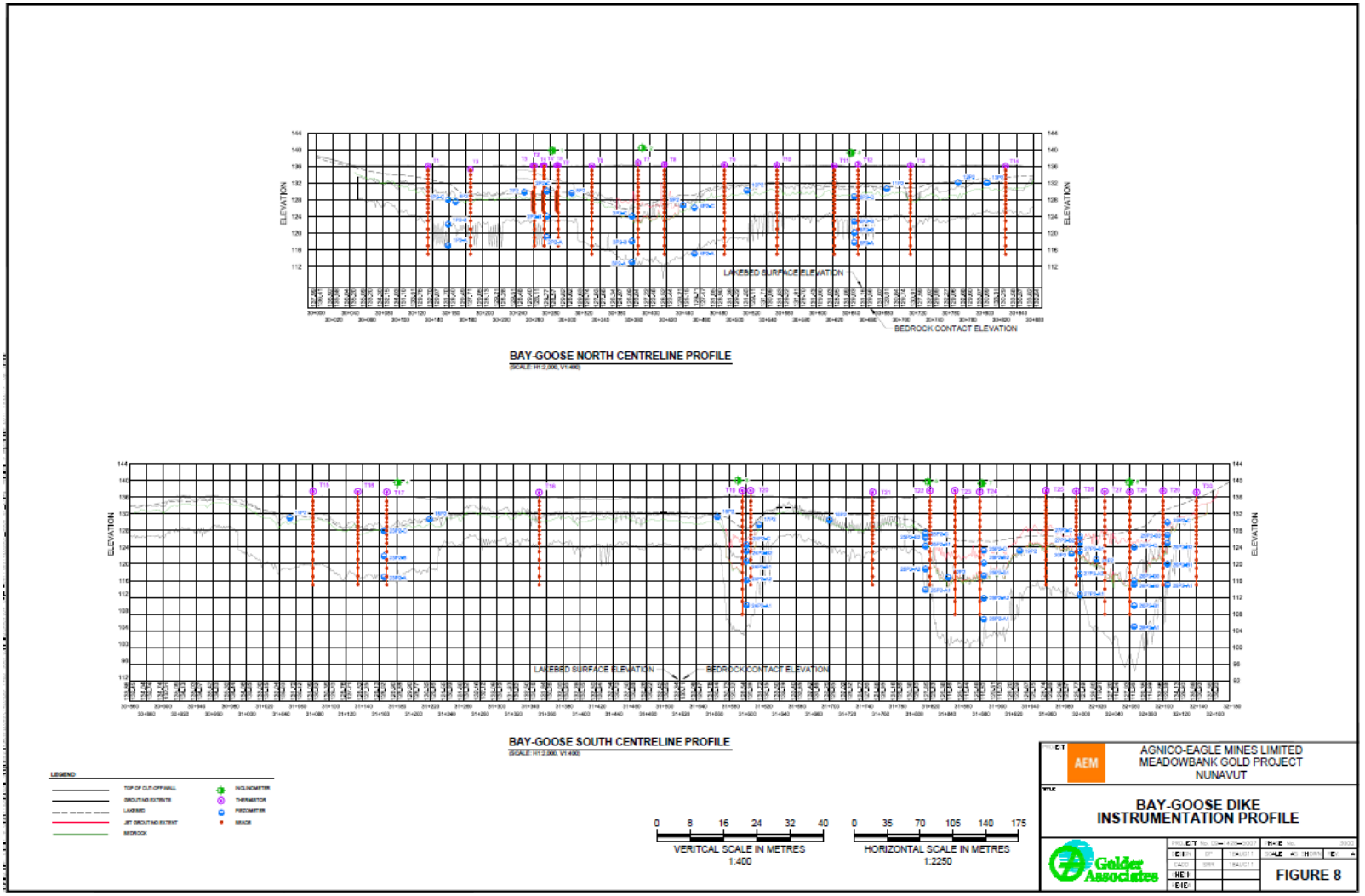
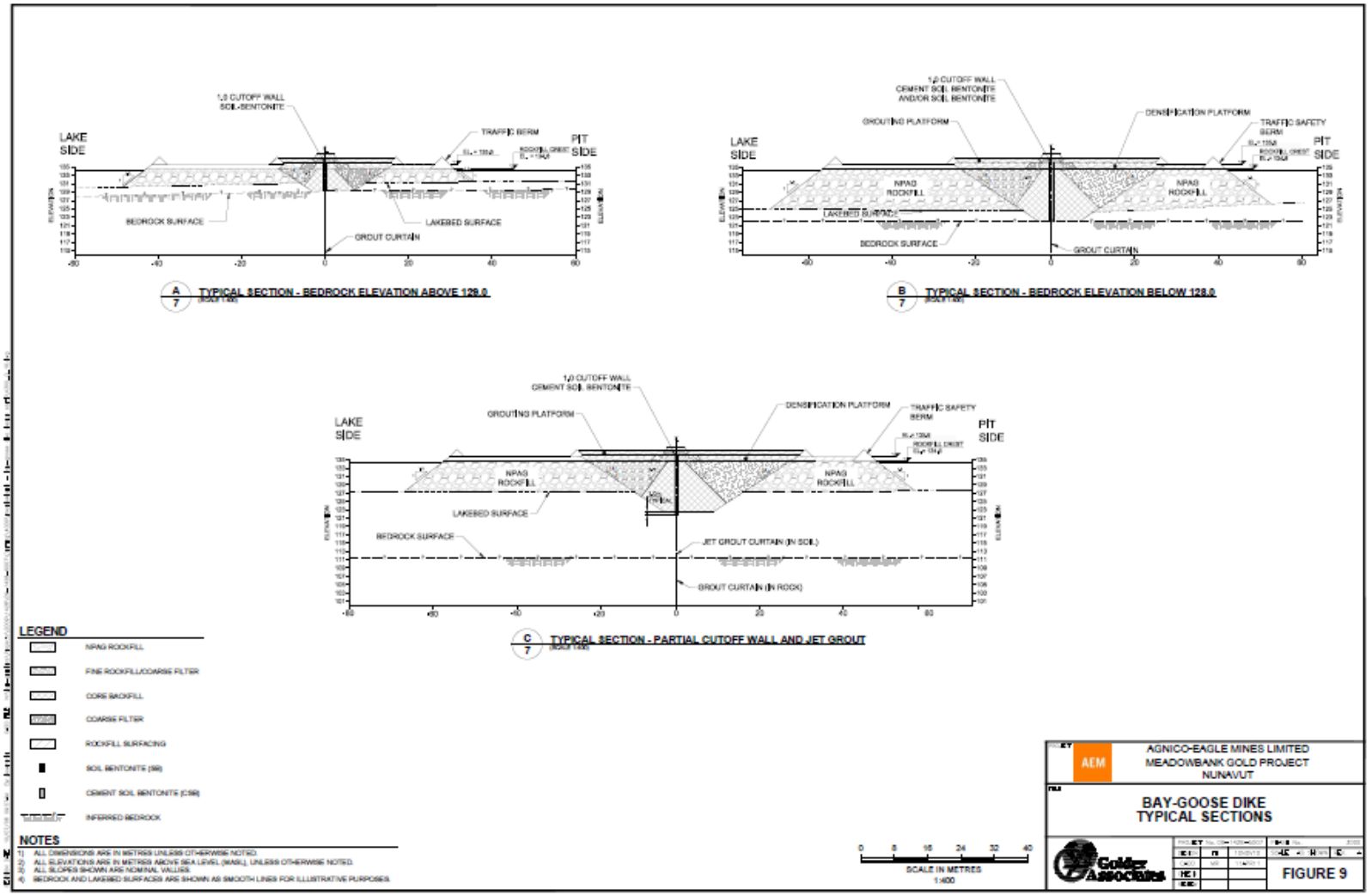


Figure 9 Bay-Goose Dike – Typical Sections



3.2.2 Bay-Goose Dike – Instrumentation

Instrumentation was installed prior to dewatering to monitor the performance of the dike and dike foundation during dewatering and throughout the operational life of the structure.

Instrumentation provides information on the performance of the structure and its foundation and allows comparison with predictions of performance made during the design studies for deformation, seepage and thermal behaviour. Instrumentation may also provide early warnings regarding the development of unexpected pore water pressure responses to dewatering, pit blasting, increasing seepage and increasing deformation.

Several types of instruments have been installed to collect the required information, including the following:

- Single vibrating wire piezometers located downstream of the cutoff wall;
- Arrays of vibrating wire piezometers, installed at various levels, upstream, immediately downstream of the cutoff wall and further downstream;
- Thermistor strings installed through the centreline of the cutoff wall;
- Inclinometers installed through the centreline of the cutoff wall; and
- Survey monuments along the centreline of the cutoff wall.

Table 3.2 summarizes existing instrumentation. The instrumentation locations are shown in plan and section on Figure 6 and Figure 8, respectively.

Table 3.2 Existing Instrumentation Summary

Instrumentation Type	Station Location	Label / Identification	Offset from Centreline (+ is d/s – is u/s)	Elevation (masl)	Details
Vibrating Wire Piezometer Array	30+158	1P1-A	14.43	116.41	1P1 Top of steel casing: El. 137.04 m
		1P1-B	14.43	121.41	
		1P1-C	14.43	127.41	
		1P2-A	1.97	117.05	1P2 Top of steel casing: El. 136.88 m
		1P2-B	1.97	122.05	
		1P2-C	1.97	128.05	
		1P3-A	1.94	117.13	1P3 Top of steel casing: El. 136.53 m
		1P3-B	1.94	122.13	
Vibrating Wire Piezometer Array	30+276.5	2P1-A	14.4	119.25	2P1 Top of steel casing: El. 136.99 m
		2P1-B	14.4	124.25	
		2P1-C	14.4	130.25	
		2P2-A	2.1	119.10	2P2 Top of steel casing: El. 137.52 m
		2P2-B	2.1	124.10	
		2P2-C	2.1	130.10	
		2P3-A	1.93	119.70	2P3 Top of steel casing: El. 137.18 m
		2P3-B	1.93	124.70	
Vibrating Wire Piezometer Array	30+378.5	3P1-A	14.42	113.12	3P1 Top of steel casing: El. 137.24 m
		3P1-B	14.42	118.12	
		3P1-C	14.42	124.12	
		3P2-A	2.03	113.10	3P2 Top of steel casing: El. 138.01 m
		3P2-B	2.03	118.10	
		3P2-C	2.03	124.10	
		3P3-A	2.01	113.58	3P3 Top of steel casing: El. 138.01 m
		3P3-B	2.01	118.58	
Vibrating Wire Piezometer Array	30+453.5	4P1-A	14.44	116.61	4P1 Top of steel casing: El. 137.14 m
		4P1-B	14.44	118.61	
		4P1-C	14.44	124.61	
		4P2-A	2.03	115.13	4P2 Top of steel casing: El. 137.40 m
		4P2-B	2.03	120.13	
		4P2-C	2.03	126.13	
		4P3-A	1.98	115.25	4P3 Top of steel casing: El. 137.68 m
		4P3-B	1.98	120.25	
Vibrating Wire Piezometer Array	30+645.5	5P1-A	14.58	118.00	5P1 Top of steel casing: El. 137.04 m
		5P1-B	14.58	123.00	
		5P1-C	14.58	129.00	
		5P2-A	1.97	117.85	5P2 Top of steel casing: El. 137.03 m
		5P2-B	1.97	122.85	
		5P2-C	1.97	128.85	
		5P3-A	2.09	115.15	5P3 Top of steel casing: El. 137.05 m
		5P3-B	2.09	122.60	
Vibrating Wire Piezometer Array	31+165	23P1-A	14.51	118.49	23P1 Top of steel casing: El. 137.62 m
		23P1-B	14.51	123.49	
		23P1-C	14.51	129.49	
		23P2-A	2.15	116.91	23P2 Top of steel casing: El. 137.86 m
		23P2-B	2.15	121.91	
		23P2-C	2.15	127.91	
		23P3-A	1.92	116.96	23P3 Top of steel casing: El. 136.59 m
		23P3-B	1.92	121.96	

Instrumentation Type	Station Location	Label / Identification	Offset from Centreline (+ is d/s – is u/s)	Elevation (masl)	Details
Vibrating Wire Piezometer Array	31+600	24P1-A1	14.50	111.30	24P1 Top of steel casing: El. 137.45 m
		24P1-A2	14.50	116.30	
		24P1-B1	14.50	121.80	
		24P1-B2	14.50	124.30	
		24P2-A1	2.10	110.15	24P1 Top of steel casing: El. 137.83 m
		24P2-A2	2.10	116.15	
		24P2-B1	2.10	120.65	
		24P2-B2	2.10	123.15	
		24P2-C	2.10	124.65	
		24P3-A1	2.20	110.64	24P3 Top of steel casing: El. 136.72 m
		24P3-A2	2.20	115.64	
		24P3-B1	2.20	121.16	
		24P3-B2	2.20	123.64	
Vibrating Wire Piezometer Array	31+815	25P1-A1	14.26	117.02	25P1 Top of steel casing: El. 137.45 m
		25P1-A2	14.26	122.02	
		25P1-B1	14.26	127.52	
		25P1-B2	14.26	129.52	
		25P2-A1	1.80	113.82	25P1 Top of steel casing: El. 137.77 m
		25P2-A2	1.80	118.82	
		25P2-B1	1.80	124.32	
		25P2-B2	1.80	126.32	
		25P2-C	1.80	127.32	
		25P3-A1	2.13	115.10	25P3 Top of steel casing: El. 138.16 m
		25P3-A2	2.13	120.10	
		25P3-B1	2.13	123.10	
		25P3-B2	2.13	125.10	
Vibrating Wire Piezometer Array	31+885	26P1-A1	14.44	104.44	26P1 Top of steel casing: El. 137.27 m
		26P1-A2	14.44	109.44	
		26P1-B1	14.44	114.94	
		26P1-B2	14.44	117.94	
		26P2-A1	1.85	106.77	26P1 Top of steel casing: El. 137.93 m
		26P2-A2	1.85	111.77	
		26P2-B1	1.85	117.27	
		26P2-B2	1.85	120.27	
		26P2-C	1.85	123.27	
		26P3-A1	2.10	105.00	26P3A Top of steel casing: El. 136.41 m
		26P3-A2	2.10	111.36	
		26P3-B1	2.10	117.46	26P3B Top of steel casing: El. 137.93 m
		26P3-B2	2.10	119.86	

Instrumentation Type	Station Location	Label / Identification	Offset from Centreline (+ is d/s – is u/s)	Elevation (masl)	Details
Vibrating Wire Piezometer Array	32+000	27P1-A1	14.45	113.25	27P1 Top of steel casing: El. 137.58 m
		27P1-A2	14.45	118.25	
		27P1-B1	14.45	123.75	
		27P1-B2	14.45	125.75	
		27P2-A1	2.03	112.61	27P1 Top of steel casing: El. 137.64 m
		27P2-A2	2.03	117.61	
		27P2-B1	2.03	123.11	
		27P2-B2	2.03	125.11	
		27P2-C	2.03	126.61	
		27P3-A1	1.91	111.72	27P3 Top of steel casing: El. 137.71 m
		27P3-A2	1.91	116.72	
		27P3-B1	1.91	122.22	
		27P3-B2	1.91	124.22	
Vibrating Wire Piezometer Array	32+065	28P1-A1	14.40	102.99	28P1 Top of steel casing: El. 136.41 m
		28P1-A2	14.40	107.99	
		28P1-B1	14.40	112.99	
		28P1-B2	14.40	115.99	
		28P2-A1	1.90	105.02	28P1 Top of steel casing: El. 138.13 m
		28P2-A2	1.90	110.02	
		28P2-B1	1.90	115.02	
		28P2-B2	1.90	118.02	
		28P2-C	1.90	124.02	
		28P3-A1	1.86	105.91	28P3 Top of steel casing: El. 137.89 m
		28P3-A2	1.86	110.91	
		28P3-B1	1.86	115.91	
		28P3-B2	1.86	118.91	
Vibrating Wire Piezometer Array	32+105	29P1-A1	14.44	115.32	29P1 Top of steel casing: El. 136.69 m
		29P1-A2	14.44	120.32	
		29P1-B1	14.44	125.32	
		29P1-B2	14.44	127.32	
		29P2-A1	2.01	114.99	29P1 Top of steel casing: El. 136.62 m
		29P2-A2	2.01	119.99	
		29P2-B1	2.01	124.99	
		29P2-B2	2.01	126.99	
		29P2-C	2.01	129.99	
		29P3-A1	2.04	115.91	29P3 Top of steel casing: El. 136.80 m
		29P3-A2	2.04	120.91	
		29P3-B1	2.04	125.91	
		29P3-B2	2.04	127.91	

Instrumentation Type	Station Location	Label / Identification	Offset from Centreline (+ is d/s – is u/s)	Elevation (masl)	Details
Vibrating Wire Piezometer Individual	30+167	6P2	1.98	127.57	6P2 Top of steel casing: El. 136.86 m
	30+249.5	7P2	2.02	129.85	7P2 Top of steel casing: El. 137.80 m
	30+306.5	8P2	1.98	129.65	8P2 Top of steel casing: El. 137.50 m
	30+440	9P2	1.98	126.73	9P2 Top of steel casing: El. 137.43 m
	30+516.5	10P2	2.00	130.26	10P2 Top of steel casing: El. 137.16 m
	30+684.5	11P2	2.04	130.65	11P2 Top of steel casing: El. 137.15 m
	30+770	12P2	2.1	132.16	12P2 Top of steel casing: El. 137.09 m
	30+804.5	13P2	1.95	132.05	13P2 Top of steel casing: El. 137.19 m
	31+052	14P2	2.04	131.06	14P2 Top of steel casing: El. 137.81 m
	31+220	15P2	2.07	130.73	15P2 Top of steel casing: El. 137.01 m
	31+565	16P2	2.10	131.28	16P2 Top of steel casing: El. 137.65 m
	31+615	17P2	2.10	129.40	17P2 Top of steel casing: El. 137.67 m
	31+700	18P2	1.87	130.53	18P2 Top of steel casing: El. 137.59 m
	31+842	22P2	2.01	116.80	22P2 Top of steel casing: El. 137.98 m
	31+928	19P2	1.99	123.22	19P2 Top of steel casing: El. 137.28 m
	31+990	20P2	2.22	122.44	20P2 Top of steel casing: El. 137.70 m
	32+020	21P2	1.93	121.13	21P2 Top of steel casing: El. 137.94 m
Thermistor Strings	30+134	T1	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	30+185	T2	0	135	Beads at Elev. 135, 134, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	30+260	T3	0	130	Beads at Elev. 130, 129.7, 129.4, 129.1, 128.8, 128.5, 128.2, 127.9, 127.6, 127.3, 127, 126.7, 126.4, 126.1, 125.8 and 125.5 masl.

Instrumentation Type	Station Location	Label / Identification	Offset from Centreline (+ is d/s – is u/s)	Elevation (masl)	Details
	30+261.5	T3’	0	136	Beads at Elev. 135.97, 134.97, 133.97, 132.97, 130.97, 128.97, 126.97, 124.97, 122.97, 120.97, 118.97 and 116.97 masl.
	30+272	T4	0	130	Beads at Elev. 130, 129.7, 129.4, 129.1, 128.8, 128.5, 128.2, 127.9, 127.6, 127.3, 127, 126.7, 126.4, 126.1, 125.8 and 125.5 masl.
	30+273.5	T4’	0	136	Beads at Elev. 135.97, 134.97, 133.97, 132.97, 130.97, 128.97, 126.97, 124.97, 122.97, 120.97, 118.97 and 116.97 masl.
	30+288.5	T5	0	130	Beads at Elev. 130, 129.7, 129.4, 129.1, 128.8, 128.5, 128.2, 127.9, 127.6, 127.3, 127, 126.7, 126.4, 126.1, 125.8 and 125.5 masl.
	30+290	T5’	0	136	Beads at Elev. 135.97, 134.97, 133.97, 132.97, 130.97, 128.97, 126.97, 124.97, 122.97, 120.97, 118.97 and 116.97 masl.
	30+330.5	T6	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	30+386	T7	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	30+417.5	T8	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	30+489.5	T9	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.

Instrumentation Type	Station Location	Label / Identification	Offset from Centreline (+ is d/s – is u/s)	Elevation (masl)	Details
	30+553.25	T10	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	30+621.5	T11	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	30+650	T12	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	30+713	T13	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	30+827	T14	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	31+080	T15	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	31+134.5	T16	0	135.08	Beads at Elev. 135.08, 134.08, 133.08, 132.08, 131.08, 130.08, 129.08, 128.08, 127.08, 126.08, 125.08, 123.08, 121.08, 119.08, 117.08 and 115.08 masl.
	31+170	T17	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	31+352	T18	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	31+595	T19	0	135	Beads at Elev. 135, 133.5, 132, 130.5, 129, 127.5, 126, 124.5, 123, 121.5, 120, 118, 116, 114, 111 and 108 masl.

Instrumentation Type	Station Location	Label / Identification	Offset from Centreline (+ is d/s – is u/s)	Elevation (masl)	Details
	31+605	T20	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	31+752.5	T21	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	31+820	T22	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	31+850	T23	0	135	Beads at Elev. 135, 133.5, 132, 130.2, 129, 127.5, 126, 124.5, 123, 121.5, 120, 118, 116, 114, 111 and 108 masl.
	31+880	T24	0	135	Beads at Elev. 135, 133.5, 132, 130.2, 129, 127.5, 126, 124.5, 123, 121.5, 120, 118, 116, 114, 111 and 108 masl.
	31+960	T25	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	31+995	T26	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	32+030	T27	0	135	Beads at Elev. 135, 133.5, 132, 130.2, 129, 127.5, 126, 124.5, 123, 121.5, 120, 118, 116, 114, 111 and 108 masl.
	32+060	T28	0	135	Beads at Elev. 135, 133.5, 132, 130.2, 129, 127.5, 126, 124.5, 123, 121.5, 120, 118, 116, 114, 111 and 108 masl.
	32+100	T29	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	32+140	T30	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130,

Instrumentation Type	Station Location	Label / Identification	Offset from Centreline (+ is d/s – is u/s)	Elevation (masl)	Details
					129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
Inclinometer	30+282	1	0	139.8 (collar elevation)	
	30+390	2	0	140.5 (collar elevation)	
	30+640	3	0	139.3 (collar elevation)	
	31+180	4	0	139.5 (collar elevation)	
	31+590	5	0	140.0 (collar elevation)	
	31+815	6	0	139.7 (collar elevation)	
	31+885	7	0	139.3 (collar elevation)	
	32+065	8	0	139.6 (collar elevation)	
Crest survey monuments	30+050	1	0	139.6	
	30+075	2	0	139.5	
	30+100	3	0	139.7	
	30+125	4	0	139.5	
	30+150	5	0	139.4	
	30+175	6	0	139.7	
	30+200	7	0	139.6	
	30+475	8	0	140.3	
	30+500	9	0	140.1	
	30+525	10	0	140.1	
	30+550	11	0	140.0	
	30+575	12	0	139.8	
	30+600	13	0	139.8	
	30+625	14	0	139.6	
	30+650	15	0	139.7	
	30+675	16	0	139.9	
	30+700	17	0	140.1	
	30+725	18	0	140.2	
	30+750	19	0	139.9	

Instrumentation Type	Station Location	Label / Identification	Offset from Centreline (+ is d/s – is u/s)	Elevation (masl)	Details
	30+775	20	0	139.7	
	30+800	21	0	140.0	
	30+825	22	0	139.5	
	30+850	23	0	139.7	
	30+875	24	0	137.0	
	30+900	25	0	139.9	
	30+925	26	0	139.6	
	30+950	27	0	137.0	
	30+975	28	0	139.8	
	31+000	29	0	139.6	
	31+025	30	0	139.6	
	31+050	31	0	139.8	
	31+075	32	0	139.8	
	31+100	33	0	139.8	
	31+125	34	0	139.8	
	31+150	35	0	139.8	
	31+175	36	0	139.7	
	31+200	37	0	139.5	
	31+225	38	0	139.3	
	31+250	39	0	139.4	
	31+275	40	0	139.5	
	31+300	41	0	139.6	
	31+425	42	0	139.4	
	31+450	43	0	139.3	
	31+475	44	0	139.4	
	31+500	45	0	139.6	
	31+525	46	0	139.5	
	31+550	47	0	139.5	
	31+650	48	0	139.6	
	31+675	49	0	139.8	

Instrumentation Type	Station Location	Label / Identification	Offset from Centreline (+ is d/s – is u/s)	Elevation (masl)	Details
	31+700	50	0	139.7	
	31+725	51	0	139.6	
	31+750	52	0	139.6	
	31+775	53	0	139.6	
	32+100	54	0	139.2	
	32+125	55	0	139.9	

3.2.3 Bay-Goose Dike - Seepage Collection System

Four small seepage areas were identified with a total of 9 seepage channels along the dike. The number of active seepage channels vary each year, as some channels stop flowing and others begin to flow. No turbidity has been observed in the seepage. The total flow coming from these seepages is 24.7 m^3/day (0.29 L/s). The overall seepage is less than anticipated and is not a concern for now. The area will continue to be monitored to follow the evolution of the seepage in these areas.

Refer to the 2012 Annual Geotechnical Inspection (Golder Associates) for detailed field observations made on the dike. No mitigation measure has been implemented on the dike other than additional geotechnical instrumentation installation and field investigation in certain areas. No seepage collection has been implemented so far as the seepage is not affecting the mine operation or the integrity of the dike. The condition of the dike will continually be monitored and if the condition of the dike is judged to be deteriorating then remediation would be reassessed.

3.2.4 Bay-Goose Dike - Access

Access to the Bay-Goose Dike is from the north and south abutments as shown on Figures 2 and 6. Access to the downstream toe is by foot from the Bay-Goose pit ring road, which is a road that runs around the top circumference of the Bay-Goose pit. The south abutment of the dike is accessible from the main camp, after passing the fuel storage and refuelling station, travelling southward crossing the South Camp Dike. The access road forks, take the access road on the left (east) and continue southward on South Camp Island until reaching the south abutment of the Bay-Goose Dike. The north abutment of the Bay-Goose Dike is accessible from the south abutment of the East Dike.

The Bay-Goose Dike is not intended to be used as a haul road, but merely a structure to dewater the isolated portion and permit open pit mining of the Goose deposit and the southern portion of Portage Pit. Traffic on the dike is restricted to dike and environment personnel only; this measure was taken to protect the dike and the instrumentation.

3.3 SOUTH CAMP DIKE

The South Camp Dike covers a narrow channel within Third Portage Lake and in conjunction with the Bay-Goose Dike isolates the Bay-Goose Basin from Third Portage Lake. No spillways or water diversion works are associated with the South Camp Dike.

The South Camp Dike is located south of the plant site area and is used to connect the mainland to South Camp Island. Figure 2 shows the location of the South Camp Dike. It covers a narrow channel, approximately 60 m in width, where water depths were between 0.5 and 1 m.

The South Camp Dike was primarily constructed between April and June of 2009, prior to ice breakup. During the winter of 2009-2010 additional thermal capping material and rockfill for the haul road was added to the dike. The South Camp Dike has a broad rockfill shell with a bituminous geomembrane liner installed on the upstream side of the shell. The liner was founded on native frozen (permafrost) till material, in a trench approximately 3 to 5 m below the lakebed surface. Compacted granular material mixed with bentonite was placed above the toe of the liner. The haul road is located on the downstream side of the dike.

3.3.1 South Camp Dike – Design and Construction

The South Camp Dike design and as-built drawings are presented within Doc. 802 (Golder 2009a). A plan view and typical section of the as-built dike are shown on Figure 10.

The dike design includes the following components: a rockfill shell, a bituminous geomembrane liner and granular material mixed with bentonite.

3.3.2 South Camp Dike - Instrumentation

Two thermistor strings exist on the upstream side of the South Camp Dike to monitor the thermal behaviour of the foundation soils at the liner key-in trench. Instrumentation is shown in section on Figure 10.

Table 3.3 summarizes existing instrumentation in the South Camp Dike.

Table 3.3 South Camp Dike Existing Instrumentation Summary

Thermistor String	Location		Approx. Offset from Centerline + is d/s; - is u/s	Elevation (masl)	Details
	Northing	Easting			
SD-09-A	7,213,148	638,151	-27 m	133 (1st bead)	Beads at Elev. 133, 132, 131, 130, 129, 128, 127, 126, 124, 122, 120, 118, 116, 114, 112 and 110 masl
SD-10	7,213,142	638,168	-45 m	132.4 (1st bead)	Beads at Elev. 132.4, 131.4, 130.4, 129.4, 128.4, 127.4, 126.4, 125.4, 123.4, 121.4, 119.4, 117.4, 115.4, 113.4, 111.4 and 109.4 masl

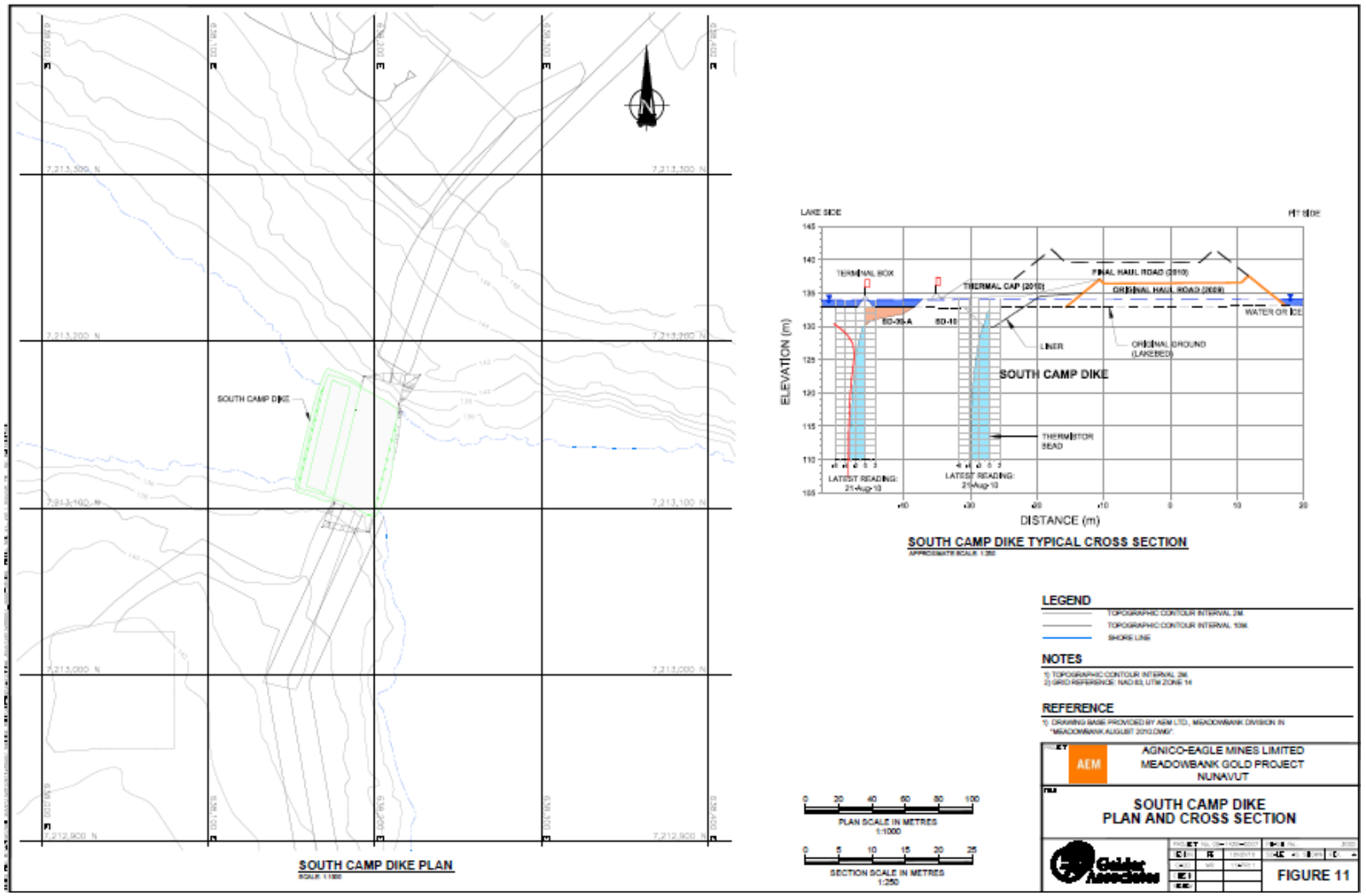
3.3.3 Seepage Collection System

As of summer 2013 no seepage through the South Camp Dike has been discovered. Seepage through the dike will be visually monitored if discovered. Seepage and runoff from the South Camp Dike will be collected in ditches along the downstream toe and directed to topographic lows if required based on the visual monitoring.

