MEADOWBANK
MINING CORPORATION

MEADOWBANK GOLD PROJECT

WATER QUALITY AND FLOW MONITORING PLAN

AUGUST 2007

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SECTION 1 • INTRODUCTION

The Nunavut Water Board has provided to Meadowbank Mining Corporation (MMC), formerly Cumberland Resources Ltd. (Cumberland), a set of guidelines for application of a Type-A Water License for the Meadowbank Gold Project (NWB, 2007a; NWB, 2007b). In reference to these guidelines, MMC has prepared the following document which summarizes the monitoring locations, sampling frequency, monitored parameters, and adaptive management plans for the Meadowbank Gold Project.

The purpose of this Site Water Quality and Flow Monitoring Plan (the Plan) is to establish programs to monitor the performance of the waste and water management system to:

- Verify and validate the predicted water quality by empirical measurement of the mine site water quality and flows; and
- Provide a framework for adaptive management that will allow the identification and rectification where necessary, of unexpected trends in water quality and flows.

The plan provides information on the monitoring locations where the Canadian Metal Mines Effluent Regulations (MMER, 2002) will be applied at the various stages of mining, and on additional monitoring that will be conducted by the mine operator to assist in evaluating the performance of the mine waste and water management system.

This Plan has been divided into four levels of investigation to characterize the range of impacts between the sources of contact water in the individual mine facilities and the point of discharge or release of contact water to the receiving environment. The four levels of monitoring from the point of discharge to the individual sources of contact water include:

Compliance Monitoring Program (CM) - The CM sites are either those that discharge directly to the environment such as attenuation ponds and diversions ditches, or interact with the receiving environment such as final pit lakes. The requirements of MMER will be applied at the mine effluent discharge points identified in the CM Program.

Internal Monitoring (**IM)** – The IM sites include sources of contact water that either report to the CM sites or are monitored for operational purposes.

Site Specific Monitoring (SSM) – The SSM sites will be identified during investigations to address specific aspects of site water quality such as point source water quality including, but not necessarily limited to: seeps from pit walls, dikes and Rock Storage Facilities (RSFs) as they occur; groundwater below the Tailings Storage Facility (TSF); and receiving water quality. Receiving water in this context includes, but may not be limited to, water bodies affected by mining activity, such as:

- Second Portage and Third Portage lakes adjacent to the dike perimeters;
- Wally Lake adjacent to the dike at Vault Lake (AEMP, Cumberland, 2005a).
- Other permanent of temporal water bodies within or adjacent to the mine footprint.

Event Monitoring (EM) – the EM locations include sites resulting from unexpected events such as spills, accidents, and malfunctions.

This Plan outlines the systematic monitoring of water quality for the various Programs during the different phases of mining. The objectives of the monitoring program are 1) to track the chemistry of the contact and non-contact water prior to and for discharge; 2) to identify if water treatment is required prior to discharge; and, 3) to minimize the potential impact of mining activities on the surrounding environment.

Additional locations outside the footprint of the mine will be monitored under the *Meadowbank Gold Project Aquatic Effects Management Program (AEMP)* (Cumberland, 2005a).

SECTION 2 • OVERVIEW

2.1 OVERVIEW OF SITE WATER MANAGEMENT PLANS

Details of the site water management plan are discussed in *Meadowbank Mine Waste and Water Management Plan* (MMC, 2007d). All contact water from the mine facilities including the Portage and Vault RSFs, open pits, plant site, and other disturbed areas will be directed by pumping or berms and other surface diversions to either of the following:

- Sumps from which the water will be pumped to either the Portage or the Vault Attenuation Pond prior to discharge, or to the Reclaim Pond if required, or
- the abandoned open pits following cessation of mining.

As specified in the Mine Waste and Water Management Plan (MMC, 2007d):

"All contact water will be intercepted, contained, analysed, treated, if required, and discharged to the receiving environment when water quality meets the discharge criteria."

Tables A-1, A-2, A-3, A-4 and A-5 of Appendix A summarize the components of the CM, IM, SSM, and EM programs including the monitoring locations, parameters analyzed, sampling frequency, and sampling methodology.

2.1.1 Compliance Monitoring Program (CM)

The CM program provides a mechanism to assess the chemistry of the water at specified sites and confirm and document compliance of effluent discharge with regulatory requirements. As part of adaptive water management, trigger levels are established to identify exceedences to predicted levels, and to activate the appropriate action plan(s) to mitigate the impacts of any exceedence.

2.1.2 Internal Monitoring Program (IM)

The IM sites include runoff from the RSFs, the TSF, individual pit sumps and mine process water from the Reclaim Pond. Sampling the mine contact water upstream of the CM sites provides mechanisms to monitor the water quality and chemical load delivered to the attenuation ponds, to compare source water chemistry to predicted levels and validate the water quality model (described in Golder, 2007b), and to track the water chemistry of mill process water and determine if treatment is required prior to discharge to the receiving environment.

2.1.3 Site Specific Monitoring Programs (SSM)

The SSM programs provide detailed information about specific sources of chemical load on the property and provide a means to evaluate the performance of water individual control strategies. These efforts are discussed in greater detail in other monitoring programs (refer to Section 6.0).

2.1.4 Event Monitoring Program (EM)

The EM sites result from unexpected events such as spills, accidents, and malfunctions. The response programs for such events are discussed in great detail in the following two documents:

- Meadowbank Gold Project Spill Contingency Plan (MMC, 2007b); and
- Meadowbank Gold Project Emergency Response Plan (MMC, 2007c).

Each of these accidental releases will require specific guidelines that include: mobilization of site equipment to stabilize the release, procedures to contain, neutralize, and dispose of the discharge, and recommendations for monitoring the site following the incident.

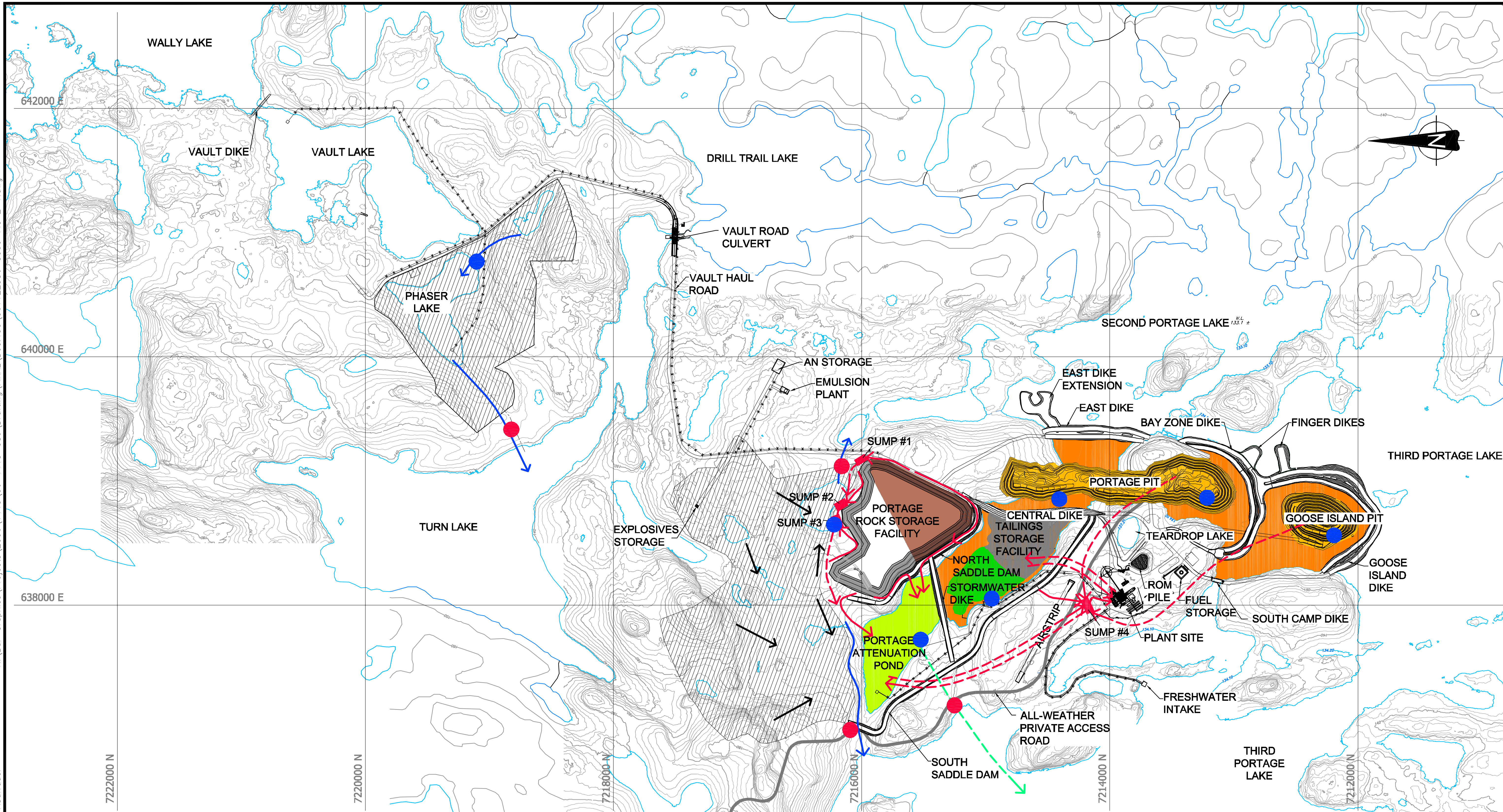
2.2 OVERVIEW OF MINE DEVELOPMENT SCHEDULE

Mining activity at the Meadowbank Project is projected to progress from the south, in the area of the Goose Island and Portage pits early in the mine life (Years 1 to 5), then northward to the Vault Pit towards the end of mine life (Years 4 to 8). The staged mined development results in the southern pits being completely mined out and undergoing closure during the operational phase of the Vault Pit, while the mill and TSF operate throughout the mine life. It is for this reason that the CM and IM sites change with time as the mining operations progress. Figures 2-1, 2-2, 2-3 and 2-4 show the sequence of staged development of the mine, including the early operational, late operational, closure and post-closure phases, respectively. The figures include the CM and IM monitoring points only. The SSM points are not shown, as their occurrence will be defined during mining. Figure 2-2, the late operational phase, shows one possible configuration of the Portage pits following cessation of mining, including separate pit lakes in the North Portage and the Third Portage Pits. The monitoring program that follows is based upon the configuration of the Portage pits shown in Figure 2-2. The actual configuration of the ultimate pits may change as mining progresses and the accumulation and flow of water between the North and Third Portage pits at the end of mine life may differ from Figure 2-2. The monitoring program (refer to Section 3.0) will need to accommodate changes in the final pit designs which may include one or more ponds during the filling phase before the single Portage Pit Lake develops from the Portage pits.

The staged development of the mine facilities has been divided into five phases for monitoring purposes. The five phases include:

- Construction phase;
- Early operational phase;
- Late operational phase;
- Closure phase; and
- Post-closure phase.

Figure 2-5 is a schematic diagram that shows the status of the different facilities during the five mining phases. The figure identifies the different activities in each facility during the operation (solid line), closure (dashed line), and post-closure monitoring phases (dotted line).



CADD FILE: N:\Bur-Graphics\Projects\2006\1413\06-1413-089\Drafting\FINAL\Doc.450\061122386-5000-FIG 2-1.dwg

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LEGEND

- TAILINGS
- WASTE ROCK
- RECLAIM POND
- ATTENUATION POND
- DEWATERED LAKE
- DIVERTED AREA
- OPEN PIT
- COMPLIANCE MONITORING POINT
- INTERNAL MONITORING POINT
- CONTACT WATER INTERCEPTION
- PUMPED CONTACT WATER
- NON-CONTACT WATER DIVERSION
- SURFACE RUNOFF
- ATTENUATION POND EFFLUENT DISCHARGE
- SUMP

NOTES

1) GRID REFERENCE: NAD 83, UTM ZONE 14.
2) CONTOUR INFORMATION ON LAND SUPPLIED BY MEADOWBANK MINING CORPORATION.

REFERENCES

1) AMEC AMERICAS LTD., DRAWING NUMBER A1-131395-100-C-0001 (100-C-0001.DWG), MEADOWBANK FEASIBILITY STUDY, APRIL 2005.

