Nanisivik Mine
Contaminated Soil Remediation
2014 Progress Report

Prepared for

CanZinco Mines Ltd

Prepared by

SRK Consulting (Canada) Inc.
1CB002.002
March 2015

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Executive Summary

This report provides a summary of contaminated soil remediation completed at the Nanisivik former bulk fuel storage facility in 2014.

Key remediation activities undertaken at the Site in 2014 included:

- Excavation of petroleum hydrocarbon (PHC) contaminated soil;
- Remediation confirmation soil sampling of the base and walls of the excavated areas;
- Relocation of a stockpile of contaminated soil within the footprint of the former facility to the concrete pad or constructed treatment cells;
- Biopile performance monitoring and management; and
- Off-loading of remediated soil from the treatment cells and pad.

Excavation of the contaminated soil continued in 2014. The PHC contaminated soil was placed directly onto the concrete pad (former concentrate storage shed pad) or into treatment cells. It was not processed through the vibrating screening plant as the plant had been removed from the Site in 2013.

Based on the confirmatory soil sampling program, two areas have been identified where additional excavation of contaminated soil is required. Approximately 50 m^3 of PHC contaminated soil remains to be excavated in 2015. There is also a 20 m length of berm remaining from the former facility adjacent to an excavation that requires the collection of remediation confirmatory soil samples in 2015.

New biopiles were created in the established treatment areas with soil excavated in 2014 or with the soil that had passed through the screener in 2012 and 2013 and stockpiled within the footprint of the former facility.

Mechanical screening, nutrient amendment, moisture content management and soil aeration has successfully reduced PHC concentrations. The average and maximum concentrations of PHC Fraction 2 (F2) in the Site soils are lower than documented in previous progress monitoring reports. Current concentrations of F2 in the Site soils are less than 1,290 mg/kg F2, which is sufficiently low to preclude risks to humans or living organisms other than plants and soil invertebrates. Studies were undertaken in 2014 to assess at what concentration of F2 the growth and success of plants and soil invertebrates were inhibited in the Site soils. A site specific remediation objective for F2 has been recommended as a result of the studies.

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ᓴᓗᒻᒪᓴᐃᓂᖅ, ᐆᒪᔾᔪᑕᐅᔪᓐᓇᕐᑐᓂᒃ ᐃᓕᐅᕐᑲᐃᓂᖅ, ᒪᓴᐅᓕᕐᑎᑦᑎᓂᖅ ᐊᒻᒪᓗ ᒪᓂᕋᕐᒥᖕᖑᕐᑐᖅ ᓯᐊᒪᐃᓂᖅ ᐅᕐᓱᐊᓗᕐᑲᐳᓐᓂᕐᑎᑦᑎᓇᓱᒃᓗᓂ. ᐅᕐᓱᐊᓗᕐᑲᕐᓂᖕᒋᑦ ᖃᐅᔨᓴᐅᑎᒃᑯᑦ ᐊᑐᕐᑕᐅᓪᓗᑎᒃ ᐱᑕᕐᑲᕐᑎᒋᔭᕆᐊᕐᑲᕐᓂᖓ ᓈᓴᐅᑎᒃᑯᑦ Fraction 2 (F2) ᒪᓂᕋᕐᒥᖕᖑᕐᑐᑦ ᑐᖓᓂᑦᑐᑦ ᑎᑎᕋᕐᑕᐅᓯᒪᔪᑦ ᖃᐅᔨᓴᐅᑉᐸᑕᐅᓂᑯᔪᓂᑦ ᐅᓂᑲᓕᐊᓂᑦ. ᓖᓐᓇᐅᔪᖅ ᐱᑕᕐᑲᕐᓂᖓ ᐅᕐᓱᐊᓗᐳᔪᓂᖓ ᑐᖓᓂᑦᑐᖅ 1,290 mg/kg F2, ᑐᖓᓂᓐᓂᖓᓄᑦ ᐅᓗᕆᐊᓇᕐᑦᑐᖅ ᐃᓄᒃᓄᑦ ᐅᓚᒍᓄᓪᓗᓐᓂᑦ ᐊᓯᖕᒋᓐᓄᑦ ᐱᕈᕐᑐᐃᑦ ᒪᓂᕋᕐᒥᐅᑕᐃᓪᓗ. ᖃᐅᔨᓴᕐᑕᐅᓯᒪᔪᑦ 2014 ᕐᑲᓄᑎᒋ ᐅᕐᓱᐊᓗᕐᑲᕐᑎᒋᖕᒪᖕᖓᑕ ᐱᕈᕐᑐᐃᑦ ᒪᓂᕋᕐᒥᐅᑕᐃᓪᓗ ᐱᑕᕐᑲᕐᓂᕋᐃᓯᒪᓚᐅᕐᑐᑦ. ᓇᒥ ᑐᕋᖓᕐᑲᕐᓗᓂ ᓴᓕᒻᒪᕐᓴᕐᑕᐅᔪᓐᓇᕐᑲᕐᓂᖓ ᐊᑐᕐᑯᔭᐅᔪᖅ ᖃᐅᔨᓴᕐᑕᐅᓯᒪᔪᑦ ᒪᓕᓗᒃᑭᑦ.

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List of Abbreviations

BETX	benzene, ethylbenzene, toluene, xylene
CCME	Canadian Council of Ministers of the Environment
DAP	Diammonium Phosphate
F1	Hydrocarbon Fraction encompasses the range of equivalent carbon number from C6 to C10
F2	Hydrocarbon Fraction encompasses the range of equivalent carbon number from C11 to C16
F3	Hydrocarbon Fraction encompasses the range of equivalent carbon number from C17 to C34
F4	Hydrocarbon Fraction encompasses the range of equivalent carbon number from C35 to C50+
LTA	lower treatment area
NWB	Nunavut Water Board
PAH	Polycyclic aromatic hydrocarbons
PHC	petroleum hydrocarbons
PQL	practical quantitation limit
QA/QC	quality assurance/ quality control
RPD	relative percent difference
SQRO	soil quality remediation objective
SSRO	site specific remediation objective
TKN	Total Kjeldahl Nitrogen
TP	Total Phosphorus
UTA	upper treatment area

1 Introduction

The Nanisivik Mine produced lead and zinc mineral concentrates from 1976 to 2002. The mine infrastructure included a large tank farm providing year-round storage of diesel, gasoline and other fuels. Following mine closure, the facility was operated by a third party to supply fuel for commercial shipping and the Canadian Coast Guard. In February 2009 the Department of National Defence (DND) requested that the bulk fuel storage facility be decommissioned to allow for the construction of a naval facility. Decommissioning of the facility required remediation of petroleum hydrocarbon (PHC) contaminated soil known to be present within the facility's footprint.

Remediation is carried out using landfarming methodologies in which nutrients are added to the soil to stimulate biological activity. The remediation work commenced in 2011 under a Nunavut Water Board (NWB) approved decommissioning and reclamation plan, the *Abandonment and Reclamation Plan, Fuel Tank Farm, Former Nanisivik Mine Site, Nunavut* (Jacques Whitford Stantec Limited 2010). The abandonment and reclamation plan was updated during the 2014 Water Licence Renewal/Amendment process. The *Abandonment and Reclamation Plan for Treatment of Contaminated Soil at the Former Nanisivik Mine* (SRK Consulting 2014a) was approved by the NWB on January 29, 2015.

This report provides a summary of soil remediation activities completed at the former Nanisivik bulk fuel storage facility (the Site) in 2014. The report has been prepared to fulfill reporting requirements specified in Schedule B, Part J, Item 13 of Water Licence No. 1AR-NAN1419.

2 Summary of Previous Remediation Activities

This section provides a brief introduction to soil remediation activities completed at the Site from 2011 to 2013. Principal reclamation and remediation work undertaken at the Site included:

- Decommissioning and removal of the petroleum storage tanks and associated infrastructure;
- Delineation of PHC contaminated soil;
- Construction of soil treatment facilities; and
- Excavation and treatment of PHC contaminated soil.

2011: Decommissioning of the tanks was undertaken in 2011. Prior to demolition, the tanks were placed in a gas free state, and waste liquids and sludge were collected and placed in drums. All scrap materials and PHC contaminated waste from the tank removal were shipped off-site for disposal in 2011. Further details are provided in the 2011 Annual Report (Nyrstar 2012).

Delineation of the PHC contaminated soil was conducted in 2011 to refine the estimated quantity of contaminated soil requiring treatment. Four areas of contamination were identified (Figure 1). Contamination extended to 2.45 m below ground level. As reported in the 2011 Annual Report, the quantities of soil requiring treatment were determined to be approximately 17,000 m^3 (Nyrstar 2012). This exceeded the 8,000 m^3 reported in the Abandonment and Reclamation Plan (Jacques Whitford Stantec Limited 2010).

Treatment facilities for PHC contaminated soil were constructed in 2011 and 2012. The constructed facilities are located in two areas referred to as the lower treatment area (LTA) and upper treatment area (UTA) (Figure 2). The treatment facilities comprise a series of sixteen cells in which 'biopiles' of PHC contaminated soil are managed. Further details on the treatment facility design and construction are provided in the *Construction Summary Report, Nanisivik Mine Site* (WESA Inc. 2012).

In 2011, PHC contaminated soil was excavated to remove liners under the tanks. The soil was placed in the treatment facilities or stockpiled above known areas of contamination. Eight cells were constructed in 2011. To provide supplementary treatment capacity, a temporary treatment facility was established within the footprint of the former fuel storage facility (the 'in-situ treatment area'). The contaminated soil in the treatment facilities were aerated mechanically every four days until winter closure. Further details are provided in the 2011 Annual Report (Nyrstar 2012).

2012: Stockpiled PHC contaminated soil was relocated as additional treatment cells were constructed in 2012. Routine aeration of the soil continued. Nutrients were applied to the soil in the treatment facilities to encourage bioremediation of hydrocarbons. A vibrating screen to separate cobbles and boulders (oversized rocks) from the finer (<10 cm) contaminated soil, and to improve aeration measures, was mobilized to the Site in August. Soil previously excavated and stockpiled within the footprint of the former fuel storage facility was screened. Further information on the 2012 remediation activities is provided in the *Nanisivik Mine Contaminated Soil Remediation 2012 Progress Report* (SRK Consulting (Canada) Inc. and WESA, a division of BlueMetric Environmental Inc. 2013 [SRK and WESA 2013]) submitted with the 2012 Annual Report (Nyrstar 2013).

2013: The excavation and treatment of PHC contaminated soil continued in 2013. All PHC contaminated soil excavated was processed through the vibrating screening plant. A portion of the concrete pad (former concentrate storage shed pad) was modified for use as a storage area for oversized rocks and low-level contaminated soil. Zinc concentrate contaminated soil was recovered during the modification of the pad. Biopiles were relocated from the treatment cells to the concrete pad. Stockpiled PHC contaminated soil was relocated to treatment cells. Routine soil aeration and nutrient application continued. Further information on the 2013 remediation activities is provided in the *Nanisivik Mine Contaminated Soil Remediation 2013 Progress Report* (SRK 2014b) submitted with the 2013 Annual Report (Nyrstar 2014).

3 Soil Quality Remediation Objectives

Soil quality remediation objectives for the treatment of contaminated soil at the Site in 2014 are specified in the Abandonment and Reclamation Plan (Jacques Whitford Stantec Limited 2010) and listed in Table 3-1. The objectives were derived from generic commercial land use guidelines established in the Canadian Council of Ministers of the Environment (CCME) in *Canadian Environmental Quality Guidelines* (CCME 1999) and *Canada-Wide Standards for Petroleum Hydrocarbons in Soil* (CCME 2008).

Table 3-1: SQROs for the Nanisivik former bulk fuel storage facility.

Parameter	Surface Soil (mg/kg)	Subsurface Soil (mg/kg)
Benzene	110	360
Toluene	250	500
Ethylbenzene	300	600
Total Xylenes	350	700
PHC Fraction 1 (F1)	320	700
PHC Fraction 2 (F2)	260	1,000
PHC Fraction 3 (F3)	1,700	3,500
PHC Fraction 4 (F4)	3,300	10,000
PAH Anthracene	32	32
PAH Benzo[a]pyrene	72	72
PAH Pyrene	100	100

Source: Jacques Whitford Stantec Limited 2010

Subsequent to the 2014 field season, a site specific remedial objective (SSRO) for PHC Fraction 2 (F2) of 410 mg/kg was developed based on an assessment of the ecotoxicity of soil at the Site (Hemmera 2015). The site specific objective for F2 is undergoing review by the NWB. An update to appendix B, *Soil Quality Remediation Objectives* of the *Abandonment and Reclamation Plan for Treatment of Contaminated Soil at the Former Nanisivik Mine* (SRK 2014a) that reflects a change in the remedial objective would be required.

The soil sampling plan to confirm the success of contaminated soil excavation was described in the NWB approved *Nanisivik Mine 2004 Reclamation and Closure Plan* (CanZinco Ltd. 2004), and its appendix F, *Nanisivik Mine Reclamation and Closure Monitoring Plan* (Gartner Lee Limited 2004). The plan calls for the capture of at least 95% of soil containing contaminants in excess of the SQRO's in each remediation area and that no residual contaminant concentrations in soils exceed twice the SQRO's. Excavation remediation confirmation soil samples are collected in a consistent 25 m grid-based.

The soil sampling plan to confirm biopile remediation was described in the 2012 Progress Report (SRK and WESA 2013). Biopile remediation confirmation soil samples are collected based on the volume of soil treated (per 250 m^3). Stockpile remediation confirmation soil sampling plan is consistent with the biopile sampling plan. The volume of soil in a stockpile typically ranged from 50 m^3 to 150 m^3.

All remediation confirmation soil samples are analyzed at a laboratory accredited by the Canadian Association for Environmental Analytical Laboratories.

The soil sampling plan applied in 2014 was provided in the NWB approved *Abandonment and Reclamation Plan for Treatment of Contaminated Soil at the Former Nanisivik Mine* (SRKa 2014) and its appendix A, *Remediation Confirmatory Soil Sampling Methodology* (SRKc 2014). The sampling methodology has been reviewed and accepted by the NWB.

4 2014 Remediation Activities

4.1 Introduction

The work plan for 2014 was overseen by SRK on behalf of CanZinco. SRK was at Site from June 27 to July 25 and August 10 to 29. Key remediation activities undertaken at the Site in 2014 included:

- Excavating PHC contaminated soil;
- Remediation confirmation soil sampling of the base and walls of the excavated areas;
- Modifying a portion of the concrete pad (former concentrate storage shed pad) and using this for storage of low-level contaminated soil;
- Managing the treatment facility;
- Monitoring biopile performance; and
- Off-loading of remediated soil from the treatment cells and pad.