3.3.4 South Camp Dike - Access

Access to the South Camp Dike is from the north and south abutments as shown on Figures 2 and 10. The South Camp Dike connects the mainland to South Camp Island.

Figure 10 Plan, cross section and profile of South Camp Dike



3.4 VAULT DIKE

The construction of the Vault Dike at Meadowbank was conducted from February 2013 to March 2013. Vault Dike is located across a shallow creek which connects Wally Lake and Vault Lake, at the Vault Pit area approximately 8 km north of the main Meadowbank site. Vault Dike is essential to allow the dewatering of Vault Lake and to isolate Vault Pit during mining activities from Wally Lake.

Vault Dike is designed and constructed as a zoned rockfill dam with filter zones, an impervious upstream liner consisting of a bituminous membrane, and an upstream key trench made of aggregate mixed with bentonite. The filter zones minimize seepage and internal erosion and facilitate seepage collection. Vault Dike includes a key trench at the base of the upstream side filled with a 0-25 mm fill amended with bentonite surrounding the liner. Coarse and fine filter material was placed on the upstream slope as geomembrane bedding. The bulk part of the dike consists of coarse rockfill material. The embankment crest is at El. 142.4 m and the upstream toe is at approximately El. 139.4 m. The downstream toe is at approximately El. 139.6 m and the bottom of the key trench ranges from El. 135.6m to El. 142.3m, with an average height of El. 137.0m. The upstream and downstream fill slopes of the dam are 1.5H:1V.

The location of the Vault dike is shown on Figure 2. Dewatering of Vault Lake is discharge into Wally lake and begin in June 27, 2013 and is supposed to be ended at the end of October 2013.

3.4.1 Vault Dike – Design and Construction

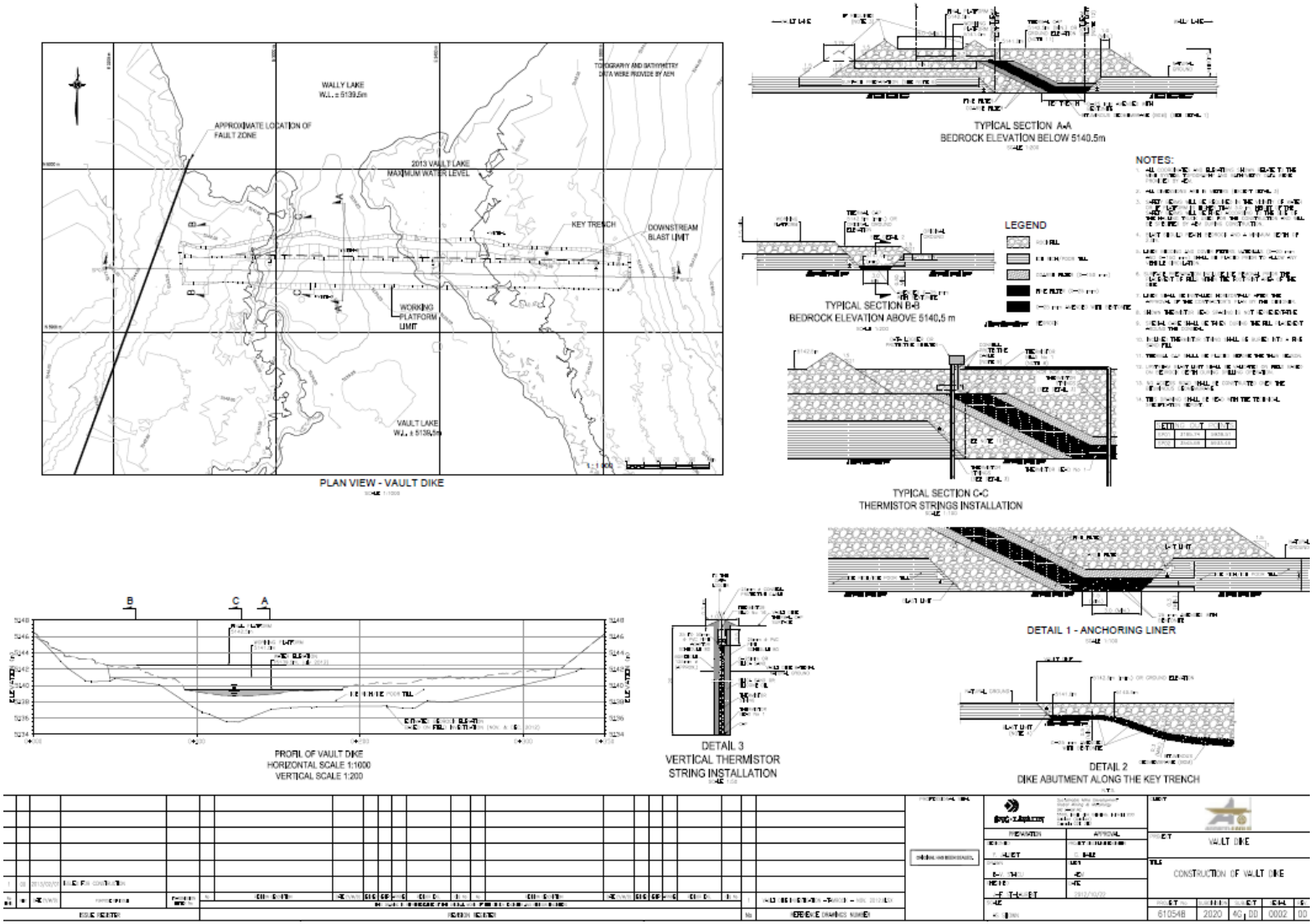
The Vault Dike design is presented in the report “Detailed Engineering of Vault Dike” (SNC, 2013a). A Vault Dike typical section plan view is included in Figure 11. As-built information and as-built drawings of the Vault Dike are provided in Construction Summary Report Vault Dike (AEM, 2013).

Vault Dike is designed and constructed as a zoned rockfill dam with filter zones, an impervious upstream liner consisting of a bituminous membrane, and an upstream key trench made of aggregate mixed with bentonite. The filter zones minimize seepage and internal erosion and facilitate seepage collection.

3.4.2 Vault Dike – Dewatering

Vault Dike is essential to allow the dewatering of Vault Lake and to isolate Vault Pit during mining activities from Wally Lake. The dewatering of Vault Lake has started on June 27th, 2013 and was supposed to be ended at the end of October 2013. The approximate pool volume to be dewatered is in the order of 2 Mm^3. The downstream water levels and the upstream water levels need to be closely monitored during dewatering to preserve the integrity of the dike.

Figure 11 Vault Dike Typical Section



3.4.3 Vault Dike - Instrumentation

Installation of the thermistor strings began on February 26, 2013 and was completed April 14, 2013. Installation of the thermistors was completed by AEM with assistance from the Contractor /TCG and complied with the construction specifications.

TH3 was installed on the downstream side of the dike. TH3 was installed in the deepest channel downstream of the dike. TH5 was installed inclined under the liner on February 26, 2013. TH6, TH7, and TH8 were installed after construction was complete using a Rockmaster drill between April 12, 2013 and April 14, 2013. T6 was installed upstream of the dike in the deepest channel upstream of the liner. TH7 was installed east of the deepest channel in the unthawed till zone found during construction. TH8 was installed upstream of the dike in the deepest channel outside of the key trench. The locations of the five thermistors at Vault Dike are shown on the as-built drawings in plan view in Figure 11 and their details are shown in Table 3-4. The five (5) thermistor strings were installed to monitor Vault Dike and the thermal behaviour of its foundation. At this point, only one critical section has been identified in the deepest section of the dike.

Table 3.4 Vault Dike Existing Instrumentation Summary

Thermistor String	Location		Elevation (masl)	Details
	Northing	Easting		
VD-TH3	5921.97	3324.066	139.5 (1st bead)	Beads at Elev. 139.5, 138.5, 137.5, 136.5, 135.5, 134.5, 133.5, 132.5, 131.5, 130.5, 128.5, 126.5, 124.5, 122.5, 120.5, and 118.5 masl
VD-TH5	5945.52	3322.511	141.4 (1st bead)	Beads at Elev. 141.4, 141.4, 141.4, 141.4, 141.1, 141.0, 140.5, 140.0, 139.5, 139.0, 138.4, 137.9, 137.4, 136.8, 136.4, and 136.1 masl
VD-TH6	5943.00	3322.000	140.5 (1st bead)	Beads at Elev. 140.5, 139.5, 138.5, 137.5, 136.5, 135.5, 134.5, 133.5, 132.5, 131.5, 130.5, 129.5, 127.5, 125.5, 124, and 121.5 masl
VD-TH7	5946.00	3346.00	140.5 (1st bead)	Beads at Elev. 140.5, 139.5, 138.5, 137.5, 136.5, 135.5, 134.5, 133.5, 132.5, 131.5, 129.5, 127.5, 125.5, 123.5, 122.0 and 119.5 masl
VD-TH8	5957.00	3322.00	140.5 (1st bead)	Beads at Elev. 140.5, 139.5, 138.5, 137.5, 136.5, 135.5, 134.5, 133.5, 132.5, 131.5, 129.5, 127.5, 125.5, 123.5, 122.0 and 119.5 masl

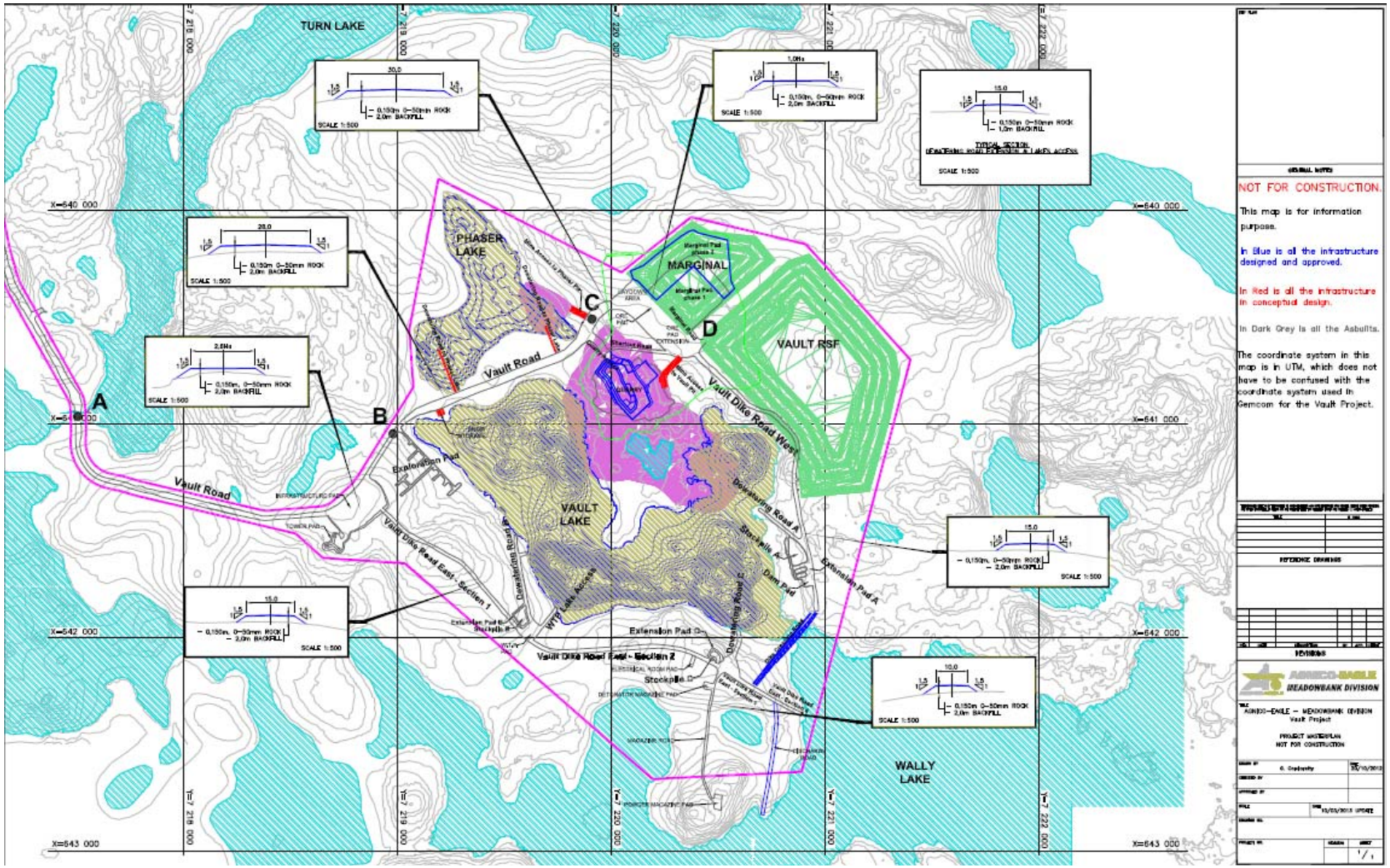
3.4.4 Vault Dike - Seepage Collection System

As of summer 2013 no seepage through the Vault Dike has been discovered. Seepage through the dike will be visually monitored if discovered. Seepage and runoff from the Vault Dike will be collected in ditches along the downstream toe and directed to topographic lows if required based on the visual monitoring.

3.4.5 Vault Dike - Access

Two access roads were constructed to the dike footprint – one from Vault Dike Road West and from Vault Dike Road East. Figure 12 presents a map of the general Vault Pit area with the access roads. Vault Dike Road West begins where Vault Road ends at the Vault Waste Dump, runs northeast to pass Dewatering Road A and ends at the northwest end of the dike (Station 0+000). Vault Dike Road East begins at Vault Road between the Tower Pad and the Office Pad, runs northeast to pass Dewatering Road B and Dewatering Road C and ends at the southeast end of the dike (Station 0+350).

Figure 12 General Vault Pit area with the access roads



SECTION 4 • DEWATERING

The Dewatering Dikes isolate the open pit mining activities from the Second Portage Lake, Third Portage Lake, and Wally Lake. The northwest arm of Second Portage Lake was dewatered upon completion of the East Dike and West Channel Dike in 2009.

The Bay-Goose Dike together with the South Camp Dike isolates the Bay-Goose Basin from Third Portage Lake. Dewatering of the Bay-Goose Basin commenced on July 25, 2011 and was completed on November 14 2011. As the operational stage of Goose Pit has started, both dikes are no longer under dewatering conditions. The approximate pool volume dewatered is in the order of 3 Mm^3. This is referring to the amount of water removed to expose the majority of the downstream toe of the Bay-Goose Dike.

Vault Dike isolates Vault Pit from Wally Lake. Dewatering of Vault Lake started on June 27th, 2013 and is scheduled to be complete at the end of October 2013. The approximate pool volume to be dewatered is in the order of 2 Mm^3. The Vault Dike is presently the only dike that was considered under dewatering condition.

The following outlines the key criteria and constraints that will need to be observed and followed in accordance with the design objectives, concepts, and assumptions for the Dewatering Dikes.

4.1 FREEBOARD

The design criteria for minimum freeboard for the Dewatering Dikes are presented in Table 4.1. The freeboard may change due to fluctuations in Second Portage and Third Portage Lakes or due to settlement in the dikes. Maintenance may be required to restore loss of freeboard due to settlement.

Table 4.1 Design Minimum Freeboard

Structure	Minimum Freeboard	
	Rockfill Structure (Dike Crest) (m)	Low Premeability Element (Cutoff Wall or Liner) (m)
East Dike	3.0	1.0
Bay-Goose Dike	4.0	1.0
South Camp Dike	3.0	1.0
Vault Dike	3.0	1.5

4.2 WATER MANAGEMENT AND QUALITY

Dewatering water from the Vault Lake Basin was pumped and directly discharged to Wally Lake thru a diffusor, or processed through the Water Treatment Plant (WTP) to reduce Total Suspended Solids (TSS). The Nunavut Water Board Water License (No. 2AM-MEA0815) states that the TSS maximum monthly mean value should not exceed 15.0 mg/L and that the short term maximum level is 22.5

mg/L and turbidity maximum monthly mean value should not exceed 15 NTU and the short term maximum level is 30 NTU. The Vault Lake discharge is also considered as an effluent under the Metal Mining Effluent Regulations (MMER) and must meet the criteria of this regulation for arsenic, copper, cyanide, lead, nickel, zinc, TSS and toxicity of trout and daphnia. Under the MMER regulation, the TSS maximum monthly mean value should not exceed 15.0 mg/L and maximum concentration in a grab sample is 30.0 mg/L. In the first stage of the Vault Lake dewatering the WTP was not required because the regulation criteria limit was reached. However, as dewatering proceeds it is anticipated the WTP will need to be used during the latter stages when TSS from bottom sediments could be present.

4.3 SURVEILLANCE AND MONITORING REQUIREMENTS

Surveillance and monitoring requirements are defined in Sections 7 and 8 of this manual.

Pore water pressures in the foundation shall be monitored during dewatering as a predictor of possible slope instability. Both pore water pressures and temperature measurements shall be monitored during dewatering as one method of detecting potential zones of seepage. The quantity of water pumped out during dewatering was monitored with flow meters in addition to monitoring the water level downstream of the Vault Dike, within the Vault Lake Basin.

4.4 SAFETY AND SECURITY

Access to the mine site is controlled by AEM security and public access to the area is restricted.

SECTION 5 • OPERATIONS

The following outlines the key criteria and constraints that will need to be observed and followed to operate the dewatering dikes in accordance with the design objectives, concepts and assumptions.

5.1 FREEBOARD

The design criteria for minimum freeboard for the Dewatering Dikes are presented in Table 5-1. The freeboard may change due to fluctuations in lake levels or due to settlement of the dikes. Maintenance may be required to restore loss of freeboard due to settlement.

Table 5.1 Freeboard

Structure	Freeboard	
	To the Dike Crest (m)	To the Dike Cut-off Wall or Liner (m)
East Dike	3.0	1.0
Bay-Goose Dike	4.0	1.0
South Camp Dike	3.0	1.0
Vault Dike	3.0	1.5

5.2 WATER MANAGEMENT

Water from the seepage collection systems of the Dewatering Dikes is to be pumped to the pit sumps and/or directly to the Tailings Storage Facility or Attenuation Pond. Seepage rates may increase with time as the pits are developed downstream of the dikes. As described in Sections 7 and 8 of the document, seepage rates, volumes and the condition of the seepage water (i.e. turbidity, temperature, etc.) are to be monitored.

Table 5.2 summarizes design criteria for the seepage and runoff flow into the seepage collection sumps. The quantity of seepage through the dike is an estimate based on design analyses and should be periodically reviewed during dewatering and operations.

Table 5.2 Sump Design Criteria

Criteria **Type of Storage**	**Description** **Temporary**
Required Storage Capacity	Seepage from the foundation and embankment plus Average daily 10 year freshet volume
Foundation and Embankment Seepage	Design rate: 300 m^3 /day prior to Portage Pit development (East Dike). However, seepage rates in 2009 and 2010 have been between 860 to 1300 m^3/day Design rate: 700 m^3 /day prior to Goose Island Pit development (Bay-Goose Dike) However, seepage rates in 2013 have been 24.7 m^3/day
Average daily 10 year freshet	Average daily 10 yr snowmelt over 14 day melt period
Design Pump Capacity	Sufficient to pump: Foundation and Embankment Seepage plus 10-year annual snow melt in 14 days

Regular monitoring of the seepage volume is required. Sumps size and pump capacity is to be regularly reviewed and upgrades made if deemed necessary by AEM.

5.3 WATER QUALITY

Water quality of the seepage and runoff collected in the sumps and ditches at the toe of the Dewatering Dikes is to be monitored during operations. Daily inspections during dewatering and weekly inspections during operation are required as an indicator of dike performance to note whether seepage water is clear, cloudy or if fine material is present.

SECTION 6 • MAINTENANCE PROCEDURES

Maintenance is important for the safe operation of the Dewatering Dikes. The Engineering Superintendent is responsible for proper and timely maintenance of the Dewatering Dikes embankments, instrumentation, seepage collection system and access.

6.1 PLANNED AND UN-PLANNED MAINTENANCE

Maintenance is divided into planned and un-planned maintenance. Planned maintenance will be scheduled according to manufacturer's requirements for instrumentation and equipment such as pumps. Planned maintenance may be routine, preventative and/or routine inspection observations including low risk / consequence observations.

Un-planned maintenance shall generally derive from routine inspection observations including medium-high risk / consequence observations and / or extreme events including extreme meteorological events, seismic events, etc. where the maintenance requirement is critical and is required immediately.

All planned and un-planned maintenance will be documented in a database organized and maintained by AEM.

6.2 EMBANKMENT EROSION

Erosion of the rockfill embankments is not expected during dewatering or operations. In the event that the upstream face is eroded by wave action or ice scouring then any gullies or depressions that develop are to be filled in with rockfill material and re-sloped.

6.3 SEEPAGE COLLECTION SYSTEM

Seepage is expected to exit the downstream toe of the Dewatering Dikes, in particular at low points along the alignment of the structure. Seepage should be monitored and ditches and sumps maintained to avoid erosion and deterioration of the seepage collection system. Sediments, snow and ice may accumulate in the ditches and sumps during operation. The ditches and sumps will require ongoing cleaning and maintenance.

Pumps located at the seepage collection system sumps will require maintenance based on the manufacturer's specifications. Pump installations are to be winterized to provide year round capacity for pumping, if necessary.

Heat tracing of the pipelines will require maintenance. It is expected that the feeder pipelines to the main pipelines are sloped sufficiently to drain the pipes and not permit ice or sediment accumulation, but this should be confirmed in the field.

6.4 INSTRUMENTATION

All cables, thermistors, inclinometers, piezometers, and survey/displacement monuments must be adequately protected with barriers, signs, and flagging to prevent accidental damage. The instrumentation installed in the Dewatering Dikes is to remain operational until closure of the facility.

Instrumentation will require regular maintenance based on manufacturer's specification. The slope inclinometer casing will require either frequent bailing or filling with a solution of non-toxic antifreeze to prevent freezing and icing.

Calibration sheets and initial instrumentation readings will be included upon replacement of malfunctioning instrumentation; the OMS Manual will be updated accordingly.

6.5 ACCESS

Access roads to the Dewatering Dikes along the crest of the dikes need to be maintained. Access will also be maintained along the seepage collection system and to the sumps at the toe of the East Dike and Bay-Goose Dike. Maintenance activities for access will be conducted.

SECTION 7 • SURVEILLANCE

A program of regular surveillance is required to ensure that the Dewatering Dikes, instrumentation and seepage collection systems are performing adequately and that problems are detected so that the necessary corrective actions can be implemented in a timely manner.

7.1 SURVEILLANCE REQUIREMENTS

Surveillance is required for early detection of possible failure mechanisms. In 1995, the International Commission on Large Dams (ICOLD) released a study summarizing failure mechanisms for world-wide water retaining dam incidents during the 1800s and 1900s. The potential failure mechanisms applicable to the Dewatering Dikes, primarily East Dike and Bay-Goose Dike, based on the ICOLD study are summarized in Table 7-1.

Table 7.1 Summary of Consequences and Proposed Monitoring/Action for Rare Events Based on Water Retaining Embankment Failure Modes Identified in ICOLD (1998)

Failure Mode	Scenario	Consequence	Monitoring/Action
Overtopping	(1) Lake level rise because of restricted outflow e.g. Second Portage outlet (excessive inflow is a far less likely scenario).	Water spilling over the crest. The crest is wide and comprises coarse rockfill. Adequate freeboard is provided by the rockfill crest elevation being 3 m above the lake level and the low permeability element 2 m above. Any rise in lake level is anticipated to be less than the freeboard. Significant damage to the dike is unlikely, based on performance of other rockfill structures subjected to overtopping or flow through events. Mining operations might need to be suspended, but there will be considerable warning time given the design freeboard and the storage volume within the lakes.	Lake levels should be part of weekly safety information provided to mine management. Outflow channels should be inspected weekly during the thaw and ice break-up. If overtopping is likely, a temporary spillway could be constructed and armoured to control and localize flow at shallow dike sections (e.g. abutment).
	(2) Dam crest settles more than 2 m over a distance of approximately 50 m. Not a credible failure mechanism. Observed settlement of the East Dike and Bay-Goose Dike crest during construction was on the order of 0.3 m to 0.5 m. Additional settlement is expected to be smaller in magnitude.	Same as (1).	The situation envisaged in this scenario should develop slowly with crest settlement evident. Monitoring of crest settlement is appropriate, and is included in the surveillance program. Rockfill and till are available from the mining operation can be placed to raise the dike crest, if settlement occurs.

Failure Mode	Scenario	Consequence	Monitoring/Action
Internal Erosion	(3) Dike Section: the low permeability element of the dikes Cutoff wall, jet grout columns, shallow foundation is defective, allowing high water flow through the structure. This defect could potentially erode zones of the dike and lead to loss of material from the dam (piping) increase the seepage, sinkholes in the crest.	The East Dike cutoff wall could progressively loose material, thereby increasing the hydraulic conductivity and resulting in an increased rate/volume of seepage through the dike and development of sinkholes in the dam crest. This is not likely to be a catastrophic failure mode as the rockfill shoulders of the dike will be stable and the filters are founded on or near bedrock. At its worst, this would lead to temporary flooding within the open pit of the mine and a cessation of mining. The Bay-Goose Dike cutoff wall system although similar to East Dike, has potential to lose more material from the dike structure, through piping as in the "deep sections" where jet grouting was conducted, downstream filter material does not extend to bedrock and a higher hydraulic head exists. Internal erosion could lead to increased seepage, sinkhole development, settlement of the crest, and although not probable, loss of containment.	Monitor seepage from downstream face for rate and volume, and for presence of sediment in seepage. Would become evident as localized intensive seepage at the dike toe or beyond. May also see settlement in the cutoff wall or dike crest. Will be most likely in deep water sections with higher gradients. Monitor piezometric and thermistor data for signs of increased flow through the cutoff wall and change in piezometric pressures. Selection of a remediation plan would be based on conditions encountered, but could include the installation of a downstream filter blanket and grouting.
	(4) Foundation: Till is non-uniform with more transmissive zones and zones of erodible material (i.e. silt layers) that may not be self-filtering. It is possible that material loss of the foundation tills and/or through the fractured bedrock with silt infillings could occur and result in high rates of seepage and a loss. Seepage could flow along the transmissive zone beneath the downstream rockfill section and erode the foundation tills at the downstream toe or into the downstream rockfill because of the lack of filtering.	Limited seepage at the toe or into the rockfill would accelerate into a larger flow and could lead to the undermining of the dike if no action was taken. This is a credible catastrophic failure mode if increased seepage is not detected in time.	Monitor seepage flow rates and condition and piezometric and thermistor responses for signs of increased seepage. Monitor dike crest for signs of sinkholes, settlement or slope instability. Remedial actions could comprise of grouting, a reverse filter and rockfill buttress depending on location of the flow and configuration of the foundation. In the worst case, the dewatered areas may be deliberately flooded in a controlled manner, the cutoff repaired, and the areas dewatered.
Seepage within Embankment	(5) Seepage on its own is not a credible failure scenario. The downstream rockfill shell has extremely high flow through capacity. The rockfill zone is both	No credible consequences. May require upgrade of the seepage collection system. May need to suspend mining activities while reducing seepage.	Seepage monitoring program.

Failure Mode	Scenario	Consequence	Monitoring/Action
	large and pervious, so that seepage will not daylight on the downstream face and lead to instability. Any seepage related failures must include internal erosion, see above.		
Seepage within Foundation	(6) Defective construction of cutoff system leading to transfer of unexpectedly high fraction of the reservoir head into the downstream part of the dike foundation, or leading to a piping event as described above (internal erosion).	This failure mechanism has caused embankment failures elsewhere because of pore pressure induced instability. However, at East Dike it is unlikely that it could cause failure of this dike. However, for Bay-Goose Dike this is more of a possibility. The most likely consequence is downstream toe slumping requiring a localized stabilizing berm before the crest roadway could be reinstated.	This mechanism is more likely to arise during dewatering. Monitoring of piezometric heads and thermistor string data.
Internal Conduit Rupture	(7) There are no internal conduits or other structures extending through the dikes.	Not applicable.	Not applicable.
Slope Instability	(8) Normal Operation: The rockfill shoulders of the dikes have high shear strength, making it a conservative design. For slope failure to be a concern, it requires failure in the foundation which would then extend into the overlying dike. Sliding failure is considered unlikely given the low horizontal forces generated by water and ice forces relative to the normal frictional force due to the weight of the dike and the friction angles of foundation materials.	A foundation failure would cause a rotational slip or sliding failure until equilibrium was reached. This mechanism would limit access along the dike until repaired. Failure through the rockfill shoulders will not necessarily compromise the water retaining element of the dikes. Failures which reach the core may cause failure.	This mechanism should develop during construction or dewatering, due to increased loads and associated pore water pressure. Initial stages of failure should be observable as tension cracks in the dike crest. Walk-over inspection of the dike by a trained inspector is an appropriate monitoring strategy. Survey of crest, face, and toe is also appropriate. Stabilizing berms can be placed inside the dike or through water along the upstream shoulder.
	(9) Pit Wall instability that extends towards the dike and causes instability of the dike	If the instability impacted the low permeability element of the dike, then failure of the entire structure and loss of mining operations could occur. This is more likely to be a cause of failure for the Bay-Goose Dike as the offset between the low permeability element and pit crest is much	Slope inclinometer monitoring of the cutoff wall. Pit wall stability monitoring. Depressurization of pit walls. Draining of lakebed soils between pit crest and dike and/or removal of these materials.

Failure Mode	Scenario	Consequence	Monitoring/Action
		less than for East Dike.	Adjustment of mine plan, if necessary.
	(10) Earthquake Induced: Occurrence of an extreme earthquake, much in excess of the current understanding of seismicity of the area.	The extreme earthquake loading for this site is a low magnitude. Settlement of the dike could occur in the event of a large earthquake. Dynamic compaction of the core in the East Dike and Bay-Goose Dike during construction may have subjected the rockfill shells to accelerations equivalent to the expected earthquake loading. This would not be a failure situation. The crest is also erosion resistant for any earthquake induced wave action in the impounded water.	Dike inspection following earthquakes felt on site.
Failure of Cutoff Wall Due to Movement of the Dike	(11) Differential horizontal movement of dike due to water or ice loading, or pit wall failure, or blast vibrations. Creates a breach in the cutoff wall system. Ice and water forces are not credible due to the ratio of frictional forces generated by the self weight of the dike versus ice loads and water pressure. Pit wall failure (see above).	Large inflows through the breach. Dewatered areas would flood requiring suspension of mining activities. Potential for loss of life for workers downstream of the dikes. Excessive vibration from overblasting could potentially damage the CSB and/or jet grout columns resulting in cracks or fissure, however the cement content within these portions of the wall should reduce the erodability of the wall and therefore protect the integrity of the dike, even though seepage rates would increase. It is anticipated that the SB material would deform adequately such that cracks would not be produced.	Prism monitoring for pit wall stability. Blast vibration monitoring on the dikes. Monitoring inclinometers within the cutoff wall.
Unexpected Settlements	(12) Unexpected foundation soils consolidate during dike construction. A significant quantity of clay that was not recognized during foundation excavation would be required to generate settlement required for a water release event. Settlement of the core will be limited.	2 m of settlement would be required to allow water flow through the rockfill and over the settled core. This flow would not cause failure of the rockfill shells. It would also be readily repaired by placing more end-dumped till into the settled zone.	Settlement monitoring of the dikes and visual inspection. Excessive settlements may be remediated by excavating rockfill above the core and placing more till.