0 300 600 900 1200 1500

Scale in Metres

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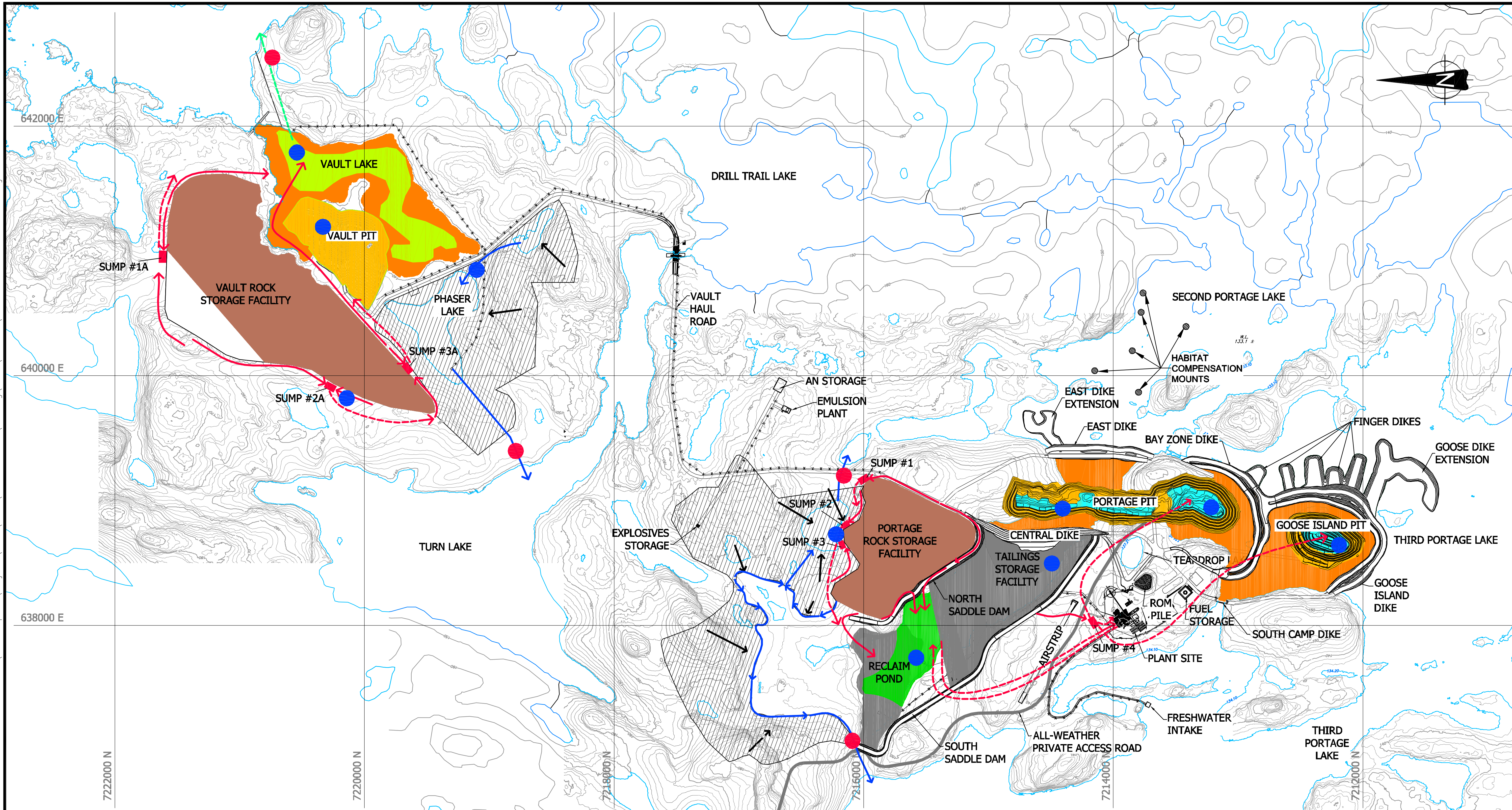
EARLY OPERATION PHASE

FIGURE 2-1



CADD FILE: N:\Bur-Graphics\Projects\2006\1413\06-1413-089\Drafting\FINAL\Doc.450\061122386-5000-FIG 2-2.dwg

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LEGEND:

- TAILINGS
- WASTE ROCK
- RECLAIM POND
- ATTENUATION POND
- DEWATERED LAKE
- DIVERTED AREA
- OPEN PIT
- PIT LAKE
- COMPLIANCE MONITORING POINT
- INTERNAL MONITORING POINT
- CONTACT WATER INTERCEPTION
- PUMPED CONTACT WATER
- NON-CONTACT WATER DIVERSION
- SURFACE RUNOFF
- ATTENUATION POND EFFLUENT DISCHARGE
- SUMP

NOTES

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Scale in Metres

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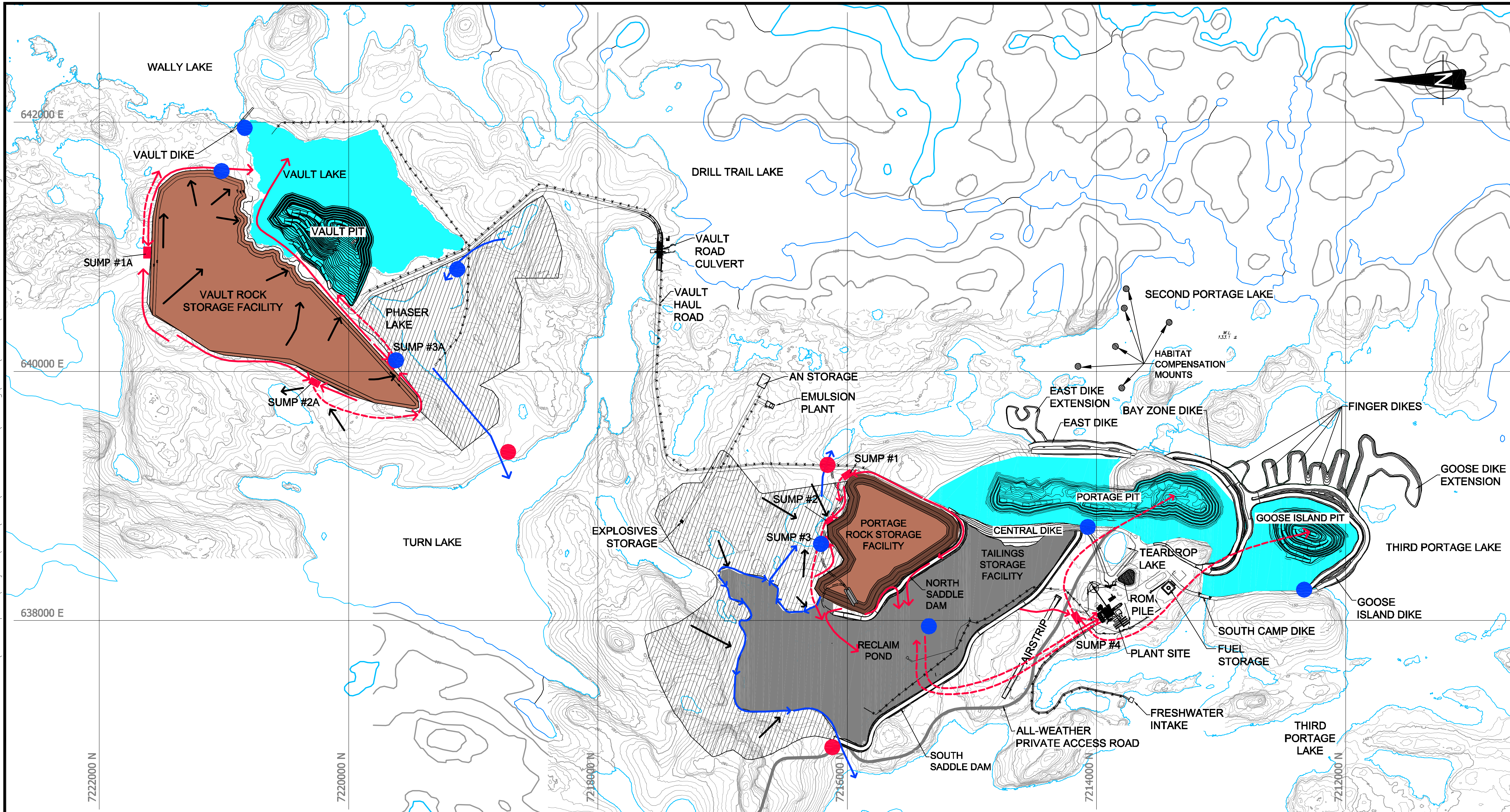
LATE OPERATION PHASE

FIGURE 2-2



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LEGEND:

- TAILINGS
- WASTE ROCK
- PIT LAKE
- DIVERTED AREA
- COMPLIANCE MONITORING POINT
- INTERNAL MONITORING POINT
- WATER DIVERSION DITCH
- SURFACE RUNOFF

NOTES

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REFERENCES

1) AMEC AMERICAS LTD., DRAWING NUMBER A1-131395-100-C-0001 (100-C-0001.DWG), MEADOWBANK FEASIBILITY STUDY, APRIL 2005.

0 300 600 900 1200 1500

Scale in Metres

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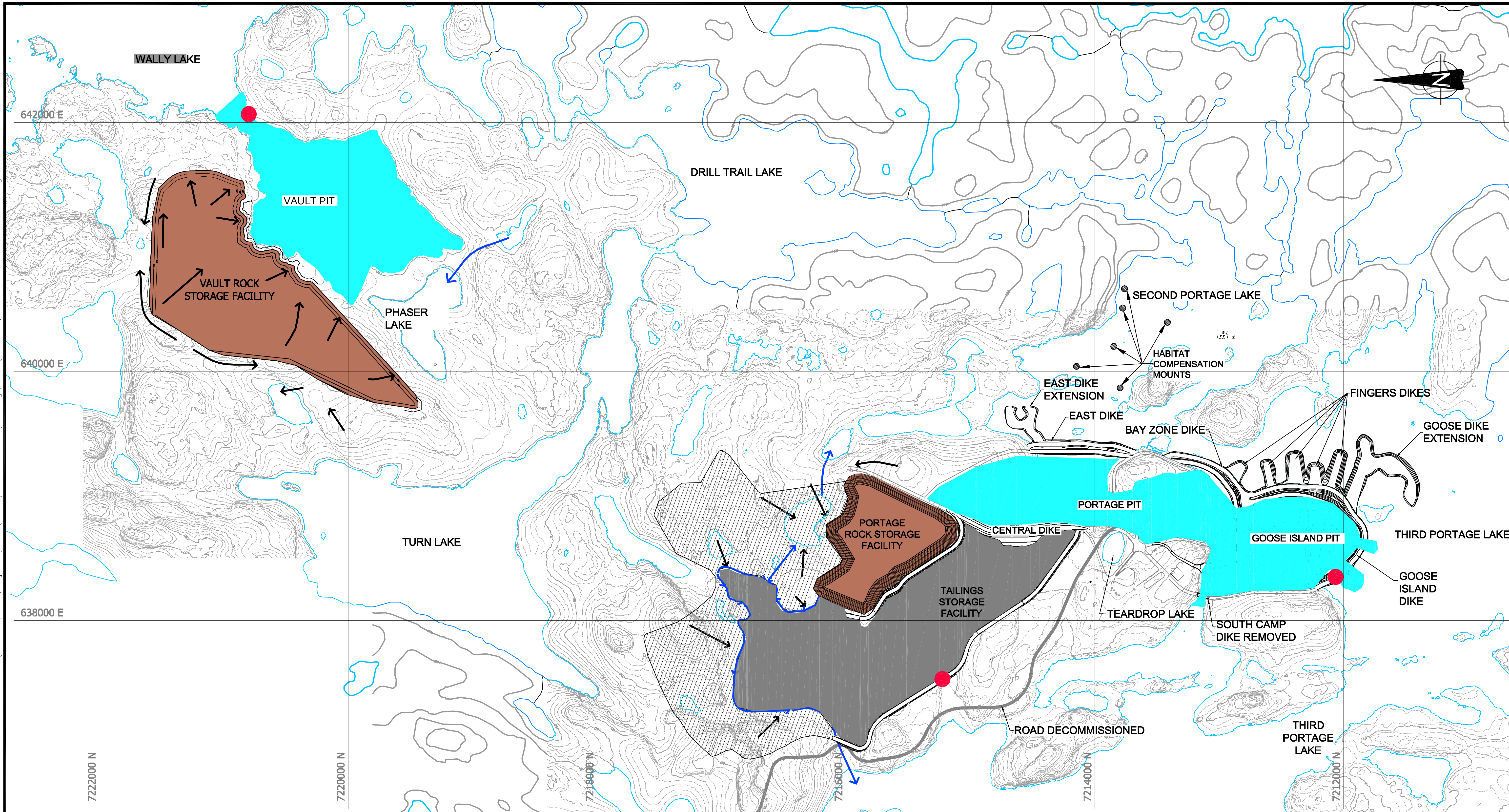
CLOSURE PHASE

FIGURE 2-3



CADD FILE: N:\Bur-Graphics\Projects\2006\1413\06-1413-089\Drafting\FINAL\Doc.450\061122386-5000-FIG 2-4.dwg

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LEGEND:

- TAILINGS
- WASTE ROCK
- PIT LAKE
- DIVERTED AREA
- COMPLIANCE MONITORING POINT
- WATER DIVERSION DITCH
- SURFACE RUNOFF

NOTES

1) GRID REFERENCE: NAD 83, UTM ZONE 14.
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REFERENCES

1) AMEC AMERICAS LTD., DRAWING NUMBER A1-131395-100-C-0001 (100-C-0001.DWG), MEADOWBANK FEASIBILITY STUDY, APRIL 2005.