Vegetation transplant trials were also initiated in 2014.

4.2 Excavation and Soil Handling

4.2.1 Overview of Contaminated Areas

Preliminary boundaries of the areas to be remediated were identified by a series of test pits excavated within the footprint of the bulk fuel storage facility in 2011. Results of the field screening measurements and analytical analysis indicated four areas of contamination (Figure 1). These four areas have been the focus of remedial efforts from 2012 to 2014.

Area 1. PHC F2 contaminated soil remained in the berm between the former pipe to the dock and the former truck loading terminal (SRK 2009). Results from test pits excavated in 2011 determined that the PHC F2 contamination extended across the area formerly occupied by the Tank 101 pad.

Area 2. The soil in the light fuels pad area was found to have isolated pockets of PHC F1 and F2 that exceeded the SQROs.

Area 3. The soil at the junction of the overlapping liners between the Tank 101 pad, the light fuels pad and the Tank 102 pad exceeded PHC F1 and F2 SQROs. Contamination in this area extended about 1 m further below ground level than observed in the other contaminated areas.

Area 4. PHC F2 contaminated soil was found in the southern corner of the secondary containment area.

4.2.2 Field Screening

Field screening of soil samples for the presence of PHC contamination was completed in accordance with CanZinco protocols. These protocols were developed in alignment with the *Nanisivik Mine Reclamation and Closure Monitoring Plan* (Gartner Lee Limited 2004).

Soil from potentially PHC contaminated areas was tested on site using a bag-headspace method with a portable gas detector and/or a photo-ionization detector, and olfactory indications, as described in the *Remediation Confirmatory Soil Sampling Methodology* (SRKc 2014). The results were then used to guide further excavation and monitor remediation performance.

The field screening readings provide an indication of the PHC concentrations. The method is however susceptible to errors when the sample preparation environment cannot be controlled (i.e. when samples are not warmed at a constant temperature over a consistent length of time and when there is interference from PHC vapours emitted from equipment operating nearby). Confirmation that the SQROs are met requires laboratory analyses of samples.

4.2.3 Excavation

In 2014, the excavation of PHC contaminated soil commenced July 5 and continued until August 27. Residual contamination was excavated from all four areas originally identified in 2011. Excavation of contaminated soil proceeded until field screening tests indicated that the remediation objectives had been met. The limits of excavation are shown on figures 2 and 4. The following summarize the excavation areas and provides reference to site photos.

Area 1. Excavations focused primarily on the east and south wall of the area. Floor excavations removed residual PHC contaminated soil (<20 m^3) from the base of the excavation. (Appendix A: Photos 1 and 2).

Area 2. A 5,000 m^3 stockpile of screened fine contaminated soil had to be removed from the in situ treatment area on Area 2 before excavation could commence. The excavation commenced August 21, once the base of the stockpile was reached. Liner remains below a portion of the base of the excavation. (Appendix A: Photos 1, 3, 4 and 5).

Area 3. Excavations focused on residual contamination in the west wall of the area. The advance of the southwest wall of the excavation in Area 3 was restricted by the proximity of the stockpile of soil on Area 2. As the stockpile was relocated access to the southwest wall excavation area was achieved. (Appendix A: Photos 1 and 3).

Area 4. Remnants of contaminated soil (<10 m^3) were removed in July 2014. Waste concrete that had previously been stored on the east side of the former facility was relocated to the excavation. Voids were filled with remediated soil and the waste was consolidated in place by tamping with the excavator bucket (Appendix A: Photo 6). Remediated soil stockpiled within the former secondary containment area in 2014 was pushed into the excavation and the area leveled off prior to demobilization.

4.2.4 Stockpile Management

In 2014, soil was stockpiled in various locations (Figure 2) based on PHC concentrations as follows:

Former secondary containment area: Stockpiles of screened fine soil that has been remediated to meet the SQROs has been placed in the former secondary containment area since 2012. (Appendix A: Photo 7).

North laydown yard: Screened coarse rock and unscreened soil that meets the SQROs is stockpiled in the north laydown yard. (Appendix A: Photo 8).

Concrete pad: The concrete pad is used to store soil based on the terms of an agreement made with the surface lease holder, the Department of Fisheries and Oceans. The stockpiles of soil on the concrete pad originated from the screened fine soil previously stockpiled in Area 2; biopiles; and the excavation areas, see Figure 3. (Appendix A: Photos 9 and 10).

In situ treatment area: The stockpiles of screened fine PHC contaminated soil were relocated to either the treatment cells or the concrete pad. (Appendix A: Photos 3, 4 and 5).

4.3 Biopile Management

The UTA and LTA treatment facilities are a series of geosynthetic lined cells containing biopiles composed of PHC contaminated soil. (Appendix A: Photos 11 and 12).The biopiles are constructed to a height of 1.5 m and each cell stores approximately 220 m^3 of contaminated soil.

The biopiles of PHC contaminated soil are treated through two principal mechanisms: volatilization and bioremediation. Volatilization occurs when the soil is aerated. In the bioremediation process, microorganisms are responsible for the degradation of the PHC in the soil. To enhance the microbial performance nutrients are added and moisture content managed.

4.3.1 Aeration

Gas transfer in the contaminated soil is important for two reasons: (i) the bioremediation process requires oxygen to occur, and (ii) gas transfer promotes volatilization of the PHC from the soil. To achieve the gas transfer, the contaminated soil in the UTA and LTA was turned and aerated as listed in Table 4-1.

The biopiles were typically aerated to a depth of 1.0 m using an excavator. Each full bucket was lifted to the vertical extent of the bucket arm and then allowed to fall from elevation to achieve an air exchange (Appendix A: Photo 13). The bottom 0.3 to 0.5 m of the biopiles was not aerated or removed during off-loading in order to reduce the risk of damaging the liner.

Table 4-1: 2014 aeration schedule.

June						
S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	**28**
29	**30**					

July						
S	M	T	W	T	F	S
		1	**2**	**3**	**4**	**5**
6	**7**	**8**	9	10	**11**	12
13	14	15	16	17	**18**	**19**
20	21	**22**	**23**	**24**	**25**	26
27	**28**	**29**	30	31		

August						
S	M	T	W	T	F	S
					1	**2**
3	4	**5**	**6**	7	8	**9**
10	**11**	12	13	14	**15**	**16**
17	**18**	19	20	21	22	**23**
24	25	**26**	**27**	28	29	30
31						

Days when biopiles were aerated

Days when biopiles in the cells were off-loaded and reloaded

4.3.2 Management of Moisture Content

Water is required for microbial respiration and therefore PHC remediation. Hydrocarbon-degrading microbes (hydrocarbonoclastes) need to come into contact with solubilised nutrients in order for PHC bioremediation to occur; this contact is largely governed by the soil moisture content. The moisture content of the soil in the biopiles was measured in the field with a handheld soil moisture meter and additional water was added to the biopiles to maintain an average above 5%, as recommended by WESA.

4.3.3 Nutrient Amendment

The nutrients needed for accelerating bioremediation are added to the soil based on the level of total PHC concentration for the microbial cells to replicate and survive. As advised by WESA, in cold region soils, nitrogen and phosphorus are the nutrients that typically limit microbial degradation. Nitrogen and phosphorus were added during biopile construction in the form of granular agricultural fertilizers Urea and diammonium phosphate (DAP). For every 400 m^3 of soil 50 kg of Urea (two bags) and 6.25 kg of DAP (¼ bag) were applied based on an assumed total PHC concentration of about 600 ppm. (Appendix A: Photo 14).

4.4 Chemical Analysis

Samples were collected and sent to Exova Canada Inc. in Ottawa. The sampling and analysis focused on:

Impact Monitoring: Samples are collected to determine if the remediation activities are impacting adjacent soil and water quality. Bi-weekly water quality samples are collected at Station 159-6, located 75 m down-gradient of the coarse rock stockpile on Twin Lakes Creek (Figure 2). Documentation of water quality testing results is provided under separate cover in the *2014 Annual Water Quality Monitoring Report – Nanisivik Mine, Nunavut* (Stantec 2015). Water samples were also collected from water that had ponded in Area 4 and within the lined sump on the pad. Soil samples were collected to monitor for the tracking of PHC contamination onto the adjacent covered portion of the pad.

Remediation Performance Monitoring: Performance monitoring included the characterization of biopiles and stockpiles throughout the 2014 season.

Remediation Confirmation Sampling: Soil samples were collected along the base and walls of the excavated areas and from biopiles in accordance with the *Remediation Confirmatory Soil Sampling Methodology* (SRKc 2014) to ensure that the contaminated soil is properly remediated.

Quality Assurance/Quality Control Sampling: QA/QC measures associated with the collection and analysis of the soil samples are described in the *Remediation Confirmatory Soil Sampling Methodology* (SRKc 2014) and included the laboratory analysis of blind duplicates and discrete QA/QC samples as follows:

- 20 QA/QC sample sets were collected from biopiles in the constructed treatment cells,
- 12 QA/AC sample sets were collected from the stockpiles on the pad, and
- 40 QA/QC samples sets from the excavation

4.5 Transplant Trials

Studies were undertaken in 2014 to demonstrate that low levels of PHC F2 contamination in the soils at the Site do not pose risks to human health or the environment. Soil samples were collected and shipped to Stantec for a laboratory-based ecotoxicity assessment of soils with a range of PHC F2 concentrations under the direction of Gladys Stephenson, PhD. Further details on the methods and procedures used and the results of the soil toxicity tests are reported in *Ecotoxicity Assessment of Nanisivik Stockpiled Glacial Tills Contaminated Predominately with F2* (Stantec 2014).

The results of the laboratory ecotoxicity trials have been interpreted by Doug Bright, PhD in *Soil Toxicity Testing and Derivation of Site Specific Soil Remediation Objectives (SSROs) for the Nanisivik docksite* (Hemmera 2015).

Transplant field trials were set up on site in July 2014 as a supplement to the laboratory-based ecotoxicity tests. Three vegetation plots, named VPL, VPM, VPH, were constructed using soil from the same biopiles that were sampled for the laboratory-based trials (Appendix A, Photo 15). Plot VPL was established with soil from the biopile used by Stantec as a reference control, UTA-10-2. Plot VPM was established with soil from biopile LTA-1-2 and plot VPH with soil from biopile UTA-3-2. Plot VPH was capped with soil from Area 3 as it exhibited the highest in situ field screening concentrations at the time the plots were constructed. The following native vegetation was transplanted into each of the plots: two arctic willow, two arctic cotton, three other sedge/grasses and two or more arctic fireweed. (Appendix A, Photos 16 to 21).

5 Results

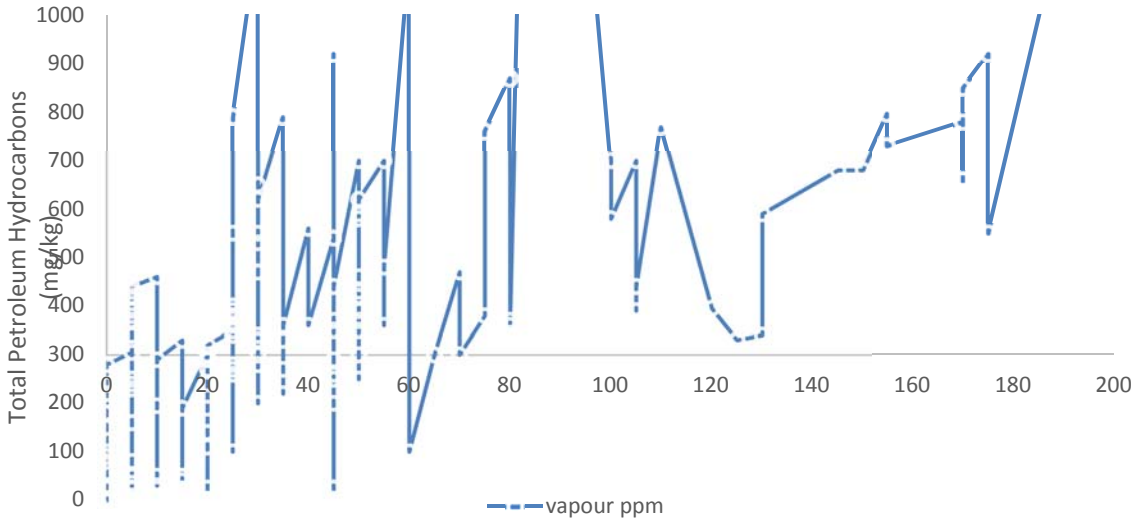
The sample locations are shown on figures 2, 3, 4 and 5 and the results are compared to the SQROs on tables 1 to 5 (back of report). The samples identified with the ending “F-C” represent composite floor samples and the samples identified with the ending “W-C” represent composite

wall samples. Samples ending in “D” instead of “C” represent discrete grab samples. Samples collected from stockpiles do not contain the wall or floor identifiers.

5.1 Field Screening

For field screening purposes, laboratory analyses has indicated that: soil with vapour readings of 20 ppm or less will likely meet the SQROs; and soil with vapour readings greater than 70 ppm will exceed the SQROs as illustrated in Figure 5-1.

Figure 5-1: Comparison of normalized 2014 field screening results to laboratory results.



Notes:

a) The graph illustrates total petroleum hydrocarbon concentrations, which is the cumulative sum of F1 to F4 concentrations.

b) The horizontal axis is set at 300 mg/kg to represent a concentration of 260 mg/kg F2, plus 20 mg/kg F3 and 20 mg/kg F3, because F1 concentrations are not routinely measured.

5.2 Impact Monitoring Results

Analytical results acquired to monitor potential impacts to soil surrounding the concrete pad are provided in Table 5-1 and Table 1 (back of report). The sample locations are shown on Figure 4. The soil sample results indicate that there has been no significant PHC impact on soil adjacent to the portion of the pad being used for the storage of PHC contaminated soil when compared to the baseline results collected in 2013 and presented in Table 5-2.

Table 5-1: Soil Quality Monitoring results.

Sample #	Date	General Location	F1 mg/kg	F2 mg/kg	F3 mg/kg	F4 mg/kg
14437-W-C	6/30/2014	East of north access ramp	-	<10	<20	<20
14438-W-C	6/30/2014	North access ramp	-	<10	<20	<20
14439-F-D	6/30/2014	Sump	-	70	780	70
15419-F-D	8/28/2014	South access ramp	<10	20	<20	<20
15420-F-D	8/28/2014	North access ramp	<10	20	<20	<20
15421-F-D	8/28/2014	Soil stockpiled to create a sump in 2013 (where the backhoe leaked hydraulic fluid)	-	10	430	<20

Table 5-2: Baseline results.