Table 7-1 to be updated as necessary during operation

7.2 SURVEILLANCE PROTOCOLS

The surveillance program consists of several types of inspections:

During Dewatering:

- Daily Dewatering Inspection – carried out on an on-going basis by designated qualified mine personnel to assess the performance of the dikes during dewatering. Reporting can be daily if routine, or immediately if conditions warrant;

- Weekly Dewatering Inspection – carried out by designated qualified mine personnel, to assess the performance of the dikes during dewatering with reporting occurring weekly or immediately if conditions warrant; and

- Design Engineer Inspection – upon exposure of the downstream toe to view seepage and review the performance of the dike.

During Operations:

- Weekly Routine Inspection – carried out weekly by designated qualified mine personnel to assess operating of the seepage collection systems including the sumps and performance of the structures;

- Monthly Routine Inspection – carried out monthly by a designated qualified mine personnel to assess operating status of the seepage collection systems including the sumps, and performance of the structures;

- Engineering Inspection – carried out annually by a qualified engineer, during open water period, to verify that the facilities are functioning as intended; and

- Dam Safety Review – carried out by an independent engineer every five years to review all aspects of the design, construction, operation, maintenance, processes and other systems affecting the dam's safety, including the dam safety management system. The review defines and encompasses all components of the "dam system" under evaluation including the dam, foundations, abutments and seepage collection works.

7.3 RESPONSIBILITIES AND FREQUENCY

It is anticipated that the Engineering Superintendent and support personnel and/or the Environment Superintendent and support personnel and/or Mine Superintendent and support personnel will be responsible for the inspections of the Dewatering Dikes, seepage collection systems, instrumentation and access routes during dewatering and operation. The inspections by the Design Engineer and for the Dam Safety Review will be conducted by qualified independent engineers. The inspection, monitoring and review requirements are summarized in Table 7-2 and described in the following sections.

Table 7.2 Inspection, Monitoring and Review Requirements

Party Responsible	Required Inspection, Review or Monitoring	Required Frequency
Design Engineer	Dewatering Inspection	During dewatering once downstream toe is exposed
Engineering Superintendent and Principal Geotechnical Engineer; and/or Environment Superintendent and support personnel; and/or	Daily Dewatering Inspection	Daily and immediately following earthquakes, high intensity rainfall events and other extreme events
	Daily and Weekly Routine Inspection of Dewatering Dikes, seepage collection system, and access.	Weekly and immediately following blasting, large blasts occurring in close proximity to the structures, earthquakes, high intensity rainfall events and other extreme events
	Monitoring of instrumentation (thermistor strings, vibrating wire piezometers, inclinometers, survey prisms and monuments, pump rates, lake water levels)	Varies – see Section 8.0
Engineering Superintendent and Principal Geotechnical Engineer and/or designated qualified mine personnel	Weekly Dewatering Inspection	Weekly and immediately following earthquakes, high intensity rainfall events and other extreme events
	Monthly Routine Inspection of Dewatering Dikes, seepage collection system, and access.	Monthly and immediately following large blasts occurring in close proximity to the dikes, earthquakes, high intensity rainfall events and other extreme events
Qualified Engineer	Engineering inspection of the Dewatering Dikes, drainage works, access and instrumentation.	Annually
Independent Engineer	Dam Safety Review	Once every five years

7.3.1 Dewatering Inspections (Daily and Weekly)

Inspections during dewatering form part of the duties and responsibilities of the Engineering Superintendent, Principal Geotechnical Engineer and support personnel and the Environment Superintendent and support personnel and must be carried out by designated and qualified personnel. It is assumed that Daily Inspections maybe conducted by less knowledgeable staff and weekly inspections by more knowledgeable staff.

Ideally the inspections should be carried out by the same individual or by a small group in order to maintain continuity in the observations. The main operational and structural parameters should be reviewed and verified by the Engineering Superintendent, Principal Geotechnical Engineer and Environment Superintendent. Data collected will be summarized on the respective Dewatering Dike Field Inspection Sheets and stored for easy access and long term record keeping.

The following information should be noted and recorded in the inspection to detect signs of wear, damage or potential loss of structural integrity:

Dike Structure:

- compliance with minimum freeboard requirements:
- crest elevation;
- upstream water elevation; and
- downstream water elevation.

Crest:

- surface cracking; and
- local subsidence.

Upstream face conditions above water line:

- cracking;
- distortion or displacement;
- wave erosion; and
- slope angle.

Downstream face conditions:

- cracking;
- distortion or displacement;
- slumping;
- erosion;
- slope angle;
- seepage quantity and quality (turbidity); and
- wet areas.

Area downstream of dike toe:

- Seepage quantity and quality (turbidity);
- cracking;

- erosion;
- bulging; and
- indications of instability.

Abutments:

- indications of instability;
- erosion at dike – ground surface contact; and
- seepage appearing from abutments.

Barges, Dewatering ramps, and pumps:

- pumping rates and dewatering rate;
- water quality being pumped in regards to turbidity;
- conditions of the holding cables and location of the barge in the dewatering pool;
- presence of ice on the barge due to leaks; and
- general condition of the pumps and the presence of leaks (pumps or piping).

The inspection forms are included in Appendix A.

Photographs should be used to augment the inspection forms. As much as possible, these should be taken from the same vantage points during each inspection so that changes in conditions can be readily identified. Photographs shall be captioned or annotated with a date stamp.

The observations and/or events indicating a trend that are considered “triggers” requiring reference to action items and reporting procedures are outlined in the Emergency Preparedness Plan in Section 11. A summary of triggers for the dewatering inspection are:

- Increasing measurements in total suspended solids at dewatering pump intake or outlet;
- Decrease in the rate of dewatering, when not attributed to a decrease in the pumped volume;
- Instrumentation responses indicating seepage; and
- Increasing measurements in dike displacement such as crest heave/settlement or lateral movements.

7.3.2 Daily and Weekly Routine Inspections

Daily and Weekly Routine Inspections are part of the duties and responsibilities of the Engineering Superintendent, Principal Geotechnical Engineer and their support personnel and the Environment Superintendent and support personnel and must only be carried out by designated and qualified personnel. Ideally the inspections should be carried out by the same individual or small group in order to maintain continuity in the observations. The main operational and structural parameters should be reviewed and verified by the Engineering Superintendent, Principal Geotechnical Engineer and the Environment Superintendent.

Daily Routine Inspections are carried out by the geotechnical technicians as they perform their data readings and other daily duties on the dewatering dikes. Technicians are trained to watch for changes in the condition of the dewatering dikes, and report anything out of the ordinary to the geotechnical engineers so it can be investigated further. Technicians look for any signs of damage to the dikes and monitor seepage conditions daily. Data collected during the Daily Routine Inspections will be summarized on the respective Dewatering Dike Field Inspection Sheets (see Appendix A), and stored in a suitable location for easy accessibility and long-term record keeping.

Weekly Routine Inspections are carried out by the geotechnical engineers and are more detailed than the Daily Routine Inspections. A Weekly Routine Inspection will also occur if a Daily Routine Inspection discovers anything that needs to be investigated further.

The following information should be noted and recorded in the weekly inspection forms to detect signs of wear, damage, or potential loss of structural integrity:

<u>Dike Structure:</u>

- Compliance with minimum freeboard requirements:
- crest elevation; and
- upstream water elevation.

<u>Crest:</u>

- Any indication of cracking or settlement/subsidence;
- Upstream face conditions:
- surface cracking;
- distortion or displacement; and
- wave erosion.

<u>Downstream face conditions:</u>

- cracking;

- distortion or displacement;
- slumping;
- erosion; and
- seepage quantity and quality (turbidity) and wet areas.

Abutments:

- indications of instability;
- erosion at dike – ground surface contact; and
- seepage appearing from abutments (quantity and quality).

Downstream toe of dike:

- seepage quantity and quality (turbidity);
- changes on surface;
- cracking;
- erosion;
- bulging;
- soft wet zones;
- accumulation of fines/silts; and
- ice.

Ditches / Seepage Collection System:

- changes in surface;
- indication of cracking;
- erosion;
- bulging;
- soft wet zones;
- accumulation of fines/silts; and

- ice blockage.

Sumps:

- changes in surface;
- indication of cracking;
- erosion;
- bulging;
- soft wet zones;
- accumulation of fines/silts; and
- ice blockage.

Pumping structures and pipelines:

- leaks; and
- function at capacity.

Seepage:

- rates and location;
- water quality, specifically the presence of fines (tubidity); and
- access.

Other:

- Review of general condition of the access to the Dewatering Dikes, along the Dewatering Dikes crest surface and access to seepage collection system, including sumps and pumping system at the downstream toe;
- Indications of instability (e.g. potholes, slumping or cracks, in the road or path or the cut slopes above them); and
- Accumulations of debris or other materials on the road or paths.

Sample inspection forms are included in Appendix A.

Photographs shall be used to augment the inspection form. As much as possible, these are to be taken from the same vantage points during each inspection so that changes in conditions can be readily identified. Photos should be annotated or captioned and should include a date stamp.

The observations and/or events indicating a trend that are considered “triggers” requiring reference to action items and reporting procedures are outlined in the Emergency Preparedness Plan (see Section 11).

7.3.3 Monthly Routine Inspections

Monthly Routine Inspections form part of the duties and responsibilities of the Engineering Superintendent and Principal Geotechnical Engineer and must only be carried out by designated and qualified personnel. It is assumed that Monthly Routine Inspections will be carried out by more experienced personnel then the Daily/Weekly Routine Inspections. Ideally the monthly inspections should be carried out by the same individual in order to maintain continuity in the observations. The main operational and structural parameters should be reviewed and verified by the Engineering Superintendent, Principal Geotechnical Engineer and the Environment Superintendent. Data collected will be summarized on the respective Dewatering Dike Field Inspection Sheet, and stored for easy accessibility and long term record keeping.

The monthly inspection will require the inspector review the same items as in the weekly inspections described above, with the following additional items:

- Review and comment on results of performance monitoring instrumentation; and
- Review operational performance and confirm that the original design assumptions are still valid.

7.3.4 Engineering Inspection

An annual inspection of each of the Dewatering Dikes should be carried out by a qualified engineer. The objective of the inspection is to carry out a detailed review of the conditions of the facilities and facility operations. This will provide information to be used to revise the operation, maintenance and surveillance programs as necessary and to assist in planning for future operation of the facility.

Each inspection should address the following:

- Review of inspections performed during dewatering;
- Review and comment on results of weekly and monthly inspection reports;
- Review and comment on results of performance monitoring instrumentation;
- Review operational performance criteria and confirm that the original design assumptions are still valid; and
- Review and provide recommendations regarding operation, maintenance and monitoring for the following year.

7.3.5 Dam Safety Review

An independent engineer should carry out a dam safety review of the Dewatering Dikes and associated facilities at five year intervals or after:

- Major modifications to the design or design criteria;
- Discovery of unusual conditions that can endanger the dikes;
- After extreme hydrological or seismic events; and
- Decommissioning.

The high consequence failure rating based on the Dam Safety Guidelines (CDA, 2007) suggests a review every seven years. A five year interval is recommended given that the operational life of the East Dike and Bay-Goose Dike is approximately 9 and 8 years, respectively. The review shall be carried out according to the recommendations laid out in the Dam Safety Guidelines (CDA, 2007).

This review will include, but is not be limited to:

- Review of the dikes classification;
- Site inspection;
- Review of design and construction records;
- Review of monitoring practices and the instrumentation records
- Update of the stability assessment based on the results of the instrumentation readings obtained to that time, construction records and site observations;
- Assessment of the operation of the facilities;
- Review of OMS Manual; and
- Review of emergency plan and response plans.

SECTION 8 • MONITORING AND INSTRUMENTATION

Monitoring of the Dewatering Dikes is carried out for the purpose of:

- Environmental monitoring during dewatering and operation;
- Assessing physical stability of the structure during dewatering and operation;
- Assessing overall performance of the dikes; and
- Aiding in design of future dikes.

Monitoring complements the Surveillance of the Dewatering Dikes and should be taken into account in combination with the routine surveillance described in Section 7.0.

Monitoring is divided into the following aspects:

- Drawdown rate and water quality during dewatering;
- Geotechnical instrumentation including piezometers, thermistors, inclinometers, survey prisms, etc.; and
- Seepage rates and water quality during operation.

8.1 DEWATERING – DRAWDOWN RATE AND WATER QUALITY

The water quality criteria for discharge are listed in Nunavut Water Board Water License 2AM-MEA0815 Part D, item 16 and into the Metal Mining Effluent Regulation. The water quality data collection protocols and schedule are included in the Water Management Plan.

8.2 GEOTECHNICAL MONITORING

The existing geotechnical instrumentation is shown in the as-built drawings for each dewatering dike.

Section 3.0 of this document describes the existing geotechnical instrumentation of the Dewatering Dikes.

8.2.1 Data Collection Protocols and Schedule

Upstream and downstream elevations of Second Portage Lake and Third Portage Lake water and ice levels, if applicable, should always be recorded when piezometer readings are recorded and when the survey prisms and monuments are monitored.

The following sections describe the routine geotechnical monitoring program of permanent instrumentation and are summarized in Table 8.1 below.

Table 8.1 Geotechnical Instrumentation Monitoring Program

Instrumentation	Monitored By	Reported To	Frequency during Dewatering	Frequency during Operations
Piezometers	Manually by Engineering Personnel during dewatering; and Automatically during operations (overseen by Engineering Personnel)	Engineering Superintendent	Daily / every 3 hours	Daily / every 3 hours
Slope Inclinometer Casings	Manually by Engineering Personnel during dewatering; and Manually during operations (overseen by Engineering Personnel)	Engineering Superintendent	Monthly	Monthly in winter, bi-monthly for the rest of the year
Thermistors	Manually by Engineering Personnel during dewatering; and Automatically during operations (overseen by Engineering Personnel)	Engineering Superintendent	Daily / every 3 hours	Daily / every 3 hours
Surface Monuments and Surface Prisms	Manually by Engineering Personnel during dewatering; and Manually during operations (overseen by Engineering Personnel)	Engineering Superintendent	Not Operational	Bi-Weekly
Seismographs	Manually by Engineering Personnel during dewatering; and Manually during operations (overseen by Engineering Personnel)	Engineering Superintendent	During blasting at the Portage Pit or Goose Island Pit adjacent to the dikes	During blasting at the Portage Pit or Goose Island Pit adjacent to the dikes

The frequency of monitoring will depend, to some degree, on preceding data and on the state of operation. Thus the data is reviewed regularly and the Engineering Superintendent may change the program and amend the OMS Manual as necessary.

Measurements and a review of all instrumentation shall be carried out immediately after significant seismic or climatic events.

An automatic data acquisition system is used to collect data from the piezometers and thermistors. The automatic data acquisition system includes data loggers and instrumentation cabins along the dikes crest. The data collected is downloaded every three hours. Each cabin is supplied with electricity through solar panels and a backup battery.

The equipment for monitoring is maintained by designated mine personnel. Data analysis, review and correction are carried out by the Engineering personnel and reported to the Engineering Superintendent.

8.2.1.1 Thermistors

Data presentation for the thermistors should include:

- temperature vs. time plots (presenting all thermistor beads on each string); and
- temperature vs. depth plots over time.

The plots should indicate the thermistor string reference number and dates of the measurements. Additionally the plots should also indicate air temperature and, if relevant, lithology and both elevations and depths.

8.2.1.2 Survey Monuments and Prisms

The lake elevation is recorded at the same time the survey monuments and prisms are measured. All survey work must be carried out to a minimum precision of 3 mm.

Data presentation for the survey monuments should include:

- total net movement plots (to present total displacement);
- vertical displacement plots; and
- lateral displacement plots parallel and perpendicular to the dike axis.

The plots should indicate the survey monument number, what is considered positive and negative movement (for example, downstream/upstream, heave/settlement) and the dates of the measurements.

8.2.1.3 Slope Inclinometer Casings

The vertical and horizontal position of the top of the inclinometer casing will be recorded by surveying when the slope inclinometers readings are taken. All survey work must be carried out to a minimum precision of 3 mm.

Data presentation for the slope inclinometers should include:

- cumulative displacement plots (to view total displacement);
- incremental displacement plots (to present increasing or accelerating movements between readings);
- cumulative displacement at crest versus time; and

- time plots at zones of identified displacement.

The plots should indicate the slope inclinometer number, what is considered positive and negative movement (for example, downstream/upstream, heave/settlement) and the dates of the measurements. Both elevations and depths should be presented together with the lithology.

8.2.1.4 Vibrating Wire Piezometers

Data presentation for the vibrating wire piezometers should include:

- plots of total head as elevation versus time; and
- plots of temperature versus time for piezometers.

The plots should indicate the vibrating wire piezometers number and dates of the measurements. Additionally the plots should also indicate upstream lake elevation or ice level and, if relevant, lithology and both elevations (referred to the mine datum) and depths.

8.2.1.5 Seismographs

Data presentation for the seismographs should include:

- Weekly summary graph showing peak accelerations registered versus the time when they occurred.

The plots should also indicate the seismograph readout identification, date and location.

8.2.2 Anomalous Instrumentation Data

Anomalous instrumentation data includes the following:

Thermistors:

- Increase or decrease in measurements (over two or more readings) that cannot be explained by seasonal temperature variations;

Survey monuments and prisms:

- Accelerating displacement rate of the survey monuments

  (x, y, z directions) (over two or more readings);

Inclinometers:

- Cumulative increases in displacement (greater than 3 cm);

Piezometers:

- Increases or decreases in pore water pressure measurements that cannot be explained by seasonal lake level variations; and

Seismographs:

- Vibrations during a blast are not observed.

If anomalous readings are observed, the following actions should be taken:

- Inspect the dike where possible and appropriate;
- Check data, reductions and calculations for accuracy and correctness;
- Re-read to check the reading;
- Check readout equipment to verify that it is functioning correctly;
- Verify calibration;
- If instrument has stopped functioning, notify the Engineering Superintendent immediately. If considered critical, a replacement instrument should be installed;
- If the anomalous reading is confirmed, a detailed review of the effects of the reading should be carried out and design or remedial actions should be implemented if determined necessary by the Engineering Superintendent; and
- Increase monitoring frequency to assess progression of anomaly.

8.3 SEEPAGE MONITORING - OPERATIONS

Seepage and runoff will be collected and conveyed in drainage ditches at the downstream toe of the East Dike and Bay-Goose Dike to sumps located at topographic lows. The rate of seepage and quality of seepage should be monitored during operations.

8.3.1 Data Collection Protocols and Schedule

The rate of seepage and run-off will be monitored indirectly by monitoring and recording pumping rates. The seepage location and elevation along the face should be noted during inspections. The water quality should be monitored daily by visual observations for sediments (turbidity). Visual inspection should document sediment, ice or snow deposits in the ditches and sumps. The data shall be collected by designated mine personnel and reviewed by the Engineering Superintendent. The Engineering Superintendent may change the sampling frequency and amend the OMS Manual as necessary.

8.3.2 Anomalous Measurements

Anomalous measurements of the seepage may occur and include the following:

- Increase or decrease in pump rates that are inconsistent with rainfall or runoff events;
- Sediments present in the seepage water; and
- Changes in seepage location, flow, and quality.

If anomalous readings are observed, the following action should be taken:

- Inspect the seepage collection area;
- Check data, reductions, and calculations for accuracy and correctness;
- Re-read to check the reading;
- Check readout equipment to verify that it is functioning correctly;
- Verify calibration;
- If instrument has stopped functioning, notify the Engineering Superintendent immediately. If considered critical, a replacement instrument should be installed;
- If the anomalous reading is confirmed, a detailed review of the effects of the increased seepage should be carried out and design or remedial actions should be implemented if determined necessary by the Engineering Superintendent; and
- Increase monitoring frequency to assess progression of anomaly.

SECTION 9 • REPORTING PROCEDURES AND DATA MANAGEMENT

9.1 REPORTING PROTOCOLS

9.1.1 Inspection Documents

All inspection documents and reviews shall be reported to the General Manager, Engineering Superintendent and the Environment Superintendent.

9.1.2 Instrumentation Measurements

All geotechnical instrumentation measurements shall be reported to the Engineering Superintendent. Pumping rates during dewatering and operation shall be reported to the Engineering Superintendent.

9.1.3 Emergencies

All documents regarding instrumentation and inspections prior to an emergency and during an emergency shall be provided to all parties involved including the General Manager, Engineering Superintendent, Environment Superintendent, and Design Engineer.

9.2 DATA MANAGEMENT

An electronic library or database, which is easily accessible, shall be set up to catalogue and store inspection documents, maintenance reports and instrumentation measurements. Hard copies shall also be catalogued and stored on site. The following will be stored in the hard copy and electronic format:

<u>Dewatering:</u>

- Daily dewatering inspection report; and
- Instrumentation measurements.

<u>Operations:</u>

- Daily routine operating and structural inspection;
- Monthly routine operating and structural inspection;
- Engineering inspection;
- Dam Safety Review;
- Planned and un-planned maintenance reports; and
- Instrumentation measurements.

SECTION 10 • DECOMMISSIONING

10.1 GENERAL

The decommissioning of the dikes will take place progressively as the Dewatering Dikes are breached and the northwest arm of Second Portage Lake and Bay-Goose Basin are allowed to flood.

The main objectives of the decommissioning are:

- Maintain dike stability;
- Meeting applicable water quality objectives;
- Sequential pit flooding in a controlled manner; and
- Maintain 1 m head difference across the East Dike at closure.

10.2 EAST DIKE EMBANKMENTS

The East Dike will remain intact during the controlled flooding of the Portage Pit and Goose Island Pit areas in order to isolate flooded pit waters from Second Portage Lake. The pit areas are flooded gradually over the course of several years. Once the water levels have stabilized within the flooded pit and water quality is considered acceptable for mixing with neighbouring lakes, parts of the other dewatering dikes will be decommissioned to allow circulation of pit water and lake water.

The East Dike will remain, preserving the 1 m difference in elevation between Third Portage Lake and Second Portage Lake.

10.3 SEEPAGE COLLECTION SYSTEM

The sumps and ditches at the downstream toe of the Dewatering Dikes will be flooded at closure. All pumps, pipe, and equipment shall be removed prior to flooding.

10.4 INSTRUMENTATION AND MONITORING

Long-term inspection shall be carried out to ensure the adequate performance of the post-closure facility.

SECTION 11 • EMERGENCY PREPAREDNESS PLAN

The Dam Safety Guidelines prepared by the Canadian Dam Association (2007) states that "A dam which does not impose an unacceptable risk to people or property, and which meets safety criteria that are acceptable to the government, the engineering profession and the public is a safe dam".

This guiding principle has been taken into account for the design of the dewatering dike embankments and the emergency procedures.

The East Dike and Bay-Goose Dike are rated as "High Consequence of Failure" (CDA 2007) as discussed in Section 1.3. The South Camp Dike and Vault Dike are rated as a "Significant Consequence of Failure" (CDA 2007) as discussed in Section 1.3.

To respond to possible hazards and emergencies involving the dewatering dikes, emergency response plans have been designed. This section provides a summary of the actions, triggers and measures in the event of an emergency.

In case of an emergency, the documents listed in Table 12.1 shall be referenced. The Emergency Response Plan (ERP) shall also be referenced. The Dike Failure Scenario Appendices from the ERP are included in Appendix B.

11.1 EMERGENCY PROCEDURES

The purpose of the Emergency Preparedness Plan (EPP) is to present a basic procedure for responding to potential failure mechanisms. The procedure identifies various measurable or observable effects or causes of the failure mechanisms and identifies the appropriate people to notify. Potential failure mechanisms are summarized in Table 12.2 with potential measurable and observable causes and effects.

11.1.1 Operation

Table 12.3, 12.4, 12.5 and 12.6 summarizes the triggers for implementing the EPP for each of the dewatering dikes with respect to the potential measurable and observable effects or causes of the various failure mechanisms.

Table 12.7 indicates the chain of communication to follow so persons in charge are notified for different states of emergency.

Table 12.8 indicates the responsibilities of persons for each emergency level in terms of who performs the decision making, mobilization, and action to be taken.

Table 12.9 indicates the names and contact numbers of the persons in charge during an emergency event.

11.2 EMERGENCY DETAILS

In the unlikely event of a catastrophic dike breach that could endanger workers the Code 1 procedure described in Section 11.2.4 would be followed to warn all workers of the situation. Then an evacuation of the affected areas and pits would be carried out and directed by the ERT Team in person and over the emergency channel. In the event of an embankment failure, the following information should be used during the emergency response:

Project Name: Meadowbank Gold Project

Dike Names: East Dike, Bay-Goose Dike, South Camp Dike, Vault Dike

Owner's Name: Agnico Eagle Mines Limited (867) 793-4610

Lake Name: Second Portage Lake /Third Portage Lake /Wally lake

Site Location: Latitude: 65°01'07''N Longitude: 96°04'26''W

11.2.1 Access to the Project Site

- 80 km north of the Hamlet of Baker Lake
- Site accessible by all-weather road from Baker Lake.
- Site accessible by aircraft and helicopter.

	Name	Phone Number
Local Charter Company:	Calm Air International Ltd.	Baker Lake : (867) 793-2873
Local Helicopter Company:	Kitikmeot Helicopters Ltd	(867) 983-2544
Charter Aircraft Company:	Propair-Nolinor	(514)631-3000

11.2.2 Emergency Assessment and Risk Assessment

In case of an event, emergency assessment will be done first by AEM Geotechnical Engineering personnel and the Engineering Superintendent on site. Assessment will be done according the criteria stated in the Table 12.2 and Table 12.3, 12.4, 12.5, 12.6.

11.2.3 Emergency Communication and Actions

In case of an event, after the emergency assessment, the persons involved in the emergency response need to be notified following the chain of command stated in Table 12.7. Contact details of each person are available in Table 12.9.

According to the state of the event, decision and action plan will be taken by the persons notified. Action plan will be defined according to the level of emergency and the cause of the event. Immediate action plan will be taken with material and equipment available on site, as listed in Section 11.4.

Table 12.10 is based on Appendix A of the AEM Emergency Response Plan, which describes the risk of failure for East Dike and Bay-Goose Dike and provides contingency or corrective actions for possible failure mechanisms.

Table 12.12 is the risk assessment for East Dike, Bay-Goose Dike, South Camp Dike and Vault Dike. The ratings for the likelihood and consequence of failure have been included for the risk assessment in Table 12.11. The overall risk rating is the product of the likelihood and consequence ratings. The overall risk rating of the structure for the identified failure mechanism can then be determined. The controls which are in place can potentially reduce the overall risk rating.

11.2.4 Site Emergency Procedure

As specified in the Emergency Response Plan, Ver. 6, Section 4:
In the event of an immediate emergency that is or could impact persons or equipment, the employee will have to follow our emergency procedure:

- Emergency is initiated - by calling **6911** on desk type phones, or calling on two-way radio on **"Working Channel" – Code 1 – Code 1 – Code 1.**
- All communication stops except for those involved with the Emergency – i.e.: First Aid Room attendants, Medics, ERT as required.
- All work stops in First Aid Room / Clinic – and in affected area – depending on seriousness of Emergency – the whole site.
- First Aid Room Attendant / Medic will answer the phone and/or radio.

  Note: if the First Aid Room Attendant / Medic do not answer, then Security Guard will answer and/or a Supervisor on radio will answer so that Emergency Response can be initiated.
- **Responder –** will ask where the medic is required.
- **Caller –** will give a brief description of the Emergency – name, location and what is wrong and/or required.
- **Responder –** will confirm location and details of incident and activate the **ERT** team. Security will be notified by responder and a page will be sent out to all **ERT** team members on site. (All **ERT** team members on site now carry pagers).
- The person at the casualty(s) will administer First Aid if trained to do so.
- Incident Commander Center will be immobilized as to ensure that communications, transportation, and effective deployment of **ERT** resources are conducted. It is mandatory that the Official In-Charge be notified immediately.
  - Transportation will be arranged to meet at the **ERT** hall by the two large doors for medical gear and **ERT** team members.

The **ERT** team (minimum of 6 team members) will assemble as quickly as possible. (Expectation – when the page goes off – all **ERT** team members will make their way expediently to the **ERT** hall.

11.2.5 Communication Equipment Location

Communication equipment can be found at the following locations (*to be updated if required*):

- 3 phone land lines are located in the main office;
- Base station radios are located in the main office;
- Drills will have either base station radios or handhelds—depending on their distance from camp and will have satellite phones available; and
- Emergency Communication Plans (including emergency contact numbers) are located adjacent to all phones and radios and in each drill.

11.3 MEDICAL AND FIRST AID SERVICES

In case of injury the medic and First Aid station are located in the Service Building. The first aid channel on the radio is 1. The nearest hospital is located in Baker Lake.