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Scale in Metres

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POST CLOSURE PHASE | **FIGURE 2-4**

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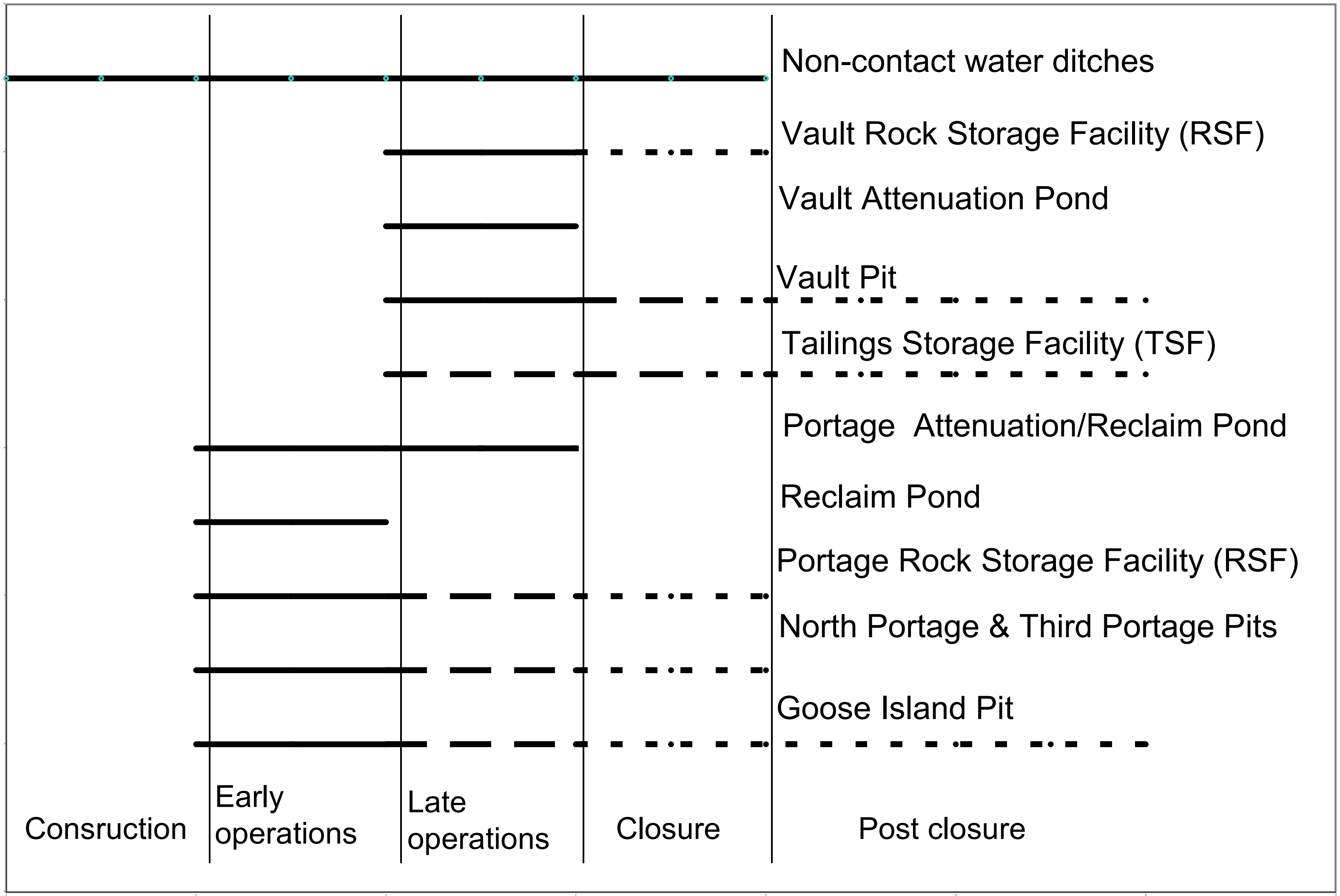

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STAGED DEVELOPMENT OF MEADOWBANK MINE FACILITIES

FIGURE 2.5

Monitoring sites associated with each phase of operation are as follows.

2.2.1 Construction Phase

Current mine plans call for construction of non-contact water diversion structures (ditches or berms) around mine facilities (MMC, 2007d). These diversion structures will be monitored for turbidity as a field surrogate for total suspended solids (TSS). Beyond the diversion structures, there is no proposed monitoring of the other facilities during the construction phase of the Meadowbank Project. The principal impact resulting from construction activities is a potential increase in turbidity and TSS and soluble salts in the Second Portage and Third Portage lakes from the release of particulates from dike construction material, surface runoff, and the disturbance of lake sediments. Management and monitoring of these impacts are discussed in the AEMP (Cumberland, 2005a).

2.2.2 Early Operations Phase

During the early operations phase, mining is planned to take place in the Goose Island and North and Third Portage pits. Most of the waste rock generated from the three pits will be delivered to the Portage RSF however some waste rock will be used for construction of mine infrastructure (roads, dikes) and fish habitat compensation features, and some will be backfilled within the Third Portage Pit (MMC, 2007d). Mill tailings will report to the TSF for final disposal. During the early operations phase, mine water from the individual pit sumps and runoff from the RSF, a small ore stockpile, and the plant area will be pumped to the Portage Attenuation Pond. Water from the Portage Attenuation Pond will be discharged to Third Portage Lake during open water season on an annual basis (Years 1 to 5). The quality of Portage Attenuation Pond water is predicted not to require treatment prior to discharge (Golder, 2007b). Process water for the Process Plant will be recycled from the Reclaim Pond in the TSF and will not be discharged to the receiving environment. In closure, reclaim water will be discharged to either the Portage or Goose Island pit lakes while the dewatering dikes are still in place.

2.2.3 Later Operations Phase

Mining in the Goose Island and Portage pits will be completed in Year 5 after which the pits will be flooded by natural inflows and water pumped from Third Portage Lake. Current mine plans call for the Portage and Goose Island pits to fill within roughly 8 years (MMC, 2007d). During Year 6, tailings deposition will begin in the Portage Attenuation Pond basin. Ultramafic (UM) waste rock will be used to progressively cap the Portage RSF and the TSF for closure (MMC, 2007e).

Mining is planned in the Vault Pit during the late operations phase with waste rock delivered to the Vault RSF and ore to the mill in the Portage area. Vault area tailings will be deposited in the Portage TSF. Runoff and infiltration drainage from the Vault RSF, dike seepage and Vault area contact water will be collected in the Vault Attenuation Pond prior to discharge to Wally Lake.

2.2.4 Closure Phase

During the closure phase, it is anticipated that mining will have ceased in the Vault Pit and the pit will be allowed to flood using natural inflows and pumped water flow from Wally Lake. Current estimates are that it will take 5 to 6 years for the Vault Pit to completely flood by which time the Vault Attenuation Pond and the Pit Lake will have merged (MMC, 2007d). There are currently no plans to cap the Vault RSF as it is not expected to generate ARD.

By the end of the late operational phase or early in the closure phase the Portage and Goose Island pits will be completely flooded and the remaining portions of the TSF capped.

2.2.5 Post Closure Phase

Activities during the post-closure phase are primarily monitoring of selected mine facilities including flooded pit lakes and the reclaimed TSF. The Goose Island and Vault Dikes will be breached once water quality within the pit lakes meets discharge criteria (Golder, 2007e).

SECTION 3 • MONITORING PROGRAM

This Plan has been divided into four levels of investigation to characterize the range of impacts between the sources of contact water in the individual mine facilities and the point of discharge or release of water to the receiving environment. The four levels of monitoring are as follows:

- Compliance Monitoring Program (CM)
- Internal Monitoring Program (IM)
- Site Specific Monitoring Program (SSM)
- Event Monitoring Program (EM)

3.1 COMPLIANCE MONITORING PROGRAM (CM)

The CM program monitors the chemistry of mine contact water and diverted water at specified discharge locations prior to release into the receiving water environment in order to confirm and document compliance with regulatory requirements. The types of water and the timing of the CM program include:

- non-contact water discharged from diversion ditches during construction, operations, and closure phases of the mine,
- mine contact water discharged from Attenuation Ponds during the operations phase of the mine,
- monitor points located within the pit lakes after the dikes have been breached during the post closure phase of the mine life, and,
- runoff from the Tailings Storage Facility after closure.

3.1.1 Location of CM Points

The CM sampling program includes six sites, in operation at different stages of mine life, from the Portage and Vault areas. The CM locations and monitored parameters are listed in Tables A-1, A-2, A-3, A-4, and A-5 of Appendix A. Table 3-1 summarizes the sites and the mining phase(s) during which time monitoring will take place.

Table 3-1: CM Sampling Locations

Facility	Construction	Early Operations	Late Operations	Closure	Post-closure
Non-contact water diversion ditches	Two ditches Portage area, one ditch Vault area	Two ditches Portage area, one ditch Vault area	Two ditches Portage area, one ditch Vault area	Two ditches Portage area, one ditch Vault area	-
Portage and Goose Island pit lakes	-	-	-	-	In the Portage Pit Lake, near the dike breach
Third Portage Diffuser discharge	-	At a sampling port in the discharge pipe to the diffuser at the edge of Third Portage Lake	-	-	-
Vault Pit Lake	-	-	-	-	In the Vault Pit Lake, near the dike breach
Wally Lake Diffuser discharge	-	-	At a sampling port in the discharge pipe to the diffuser at the edge of Wally Lake	-	-
Tailing Storage Facility					Margin of Tailing Storage Facility

Figures 2-1, 2-2, 2-3 and 2-4 show the approximate location of each sampling sites. The actual location of each sampling site will be determined by access and safety considerations and will be marked by a highly visible stake that will define the exact location of the collection point for subsequent sampling events.

3.1.2 Monitored Parameters

Proposed parameters for monitoring are based on the CM sites as listed in Table 3-2. For CM sites where non-contact water from diversion ditches is discharged, turbidity will be monitored as a surrogate for total suspended solids (TSS). For CM sites where effluent is discharged from a diffuser pipe (operation phase only), all MMER parameters stipulated in the Regulations will be monitored MMER parameters include: deleterious substances (total cyanide, arsenic, copper, lead, nickel, zinc, total suspended solids, pH), volume and flow rate of discharge, acute toxicity, Daphnia Magna and environmental effects monitoring (EEM). For CM sites in the fully flooded pit lakes during the post-closure phase, all MMER-regulated parameters will also be monitored except for volume and flow rate of discharge.

3.1.3 Sampling and Analysis Program

Surface grab samples or samples from diversion ditches and piped discharge points will be collected in clean laboratory-supplied containers from the CM locations at open water. During the construction phase, samples will be analyzed offsite. After the construction phase, the samples will be analyzed at the analytical laboratory on site, which is anticipated to be certified for the required parameters.

All laboratory metals analyses will be for total concentrations. Table B-1 of Appendix B summarizes the monitored parameters, sampling and analytical methods, and method detection limits for each analyte. The minimum sample volumes, container, preservation, and holding times are from the *USEPA Methods for Chemical Analysis of Water and Waste Water* (EPA-600/4-79-020, 1979) and the analytical method and method detection limits are from CANTEST, the laboratory currently conducting all water analyses for the Meadowbank Project. The method detection limits will meet the requirements of MMER-Schedule 3.

3.1.4 Monitoring Frequency

The CM program will have two primary sampling strategies during the construction, operations and closure phases of the mine: a) monthly for non-contact (diverted) water and b) weekly during attenuation pond discharge periods (AEMP, 2005; MMER, 2002 and 2006). The monitoring schedule for the post closure phase of the project is defined in the *Meadowbank Gold Project Preliminary Closure and Reclamation Plan* (MMC, 2007e) and will initially include annual sampling for the first 10 years after closure phase. Table 3-2 summarizes the monitoring schedule for the CM locations. The table includes the parameters for each monitoring event.

Table 3-2: Water Quality Monitoring Schedule and Parameters for CM Points

Sampling Frequency	Analyte list
Construction Phase	
Monthly – non-contact water	turbidity
Operations Phase	
Monthly - non-contact water	turbidity
Weekly during discharge periods - effluent from Vault and Portage attenuation ponds	MMER parameters
Closure Phase	
Monthly – non-contact water	turbidity
Post-closure Phase (after dewatering dikes are breached)	
Annually during open water season for first 10 years – breach inflows	MMER parameters, except flow rates and volumes which are not applicable to these sampling sites

- All monitoring to be done during the ice free season, (i.e. during open water)

Results of the site water quality monitoring will be reviewed by the Meadowbank Environmental Advisor and chemical trends of constituents of interest will be updated on a monthly basis. This will allow early detection of significant changes in water quality. Action plans will then be implemented to ensure that the environment protection objectives are met.

3.1.5 Trigger Levels

The trigger level is a defined concentration level of one or more parameters regulated under MMER guidelines from the water samples collected at 1) the discharge points of the non-contact water (turbidity only) and 2) the Third Portage and Wally lake diffuser sampling points. Reaching trigger level concentrations will initiate the adaptive management program. The trigger level for the CM stations follows a staged progression:

- Stage 1: concentration of one or more chemical constituents exceed 50% of the MMER limits
- Stage 2: concentration of one or more chemical constituents exceeds 90% of the MMER limits

Figure 3-1 is a logic diagram showing the decision path for evaluating analytical results from the attenuation pond CM program.

3.1.6 Action Plan

The adaptive management program requires that if one or more of the key monitored parameters exceed the respective trigger level, a staged sequence of responses will follow. Table 3-3 summarizes the staged adaptive action plan for the CM program.