Sample #	Date	General Location	F2 mg/kg	F3 mg/kg	F4 mg/kg
13300-W-C	6/28/2013	North end of sump	<30	894	<50
13302-W-C	6/28/2013	North access ramp	<30	<50	<50
13303-W-C	6/28/2013	East of north access ramp	<30	<50	<50
14195-D	7/31/2013	Soil stockpiled to create sump in 2013 (where the backhoe leaked hydraulic fluid)	310	70	<20

The samples from the north access ramp were also analyzed for metals. Lead and zinc concentrations in 13302-W-C were 141 and 2,370 mg/kg respectively in 2013. In 2014 the composite sample collected across the same north access ramp (14438-W-C) returned 251 mg/kg lead and 4,060 mg/kg zinc. These results do not exceed the site specific soil quality remediation objectives developed for the Site of 4,500 mg/kg lead and 44,000 mg/kg zinc.

Water that accumulated in the sump was visually monitored throughout the 2014 field season. No visual sheen was observed. A water sample was collected from the sump on August 27, 2014, and tested for F1, oil and grease, benzene, ethylbenzene, toluene and xylene (BETX). Results were below method detection limits for all parameters tested.

5.3 Remediation Performance Monitoring Results

5.3.1 Nutrient Amendment

The nutrient content of the soil was measured as Total Kjeldahl Nitrogen (TKN) and Total Phosphorus (TP). TKN is the sum of organic nitrogen, ammonia (NH_3), and ammonium (NH_4^+) in the chemical analysis of soil. The results of the TKN and TP analyses are illustrated in Figure 5-2. TKN concentrations appear to drop off after 10 weeks of active management. TP results remain constant. Active weeks are the number of weeks the biopile was being aerated since nutrients were added. Seasonally, active weeks are between mid-June and early September.

5.3.2 Microbial Colony

Bacteria that target PHC, hydrocarbonoclastes, were measured in biopiles in the UTA and LTA and in the screened fine soil stockpile on Area 2 from 2012, 2013 and 2014. The sample results

demonstrated that the populations of hydrocarbon degrading bacteria thrive for up to seventeen weeks. The results of the bacteria analyses are illustrated in Figure 5-2.

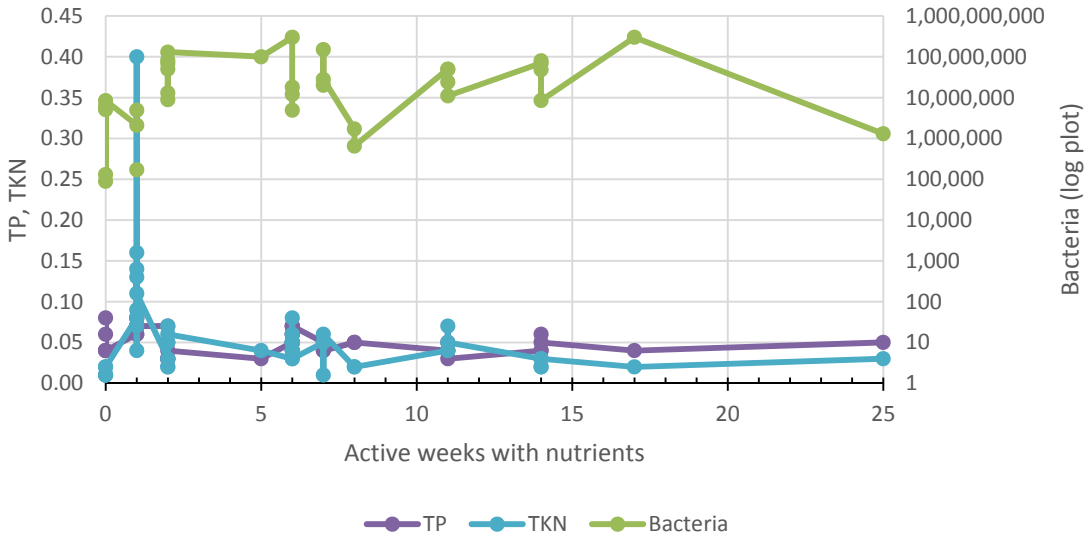


Figure 5-2: Biopile performance monitoring.

5.3.3 Moisture Content

Through July and August of 2014 biopile soil moisture contents were measured. Field moisture contents of the biopiles ranged from 0.7% to 25.4% with an average of 10%. Over the same period, the laboratory analyzed moisture content of the biopiles averaged 7%. During dry periods water was added to the biopiles to increase the moisture content. The water was obtained from the Area 4 excavation.

5.3.4 Characterization of Biopiles and Stockpiled Soil

Throughout the 2014 field season the biopiles in the UTA and LTA were managed as described in Section 4.3. Soil from the excavation with higher field screening readings was preferentially placed within the LTA. Successive sampling during the remediation process showed declining concentrations between sampling as summarized in Table 2 (back of report). Results for biopiles removed from the treatment cells and stockpiled on the pad are provided in Table 3 (back of report). Biopiles relocated to the pad are recorded on Figure 3 and include the small stockpile that was on Area 2 at the end of the 2013 season (was from UTA-1-1, UTA-5-1 and UTAS-6-1), UTA-1-2, UTA-1-3, UTA-5-3, UTA-6-3, UTA-10-3, LTA-1-2, LTA-3-2, LTA-4-2 and LTA-6-2. The biopiles ending with the suffix “-3” above were created with unscreened soil from the excavation.

The PHC characteristics of soil stockpiles relocated to the pad directly from the excavation and soil transferred from the screened fine soil stockpile on Area 2 are also summarized in Table 3 (back or report).

The ex situ remediation confirmatory soil sampling procedure was followed when testing all biopiles and stockpiles except stockpile Pad 4-1 on the pad. Stockpile Pad 4-1 is predominately composed of screened fine soil transferred from the stockpile on Area 2. Between 10% and 15% of the stockpile is unscreened soil from the excavation. Stockpile Pad 4-1 is estimated to contain 2,200 m^3 of PHC contaminated soil. The results for Pad 4-1 merely provide an indication of the range of PHC concentrations present in that stockpile.

PAH concentrations in the Site soils are summarized in Table 5 (back of report). The PAH concentrations meet the remediation objectives

5.4 Remediation Confirmation Results

5.4.1 In Situ Sampling of Excavation Limits

Results for 67 in situ confirmatory soil samples analyzed for PHC are summarized in table 4 and 5 (back of report) and illustrated on Figure 5. Table 5-3 below indicates the areas where samples were collected and the type of sample collected.

Table 5-3: Sample summary.

Area	Floor Composite ("F-C")	Floor QA/QC ("F-Q, F-D")	Wall Composite ("W-C")	Wall QA/QC ("F-Q, F-D")	Total
Area 1	6	4	4	10	24
Area 2	3	16	-	-	19
Area 3	-	-	3	9	12
Area 4	4	-	4	4	12
Total	**9**		**8**		**67**

All samples were analyzed for the contaminants of concern as explained in Section 4.2.1. All samples were analyzed for PHC F2 to F4 and Table 5-4 indicates where samples were selected for other analyses.

Table 5-4: Summary of analyses conducted.

Area	F2 to F4	F1, BETX	PAH
Area 1	24	2	-
Area 2	19	19	-
Area 3	12	12	1
Area 4	12	-	-
Total	**67**	**33**	**1**

Based on the confirmatory soil sampling program two areas have been identified where additional excavation of contaminated soil is required in 2015; one along the east wall of Area 1 and another area at the junction of Area 2 and Area 3. It is estimated that 50 m^3 of PHC contaminated soil remains to be excavated in 2015. There is also a 20 m length of berm remaining from the former

facility at the north end of Area 2 that requires the collection of remediation confirmatory soil samples in 2015.

5.4.2 Ex Situ Remediation Sampling of Biopiles and Stockpiled Soil

Ex situ remediation confirmation samples were collected from biopiles in the UTA and LTA and stockpiles on the pad when field screening results indicated the SQROs may be met (Table 2). Biopiles UTA-2-2, UTA-4-2, UTA-5-2, UTA-5-4, UTA-7-2, UTA-8-2, UTA-9-2, UTA-10-2, LTA-1-3, LTA-2-2, LTA-3-3, LTA-4-3, LTA-5-2 and LTA-6-3 were off-loaded to the former secondary containment area upon receipt of laboratory results that confirmed the remediation objectives were met.

The PHC concentrations associated with each biopile in the treatment cells at the of the 2014 field season are illustrated on Figure 2. Biopiles UTA-2-3, UTA-5-4, UTA-7-3, and UTA-8-3 meet 2014 remediation objectives and biopiles UTA-6-3, UTA-8-3, UTA-9-3, UTA-10-4, LTA-1-4, LTA-2-2, LTA-5-3 and LTA-6-4 meet the recommended 2015 revised remediation objectives.

Throughout the 2014 field season stockpiles on the pad were off-loaded to the former secondary containment area upon receipt of laboratory results that confirmed the remediation objectives were met as illustrated on Figure 3 and listed in Table 3.

At the end of the 2014 field season remediation confirmation samples determined that stockpiles Pad 2-4, Pad 2-5, Pad 2-7, Pad 4-5 and Pad 4-6 met the 2014 remediation objectives and that stockpiles Pad 4-3 and Pad 4-4 met the recommended 2015 revised remediation objectives.

5.5 Quality Assurance and Quality Control

The complete listing of laboratory QA/QC samples and their relative percent difference (RPD) are shown in Table 6. QA/QC sample identifiers ending in “Q” represent blind field duplicate samples. These monitor a combination of the precision of the laboratory analyses, sample preparation errors, sample collection errors and genuine short scale variations in soil geochemistry. QA/QC sample identifiers ending in “D” represent discrete samples which monitor the homogeneity of composite sample areas. Results that are either below the detection limit for one or both sample pairs, or below the Practical Quantitation Limit (“PQL”) have RPD’s identified as not applicable.

Thirteen sample pairs have blind field duplicate analyses for PHC. Two of these have results that are below the PQL for all parameters. Of the remaining eleven pairs, RPDs are greater than 40% for PHC F2 for four sample pairs. Sample 14836-Q was collected from the wall of the Area 1 excavation and the result does not impact the conclusions of this report because further excavation was undertaken where the sample had been collected. Sample 15260-Q was collected from a stockpile (Pad 3-2) of unscreened soil on the pad and the result reflects the heterogeneity of PHC in soil that was not processed through the vibrating screener. Samples 15112-Q and 15355-Q were collected from stockpile Pad 4-2 and biopile UTA-3-2 respectively. The average concentrations of PHC exceed the recommended SQROs in Pad 4-2 and this material requires further remediation efforts in 2015. The soil in Pad 3-2 and UTA-3-2 will be resampled at the start of the 2015 season to confirm that the SQROs have been met.

Fifty nine composite and discrete sample pairs were analyzed for petroleum hydrocarbons. 12 of these have results that are below the PQL for all parameters. Of the remaining 47 sample pairs, RPDs are greater than 40% for 27 sample pairs. Sixteen of these sample pairs are from the excavation areas and represent the heterogeneity of the PHC concentrations insitu. Samples 15243-D, 14680-D, 14852-D, 15208-D and 15210-D were collected from soil excavated in 2014 and therefore not processed through the vibrating screener. Three sample pairs were collected from stockpile Pad 4-2 which requires further remediation efforts. The remaining three sample pairs with RPDs greater than 40% were collected from UTA 3-2.

5.6 Transplant Trials

The results of the laboratory-based transplant trials have determined that soils that contain less than 410 mg/kg PHC F2 require no further management at the Site as noted in Section 3.

PHC F2 concentrations in the field vegetation plots set up to supplement the laboratory-based ecotoxicity trials were monitored throughout the 2014 field season as listed in Table 5-5. The metals of concern for the site were tested for each vegetation plot (Table 5-6).

Table 5-5: PHC F2 vegetation plot PHC F2 monitoring results.

Date Sampled	VPL F2 mg/kg	VPM F2 mg/kg	VPH F2 mg/kg
8/20/2013	160	440	610
6/30/2014	100	360	610
7/11/2014	140	330	270
8/28/2014	40	220	160

Table 5-6: Metal concentrations in vegetation plots.

Vegetation Plot	Lead mg/kg	Zinc mg/kg	Cadmium mg/kg	Copper mg/kg
VPL	65	670	1.7	28
VPM	67	806	2.2	25
VPH	54	547	1.5	26

At the end of the 2014 field season the arctic cotton and sedge/grasses had fresh growth in all vegetation plots. The arctic fireweed did not survive being transplanted and the arctic willow was stressed and it appeared to have died by the end of the field season.

Toward the middle of the active growing season in 2015, the root and shoot length and biomass for all transplanted and volunteer plants will be measured in the plots, and samples of soil will be collected for the analysis of hydrocarbon concentrations.

6 Discussion

6.1 Volume of Contaminated Soil

In 2014, 3,650 m^3 of soil meeting the soil quality remediation objectives was relocated from the treatment cells and pad to the former secondary containment area. An additional 800 m^3 of soil in 4 biopiles in the constructed treatment cells and five stockpiles on the pad also meet the SSROs applied in 2014. The estimated volumes of soil requiring further remediation, applying existing SQROs as well as the recommended new (2015) SSRO, are summarized in Table 6-1.

Table 6-1: Estimated volume of soil requiring treatment.

Location of PHC contaminated soil	Applying Existing SQRO	Applying Recommended (2015) SSRO
Below ground within area of former tanks	50 m^3	50 m^3
Stockpiled on Pad	2,900 m^3	2,450 m^3
Upper Treatment Area	1,700 m^3	1,300 m^3
Lower Treatment Area	1,300 m^3	800 m^3
Total Volume of Soil Requiring Treatment	**5,950 m^3**	**4,600 m^3**

6.2 PHC Concentrations

At the end of the 2014 season remediation progress sampling determined the PHC F2 soil concentrations in soil within the excavations and from the remaining biopiles and stockpiles. Table 6-2 summarizes the PHC F2 concentrations in the various locations at the end of the season.

Table 6-2: Concentrations of PHC F2 requiring treatment.