Health Center: Baker Lake Health Center *Phone #:* (867) 793-2816

11.4 ON SITE EQUIPMENT AND MATERIAL

11.4.1 Pumping Equipment

The following is a list of onsite pumping equipment available for use during an emergency event:

Unit Number	Description	Model
61PWA01	Dewatering pump #1	Godwin model HL250M
61PWA02	Dewatering pump #2	Godwin model HL250M
61PWA03	Dewatering pump #3	Godwin model HL250M
61PWA04	Dewatering pump #4	Godwin model HL250M
61PWA05	Dewatering pump #5	Godwin model HL250M
61PWA06	Dewatering pump #6	Godwin model HL250M
61PWA07	Pit Dewatering pump #7	Godwin model CD80M
61PWA08	Pit Dewatering pump #8	Godwin model CD80M
61PWA09	Dike Dewatering pump #9	Godwin model CD100M
61PWA10	Dike Dewatering pump #10	Godwin model CD103M
61PWA11	Dike Dewatering pump #11	Godwin model CD103M
61PWA12	Dike Dewatering pump #12	Godwin model CD103M
61PWA13	Pit Dewatering pump #13	Godwin model HL5MS
61PWA14	Pit Dewatering pump #14	Godwin model HL5MS

Unit Number	Description	Model
61PWA15	Bay-Goose Seepage dewatering pump #9	Godwin model CD103M
61PWA16	Bay-Goose Seepage dewatering pump #10	Godwin model CD103M

Note: To be updated as required

11.4.2 Mobile Equipment

The following are lists of onsite mobile equipment of AEM and FGL available for use during an emergency event:

AEM Mobile Equipment List (to be updated as required)

MODEL	EQUIP. #
LOADING	
RH 40	BAC01
345CL	BAC02
307	BAC03
345D	BAC05
385C	BAC06
345DL	BAC07
RH120	BAC10
RH120	BAC11
RH120	BAC12
IT14G	LOA02
992G	LOA03
992G	LOA04
980H	LOA12
DOZER	
D8T	DOZ01
D9T	DOZ02
D9T	DOZ05
D9T	DOZ06
D9T	DOZ07
834H	DOZ08
GRADER	
16M	GRA03
16M	GRA04
HAULING	
777F	HTR01
777F	HTR02
777F	HTR03
777F	HTR04
777F	HTR05
777F	HTR06
777F	HTR07
777F	HTR08
785B	HTR20
785B	HTR21
785B	HTR22
785D	HTR23
785D	HTR24
785D	HTR25
785C	HTR26
785C	HTR27
785C	HTR28
785D	HTR29
785D	HTR30
777B	HTR10
773E	HTR09
DRILL	
DM45E	RBD01
DM45E	RBD02
DM45E	RBD03
DM45E	RBD04
CM785	RBD05
DML	RBD06
DML	RBD07
DML	RBD08
HANMER	
V58	HAM01
V58	HAM02
BUS	
H77 (SS)	BUS01
E-350	BUS02
E-350 (SS)	BUS03
VAN E350	BUS04
32006-S (SS)	BUS05
E-350	BUS06
S30	BUS07
3800	BUS08
3800	BUS09
SITE SERVICE	
330D	BAC04
DOZER	
D8R	DOZ03
D8T	DOZ09
GRADER	
16H	GRA01
160H	GRA02

MODEL	EQUIP. #
LOADER	
IT14G (SS)	LOA01
420E (SS)	LOA05
966H (SS)	LOA06
TC44H (SS)	LOA08
966H (SS)	LOA09
980H (SS)	LOA10
420E	LOA11
TRUCK	
T800	TRK01
KENWORTH	TRK02
KENWORTH	TRK03
KENWORTH	TRK04
TRUCK (SS)	TRK05
KENWORTH	TRK06
FRD WATER	TRK07
SEPTIC	TRK08
HIAB	TRK09
CEMENT	TRK10
CEMENT	TRK11
Truck	TRK12
KENWORTH	TRK14
KENWORTH	TRK15
TRUCK (SS)	TRK16
FUEL	TRK17
GARBAGE (SS)	TRK18
FIRE TRUCK	TRK19
FUEL	TRK21
S.Plow	TRK22
S.Plow	TRK23
STEAMER	TRK24
Fountaine T.	TRK29
LUB	TRK30
Service	TRK31
AIR PLANE FUEL TANKER	TRK32
LUB	TRK33
SHOP	TRK34
FUEL	TRK35
S.Plow	TRK36
Service Truck	TRK38
GENSET	
XQ2000	GEN01
XQ2000	GEN02
XQ2000	GEN03
3412	GEN05
XQ202	GEN06
XQ202	GEN07
3508	GEN08
C6T	GEN09
C6T	GEN10
DQHE	GEN11
DQCG	GEN12
D200P	GEN13
D100P4S	GEN14
D100P1SX	GEN15
D30-8	GEN16
D25-8S	GEN17
D25-8S	GEN18
D13-4S	GEN19
D13-4S	GEN20
QAS30	GEN21
QAS30	GEN22
DSFAE	GEN23
3412	GEN24
3412	GEN25
GEH220-2	GEN26
D200P3	GEN27
DSKAA	GEN28
DSKAA	GEN29
QAS30	GEN30
QAS38	GEN31
?	GEN32
D30-10 (SS)	GEN33
QAS 30	GEN34
QAS 30	GEN35
D30-10	GEN36
8081AF001	GEN37
D30-10	GEN38
D30-8	GEN39

MODEL	EQUIP. #
PICKUP	
F-350	PCK01
F-350 (SS)	PCK02
F-350	PCK03
F-350	PCK04
F-350	PCK05
F-350	PCK06
F-350	PCK07
F-350	PCK08
F-350	PCK09
F-350	PCK10
F-350	PCK11
F-350	PCK12
E-350	PCK13
F-350	PCK14
F-350	PCK15
F-350	PCK16
F-350	PCK17
F-350	PCK18
F-250	PCK19
F-250	PCK20
F-250	PCK21
F-350	PCK22
F-350	PCK23
F-250	PCK24
F-250	PCK25
F-250 (SS)	PCK26
F-250 (SS)	PCK27
F-250	PCK28
F-250	PCK29
F-250 (SS)	PCK30
F-250	PCK31
F-250	PCK32
F-250	PCK33
F-250	PCK34
F-250	PCK35
F-250	PCK36
F-250	PCK37
F-250	PCK38
E-350	PCK39
F-250	PCK40
F-250	PCK41
F-250	PCK42
F-350	PCK43
F-250	PCK44
F-350	PCK45
F-250	PCK46
F-250	PCK47
F-250	PCK48
F-250	PCK49
F-250	PCK50
F-250	PCK51
F-450 WH	PCK52
F-250	PCK53
F-250	PCK54
F-250	PCK55
F-250	PCK56
F-250	PCK57
F-250	PCK58
F-250	REN56
ATV	
	ATV02
	ATV03
	ATV05
BOAT ENGINE	
	ENG56
	ENG57
COMPACTOR	
	CPT01
	CPT02
EMERGENCY VEHICULE	
SNOWCAT	SNC01
FORK LIFT	
HYSTER RH35	FKL02
CAT (WH)	FKL03
RZ2	FKL04
CAT	FKL05
CAT (SHOP)	FKL06
740DR321T	FKL07
ETDR40TT	FKL08
HYSTER	FKL09

MODEL	EQUIP. #
FROST FIGHTER	
IDF-350	HEA01
IDF-350	HEA02
IDF-350	HEA03
IDF-350	HEA04
IDF-350	HEA05
IDF-350	HEA06
IDF-350	HEA07
IDF-350	HEA08
IDF-350	HEA09
IDF-350	HEA10
IDF-350	HEA11
IDF-350	HEA12
IDF-350	HEA13
IDF-350	HEA14
FROST FIGHTER	
MOBILE TANK	MFT01
GÉNIE	
GS3232	SCI05
S85	SCI06
Z-45/25	SCI07
Z-45/25	SCI08
S85	SCI11
S85	SCI12
S125	SCI13
S125	SCI14
S85	REN07
Crane	
120T (SS)	MCR01
80T (SS)	MCR02
35T (SS)	MCR03
90T (SS)	MCR04
25T (SS)	MCR05
200T	MCR06
LIGHT TOWER	
AL5060D	LGT01
L-20	LGT02
L-20	LGT03
L-20	LGT04
L-20	LGT05
L-20	LGT06
L-20	LGT07
L-20	LGT08
LTC4	LGT09
LTC4	LGT11
LTC4	LGT12
LT5000-4MH	LGT18
MECHANICAL SERVICE TRUCK	
SERVICE	WMM02
MULE	
OBSOLETE	VSE01
Mule	VSE02
Mule	VSE03
Mule	VSE04
Mule	VSE05
Mule	VSE06
Mule	VSE07
Kubota	VSE08
Kubota	VSE09
Kubota	VSE10
Mule	VSE11
SKID STEER	
262C	SKD01
753	SKD02
262C	SKD03
SNOW BLOWER	
SNOW BLOWER	SBL01
SNOW BLOWER	SBL02
HYSTER HANDLER	
GTH844	TPA01
GTH844	TPA02
HR45 (SS)	TPA03
PETER	TPA03P
1056C (SS)	TPA04
SPARE	TPA05
INGERSOLL RAN	REN15
COMPRESSOR	
	COM01
SULLAIR	COM02
SULLAIR	COM03

MODEL	EQUIP. #
TRAILER	
TANKER	TRL01
LOW BED	TRL04
LOW BED	TRL05
FUEL TANK	TRL06
FUEL TANK	TRL07
LOW BOY	TRL08
FIRE PUMP TRAILER	TRL09
WELDING MACHINE	
400D	SMD01
WITH AIR PACK	SMD02
500P WIT AIR	SMD03
WITH AIR PACK	SMD05
RH120 BUCKET	
Bucket 01	
Bucket 02	
Bucket 03	
Bucket 04	
345 BUCKET	
Bucket 01	
Bucket 02	
Bucket 03	
Bucket 04	
385 BUCKET	
Bucket 01	
Bucket 02	
992 BUCKET	
Bucket 01	
Bucket 02	
Bucket 03	
Bucket 04	
TRUCK BOX REPAIR	
TRUCK BOX	BOX01
TRUCK BOX	BOX02
TRUCK BOX	BOX03
TRUCK BOX	BOX04
TRUCK BOX	BOX05
TRUCK BOX	BOX06
TRUCK BOX	BOX07
TRUCK BOX	BOX08
TRUCK BOX	BOX09
TRUCK BOX	BOX10
TRUCK BOX	BOX11
TRUCK BOX	BOX12
TRUCK BOX	BOX13
TRUCK BOX	BOX14
TRUCK BOX	BOX15
TRUCK BOX	BOX16
TRUCK BOX	BOX17
TRUCK BOX	BOX18
TRUCK BOX	BOX19

FGL Mobile Equipment List (to be updated as required)

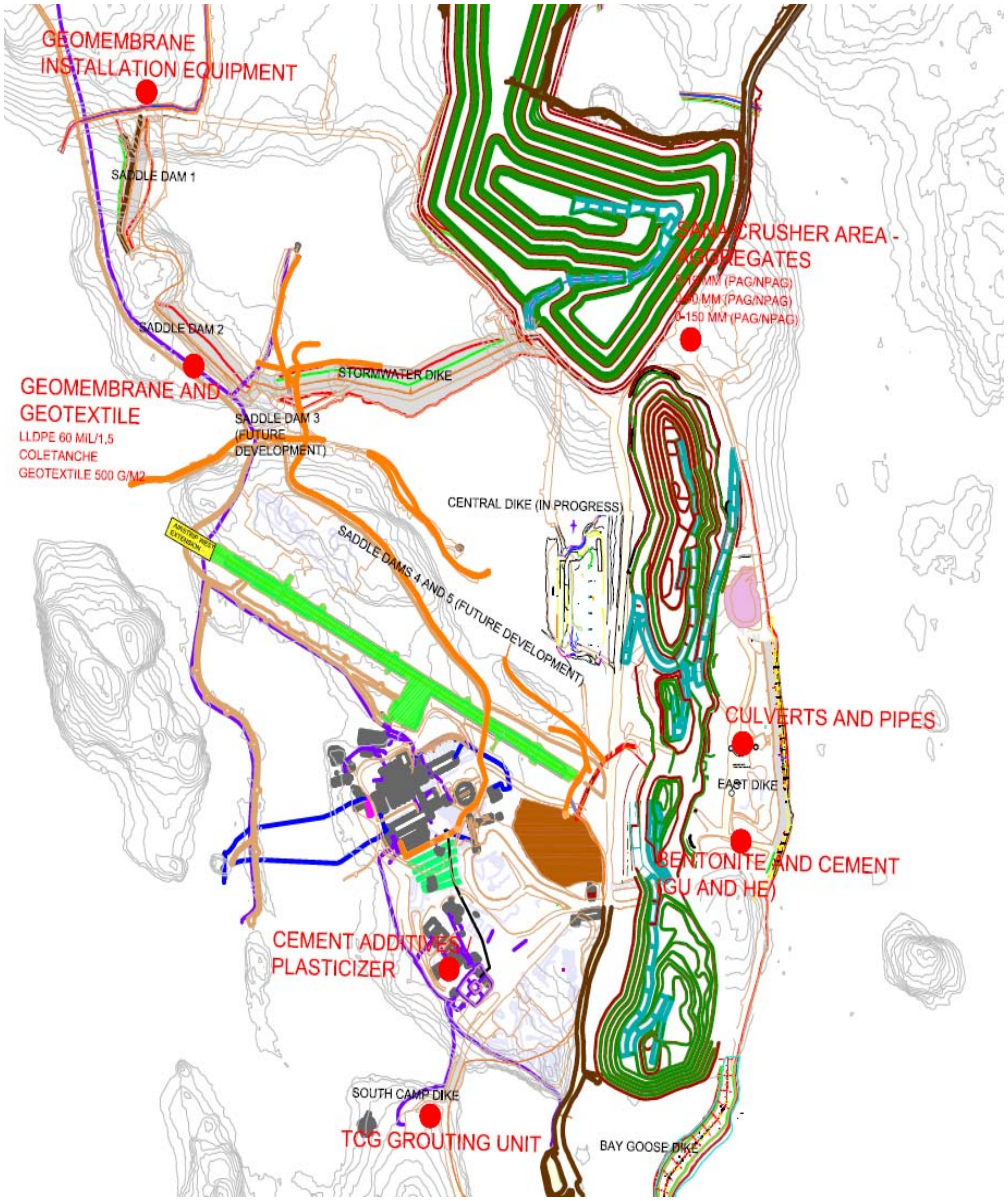
Qamanittuaq SANA FGL HEAVY EQUIPMENTS

SHOVELS		
TYPE	UNIT NUMBER	Models
PC 1250	11-0303	Komatsu
385	395	Caterpillar
385	1333	Caterpillar
365	1313	Caterpillar
345	11-0301	Caterpillar
345	393	Caterpillar
GRADER		
TYPE	UNIT NUMBER	OPERATOR NAME
14-M	513	Caterpillar
HAULING TRUCKS		
TYPE	UNIT NUMBER	OPERATOR NAME
773	1516	HTR 773F
773	1517	HTR 773F
773	1518	HTR 773F
773	1519	HTR 773F
773	1520	HTR 773F
773	1535	HTR 773F
773	1536	HTR 773F
740	1522	HTR 740
740	1530	HTR 740
100T	11-1001	TR 100
100T	11-1002	TR 100
100T	11-1003	TR 100
100T	11-1004	TR 100
DOZERS		
TYPE	UNIT NUMBER	OPERATOR NAME
D6	441	Caterpillar
D8T	438	Caterpillar
D8T	443	Caterpillar

11.4.3 Earthwork Material and Equipment

The following map presents the earthwork material, including geomembrane and cement, available on site in case of an emergency.

Figure 13 Earthwork Material and Equipment Location



SECTION 12 • EMERGENCY RESPONSE REFERENCE DOCUMENTS

Table 12.1 Emergency Response Reference Documents

Document	Current Revision
Emergency Response Plan	Updated by AEM. Version 6, August 2013
Emergency Preparedness Plan	In Dewatering Dikes OMS Manual, Version 2, August 2013

Note: To be updated as required

Table 12.2 Potential Effects or Causes of Failure Mechanisms

Failure Mechanism	Potential Measurable and Observable	
	Causes	**Effects**
Overtopping	(1) Lake level rise. (2) Dam crest settlement	Increase of seepage leading to erosion of downstream foundation soils and associated crest settlement.
Internal Erosion	(1) Loss of cut-off wall/liner at construction defects in cut-off wall/liner, Core Backfill and filter. (2) Loss of bentonite from cut-off wall at defect in construction (3) Loss of till foundation at defect in dike section.	Sinkhole observable at crest Slower lake drawdown during dewatering Increase in seepage pumping rate during operations Increase in pore water pressures downstream of cut-off wall/liner Increase in turbidity / suspended solids of seepage
Seepage Within Embankment	Increase in seepage rate due to cut-off wall/liner failure	Increased seepage water handling. Not likely to compromise stability of dike.
Seepage Within Foundation	Un-observable defects in cut-off/liner construction.	High flow during initial dewatering or shortly thereafter.
Internal Conduit Rupture	Not applicable	Not applicable
Slope Instability	(1) ice or wave forces, or traffic on crest, seepage, weakness of foundation soils (2) Earthquake seismic event or blasting (3) Pit wall failure	Increase in settlement and/or settlement rate Increase in displacement and/or displacement rate of dike toe Cracks along the dike crest Sloughing of the face Bulging of dike toe Disruption of seepage collection ditch

Failure Mechanism	Potential Measurable and Observable	
	Causes	**Effects**
Failure of Cut-off Wall/Liner Due to Movement of the Dike (Cut-off wall/liner lateral movement)	Differential horizontal movement of dike due to water or ice loading, pit wall stability, excessive dike settlement Seepage.	Large inflows associated with a breach in the dike. Increase in lateral deformation or increase in rate of deformation in slope inclinometer reading Increase in pore water pressure downstream of cut-off wall/liner Increase in pumping rate Dislocation, cracks, settlement localized above or adjacent to cut-off wall/liner
Unexpected settlements	Consolidation of foundation soils or dike fills	Overtopping in extreme case large settlement of cut-off wall/liner.

Table 12.3 Threshold Criteria during Operation for East Dike

		Threshold Criteria During Operation			
		Green **Acceptable Situation**	**Yellow** **Areas of concern**	**Orange** **High Risk Situation**	**Red** **Emergency Situation**
Criteria	Downstream toe displacement, sloughing or bulging	None visible	Visible displacement or bulging	Toe displacement related to a sloughing slide from near downstream crest to 5 m from centreline Bulging > 1 m in height	Toe displacement related to a sloughing slide reaching 5 m from centreline Bulging greater than 4m in height
	Tension crack along downstream rockfill embankment (more than 3 m from centreline)	Within 7 m of the downstream crest edge and < 0.1 m deep and < 3 m length along the dike	Within 10 m of the downstream crest edge and > 0.1 m and < 1.0 m deep	> 1.0 m deep	> 1.0 m deep
	Tension crack along upstream rockfill embankment (more than 3 m from centreline)	< 0.1 m deep and < 3 m length along the dike	> 0.1 m and < 1.0 m deep	> 1.0 m deep	> 1.0 m deep
	Tension crack within 3 m each side of the cutoff wall at crest (upstream or downstream)	None visible	< 0.1 m deep or < 0.1 m wide	> 0.1 m deep or > 0.1 m wide	> 0.1 m deep or > 0.1 m wide
	Sinkhole on crest	Not visible	> 5 m outside from centreline	Within 5 m from centreline	Within 5 m from centreline
	Cut-off wall lateral cumulative deformation (based on survey monument)	None	<0.05 m	> 0.05 and 0.10 m	> 0.10 m
	Cut-off wall lateral cumulative deformation (based on inclinometer)	None	< 0.05 m	> 0.05 m and < 0.10 m	> 0.10 m
	Lake elevation	< 134.1 masl	> 134.1 and < 134.8 masl	> 134.8 and < 135.6 masl	> 135.6 masl
	Pore water pressure (based on piezometers)	Pore water pressure measurements stable or decreasing.	Increasing trend in pore water pressure downstream of cut-off wall.	Anomalous trends (sharp increase) in pore water pressure downstream of cut-off wall.	Anomalous trends (sharp increase) in pore water pressure downstream of cut-off wall.
	Temperature variation along centreline (based on thermistors and piezometers)	Temperature measurement stable and similar variation at surface from previous years.	Increasing trend in temperature below the active layer	Continuous increasing trend in temperature below the active layer	Continuous increasing trend in temperature below the active layer
	Seepage through dike (excluding Freshet water)	< 3,000 m^3/day	>3,000 m^3/day and <6,000 m^3/day and / or turbidity in the water	> 6,000 m^3/day and < 20,000 m^3/day and / or turbidity in the water	> 20,000 m^3/day *Condition where the seepage inflow is rapidly increasing and projected to soon exceed pumping capacity*
Action Required		• Instrumentation monitoring and visual inspection according to frequency set out in OMS manual. • Possibility of a mitigation plan to be evaluated by Engineering Department.	• Increased instrumentation monitoring frequency, particularly in area of concern. • Document location, photograph, survey, and increase inspection and monitoring in area of concern. • Identify potential cause • Implement engineering review.	• Suspend activities on dike crest at area of concern • Increased instrumentation monitoring frequency, particularly in area of concern. • Document location, photograph, survey, and increase inspection and monitoring in area of concern. • Plan and take appropriate mitigation measures with engineering review. (Use as reference contingency measures for different scenarios proposed by AEM (See Table 12-9)). • Reassess thresholds and conditions for red category (emergency situation) taking into account the changing conditions presently observed and interactions of various items.	• Temporary evacuation of personnel and equipment from pit and suspension of activities. • Update planning and take appropriate mitigation with engineering review.
Personnel Notified		Principal Geotechnical Engineer, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC, if required).	Principal Geotechnical Engineer, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC), Specialized Contractor (if required), Environment Superintendent, Mine Manager, Discuss at MDRB Meeting.	Principal Geotechnical Engineer, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC), Specialized Contractor, Environment Superintendent, Mine Manager, Dike Review Board, Mine Inspector, Health and Safety, ERT (Emergency Personnel, if required).	Principal Geotechnical Engineer, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC), Specialized Contractor, Environment Superintendent, Mine Manager, Dike Review Board, Mine Inspector, Health and Safety, ERT (Emergency Personnel).

Table 12.4 Threshold Criteria during Operation for Bay-Goose Dike

		Threshold Criteria During Operation			
		Green **Acceptable Situation**	**Yellow** **Areas of concern**	**Orange** **High Risk Situation**	**Red** **Emergency Situation**
Criteria	Downstream toe displacement, sloughing or bulging	None visible	Visible displacement or bulging	Toe displacement related to a sloughing slide from near downstream crest to 5 m from centreline and bulging > 1 m in height	Toe displacement related to a sloughing slide reaching 5 m from centreline Bulging greater than 4m in height
	Tension crack along downstream rockfill embankment (more than 3 m from centreline)	Within 7 m of the downstream crest edge and < 0.1 m deep and < 3 m length along the dike	Within 10 m of the downstream crest edge and > 0.1 m and < 1.0 m deep	> 1.0 m deep	> 1.0 m deep
	Tension crack along upstream rockfill embankment (more than 3 m from centreline)	< 0.1 m deep and < 3 m length along the dike	> 0.1 m and < 1.0 m deep	> 1.0 m deep	> 1.0 m deep
	Tension crack within 3 m of either side of the cutoff wall at crest	None visible	< 0.1 m deep or < 0.1 m wide	> 0.1 m deep or > 0.1 m wide	> 0.1 m deep or > 0.1 m wide
	Sinkhole on crest	Not visible	> 5 m outside from centreline	Within 5 m from centreline	Within 5 m from centreline
	Cut-off wall lateral cumulative deformation (based on survey monument)	None	<0.05 m	> 0.05 and 0.10 m	> 0.10 m
	Cut-off wall lateral cumulative deformation (based on inclinometer)	None	< 0.05 m	> 0.05 m and < 0.10 m	> 0.10 m
	Lake elevation	< 135.1 masl	> 135.1 and < 135.8 masl	> 135.8 and < 136.1 masl	> 136.1 masl
	Pore water pressure (based on piezometers)	Pore water pressure measurements stable or decreasing.	Increasing trend in pore water pressure downstream of cut-off wall.	Anomalous trends (sharp increase) in pore water pressure downstream of cut-off wall.	Anomalous trends (sharp increase) in pore water pressure downstream of cut-off wall.
	Temperature variation along centreline (based on thermistors and piezometers)	Temperature measurement stable and similar variation at surface from previous years.	Increasing trend in temperature below the active layer	Continuous increasing trend in temperature below the active layer	Continuous increasing trend in temperature below the active layer
	Seepage through dike at toe (excluding Freshet water)	< 300 m^3/day	>300 m^3/day and <1,000 m^3/day and / or turbidity in the water	> 1,000 m^3/day and < 2,000 m^3/day and / or turbidity in the water	> 2,000 m^3/day *Seepage inflow is rapidly increasing and projected to soon exceed pumping capacity*
	Seepage through dike in North Channel area	< 150 m^3/day	>150 m^3/day and <500 m^3/day and / or turbidity in the water	> 500 m^3/day and < 1,000 m^3/day and / or turbidity in the water	> 1,000 m^3/day *Seepage inflow is rapidly increasing and projected to soon exceed pumping capacity*
	Seepage through dike in pit (excluding Freshet water, estimated visually)	Slow trickle of water along pit walls, easily handled by regular pit sumps	Steady stream of water along pit walls, easily handled by regular pit sumps	Large quantity of water flowing down the pit walls, cannot be easily handled by regular pit sumps, mining activities are impacted	Water flowing down the walls cannot be handled by regular pit sumps and has markedly increased in flow rate and quantity, mining activities are disrupted.
Action Required		• Instrumentation monitoring and visual inspection according to frequency set out in OMS manual. • Possibility of a mitigation plan to be evaluated by Engineering Department.	• Increased instrumentation monitoring frequency, particularly in area of concern. • Document location, photograph, survey, and increase inspection and monitoring in area of concern. • Identify potential cause • Implement engineering review.	• Suspend activities on dike crest at area of concern • Increased instrumentation monitoring frequency, particularly in area of concern. • Document location, photograph, survey, and increase inspection and monitoring in area of concern. • Plan and take appropriate mitigation measures with engineering review. (Use as reference contingency measures for different scenarios proposed by AEM (See Table 12-9)). • Reassess thresholds and conditions for red category (emergency situation) taking into account the changing conditions presently observed and interactions of various items.	• Temporary evacuation of personnel and equipment from pit and suspension of activities. • Update planning and take appropriate mitigation with engineering review.
Personnel Notified		Principal Geotechnical Engineer, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC, if required).	Principal Geotechnical Engineer, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC), Specialized Contractor (if required), Environment Superintendent, Mine Manager, Discuss at MDRB Meeting.	Principal Geotechnical Engineer, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC), Specialized Contractor, Environment Superintendent, Mine Manager, Dike Review Board, Mine Inspector, Health and Safety, ERT (Emergency Personnel, if required).	Principal Geotechnical Engineer, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC), Specialized Contractor, Environment Superintendent, Mine Manager, Dike Review Board, Mine Inspector, Health and Safety, ERT (Emergency Personnel).

Table 12.5 Threshold Criteria during Operation for South Camp Dike

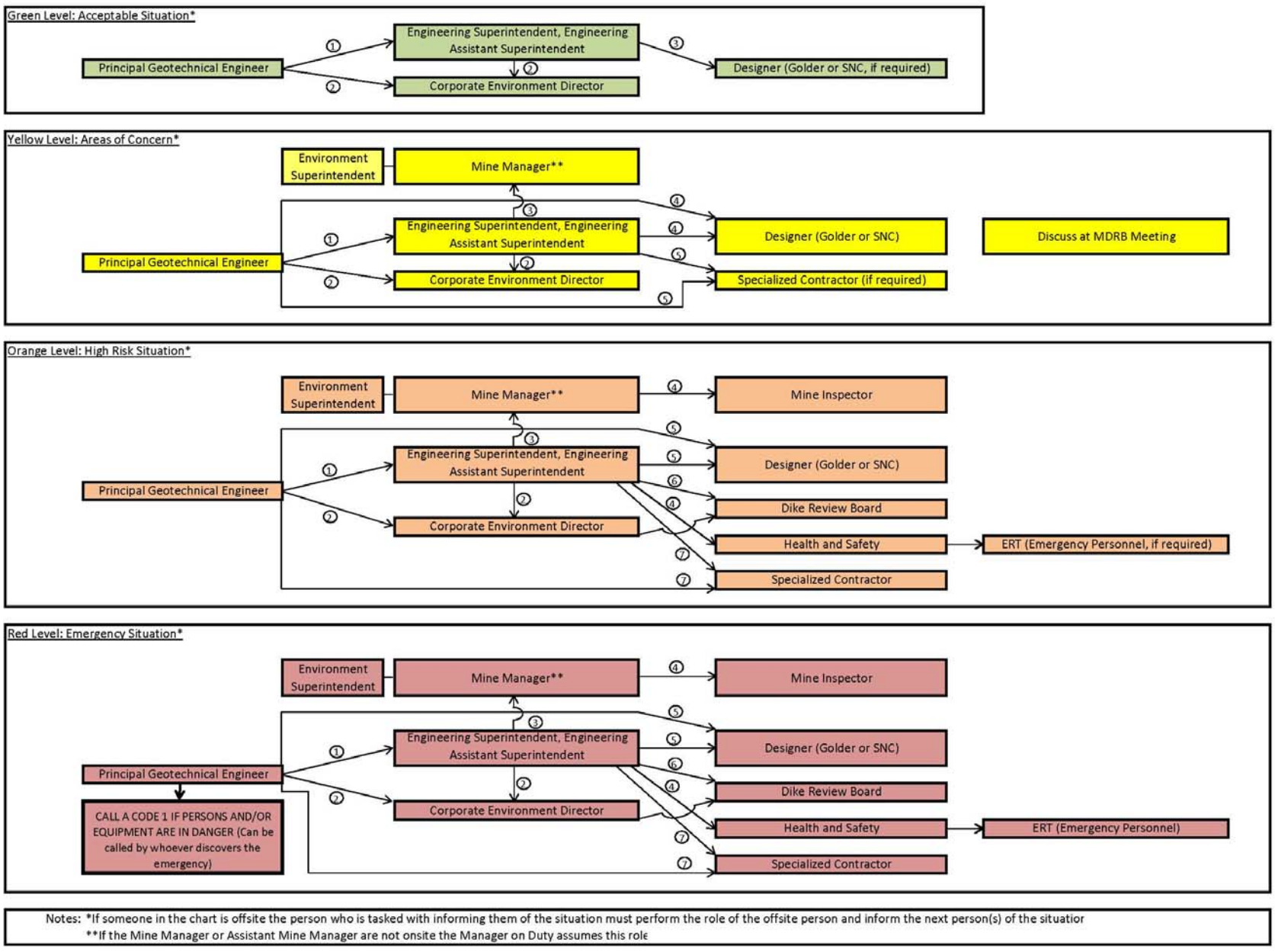
		Threshold Criteria During Operation			
		Green **Acceptable Situation**	**Yellow** **Areas of concern**	**Orange** **High Risk Situation**	**Red** **Emergency Situation**
Criteria	Downstream toe displacement, sloughing or bulging	None visible	Visible displacement or bulging	Toe displacement related to a sloughing slide from near downstream crest to 5 m from centreline Bulging > 1 m in height	Toe displacement related to a sloughing slide reaching 5 m from centreline Bulging greater than 4m in height
	Tension crack along downstream rockfill embankment (more than 3 m from centreline)	Within 7 m of the downstream crest edge and < 0.1 m deep and < 3 m length along the dike	Within 10 m of the downstream crest edge and > 0.1 m and < 1.0 m deep	> 1.0 m deep	> 1.0 m deep
	Tension crack along upstream rockfill embankment (more than 3 m from centreline)	< 0.1 m deep and < 3 m length along the dike	> 0.1 m and < 1.0 m deep	> 1.0 m deep	> 1.0 m deep
	Sinkhole on crest	Not visible	> 5 m outside from centreline	Within 5 m from centreline	Within 5 m from centreline
	Lake elevation	< 135.6 masl	> 135.6 and < 136.3 masl	> 136.3 and < 136.6 masl	> 136.6 masl
	Temperature variation within foundation (based on thermistors)	Temperature measurement stable and similar variation at surface from previous years.	Increasing trend in temperature below the active layer	Continuous increasing trend in temperature below the active layer	Continuous increasing trend in temperature below the active layer
	Seepage through dike (excluding Freshet water)	< 300 m^3/day	>300 m^3/day and <1,000 m^3/day and / or turbidity in the water	> 1,000 m^3/day and < 2,000 m^3/day and / or turbidity in the water	> 2,000 m^3/day *Condition where the seepage inflow is rapidly increasing and projected to soon exceed pumping capacity*
Action Required		• Instrumentation monitoring and visual inspection according to frequency set out in OMS manual. • Possibility of a mitigation plan to be evaluated by Engineering Department.	• Increased instrumentation monitoring frequency, particularly in area of concern. • Document location, photograph, survey, and increase inspection and monitoring in area of concern. • Identify potential cause • Implement engineering review.	• Suspend activities on dike crest at area of concern • Increased instrumentation monitoring frequency, particularly in area of concern. • Document location, photograph, survey, and increase inspection and monitoring in area of concern. • Plan and take appropriate mitigation measures with engineering review. • Reassess thresholds and conditions for red category (emergency situation) taking into account the changing conditions presently observed and interactions of various items.	• Temporary evacuation of personnel and equipment from pit and suspension of activities. • Update planning and take appropriate mitigation with engineering review.
Personnel Notified		Principal Geotechnical Engineer, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC, if required).	Principal Geotechnical Engineer, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC), Specialized Contractor (if required), Environment Superintendent, Mine Manager, Discuss at MDRB Meeting.	Principal Geotechnical Engineer, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC), Specialized Contractor, Environment Superintendent, Mine Manager, Dike Review Board, Mine Inspector, Health and Safety, ERT (Emergency Personnel, if required).	Principal Geotechnical Engineer, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC), Specialized Contractor, Environment Superintendent, Mine Manager, Dike Review Board, Mine Inspector, Health and Safety, ERT (Emergency Personnel).