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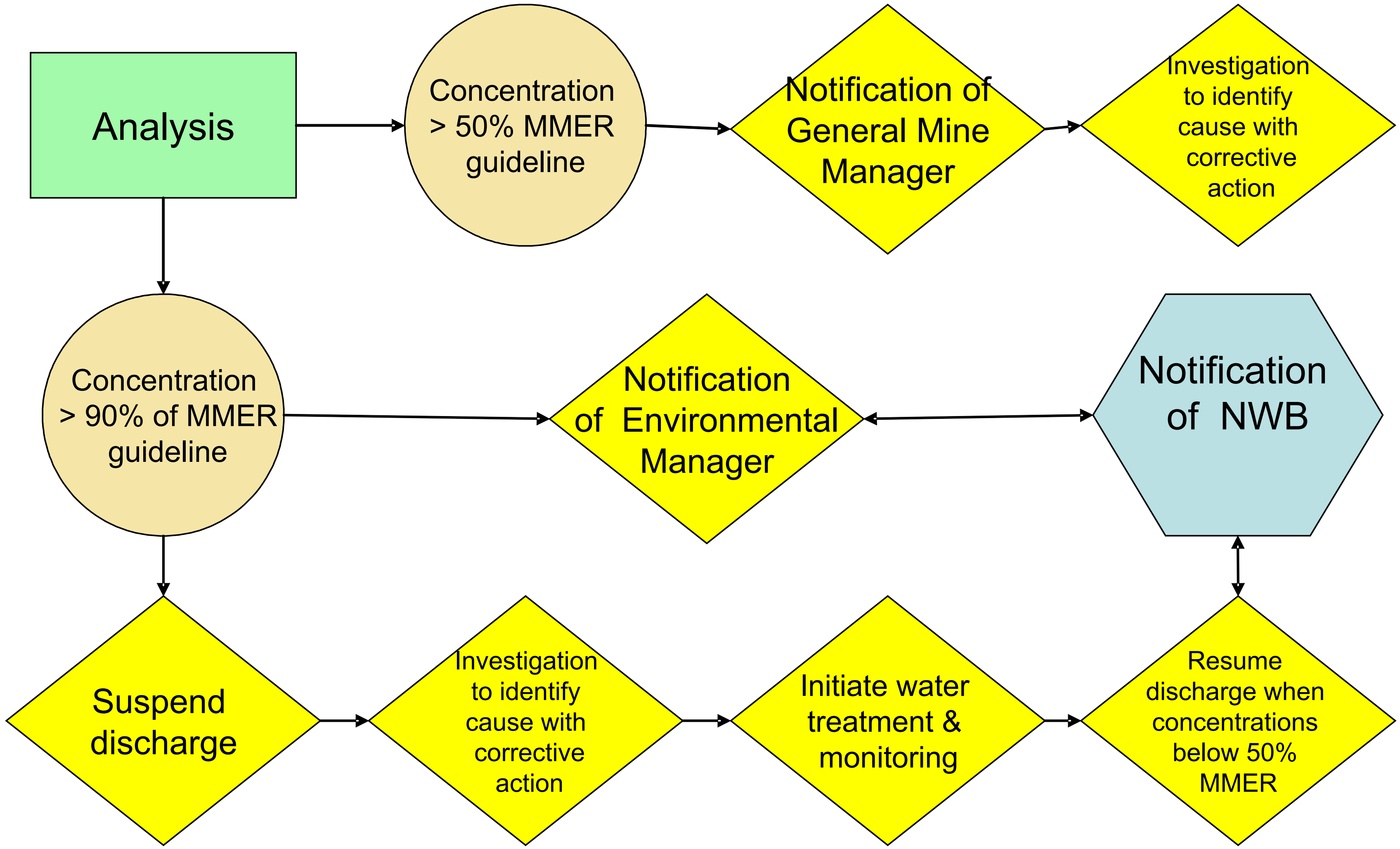

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CM WATER QUALITY ANALYSIS LOGIC DIAGRAM

FIGURE 3.1

Table 3-3: Action Plan for the CM Program

Stage	Trigger	Action plan
Stage 1	50% MMER	• notification of mine management • initiation of an investigation to identify possible source(s) and cause(s) of the exceedence • initiation of corrective action, if required
Stage 2	90% MMER	• confirmation of the correctness of the analysis which may include review of the sampling procedure and re-sampling of the particular site if necessary. • courtesy notification of NWB by the Meadowbank Environmental Advisor • suspension of discharge activities • investigation to identify cause and application of corrective action • initiation of water treatment and monitoring • resumption of discharge when concentrations are below 50% of the MMER limits.

At any time during mine construction, operations, or closure phases, if the water quality of the Vault area non-contact water diversion ditch from Phaser Lake to Turn Lake exceeds the water quality standard:

- water in the non-contact water ditch from the un-named pond to Phaser Lake will be diverted around Phaser Lake to the CM discharge point in Turn Lake (if the water at the IM location meets water quality standards); and/or,
- water in the non-contact water diversion ditch from Phaser Lake to Turn Lake will be pumped to the Vault Attenuation Pond.

Should the TSS value (calculated from turbidity measurement) of non-contact water at any time during the construction, operation, or closure phases at the Portage mining area exceed regulatory guidelines, the water will be discharged to the Portage Attenuation Pond or TSF until the cause of the exceedence can be identified and the situation rectified.

3.2 INTERNAL MONITORING PROGRAM (IM)

The IM sites include sources of contact water that are monitored for operational purposes.

3.2.1 Location of IM Points

The IM locations include a range of sampling sites that change with time and with phases of the mining operations. The internal sampling locations are listed in Tables A-2, A-3, and A-4 of Appendix A and the sites are shown in Figure 2-1, 2-2, and 2-3. Table 3-4 summarizes the sites and the sampling periods.

Table 3-4: IM Sampling Locations

Facility	Early Operations	Late Operations	Closure	Post-closure
Non-contact water Vault area	Diversion ditches	Diversion ditches	Diversion ditches	
Goose Island Pit	Sump during operation	Pit lake water during flooding	Pit lake during flooding	-
North and Third Portage pits	Two sumps during operation	Two IM points in pit lake water during flooding	Pit lake during flooding	-
Portage RSF	Toe sump(s) during operation	Toe sump(s) during capping	Toe sump	-
Reclaim Pond	Reclaim water	Reclaim water	-	-
Portage Attenuation Pond	Attenuation pond water	-	-	-
Portage TSF	-	Runoff from capped area of TSF	Runoff from cap on TSF	-
Vault Pit	-	Vault Attenuation Pond	Pit lake during flooding	-
Vault RSF	-	Toe sump(s) during operation	Toe sump	-

- * Vault non-contact water ditch transports water to the un-named pond to Phaser Lake.

3.2.1.1 Open Pits

Monitoring sites in the open pit sumps will be located to collect samples either directly from the sumps or from the discharge lines of pumped water from the pit sumps during mining operations. During pit flooding, sampling sites will be located along the banks of the pits. It is likely that the sampling sites will change as the pits are mined to greater depth and as the water level in the pits rises in response to flooding. The actual sampling locations will be dictated by access and safety considerations but will be identified at the time of sampling by either GPS coordinates or location on a map. Depending upon the choice of sample nomenclature (ID) selected during operations, the ID of the open pit sump and pit lake samples will change to reflect the different sample location. It is anticipated that during the early flooding phase of the Portage Pit, water may accumulate in more than one area of the pit (refer to Section 2.2). The current monitoring program assumes separate samples will be collected from ponds in the North Portage and the Third Portage pits during flooding and prior to the two water bodies merging into a single pit lake.

3.2.1.2 Portage and Vault RSF

Water samples will be collected from the toe sumps of each RSF during operations. The actual sampling locations will be dictated by access and safety and may include discharge lines or open pools. Regardless of the choice of sampling sites, once established all subsequent sampling events will be conducted at the same site. The site will be marked by either a stake or flagging and identified at the time of initial sampling by either GPS coordinates or location on a map.

3.2.1.3 Reclaim Pond

The Reclaim Pond is designed to migrate northward as the TSF fills with tailings and eventually combine with the Portage Attenuation Pond (refer to Section 2.2). Samples will be collected from the open water of the Reclaim Pond or from the reclaim line to the mill. The actual sampling location within the Reclaim Pond will be dictated by access to the pond and safety considerations. Once established, the selected sampling location will be used for all subsequent sampling events.

At the end of mine life, water in the Reclaim Pond will be drained to complete the reclamation of the TSF. Reclaim water will be transferred to the Portage Pit Lake, which, at that time, will still be isolated from adjacent open waters by the Dewatering Dikes. Reclaim water quality will be monitored during operation and may be treated prior to release to the Goose Island or Portage pit lakes. Reclaim water treatment requirements will be evaluated prior to transfer to the pit lakes, and will be based on achieving drinking water quality guidelines within the pit lakes after incorporation of reclaim water. The Goose Island Dike will be breached after reclaim water has been released to the pit lakes and water quality has all met Territorial Drinking Water guidelines and all MMER criteria including environmental effects monitoring (EEM) in the receiving environment (Cumberland 2005a).

3.2.1.4 Tailings Storage Facility (TSF)

Concurrent reclamation is planned for the TSF during the late operations phase of the mine using non-acid generating UM waste rock. The current cap design includes a sloped surface to promote runoff and catchment devices to capture the runoff from the TSF. Sampling of the TSF cap runoff will be conducted in either ditches or sumps adjacent to the TSF. The actual sampling location will be dictated by access and safety and once established will be used for all subsequent sampling events conducted at the same site. The site will be marked by either a stake or flagging and identified at the time of initial sampling by either GPS coordinates or location on a map.

3.2.2 Monitored Parameters

Proposed parameters for monitoring are based upon the analytes used in, and for which there are predicted concentrations from the geochemical model simulations conducted for the Meadowbank site (Golder, 2007b).

The individual parameters for the IM monitoring sites are listed in Tables, A-2, A-3, A-4, and A-5 of Appendix A and shown in Table B-1 of Appendix B. *Schedule 3* parameters include: alkalinity, aluminium, ammonia, arsenic, barium, cadmium, chloride, chromium, copper, fluoride, iron, lead, manganese, mercury, molybdenum, nickel, nitrate, pH, selenium, silver, sulphate, thallium, zinc, turbidity and hardness. The tailings reclaim water and groundwater under the TSF will also be analyzed for total cyanide and free cyanide. *Schedule 2* parameters include: alkalinity, ammonia, arsenic, copper, lead, nickel, zinc, pH, turbidity and total dissolved solids (TDS).

3.2.3 Sampling and Analysis Program

Surface grab samples or samples from piped discharge points will be collected in clean laboratory-supplied containers from the monitoring locations during ice free periods of the year. During the construction phase, samples will be analyzed offsite. After the construction phase, the samples will be analyzed at the analytical laboratory on site. All laboratory metals analyses for IM locations will be for dissolved concentrations. Table B-1 of Appendix B summarizes the monitored parameters, sampling and analytical methods, and detection limits for each analyte. The minimum sample volumes, container, preservation, and holding times are from the USEPA Methods for Chemical Analysis of Water and Waste Water (EPA-600/4-79-020, 1979) and the analytical method and method detection limits are from CANTEST, the laboratory currently conducting all water analyses for the Meadowbank Project. The method detection limits will meet the requirements of MMER-Schedule 3.

3.2.4 Monitoring Frequency

Monitoring of IM sites will consist of two primary sampling strategies during the operations phases of the mine: a) monthly for *Schedule 2* parameters and b) biannually (during the spring freshet and late summer) for *Schedule 3* parameters. There is a planned reduction in sampling frequency during the closure phase, depending on the performance of these structures. Table 3-5 summarizes the monitoring schedule for the IM locations during ice-free periods. The table includes the parameters for each monitoring event.

Table 3-5: Water Quality Monitoring Schedule and Parameters for IM Points

Sampling Frequency	Analyte list
Construction Phase	
Monthly (non-contact)	turbidity
Operations Phase	
Monthly (non-contact)	turbidity
Monthly monitoring	*Schedule 2*
Biannual monitoring (spring freshet and late summer)	*Schedule 3*
Closure Phase	
Monthly (non-contact)	turbidity
Monthly for open pits (during flooding)	*Schedule 2*
Biannual monitoring (open pits fully flooded, TSF, RSF)	*Schedule 3*

Data required for MMER monitoring (chemical parameters) is covered in the water quality monitoring parameters for IM Points, although in a dissolved phase. Monitoring of the biological components of MMER will be covered under the AEMP (Cumberland, 2005).