PHC F2 Concentrations	Average mg/kg	Minimum mg/kg	Maximum mg/kg
Below ground, remaining to be excavated	445	50	1,290
Stockpiled on Pad*	335	20	690
Upper Treatment Area	295	120	490
Lower Treatment Area	390	270	910

Note: * weighted average based on estimated volume of the various stockpiles

6.3 Remediation Rate

The 2014 remediation process tracked the remediation progress of the biopiles in the UTA and LTA cells and the stockpiles on the concrete pad. Figure 6-1 illustrates the rate of remediation of F2 achieved in the biopiles in the UTA and LTA in 2014.

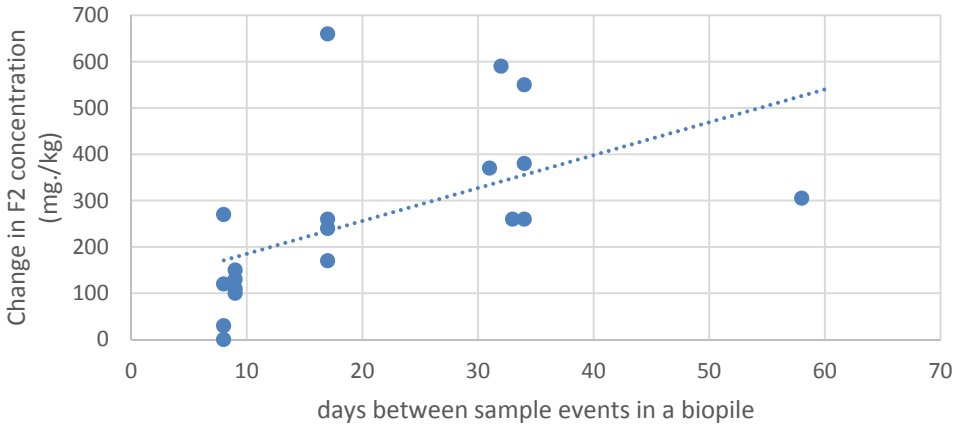


Figure 6-1: 2014 remediation rate achieved in the treatment cells.

Applying the existing SQROs, current projections indicate that active treatment of the PHC contaminated soil biopiles and stockpiles will need to continue in 2015 and 2016. If the 2015 recommended SSRO for PHC F2 is approved by the NWB then active treatment can most likely be concluded by September 2015.

7 Recommendations

The following recommendations are provided for the 2015 field season:

- It is recommended that a portable gas detector continue to be utilized to assess the presence or absence of PHC in the soil being excavated and to monitor PHC attenuation in the field. Ultimately the sample results from laboratory analysis will determine concentrations and provide the basis to which remediation progress is tracked.
- Residual contamination (<50 m^3) within the footprint of the former bulk fuel storage facility is to be excavated and managed in biopiles in the constructed treatment cells. Final confirmatory samples are to be collected from the excavation limits.
- The north berm adjacent to Area 2 is to be sampled following the in situ sampling procedure and managed according to the laboratory results obtained.
- The liner remaining in Area 2 is to be removed and disposed of in the non-hazardous waste landfill, once the water licence conditions for use of the landfill have been met.
- Zinc concentrate contaminated soil stored in wooden boxes on the pad will be packaged in a container suitable for shipping off-site and disposed of at an approved facility. A waste generator number is required from the Government of Nunavut prior to transporting any hazardous waste off site.

- It is recommended that biopiles UTA-2-3, UTA-5-4, UTA-7-3, and UTA-8-3 and stockpiles Pad 2-4, Pad 2-5, Pad 2-7, Pad 4-5 and Pad 4-5 be off-loaded to the secondary containment facility at the start of the 2015 season as this soil meets the current SQROs.

- Upon receipt of NWB approval for the recommended SSRO for PHC F2 it is recommended that biopiles LTA-1-4, LTA-2-3, LTA-5-3, LTA-6-4, UTA-6-4, UTA-9-3 and UTA-10-4 and stockpiles Pad 4-3 and 4-4 be off-loaded to the former secondary containment area.

- Biopiles that exceed the SQROs are to be managed with the same aeration schedule as undertaken previously, once every three or four days during dry periods.

- Biopiles are not to be off-loaded without confirmation that the soil meets the SQROs unless the soil is destined for further management on the concrete pad.

- Ex situ remediation confirmation samples are to be collected from biopile UTA-3-2 and stockpiles Pad 3-2 and Pad 4-2 at the start of the 2015 season.

- Stockpile Pad 4-1 is to be subdivided into smaller (<250 m^3) stockpiles and sampled during the construction of the small stockpiles in accordance with the ex situ sample procedure.

- Biopiles and stockpiles that exceed the SQROs should be sampled every three to four weeks following the ex situ sampling procedure.

- Based on terms of an agreement made with the surface lease holder, CanZinco is to cease using the pad and restore it to the condition that existed on May 31, 2013 by August 1, 2015.

8 Conclusions

Key conclusions from the 2014 soil remediation activities are as follows:

- Soil removed from the concrete pad and constructed treatment cells and placed in the former secondary containment area was remediated in accordance with the SQROs.
- The confirmatory soil sampling program identified two areas where additional excavation of contaminated soil is required. Approximately 50 m^3 of PHC contaminated soil remains to be excavated in 2015. There is also a 20 m length of berm remaining from the former facility adjacent to an excavation that requires the collection of remediation confirmatory soil samples in 2015.
- The soil remediation project has successfully reduced PHC concentrations. The average and maximum PHC concentrations in the Site soils are lower than documented in previous progress monitoring reports. Current PHC concentrations in the Site soils are sufficiently low to preclude risks to humans or living organisms other than plants and soil invertebrates.

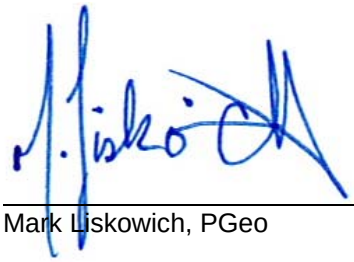
- BETX, PAH, and PHC fractions 1, 3 and 4 meet the current SQROs. A site specific remediation objective (SSRO) for PHC F2 has been recommended based on studies undertaken to assess at what concentration of F2 the growth and success of plants and soil invertebrates were inhibited in the Site soils.

Approval of the recommended SSRO for PHC F2 is expected to allow remaining PHC contaminated soils to be treated during the 2015 field season. In this scenario, foreseeable tasks to be addressed in 2016 would be the offloading and closure of the Treatment Areas and the closure of the non-hazardous waste landfill. Without the approval of the recommended SSRO for F2 it is unlikely that there will be sufficient space in the UTA and LTA to manage the soil currently stockpiled on the pad as biopiles by the end of July 2015.

This report, Nanisivik Mine Contaminated Soil Remediation 2014 Progress Report, was prepared by

Arlene Laudrum, PGeo, FGC

and reviewed by



Mark Liskowich, PGeo

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

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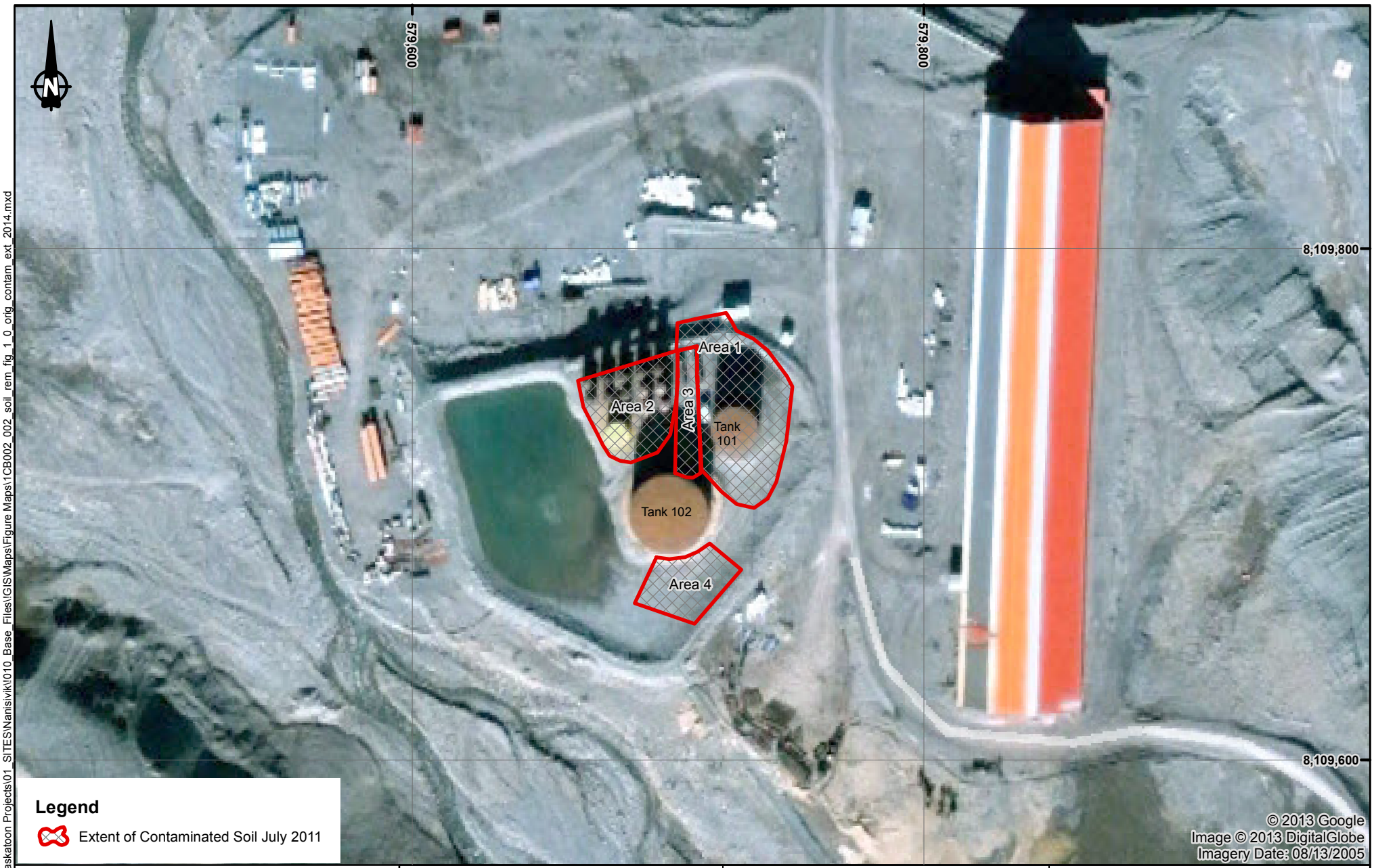
Figures



Notes:
1. Coordinate system is NAD83, UTM Zone 16

0 12.5 25 50 75 100 Meters

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nyrstar

Original Areas of Contaminated Soil

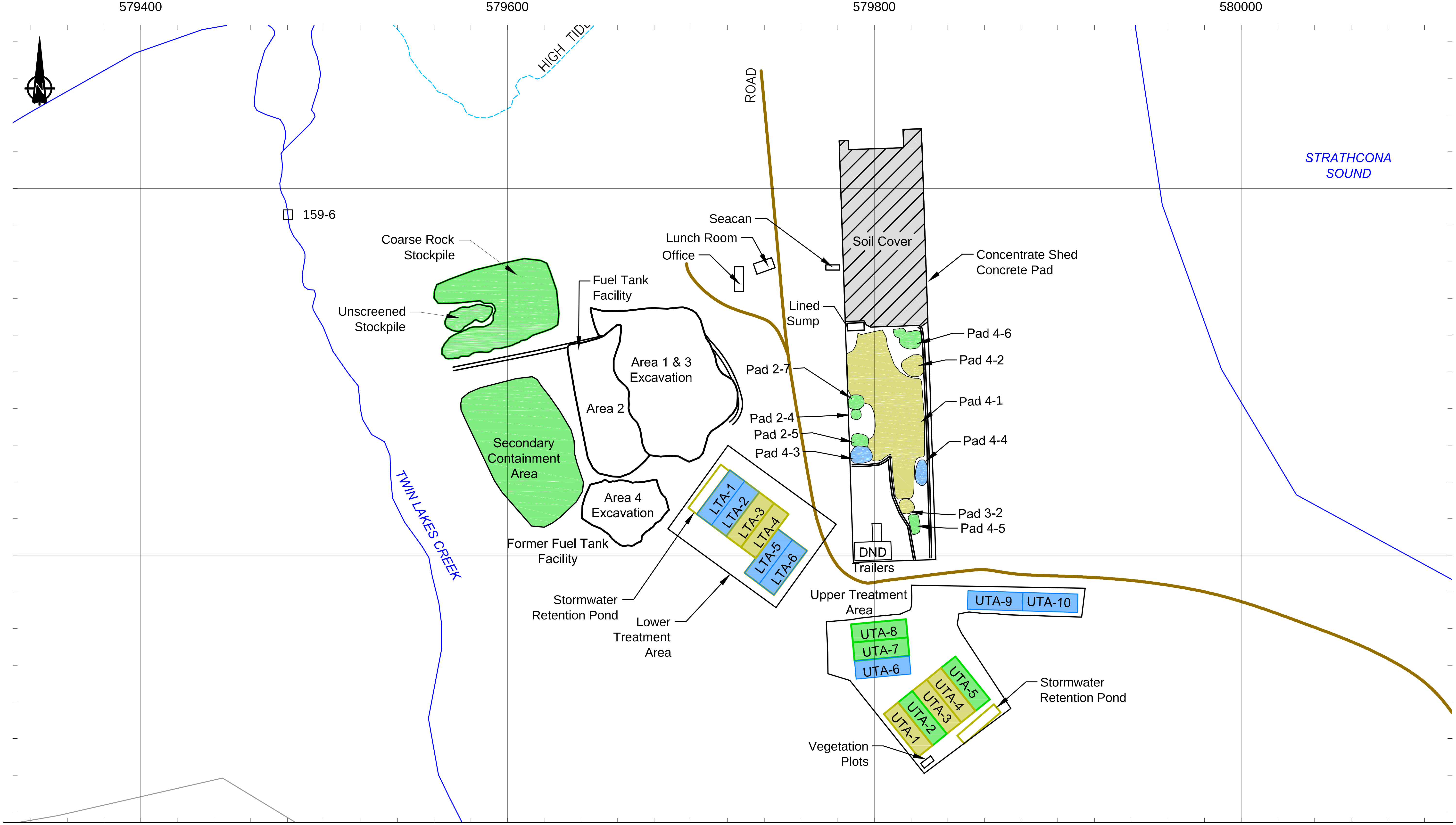
Job No: 1CB002.002

Filename: 1CB002_002_soil_rem_fig_1_0_orig_contam_ext_2014

Nanisivik Mine
Contaminated Soil Remediation
2014 Progess Report

Date:	Approved:	Figure:
March 2015	A.L.	1

\\SSK-SVR0.ssk.na.srk.ad\Saskatoon Projects\01_SITES\Nanisivik\1010_Base_Files\GIS\Maps\Figure Maps\1CB002_002_soil_rem_fig_1_0_orig_contam_ext_2014.mxd