Table 12.6 Threshold Criteria during Operation for Vault Dike

		Threshold Criteria During Operation			
		Green **Acceptable Situation**	**Yellow** **Areas of concern**	**Orange** **High Risk Situation**	**Red** **Emergency Situation**
Criteria	Downstream toe displacement, sloughing or bulging	None visible	Visible displacement or bulging	Toe displacement related to a sloughing slide from near downstream crest to 5 m from centreline Bulging > 1 m in height	Toe displacement related to a sloughing slide reaching 5 m from centreline Bulging greater than 4m in height
	Tension crack along downstream rockfill embankment (more than 3 m from centreline)	Within 7 m of the downstream crest edge and < 0.1 m deep and < 3 m length along the dike	Within 10 m of the downstream crest edge and > 0.1 m and < 1.0 m deep	> 1.0 m deep	> 1.0 m deep
	Tension crack along upstream rockfill embankment (more than 3 m from centreline)	< 0.1 m deep and < 3 m length along the dike	> 0.1 m and < 1.0 m deep	> 1.0 m deep	> 1.0 m deep
	Sinkhole on crest	Not visible	> 5 m outside from centreline	Within 5 m from centreline	Within 5 m from centreline
	Lake elevation	< 141.5 masl	> 141.5 and < 142.2 masl	> 142.2 and < 142.5 masl	> 142.5 masl
	Temperature variation within foundation (based on thermistors)	Temperature measurement stable and similar variation at surface from previous years.	Increasing trend in temperature below the active layer	Continuous increasing trend in temperature below the active layer	Continuous increasing trend in temperature below the active layer
	Seepage through dike (excluding Freshet water)	< 300 m^3/day	>300 m^3/day and <1,000 m^3/day and / or turbidity in the water	> 1,000 m^3/day and < 2,000 m^3/day and / or turbidity in the water	> 2,000 m^3/day *Condition where the seepage inflow is rapidly increasing and projected to soon exceed pumping capacity*
Action Required		• Instrumentation monitoring and visual inspection according to frequency set out in OMS manual. • Possibility of a mitigation plan to be evaluated by Engineering Department.	• Increased instrumentation monitoring frequency, particularly in area of concern. • Document location, photograph, survey, and increase inspection and monitoring in area of concern. • Identify potential cause • Implement engineering review.	• Suspend activities on dike crest at area of concern • Increased instrumentation monitoring frequency, particularly in area of concern. • Document location, photograph, survey, and increase inspection and monitoring in area of concern. • Plan and take appropriate mitigation measures with engineering review. • Reassess thresholds and conditions for red category (emergency situation) taking into account the changing conditions presently observed and interactions of various items.	• Temporary evacuation of personnel and equipment from pit and suspension of activities. • Update planning and take appropriate mitigation with engineering review.
Personnel Notified		Principal Geotechnical Engineer, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC, if required).	Principal Geotechnical Engineer, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC), Specialized Contractor (if required), Environment Superintendent, Mine Manager, Discuss at MDRB Meeting.	Principal Geotechnical Engineer, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC), Specialized Contractor, Environment Superintendent, Mine Manager, Dike Review Board, Mine Inspector, Health and Safety, ERT (Emergency Personnel, if required).	Principal Geotechnical Engineer, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC), Specialized Contractor, Environment Superintendent, Mine Manager, Dike Review Board, Mine Inspector, Health and Safety, ERT (Emergency Personnel).

Table 12.7 Communication Charts for Each Emergency Level

Communications are rated to indicate in which order responsible persons should be notified in the case where a person needs to advise more than one persor



Notes: *If someone in the chart is offsite the person who is tasked with informing them of the situation must perform the role of the offsite person and inform the next person(s) of the situatior
**If the Mine Manager or Assistant Mine Manager are not onsite the Manager on Duty assumes this role

Table 12.8 Responsibilities of Persons for Each Emergency Level

	Decision Making	Mobilization	Performing the Action to be Taken
Green Acceptable Situation	Principal Geotechnical Engineer	Principal Geotechnical Engineer	Geotechnical Team*
Yellow Areas of Concern	Principal Geotechnical Engineer Engineering Superintendent Engineering Assistant Superintendent Designer (Golder or SNC)	Principal Geotechnical Engineer	Geotechnical Team* Specialized Contractor (if required)
Orange High Risk Situation	Principal Geotechnical Engineer Engineering Superintendent Engineering Assistant Superintendent Designer (Golder or SNC) Corporate Environment Director Dike Review Board Mine Manager Health and Safety (if required)	Principal Geotechnical Engineer Engineering Superintendent Engineering Assistant Superintendent	Geotechnical Team* Specialized Contractor ERT (if required)
Red Emergency Situation	Principal Geotechnical Engineer Engineering Superintendent Engineering Assistant Superintendent Designer (Golder or SNC) Corporate Environment Director Dike Review Board Mine Manager Health and Safety	Principal Geotechnical Engineer Engineering Superintendent Engineering Assistant Superintendent Mine Manager Health and Safety	Geotechnical Team* Specialized Contractor ERT

*The Geotechnical Team consists of the Principal Geotechnical Engineer, the Dewatering and Pit Geotechnical Engineer/Geologist, Water Management, and the Geotechnical Technician.

Table 12.9 Names and Contact Details

Internal Emergency Response Contact Information Chart		
Position	**Name/Location**	**24-Hour Contact #**
Principal Geotechnical Engineer	Erika Voyer	Ph: 867-793-4610 ext. 6837 cell: 581-982-7107
	Thomas Lepine	Ph: 867-793-4610 ext. 6837 cell: 418-473-8077
Engineering Superintendent	Julie Belanger	Ph: 867-793-4610 ext. 6721 cell: 819-856-1667
Engineering Assistant Superintendent	Stephane Frechette	Ph: 867-793-4610 ext. 6721 cell: 819-856-3152
Corporate Environment Director	Michel Julien	Ph: 416-947-1212 ext. 3738 cell: 514-244-5876
Designer (Golder or SNC)	Golder Burnaby: Dan Walker, Fiona Esford Golder Montreal: Yves Boulianne, Annie Beaulieu	Burnaby Office: 604-296-4200 Montreal Office: 514-383-0990
	SNC: Jean-Francois St-Laurent, Yohan Jalbert, Simon Beaulieu	Quebec City Office: 418-621-9700
Specialized Contractor	SANA (FGL Group)	Onsite Ph: 867-793-4610 ext. 6963 Ph: 418-615-0559
Environment Superintendent	Kevin Buck	Ph: 867-793-4610 ext 6838 Cell: 819-856-1956
Mine Manager	Jean Beliveau	Ph: 867-793-4610 ext. 6901 cell: 819-856-5605
	Alexandre Proulx (asst.)	Ph: 867-793-4610 ext. 6843 cell: 819-860-6389
Dike Review Board	Anthony Rattue Norbert Morgenstern Don Hayley	Anthony.Rattue@snclavalin.com norbertm@ualberta.ca dhayley@eba.ca
Mine Inspector	Martin VanRooy	Martin.vanRooy@wscc.nu.ca_contact1
Health and Safety	Normand Ladouceur	Ph: 867-793-4610 ext. 6720 cell: 819-860-6258
	Yves Levesque (asst.)	Ph: 867-793-4610 ext. 6720 cell: 819-856-9051
ERT (Emergency Personnel)	Emergency response personnel available on site to assist with spill and emergency response activities	Coordinated by the Emergency Measures Counsellor
Incident Commander	André Rouleau	Ph: 867-793-4610 ext. 6809 cell: 819-355-2191 Channel #1
	Normand Ladouceur	Ph: 867-793-4610 ext. 6720 cell: 819-860-6258 Channel #1
Emergency Measures Counsellor	André Rouleau	Ph: 867-793-4610 ext. 6809 cell: 819-355-2191

Health Professionals / Medical Clinic	Medical Clinic 1	Ph: 867-793-4610 ext. 6734
	Medical Clinic 2	Ph: 867-793-4610 ext. 6751
AEM Management Representative	Dominique Girard	Ph: 867-793-4610 ext. 6901 cell: 819-277-4080
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Table 12.10 Emergency Response Summary for East Dike and Bay-Goose Dike

Concern	Area		Failure Likelihood	Comments/Monitoring	Contingency or Corrective Action
Overtopping and Subsidence	1a	Lake level rise because of restricted outflow from Third Portage or Second Portage Lake (excessive inflow is a far less likely scenario)	Low	Lake levels and crest elevations should be monitored as part of daily safety information provided to mine management. Outflow channels should be inspected during thaw, open water season and during ice break-up.	The crest is wide and comprises coarse rockfill. Significant damage to the dike is not credible, based on performance of other rockfill structures subjected to overtopping or flow through events. Mining operations may need to be suspended, but there will be considerable warning time given the design freeboard and the storage volume within the lakes.
	1b	Dam crest settles more than 2 m	Low	This scenario requires extensive loss of support in the foundation since the rockfill of the dikes is essentially not settlement prone itself after construction and dewatering. For foundation settlement of this magnitude to occur, a piping event must develop or there is unexpected layer of compressible soil in the foundation. A foundation investigation was carried out prior to construction. The situation would develop slowly with crest settlement evident at least several weeks before a run-away event develops. Easily observed cracks should be evident. Monitoring of the crest settlement should be conducted routinely.	The crest is wide and comprises of coarse rockfill. Significant damage to the dike is not credible, based on performance of other rockfill structures subjected to overtopping or flow through events Rockfill and till available from the mining operations can be placed to raise the dike crest. Mining operations may need to be suspended, but there will be considerable warning time given the slow development of the scenario.
	1c	Wave action	Low	Wide beach, large freeboard and wide rock dam crest zone makes this a low concern	If large wave action is observed, can add rip-rap and/or raise dam crest
Internal Erosion	2a	Dike Section: Cut-off wall is defective, allowing high water flow. This defect occurs at a location where the core allows high flows and where the fills are defective; the combination allows erosion of the cut-off and/or the Core Backfill.	Low	The cut-off wall and/or core backfill will develop a progressively increasing void ratio, thereby increasing the rate of water flow through the dike. This is not a catastrophic failure mode as the rockfill will be stable and at its worst would lead to temporary suspension of mining.	Monitor seepage from downstream face for rate of seepage and for presence of sediment in seepage. Will become evident as localized intensive seepage at dike toe and can be repaired. May also see settlement in the core or cut-off wall near the filter. Will be most likely in deepest section. Gradients across the core in shallow water may not be high enough to cause piping.
	2b	Dike Section: Cut-off wall loses bentonite because of improper construction	Low	The cut-off wall will develop progressively increasing voids, thereby increasing the rate of water flow through the dike. This is not a catastrophic failure mode as the rockfill will be stable and at its worst would lead to temporary suspension of mining.	Monitor seepage from downstream face for rate of seepage and for presence of sediment in seepage. Will become evident as localized intensive seepage at dike toe and can be repaired. May also see settlement in the core near the filter. Will be most likely in deepest section. Gradients across the core and cut-off in shallow water may not be high enough to cause piping.
	2c	Foundation till is possibly non-uniform with more transmissive zones and not self-filtering. It is possible that one of these zones may align with defective construction of the cut-off wall allowing high flows. Seepage would lead to erosion of the cut-off into the downstream rockfill. Seepage could also erode the foundation tills at the downstream toe or into the downstream rockfill because of the lack of filtering.	Low	Limited seepage at the toe or into the rockfill would accelerate in to a large inflow, and could lead to the undermining of the dike if no action was taken. This is a credible catastrophic mode if increased seepage is not detected in time. No particular instrumentation is needed as this failure mode will show itself as localized and increasing seepage. It could be detected by walk-over inspection by an experienced engineer or technician.	Remedial action could comprise a reverse filter and rockfill buttress depending on location of the flow and configuration of the foundation, freezing or grouting, if identified in time. In the worst case, the pit may be deliberately flooded in a controlled manner, the cut-off repaired and the pit dewatered. Build additional dike downstream increasing pumping.

Concern	Area		Failure Likelihood	Comments/Monitoring	Contingency or Corrective Action
Seepage	3a	Within the Embankment	Low	Seepage on its own is not a credible failure scenario. The downstream rockfill shell has extremely high flow through capacity. The rockfill zone is both large and pervious, so that seepage will not daylight and lead to instability. Any seepage related failures must include internal erosion.	No credible consequences. May require upgrade of the seepage collection system. May need to suspend mining activities while reducing seepage.
	3b	Within the Foundation	Medium	Defective construction of cut-off leading to transfer of unexpectedly high fraction of the reservoir head into the downstream part of the dike foundation, or leading to a piping event as described in internal erosion(2c). If this mechanism arises it should show itself during initial dewatering or very shortly thereafter.	This failure mechanism has caused embankment failures elsewhere because of straightforward pore water pressure induced instability. However it is unclear that it could cause failure of the dike because of the large width compared to the retained water head. The most likely consequence is downstream toe slumping requiring a localized stabilizing berm before the crest could be reinstated.
Structural - Slope Instability	4a	Normal Operation: Slope Failure	Low	The rockfill shoulders of the dike are wide and have high shear strength, making it a conservative design. Slope failure requires failure in the foundation and which would extend into the overlying dike. Sliding failure is considered unlikely given the low horizontal forces generated by the water and ice relative to the normal frictional force due to the weight of the dikes and the frictional angles of foundational materials. This mechanism should develop during construction or dewatering, due to the increase in load and associated pore water pressure development. Initial stages of failure should be observable as tension cracks in the dike crest. Walk-over inspection of the dike by trained inspector is an appropriate monitoring strategy in addition the instrumentation. Survey of crest face and toe should also be conducted.	A foundation failure would cause a rotational slip or sliding failure until equilibrium was reached. This mechanism would limit access along the dike until repaired. Failure through the rockfill should not necessarily compromise the water retaining function of the dike. Slope failures which reach the core may cause dam failure. Stabilizing berms can be placed at the downstream toe of the dike.
	4b	Earthquake Induced: Slope Failure	Low	Site is located in a low seismic zone. Dam consisting of massive rock zone has a low sensitivity to seismic motion.	In the event a seismic event produced cracks, construction material and equipment will be available for rapid response.
	4c	Erosion; washout, ice scour	Low	Crest – minimum 50 m section, Downstream – large quarry rock face.	Monitor – if any erosion is observed place additional mine rock
Structural – Lateral Movement	5a	Failure of Cut-off Wall	Low	Differential horizontal movement of the dike due to dewatering, water or ice loading or pit wall failure may create a breach in the cut-off wall. Ice and water forces are not credible due to the ratio of frictional forces generated by the self weight of the dike versus ice loads and water pressure. Pit wall failure unlikely based on assessments of pit wall stability. Large inflows through the breach may occur as a consequence if the cut-off wall breached. Pit would flood requiring suspension of mining activities. Potential for loss of life of workers inside dikes. Inclinometer, settlement prism and monument monitoring should be done routinely.	If the pit floods, then repairs to cut-off would be done prior to dewatering.
Subsidence	6	Foundation Soils	Low	Unexpected foundation soils consolidated during dike construction or dewatering. A significant quantity of clay would be required to generate settlement resulting in a water release event. Settlement of the core zone will be limited by dynamic compaction. Prism and monument monitoring should be done routinely.	A 2 m core settlement would be required to allow water to flow through the rockfill and over the settled cut-off. This flow would not cause failure of the rockfill shells. It would also be readily repaired by excavating rockfill above the cut-off wall and placing more till. Soil conditions will be observed during dewatering to accommodate actual conditions.

Concern	Area		Failure Likelihood	Comments/Monitoring	Contingency or Corrective Action
Premature Closure	7	Corporate Bankruptcy or Early Resource Depletion	Low	Bond is provided for this eventuality. Design of rehabilitation is the same as rehabilitation at closure of project.	Pumping will be suspended and the downstream area allowed to flood. The East Dike and Bay-Goose Dike will be monitored to meet closure requirements.
Pump and Pipeline Failure	8	Pumping from Sumps to Process Plant	Medium	Freezing protection is provided by heat tracing and insulation. Pipelines monitored pump pressures at plant and frequent site inspection.	Sump designed for expected seepage capacity. Pumping equipment designed for 1 in 25 year storm events and average freshet. Redundant lines (Minimal interruption to Process Plant operation).

Table 12.11 Risk Matrix

				Consequence :				
				HIGH	MEDIUM		LOW	
Likelihood:				Catastrophic	Major	Significant	Minor	Insignificant
				5	4	3	2	1
Almost Certain	HIGH		5	25 (very high risk)	20	15	10	5
Likely		MEDIUM	4	20	16 (high risk)	12	8	4
Possible			3	15	12	9 (medium risk)	6	3
Unlikely		LOW	2	10	8	6	4 (low risk)	2
Rare			1	5	4	3	2	1 (very low risk)

Table 12.12 Risk assessment for East Dike, Bay-Goose Dike, South Camp Dike and Vault Dike

Failure Mechanism	Cause	Likelihood Rating	Effect	Consequence Rating	Controls		Overall Risk Rating
					Monitoring	Corrective Action	
Overtopping	Lake level rise because of restricted outflow (e.g., blockage of outlet from Second Portage Lake).	**LOW – 2** Temporary ice jam occurring at the outlet is possible for a short duration in the spring. The cutoff wall and liner system provide adequate freeboard above normal lake level.	Water spilling over the crest. Erosion of the dike abutment and / or downstream foundation	**LOW - 2** The crest is wide and comprises coarse rockfill. Significant damage to the dike is unlikely based on design.	Routine monitoring of lake levels. Outflow channels should be inspected regularly just before and during the thaw and ice break-up (freshet).	If an obstruction is present, clear blockage at outlet. Develop action plan based on conditions encountered.	**4**
	Lake level rise because of excessive inflow.	**LOW – 2** Due to the large surface area of the lakes, a large volume of water is required to cause a significant increase in the lake elevation. The cutoff wall and liner system provide adequate freeboard above normal lake level.	Water spilling over the crest. Erosion of the dike abutment and / or downstream foundation	**LOW - 2** The crest is wide and comprises coarse rockfill. Significant damage to the dike is unlikely based on design.	Routine monitoring of lake levels.	Develop action plan based on conditions encountered.	**4**
	Settlement of the cutoff wall system. (NOT APPLICABLE TO SOUTH CAMP DIKE OR VAULT DIKE)	**MED – 3** The cutoff wall system is founded on or close to bedrock reducing potential for the foundation, and in turn the cutoff wall, to settle. Some settlement of the soil bentonite may be expected. The maximum depth of the soil bentonite cutoff wall is typically such that settlement exceeding the minimum freeboard is unlikely.	Water spilling over the crest. Erosion of the dike abutment and / or downstream foundation.	**MED - 3** The crest is wide and comprises coarse rockfill. Significant damage to the dike is unlikely based on design.	Survey of cutoff wall to detect and quantify settlement. Routine monitoring of lake levels.	Till available from the mining operation could be placed above the cutoff wall if significant settlement occurred. (Note – all material over cut-off wall would need to be excavated (i.e. thermal cap, grouting platform))	**9**
	Settlement of the rockfill embankment over a significant width of the crest.	**<u>EAST DIKE</u>** **<u>BAY-GOOSE DIKE</u>** **LOW – 2** Adequate rockfill freeboard has been provided such that settlement in excess of the freeboard is not anticipated. Settlement can only occur where lakebed soils were left underneath the rockfill embankment but the majority of the settlement is anticipated to have occurred during construction since additional fill was placed to bring to design elevation. The East Dike has had additional maintenance as it was operated as a haul road.	Potential erosion of upstream filters and cutoff for BG and ED. Potential exposure to wave action (see below in wave action section).	**MEDIUM - 3** The hydraulic barrier, cutoff wall system, remains in place. Wave erosion of the cutoff system unlikely due to the presence of surrounding granular material.	Monitoring of Rockfill settlement	Rockfill available from the mining operation can be placed to raise the crest height, if settlement occurs.	**6**
	Settlement of the rockfill embankment over a significant width of the crest.	**<u>SOUTH CAMP DIKE</u>** **<u>VAULT DIKE</u>** **LOW – 1** Existing monitoring of the dike within the foundation shows that it remains frozen throughout the year; therefore, thawing of foundation material is unlikely to happen, but in the event it does happen, it will allow settlement of the rockfill.	Potential exposure to wave action (see below in wave action section).	**LOW - 2** The hydraulic barrier, liner system, remains in place. Additional water will flow towards the open pit and mining infrastructures.	Routine monitoring of the foundation's temperature.	Develop an action plan to add low hydraulic conductivity barrier if flow is not manageable.	**2**
	Wave Action	**LOW – 2** Adequate freeboard is provided by the rockfill crest elevation. A wide rockfill crest which is erosion resistant reduces potential impact to the cut-off wall/liner.	Water spilling over the crest. Erosion of the dike abutment and / or downstream foundation	**LOW - 2** Wave erosion of the cutoff wall system unlikely due to the presence of surrounding granular filter system.	Monitor wave height during storm events or periods of strong winds.	Rockfill can be placed to raise the crest height, if necessary.	**4**

Failure Mechanism	Cause	Likelihood Rating	Effect	Consequence Rating	Controls		Overall Risk Rating
					Monitoring	Corrective Action	
Internal Erosion (piping)	Erosion of the cutoff wall. If a component of the cutoff wall is defective allowing high water flow through the structure. This defect could potentially erode the cutoff wall. (NOT APPLICABLE TO SOUTH CAMP DIKE OR VAULT DIKE)	**MEDIUM HIGH – 4** The soil bentonite has the potential to be eroded under high hydraulic gradients. Although erosion of the downstream foundation soils could potentially occur in association with erosion of the cutoff wall, the width of the rockfill embankment, thickness of soils, and hydraulic head significantly reduce the likelihood of failure. The granular materials within the dike have been designed to be filter compatible reducing the risk for erosion. This mechanism is more likely to occur during dewatering or shortly thereafter. **EAST DIKE**: As the East Dike has been dewatered since 2010, the likelihood of further deterioration is less. **BAY-GOOSE DIKE**: The cement content of the cement soil bentonite and jet grout should reduce its potential for erosion. A layer of erodible material (e.g. silt) at the base of the cutoff wall / bedrock contact, was identified and jet grouted to reduce erosion potential. Other areas of erodible material may still exist beneath the cutoff wall. Two areas at Bay-Goose Dike (Sta. 30+230 to 03+350 and Sta. 30+795 to 30+850) have a higher risk for flow through the cutoff wall because the more rigid cement soil bentonite was placed over softer, more deformable soil bentonite. A gap at the interface due to differential settlement or cracking of the cement soil bentonite is possible. The zone between Sta. 30+230 and 30+350 is considered at greater risk. The Bay-Goose design has included a filter blanket downstream of the cutoff wall to reduce internal erosion of the cut-off wall.	Increased seepage, through the dike core evident as localized intensive seepage at the dike toe or beyond. Settlement of the cutoff wall or dike crest, most likely in deep water sections with higher gradients.	**MEDIUM HIGH - 4** This is not likely to be a catastrophic failure mode as the filter material and rockfill embankments of the dike will remain stable. Additional seepage would come into the pit as the seepage collection system is not designed for such inflow. Could lead to the undermining of the dike if no action was taken and significant erosion of the foundation soils on the downstream side of the dike occurred. Loss of containment may result. Potential economic loss due to cessation/suspension of mining. **BAY-GOOSE DIKE**: High seepage leading to erosion is more likely to occur during dewatering when the pit has not been developed. The high seepage rate would delay the start of mining, with financial implication. With no pit development, minimal health and safety risk to personnel are expected.	Monitor seepage flow for rate and volume, and for presence of sediment in seepage (turbidity). Monitor piezometric and thermistor data for signs of increased flow through the cutoff wall and change in piezometric pressures. Monitor dike crest for signs of sinkholes or settlement. Increased seepage, evident as localized flow at the dike toe or beyond, in particular in topographic lows along the dike alignment	Based on conditions encountered, develop an action plan. This could include grouting, compaction grouting, and/or the installation of a downstream filter blanket.	**16**
	BAY-GOOSE DIKE ONLY: Erosion of the foundation (primarily applies where initial excavation was terminated above bedrock). Seepage flows through / between the jet grout columns, along sand and gravel zones within the till, and through potential erodible material. The foundation tills may be eroded into the downstream rockfill or through fractures in the bedrock.	**MEDIUM-4** The potential for gaps within the jet grout columns exist and allow for flow. The cement content of the jet grout columns should reduce the columns potential for erosion. Till is non-uniform with discontinuous layers / lenses of sand and gravel, and erodible material (i.e. silt layers) that may not be self-filtering. For erosion to occur, the seepage through or between the jet grout columns would need to connect with a permeable zone (e.g. zone of sand and gravel) which in turn needs to be in close proximity to a zone of erodible material that can be removed and the seepage forces need to be sufficient to cause the erosion. If this mechanism arises, it should show itself during initial dewatering or very shortly thereafter. May result in slower lake drawdown.	Increased seepage, evident as localized intensive seepage at the dike toe or beyond.	**MEDIUM HIGH-4** This is a significant failure mode if increased seepage is not detected in time. Undermining of the dike could lead to overall failure of the structure and flooding within the open pit resulting in cessation of mining and economic loss. Could lead to the undermining of the dike if no action was taken and significant erosion of the foundation soils on the downstream side of the dike occurred. Loss of containment may result.	Monitor seepage flow for rate and volume, and for presence of sediment. Monitor piezometric and thermistor data for signs of increased flow through the foundation and change in piezometric pressures. Monitor dike crest for signs of sinkholes, settlement or slope instability. Monitor inclinometers.	Remedial action could comprise grouting, a reverse filter on downstream and rockfill buttress, depending on location of the flow and configuration of the foundation. In the extreme, the dewatered areas may be deliberately flooded in a controlled manner, the cutoff wall repaired, and then dewatered.	**16**

Failure Mechanism	Cause	Likelihood Rating	Effect	Consequence Rating	Controls		Overall Risk Rating
					Monitoring	Corrective Action	
	Interconnected open fractures in the bedrock that permit foundation material or cutoff wall material to be lost. (NOT APPLICABLE TO SOUTH CAMP DIKE OR VAULT DIKE)_	**MEDIUM – 3** High hydraulic gradients exist at the base of the cutoff wall and potentially within the bedrock, especially along deeper areas of the dike. Grouting was conducted to reduce the permeability of the bedrock and contact zone. There is, however, a potential that bedrock fractures were initially infilled with silt prior grouting. This silt may erode once a hydraulic gradient is imposed and thereby form a pathway for either foundation soil or soil bentonite cutoff wall material to erode. Large setback of dike from pit crest in some parts increases the seepage path thereby reducing the hydraulic gradient imposed. BAY-GOOSE DIKE The cement content of the cement soil bentonite and jet grout reduces potential erodability and was used in the deepest portions of the dike.	Increased seepage, initially evident downstream of the dike or within the pit wall.	**HIGH - 5** This is a catastrophic failure mode if increased seepage is not detected in time. Could lead to the undermining of the dike if no action was taken and significant erosion of the foundation soils on the downstream side of the dike occurred. Loss of containment may result. This could lead to flooding within the open pit of the mine and a cessation of mining.	Monitor seepage flow for rate and volume, and for presence of sediment (turbidity). Monitor piezometric and thermistor data for signs of increased flow through the foundation and change in piezometric pressures. Monitor dike crest for signs of sinkholes, settlement or slope instability. Monitor inclinometers.	Grouting of the fractured bedrock. Deep bedrock grouting. In shallower areas, grouting or freezing. Installation of downstream filter blanket, stability berm.	**15**
	Erosion along instrumentation installed within the cutoff wall system. (NOT APPLICABLE TO SOUTH CAMP DIKE OR VAULT DIKE)	**LOW – 1** Preferential flow paths may exist along the edge of vertical instrumentation conduits (thermistors, inclinometers, grout casings) due to inadequate sealing. Preferential seepage path of precipitation and melt water are potential sources of water which can flow down along the edge of the conduits. Erosion caused by precipitation and melt water is very unlikely due to the small volume of water. If this mechanism arises, it should show itself during initial dewatering or very shortly thereafter.	Gradual erosion of the SOIL BENTONITE material adjacent to the instrumentation.	**LOW – 2** This is not a catastrophic failure mode as the filter material and rockfill embankments of the dike will remain stable.	Monitor seepage flow for rate and volume, and for presence of sediment. Monitor piezometric and thermistor data for signs of increased flow through the foundation and change in piezometric pressures. Monitor dike crest for signs of sinkholes, settlement or slope instability.	Replacement of the instrumentation and sealing of the annular space.	**2**
High Seepage rates with no internal erosion	Through the Dike Section (including bedrock contact) : **EAST DIKE DIKE:** Increase in hydraulic conductivity of the dike's cutoff wall system resulting in high seepage flow through the structure. **BAY-GOOSE DIKE:** Increase in hydraulic conductivity of the dike's cutoff wall system (cutoff wall and jet grout columns) resulting in high seepage flow through the structure. **SOUTH CAMP DIKE AND VAULT DIKE:** Punctured or torn liner which will likely increase flow through the structure.	**MEDIUM – HIGH– 4** This seepage on its own is not a failure scenario. Seepage-related failures must include internal erosion (see above). Interface between different material exist and could lead to seepage with preferential paths (bedrock contact and for Bay-Goose dike: cement soil bentonite over soil bentonite material and potential gaps between jet grouting columns) If this mechanism arises it should show itself during initial dewatering or very shortly thereafter.	Increased seepage water handling.	**MEDIUM -3** May require upgrade of the seepage collection system. May need to suspend mining activities while reducing seepage. The downstream rockfill shell is both large and pervious and has an extremely high flow through capacity. **EAST DIKE AND BAY-GOOSE DIKE:** The large filter zone combination of core backfill and coarse filter are filter compatible and would maintain the structural integrity of the dike.	Monitor seepage flow for rate and volume, and for presence of sediment (turbidity).	Upgrade seepage collection system and increase pump capacity. Investigate and delineate high permeability zone. Installation of downstream filter blanket, stability berm	**12**

Failure Mechanism	Cause	Likelihood Rating	Effect	Consequence Rating	Controls		Overall Risk Rating
					Monitoring	Corrective Action	
	Through the bedrock: Fractures in the bedrock results in increased seepage into the pit.	**MEDIUM - 3** Seepage on its own is not a failure scenario. **<u>EAST DIKE AND BAY-GOOSE DIKE</u>:** Extensive bedrock grouting within the dike foundation reduces the likelihood for seepage at shallow depths. If this mechanism arises it should show itself as the pit advances with depth. **<u>SOUTH CAMP DIKE AND VAULT DIKE</u>:** Existing monitoring show that foundation material and bedrock beneath the structure is frozen throughout the year.	Increased seepage through the pit wall.	**LOW – 1** No significant consequences for the dike itself. May require upgrade of the seepage collection system. May result in increased inflows into the pit, and the potential cessation of mining with resulting financial loss.	Monitor seepage flow for rate and volume, and for presence of sediment (turbidity).	Installation of dewatering / depressurization wells to remove water before it reaches the pit. Deep bedrock grouting. In shallower areas, grouting or freezing.	**3**
Slope Instability (rotational or slip or sliding failure on the upstream and downstream side)	Failure through the dike and/or foundation. Concentrated seepage and elevated pore pressures may result in weakening of the foundation.	**LOW -2** The rockfill embankments have high shear strength. For slope failure to be a concern, it requires failure in the foundation which would then extend into the dike. Failure through the rockfill embankments will not necessarily compromise the water retaining element of the dike. Sliding failure is considered unlikely given the low horizontal forces generated by water and ice forces relative to the normal frictional force due to the weight of the dike and the friction angles of foundation materials. Limited available information on soil properties for dike stability analysis. This mechanism should develop during construction or dewatering, due to increase loads and associated pore water pressure.	Sloughing of the face Large seepage / inflow only if instability resulted in loss of the cutoff wall system.	**HIGH - 5** If failure were to occur it is likely to be through the lakebed soils affecting the rockfill embankments Failure which reaches the core may cause overall failure of the structure, leading to flooding within the open pit of the mine and a cessation of mining. Potential for loss of life for workers downstream of the dike. Limited access along the dike until repaired.	Initial stages of failure should be observable as tension cracks in the dike crest. Walk-over inspection of the dike by a trained inspector. Monitoring for bulging of dike toe. Survey of the dike crest, face, and toe. Slope inclinometer monitoring of the cutoff wall. Monitor piezometric and thermistor data for signs of increased flow through the foundation and change in piezometric pressures.	Stabilizing berms can be placed upstream and/or downstream of the dike. Installation of downstream filter blanket, buttress	**10**
	Excessive Vibration Due to blasting within the pit; or due to the occurrence of an extreme earthquake.	**LOW -2** The extreme earthquake loading for this site is of low magnitude. The East Dike setback of dike from pit crest reduces the vibration caused by blasting. The Bay-Goose Dike setback of dike from pit crest reduces the vibration caused by blasting. Rockfill structures are designed to resist against wave created by earthquake. **<u>EAST DIKE AND BAY-GOOSE DIKE</u>:** Dynamic compaction of the core during construction likely subjected the rockfill shells to accelerations equivalent to the expected earthquake loading and blasting vibration. Excessive vibration is unlikely to cause failure through the rockfill. The vibration may result in increased pore pressures within the foundation soils, weakening the foundation. This may cause failure in the rockfill but is unlikely to extend into the cutoff wall system.	Settlement of the dike could occur in the event of large vibrations. Increase in displacement and/or displacement rate of dike toe Sloughing of the face. Large seepage / inflow only if instability resulted in loss of the cutoff wall system.	**MEDIUM - 4** If failure were to occur it is likely to be through the lakebed soils affecting the rockfill shell. Limited access along the dike until repaired. Although unlikely, failure which reaches the core / liner may cause overall failure of the structure, leading to flooding within the open pit of the mine and a cessation of mining. Potential for loss of life for workers downstream of the dikes.	Survey of the dike crest, face, and toe. Dike inspection following larger than anticipated vibrations and earthquakes. Blast vibration monitoring Monitoring for bulging of dike toe. Look for cracks along the dike crest.	In the event the vibration produced cracks, monitor and assess the situation, and develop a remediation plan.	**8**