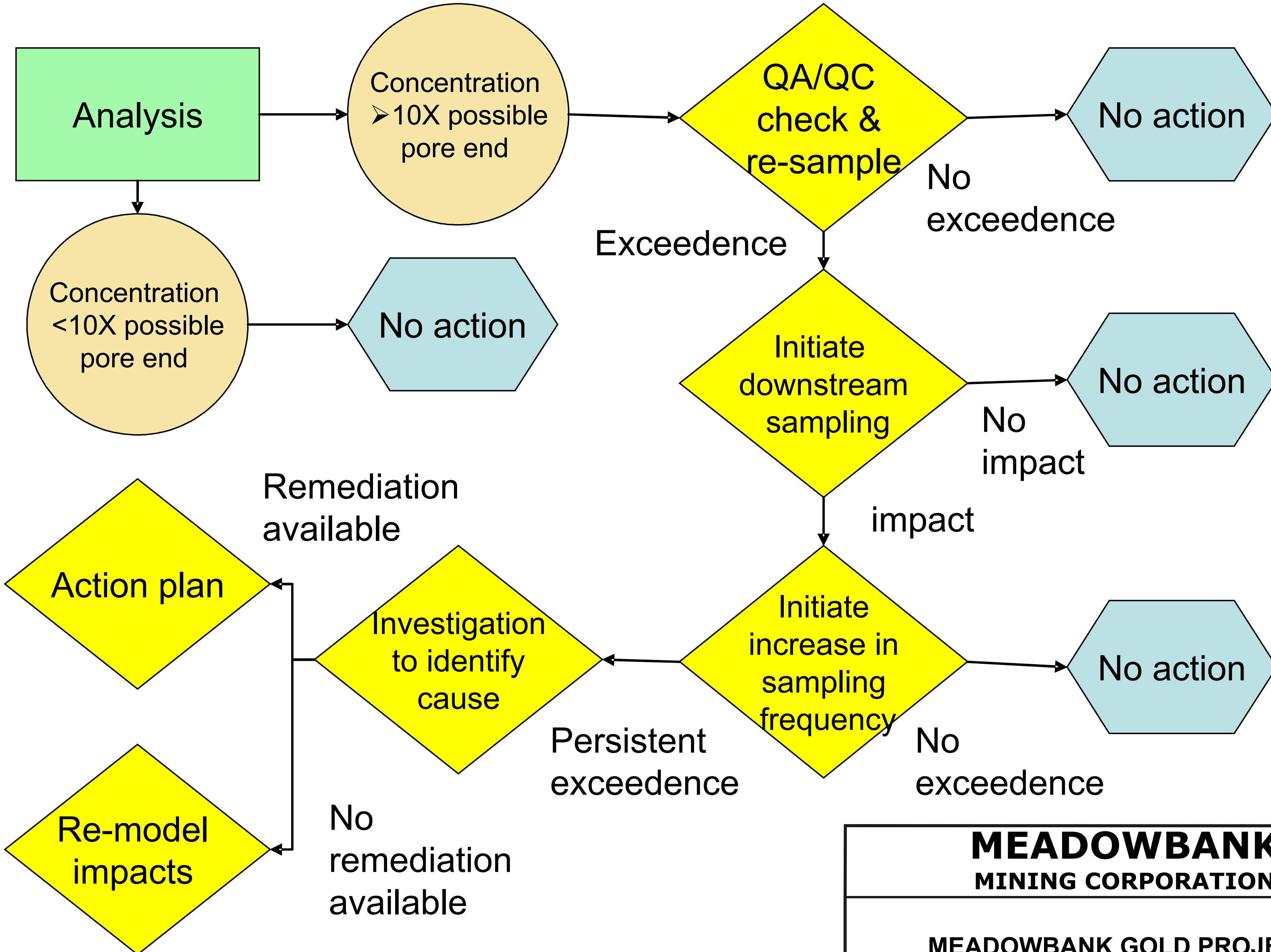
3.2.5 Adaptive Management

Results of the site water quality monitoring will be reviewed by the Meadowbank Environmental Advisor and chemical and trends of constituents of interest will be updated on a monthly basis. This will allow early detection of significant changes in water quality. Action plans will then be implemented to ensure that the environment protection objectives are met.

3.2.5.1 Trigger Levels

The trigger level is the defined concentration level of one or more analytes of interest from the water samples collected at IM locations, that initiates the adaptive management program. Figure 3-2 is a logic diagram showing the decision path for evaluating analytical results from the IM program.

For IM sites, as waters from these locations are not released to the receiving environment, a concentration of 10 times the predicted “Possible Poor End” concentrations for one or more of the



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IM WATER QUALITY ANALYSIS LOGIC DIAGRAM

FIGURE 3.2

MMER parameters is the proposed trigger level, in consideration of the order-of-magnitude accuracy of the predictions (Golder, 2007b).

Table C-1 of Appendix C lists the arithmetic mean of the predicted concentration of Schedule 2 parameters based on “Possible Poor End” simulations (Golder, 2007b). The “Possible Poor End” model results have been adopted for the adaptive management plan trigger levels because these concentrations have been used to assess environmental impacts associated with mining activities (Golder, 2007b). They represent the potential end member concentrations within the model results.

The average model predicted “Possible Poor End” water quality is the arithmetic mean of concentrations for a given parameter over the years for which the model simulations were conducted, for each phase of the mine life. The time intervals over which the arithmetic mean was calculated are shown in Table C-1 of Appendix C for each of the IM sites.

3.2.5.2 Action Plan

The adaptive management program requires that if one or more of the monitored parameters exceed the respective trigger level by an order-of-magnitude or more, a staged sequence of responses will follow including:

- Confirmation of the correctness of the analysis including a review of the sampling procedures, chain of custody documentation, laboratory analytical procedure, and laboratory QA/QC data. This may include re-sampling of the particular site if necessary.
- Initiation of supplemental water quality sampling down stream of the IM site to quantify the extent of the exceedence and impacts of the exceedence on water quality.
- Initiation of an increase in sampling frequency to document the long term trends in water chemistry at the sampled site.
- Initiation of an investigation to identify the source(s) and cause(s) of the exceedence.
- If the exceedence is correct (i.e., not a false positive), persists over several sampling events regardless of corrective action, and impacts the downstream water quality, either a) a corrective action plan must be designed and mitigation measures initiated or b) if no remediation technology is available, the geochemical predictive model for the facility must be re-run using the new parameters as input to the model to assess the long term impacts of the exceedence.

3.3 SITE SPECIFIC MONITORING PROGRAM (SSM)

The site specific monitoring program addresses topical monitoring issues as they may arise during the course of mine life, including:

- Seep water chemistry;
- Groundwater quality;
- Receiving water chemistry;
- Landfills, and

- Process Plant.

3.3.1 Seep Water Chemistry

This effort is intended to characterize the hydrochemistry and volumes of seasonal flows from a range of sites within the project area including:

- Seeps from the Portage and Vault RSF;
- Seeps from the Central Dike and dewatering dikes; and
- Water-bearing fractures in the pit walls.

Model predictions for drainage water chemistry from the RSF and pit lake water chemistry are based upon laboratory-derived loading rates for many of the influent water sources, scaled to approximate field conditions (Golder, 2007b). Site specific empirical data for seeps from the RSFs, pit walls, and dikes will be used to calibrate and validate the water quality model.

3.3.1.1 Sampling Locations

Samples will be collected from discharge points where these are found. They may include the following:

- Seeps at or near the toe of the Portage and Vault RSF;
- Seeps in the faces or at the base of the Goose Island Dike, Bay Zone Dike, East Dike, Central Dike, Vault Dike, and South Camp Dike; and
- Seeps discharging from fractures in open pit walls of the Goose Island, Portage, and Vault pits.

3.3.1.2 Monitored Parameters

Should seeps be detected, they will be sampled and analyzed for the *Schedule 1* list of parameters. The individual parameters are listed in Tables A-1, A-2, A-3, A-4 and A-5 of Appendix A and shown in Table B-1of Appendix B.

3.3.1.3 Sampling and Analysis Program

Surface grab samples will be collected from the seeps during ice free seasons of the year using the *Schedule 1* list of parameters and will be analysed for total concentrations. Table B-1 of Appendix B summarizes the monitored parameters, sampling and analytical methods, and detection limits for each analyte.

3.3.1.4 Monitoring Frequency

Sampling of seeps will be conducted monthly or as flows are detected. It is anticipated that the flow will be seasonal with maximum flow during the freshet season (mid-May to mid-June). Seep sampling frequency will be re-evaluated on an annual basis. It is anticipated that during freeze-back within the RSFs, seepage may occur and if seeps are observed during the closure period at the Portage and/or Vault RSFs, selected samples would also be collected.

3.3.2 Groundwater Quality

This effort is intended to track the groundwater chemistry at two locations:

- Beneath the TSF; and
- In or about the fault zone underlying the Central Dike

The TSF is located in an area of unfrozen groundwater (talik) in the basin of the Northwest Arm of Second Portage Lake. Groundwater monitoring wells were installed in 2003 and 2006 to sample talik water in these areas as part of the baseline study for the Project (Golder, 2007f). Monitoring wells have also been installed in the talik zones under Goose and Portage pits, in each of the three main lithologies that will be encountered in pits: namely Iron Formation (IF), Intermediate Volcanic (IV) and Ultramafic (UM) rock. Four of the seven wells were installed in 2003: MW03-01, MW03-02, MW03-03, and MW03-04. During subsequent sampling events, it was discovered that three of these wells (MW03-02, MW03-03, and MW03-04) developed internal damage, likely due to freezing, rendering them inoperable. In 2006, three additional wells (MW06-05, MW06-06, and MW06-07) were installed to replace the damaged wells (Golder, 2007f).

3.3.2.1 Sampling Locations

All operable groundwater monitoring wells will be sampled as part of the Plan. It is expected that the wells in the areas of the pit will be destroyed as mining progresses. The need for replacement wells will be evaluated during operation, based on the feasibility of well installations in these areas, and on the presence and volume of groundwater inflow into the open pits.

A minimum of two additional wells will be installed beneath the TSF; the screened interval of these wells will be located within or as close to the Portage fault zone as possible, beneath the Central Dike to serve as an early warning of potential seepage of tailings pore water through this fault (MMC, 2007a). These wells are to be installed during the construction phase of the Project. The presence of additional water-bearing fault zones may also warrant the installation of groundwater wells.

3.3.2.2 Monitored Parameters

Groundwater samples will be analyzed for *Schedule 3* list of parameters. The elements include: pH, alkalinity, turbidity, hardness, ammonia, chloride, fluoride, sulphate, total dissolved solids, and dissolved aluminium, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, molybdenum, nickel, nitrate, selenium, silver, thallium and zinc. Groundwater samples from under the TSF will also be analyzed for total cyanide and free cyanide.

3.3.2.3 Monitoring Frequency

Sampling will be conducted once annually during the ice free season.

3.3.3 Receiving Water Chemistry

Receiving water quality monitoring is discussed in the AEMP (Cumberland, 2005a). Within the AEMP are a) a core monitoring program; and b) a targeted monitoring program. The core monitoring program includes two arcs of sampling stations that surround each of the mine developments (near field and far field) for early detection of mine-related impacts. The targeted studies are limited in scope and intended to address "specific questions related to particular components of mine development during construction and operation." The core monitoring plan is summarized in Table 6.1 of the AEMP (Cumberland, 2005a); which includes components (water quality, sediment chemistry, benthos, periphyton, phytoplankton, fish, and assessment of fish pressure), parameters, sampling locations, sampling frequency, sampling methods, and criteria for data evaluation. The components comprise the *Schedule 4* list of parameters (refer to Table A-2, A-3, A-4 in Appendix A)

A water quality monitoring program is also defined in the AEMP for discharge events during operations of the Portage and Vault attenuation ponds (Cumberland, 2005). During the first 5 years of mine operation, water will be discharged annually from the Portage Attenuation Pond to Third Portage Lake and during the later years of mine operations, water will be discharged annually from the Vault Attenuation Pond to Wally Lake (MMC, 2007d). Table 3-6 summarizes the monitoring requirements for the Third Portage and Wally lakes. Monitoring locations for the effluent outfall diffusers for Third Portage and Wally lakes (Golder, 2007e and Golder, 2007c, respectively) are to be located at the edge of the 30-m radius mixing zone either within the AEMP Core Near-Field sampling zones or as separate monitoring locations, depending upon the final location of the diffusers.

Table 3-6: AEMP monitoring requirements during attenuation pond discharge events

Monitoring Schedule	Parameters
Weekly	*Schedule 4*
Monthly	Acute lethality of effluent to rainbow trout (*Oncorhynchus mykiss*) and water flea (*Daphnia magna*)

3.3.4 Landfill Monitoring

Waste material from the Meadowbank Project site is classified (Golder, 2007a) as:

- inert waste material or "acceptable waste" consisting of primarily construction waste which will be disposed of in the landfill facility immediately adjacent to the Portage RSF; and
- "unacceptable waste" which will be excluded from the site landfill. "Unacceptable" waste is includes hazardous material which discussed in the *Meadowbank Gold Project Hazardous Material Management Plan* (MMC, 2007f).

The list of "acceptable" and "unacceptable" waste materials is shown in Appendix D.

The landfill is located within the catchment of the Portage RSF. Monitoring of the Portage RSF will provide concurrent monitoring of any discharge from the landfill.

3.3.5 Process plant

The Process Plant is designed to be self contained with no discharges to the receiving environment. Runoff from the plant area will be captured in the Mill Sump(s) located on the northwest edge of the plant area (refer to Figures 2-1 and 2-2). Excess water not used to satisfy process make-up water requirements will be pumped from the Mill Sump(s) to the Portage Attenuation Pond during Years 1 to 5 and then to the Goose Island pit in subsequent years (refer to Section 2.2). The water in the Portage Attenuation Pond and the Goose Island Pit lake are monitored as part of the CM and IM programs which will provide concurrent monitoring of any releases from the Process Plant.