LEGEND

- Soil that meets the 2014 remediation objectives
- Soil that exceeds the remediation objectives
- Soil that meets the recommended remediation objectives
- Berms
- Water Quality Monitoring Station

0 20 40 60 80 100
Scale in Metres

NOTES
Coordinate System: UTM NAD 1983 Zone 16

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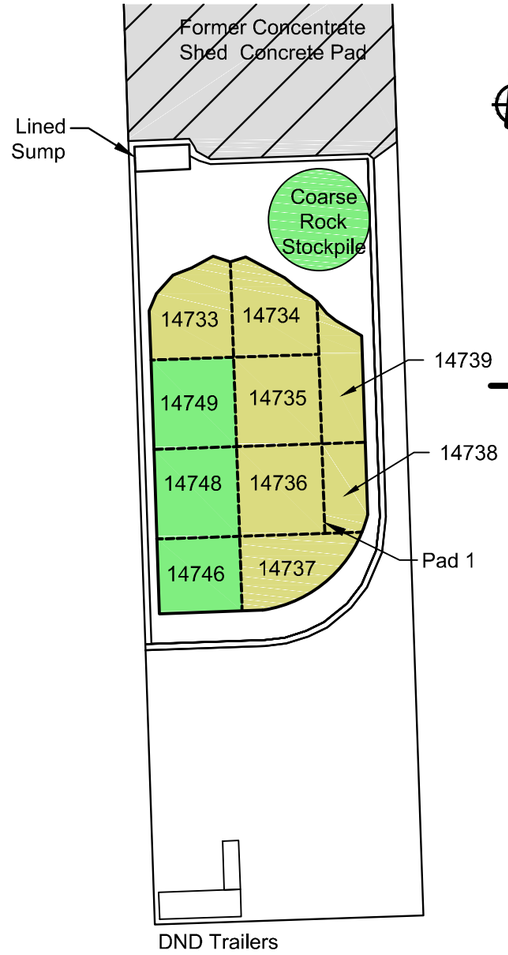
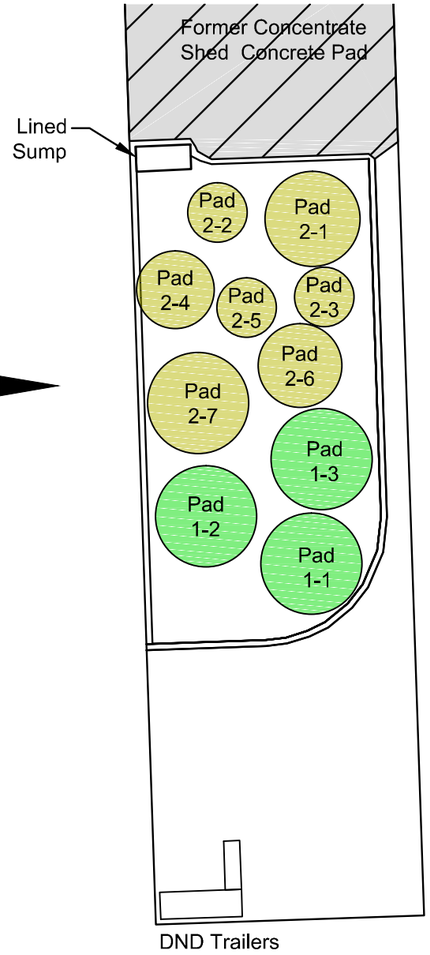
Nanisivik Mine Contaminated Soil Remediation
2014 Progress Report

General Site Arrangement

SRK JOB NO.: 1CB02.02	DATE: March 2015	APPROVED: SM	FIGURE: 2	
FILE NAME: 1CB002 002_Nanisivik_sample_loc_plan.dwg				

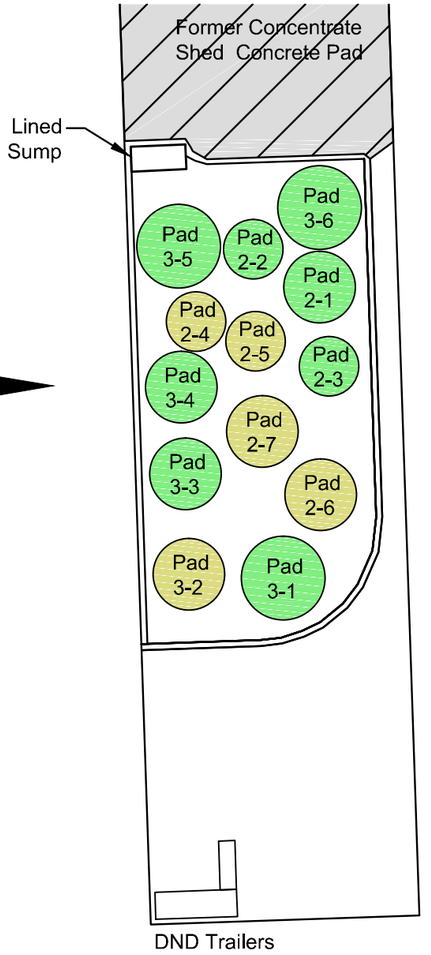


July 8, 2014
Stockpile Configuration



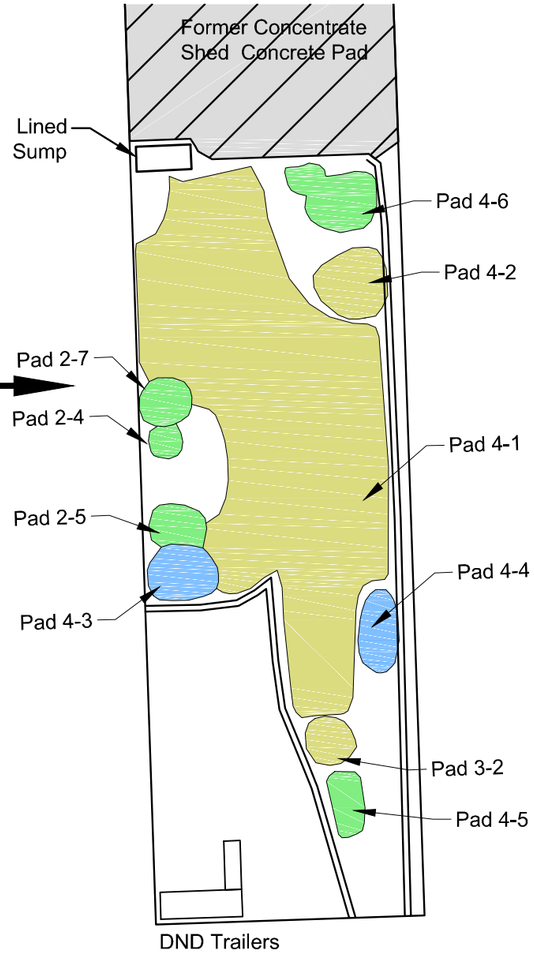
July 17, 2014
Stockpile Configuration

Location	Compostion
Pad 1-1	14737
Pad 1-2	14736
Pad 1-3	14738
Pad 2-1	14734
Pad 2-2	14733
Pad 2-3	Fines form Coarse Rock Stockpile
Pad 2-4	Area 2 Fine Stockpile (FSP)
Pad 2-5	FSP
Pad 2-6	14739
Pad 2-7	14735



July 24, 2014
Stockpile Configuration

Location	Compostion	Location	Compostion
Pad 2-1	14734	Pad 3-1	UTA-1-3
Pad 2-2	14733	Pad 3-2	UTA-1-3
Pad 2-3	Fines form Coarse Rock Stockpile	Pad 3-3	UTA-6-3
Pad 2-4	FSP	Pad 3-4	UTA-6-3
Pad 2-5	FSP	Pad 3-5	UTA-10-3
Pad 2-6	14739	Pad 3-6	UTA-10-3
Pad 2-7	14735		



August 28, 2014
Stockpile Configuration

Location	Compostion
Pad 2-4	FSP
Pad 2-5	FSP
Pad 2-7	14735
Pad 3-2	UTA-1-3
Pad 4-1	Pad 2-6, FSP East Wall Area 1
Pad 4-2	FSP
Pad 4-3	FSP
Pad 4-4	FSP
Pad 4-5	Northwest Area 3
Pad 4-6	UTA-5-3, East Wall Area 1

NOTES

a. Stockpile composed of biopiles relocated to pad in 2013, the small stockpile from Area 2 (was from UTA-1, UTA-5, UTA-6), plus UTA-1-2, UTA-6-2, LTA-1-2, LTA-3-2, LTA-4-2 and LTA-6-2.
b. Stockpile ~ 1 m high.
c. Numbers correspond to composite sample numbers.

LEGEND

- Soil that meets the 2014remediation objectives
- Soil that meets the recommended remediation objectives*
- Soil that exceeds the remediation objectives
- Covered Portion of Concrete Pad
- Sample Grid
- Berms

* only applies to soil remaining on the pad at the end of the 2014 field season.

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SRK JOB NO.: 1CB002.002

FILE NAME: 1CB002 002_Nanisivik_Remediation Pad Configuration.dwg

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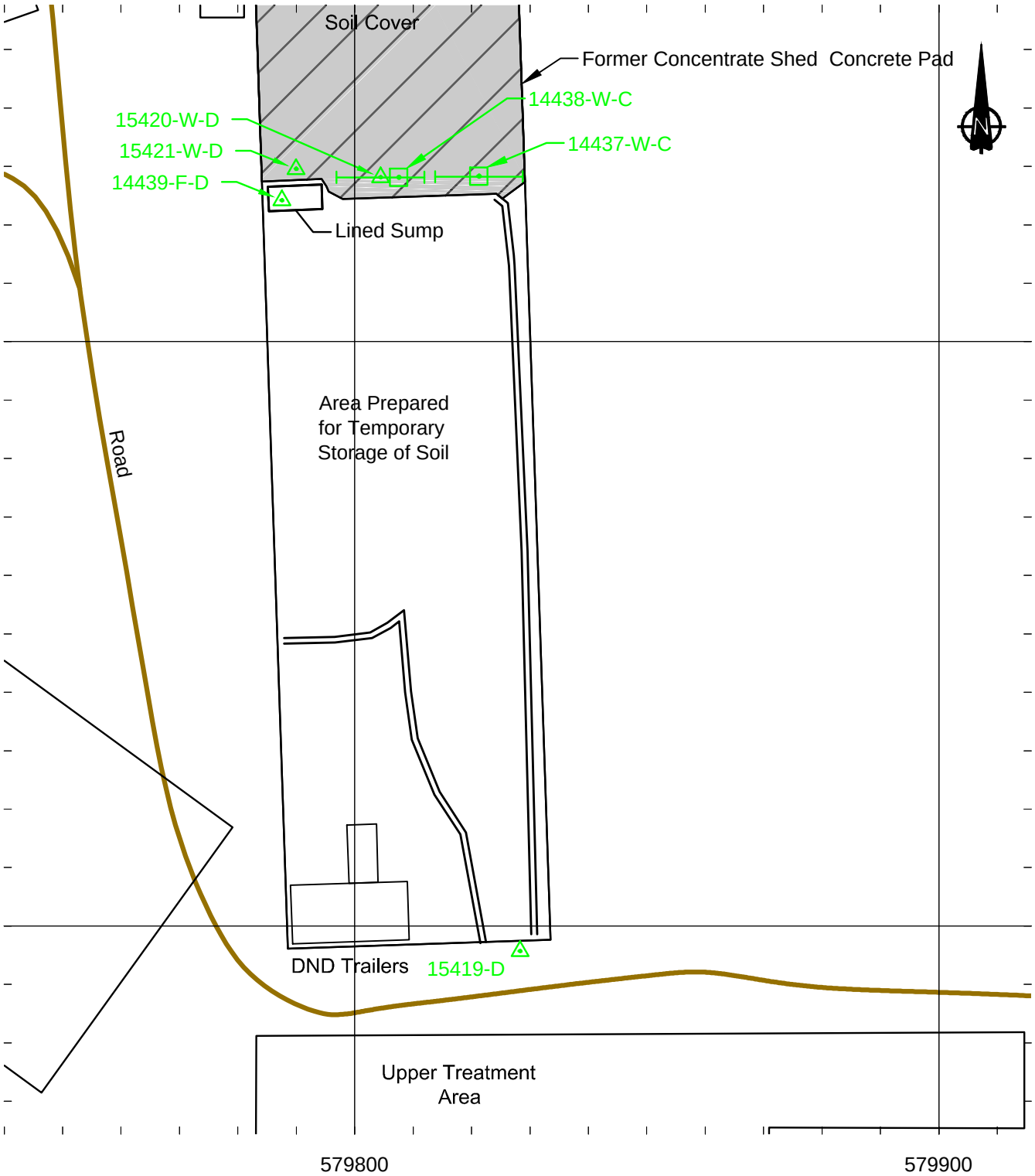
Former Nanisivk Mine Contaminated Soil Remediation
2014 Progress Report

2014 Concrete Pad Soil Stockpile Progression

DATE: March 2015 | APPROVED: SM | FIGURE: 3

J:\G\1_SITES\Nanisivik\1040_AutoCAD\1CB002 002_Nanisivk_Remediation Pad Configuration.dwg



LEGEND

- Soil that meets the 2014 remediation objectives
- Soil that meets the recommended remediation objectives
- Soil that exceeds the remediation objectives
- Berm
- Wall Sample

14428-W-D <Sample ID><Location><Type>

Location
- F Floor of Excavation
- W Wall of Excavation

Type
- D - Discrete
- C - Composite
- Q - Duplicate

0 10 20 30 40 50
Scale in Metres

NOTE:

Coordinate System is NAD83, UTM Zone 16.