Failure Mechanism	Cause	Likelihood Rating	Effect	Consequence Rating	Controls		Overall Risk Rating
					Monitoring	Corrective Action	
	Pit wall instability that extends towards the dike and causes instability of the dike (NOT APPLICABLE TO SOUTH CAMP DIKE AND VAULT DIKE)	**EAST DIKE: LOW -2** **BAY-GOOSE DIKE: MEDIUM -3** Pit wall failure unlikely based on assessments of pit wall stability and setback. East Dike setback is greater than Bay-Goose Dike setback; therefore, it is viewed that the likelihood rating would be different for each structure. The respect of the setback established from pit crest. East Dike has a large setback from the pit crest, and therefore a low probability that pit instability will affect the dike. The Bay-Goose Dike setback from the pit crest is less than East Dike, and therefore has a higher probability that pit instability will affect the dike.	Increase in displacement and/or displacement rate of dike toe. Large seepage / inflow only if instability resulted in loss of the cutoff wall system.	**HIGH-5** If the instability impacted the cutoff wall system of the dike, then failure of the entire structure could result. Cessation /suspension of mining operations would have already occurred due to significant pit wall instability or failure.	Slope inclinometer monitoring of the cutoff wall. Survey of the dike crest and visual inspection. Pit wall stability monitoring. Visual observation related to cracks along the dike crest.	Depressurization of pit walls. Draining of lakebed soils between pit crest and dike and/or removal of these materials. Cut back slopes of pit wall and soils to unload the crest. Adjustment of mine plan, if necessary. Develop action plan to stabilize the instable pit wall area.	**EAST DIKE** **10** **BAY-GOOSE DIKE** **15**
Failure of cutoff wall	**BAY-GOOSE DIKE ONLY:** Excessive vibration from overblasting or earthquake above design could potentially damage the cement soil bentonite and/or jet grout columns resulting in cracks or fissures.	**LOW-2** The vibration may result in increased pore pressures within the foundation soils, weakening the foundation. This may cause failure in the rockfill but is unlikely to extend into the cutoff wall system. Refer to internal erosion as a failure mechanism if cracks lead to internal erosion. It is anticipated that the soil bentonite material would deform such that cracks would not be produced.	Increased seepage water handling.	**MEDIUM HIGH-4** May require upgrade of the seepage collection system. May need to suspend mining activities while reducing seepage. The cement content within these portions of the wall should reduce the erodability of the wall and therefore protect the integrity of the dike, even though seepage rates would increase.	Monitor seepage flow for rate and volume, and for presence of sediment (turbidity). Blast vibration monitoring on the dikes. Monitoring inclinometers within the cutoff wall.	Upgrade seepage collection system and increase pump capacity. Develop action plan related to potential grouting in cutoff wall fractured zone.	**8**
Failure of the liner system	**SOUTH CAMP DIKE AND VAULT DIKE ONLY:** Settlement of the foundation material	**LOW-2** In the unlikely event of thawing of the foundation material beneath the liner, settlement of the dike's foundation material will increase tension in liner, and potentially tear the liner	Increased seepage water handling.	**LOW-2** No significant consequences for the dike itself. May require upgrade of the seepage collection system.	Monitor seepage flow for rate and volume. Monitor thermistor data for signs of increased flow through the foundation.	Upgrade seepage collection system and increase pump capacity. Installation of downstream filter blanket, buttress Develop mitigation plan to decrease seepage through the structure	**4**
Premature Closure	Corporate Bankruptcy or Early Resource Depletion	**LOW-2**	Pumping will be suspended allowing the downstream area to flood (Note – long term closure plan is for flooding to occur). No or limited monitoring of dikes.	**LOW-2** Bond is provided for this eventuality. Design of rehabilitation is the same as rehabilitation at closure of project. Before mining operations could resume any water downstream would need to be pumped out and assessment of performance would need to be done.	Environmental monitoring to ensure closure requirements are met.		**4**

SECTION 13 • REFERENCES

Table 13.1 References

No.	Title	Document Centre Reference
1	AEM 2012. South Camp Dike Construction Summary Report. March 2012.	
2	AEM 2013. Construction Summary Report Vault Dike. July 29, 2013. Ver. 1.	
3	AMEC (AMEC Earth and Environmental) 2003. Baseline Hydrology Study.December 2003 with January 2004 errata sheets.	
4	AMEC 2005a. Meadowbank Gold Project Hydrologic Monitoring 2004 Draft Data Report. February.	
5	AMEC 2005b. Meadowbank Gold Project Feasibility Study Report. June.	
6	CDA (Canadian Dam Association) 2007. Dam Safety Guidelines.	
7	Golder (Golder Associates Ltd.) 2002. Factual Report on Geotechnical Drilling, Hydrogeological and Geophysical Investigations, Meadowbank Project, Nunavut. July 12. Doc. No. 116	
8	Golder 2003. Summary Report on Spring 2003 Field Geotechnical Studies, Meadowbank Project, Nunavut. September 8. Doc. No. 208	
9	Golder 2007a. Final Report Detailed Design of Dewatering Dikes Meadowbank Gold Project. Final Report. March 13. Doc. No. 342 Ver. 0.	
10	Golder 2007b. Report Addendum Detailed Design of Dewatering Dikes Meadowbank Gold Project. July 12. Doc. No. 492 Ver. 0.	
11	Golder 2008a. 2007 Till Core Material Investigation and Laboratory Testing, Meadowbank Gold Project. Technical Memo. January 25. Doc. No. 538 Ver. 0.	
12	Golder 2008b. East Dike Design Meadowbank Gold Project. Report. October 31 Doc. No. 572 Ver. 0.	
13	Golder 2009a. Bay-Goose Dike and South Camp Dike Designs. Meadowbank Gold Project, Nunavut. February 2. Doc. No. 802 Ver. 0.	
14	Golder 2009b. Meadowbank East Dike Grouting Response Plan - Completed Works. July 14. Doc. No. 916 Ver. 0.	
15	Golder 2009c. 2009 Annual Geotechnical Inspection - Meadowbank Gold Project. November 30. Doc. No. 969 Ver. 0.	
16	Golder 2009d. East Dike Additional Details for Work Carried Out Between Stations 60+452 and 60+500. Meadowbank Gold Project. November, 2009. Doc. No. 961 Ver. 0.	
17	Golder 2009e. East Dike Construction As-Built Report Meadowbank Gold Project, Nunavut. December 15. Doc. No. 900 Ver. 0 Rev. 1.	
18	Golder 2009f. West Channel Dike Construction As-Built Report Meadowbank Gold Project, Nunavut. December 16. Doc. No. 980 Ver. 0.	
19	Golder 2010a. East Dike Sinkhole Investigation Program, October-November 2009, Meadowbank Gold Project. March 5 2010. Doc. No. 986 Ver. 0.	
20	Golder 2010. Draft of South Camp Construction As-built report. No. 1037 Ver. B. Meadowbank Gold Project. 22 April 2010	
21	Golder 2010b. East Dike CPT Investigation - Meadowbank Gold Project, Nunavut. July 22. Doc. No. 953 Ver. 0.	
22	Golder 2010c. 2010 Annual Geotechnical Inspection. Meadowbank Gold Project, Nunavut. December 3. Doc. No. 1216 Ver. 0.	

No.	Title	Document Centre Reference
23	Golder 2011a. Draft of 2011 Annual Geotechnical Inspection. Meadowbank Gold Project, Nunavut. November 21 2011. Doc. No. 1305 Ver. B.	
24	Golder 2013. Bay Goose Dike Construction As-Built Report Meadowbank Gold Project. Meadowbank Gold Project, Nunavut. April 2013. Doc. No. 1328 Ver. 0.	
25	ICOLD (International Congress of Large Dams) 1998. Dam Failures and Statistical Analysis. Bulletin 99.	
26	MAC (Mining Association of Canada) 2005. Developing an Operation, Maintenance and Surveillance Manual for Tailings and Water Management Facilities.	
27	MMC (Meadowbank Mining Corporation) 2008. Emergency Response Plan. October. Rev. 1	
28	SNC 2013a. Detailed Engineering of Vault Dike. Meadowbank Gold Project, Nunavut. January 14. Doc. No. 610548-2020-4GER-0001 Ver. 0.	
29	SNC 2013b. Construction of Vault Dike – Technical Specifications. Meadowbank Gold Project, Nunavut. February 1. Doc. No. 610548-2020-4GEF-0001 Ver. 0.	

Appendix A

Inspection Forms

DETAILED FIELD INSPECTION FORM A
DEWATERING / DIKE INSPECTION REPORT
MEADOWBANK GOLD PROJECT

AGNICO EAGLE
MEADOWBANK

All parts of this inspection form should be completed. Adverse conditions should be described and location stated. Additional information and relevant photographs should be attached.

Inspecting Officer: *Report No.:BG-IR-* *Inspection Date:* _____

DAM/DIKE INFORMATION:

Dam ☐ Dike ☒ _____ Crest Elevation: _____ Third Portage Lake _____
Goose Pit _____

A) CREST / BERM / ROAD SURFACE

	NO	YES
cracking	☐	☐
settlement	☐	☐
erosion	☐	☐
other movement	☐	☐

B) DOWNSTREAM SLOPE AND TOE AREA

	NO	YES
erosion	☐	☐
settlement	☐	☐
Bulging	☐	☐
sloughing	☐	☐
slope protection	☐	☐

Seepage ☐ none ☐

location 1:
rate: ☐ damp ☐ trickle ☐ steady _ (L/s)
clarity: ☐ clear ☐ muddy Slowing down
sample taken: ☐ yes ☐ no

location 2:
rate ☐ damp ☐ trickle ☐ steady __ (L/s)
clarity ☐ clear ☐ muddy
sample taken ☐ yes ☐ no

Sand boils ☐ none ☐ type:
location(s) _____

DETAILED FIELD INSPECTION FORM A
DEWATERING / DIKE INSPECTION REPORT
MEADOWBANK GOLD PROJECT

AGNICO EAGLE
MEADOWBANK

C) UPSTREAM SLOPE

	NO	YES				
erosion	☐	☐	wave induced		☐ surface runoff	
			location(s):			
			degree	☐ minor	☐ moderate	☐ severe
geomembrane	☐ N/A	☐				
settlement	☐	☐				
bulging	☐	☐				
sloughing	☐	☐				
slope protection	☐	☐				
sinkholes	☐	☐				
tailings surface	☐ N/A	☐				

DAM / DIKE INSTRUMENTATION: (plot any newly installed instrumentation on relevant plans and cross-sections)

	Operational	Damaged	Measurement Taken
☐ Inclinometers	☐	☐	☐ Bi-monthly
☐ piezometers	☐	☐	☐ Daily 3hrs interval
☐ Thermistors	☐	☐	☐ Daily 3hrs interval
☐ Survey Prisms	☐	☐	☐ Bi-monthly
☐ Thermistors (manual)	☐	☐	☐ Daily and weekly

DETAILED FIELD INSPECTION FORM A
DEWATERING / DIKE INSPECTION REPORT
MEADOWBANK GOLD PROJECT

COMMENTS AND RECOMMENDATIONS:

☐ Action Required: ☐ none ☒ further monitoring ☐ immediate remediation
☐ Plan or Sketch Attached
☒ Photographs (number) See Appendix

Review Officer: _____ Review Agency: _____ Date Reviewed: _____ (DD/MM/YR)

REVIEW COMMENTS: ☒ ***none***

DAILY REPORT
DIKE AND GEOTECHNICAL ENGINEERING
AGNICO-EAGLE MINES MEADOWBANK PROJECT

AGNICO-EAGLE

Date: _____ **Technician / Engineer:** _____

Weather : Sunny ☐ Overcast ☐ Rain ☐ Snow ☐ Wind ☐ Comments: _____

Health and Safety: Concern / Incident Y ☐ N ☐

Comments:

Dewatering Dikes					
BayGoose Dike		Field Visit	Y ☐	N ☐	Comment / Observation:
Instrumentation Piezometers (Auto.)	☐	Photos	Y ☐	N ☐	
	☐				
Thermistors (Auto.)	☐				
Thermistors (4) (Manual)	☐				
Inclinometer	☐	Work Activity	Y ☐	N ☐	Description:
Seepage	☐				
USB key (DL9)	☐				
East Dike		Field Visit	Y ☐	N ☐	Comment / Observation:
Instrumentation Piezometers (Auto.)	☐	Photos	Y ☐	N ☐	
Thermistors (Auto.)	☐				
Thermistors (Manual)	☐	Work Activity	Y ☐	N ☐	Description:
Inclinometer	☐				
Survey Prisms	☐				
South Camp Dike		Field Visit	Y ☐	N ☐	Comment / Observation:
Instrumentation Thermistor (Manual)	☐	Photos	Y ☐	N ☐	
		Work Activity	Y ☐	N ☐	Description:
Vault Dike		**Field Visit**	Y ☐	N ☐	Comment / Observation:
Instrumentation Thermistors (Manual)	☐	Photos	Y ☐	N ☐	
Vault Lake : Flowmeter	☐	Work Activity	Y ☐	N ☐	Description:
Instrumentation Piezo. Vpond 11 (Manual)	☐				
Tailings Facilities System					
Stormwater Dike		Field Visit	Y ☐	N ☐	Comment / Observation:
		Photos	Y ☐	N ☐	
		Work Activity	Y ☐	N ☐	Description:
Saddle Dam 1		Field Visit	Y ☐	N ☐	Comment / Observation:
		Photos	Y ☐	N ☐	
Instrumentation Thermistors (Manual)	☐				
		Work Activity	Y ☐	N ☐	Description:
Saddle Dam 2		Field Visit	Y ☐	N ☐	Comment / Observation:
		Photos	Y ☐	N ☐	
Instrumentation Thermistors (Manual)	☐				
		Work Activity	Y ☐	N ☐	Description:
Coffer Dam - Central Dike		Field Visit	Y ☐	N ☐	Comment / Observation:
Instrumentation Piezo. Vpond 8 (Manual)	☐	Photos	Y ☐	N ☐	
Instrumentation Piezometers (Manual)	☐				
Instrumentation Thermistor (Manual)	☐	Work Activity	Y ☐	N ☐	Description:
OTHER		Work Activity	Y ☐	N ☐	Description:
Reclaim Barge : Flowmeter	☐				
Ground Control Inspection - Open Pit					
Review of Ground Control F Y ☐		N ☐	**Pit Visit**	Y ☐	N ☐ Comment/Observations:
Items to Review (num.):					
Items Follow Up in Ground Control Registrer (after visit)	Y ☐	N ☐			

Appendix B

Dike Failure Scenario Appendices from the ERP

Dike Failure Scenarios

1. **Dewatering Dikes**
2. **Central Dike (removed)**
3. **Saddle Dams (removed)**
4. **Storm water Dike (removed)**

Appendix 1

Dewatering Dikes

Dewatering Dike System

The Dewatering Dike System includes the East Dike, Bay Goose Dike, South Camp Dike and Vault Dike as shown on the general mine site plan provided at the beginning of this document. The dike construction for East Dike and Bay Goose Dike involved the dumping of rockfill into water to create the shells of the dikes, excavation through rockfill and lakebed soils to bedrock, placement of granular filter and core materials, dynamic compaction, construction of the cut off wall using slurry supported trench techniques and grouting of the bedrock and contact between the cut off wall and bedrock using cementitious grout. South Camp Dike and Vault Dike both include a bituminuous liner and a key trench cut-off to make the structure impermeable. East Dike and Bay Goose Dike have crest widths in excess of 50 m and are not used by haul trucks during normal mine operation. South Camp Dike and Vault Dike have crest widths in excess of 25 m and may be used as haul roads during normal mine operation.

East Dike and Bay Goose Dike are considered high consequence structures, based on Canadian Dam Association (CDA, 2007) Dam Safety Guidelines. South Camp Dike is considered to be a significant consequence structure, based on Canadian Dam Association (CDA, 2007) Dam Safety Guidelines. Vault Dike is considered to be a low consequence structure, based on Canadian Dam Association (CDA, 2007) Dam Safety Guidelines. The dikes are relatively low, wide structures that exceed the minimum design criteria factors-of-safety (FoS) for stability for pre-drawdown conditions, operation conditions with maximum head difference across the dikes, pseudo-static earthquake conditions, and post closure conditions. Consequently, the probability of dike failure is considered to be low provided that the dikes are constructed according to the design. Mitigation against failure of the dikes includes a quality control and quality assurance program during construction, and an ongoing program of dike surveillance and monitoring during operations, as specified in the design.

For information on the consequences and monitoring/action for the various embankment failure modes possible at the Dewatering Dikes see Table 1.1 below.

East Dike

The East Dike was constructed in 2008, with foundation grouting continuing into early 2009. The East Dike has a crest length of 800 m, including abutments, and was constructed in water with a maximum water depth to bedrock at the cut off of 7.2 m. The crest of the East Dike is at elevation 137.1 m and the average lake level along the dike is 133.1 m. The main components of the East Dike include a rockfill shell, a granular core with downstream filter zone, a soil-bentonite cut-off wall through the densified granular core zone to the underlying foundations, and a grout curtain from the base of the cut-off wall into the underlying bedrock.

During operations, the East Dike separates the eastern portion of Second Portage Lake from the Portage Pit and the Tailings Storage Facility behind the Central Dike. Following closure, the East Dike will remain as a permanent structure that will separate Third Portage Lake (El. 134.1 m) from Second Portage Lake (El. 133.1 m) and maintain the existing water elevation difference of 1 metre.

The East Dike is approximately 800 m in length through an average water depth of approximately 2.3 metres, and a maximum water depth to bedrock of about 7.2 m. Crest width is approximately 55 metres. Minimum setback from the Portage Pit (distance between dike toe and pit crest) is greater than 170 metres.

Bay Goose Dike

The Bay Goose Dike together with the South Camp Dike isolates the Bay-Goose Pit from Third Portage Lake. The Bay Goose Dike acts as a permanent structure to allow mining of the Goose Pit and the southern portion of Portage Pit. The main components of the Bay Goose Dike include a rockfill shell, a granular core with downstream filter zone, a soil-bentonite and cement-soil-bentonite cut-off wall through the densified granular core zone to the underlying foundations, a jet grouted wall between the base of the cut-off wall and bedrock where the cutoff wall was not constructed on bedrock, and a grout curtain from the base of the cut-off wall or jet grouted wall into the underlying bedrock.

The Bay Goose Dike is approximately 2,200 m in length, and was constructed in water depths less than 9 metres at the cut off. Crest width varies between approximately 85 and 100 m. Minimum design setback from the Portage and Goose Pit is 70 metres.

South Camp Dike

The South Camp Dike covers a narrow channel within Third Portage Lake and in conjunction with the Bay Goose Dike isolates the Bay Goose Pit from Third Portage Lake.

The South Camp Dike is located south of the plant site area and is used to connect the mainland to South Camp Island. It covers a narrow channel, approximately 60 m in width, where water depths were between 0.5 and 1 m.

The South Camp Dike was primarily constructed between April and June of 2009, prior to ice breakup. During the winter of 2009-2010 additional thermal capping material and rockfill for the haul road was added to the dike. The South Camp Dike has a broad rockfill shell with a bituminous geomembrane liner installed on the upstream side of the shell. The liner was founded on native frozen (permafrost) till material, in a trench approximately 3 to 5 m below the lakebed surface. Compacted granular material mixed with bentonite was placed above the toe of the liner. The haul road is located on the downstream side of the dike. The South Camp Dike is approximately 85 m in length through water depths between 0.5 and 1m. Crest width is approximately 25 metres.

Vault Dike

The construction of the Vault Dike at Meadowbank was conducted from February 2013 to March 2013. Vault Dike is located across a shallow creek which connects Wally Lake and Vault Lake, at the Vault Pit area approximately 8 km north of the main Meadowbank site. Vault Dike is essential to allow the dewatering of Vault Lake and to isolate Vault Pit from Wally Lake during mining activities.

Vault Dike is designed and constructed as a zoned rockfill dam with filter zones, an impervious upstream liner consisting of a bituminous membrane, and an upstream key trench made of aggregate mixed with bentonite. The filter zones minimize seepage and internal erosion and facilitate seepage collection. Vault Dike includes a key trench at the base of the upstream side filled with a 0-25 mm fill amended with bentonite surrounding the liner. Coarse and fine filter material was placed on the upstream slope as geomembrane bedding. The bulk part of the dike consists of coarse rockfill material. The embankment crest is at El. 142.4 m and the upstream toe is at approximately El. 139.4 m. The downstream toe is at approximately El. 139.6 m and the bottom of the key trench ranges from El. 135.6m to El. 142.3m, with an average height of El. 137.0m. The upstream and downstream fill

slopes of the dam are 1.5H: 1V. The Vault Dike is approximately 275 m in length through a maximum water depth of 1 m. The crest width is approximately 25 metres.

Table 1.1: Meadowbank Dewatering Dikes Summary of Consequences and Proposed Monitoring/Action for Rare Events Based on Water Retaining Embankment Failure Modes Identified in ICOLD Study (1995)

Failure Mode	Scenario	Consequence	Monitoring/Action
Overtopping	(1) Lake level rise because of restricted outflow from Third Portage, Second Portage Lake or Wally Lake (excessive inflow is a far less likely scenario).	Water spilling over the crest. The crest is wide and comprises coarse rockfill. Significant damage to the dike is not credible, based on performance of other rockfill structures subjected to overtopping or flow through events. Mining operations might need to be suspended, but there will be considerable warning time given the design freeboard and the storage volume within the lakes.	Lake levels should be part of safety information provided to mine management. Outflow channels should be inspected weekly during thaw, open water season, and during ice break-up. If overtopping is likely, a temporary spillway could be constructed and armoured to control and localize flow at shallow dike sections.
	(2) Dam crest settles more than 2m over a distance of (say) 50m or so. This scenario requires extensive loss of support in the foundation since the rockfill of the dikes is essentially not settlement prone itself. For foundation settlement of this magnitude to occur, a piping event must develop and which in itself might be a failure mode. Or, there would have to be an unexpected layer of compressible soil in the foundation.	Same as (1).	The situation envisaged in this scenario should develop slowly with crest settlement evident at least several weeks before a run-away event develops. Easily observed cracks should be evident. Monitoring of crest settlement is appropriate, and is included in the design. Rockfill and till available from the mining operation can be placed to raise the dike crest.
Internal Erosion	(1) Dike Section: Cut off wall, cut off key trench or bituminuous liner is defective, allowing high water flow across the wall. This defect occurs at a deep water location where the core backfill and filters are segregated and permeable; the combination allows erosion of the cut off wall and increasing seepage.	The cut off wall will develop a progressively increasing void ratio, thereby increasing the rate of water flow through the dike. This is not a catastrophic failure mode as the rockfill shoulders of the dike will be stable, and at its worst, would lead to temporary suspension of mining.	Monitor seepage from downstream face for rate of seepage, and for presence of sediment in seepage. Will become evident as localized intensive seepage at dike toe and can be repaired. May also see settlement in the cut off wall. Will be most likely in deep water sections. Gradients across the cut off wall in shallow water are not high enough to cause piping.
	(2) Dike Section: Cut off wall loses bentonite because of improper construction.	Same consequences as erosion because of defect, as above.	Bentonite makes up 2% of the cut off wall fill. Loss of this material will increase the permeability of the cut off wall and increase the rate of seepage.

Failure Mode	Scenario	Consequence	Monitoring/Action
	(3) Foundation: Till is possibly non-uniform with more transmissive zones and not self-filtering. It is possible that one of these zones may align with defective construction of the core backfill and defective construction of the cut off wall allowing high flows. Seepage along the transmissive zone beneath the downstream rockfill section could erode the foundation tills at the downstream toe or flow into the downstream rockfill because of the lack of filtering.	Limited seepage at the toe or into the rockfill would accelerate into a large inflow, and could lead to the undermining of the dike if no action was taken. This is a credible catastrophic failure mode if increased seepage is not detected in time.	No particular instrumentation is needed as this failure mode will show itself as localized and increasing seepage. It could be detected by walk-over inspection by an experienced engineer or technician. Remedial action could comprise a reverse filter and rockfill buttress depending on location of the flow and configuration of the foundation, freezing, or grouting if identified in time. Quality control of cut off is important, and most important for deep water sections. In the worst case, the pit may be deliberately flooded in a controlled manner, the cut off repaired, and the pit dewatered.
Seepage within Embankment	Seepage on its own is not a credible failure scenario. The downstream rockfill shell has extremely high flow through capacity. The rockfill zone is both large and pervious, so that seepage will daylight on the downstream face and lead to instability. Any seepage related failures must include internal erosion, see above.	No credible consequences. May require upgrade of the seepage collection system. May need to suspend mining activities while reducing seepage.	Seepage monitoring program.
Seepage within Foundation	Defective construction of cut off leading to transfer of unexpectedly high fraction of the reservoir head into the downstream part of the dike foundation, or leading to a piping event as above.	This failure mechanism has caused embankment failures elsewhere because of straightforward pore pressure induced instability. However, it is unclear that it could cause failure of the Dewatering Dikes because of their large width compared to the retained water head. The most likely consequence is downstream toe slumping requiring a localized stabilizing berm before the crest roadway could be reinstated.	If this mechanism arises it should show itself during initial dewatering or very shortly thereafter.

Failure Mode	Scenario	Consequence	Monitoring/Action
Internal Conduit Rupture	There are no water off take works or other structures extending through the dikes.	Not applicable.	Not applicable.
Slope Instability	(1) Normal Operation: The rockfill shoulders of the dikes are wide and have high shear strength, making it a conservative design. Slope failure requires failure in the foundation and which would then extend into the overlying dike. Sliding failure is considered unlikely given the low horizontal forces generated by water and ice forces relative to the normal frictional force due to the weight of the dikes and the friction angles of foundation materials	A foundation failure would cause a rotational slip or sliding failure until equilibrium was reached. This mechanism would limit access along the dike until repaired. Failure through the rockfill shoulders will not necessarily compromise the water retaining function of the dikes. Failures which reach the core may cause failure.	This mechanism should develop during construction or dewatering, due to increase in load and associated pore water pressure increase. Initial stages of failure should be observable as tension cracks in the dike crest. Walk-over inspection of the dikes by a trained inspector is an appropriate monitoring strategy. Survey of crest, face, and toe is also appropriate. Stabilizing berms can be placed inside the dikes or through water along the upstream shoulder.
	(2) Earthquake Induced: Occurrence of an extreme earthquake, much in excess of the current understanding of seismicity of the area.	The extreme earthquake loading for this site is a low magnitude. Settlement of the dikes could occur in the event of a large earthquake. Dynamic compaction of the core during construction may have subjected the rockfill shells to accelerations equivalent to the expected earthquake loading. This would not be a failure situation. The crest is also erosion resistant for any earthquake induced wave action in the impounded water.	Dike inspection following earthquakes felt on site.

Failure Mode	Scenario	Consequence	Monitoring/Action
Failure of Cut off Wall or Bituminuous Liner Due to Movement of the Dikes	Differential horizontal movement of dikes due to water or ice loading, or pit wall failure. Creates a breach in the cut off wall, cut off key trench or bituminuous liner. Ice and water forces are not credible due to the ratio of frictional forces generated by the weight of the dike versus ice loads and water pressure. Pit wall failure involving the dike unlikely based on assessments of pit wall stability and setback distance between the pit and the dikes.	Large inflows through the breach. Pit would flood requiring suspension of mining activities. Potential for loss of life for workers inside dikes.	No enhanced monitoring. Prism monitoring program sufficient. If the pit floods, then repairs to cut off or bituminuous liner would be done prior to dewatering.
Unexpected Settlements	Unexpected foundation soils consolidate during dike construction. A significant quantity of clay that was not recognized during foundation excavation would be required to generate settlement required for a water release event. Settlement of the core will be limited by dynamic compaction.	2 m of core settlement would be required to allow water flow through the rockfill and over the settled core. This flow would not cause failure of the rockfill shells. It would also be readily repaired by placing more end-dumped till into the settled zone.	No enhanced monitoring required, as settlement would be apparent from prism monitoring data and visual inspection. Excessive settlements may be remediated by excavating rockfill above the core and placing more till. Soil conditions will be observed during construction, and design revised to accommodate actual conditions.

1.1 Failure Scenario during Operations

The 'worst-case' scenario for failure of the dewatering dikes during operations would involve a movement of the dikes that compromises the integrity of the cut off wall, cut off key trench or bituminous liner. However, the rockfill has a very high flow-through capacity and a high strength and will not move unless the foundation is involved. The water will flow through the upstream rockfill first, then through the core and cut off wall, cut off key trench or bituminous liner, and finally through the downstream rockfill berm. Flow through cracks opening in the foundation may erode the foundation soils and the core. The upstream rockfill will choke the flow to some degree, and flow will decrease once the downstream toe of the dike is inundated and the head difference across the dike begins to reduce.

Although this describes a 'worst-case' scenario, a catastrophic failure of the pit dewatering dike system is not considered a credible failure mode. Elements of the dike design, including the width of the dike section, and the inclusion of filters, in addition to the cut off wall, cut off key trench and bituminous liner make catastrophic failure of the dike highly unlikely. However, for the purposes of this document, the effects of such a failure are described below.

Potential Effect

In the case of East Dike, the worst-case scenario would be associated with the short portion of the dike through the deepest water along the alignment at the centre of the dike. In this area the water depth is as much as 7 m to bedrock at the cut off wall within the dike. This inflow could potentially result in loss of workers caught in flowing water. Breach of the East Dike would be unlikely to trap workers in the pit when access ramps are on the west side, opposite the inflows. Breach of the East Dike would result in cessation of mining, either temporarily or permanently.

Upon completion of the East Dike and dewatering of the northwest arm of Second Portage Lake, there was approximately 17 million m^3 (Mm^3) of water remaining in Second Portage Lake. If the segment of dike at the deepest portion were suddenly removed, flow from Second Portage Lake into the pit would continue until the elevation of the lake drops by several metres, at which time the current lake bottom would be exposed and would act as a barrier to flow towards the pit. This scenario is the worst in the final year of pit operation when pit volume is the largest. The volume of water associated with this drawdown would be on the order of about 10 Mm^3. Some erosion of the till between the pit crest and dike toe would be expected, so the depth of water loss from the lake may be larger, but this would take some time to fully develop.

Inflow to the pit could expose large amounts of shoreline and shoal habitat around the lake. Water flowing into the pit could entrain suspended solids and dissolved constituents from the dike material and pit walls. If necessary, the water could be retained within the pit and diked area and would be amenable to treatment (e.g., particle settling, in-situ amendment) before discharge, should it be required.

The ecological effects of the exposure of shoreline and shoal habitat on fish and fish habitat would be to temporarily eliminate spawning areas and result in reduced water quality from exposure of sediment to wave and wind induced erosion. The effect of this would last approximately one year as inflow from Third Portage Lake to Second Portage Lake averages 10 Mm^3 annually (AMEC, 2003). Presuming that the dike breach is repaired, water levels in Second Portage Lake would rise over the

spring and summer to return to pre-breach elevations and would re-fill the lake in the event of a 'worst-case' scenario.