3.4 EVENT MONITORING

The Event Monitoring (EM) program addresses the site specific monitoring that is required following any accidental release. A “release” may be caused by:

- spills (Meadowbank Gold Project Spill Contingency Plan; MMC, 2007b);or
- emergencies (Meadowbank Gold Project Emergency Response Plan; MMC, 2007c).

The spill reporting procedure has been prepared in accordance with *Spill Contingency Planning and Reporting Regulations* (NTWEDEPS, 1988). The EM program is designed to verify whether contamination of the surface soil and active zone has occurred as a result of an accidental release of a hazardous material, through monitoring of surface runoff following remediation of any release. It is anticipated that owing to the presence of permafrost beneath most of the mine footprint, there will be minimum impact to groundwater. These plans would be developed subsequent to a spill, and would consider the type of product spilled, the potential receptors and the potential for any remaining contamination after clean up. The plan will be done in coordination with the Environmental Adviser as described in the *Meadowbank Gold Project Spill Contingency Plan* (MMC, 2007b)

An EM program would be initiated upon the release of a hazardous material listed in the *Meadowbank Gold Project Hazardous Management Plan* (MMC, 2007f). Table E-1 of Appendix E summarizes the hazardous materials expected to be used during operations of the mine. Hazardous materials are grouped by use and include: process plant reagents, explosives, and fuel products.

Additional hazardous materials other than those listed may be required during mine operations The EM program for these chemicals will be addressed when the materials are brought on site.

3.4.1 Location of EM Points

In the event of an accidental spill, the water quality of the downstream receptor and possibly upstream of the receiving point, if any, would be sampled (during the ice-free season) and analyzed. Should the spill have happened over snow cover, water and possibly soil sampling would take place at the earliest feasible time after thaw to verify if there has been any impact to the receiving water or soil quality.

During the post-closure phase, the mine will have undergone decommissioning and hazardous materials will be permanently removed from the site.

3.4.2 Monitored parameters

The specific parameters monitored as part of the EM program will depend on the nature of the spill, and would be determined for the specific hazardous material released. Table E-2 of Appendix E lists the parameters of concern for each type of hazardous material and the action level. Sampling protocol, analytical method, and detection limits are shown in Table B-1.

3.4.3 Monitoring Frequency

The EM monitoring activities would occur during the ice-free season. EM sampling would occur following the clean up of a release and the frequency of sampling would depend on the type of material spilled (wet or dry spill), the environment into which the chemical was released (surface water body or soil; frozen or thawed), and the quantity of spill material. The EM program for a particular spill would cease upon obtaining satisfactory analytical results (within 20% of background level, to accommodate for analytical accuracy) from the potentially affected areas.

3.4.4 Contingency plan

Should any specific monitored parameter exceed the action level in the downstream monitoring point, further remediation will be undertaken immediately. EM monitoring will be restarted following site restoration and will continue until satisfactory analytical results (within 20% of background level, to accommodate for analytical accuracy; EPA 1994) from the affected areas.

SECTION 4 • QA/QC

The QA/QC program is designed to identify and minimize the impacts of potential sampling and analytical errors in the CM, IM, SSM, and EM programs. The QA/QC program adheres to principles outlined by INAC (1996) for A-licence water quality monitoring and is based upon an industry standard frequency and includes the use sample duplicates and blank.

It is recommended that one 1 field duplicate, 1 trip blank and 1 filter blank be used for a) each 10 samples; or b) each sampling event as shown in Table 4-1.

Table 4-1: QA/QC Sampling Frequency

Sampling Site	Sample Frequency	QA/QC Sampling Frequency
CM Program		
Attenuation ponds	Weekly at open water	One field duplicate, one trip blank and one filter blank per week; MMER parameters
Mine facilities – post-closure	Annually	One field duplicate, 1 trip blank and one filter blank per year, MMER parameters
IM Program		
Mine facilities operations	Monthly/biannually	One field duplicate, 1 trip blank and 1 filter blank per biannual sample – full list of parameters
Mine facilities closure	Monthly	One field duplicate, 1 trip blank and 1 filter blank per quarter – spring and fall – full list of parameters
SSM Program		
Seep water chemistry	One field duplicate, 1 trip blank and 1 filter blank per 10 samples	
Groundwater samples	One field duplicate, 1 trip blank and 1 filter blank per groundwater sampling round	
Receiving water chemistry	Field duplicates, laboratory and field blanks, swipes, matrix spike duplicates, blind duplicates (AEMP, Cumberland Resources, 2005a)	
EM Program		
Each event	One field duplicate per 10 samples	

4.1 SAMPLING METHODS

4.1.1 Surface Water Sampling

Stream and surface water sampling will follow INAC (1996) recommended methods of submerging the sample bottle to half depth of the stream, or for sumps and stagnant water bodies, to below the surface of the water. Bottles will be rinsed three times with sample water before filling. Preservatives, when required, will be added after filling. Field blanks and duplicates will be collected in the same manner, and concurrently with the other samples.

4.1.2 Groundwater Sampling

The sampling procedures for groundwater will be the same as previously employed to sample the existing wells (Golder, 2007f). All of the wells will be purged, to remove standing water inside the wells and provide a representative sample of fresh rock formation water for sampling. Groundwater will be purged from the wells until electrical conductivity and pH readings stabilize (values remaining within 10% for three consecutive readings). Groundwater will be sampled immediately after each well has been purged. Water samples will be collected using guideline procedures provided by the United States Environmental Protection Agency (EPA, 2002). Indicator parameters (conductivity, pH) will be measured during purging and sampling. Groundwater samples will 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 will be filtered through a 45 μm inline filter for the analysis of dissolved metals. All groundwater samples will be stored at or close to 4^{o}C and preserved as specified in Appendix B or as specified by the laboratory.

4.1.3 Sample Identification

All water samples will be identified with the station number, time and date of collection and initials of the sampler.

4.1.4 Sample Transportation

All water samples will be stored in coolers with ice packs and preserved as specified in Appendix B or as specified by the laboratory. Samples will be shipped to an accredited laboratory as soon as sampling is completed. All samples will be listed on a Chain-of-custody form, a copy of which will travel with the samples and another copy will remain at the mine site for reference. The Chain-of-custody will contain the following information:

- Company name and sampler's name;
- Sample identification number;
- Time and date of sampling;
- Presence and type of preservative and whether the sample was filtered or not

- Requested analytical parameters for each bottle;
- Time and date of shipping; and
- Analytical Laboratory, address and reference person.

4.1.5 Data verification

Upon reception of analytical results, the blank and duplicate analyses will be verified for potential contamination and for accuracy, respectively. Relative percent differences (RPDs) will be calculated for each duplicate pair of analyses and results will be compared against USEPA Guidelines for Inorganic Data Review (USEPA, 1994) which suggests RPD values should not exceed 20% for accurate analyses. All QA/QC data will be reported along with analytical results.

SECTION 5 • FLOW VOLUMES

Flow volumes within the mine footprint will be monitored daily through the volume of discharge pumped from the individual sumps and ponds. Flow volume measurement will be conducted using volumetric flow meters attached to each pump. Detailed pump records will be maintained including date, pond/sump number, recipient of pumped water, pump ID, flow meter ID, duration of pumping, and total volume pumped. The average flow rates, total discharge per event and total cumulative discharge will be recorded in an annual Mine Site Water Quality and Flow Monitoring report. Table 5-1 lists the pumped intervals for contact water at the Meadowbank Project site.

Table 5-1: Pumped Intervals for Surface Water at the Meadowbank Project, Mine Operation Period.

Pumped from	Pumped to
Process Plant (Years 1 to 8)	TSF
Reclaim Pond (Years 1 to 8)	Process Plant
Reclaim Pond (Year 8)	Portage Pit Lake or Goose Island Pit Lake
Portage RSF sumps (Years 1 to 5)	Portage Attenuation Pond
Portage RSF sumps (Years 5+)	Reclaim Pond
Mill sump(s) (Years 1 to 5)	Portage Attenuation Pond
Mill sump(s) (Years 5+)	Goose Island Pit Lake
Portage Pit sump(s) (Years 1 to 5)	Portage Attenuation Pond
Goose Island pit sump(s) (Years 1 to 4)	Portage Attenuation Pond
Vault RSF sumps (Years 4 to 8)	Vault Attenuation Pond
Vault Pit sump(s) (Years 4 to 8)	Vault Attenuation Pond
Portage Attenuation Pond (Years 1 to 5)	Third Portage Lake
Vault Attenuation Pond (Year 4 to 8)	Wally Lake

SECTION 6 • REPORTING

Reporting of water quality results will be conducted on two levels a) annually with the results of the CM, IM and SSM program and per MMER requirements and b) in response to exceedences.

6.1 ANNUAL REPORTING

An annual Mine Site Water Quality and Flow Monitoring report will be submitted to the NWB by March 31st of the following year (90 days after year-end,). The report will summarize the following:

- Monitoring results for each CM station during the year and for the life of mine (construction to end of closure); activities during the year at each CM station; and any exceedences at CM stations, the action plan applied to the exceedence, and the results of the action plan.
- Monitoring results for each IM station during the year and for the life of mine (construction to end of closure); activities during the year are each IM station; and any exceedences at IM stations.
- Monitoring results for SSM samples during the year (excluding groundwater monitoring) to include location of the samples, sources of the water collected, and results of chemical analyses of the samples.
- Annual groundwater monitoring results; activities during the year at each well site and record of well operations, well replacement, and proposed drilling for the next year; and installation details of new wells and identification of any abandoned or destroyed wells.
- Receiving water monitoring results (AEMP, Cumberland, 2005a).
- Spills and any accidental releases; EM activities conducted following containment, remediation, and reclamation; and the results of EM program, any exceedence in EM results, and the action plan following the exceedence.
- Effluent flow rates, volumes and calculated chemical loadings following the requirements of MMER.
- Results of QA/QC analytical data.
- Any sampling and analyses conducted at the Meadowbank Mine site required under MMER or the Type-A Water License for the Project.

6.2 EXCEEDENCE REPORTING

Any concentration of a MMER parameter at a CM location that exceeds the action level (Table 3-3) will be reported within 30 days of the receipt of the analysis. In addition, results of the action plan will be reported and, where necessary, mitigation options identified within 90 days after receipt of the analyses.

The presence of tailings process reagents or explosives in the groundwater samples will be reported within 30 days of the receipt of the analysis.

Exceedence in the concentration of a parameter in receiving water will be reported as specified in the AEMP (Cumberland, 2005a).

Concentration of a monitored parameter at an EM location that exceeds the reference concentration (Table E-2 of Appendix E) will be reported upon receipt of the analysis to the On-Scene Coordinator, the Environmental Advisor, General Mine Manager, and the Meadowbank Mine Management as described in the *Meadowbank Gold Project Spill Contingency Plan* (MMC, 2007b).

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APPENDIX A

Monitoring Locations and Monitoring Program

Table A-1: Construction Phase Monitoring Plan

Facility	Status	Location(s)	Parameters	Frequency	Method
CM					
Non-contact water diversion ditches	construction, site development	Two Portage area and one Vault area	turbidity	monthly during open water season	Unfiltered grab sample
IM					
Non-contact water diversion ditches	site preparation	Vault	turbidity	monthly during open water season	Unfiltered grab sample
SSM					
Seep	site preparation	As found	Schedule 3	As found	filtered grab sample
Groundwater	site preparation	All functioning wells	Schedule 3	Annually	(see Note 1)
Receiving water (AEMP, Cumberland Resources, 2005a)	site preparation	4 areas (near-field, mine footprint, far-field, Tehek Lake)	Schedule 4	Monthly during open water season all AEMP stations. Monthly throughout year at a smaller number of sampling locations (through ice)	Depth integrated sample using diaphragm pump, surface grab samples
EM					
		Per event	Per event	Per event	Per event

Notes:

Schedule 1 parameters: pH, alkalinity, turbidity, hardness, ammonia nitrogen, nitrate, chloride, fluoride, sulphate, total metals: aluminum, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, thallium and zinc

Schedule 2 parameters include: alkalinity, ammonia, arsenic, copper, lead, nickel, zinc, pH, turbidity and total dissolved solids (TDS).

Schedule 3 parameters: pH, alkalinity, turbidity, hardness, ammonia nitrogen, nitrate, chloride, fluoride, sulphate, total dissolved solids and dissolved metals: aluminium, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, thallium and zinc. Total and free cyanide for wells in groundwater flow path of the tailing storage facility

1. Wells will be purged until electrical conductivity and pH readings stabilize for three consecutive readings. Groundwater samples for metals analyses will be filtered through a 45 m filter apparatus.

Schedule 4 parameters: **Total and dissolved metals**: aluminium, antimony, arsenic, boron, barium, beryllium, cadmium, copper, chromium, copper, iron, lithium, manganese, mercury, molybdenum, nickel, lead, selenium, tin, strontium, titanium, thallium, uranium, vanadium, zinc; **Nutrients**: ammonia-nitrogen, total kjeldahl nitrogen, nitrate nitrogen, nitrite-nitrogen, ortho-phosphate, total phosphorous, total organic carbon , total dissolved organic carbon, reactive silica; **Conventional parameters**: bicarbonate alkalinity, chloride, carbonate alkalinity, conductivity, hardness, calcium, potassium, magnesium, sodium, sulphate, pH, total alkalinity, total dissolved solids, and total suspended solids.