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Nanisivik Mine Contaminated Soil Remediation
2014 Progress Report

Soil Quality Monitoring Samples

SRK JOB NO.:	1CB002.002			
FILE NAME:	1CB002 002_Nanisivik_sample_loc_plan.dwg	DATE: March 2015	APPROVED: SM	FIGURE: 4

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579600 579700 579800 579900

8109700 8109600

Coarse Rock Stockpile
Unscreened Stockpile
Soil Cover
Former Concentrate Shed Concrete Pad
Area\1&3 Excavation
Area 2 Excavation
Area 4 Excavation
Former Secondary Containment Area
Road
TWIN LAKES CREEK
Lower Treatment Area
Upper Treatment Area
DND Trailers
Pad 4-6
Pad 4-2
Pad 2-7
Pad 2-4
Pad 2-5
Pad 4-1
Pad 4-4
Pad 4-3
Pad 3-2
Pad 4-5

15433-W/15436-Q 15431-W 15430-W 15434-W 15429-W 15432-W 14804-F 15426-W 15427-W/15428-Q 15424-W 15423-W 14798-F 14789-F 14827-W 14792-F/14834-Q 14791-F 14787-F 14820-W 15130-W 15131-W 15134-W 15132-W 14816-W 14429-W 15133-W 14426-W 14422-F 14427-W 14425-F 14424-F 14423-F 14785-W/14786-Q 14785 14782-W 14780-W 14775-F 14776-W 14835-F 14815-F 15435-W 15389-W 15390-W 15388-W 15387-W 15383-F 15382-F 15366-F 15384-F 15397-F 15378-F 15385-F 15379-F 15364-F 15367-F 15398-F 15368-F 15362-F 15369-F 15381-F 15373-F 15399-F 15380-F 15370-F 11016-W 11015-W 11014-W 11013-W

15418 15400 15184 15111/15112-Q 15182 15181 15404 15262 15222 15258 15110 15297 15259/15260-Q 15210 15206 15413 15410 15299 15261 15113 15208 15298

LEGEND

- Soil that meets the 2014 remediation objectives
- Soil that meets the recommended remediation objectives
- Soil that exceeds the remediation objectives
- Berm
- Floor Sample Grid
- Wall Sample

14428-W-D <Sample ID><Location><Type>

Location
- F Floor of Excavation
- W Wall of Excavation

Type
- D - Discrete
- C - Composite
- Q - Duplicate

NOTE:

Coordinate System is NAD83, UTM Zone 16.

0 10 20 30 40 50
Scale in Metres

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SRK JOB NO.: 1CB002.002
FILE NAME: 1CB002 002_Nanisivik_sample_loc_plan.dwg

nyrstar

Nanisivik Mine Contaminated Soil Remediation
2014 Progress Report

Excavation and Stockpile Characterization Samples

DATE: March 2015 | APPROVED: SM | FIGURE: 5

J:\01_SITES\Nanisivik\1040_AutoCAD\1CB002 002_Nanisivik_sample_loc_plan.dwg

Tables

Table 1: Background Soil Quality Impact Monitoring Samples

Location:				Pad				
Sample ID:				14437-W-C	14438-W-C	14439-F-D	15419-F-D	15420-F-D	15421-F-D
Sample Date:				6/30/2014	6/30/2014	6/30/2014	8/28/2014	8/28/2014	8/28/2014
Sample Depth (m):				0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15	0.1-0.15
Field Screen (ppm):				45	20	45	-	-	-
Moisture				2.9	1.8	1.1	2	1.9	5.7
Exova File #				1414350	1414350	1414350	1418825	1418825	1418825
Parameter	Units	SQROs[a] SSRO[b]	SQROs[a] CCME[c]	Analytical Results					
Volatile Organic Compounds									
Ethylbenzene[d]	µg/g		300	-	-	-	<0.05	<0.05	-
Toluene[d]	µg/g		250	-	-	-	<0.20	<0.20	-
Benzene[d]	µg/g		110	-	-	-	<0.02	<0.02	-
Xylenes (Total)[d]	µg/g		350				0.26	<0.16	-
Extractable Hydrocarbons									
F1 (C6-C10) surface[d,e]	µg/g		320	-	-	-	<10	<10	-
F2 (C10-C16) surface[d,e]	µg/g	410	260	<10	<10	70	20	20	10
F3 (C10-C16) surface[d,e]	µg/g		1700	<20	<20	780	<20	<20	430
F4 (C34-C50) surface[d,e]	µg/g		3300	<20	<20	70	<20	<20	<20

Bold	Concentration greater than or equal to the recommended SQROs
Italics	Concentration greater than or equal to the 2014 SQROs

Notes:

"<" = Less than analytical method detection limit.

"-" = Analysis not conducted, or no guideline.

a) Former Nanisivik Mine Soil Quality Remediation Objectives (SQROs)

b) Recommended Site-specific Soil Remediation Objective (SSRO)

c) Canadian Council of Ministers of the Environment (CCME) petroleum hydrocarbon soil quality guidelines for commercial land use. The site-specific exposure pathways used to determine the standards include: soil ingestion, soil contact and management limits.

d) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth).

e) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

Table 2: Biopile Remediation Progress Soil Samples

Location:				UTA-1-3					UTA-1-4			UTA-2-2		UTA-2-3		
Sample ID:				14848-D	14850-D	14852-D	14860-C	14861-Q	15026-C	15058-C	15357-C	14663-C	14853-C	15025-C	15038-C	15356-C
Sample Date:				7/16/2014	7/16/2014	7/16/2014	7/16/2014	duplicate of	7/24/2014	8/10/2014	8/27/2014	7/7/2014	7/16/2014	7/24/2014	8/10/2014	8/27/2014
Field Screen (ppm):				130	170	175	155	14860-C	75	-	55	45	5	80	-	20
Moisture				8.1	8.6	6.4	8.5	7.5	6.8	9	7.9	6.1	7.2	7.5	10.1	8.3
Exova File #				1415011	1415011	1415011	1415011	1415011	1415682	1417256	1418825	1414335	1415015	1415682	1417256	1418825
Parameter	**Units**	**SQROs[a] SSRO[b]**	**CCME[c]**	**Analytical Results**												
Volatile Organic Compounds																
Ethylbenzene[d]	µg/g		300	-	-	-	0.13	-	-	-	-	-	-	-	0.06	-
Toluene[d]	µg/g		250	-	-	-	<0.20	-	-	-	-	-	-	-	<0.20	-
Benzene[d]	µg/g		110	-	-	-	<0.02	-	-	-	-	-	-	-	<0.02	-
Xylenes (Total)[d]	µg/g		350	-	-	-	1.45	-	-	-	-	-	-	-	0.36	-
Extractable Hydrocarbons																
F1 (C6-C10) surface[d,e]	µg/g		320	-	-	-	110	-	-	-	-	-	-	-	<10	-
F2 (C10-C16) surface[d,e]	µg/g	410	260	**560**	**600**	**1120**	**570**	**730**	**800**	**800**	**420**	*310*	210	*310*	*360*	120
F3 (C10-C16) surface[d,e]	µg/g		1700	20	50	80	40	40	60	130	50	30	30	40	80	<20
F4 (C34-C50) surface[d,e]	µg/g		3300	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20

Bold Concentration greater than or equal to the recommended SQROs

Italics Concentration greater than or equal to the 2014 SQROs

Notes:

"<" = Less than analytical method detection limit.

"-" = Analysis not conducted, or no guideline.

a) Former Nanisivik Mine Soil Quality Remediation Objectives (SQROs)

b) Recommended Site-specific Soil Remediation Objective (SSRO)

c) Canadian Council of Ministers of the Environment (CCME) petroleum hydrocarbon soil quality guidelines for commercial land use. The site-specific exposure pathways used to determine the standards include: soil ingestion, soil contact and management limits.

d) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth). Biopile samples are compared to surface guidelines.

e) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

Location:				UTA-3-2												
Sample ID:				14433-C	14636-D	14637-D	14638-D	14661-C	14662-Q	14854-C	15024-C	15039-C	15320-D	15322-D	15324-D	15354-C	15355-Q
Sample Date:				6/30/2014	7/7/2014	7/7/2014	7/7/2014	7/7/2014	duplicate of	7/16/2014	7/24/2014	8/10/2014	8/27/2014	8/27/2014	8/27/2014	8/27/2014	duplicate of
Field Screen (ppm):				145	30	45	30	55	14661-C	5	50	-	20	25	30	20	15354-C
Moisture				6.6	5.4	6.9	6.8	7.6	7.7	7	7.8	8.2	7.3	8.2	7.9	7.8	8
Exova File #				1414350	1414350	1414350	1414350	1414335	1414350	1415015	1415682	1417256	1418794	1418794	1418794	1418825	1418825
Parameter	**Units**	**SQROs[a] SSRO[b]**	**CCME[c]**	**Analytical Results**												
Volatile Organic Compounds																
Ethylbenzene[d]	µg/g		300	0.48	0.17	0.05	<0.05	0.09	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Toluene[d]	µg/g		250	1.57	0.28	<0.20	<0.20	0.24	-	-	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Benzene[d]	µg/g		110	0.13	<0.02	<0.02	<0.02	<0.02	-	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Xylenes (Total)[d]	µg/g		350	5.0	1.4	0.4	0.3	0.6	-	-	-	0.25	0.3	0.3	0.3	<0.12	0.3
Extractable Hydrocarbons																
F1 (C6-C10) surface[d,e]	µg/g		320	20	30	30	30	20	-	-	-	19	20	20	40	20	<10
F2 (C10-C16) surface[d,e]	µg/g	410	260	**610**	**450**	**650**	**570**	*310*	**440**	*330*	*370*	**520**	220	250	**490**	190	*380*
F3 (C10-C16) surface[d,e]	µg/g		1700	40	40	<20	<20	20	<20	50	40	140	40	60	110	20	50
F4 (C34-C50) surface[d,e]	µg/g		3300	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20

Bold Concentration greater than or equal to the recommended SQROs

Italics Concentration greater than or equal to the 2014 SQROs

Notes:

"<" = Less than analytical method detection limit.

"-" = Analysis not conducted, or no guideline.

a) Former Nanisivik Mine Soil Quality Remediation Objectives (SQROs)

b) Recommended Site-specific Soil Remediation Objective (SSRO)

c) Canadian Council of Ministers of the Environment (CCME) petroleum hydrocarbon soil quality guidelines for commercial land use. The site-specific exposure pathways used to determine the standards include: soil ingestion, soil contact and management limits.

d) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth). Biopile samples are compared to surface guidelines.

e) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

Location:				UTA-4-2		UTA-4-3			UTA-5-2			UTA-5-3		UTA-5-4	UTA-6-3	
Sample ID:				14436-C	14855-C	15023-C	15059-C	15353-C	14435-C	14857-C	15002-C	15060-C	15066-D	15352-C	14690-C	14856-C
Sample Date:				7/7/2014	7/16/2014	7/24/2014	8/10/2014	8/27/2014	7/7/2014	7/16/2014	7/24/2014	8/10/2014	8/14/2014	8/27/2014	7/7/2014	7/16/2014
Field Screen (ppm):				25	0	200	-	30	80	5	5	100	-	35	190	105
Moisture				6.3	8.1	6.8	9	8.4	5.4	7.8	8.4	6.8	7.3	7.6	5.8	7.7
Exova File #				1414350	1415015	1415682	1417256	1418825	1414350	1415015	1415682	1417256	1417256	1418825	1414350	1415011
Parameter	**Units**	**SQROs[a] SSRO[b]**	**CCME[c]**	**Analytical Results**												
Volatile Organic Compounds																
Ethylbenzene[d]	µg/g		300	-	-	-	-	-	-	-	-	0.28	0.32	-	-	-
Toluene[d]	µg/g		250	-	-	-	-	-	-	-	-	0.29	0.29	-	-	-
Benzene[d]	µg/g		110	-	-	-	-	-	-	-	-	<0.02	<0.02	-	-	-
Xylenes (Total)[d]	µg/g		350	-	-	-	-	-	-	-	-	1.68	2.16	-	-	-
Extractable Hydrocarbons																
F1 (C6-C10) surface[d,e]	µg/g		320	-	-	-	-	-	-	-	-	49	56	-	-	-
F2 (C10-C16) surface[d,e]	µg/g	410	260	*360*	230	**610**	**640**	**470**	**2140**	*310*	190	**660**	**570**	250	**1250**	*400*
F3 (C10-C16) surface[d,e]	µg/g		1700	30	40	50	70	70	310	50	30	50	160	<20	<20	30
F4 (C34-C50) surface[d,e]	µg/g		3300	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20

Bold Concentration greater than or equal to the recommended SQROs

Italics Concentration greater than or equal to the 2014 SQROs

Notes:

"<" = Less than analytical method detection limit.

"-" = Analysis not conducted, or no guideline.

a) Former Nanisivik Mine Soil Quality Remediation Objectives (SQROs)

b) Recommended Site-specific Soil Remediation Objective (SSRO)

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d) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth). Biopile samples are compared to surface guidelines.

e) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

Location:				UTA-6-4			UTA-7-2	UTA-7-3			UTA-8-2		UTA-8-3			UTA-9-2	
Sample ID:				15021-C	15061-C	15358-C	14665-C	15020-C	15062-C	15359-C	14664-C	14859-C	15019-C	15063-C	15360-C	14623-C	14858-C
Sample Date:				7/24/2014	8/10/2014	8/27/2014	7/7/2014	7/24/2014	8/10/2014	8/27/2014	7/7/2014	7/16/2014	7/24/2014	8/10/2014	8/27/2014	7/7/2014	7/16/2014
Field Screen (ppm):				170	25	45	30	75	-	15	45	0	170	0	30	105	0
Moisture				6.7	9.1	7.2	5.8	9	7.8	8.6	6.4	8.7	7.6	8.5	8.1	5.7	7.4
Exova File #				1415682	1417256	1418825	1414335	1415682	1417256	1418825	1414335	1415015	1415682	1417256	1418825	1414335	1415015
Parameter	**Units**	**SQROs[a] SSRO[b]**	**CCME[c]**	**Analytical Results**													
Volatile Organic Compounds																	
Ethylbenzene[d]	µg/g		300	-	-	0.07	-	-	-	<0.05	-	-	-	-	-	-	-
Toluene[d]	µg/g		250	-	-	<0.20	-	-	-	<0.20	-	-	-	-	-	-	-
Benzene[d]	µg/g		110	-	-	<0.02	-	-	-	<0.02	-	-	-	-	-	-	-
Xylenes (Total)[d]	µg/g		350	-	-	0.6	-	-	-	<0.12	-	-	-	-	-	-	-
Extractable Hydrocarbons																	
F1 (C6-C10) surface[d,e]	µg/g		320	-	-	20	-	-	-	20	-	-	-	-	-	-	-
F2 (C10-C16) surface[d,e]	µg/g	410	260	**790**	**1030**	*370*	250	**700**	**660**	150	*310*	200	**850**	**450**	260	*330*	180
F3 (C10-C16) surface[d,e]	µg/g		1700	50	200	40	40	50	140	<20	50	30	60	80	<20	50	30
F4 (C34-C50) surface[d,e]	µg/g		3300	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20