In the case of Bay Goose Dike, the worst-case scenario dike breach that could allow the greatest amount of water inflow would be associated with the southeast segment of the dike through the deepest water along the alignment. In this area, water depth is as much as 20 m deep at the cut off, and the pit could be as deep as 130 m. This inflow could potentially result in loss of workers caught in flowing water. Breach of the Bay Goose Dike would be unlikely to trap workers in the pit when access ramps are on the northwest side, opposite the inflows. Breach of the Bay Goose Dike would result in cessation of mining of the Goose Pit, either temporarily or permanently.

In the unlikely event that such a failure of the Bay Goose Dike were to occur, the rate and volume of water entering the downstream pit would depend on the magnitude of the breach and the length of time to repair the breach. Third Portage Lake has an estimated volume of 446 Mm^3 (Golder, 2006). The final volume of Portage Pit (30.0 Mm^3) is roughly 6.7% of the volume of the lake, while Goose Pit (14.8 Mm^3) is approximately 3.3% of the volume. In the case of a catastrophic breach of the Bay Goose Dike, the estimated Third Portage Lake water level drawdown would be approximately 1.0 m and 0.5 m, respectively assuming that the failure occurs when the pits are completely excavated and a complete filling of the pits. These estimated worst-case scenario changes in water level are comparable to the mean average annual difference between high and low water (0.3 m) on Third Portage Lake.

There would be a small impact to fish and fish habitat in Third Portage Lake in the event of a 0.5 m to 1.0 m drop in water level. Areas used for spawning may be slightly nearer to the ice cover and a small amount of habitat might be vulnerable to freezing. Water quality within the pit would be temporarily impaired from an increase in suspended and dissolved solids, although water quality would return to near background during the first winter as sediment would settle under the ice cover.

In the case of South Camp dike, the worst-case scenario dike breach that could allow the greatest amount of water inflow would be associated with the centre segment of the dike through the deepest water along the alignment. In this area, the water depth is only a maximum of 1 m. This inflow could put the workers at risk at the site on a temporary basis and a potential loss of life between 0 and 10 due to workers caught in flowing water. Breach of South Camp Dike could eventually result in cessation of mining, either temporarily or permanently.

If the segment of dike at the deepest portion were suddenly removed, flow from Third Portage Lake into the pit would continue until the elevation of the lake drew down slightly as South Camp Dike retains a maximum depth of 1 m of water. The impact of a potential failure would likely be limited.

Inflow to the pit could expose a limited amount of shoreline and shoal habitat around the lake. Water flowing into the pit could entrain suspended solids and dissolved constituents from the dike material and pit walls. If necessary, the water could be retained within the pit and diked area and would be amenable to treatment (e.g., particle settling, in-situ amendment) before discharge, should it be required.

The ecological effects of the dike failure will probably have no significant fish or wildlife habitat, affected or deteriorated. Presuming that the dike breach is repaired, water levels in Third Portage Lake would rise over the spring and summer to return to pre-breach elevations and would re-fill the lake in the event of a 'worst-case' scenario.

In the case of Vault dike, the worst-case scenario dike breach that could allow the greatest amount of water inflow would be associated with the centre segment of the dike through the deepest water along the alignment. In this area, the water depth is only a maximum of 1 m. This inflow could put the workers at risk at the site on a temporary basis and a potential loss of life between 0 and 10 due to workers caught in flowing water. Breach of the Vault Dike could eventually result in cessation of mining, either temporarily or permanently.

If the segment of dike at the deepest portion were suddenly removed, flow from Wally Lake into the pit would continue until the elevation of the lake drew down slightly as Vault Dike retains a maximum depth of 1 m of water. The impact of a potential failure would be limited.

Inflow to the pit could expose a limited amount of shoreline and shoal habitat around the lake. Water flowing into the pit could entrain suspended solids and dissolved constituents from the dike material and pit walls. If necessary, the water could be retained within the pit and diked area and would be amenable to treatment (e.g., particle settling, in-situ amendment) before discharge, should it be required.

The ecological effects of the dike failure will probably have no significant fish or wildlife habitat, affected or deteriorated. Presuming that the dike breach is repaired, water levels in Wally Lake would rise over the spring and summer to return to pre-breach elevations and would re-fill the lake in the event of a 'worst-case' scenario.

Mitigation, Management, and Monitoring

A major cut off breach scenario due to pit wall movement, while possible, has a low probability of occurrence in East Dike or Bay Goose Dike. If foundation movement was sufficient to compromise the cut off wall, then the core backfill would act as a semi-permeable element and limit flow. Water would first need to flow through the rockfill shell, the core backfill, the damaged cut off wall, and then through more of the core, filters, and the downstream rockfill. Provided that the downstream filter elements against the rockfill shell are properly constructed, then migration of the core and cut off wall into the rockfill will not occur. Some additional seepage may occur due to failure of the cut off wall; however this would be noted during regular monitoring. Mitigation could be by jet grouting, freezing, or installation of sheet piling through the cut off wall.

The use of appropriately graded filters in the design of dikes and dams is standard engineering practice, and is the key to preventing internal erosion. The dike design includes the use of a two zone filter on the upstream face of the pit side rockfill. During the construction of the dikes a quality control and quality assurance program was undertaken.

Routine visual inspection of the dikes is to be conducted on a regular basis to document any changes in the dikes.

During the operation of the dikes, a series of monitoring instrumentation will be installed, including:

- Thermistors to monitor the thermal regime in the dike and foundations;
- Slope inclinometers and prisms to monitor deformations within the dikes; and
- Piezometers to measure pressure and to infer flow through the dikes.

Piezometers downstream of the cut off wall would be monitored for pressure changes as the pits are deepened. Increasing pressure would indicate that less head loss is occurring across the seepage cut off, which might indicate that a crack has formed, permeability is increasing, or the pit is experiencing inflows from some other potential flow pathway. The instrumentation will be monitored to identify any potentially problematic areas relating to dike instability. Mitigation measures for seepage and piping could include:

- Additional pressure grouting of bedrock materials;
- De-pressurization wells;
- Construction of a slurry cut off wall within the core just upstream of the suspected seepage area;
- Jet grouting of the core and foundation in the suspected seepage or crack area;
- Construction of a cutter soil mixing (CSM) wall in the suspected crack area;
- Freezing;
- Installation of toe drains; and
- Construction of interceptor ditches within the down-stream overburden materials.
- Allow pit to flood, install new cut off or bituminous liner under no-flow conditions, then dewater and resume mining.

Specific monitoring and mitigation strategies have been be developed as part of an Operations Plan (OMS Manual) for the dewatering dikes.

1.2 Failure Scenario during Closure

At end of mine life, once the water quality of the pit lake has been determined to be suitable for release, a portion of the south end of the Bay-Goose Dike will be removed resulting in a hydraulic connection between the Goose/Portage Pit Lake and Third Portage Lake. The East Dike will be the only dike that will remain in service. The elevation of the pit lake will be equal to Third Portage Lake. The elevation difference between the pit lake and Second Portage Lake will be approximately 1 m. Consequently, there will be a low hydraulic gradient from the pit lake towards Second Portage Lake. During the closure and post-closure period, the natural central and east channel outlets that connect Third Portage to Second Portage Lake will continue to carry the entire flow between the two lakes.

Potential Effect

A breach of the East Dike would create an additional outlet and cause water to leave the Portage/Goose pit area and spill into Second Portage Lake at a greater rate, partly at the expense of flow from the central and east channel outlets. This would cause a rise in water level in Second Portage Lake and a reduction in level in Third Portage Lake. The additional water would flow through the channel connecting Second Portage Lake to Tehek Lake until the water elevations in Second and Third Portage lakes equilibrated.

In the event of such a scenario, water would flow from Third Portage Lake, northward through the pit lake area, and then east through a potential East Dike breach and into Second Portage Lake. There is a naturally large outlet capacity via the connecting channel from Second Portage to Tehek Lake. Water residence time in Second Portage Lake during and after mine development is less than one year. Thus, in the event of an East Dike breach, any additional water added to Second Portage Lake would leave the system relatively quickly. Given the flow-through nature of the lake there would be little net change in Second Portage Lake volume or lake elevation as water would easily be absorbed into the much larger Tehek Lake.

Drawdown of Third Portage Lake would be limited, given the large size of the lake (33 km^2) and the constriction points within the system that would slow drawdown. Specifically, the magnitude of drawdown in the event of a breach would depend on the magnitude and depth of the breach, time of year (winter ice cover would prevent loss of water), response time, flow rate (i.e., the loss of water depends on the location of the breach and friction through the system), and the outlet capacity of Second Portage Lake. For example, total annual average discharge from Third Portage to Second Portage Lake is approximately 10 Mm^3 with a mean annual difference in water level between spring and fall of 0.3 m. Given the large size of Third Portage Lake, a breach resulting in the loss of 10 Mm^3 of water, which is equivalent to an entire open water season of runoff through all discharge channels would result in a drawdown of only about 0.3 m. Maximum drawdown would be one metre.

Reductions in water level would therefore be small and have only minor impacts to fish habitat in Third Portage Lake. Adverse impacts to water quality would not be expected given that water quality within Goose/Portage pits is expected to be very high.

Mitigation, Management and Monitoring

Internal erosion of the cut off wall could result in an increase of the rate of water flow through the East Dike. However, this is extremely unlikely due to the low hydraulic gradient across the East Dike (~ 1 m of head difference) and the filter effect of the core backfill. Such a scenario is more likely to occur during the operational phase of the East Dike when the hydraulic gradient across the dike section is much higher, though in the opposite direction. If such a scenario were to occur, it would not be considered a catastrophic failure mode due to the stability of the rockfill shoulders comprising the outside structural elements of the dike.

A breach in the East Dike during closure could be managed by the placement of material to reduce the flow of water and reduce potential erosion of the till core. The hydraulic gradient across the dike at closure is low. The dike could be repaired and hydrologic conditions restored without any danger to the overall stability of the dike, provided annual monitoring is carried out following closure.

MEADOWBANK GOLD PROJECT

Transportation Management Plan: All Weather Private Access Road

Prepared by:
Agnico-Eagle Mines Limited – Meadowbank Division

Version 3
March 2014

EXECUTIVE SUMMARY

Agnico-Eagle Mines Limited – Meadowbank Division (AEM) is required to implement an access management plan for the Tehek Lake All Weather Private Access Road (AWPAR) under covenant #54 of Indian and Northern Affairs Canada (INAC) Crown land lease 66A/8-71-2 and condition 47 of Kivalliq Inuit Association (KIA) Right of Way (ROW) Agreement KVRW06F04 and Condition 32 of Project Certificate No.004 issued by the Nunavut impact Review Board (NIRB). This Transportation Management Plan has been prepared to provide information on the planned utilization of the access road for the Meadowbank site. This Plan has been updated to include the criteria and processes used to authorize controlled non-mine use of the road for the purpose of traditional Inuit activities pursuant to the 2009 revision of NIRB Project Certificate No.004, Condition 32.

The Meadowbank Gold Project is located approximately 70 kilometers north of the Hamlet of Baker Lake, Nunavut (Figure 1). The mine plan includes open pit mining from three separate open pits at the site over a 10 year mine life. The Project is host to an open pit mineral reserve of 3.64 M ounces gold. The AWPAR extends from the Hamlet of Baker Lake to the Meadowbank Project site, a distance of approximately 110 kilometers.

Baseline environmental and geotechnical analysis of the proposed route was conducted prior to the submission of the Final Environmental Impact Statement. The right of way for the road was selected to minimize possible effects on the environment. The AWPAR was completed in March 2008 and was constructed above grade, using quarried material from non-acid generating country rock, with a minimum number of bridge crossings (nine).

The AWPAR is used to provide access to the site during construction of the mine and milling facilities, and to provide a transportation route from Baker Lake to the site for supplies (dry goods, fuel, etc.) required until the end of production and reclamation (through 2020 at the earliest). Year-round road access reduces the amount of infrastructure required at the site by significantly reducing the volumes of fuel and other consumable supplies that must be stored at the mine in order to support ongoing operations.

IMPLEMENTATION SCHEDULE

This Plan will be implemented immediately.

DISTRIBUTION LIST

Hamlet of Baker Lake
Baker Lake Hunter and Trapper's Organization
Meadowbank Occupational Health & Safety Committee
Meadowbank Community Liaison Committee
Government of Nunavut – Department of Environment
Aboriginal Affairs and Northern Development Canada – Water Resources and Land Administration
Kivalliq Inuit Association
Nunavut Impact Review Board
Nunavut Water Board
AEM - Health & Safety Superintendent
AEM - Environmental Superintendent
AEM - Site Services Superintendent
AEM - Security Officer
AEM - Mine Superintendent
AEM - Mine General Manager
AEM - AWPAR Dispatch / Gatehouse
Post on AEM Meadowbank Intranet
Arctic Fuels in Baker Lake
Peter Tapatai Expediting in Baker Lake
BLCS in Baker Lake
Dyno Nobel Meadowbank

DOCUMENT CONTROL

Version	Date (YMD)	Section	Page	Revision
Draft	07/18/31			Comprehensive plan for AWPAR
Draft	09/04/17			Updated to reflect completion of road construction and compromise solution for limited public access
1	09/10/03	2.2 Appendix A	6	Updated to include criteria and processes to authorize non-mine use of the road pursuant to 2009 revision of NIRB Project Certificate No.004, Condition 32
2	10/05/12	2.2 2.3.2 2.3.4 Appendix A	5 7 8 9 Ap A	Modification of safety procedures in sec 2.2 to address INAC comments Removal of herding of wildlife as per GN Department of Environment; Addition of Section 2.3.4 addressing accidents on AWPAR Appendix A modified to address INAC comments
3	14/03/15	1.1 1.3 2 2.2 2.3 2.4 4	1 3 4 5 6 8 9	Surface material size Update maintenance section Remove paragraph on Emergency Shelters Add paragraph on TDG requirements Remove use of HTO pass Spill kits at each major water crossing AWPAR Procedures New Closure plan document

Prepared By: _____
Jeffrey Pratt
Environmental Coordinator

Approved By: _____
Kevin Buck
Environmental Superintendent

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Figure 1: Meadowbank Project Location
Figure 2: AWPAR Road Alignment

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Appendix A: AWPAR Safety Briefing for Non-Mine Users
Appendix B: AWPAR Procedures

SECTION 1 • AWPAR CONSTRUCTION

In order to facilitate the movement of equipment and supplies from Baker Lake to Meadowbank during construction and subsequent production at the site, the 110 km long AWPAR was constructed in 2007 and 2008. The route from Baker Lake to the Meadowbank site traverses lands administered by the Hamlet of Baker Lake, INAC (Crown lands) and the KIA (Inuit Owned Lands). The land tenure along the route is broken down as follows:

- 6.92 km within the municipal boundaries of Baker Lake;
- 61.34 km on Crown Land; and
- 43.08 km on Inuit Owned Lands (25.38 km within IOL BL-14 and 19.24 km within IOL BL-18).

In selecting the preferred route for the road, care was taken to select a route which would have a minimal impact on the environment by avoiding environmentally sensitive areas and by keeping the number of required stream crossings to a minimum. The current planned route for the road required 22 stream crossings to be constructed. Nine of these proposed crossing sites are bridge crossings due to either the physical size of the channel to be crossed or because the stream is ranked as having a high fish habitat value. The remainder of the proposed crossings were accomplished using culverts of various dimensions and configurations specific to the requirements for each individual drainage channel.

Road construction required the development of a total of 22 quarries along the route to provide the necessary aggregate for construction.

1.1 DESIGN CRITERIA

The following criteria were followed during the design and construction of the AWPAR:

Length……approximately 110 km long
Travel surface width (nominal) ……8.2 m (27 ft)
Maximum Slope Gradient ……8%
Maximum design speed……..50 km/h
Travel surface ……0-3/4" minus crushed rock
Stream crossings ……22 (9 bridges, 13 culverts)
Bridge type…….. prefabricated steel *(*logging industry style)

The AWPAR has the following features:

- Flexible delineators (flags) at 100 m intervals each side;
- Kilometer markers each kilometer each side;
- Single lane bridges; and

- Radio controlled traffic

1.2 CONSTRUCTION

The AWPAR was constructed using conventional road building techniques used in permafrost conditions. Construction of the road began in early 2007 and was completed in March 2008. NUNA M&T Services Ltd. was retained as contractor for the road construction. Work on the road began from the Baker Lake end and progressed toward the site. This allowed for equipment and materials to be shipped to Baker Lake and transported to the site for the beginning of mine site construction in mid 2008. All of the proposed stream crossings had shallow water depths (<0.8m) and were frozen to the bottom during culvert or bridge installation. This reduced or eliminated potential problems related to sedimentation in the watercourse and erosion of the stream bed.

The road was constructed above current grade using mostly quarried non-acid generating country rock. To preserve the underlying permafrost, there was virtually no removal or disturbance of the natural ground surface, except in localized instances. Wherever possible, permanent freezing of the natural sub grade was promoted by placing fills when the ground was frozen to surface. The construction standards for the road adhered to the design recommendations developed by Golder Associates Ltd. These construction standards were outlined in a report entitled "Design Recommendations for the Proposed Tehek Lake Access Road" produced by Golder on July 7, 2006 and further clarified in a memo dated December 14, 2006.

The road was constructed to the same standards, regardless of land owner (IOL, Crown or Commissioner's Lands). In order to maintain the integrity of the permafrost under the road bed, the following minimum thickness guidelines were followed for the road. In areas of thaw susceptible soils, the road bed was constructed to a minimum thickness of 1.05 metres overlain by 0.15 metres of surfacing material for an overall thickness of 1.20 metres. In areas underlain by thaw stable soils, the road bed was constructed to a minimum thickness of 0.85 metres overlain by 0.15 metres of surfacing material for an overall thickness of 1.0 metre. However, in areas of exposed bedrock or where bedrock is known to be within 0.5 metres of surface, the road bed was constructed to a minimum thickness of 0.35 metres overlain by 0.15 metres of surfacing material for an overall minimum thickness of 0.50 metres.

The top width or travel surface of the road was maintained with a minimum width of 8.2 metres. This minimum width is the optimal size for the road, from both an economic and ease of construction perspective, based on the type of equipment being used.

Due to the lack of significant quantities of marine gravels or glacio-fluvial gravels that are suitable for road construction along the route, most of the material for the road bed was quarried. A total of twenty-two quarry sites were selected along the proposed route to provide the crushed material for road construction; six quarries are located on Inuit Owned Lands, fifteen are located on Crown Land and one is located within the Baker Lake municipal boundary. Each quarry has a footprint of approximately 150 m by 150 m.

There are 22 stream crossings along the route for the access road. The stream crossings consist of either culverts or bridges, depending on the potential of these streams for fish habitat. Thirteen of

the proposed stream crossings are characterized as having no potential for fish habitat and were crossed using culverts, while nine of the proposed stream crossings are characterized as having potential fish habitat and are crossed using prefabricated bridges.

Bridge installations were accomplished using steel bridges of a prefabricated design with span lengths of either 12 m or 30 m depending on the width of the wetted channel. Two different abutment designs were employed for the bridges, depending on the span length. These abutments were constructed on each side of the channel so that they did not encroach on the watercourse, thereby reducing the environmental impact of the construction. For the 30 m bridges, the abutments utilized a bin wall design. The framing for the bin wall was constructed from bolted together sheets of corrugated steel and filled with rock. The abutments for the 12 m spans were constructed using a pre-cast concrete pad foundation with a structural steel support for the bridge. This configuration was filled in with rock from the road bed. The bridge deck, for both designs, was launched from one side or installed with the use of a mobile crane.

1.3 MAINTENANCE

AEM has a designated road crew that looks after maintenance of the AWPAR 365 days of the year. During winter months maintenance is generally snow removal and continuing to keep the road open to allow fuel transfer from the Baker Lake tank farm. Summer month's maintenance includes grading and repairs to the road. Reject NPAG material from mining activities is used to repair the surface of the AWPAR.

No repairs to steam crossing areas are completed during fish spawning periods. All work is completed on fish bearing streams only upon receiving authorization of the Department of Fisheries and Oceans.

SECTION 2 • ROAD OPERATION

The road is designed for use by conventional tractor trailers which will transport supplies from the Baker Lake Marshalling Facility and Bulk Fuel Storage area to the site. The road will be used year round however the road can be closed on a short term basis for different reason (bad weather, wildlife, heavy traffic, etc).

The key haulage equipment operating on the road is supported by radio controls. Radio communications are relayed through the Dispatch located at the Baker Lake Gatehouse.

It is anticipated that approximately 60,000 to 70,000 tonnes of dry freight and diesel fuel will have to be transported to the site each year. At approximately 40 tonnes per load, this translates into the delivery of 11,750 loads (or 3,500 passes including return trip) of supplies each year.

The road will be maintained by AEM to ensure timely delivery of freight for mine operations. Policing of the road will be conducted by AEM's security and road maintenance and haulage staff.

2.1 HAULAGE AND ROAD SAFETY

All of the required fuel and supplies for the operation of the mine will be transported to the site via the AWPAR. During the life of the mine, the transportation of freight and road maintenance operations will be conducted by an owner operated fleet. All drivers will either be employees of the company or a company hired contractor (such as Arctic Fuels) and must possess a valid driver's license from a Canadian province or territory, for the appropriate class of vehicle, in order for them to be allowed to operate vehicles on the access road.

When transporting Dangerous Goods on the AWPAR each driver must possess Transportation of Dangerous Goods (TDG) certification from an accredited trainer. Proof of certification must accompany each driver at all times.

2.2 ROAD ACCESS

As mandated by Condition 32 of the NIRB Project Certificate, amended in July 2009, the AWPAR is maintained and operated as a private access road for the Meadowbank Project with controlled access for non-mine use by ATV for the purpose of carrying out traditional activities. The following measures have been implemented to manage access and use of the road:

- A manned gatehouse with lockable gate is in operation at KM 5 (on Commissioner’s land administered by the Hamlet of Baker Lake). The gatehouse is manned by an AEM employee whenever the road is in operation. This employee acts as the Dispatch for all traffic on the road and all vehicles are required to stop and report in at the gate prior to entering or exiting the road;

- English and Inuktitut signs are posted at the gatehouse, at each bridge crossing, and every 10 kilometers along the road, stating that unauthorized public use of the road is prohibited;

- Signs in English and Inuktitut are posted along the road route to indicate when entering and leaving Crown Land;

- Notices are placed on radio and television to inform the residents of the Hamlet of Baker Lake that the road is private with non-mine use limited to authorized use by ATV for pursuit of traditional Inuit activities; and

- All mine personnel using the road are required to monitor and report unauthorized non-mine use of the road. Dispatch will record all authorized and unauthorized use (when we are aware of such use) of the AWPAR by non-mine vehicles using the data form attached in Appendix A to this Plan.

To ensure safe and controlled use of the AWPAR by ATVs for the purpose of traditional Inuit activities, AEM has implemented the following measures:

1. The road remains closed to cars and trucks owned by the public. Access is restricted to All Terrain Vehicles (ATVs) only;

2. All ATVs accessing the road are required to report to the gatehouse. The resident will present themselves at the AEM gatehouse and will then be given access to the road. Prior to granting access, the AEM Dispatch will:

    - Provide a safety briefing on the road, specifically on the prevailing traffic and road conditions of the day and time, the safety rules and procedures and the extent of the no-shooting zone (Appendix A);
    - Record who is traveling on the road, where they are heading and when they expect to return so that other traffic can be warned by radio of their presence;
    - Have the driver acknowledge that they are traveling on a mining road and have been informed of the risks.

3. AEM collaborates with the HTO and the Hamlet of Baker Lake to develop the safety rules and procedures for all ATV's using the road including pulling off the road whenever a truck approaches. These safety rules are published in Inuktitut and English and then provided to all ATVs at the gatehouse. AEM, the HTO and the Hamlet will jointly educate the residents of Baker Lake on these safety procedures through community radio and through community training sessions. ,

4. As mandated by Condition 32 e) of the NIRB Project Certificate, AEM will hold an annual public meeting in the Hamlet of Baker Lake to review the safety rules of the AWPAR and discuss any items of importance in regards to the AWPAR.

5. AEM provides buggy whips and safety vest for on all ATVs using the road in order to improve its visibility on hills. Use of this safety equipment is mandatory while on the AWPAR. AEM will not police safety once the ATV's are off the AWPAR;

6. For security purposes, access is forbidden past km 85 for all the ATVs. AEM has established a second barrier at the mine site end of the road to prevent ATVs from traveling into the active mine zone where special safety equipment and training is required under the Nunavut Mining Act. This consists of a crossing gate constructed at the mine site airstrip terminal building. This structure has been sited so that it can be used both to service the airstrip and to control access onto the mine site.

7. All hunting activity must avoid cross shooting over the road, respect a safe zone along the road and no shooting around work area; and

8. AEM reserves the right to refuse future access to individuals who do not respect the rules on safety, speed and the no shooting zone when using the road.

2.3 OPERATIONAL PARAMETERS

In general, the operational parameters for the road are summarized below:

- Wildlife has the right of way;
- All vehicles (except ATVs) are to be insured and licensed;
- At each major water crossing AEM has placed first response spill kits;
- Hunting and fishing restrictions will be as per HTO's stipulations. All AEM employees are not allowed to hunt or fish while they are on their work rotation. Outside of the work rotation employees are subject to control measures as set by the Baker Lake HTO;
- All spills of any materials will be reported and cleaned up, as set out in the spill contingency plans. The haulage fleet will be required to have appropriate spill containment and clean-up equipment on hand or available on demand;
- Signs will be posted at key points near and around the site again to advise the public traveling by skidoo or ATVs that they are in a restricted and potentially hazardous area.

2.3.1 Mitigation Measures – Potential Effects From Traffic

Mitigative measures taken to limit potential effects from traffic during mine construction and mine operations are:

- Provide all road operators informational regarding the potential for wildlife/vehicle collisions;
- Restrict vehicles to designated roads and approved construction areas (i.e. no off road travel allowed);
- Ban any AEM use of off-road vehicles outside exploration to avoid damage to local vegetation (tundra);

- Monitoring and reporting of significant numbers of wildlife observed in the vicinity of roads and immediately reporting to appropriate environmental mine staff who will issue notices to vehicle operators accordingly;
- Posting appropriate speed limits (e.g., 50 km/h);
- Giving wildlife the right of way and reducing traffic speeds when animals are detected near roads or other approved work areas;
- Reporting and disposing of accidental wildlife mortalities near the mine site.

2.3.2 Mitigation Protocols – Wildlife

Wildlife is expected occasionally to be observed on the site roads, the airstrip, or the access road. Caribou and other wildlife will have the right-of-way at all times. All project personnel will be notified by dispatch radio if any wildlife is observed in the site vicinity.

The GN Department of Environment has indicated to AEM that herding as a technique to move wildlife from their normal pathways, migration routes, and habitat is not acceptable and may be a violation of sections 73 and 74 of the Nunavut Wildlife Act. Consequently wildlife is not to be herded from the AWPAR under any circumstance. When caribou are present on the road they are to be given the right of way. Vehicles should pull over and stop until the animals clear the roadway. Alternatively the vehicle can turn around and try to pass at a later time once the road is clear. This type of action (shutting down or turning around) should be immediately reported by radio to the Dispatch.

Herding is not to be used as a technique to move wildlife without the permission of the Meadowbank Environmental Superintendent. The Environmental Superintendent will not grant such permission unless he believes that there is an imminent risk to the safety of mine personnel or the wildlife and that he has a valid permit for such activity from the GN Department of Environment. This permission will not be given under normal circumstances. It will only be given in very unique situations where there is an imminent danger that cannot be mitigated by other means.

Wildlife movement will be monitored throughout the mine life and improvements in mitigation plans made as appropriate (adaptively managed).

Wildlife mitigation for potential effects of road and airstrip construction includes:

- Protecting locally sensitive areas;
- Temporarily suspending circulation on the road when the safety of caribou, grizzly bears, or other wildlife is threatened.

2.3.3 Spill Contingency Plan

A trained site-based emergency response and spill clean-up team is available on site with appropriate equipment to respond to all spills. Spill response is implemented by environmental staff who advise, document, and report on initial response and clean-up actions.

2.3.4 Accident Procedures

The following action is to be taken in the event of an accident on the AWPAR involving other vehicles (including ATV's) or in the event of an accident involving contact with wildlife such as caribou, musk ox, bear, wolf, etc.;

- ✓ Check condition of people involved in the accident and provide immediate first aid if appropriate;
- ✓ Call Dispatch and report the location and nature of the accident and indicate the type of assistance required (medical help, environmental clean up, fire and/or mechanical help);
- ✓ Secure the accident site so that the vehicles do not continue to present a hazard to others. This may involve moving the vehicles to the nearest pull off in the event of a minor accident; or blocking off the road back from the site in both directions in the event of a more serious accident.
- ✓ If safe to do so secure the site to prevent continued spill or leakage of contaminants into the surrounding environment.

Upon receiving the accident call, Dispatch will initiate the mine's emergency response procedure passing along the information to the emergency response coordinator. The emergency response coordinator will then call out the required emergency response personnel to assist at the accident site.

Once the accident site is secured and all people requiring assistance have been removed to medical care, the emergency coordinator will turn the scene over to the mine's safety personnel so that an appropriate accident investigation can be initiated.

In the event of an incident involving contact with wildlife the Dispatcher will notify the site security personnel and the Environmental Superintendent (or designate). Security and the site environmental team will then initiate an appropriate accident investigation. The Environmental Department will ensure that appropriate reporting of such incidents is made on a timely basis to the Kivalliq Inuit Association, the Baker Lake HTO and the GN Department of Environment. The reader should refer to the Meadowbank Terrestrial Ecosystem Management Plan for further detail on how accidents involving wildlife are to be investigated.

The AWPAR is a private road and is thus not policed by the Baker Lake RCMP. Emergency response is the responsibility of AEM. However in the event of a serious accident the RCMP will be contacted and advised of the incident. The RCMP will then decide on whether they will become involved or take the lead on any subsequent accident investigation.

2.4 AWPAR PROCEDURES

Meadowbank has developed site associated procedures for the AWPAR. These procedures can be found in Appendix B of this document, as well as on file at the mine site.

SECTION 3 • REPORTING

Dispatch will record all authorized and unauthorized use (when we are aware of such use) of the AWPAR by non-mine vehicles using the data form attached in Appendix A to this Plan. The data will be submitted to DFO, GN, NIRB, Environment Canada, and the Nunavut Water Board annually in the Meadowbank Annual Report.

This data will be incorporated into annual reporting to the NIRB. The objective is to collect such data so that this plan can be adaptively amended based on actual experience.