Table A-2: Early Operations Monitoring Plan

Facility	Status	Location(s)**	Parameters	Frequency	Method
CM					
Non-contact water diversion ditches	In operation	Two Portage area and one Vault area	turbidity	monthly during open water season	Unfiltered grab sample
Third Portage Diffuser Discharge	Portage attenuation pond in operation	1 sampling port in effluent discharge pipe	MMER Parameters (see Note 2)	weekly during discharge	Unfiltered grab sample
IM					
Non-contact water diversion ditches	In operation	Vault area	turbidity	monthly during open water season	filtered grab sample
Portage Rock Storage Facility	RSF in operation	1 sample location	Schedule 3 and Schedule 2	monthly during open water season (Schedule 2). Bi-annually during open water season (Schedule 3)	filtered and unfiltered grab samples
North Portage Pit sump	Pit in operation	1 sample location	Schedule 3 and Schedule 2	monthly during open water season (Schedule 2). Bi-annually during open water season (Schedule 3)	filtered and unfiltered grab samples
Portage Attenuation Pond	Attenuation pond in operation	1 sample location	Schedule 3 and Schedule 2	monthly during open water season (Schedule 2). Bi-annually during open water season (Schedule 3)	filtered and unfiltered grab samples
Third Portage Pit sump	Pit in operation	1 sample location	Schedule 3 and Schedule 2	monthly during open water season (Schedule 2). Bi-annually during open water season (Schedule 3)	filtered and unfiltered grab samples
Goose Island Pit sump	Pit in operation	1 sample location	Schedule 3 and Schedule 2	monthly during open water season (Schedule 2). Bi-annually during open water season (Schedule 3)	filtered and unfiltered grab samples
Tailings Reclaim Pond	Mill in operation	1 sample location	Schedule 3	monthly during open water season	filtered grab sample
SSM					
Seep		As found	Schedule 1	Monthly or as found	Grab sample
Groundwater		all functioning wells	Schedule 3	Annually	(see Note 1)
Receiving (AEMP, Cumberland Resources, 2005)		4 areas (near- field, mine footprint, far-field, Tehek Lake)	Schedule 4	Monthly during open water season all AEMP stations. Monthly throughout year at a smaller number of sampling locations (through ice)	Depth integrated sample using diaphragm pump, surface grab samples
Portage effluent outfall (AEMP, Cumbreland Resources, 2005a)		Effluent outfall mixing zone perimeter Third Portage Lake	MMER Parameters (see Note 2)	At open water season weekly MMER parameters, monthly acute lethality biological sampling	Depth integrated sample using diaphragm pump, surface grab samples
EM					
		Per event	Per event	Per event	Per event

Notes:

** Refer to Figure 2-1

Schedule 1 parameters: alkalinity, aluminium, ammonia, arsenic, barium, cadmium, chloride, chromium, copper, fluoride, iron, lead, manganese, mercury, molybdenum, nickel, nitrate, pH, selenium, silver, sulphate, thallium, zinc, turbidity and hardness

Schedule 2 parameters include: alkalinity, ammonia, arsenic, copper, lead, nickel, zinc, pH, turbidity and total dissolved solids (TDS).

Schedule 3 parameters: pH, alkalinity, turbidity, hardness, ammonia, chloride, fluoride, sulphate, total dissolved solids, and dissolved aluminium, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, molybdenum, nickel, nitrate, selenium, silver, thallium and zinc. Total and free cyanide for wells in groundwater flow path of TSF

1. Wells will be purged until electrical conductivity and pH readings stabilize for three consecutive readings. Groundwater samples for metals analyses will be filtered through a 45 m filter apparatus.

2. MMER parameters: total cyanide, arsenic, copper, lead, nickel, zinc, suspended solids, pH, effluent volume and flow rate of discharge, acute toxicity, Daphnia Magna and environmental effects monitoring (EEM).
Schedule 4 parameters: **Total and dissolved metals**: aluminium, antimony, arsenic, boron, barium, beryllium, cadmium, copper, chromium, copper, iron, lithium, manganese, mercury, molybdenum, nickel, lead, selenium, tin, strontium, titanium, thallium, uranium, vanadium, zinc; **Nutrients**: ammonia-nitrogen, total kjeldahl nitrogen, nitrate nitrogen, nitrite-nitrogen, ortho-phosphate, total phosphorous, total organic carbon , total dissolved organic carbon, reactive silica; **Conventional parameters**: bicarbonate alkalinity, chloride, carbonate alkalinity, conductivity, hardness, calcium, potassium, magnesium, sodium, sulphate, pH, total alkalinity, total dissolved solids, and total suspended solids.

Table A-3: Late Operations Phase Monitoring Plan

Facility	Status	Location(s)**	Parameters	Frequency	Method
CM					
Non-contact water diversion ditches	In operation	Two Portage area and one Vault area	turbidity	monthly during open water season	Unfiltered grab sample
Wally Lake Diffuser Discharge	Vault attenuation pond in operation	1 sampling port in effluent discharge pipe	MMER Parameters (see Note 2)	weekly during discharge	Unfiltered grab sample
IM					
Non-contact water diversion ditches	In operation	Vault area	turbidity	monthly during open water season	Unfiltered grab sample
Goose Island Pit Lake	Closure status during flooding	1 sample location	Schedule 2	monthly during open water season	filtered grab sample
Portage Pit Lake	Closure status during flooding	2 sample locations	Schedule 2	monthly during open water season	filtered grab sample
Portage Rock Storage Facility	Closure status during capping with UM	1 sample location	Schedule 2	monthly during open water season	filtered grab sample
Tailings Reclaim Pond	Mill in production	1 sample location	Schedule 3	bi-annually during open water season	filtered grab sample
Tailing Storage Facility drainage, runoff	Closure	1 sample location	Schedule 3	bi-annually during open water season	filtered grab sample
Vault Pit Sump	In operation	1 sample location	Schedule 3 and Schedule 2	monthly during open water season (Schedule 2). Bi-annually during open water season (Schedule 3)	filtered and unfiltered grab samples
Vault Rock Storage Facility	RSF in operation	1 sample location	Schedule 3 and Schedule 2	monthly during open water season (Schedule 2). Bi-annually during open water season (Schedule 3)	filtered and unfiltered grab samples
Vault Attenuation Pond	Attenuation pond in operation	1 sample location	Schedule 3 and Schedule 2	monthly during open water season (Schedule 2). Bi-annually during open water season (Schedule 3)	filtered and unfiltered grab samples
SSM					
Seep		As found	Schedule 1	Monthly or as found	Grab sample
Groundwater		all functioning wells	Schedule 3	Annually	(see Note 1)
Receiving (AEMP, Cumberland Resources, 2005)		4 areas (near-field, mine footprint, far-field, Tehek Lake)	Schedule 4	Monthly during open water season all AEMP stations. Monthly throughout year at a smaller number of sampling locations (through ice)	Depth integrated sample using diaphragm pump, surface grab samples
Vault effluent outfall		Effluent outfall	MMER	At open water season weekly	Depth integrated

(AEMP, Cumberland Resources, 2005)		mixing zone perimeter Wally Lake	Parameters (see Note 2)	MMER parameters, monthly acute lethality biological sampling	sample using diaphragm pump, surface grab samples
EM					
		Per event	Per event	Per event	Per event

Notes:

** Refer to Figure 2-2

Schedule 1 parameters: alkalinity, aluminium, ammonia, arsenic, barium, cadmium, chloride, chromium, copper, fluoride, iron, lead, manganese, mercury, molybdenum, nickel, nitrate, pH, selenium, silver, sulphate, thallium, zinc, turbidity and hardness
Schedule 2 parameters include: alkalinity, ammonia, arsenic, copper, lead, nickel, zinc, pH, turbidity and total dissolved solids (TDS).

Schedule 3 parameters: pH, alkalinity, turbidity, hardness, ammonia, chloride, fluoride, sulphate, total dissolved solids, and dissolved aluminium, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, molybdenum, nickel, nitrate, selenium, silver, thallium and zinc. Total and free cyanide for wells in groundwater flow path of TSF

1. Wells will be purged until electrical conductivity and pH readings stabilize for three consecutive readings. Groundwater samples for metals analyses will be filtered through a 45 m filter apparatus.

2. MMER parameters: total cyanide, arsenic, copper, lead, nickel, zinc, suspended solids, pH, effluent volume and flow rate of discharge, acute toxicity, Daphnia Magna and environmental effects monitoring (EEM).
Schedule 4 parameters: **Total and dissolved metals**: aluminium, antimony, arsenic, boron, barium, beryllium, cadmium, copper, chromium, copper, iron, lithium, manganese, mercury, molybdenum, nickel, lead, selenium, tin, strontium, titanium, thallium, uranium, vanadium, zinc; **Nutrients**: ammonia-nitrogen, total kjeldahl nitrogen, nitrate nitrogen, nitrite-nitrogen, ortho-phosphate, total phosphorous, total organic carbon , total dissolved organic carbon, reactive silica; **Conventional parameters**: bicarbonate alkalinity, chloride, carbonate alkalinity, conductivity, hardness, calcium, potassium, magnesium, sodium, sulphate, pH, total alkalinity, total dissolved solids, and total suspended solids.

Table A-4 Closure Phase Monitoring

Facility	Status	Location(s)**	Parameters	Frequency	Method
CM					
Non-contact water diversion ditches	In operation	Two Portage and One Vault locations	turbidity	monthly during open water season	Unfiltered grab sample
IM					
Non-contact water diversion ditches	In operation	Vault area	turbidity	monthly during open water season	Unfiltered grab sample
Goose Island Pit Lake	flooded, dikes not breached	1 sample location	Schedule 3	bi-annually during open water season	filtered grab sample
Portage Pit Lake	flooded, dikes not breached	1 sample location	Schedule 3	bi-annually during open water season	filtered grab sample
Portage Rock Storage Facility	closed, cover completed	1 sample location	Schedule 3	bi-annually during open water season	filtered grab sample
TSF drainage, runoff	closed, cover completed	1 sample location only	Schedule 3	bi-annually during open water season	filtered grab sample
Vault Rock Storage Facility	closed	2 sample locations	Schedule 3	monthly during open water season	filtered grab sample
Vault Pit Lake	flooding then fully flooded, dikes not breached	1 sample location	Schedule 3 and Schedule 2	While flooding: monthly during open water season (Schedule 2). Fully flooded: quarterly (Schedule 3)	filtered and unfiltered grab samples
SSM					
Seeps		As found	Schedule 1	Monthly or as found	Grab sample
Groundwater		all functioning wells	Schedule 3	Annually	(see Note 1)
Receiving water (AEMP, Cumberland Resources, 2005a)		4 areas (near- field, mine footprint, far-field, Tehek Lake)	Schedule 4	Monthly during open water season all AEMP stations. Monthly throughout year at a smaller number of sampling locations (through ice)	Depth integrated sample using diaphragm pump, surface grab samples
EM					
		Per event	Per event	Per event	Per event
Notes:					
** Refer to Figure 2-3					
Schedule 1 parameters: alkalinity, aluminium, ammonia, arsenic, barium, cadmium, chloride, chromium, copper, fluoride, iron, lead, manganese, mercury, molybdenum, nickel, nitrate, pH, selenium, silver, sulphate, thallium, zinc, turbidity and hardness					
Schedule 2 parameters include: alkalinity, ammonia, arsenic, copper, lead, nickel, zinc, pH, turbidity and total dissolved solids (TDS).					
Schedule 3 parameters: pH, alkalinity, turbidity, hardness, ammonia, chloride, fluoride, sulphate, total dissolved solids, and dissolved aluminium, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, molybdenum, nickel, nitrate, selenium, silver, thallium and zinc. Total and free cyanide for wells in groundwater flow path of TSF					
1. Wells will be purged until electrical conductivity and pH readings stabilize for three consecutive readings. Groundwater samples for metals analyses will be filtered through a 45 µm filter apparatus.					

Schedule 4 parameters: **Total and dissolved metals**: aluminium, antimony, arsenic, boron, barium, beryllium, cadmium, copper, chromium, copper, iron, lithium, manganese, mercury, molybdenum, nickel, lead, selenium, tin, strontium, titanium, thallium, uranium, vanadium, zinc; **Nutrients**: ammonia-nitrogen, total kjeldahl nitrogen, nitrate nitrogen, nitrite-nitrogen, ortho-phosphate, total phosphorous, total organic carbon , total dissolved organic carbon, reactive silica; **Conventional parameters**: bicarbonate alkalinity, chloride, carbonate alkalinity, conductivity, hardness, calcium, potassium, magnesium, sodium, sulphate, pH, total alkalinity, total dissolved solids, and total suspended solids.

Table A-5: Post-Closure Phase Monitoring Plan

Facility	Status	Location(s)**	Parameters	Frequency	Method
CM					
Vault Pit Lake	post dike breaching	1 sample location	MMER Parameters (see Note 1)	annually during open water season	unfiltered grab sample
Portage Pit Lake	post dike breaching	1 sample location	MMER Parameters (see Note 1)	annually during open water season	unfiltered grab sample
TSF drainage, runoff	post dike breaching	1 sample location	MMER Parameters (see Note 1)	annually during open water season	unfiltered grab sample
Note:					
** Refer to Figure 2-4					
1. MMER parameters: total cyanide, arsenic, copper, lead, nickel, zinc, suspended solids, pH, effluent volume and flow rate of discharge, acute toxicity, Daphnia magna and environmental effects monitoring (EEM).					