Bold Concentration greater than or equal to the recommended SQROs

Italics Concentration greater than or equal to the 2014 SQROs

Notes:

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d) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth). Biopile samples are compared to surface guidelines.

e) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

Location:				UTA-9-3			UTA-10-2	UTA-10-3		UTA-10-4						LTA-1-2	LTA-1-3	
Sample ID:				15018-C	15064-C	15351-C	14431-C	14622-C	14838-C	14949-D	14950-D	15017-C	15065-C	15350-C		14432-C	14847-C	15032-C
Sample Date:				7/24/2014	8/10/2014	8/27/2014	6/30/2014	7/7/2014	7/15/2014	7/23/2014	7/23/2014	7/24/2014	8/14/2014	8/27/2014		6/30/2014	7/16/2014	7/24/2014
Field Screen (ppm):				50	0	20	80	6	45	600	600	50	10	25		110	125	50
Moisture				6.2	9.1	8.2	5.1	510	7.4	6.4	7.6	5.8	10.4	7.1		5.6	7.7	6.9
Exova File #				1415682	1417256	1418794	1414350	1414350	1415011	1415676	1415676	1415682	1417256	1418794		1414350	1415011	1415682
Parameter	**Units**	**SQROs[a] SSRO[b]**	**CCME[c]**	**Analytical Results**														
Volatile Organic Compounds																		
Ethylbenzene[d]	µg/g		300	-	-	-	<0.05	-	-	<0.05	<0.05	-	-	-		<0.05	0.07	-
Toluene[d]	µg/g		250	-	-	-	<0.20	-	-	<0.20	<0.20	-	-	-		<0.20	<0.20	-
Benzene[d]	µg/g		110	-	-	-	<0.02	-	-	<0.02	<0.02	-	-	-		<0.02	<0.02	-
Xylenes (Total)[d]	µg/g		350	-	-	-	0.3	-	-	0.3	0.4	-	-	-		0.3	0.6	-
Extractable Hydrocarbons																		
F1 (C6-C10) surface[d,e]	µg/g		320	-	-	-	<10	-	-	60	60	-	-	-		<10	50	-
F2 (C10-C16) surface[d,e]	µg/g	410	260	**540**	**520**	*280*	100	**510**	240	**600**	**590**	**640**	**400**	*350*		*360*	*260*	230
F3 (C10-C16) surface[d,e]	µg/g		1700	40	80	30	30	50	<20	40	40	50	80	30		20	20	<20
F4 (C34-C50) surface[d,e]	µg/g		3300	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20		<20	<20	<20

Bold Concentration greater than or equal to the recommended SQROs

Italics Concentration greater than or equal to the 2014 SQROs

Notes:

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d) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth). Biopile samples are compared to surface guidelines.

e) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

Location:				LTA-1-4	LTA-2-2			LTA-2-3	LTA-3-3	LTA-3-4	LTA-4-3		LTA-4-4			
Sample ID:				15263-C	14691-C	14844-C	15031-C	15264-C	14845-C	15265-C	14846-C	15029-C	15243-D	15244-D	15247-D	15266-C	15267-Q
Sample Date:				8/24/2014	7/7/2014	7/16/2014	7/24/2014	8/24/2014	7/16/2014	8/24/2014	7/16/2014	7/24/2014	8/24/2014	8/24/2014	8/24/2014	8/24/2014	duplicate of
Field Screen (ppm):				45	35	50	10	50	130	50	145	100	55	105	40	65	15266-C
Moisture				6.8	5.8	9.2	<0.1	7.6	6.6	7.6	6.7	7	6.4	9.2	8.5	7.1	7
Exova File #				1418794	1414335	1415015	1415682	1418794	1415011	1418794	1415011	1415682	1418794	1418794	1418794	1418794	1418794
Parameter	**Units**	**SQROs[a] SSRO[b]**	**CCME[c]**	**Analytical Results**													
Volatile Organic Compounds																	
Ethylbenzene[d]	µg/g		300	-	-	-	-	-	0.07	-	3.9	-	<0.05	<0.05	<0.05	<0.05	0.11
Toluene[d]	µg/g		250	-	-	-	-	-	<0.20	-	5.11	-	<0.20	<0.20	<0.20	<0.20	<0.20
Benzene[d]	µg/g		110	-	-	-	-	-	<0.02	-	0.06	-	<0.02	<0.02	<0.02	<0.02	<0.02
Xylenes (Total)[d]	µg/g		350	-	-	-	-	-	0.6	-	25.0	-	0.3	0.4	0.3	0.3	0.8
Extractable Hydrocarbons																	
F1 (C6-C10) surface[d,e]	µg/g		320	-	-	-	-		30	-	190	-	20	30	20	20	30
F2 (C10-C16) surface[d,e]	µg/g	410	260	*270*	**500**	*310*	240	*330*	100	**560**	120	170	**910**	**600**	**450**	**410**	**560**
F3 (C10-C16) surface[d,e]	µg/g		1700	<20	50	30	40	30	<20	50	<20	<20	170	130	60	30	130
F4 (C34-C50) surface[d,e]	µg/g		3300	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20

Bold Concentration greater than or equal to the recommended SQROs

Italics Concentration greater than or equal to the 2014 SQROs

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d) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth). Biopile samples are compared to surface guidelines.

e) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

Location:				LTA-5-2	LTA-5-3		LTA-6-3						LTA-6-4
Sample ID:				14629-C	15028-C	15268-C	14680-D	14682-D	14683-D	14693-C	14684-Q	14837-C	15269-C
Sample Date:				7/7/2014	7/24/2014	8/24/2014	7/7/2014	7/7/2014	7/7/2014	7/7/2014	duplicate of	7/15/2014	8/24/2014
Field Screen (ppm):				70	85	50	225	310	70	475	14693-C	80	30
Moisture				6.6	6.7	8.7	5.7	5	6.3	5.8	5.9	7.3	8.4
Exova File #				1414335	1415682	1418794	1414350	1414350	1414350	1414350	1414350	1415011	1418794
Parameter	**Units**	**SQROs[a]** **SSRO[b]**	**SQROs[a]** **CCME[c]**	**Analytical Results**									
Volatile Organic Compounds													
Ethylbenzene[d]	µg/g		300	-	-	-	0.18	0.08	0.12	0.13	0.1	0.08	-
Toluene[d]	µg/g		250	-	-	-	0.37	0.22	0.27	0.32	0.24	0.22	-
Benzene[d]	µg/g		110	-	-	-	0.05	0.03	0.05	0.04	0.04	0.04	-
Xylenes (Total)[d]	µg/g		350	-	-	-	5.0	1.3	1.7	2.3	1.7	0.88	-
Extractable Hydrocarbons													
F1 (C6-C10) surface[d,e]	µg/g		320	-	-	-	160	100	110	90	100	50	-
F2 (C10-C16) surface[d,e]	µg/g	410	260	260	**640**	*270*	70	220	<10	<10	40	70	*300*
F3 (C10-C16) surface[d,e]	µg/g		1700	30	50	20	<20	<20	<20	<20	<20	<20	20
F4 (C34-C50) surface[d,e]	µg/g		3300	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20

Bold Concentration greater than or equal to the recommended SQROs

Italics Concentration greater than or equal to the 2014 SQROs

Notes:

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d) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth). Biopile samples are compared to surface guidelines.

e) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

Table 3: Stockpile Characterization Soil Samples

Location:				Screened Fines Stockpiled in Area 2 from excavation of Areas 1, 3 and 4								Pad 1						
Sample ID:				14688-D	14689-D	14694-D	15033-C	15034-C	15035-C	15036-C	15037-C	14718-D	14719-D	14722-D	14746-C	14747-Q	14748-C	14749-C
Sample Date:				7/8/2014	7/8/2014	7/8/2014	7/24/2014	7/24/2014	7/24/2014	7/24/2014	7/24/2014	7/9/2014	7/9/2014	7/9/2014	7/9/2014	duplicate of	7/9/2014	7/9/2014
Field Screen (ppm):				-	-	130	100	30	25	5	20	10	5	25	0	14746-C	15	20
Moisture				7.7	6.9	6.5	7.7	6.8	7.8	6.9	9	4.8	5.4	4.7	4.8	4.9	5.4	4
Exova File #				1414350	1414350	1414350	1415682	1415682	1415682	1415682	1415682	1414350	1414350	1414350	1414335	1414350	1414335	1414335
Parameter	Units	SQROs[a]		Analytical Results														
		SSRO[b]	CCME[c]															
Volatile Organic Compounds																		
Ethylbenzene[d]	µg/g		300	<0.05	-	-	-	-	-	-	-	-	-	-	<0.05	-	-	-
Toluene[d]	µg/g		250	<0.20	-	-	-	-	-	-	-	-	-	-	<0.20	-	-	-
Benzene[d]	µg/g		110	<0.02	-	-	-	-	-	-	-	-	-	-	<0.02	-	-	-
Xylenes (Total)[d]	µg/g		350	0.29	-	-	-	-	-	-	-	-	-	-	<0.16	-	-	-
Extractable Hydrocarbons																		
F1 (C6-C10) surface[d,e]	µg/g		320	30	-	-	-	-	-	-	-	-	-	-	<10	-	-	-
F2 (C10-C16) surface[d,e]	µg/g	410	260	**560**	*400*	**660**	**530**	*300*	**1060**	**640**	150	*310*	*320*	*340*	240	*310*	230	210
F3 (C10-C16) surface[d,e]	µg/g		1700	<20	<20	<20	40	30	90	70	30	<20	<20	<20	50	<20	60	50
F4 (C34-C50) surface[d,e]	µg/g		3300	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20

Bold Concentration greater than or equal to the recommended SQROs

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d) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth). Stockpile samples are compared to surface guidelines.

e) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

Table 3: Stockpile Characterization Soil Samples

Location:				Pad-1-1		Pad-1-2		Pad-1-3		Pad-2-1			Pad-2-2		Pad-2-3	Pad-2-4			Pad-2-5	
Sample ID:				14737-C	14877-C	14736-C	14878-C	14738-C	14879-C	14734-C	14839-C	14989-C	14733-C	14990-C	14996-C	15002-C	15045-C	15222-C	15008-C	15258-C
Sample Date:				7/9/2014	7/16/2014	7/9/2014	7/16/2014	7/9/2014	7/16/2014	7/9/2014	7/15/2014	7/24/2014	7/9/2014	7/24/2014	7/24/2014	7/24/2014	8/10/2014	8/24/2014	7/24/2014	8/21/2014
Field Screen (ppm):				70	0	50	0	120	30	25	35	0	50	5	45	40	-	25	50	5
Moisture				4.9	7.2	5.7	7.5	5.3	8.4	5.6	7.3	7.9	5.8	8.8	6.9	6.9	9.2	6.4	7.8	7.4
Exova File #				1414335	1415011	1414335	1415011	1414335	1415011	1414335	1415011	1415682	1414335	1415682	1415682	1415682	1417256	1418794	1415682	1418794
Parameter	Units	SQROs[a]		Analytical Results																
		SSRO[b]	CCME[c]																	
Volatile Organic Compounds																				
Ethylbenzene[d]	µg/g		300	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.05	-	-	-
Toluene[d]	µg/g		250	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	-	-	-
Benzene[d]	µg/g		110	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.02	-	-	-
Xylenes (Total)[d]	µg/g		350	-	-	-	-	-	-	-	-	-	-	-	-	-	0.23	-	-	-
Extractable Hydrocarbons																				
F1 (C6-C10) surface[d,e]	µg/g		320	-	-	-	-	-	-	-	-	-	-	-	-	-	16	-	-	-
F2 (C10-C16) surface[d,e]	µg/g	410	260	*300*	100	*310*	130	*270*	160	*300*	*280*	140	*340*	190	160	*310*	550	230	510	130
F3 (C10-C16) surface[d,e]	µg/g		1700	70	40	70	40	50	30	70	40	30	80	40	30	40	150	40	60	20
F4 (C34-C50) surface[d,e]	µg/g		3300	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20

Bold Concentration greater than or equal to the recommended SQROs

Italics Concentration greater than or equal to the 2014 SQROs

Notes:

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d) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth). Stockpile samples are compared to surface guidelines.

e) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

Table 3: Stockpile Characterization Soil Samples

Location:				Pad-2-6							Pad-2-7				Pad-3-1	Pad-3-2			
Sample ID:				14739-C	15011-D	15012-D	15013-D	15014-C	15016-Q	15051-C	14735-C	15015-C	15057-C	15262-C	14956-C	14962-C	15206-D	15208-D	15210-D
Sample Date:				7/9/2014	7/24/2014	7/24/2014	7/24/2014	7/24/2014	duplicate of	8/10/2014	7/9/2014	7/24/2014	8/10/2014	8/24/2014	7/23/2014	7/24/2014	8/22/2014	8/22/2014	8/22/2014
Field Screen (ppm):				175	5	5	5	5	15014-C	-	50	35	-	25	25	100	25	25	20
Moisture				5.4	6.8	8.3	8.3	8	7.1	8.3	5.1	7.1	7.8	7.9	8.1	6.9	6.3	6.5	7.2
Exova File #				1414335	1415682	1415682	1415682	1415682	1415682	1417256	1414335	1415682	1417256	1418794	1415682	1415682	1418794	1418794	1418794
Parameter	Units	SQROs[a] SSRO[b]	SQROs[a] CCME[c]	Analytical Results															
Volatile Organic Compounds																			
Ethylbenzene[d]	µg/g		300	-	-	-	-	-	-	-	-	-	<0.05	-	-	-	-	-	-
Toluene[d]	µg/g		250	-	-	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-
Benzene[d]	µg/g		110	-	-	-	-	-	-	-	-	-	<0.02	-	-	-	-	-	-
Xylenes (Total)[d]	µg/g		350	-	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-	-
Extractable Hydrocarbons																			
F1 (C6-C10) surface[d,e]	µg/g		320	-	-	-	-	-	-	-	-	-	16	-	-	-	-	-	-
F2 (C10-C16) surface[d,e]	µg/g	410	260	**470**	***330***	***380***	***370***	***380***	***290***	**580**	***370***	***310***	**590**	**230**	**250**	**650**	***300***	**400**	**530**
F3 (C10-C16) surface[d,e]	µg/g		1700	70	40	50	40	40	40	130	80	40	170	20	<20	40	50	140	70
F4 (C34-C50) surface[d,e]	µg/g		3300	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20