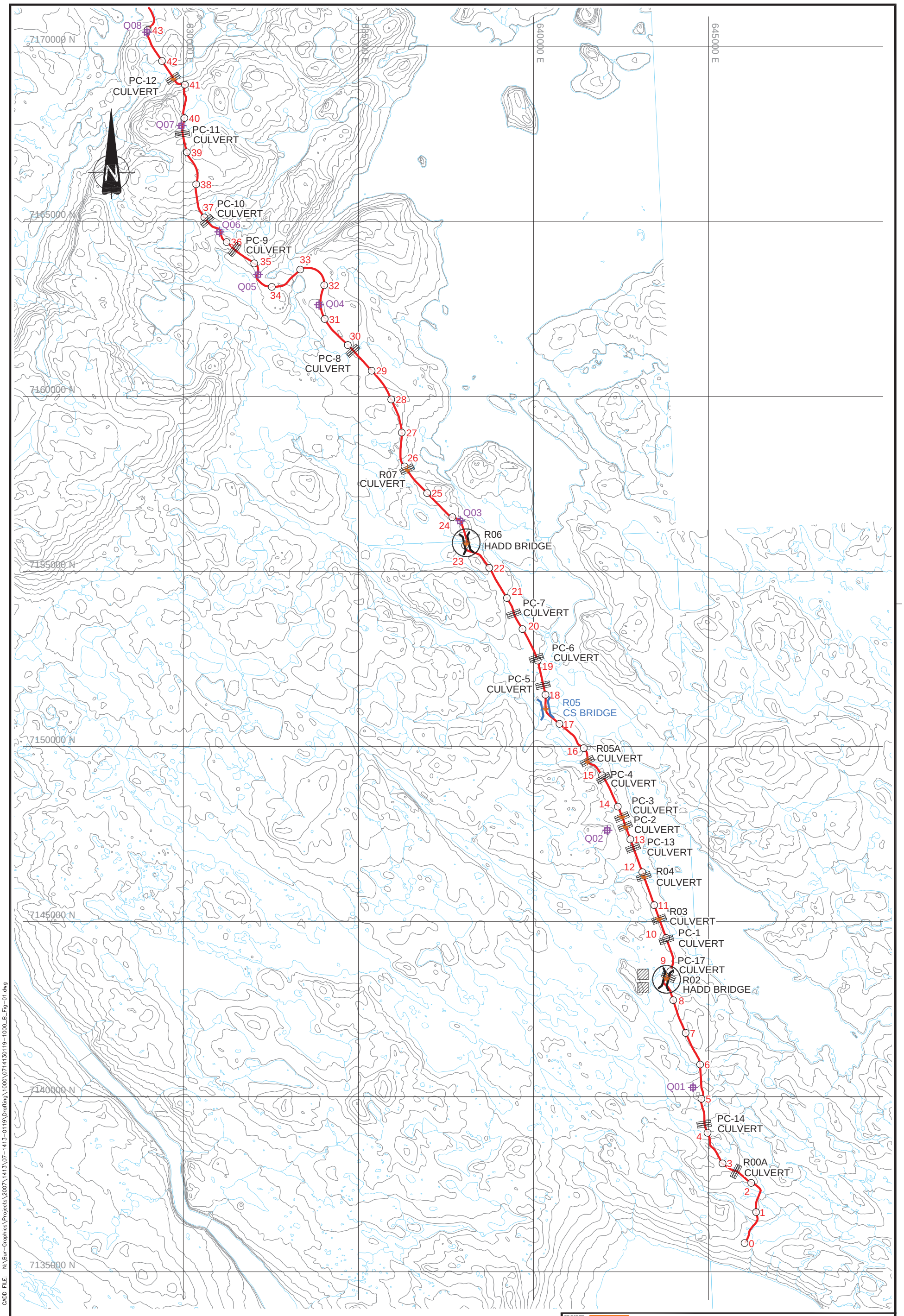
SECTION 4 • DECOMMISSIONING AND RECLAMATION

Decommissioning of the all-weather access road will be accomplished by loosening compacted surfaces, flattening side slopes, and removing all culverts and other potential obstructions to drainages paths. Details are provided in section 3.3.3 of the *Interim Closure and Reclamation Plan January 2014 - Report Number: 13-1151-0131* prepared by Golder and Associates.

Figures

Figure 1: Meadowbank Project Location
Figure 2: AWPAR Road Alignment

Nunavut
0 100 200 300 400
Kilometers
© World Sites Atlas (sitesatlas.com)
Ellesmere Island Nat. Park
ARCTIC OCEAN
GREENLAND (Denmark)
Qaannaq
Grise Fjord
Polaris
Resolute
BAFFIN BAY
Nanisivik
Arctic Bay
Pond Inlet
Kugluktuk (Coppermine)
NUNAVUT
Qeqertarsuaq
Cambridge Bay
Clyde River
Port Radium
Taloyoak
Hope Bay
Igloolik
Qikiqtarjuaq (Broughton I.)
Gjoa Haven
Kugaaruk (Pelly Bay)
Hall Beach
Jericho
Lupin
George Lake
Auyuittuq Nat. Park
Nuuk
Meadowbank Gold Project
Ekati
Diavik
Pangnirtung
Repulse Bay
Baker Lake
Iqaluit
NORTHWEST TERRITORIES
ATLANTIC OCEAN
Chersterfield Inlet
Coral Harbour
Cape Dorset
Kimmirut (Lake Harbour)
Rankin Inlet
Uranium City
Whale Cove
Cullaton Lake / Shear Lake
Arviat
Western Churchill Geological Province
Churchill
HUDSON BAY
Inukjuak
Kuujjuaq
Nain
SASKATCHEWAN
Flin Flon
Thompson
Sanikiluaq
Fort Severn
MANITOBA
QUEBEC
NFLD
Labrador City
ONTARIO
Churchill
Brandon
Moosonee



LEGEND

- CULVERT
- HADD BRIDGE
- CLEAR-SPAN BRIDGE
- HOOP NETS INSTALLED
- LARVAL DRIFT TRAP
- EXISTING QUARRY
- 10 KILOMETER MARKER

REFERENCES

1) ROAD ALIGNMENT, BRIDGE, CULVERT AND QUARRY LOCATIONS FROM NUNA M&T SERVICES Ltd.
2) BASE DRAWING FROM GOLDER ASSOCIATES Ltd.

PROJECT

AGNICO-EAGLE MINES LIMITED
MEADOWBANK DIVISION

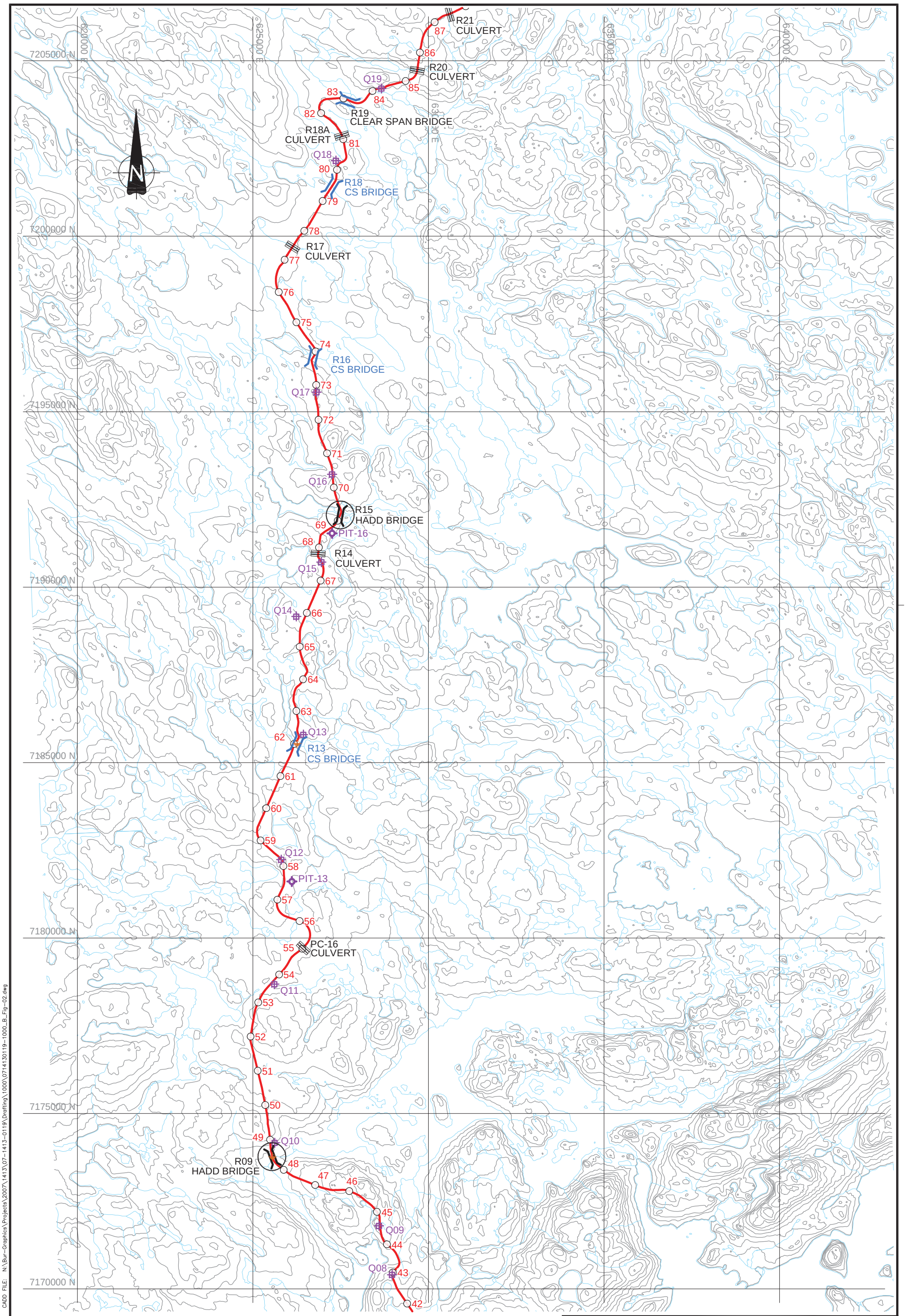
TITLE

ALL-WEATHER PRIVATE ACCESS ROAD

AZIMUTH

PROJECT No.			FILE No. 0714130119-1000_B_Fig-01
DESIGN			SCALE AS SHOWN REV. -
CADD	EA/GG	16MAR08	FIGURE 2a
CHECK			
REVIEW			

REVISION DATE: 08/12/16 10:22AM By: ggorczynski CADD FILE: N:\Bur-Graphics\Projects\2007\1413\07-1413-0119\Drafting\1000\0714130119-1000_B_Fig-01.dwg



LEGEND

- CULVERT
- HADD BRIDGE
- CLEAR-SPAN BRIDGE
- HOOP NETS INSTALLED
- LARVAL DRIFT TRAP
- EXISTING QUARRY
- 10 KILOMETER MARKER

REFERENCES

1) ROAD ALIGNMENT, BRIDGE, CULVERT AND QUARRY LOCATIONS FROM NUNA M&T SERVICES Ltd.
2) BASE DRAWING FROM GOLDER ASSOCIATES Ltd.

PROJECT

AGNICO-EAGLE MINES LIMITED
MEADOWBANK DIVISION

TITLE

ALL-WEATHER PRIVATE ACCESS ROAD

AZIMUTH

PROJECT No.			FILE No. 0714130119-1000_B_Fig-02
DESIGN			SCALE AS SHOWN REV. -
CADD	EA/GG	16MAR08	FIGURE 2b
CHECK			
REVIEW			

REVISION DATE: 08/12/16 10:10AM By: ggorczynski CADD FILE: N:\Bur-Graphics\Projects\2007\1413\07-1413-0119\Drafting\1000\0714130119-1000_B_Fig-02.dwg

Appendix A

AWPAR Safety Briefing

Safety Rules and Procedures

MEADOWBANK GOLD PROJECT

All Weather Private Access Road Safety Briefing For Non-Mine Users

Prepared by:
Agnico-Eagle Mines Limited – Meadowbank Division

Version 3
March 2014

Safety Briefing for AWPAR Non-Mine Users

In July 2009, Condition 32 of the Meadowbank Project Certificate was amended by the Nunavut Impact Review Board to allow limited use of the All Weather Private Access Road to local Baker Lake residents for the purpose of accessing traditional hunting grounds. AEM has collaborated with the Baker Lake Hunters and Trappers Organization (HTO) in efforts to control non-mine access to the AWPAR and to properly inform Baker Lake residents.

AEM Security guard will give a mandatory safety briefing to the resident prior to road access. The Security guard will make sure residents understand all the points listed in the Safety Briefing Procedure.

This document provides a standard procedure for implementing the AWPAR safety briefing to Baker Lake residents who require road access. Delivering the safety briefing in a consistent manner by addressing each point below and recording information about the road users will help ensure that AEM has performed its due diligence in educating each individual on the safety procedures and inherent risks of using the road.

These safety rules will be reviewed at least annually to determine what worked and what didn't work and will be amended in an adaptive fashion to learn from experience. Such amendments are to be implemented in consultation with the Baker Lake HTO.

Safety Briefing Procedure

The Security guards will:

1. Fill out the related control log form.
2. Give the resident a printed copy of the Safety Rules and Procedures available in Inuktitut and English.
3. Explain each safety rule and procedure.
4. Explain current road and weather conditions.
5. Explain that any violation of the rules or procedures may result in refusal of future entry.
6. Ask for verbal confirmation that the resident understands the safety rules and procedures and make sure he /she signs and dates our related document.
7. Give resident a buggy whip and assist with installation if required. Explain purpose of buggy whip and that it must be returned to AEM upon their return to Baker Lake Gatehouse.
8. Give resident a safety vest and write the number of the vest on the form. Explain that it must be returned to AEM upon their return to Baker Lake Gatehouse.

AWPAR Record of Non-Mine Use

DATE	FIRST NAME LAST NAME	EXPECTED RETURN DATE	EXPECTED TIME OF RETURN	HTO PERMIT #	ATV LICENSE PLATE	SECURITY VEST #	BUGGY WHIP #	RESP. WAVER	EXPL. SHOOTING ZONE/ ROAD ACCESS	PHONE #	RETURN DATE	RETURN TIME	RETURNED SECURITY VEST	RETURNED BUGGY WHIP	SECURITY GUARD PRINT NAME
06/13/09	HUNTER FISHER	6/14/2009	1:30 PM	123	ABC	10	20	√	√	793-1234	6/14/2009	1:40 PM	√	√	WILLIAM SCOTTIE

AGNICO EAGLE

Meadowbank Gold Project

All Weather Private Access Road

Safety Rules and Procedures

Safety Rules

- This is not a public road. Access to the road is authorized by AEM Security Guard at the Baker Lake Gatehouse.
- Only ATVs are allowed to travel on the road.
- If the Gatehouse is closed, the road is also closed, and access is not allowed. This is likely due to unsafe weather, road conditions or safety reasons.
- Use of the Meadowbank All Weather Private Access Road is at your own risk. AEM is not responsible for personal injury or property damage.
- AEM reserves the right to refuse entry to anyone who does not respect these safety rules and procedures.
- AEM reserves the right to restrict public access in periods of heavy mine traffic flow, for example, during the transfer of supplies from Baker Lake to Meadowbank after the annual sealift. This will only be done in consultation with the HTO and Baker Lake Hamlet (Mayor).

Procedures for Road Access

1. Report to the Baker Lake Gatehouse to access the road. Provide your name and expected time of return. AEM Dispatch will explain the safety rules and procedures and provide an update on current road and weather conditions.
2. Install a buggy whip on the ATV while at the AEM Gatehouse. The buggy whip must remain installed until the ATV returns to Baker Lake Gatehouse
3. AEM Dispatch will provide a safety vest that must be worn while travelling on the AWPAR.
4. AEM traffic has the right of way – the ATV must pull off the road when a vehicle is oncoming or approaching from behind and wait for that vehicle to pass before entering back onto the road.
5. If you stop pull off to the side of the road. Do not stop in the middle of the road.

6. When travelling in groups please travel one behind the other, do not travel side by side.
7. Maximum speed is 50 km/hr.
8. All hunting activity must avoid cross shooting over the road, respect a safe zone along the road and no shooting around work area.
9. Access is forbidden beyond km 85 as this is getting close to active mining areas where safety concerns are more critical.
10. Return buggy whip and safety vest to Baker Lake Gatehouse.

_____	_____	_____
Printed name	Date	Signature

Appendix B

MBK-SIT-0010

MBK-SIT-0046

MBK-SIT-0059

MBK-SIT-0071

MBK-ENV-0010

AWPR Road Maintenance

	PROCEDURE NUMBER:	**MBK-SIT-0010**	
People concerned	• **AWPR Maintenance Crew**	**Prepared by**	Site Services
		Authorized by	Éric Trudel, Site Services Superintendant
Effective :	2011-10-07	***"Safety First, Safety Last … Safety Always!"*** ***"No Repeats" – Our Stepping Stone to ZERO HARM***	
This procedure corresponds to the required minimum standard. Each and every one also has to comply with the rules and regulations of the Nunavut Government in terms of health and safety at work.			

Objective:

To improve efficiency and safety for AWPR maintenance.

Concerned departments:	**Required equipment**
Site services	

Risks /Impacts legend			
Health & Safety	Process/Quality	Costs	Environment

Procedure	Risks/ Impacts
Agnico-Eagle Mines Limited, Meadowbank Division (AEM-Meadowbank) is the owner of the AWPR between Baker Lake and the Meadowbank mine site.	Prevent incident and /or accident
1. AEM road Crew and all contractors working on AWPR maintenance must read, understand, sign off and comply with: a) AWPR procedure b) Convoy procedure c) Check-in road procedure d) Fuel truck escort procedure (if applies).	
2. Any Operator on the road must inform the road supervisor, his designate or dispatch and make request to close the road when: a) Road width is wide enough for one vehicle b) An incident or accident putting traffic at risk c) Any equipment is being towed d) During wintertime, the road is closing behind equipment e) Visibility is poor (visibility of 1 flag minimum).	
3. Dozer pushing snow a) Operator must identify working area with traffic signs b) Ensure traffic signs follow the working areas c) Report change of working area to dispatch on ongoing basis d) Ensure good radio communication and eye contact with traffic approaching working area	
4. Radio communication a) Report to dispatch when leaving gate with equipment or passenger vehicle b) Report dropping or picking passenger by equipment on the road c) Report arrival or departure with passenger vehicle or equipment d) Report being outside for equipment walk around or any time during the shift	

e) Report starting or stopping operation f) Listen for others so you are aware of any traffic approaching the working area	

Circulation on the AWPR

	PROCEDURE NUMBER:	**MBK-SIT-0046**	
People concerned	Road maintenance crew	**Prepared by**	Site Services
		Authorized by	Éric Trudel, Site Services Superintendant
Effective :	2013-08-19	***"Safety First, Safety Last … Safety Always!"*** ***"No Repeats" – Our Stepping Stone to ZERO HARM***	
This procedure corresponds to the required minimum standard. Each and everyone also have to comply with the rules and regulations of the Nunavut Government in terms of health and safety at work.			

Objective:

- To ensure safe circulation on the AWPR

Concerned department:

Site services

Required equipment:

Risks/ Impacts Legend

Health & Safety

Process/quality

Costs

Environment

Circulation on the AWPR

Procedure	Risks/ Impacts

Circulation on the AWPR
 	
• Anyone using the AWPR with any kind of vehicle must:
  • Fully respect the Right of Way as presented in the S.O.P. Surface training.
  • Call blind hills as requested by signs.
  • Stay on the right side of the road at all times and especially while crossing blind hills.
  • Respect the speed limit on all of the AWPR (50 km/h).
  • Slow down on bridges. Maximum speed is the lower between 30 km/h or what is written on sign.
  • Reduce speed to 30 km/h passing a vehicle coming in the opposite direction.
  • Wear his seatbelt and ensure vehicle lights are on at all times.
  • Acquire the required authorization from the Gatehouse/Dispatch before using the AWPR	

Radio communications on AWPR

	PROCEDURE NUMBER:	**MBK-SIT-0059**	
People concerned	Road maintenance crew	**Prepared by**	Site Services
		Authorized by	Éric Trudel, Site Services Superintendant
Effective :	2013-08-19	***"Safety First, Safety Last … Safety Always!"*** ***"No Repeats" – Our Stepping Stone to ZERO HARM***	
This procedure corresponds to the required minimum standard. Each and everyone also have to comply with the rules and regulations of the Nunavut Government in terms of health and safety at work.			

Objective:

- To ensure safe and proper communications on the AWPR

Concerned department:

Site services

Required equipment:

Risks/ Impacts Legend

Health & Safety

Process/quality

Costs

Environment

Radio communications on AWPR

Procedure	Risks/ Impacts

Mandatory radio communications
 	
• Upon reaching one of the two gatehouses, the driver must provide the following information to the dispatch:
  • Vehicle unit number.
  • Destination.
  • His name.
  • Amount of passengers.
 	
• When seeing a blind hill sign and before going by it, the driver must communicate the following information on the road channel:
  • Type of vehicle.
  • Location (blind hill kilometer).
  • Direction (northbound or southbound).
 	
• This information also has to be communicated upon reaching switchback (clearly indicated by sign).
 	
• If a special situation that could affect traffic is encountered, the operator must communicate the following information on the road channel:
  • Nature of the situation.
  • Location.
  • Precautions to be taken.
 	
• These special situations include but are not limited to large wildlife activities, problematic road conditions and incidents.	

Guidelines to radio communications on the Road Channel • All radio communications should be as clear and short as possible. • The Road Channel should be used for work-related communications only.	

• Always monitor the Road Channel when driving on the AWPR to stay aware of oncoming traffic.	

Radio communication guidelines for the Road Crew
 	
• Operators must use the GPS radio to communicate with each other as to minimize the Road Channel usage.
 	
• These communications include but are not limited to coordination when working together, special communication with the Road Supervisor and operating tips or questions.
 	
• Operators must have both equipment and portable radio functional at all times when working on the AWPR.
 	
• Any Operator on the road must inform the road supervisor, his designate or dispatch and make request to close the road when:
  • Road width is only wide enough for one vehicle
  • An incident or accident is putting traffic at risk
  • Any equipment is being towed
  • During wintertime, the road is closing behind equipment
  • Visibility is poor (visibility of 1 flag minimum).	

All weather private road
AWPR

	PROCEDURE NUMBER:	**MBK-SIT-0071**	
People concerned	• **Agnico-Eagle employees and contractors' employees working on the Meadowbank site** • **Visitors on site**	**Prepared by**	Site Services
		Authorized by	Éric Trudel, Site Services Superintendant
Effective :	2010-11-19	***"Safety First, Safety Last … Safety Always!"*** ***"No Repeats" – Our Stepping Stone to ZERO HARM***	
This procedure corresponds to the required minimum standard. Each and every one also has to comply with the rules and regulations of the Nunavut Government in terms of health and safety at work.			

Objective:

- To obtain access, prepare and drive safely on the All Weather Private Road (AWPR)

Concerned departments:	**Required equipment**
Site services	

Risks /Impacts legend

Health & Safety | Process/Quality | Costs | Environment

Procedure	Risks/ Impacts
1. Agnico-Eagle Mines Limited, Meadowbank Division (AEM-Meadowbank) is the owner of the AWPR between Baker Lake and the Meadowbank mine site. Depending on climate and road conditions, AEM-Meadowbank will decide whether the AWPR must be opened or closed. The road supervisor is responsible for informing concerned parties about the status of the AWPR. However, it is the responsibility of every AWPR user to adjust his driving with the following: a) Weather and road conditions b) Capacity and performance of vehicle used c) His competence and experience in driving d) All road deterioration that may occur due to the weather change has to be notified directly or via dispatch by radio immediately to the AEM supervisor responsible or his replacement.	Prevent incident and /or accident
In any circumstance, when an AWPR user finds himself in dangerous driving conditions, he will: i. Immediately stop vehicle on the side of the road ii. Call the dispatch, report on the situation and exact location iii. Make a request if equipment or material is required iv. If possible, find a safe parking space v. Wait for help vi. Ensure follow up on the situation with the Dispatch if possible	Prevent incident and / or accident.
2. Information on the road conditions a) In the event of bad temperature/inclement weather, AEM-Meadowbank road supervisors will monitor road conditions with the Baker Lake Security guard (Dispatch). b) When the ROAD IS CLOSED, before 7 AM, the AEM supervisor will publish road conditions through Email.	Prevent incident and /or accident

c) Road conditions will be posted at Exploration Camp by camp by camp manager and at both south and north Gatehouses by the security employee in duty. d) Important phone numbers (and/or road channel): ROAD CHANNELS ARE: #14, #15, #16 i. AEM Baker Lake Office (867)793-4610, ext. 6624 ii. Road Supervisor (867)793-4610 ext. 6836 iii. Mine Supervisor (night shift)- call dispatch iv. Dispatch Ext 6628 or 6620 (Baker Lake Office) v. Security Office (867)793-4610 ext. 6748	
3. Road Maintenance a) Nobody is allowed on the AWPR when the road is closed except for road maintenance team authorized by the road Supervisor or his replacement.	Avoid personal injuries.
4. Use radios as follows a) While in Baker Lake, use RD Baker Channel. (AEM handheld radio channel 14), and when traveling towards Meadowbank. b) When you reach the signs to switch channels, switch to RD KL037 (AEM handheld radio channel 15). c) When you reach road sign KM 77, change to RD MBANK (AEM handheld radio channel 16) and remain on this channel until you reach Meadowbank camp. d) RADIO CALLING / MESSAGE MUST BE KEPT TO A MINIMUM in order to maximize access to radio system for safety and emergency use.	Use proper radio frequencies and call at all posted call locations.
5. Before using the AWPR from Baker Lake or the mine site, every user must contact the AEM dispatch and get authorization to use the road. They will also have to submit the vehicle inspection sheet to the Security Guard. If they do not have it on hand, they will have to fill one in before they get the authorization for accessing the road. While on AWPR, every user will: a) Report to dispatch every unusual situation, dangerous wildlife or	Communicate with dispatch before entering AWPR.

large herd of animals b) Keep dispatch informed when stopping on the road and give location c) Consider road signs and call in location where requested to do so d) IMPORTANT: Listen to others calling their location, especially those approaching you e) Upon arrival at destination, every user must inform the AEM dispatch.	
6. All vehicles using the road require the following items: AEM approved VHF base Radio, a full tank of fuel, a good spare tire, jack and wrenches as well as a First Aid Kit.	Ensure proper safety equipment when travelling on AWPR.
7. In the winter, a survival kit (survival kits will be issued at the point of departure, either at Baker Lake or Meadowbank Gatehouse). Survival kits must be turned over at the gatehouse Security guard upon arrival. Vehicles without proper communication must be escorted by a vehicle with approved communications.	
8. Take note that in the "Dress code for Meadowbank division HR-002" is applicable on AWPR. June to September: - Warm jacket/ wind cutter - Warm closed toe shoes - Pants October to May: - Parka - Winter pants (suggested) - Mittens/ gloves - Tuque - Winter boots (-40 approved) - Warm underwear (suggested)	Ensure that you are dressed for the weather and season.
9. The AEM-Meadowbank road supervisor will be responsible to determine when vehicles must travel in convoys.	

10. A pilot vehicle is required for all oversize loads; it must travel 500 meters ahead of the oversize loads and could be another tractor/ trailer unit providing it is not oversized.	
11. For loads exceeding 8.5 feet wide, the driver and the Security Guard will fill in the "*All Weather Road Non-standard heavy loads transportation report"* before accessing the road and the report will be kept at the Gatehouse.	
12. Overtaking another vehicle or road maintenance equipment working on the road requires the following: a) Radio communications or clear visual contact must be established with the operator of the vehicle/ equipment you intend to overtake including dozers or loaders clearing the snow banks. b) You must wait for the operator's clear signal before overtaking. c) Unless these 2 conditions have been met, overtaking or passing is not permitted.	
13. Right of way priorities on the AWPR are in the following order: a) Wildlife b) Emergency vehicles with flashing lights and sirens c) Crew buses d) Explosive vehicles e) Fuel trucks f) Freighter trucks g) Pick-up trucks h) Snowmobiles/ All-Terrain Vehicles (ATV)	Know the right away of vehicles.
14. All vehicles shall yield based on the above priority list. The yielding vehicle shall stop on the side of the road leaving enough space to let the priority vehicle pass. The priority vehicle shall reduce speed to a maximum of 20 km/ hour to pass.	
15. Maximum speed on the AWPR is 50 km/ hour.	Follow the speed limit – reduce speed in inclement weather.

16. No vehicle shall leave the road to pass or overtake another vehicle.

17. The following emergency radio communication applies to all vehicles using the AWPR

EMERGENCY RADIO COMMUNICATIONS	
• CODE 1 • EMERGENCIES INJURIES	• Call for Emergency on your radio frequency. Repeat the following: Code 1, Code 1, Code 1, your name, your exact location and state the nature of the emergency. All activity on the road should come to halt, except for the responders.
	• Inform Dispatch what the problem is. Security Guard will assess the situation and contact help. The closest responder will go to the emergency location to help you.
	• If the surface rescue team is required, they will be dispatched from the Meadowbank site.

18. Compliance

a) Failure to comply with this procedure will result in disciplinary action.

Meadowbank Transportation of Dangerous Goods

	PROCEDURE NUMBER:		**MBK- ENV-0010**
People concerned	• **Agnico-Eagle employees, contractors, visitors on the Meadowbank site**	**Prepared by**	**Jeffrey Pratt Environmental Coordinator**
		Authorized by	**Kevin Buck Environmental Superintendent Norman Ladouceur Health And Safety Superintendent**
Issuing date :	**March 11, 2014**		
This procedure corresponds to the required minimum standard. Each and everyone also have to comply with the rules and regulations of the Nunavut Government in terms of health and safety at work.			

Objective:

- To ensure the health and safety of workers and contractors working for the Meadowbank Gold Project and to ensure the sustainability of the environment that surrounds the Meadowbank Project and its transportation route
- To comply with the International Cyanide Management Code and Transportation of Dangerous Goods

Concerned departments:

All departments

Required equipment:

- Vehicle log
- Working Radio with AWPAR and Baker Lake Channels
- Proper placards

Risks /Impacts legend

Health & Safety	Operation Quality/Costs	Environment

Meadowbank Transportation of Dangerous Goods

Procedure	Risks/ Impacts
1. Visual inspections of the road and bridges between Baker Lake Marshalling Area to the Meadowbank Mine Site are to be undertaken by the Road Supervisor and recorded 2-3 days prior to the beginning of Dangerous goods being transported between Baker Lake Marshalling area to the Meadowbank Site, and every day during the transportation of Cyanide. Any hazards identified must be reviewed, reassessed and mitigated immediately, or transportation of Dangerous Goods will cease.	In proper road or bridge conditions can result in major incidents or spills.
2. Drivers travelling between Baker Lake Marshalling area to the Meadowbank Site are to advise Baker Lake Dispatch of any changes to the road or any hazardous conditions. Baker Lake Dispatch will immediately contact the Road Supervisor about the situation.	In proper road or bridge conditions can result in major incidents or spills.
3. Only equipment fit for transport shall be used to haul Dangerous Goods from the Baker Lake Marshalling area to the Meadowbank Site. Maintenance records shall be kept for equipment servicing.	In proper road or bridge conditions can result in major incidents or spills.
4. Vehicle inspection log must be completed prior to each shift.	Improper maintenance can cause equipment to break down and transport cannot be possible and or can result in major incidents or spills.
5. All drivers transporting Dangerous Goods between Baker Lake Marshalling area to the Meadowbank Site must hold a valid driver's license from a Canadian province or territory. In addition, they must also hold a valid Transportation of Dangerous Goods (TDG) certification. A copy of both shall be held by the transporter at all times during transportation.	Not having the proper training can result in major incidents

6. All drivers must keep a log book / transport document. This will include: a. Driver Name b. Product being hauled c. UN Number d. Dangerous Good Class e. Quantity f. Drivers shift start time g. MSDS present h. Etc. *****This log must be completed prior to each transport.**	 Knowing what you are hauling and being prepared to react if there is a problem is improtant.
7. All transporters must have minimum of 8 hours of rest in between each 12 hour work shift.	 Not having adequate rest makes for unfit work conditions
8. All drivers are required to take the most direct route the from Baker Lake Marshalling area to the Meadowbank Site. **Under no circumstances is any Dangerous Goods to be transported into the Hamlet of Baker Lake.**	 By taking the most direct route this avoids inhabitted areas, therefore avoid affecting thwe public in the event of an incident
9. All personnel are to ensure the proper placards, UN Number, and shipping labels are in place prior to any shipping of Dangerous Goods. As well the transporter must have an up to date MSDS for the product they are hauling.	 Knowing what you are hauling and being prepared to react if there is a problem is improtant.
10. All speed limits must be obeyed between Baker Lake Marshalling area and the Meadowbank Site.	 Not following can result in major incidents.

11. Radio contact with Baker Lake Dispatch must be kept during transport of all Dangerous Goods between Baker Lake Marshalling area and the Meadowbank Site.	 The dispatch keeps a special eye on the time you are travelling to ensure there are no problems during your travel.
12. In the event of an emergency please follow the up to date Meadowbank: Emergency Response Plan. In the event of a spill please follow the up to date Meadowbank: Spill Contingency Plan.	 These documents will help you in theinstance of a major incident or spill.
13. In addition to the above mentioned the following Meadowbank procedures should be reviewed prior to initial transport should also be reviewed: o MBK-SIT-0010 – AWPR Road Maintenance o MBK-SIT-0046 – Circulation on the AWPR o MBK-SIT-0059 – Radio Communication on AWPR o MBK-SIT-0071 – All weather private road AWPR	 Ensure you know all the procedures.