APPENDIX B

CM, IM, and EM Monitored Parameters

Table B-1: Summary of analytes for the monitoring program (1)

Parameter	Min Vol		Preservation	Holding Time	Analytical Method	Detection Limit
Inorganics						
pH	25	P	none	Immediately (on site measurement)	4500-H (1)	0.01 su
NO3_N (2)	100	P	Unfiltered, cool 4°C	48 hrs	4110	0.05 mg/L
NH3_N (2)	500	P	cool 4 deg C, H2SO4 – pH below 2	28 days	4500-NH3	0.1 mg/L
Alkalinity	100	P,G	Unfiltered, cool 4°C	14 days	2320 (1)	0.5 mg/L
SO4	50	P,G	Unfiltered, cool 4°C	28 days	4110	0.5 mg/L
F	300	P,G	none	28 days	4110	0.05 mg/L
Cl	50	P,G	none	28 days	4110	0.2 mg/L
Hardness	250	P	HNO3 – pH below 2	6 months	*	1.0 mg/L
TDS	200	P	Unfiltered, cool 4°C	7 days	2540 C	10 mg/L
TSS	1000	P	Unfiltered, cool 4°C	7 days	2540 D	1 mg/L
Turbidity	100	P	Unfiltered, cool 4°C	48 hours	2130B	0.1 ntu
Cyanide (total) (2)	500	P	Unfiltered, cool 4°C in dark, NaOH over 12	14 days	4500-CN	0.01 mg/L
Cyanide (Free)	500	P	Unfiltered, cool 4°C, NaOH over 12	14 days	D7237-06	0.002 µg/L
Ag (2)	250	P	Filtered on site, HNO3 – pH below 2	6 months	ICP/OES or ICP/MS	0.05 µg/L
Al (2)	250	P	Filtered on site, HNO3 – pH below 2	6 months	ICP/OES or ICP/MS	1.00 µg/L
As (2)	250	P	Filtered on site, HNO3 – pH below 2	6 months	ICP/OES or ICP/MS	0.20 µg/L
Ba (2)	250	P	Filtered on site, HNO3 – pH below 2	6 months	ICP/OES or ICP/MS	0.20 µg/L
Cd (2)	250	P	Filtered on site, HNO3 – pH below 2	6 months	ICP/OES or ICP/MS	0.04 µg/L
Cr (2)	250	P	Filtered on site, HNO3 – pH below 2	6 months	ICP/OES or ICP/MS	0.20 µg/L
Cu (2)	250	P	Filtered on site, HNO3 – pH below 2	6 months	ICP/OES or ICP/MS	0.20 µg/L
Fe (2)	250	P	Filtered on site, HNO3 – pH below 2	6 months	ICP/OES or ICP/MS	0.01 mg/L
Hg (2)	250	G	Filtered on site, HNO3 – pH below 2	28 days	CVAA	0.02 µg/L
Mn (2)	250	P	Filtered on site, HNO3 – pH below 2	6 months	ICP/OES or ICP/MS	0.20 µg/L
Mo (2)	250	P	Filtered on site, HNO3 – pH below 2	6 months	ICP/OES or ICP/MS	0.10 µg/L
Ni (2)	250	P	Filtered on site, HNO3 – pH below 2	6 months	ICP/OES or ICP/MS	0.20 µg/L
Pb (2)	250	P	Filtered on site, HNO3 – pH below 2	6 months	ICP/OES or ICP/MS	0.20 µg/L
Se (2)	250	P	Filtered on site, HNO3 – pH below 2	6 months	ICP/OES or ICP/MS	0.20 µg/L
Tl (2)	250	P	Filtered on site, HNO3 – pH below 2	6 months	ICP/OES or ICP/MS	0.02 µg/L
U (2)	250	P	Filtered on site, HNO3 – pH below 2	6 months	ICP/OES or ICP/MS	0.10 µg/L

Parameter	Min Vol		Preservation	Holding Time	Analytical Method	Detection Limit
Zn [2]	250	P	Filtered on site, HNO3 – pH below 2	6 months	ICP/OES or ICP/MS	0.001 mg/L
Organics						
Oil and grease [2]	1000	Amber glass	Unfiltered, H2SO4 – pH below 2	28 days	5520 b and f	
VOC	2 x 40	**	HCl, cool 4°C	7 days		

- Notes:
- [1] USEPA Methods for Chemical Analysis of Water and Waste Water, EPA-600/4-79-020.
- P,G: P = plastic, G = glass
- ICP/OES = Inductively Coupled Plasma, Optical Emission Spectroscopy
- ICP/MS = Inductively Coupled Plasma/Mass Spectrometry
- CVAA = Cold Vapour Atomic Adsorption Spectroscopy
- British Columbia Environmental Laboratory Manual for the Analysis of Water, Wastewater, Sediment and Biological Materials (2005)
- ** Purge and Trap Vials
- [2] Quality Assurance (QA) and Quality Control (QC) Guidelines for use by class “A” Licensees in Meeting SNP Requirements and Submission of a QA/QC Plan, Department of Indian and Northern Affairs Canada, Water Resources Division and the Northwest Territories Water Board

APPENDIX C

Trigger Levels for the Adaptive Management Plan

Table C-1: Modeled MMER Parameter Concentrations from the 2005 Model Predictions (Cumberland, 2005e)

Monitoring Site	Site	Modelled Years	As	pH	Cu	CN	Ni	Pb	Zn
Units			**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
MMER Guidelines			**0.5**	**6.0-9.5**	**0.3**	**1**	**0.5**	**0.2**	**0.5**
Early operations									
Portage Attenuation Pond	IM	1-5	0.022	6.0	0.0038	-	0.0246	0.0021	0.0337
Portage RSF	IM	1-5	0.308	5.3	0.0202	-	0.1236	0.0082	0.1086
North Portage Pit Sump	IM	3-4	0.049	6.1	0.0057	-	0.0342	0.0023	0.0296
Third Portage Pit Sump	IM	1-4	0.045	6.1	0.0103	-	0.0583	0.0052	0.0548
Goose Island Pit Sump	IM	2-3	0.002	6.1	0.0010	-	0.0020	0.0011	0.0052
Tailings Reclaim Pond	IM	1-4	0.035	8.0	0.5439	22.43	0.0594	0.0029	0.0592
Late operations									
Vault Attenuation Pond	IM	4-8	0.011	6.6	0.0014	-	0.0008	0.0001	0.0022
Goose Island Pit Lake	IM	5-8	0.010	6.7	0.0014	-	0.0053	0.0008	0.0074
Portage Pit Lake	IM	5-8	0.010	6.7	0.0031	-	0.0153	0.0012	0.0246
Vault RSF	IM	5-8	0.080	8.0	0.0012	-	0.0002	0.000017	0.0008
Vault Pit Sump	IM	5-7	0.088	8.0	0.0013	-	0.0002	0.000019	0.0009
Tailings Reclaim Pond	IM	5-8	0.060	8.0	0.1561	1.01	0.1169	0.0028	0.0761
Portage RSF	IM	6-8	1.248	5.3	0.0710	-	0.4337	0.0289	0.3832
Closure									
Vault RSF	IM	9-13	0.221	8.0	0.0032	-	0.0005	0.000476	0.0022
Vault Pit Lake (flooding)	IM	8-13	0.018	6.8	0.0007	-	0.0005	0.0002	0.0023
Goose Island Pit Lake(flooding)	IM	9-13	0.009	6.7	0.0013	-	0.0049	0.0007	0.0070
Portage Pit Lake(flooding)	IM	9-13	0.013	6.7	0.0036	-	0.0177	0.0013	0.0337
Portage RSF	IM	9-13	1.248	5.3	0.0710	-	0.4337	0.0289	0.3832
IM- Internal Monitoring									

APPENDIX D

Acceptable Waste for Landfilling

Unacceptable waste for Landfilling

ACCEPTABLE WASTE FOR LANDFILLING

The following materials are acceptable for disposal at the proposed landfills:

- Plastic (except expanded polystyrene);
- Steel, copper, aluminium, iron;
- White goods;
- Wire in lengths of 30 m or less;
- Incidental pieces of wood (wood that cannot be separated and burned);
- Fibreglass Insulation;
- Fibreglass;
- Roofing;
- Asphalt;
- Concrete;
- Carpet;
- Bricks;
- Ceramics;
- Rubber including shredded tires (excluding whole tires) provided it is not concentrated in the overall waste;
- Empty caulking tubes;
- Hardened caulk;
- Clothing;
- Glass including light bulbs;
- Asbestos;
- Small appliances (with batteries removed);
- Gyproc (to be segregated in a designated area);
- Ash provided it has cooled to 60ºC or less; and
- Vehicles and machinery provided all liquids, grease, batteries, and electronics have been removed.

UNACCEPTABLE WASTE FOR LANDFILLING

Materials that are not listed above are unacceptable for placement at the proposed landfills, unless approved in writing by a solid waste engineer. These materials include:

- Organic matter including food, wood, septic tank pumpings or sludge from waste water treatment, dead animals, paper, cardboard;
- Food containers and wrappings, unless cleaned;
- Wood, unless it is not practical to separate from other larger materials;
- Whole tires;
- Hazardous waste including mercury, medical waste, batteries, solvents, glues, ethylene glycol antifreeze, adhesives (except empty caulking tubes);
- Electronics;
- Petroleum products, including materials contaminated with petroleum products; and
- Expanded polystyrene.

APPENDIX E

EM Monitored Parameters

Table E-1: Summary of Hazardous Materials at the Meadowbanks Project Site during Operations (Cumberland, 2007f)

Hazardous material		
Fuel products	Explosives	Process plant & water treatment reagents
Diesel	Ammonium nitrate	Acetylene
Motor oil	High explosive detonators	Activated carbon
Aviation fuel	Blasting caps	Anti-scalant
Hydraulic fluid		Borax
Varosol		Calcium hydroxide
Automotive grease		Calcium oxide
Ethylene glycol		Calcium peroxide
		Carbon dioxide
		Cement
		Copper sulphate
		Ferric iron product
		Flocculant
		Hydrochloric acid
		Hydrofluoric acid
		Hydrogen peroxide
		Lead acid batteries
		Nitric acid
		Paints
		Silica
		Sodium cyanide
		Sodium hydroxide
		Sodium metabisulphite
		Sodium nitrate
		Sulphur
		Sulphuric acid

- L and S = liquid and solid, respectively

TABLE E-2: Analytes of concern and reference concentrations for Internal and External EM sites

Parameter	Analyte of concern	Internal EM	External EM
Fuel products			
Diesel	Oil and grease	Historic background	CCME or historic background
Motor oil	Oil and grease	Historic background	CCME or historic background
Aviation fuel	Oil and grease	Historic background	CCME or historic background
Hydraulic fluid	Oil and grease	Historic background	CCME or historic background
Varosol	Volatile organic compounds (VOC)	Historic background	CCME or historic background
Automotive grease	Oil and grease	Historic background	CCME or historic background
Ethylene glycol	Not regulated	Historic background	CCME or historic background
Process plant reagents			
Acetylene	Volatile organic compounds (VOC)	Historic background	CCME or historic background
Activated carbon		Historic background	CCME or historic background
Anti-scalant	Not regulated	Historic background	CCME or historic background
Borax	Not regulated	Historic background	CCME or historic background
Calcium hydroxide	Not regulated	Historic background	CCME or historic background
Calcium oxide	Not regulated	Historic background	CCME or historic background
Calcium peroxide	Calcium	Historic background	CCME or historic background
Carbon dioxide	pH	Historic background	CCME or historic background
Cement	Not regulated	Historic background	CCME or historic background
Copper sulphate	Copper, sulphate	Historic background	CCME or historic background
Ferric iron product	Not regulated, iron, chloride	Historic background	CCME or historic background
Flocculant	Not regulated	Historic background	CCME or historic background
Hydrochloric acid	pH, chloride	Historic background	CCME or historic background
Hydrofluoric acid	pH, fluoride	Historic background	CCME or historic background

Hydrogen peroxide	Redox	Historic background	CCME or historic background
Lead acid batteries	Lead	Historic background	CCME or historic background
Nitric acid	pH, nitrate	Historic background	CCME or historic background
Paints	Not regulated	Historic background	CCME or historic background
Silica	Silica	Historic background	CCME or historic background
Sodium cyanide	Sodium, cyanide, nitrate	Historic background	CCME or historic background
Sodium hydroxide	pH, sodium	Historic background	CCME or historic background
Sodium metabisulphite	Not regulated	Historic background	CCME or historic background
Sodium nitrate	Sodium, nitrate	Historic background	CCME or historic background
Sulphur	Sulphur, sulphate	Historic background	CCME or historic background
Sulphuric acid	pH, sulphate	Historic background	CCME or historic background
Explosives			
Ammonium nitrate (NH_4NO_3)	Ammonia, nitrate	Historic background	CCME or historic background
High explosive Detonators (RDX – $C_3H_6N_6O_6$)	Ammonia, nitrate	Historic background	CCME or historic background
Blasting caps	Ammonia, nitrate	Historic background	CCME or historic background