Bold Concentration greater than or equal to the recommended SQROs

Italics Concentration greater than or equal to the 2014 SQROs

Notes:

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d) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth). Stockpile samples are compared to surface guidelines.

e) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

Table 3: Stockpile Characterization Soil Samples

Location:				Pad-3-2		Pad-3-3	Pad-3-4	Pad-4-1						Pad-4-2				Pad-4-3
Sample ID:				15259-C	15260-Q	14968-C	14974-C	15297-D	15299-C	15413-C	15404-D	15410-D	15418-C	15181-D	15182-D	15184-D	15111-C	15110-C
Sample Date:				8/22/2014	duplicate of	7/24/2014	7/24/2014	8/27/2014	8/27/2014	8/28/2014	8/28/2014	8/28/2014	8/28/2014	8/19/214	8/19/2014	8/19/2014	8/19/2014	8/18/2014
Field Screen (ppm):				20	15259-C	35	45	-	-	-	-	-	-	30	25	5	30	60
Moisture				7.3	7.1	7.4	8.6	8.4	6.3	7.5	6.8	6.4	6.6	6.8	7.3	7.3	7.1	6.2
Exova File #				1418794	1418794	1415682	1415682	1418825	1418825	1418825	1418825	1418825	1418825	1418794	1418794	1418794	1418794	1418794
Parameter	Units	SQROs[a]		Analytical Results														
		SSRO[b]	CCME[c]															
Volatile Organic Compounds																		
Ethylbenzene[d]	µg/g		300	-	-	-	-	-	-	-	-	-	-	<0.05	-	-	-	-
Toluene[d]	µg/g		250	-	-	-	-	-	-	-	-	-	-	<0.20	-	-	-	-
Benzene[d]	µg/g		110	-	-	-	-	-	-	-	-	-	-	<0.02	-	-	-	-
Xylenes (Total)[d]	µg/g		350	-	-	-	-	-	-	-	-	-	-	0.37	-	-	-	-
Extractable Hydrocarbons																		
F1 (C6-C10) surface[d,e]	µg/g		320	-		-	-	-	-	-	-	-	-	40	-	-	-	-
F2 (C10-C16) surface[d,e]	µg/g	410	260	240	**420**	200	230	**430**	***300***	***310***	***400***	250	**520**	**670**	**660**	**690**	**420**	***270***
F3 (C10-C16) surface[d,e]	µg/g		1700	40	90	<20	<20	30	20	20	<20	<20	60	70	120	110	40	20
F4 (C34-C50) surface[d,e]	µg/g		3300	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20

Bold Concentration greater than or equal to the recommended SQROs

Italics Concentration greater than or equal to the 2014 SQROs

Notes:

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c) Canadian Council of Ministers of the Environment (CCME) petroleum hydrocarbon soil quality guidelines for commercial land use. The site-specific exposure pathways used to determine the standards include: soil ingestion, soil contact and management limits.

d) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth). Stockpile samples are compared to surface guidelines.

e) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

Table 3: Stockpile Characterization Soil Samples

Location:				Pad-4-4		Pad-4-5	Pad-4-6
Sample ID:				15113-C	15261-C	15298-C	15400-C
Sample Date:				8/19/2014	8/22/2014	8/27/2014	8/28/2014
Field Screen (ppm):				5	25	-	-
Moisture				7.4	7.6	5.2	7.2
Exova File #				1418794	1418794	1418825	1418825
Parameter	Units	SQROs[a]		Analytical Results			
		SSRO[b]	CCME[c]				
Volatile Organic Compounds							
Ethylbenzene[d]	µg/g		300	-	-	<0.05	-
Toluene[d]	µg/g		250	-	-	<0.20	-
Benzene[d]	µg/g		110	-	-	0.02	-
Xylenes (Total)[d]	µg/g		350	-	-	0.40	-
Extractable Hydrocarbons							
F1 (C6-C10) surface[d,e]	µg/g		320	-	-	40	-
F2 (C10-C16) surface[d,e]	µg/g	410	260	*400*	*330*	20	250
F3 (C10-C16) surface[d,e]	µg/g		1700	50	40	<20	20
F4 (C34-C50) surface[d,e]	µg/g		3300	<20	<20	<20	<20

Bold Concentration greater than or equal to the recommended SQROs

Italics Concentration greater than or equal to the 2014 SQROs

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d) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth). Stockpile samples are compared to surface guidelines.

e) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

Table 4: In situ Remediation Confirmation Soil Samples

Location:				Excavation Limits of Area 1													
Sample ID:				14775-F-C	14776-W-C	14787-F-D	14789-F-D	14791-F-D	14792-F-C	14834-F-Q	14798-F-C	14804-F-C	14815-F-C	14816-W-D	14820-W-D	14827-W-C	14835-F-C	15130-W-D
Sample Date:				7/14/2014	7/14/2014	discrete for	discrete for	discrete for	7/15/2014	duplicate of	7/15/2014	7/15/2014	7/15/2014	discrete for	discrete for	7/15/2014	7/15/2014	discrete for
Sample Depth (m):				0.1-0.15	0.1-0.15	14792-F-C	14792-F-C	14792-F-C	0.1-0.15	14792-F-C	0.1-0.15	0.1-0.15	0.1-0.15	14821-W-C	14821-W-C	0.1-0.15	0.1-0.15	15134-W-C
Field Screen (ppm):				-	5	8	5	0	-	0	-	15	5	0	5	5	10	5
Moisture				6.4	5.8	7.8	5.3	7	7.8	7.5	6.6	6	7.2	8.3	9.4	8.9	9.2	7.1
Exova File #				1415011	1415011	1415011	1415011	1415011	1415011	1415011	1415015	1415015	1415015	1415015	1415015	1415015	1415015	1418794
Parameter	Units	SQROs[a] SSRO[b]	SQROs[a] CCME[c]	Analytical Results														
Volatile Organic Compounds																		
Ethylbenzene surface	µg/g		300	-	-	-	-	-	-	-	-	-	<0.05	-	-	-	<0.05	-
Ethylbenzene subsoil	µg/g		600															
Toluene surface	µg/g		250	-	-	-	-	-	-	-	-	-	<0.20	-	-	-	<0.20	-
Toluene subsoil	µg/g		500															
Benzene surface	µg/g		110	-	-	-	-	-	-	-	-	-	<0.02	-	-	-	<0.02	-
Benzene subsoil	µg/g		360															
Xylenes (Total) surface	µg/g		350	-	-	-	-	-	-	-	-	-	<0.16	-	-	-	<0.10	-
Xylenes (Total) subsoil	µg/g		700															
Extractable Hydrocarbons																		
F1 (C6-C10) surface[d,e]	µg/g		320	-	-	-	-	-	-	-	-	-	<10	-	-	-	<10	-
F1 (C6-C10) subsoil[d,e]	µg/g		700															
F2 (C10-C16) surface[d,e]	µg/g	410	260	10	<10	<10	<10	<10	<10	10	<10	30	10	60	60	<10	<10	<10
F2 (C10-C16) subsoil[d,e]	µg/g		1000															
F3 (C10-C16) surface[d,e]	µg/g		1700	<20	<20	<20	<20	<20	<20	<20	<20	<20	<10	<20	<20	<20	<20	<20
F3 (C16-C34) subsoil[d,e]	µg/g		3500															
F4 (C34-C50) surface[d,e]	µg/g		3300	<20	<20	<20	<20	<20	<20	<20	<20	<20	<10	<20	<20	<20	<20	<20
F4 (C34-C50) subsoil[d,e]	µg/g		10000															

Bold Concentration greater than or equal to the recommended SQROs

Italics Concentration greater than or equal to the 2014 SQROs

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d) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth).

e) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

Location:				Excavation Limits of Area 1									Excavation Limits of Area 2				
Sample ID:				15131-W-D	15132-W-D	15133-W-D	15134-W-C	15423-W-D	15424-W-D	15426-W-D	15427-W-C	15428-W-Q	15362-F-D	15364-F-D	15366-F-D	15378-F-D	15379-F-D
Sample Date:				discrete for	discrete for	discrete for	8/17/2014	discrete for	discrete for	discrete for	8/28/2014	duplicate of	8/28/2014	8/28/2014	discrete for	discrete for	discrete for
Sample Depth (m):				15134-W-C	15134-W-C	15134-W-C	0.1-0.15	15427-W-C	15427-W-C	15427-W-C	0.1-0.15	15426-W-D	0.1-0.15	0.1-0.15	15397-F-C	15397-F-C	15397-F-C
Field Screen (ppm):				5	15	10	15	-	-	-	-	-	-	-	-	-	-
Moisture				5.3	5.2	8.2	7.1	4.9	2.5	4.3	4.8	4.3	6.6	5.7	9.6	6.5	2.9
Exova File #				1418794	1418794	1418794	1418794	1418825	1418825	1418825	1418825	1418825	1418825	1418825	1418825	1418825	1418825
Parameter	Units	SQROs[a] SSRO[b]	SQROs[a] CCME[c]	Analytical Results													
Volatile Organic Compounds																	
Ethylbenzene surface	µg/g		300	-	-	-	-	-	-	-	-	-	<0.05	<0.05	0.07	<0.05	<0.05
Ethylbenzene subsoil	µg/g		600														
Toluene surface	µg/g		250	-	-	-	-	-	-	-	-	-	<0.20	<0.20	<0.20	<0.20	<0.20
Toluene subsoil	µg/g		500														
Benzene surface	µg/g		110	-	-	-	-	-	-	-	-	-	<0.02	<0.02	<0.02	<0.02	<0.02
Benzene subsoil	µg/g		360														
Xylenes (Total) surface	µg/g		350	-	-	-	-	-	-	-	-	-	0.38	0.35	0.62	0.25	0.16
Xylenes (Total) subsoil	µg/g		700														
Extractable Hydrocarbons																	
F1 (C6-C10) surface[d,e]	µg/g		320	-	-	-	-	-	-	-	-	-	<10	<10	20	<10	<10
F1 (C6-C10) subsoil[d,e]	µg/g		700														
F2 (C10-C16) surface[d,e]	µg/g	410	260	30	30	30	20	**1290**	50	**530**	230	**410**	90	60	***280***	160	60
F2 (C10-C16) subsoil[d,e]	µg/g		1000														
F3 (C10-C16) surface[d,e]	µg/g		1700	<20	<20	<20	<20	<20	<20	50	<20	40	<20	<20	30	<20	<20
F3 (C16-C34) subsoil[d,e]	µg/g		3500														
F4 (C34-C50) surface[d,e]	µg/g		3300	<20	<20	<20	<20	<20	<20	<20	<20	30	<20	<20	<20	<20	<20
F4 (C34-C50) subsoil[d,e]	µg/g		10000														

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d) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth).

e) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

Location:				Excavation Limits of Area 2												
Sample ID:				15384-F-D	15385-F-D	15397-F-C	15367-F-D	15368-F-D	15382-F-D	15383-F-D	15398-F-C	15369-F-D	15370-F-D	15373-F-D	15380-F-D	15381-F-D	15399-F-C
Sample Date:				discrete for	discrete for	8/28/2014	discrete for	discrete for	discrete for	discrete for	8/28/2014	discrete for	discrete for	discrete for	discrete for	discrete for	8/28/2014
Sample Depth (m):				15397-F-C	15397-F-C	0.1-0.15	15398-F-C	15398-F-C	15398-F-C	15398-F-C	0.1-0.15	15399-F-C	15399-F-C	15399-F-C	15399-F-C	15399-F-C	0.1-0.15
Field Screen (ppm):				-	-	-	-	-	-	-	-	-	-	-	-	-	-
Moisture				4.9	5.8	5.4	7.7	7.5	8.1	3.8	8.00	10.6	6.8	3.4	5.3	5.8	5.6
Exova File #				1418825	1418825	1418825	1418825	1418825	1418825	1418825	1418825	1418825	1418825	1418825	1418825	1418825	1418825
Parameter	Units	SQROs[a] SSRO[b]	SQROs[a] CCME[c]	Analytical Results													
Volatile Organic Compounds																	
Ethylbenzene surface	µg/g		300	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.1	<0.05	0.07	<0.05	<0.05
Ethylbenzene subsoil	µg/g		600														
Toluene surface	µg/g		250	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.3	<0.20	<0.20
Toluene subsoil	µg/g		500														
Benzene surface	µg/g		110	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.03	<0.02	0.03
Benzene subsoil	µg/g		360														
Xylenes (Total) surface	µg/g		350	1	0.45	0.54	0.26	0.18	0.58	0.54	0.37	0.43	0.95	0.33	0.86	0.25	0.41
Xylenes (Total) subsoil	µg/g		700														
Extractable Hydrocarbons																	
F1 (C6-C10) surface[d,e]	µg/g		320	20	20	<10	<10	<10	30	<10	30	20	20	<10	<10	<10	20
F1 (C6-C10) subsoil[d,e]	µg/g		700														
F2 (C10-C16) surface[d,e]	µg/g	410	260	20	150	110	200	160	**420**	<10	90	250	120	*400*	<10	40	80
F2 (C10-C16) subsoil[d,e]	µg/g		1000														
F3 (C10-C16) surface[d,e]	µg/g		1700	<20	<20	<20	<20	<20	60	<20	<20	30	<20	100	<20	<20	<20
F3 (C16-C34) subsoil[d,e]	µg/g		3500														
F4 (C34-C50) surface[d,e]	µg/g		3300	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
F4 (C34-C50) subsoil[d,e]	µg/g		10000														

Bold Concentration greater than or equal to the recommended SQROs

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d) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth).

e) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

Table 4: In situ Remediation Confirmation Soil Samples

Location:				Excavation Limits of Area 3											
Sample ID:				15387-W-D	15388-W-D	15390-W-D	15389-W-C	15429-W-D	15430-W-D	15431-W-D	15432-W-D	15433-W-D	15436-W-Q	15434-W-C	15435-W-C
Sample Date:				discrete for	discrete for	discrete for	8/28/2014	discrete for	discrete for	discrete for	discrete for	discrete for	duplicate of	8/28/2014	8/28/2014
Sample Depth (m):				15389-C	15389-C	15389-C	0.1-0.15	15434-W-C	15434-W-C	15434-W-C	15434-W-C	15434-W-C	15433-W-D	0.1-0.15	0.1-0.15
Field Screen (ppm):				-	-	-	-	-	-	-	-	-	-	-	-
Moisture				9.1	7.9	10.5	7.7	7.0	6.2	6.0	7.4	7.6	6.6	7.1	7.6
Exova File #				1418825	1418825	1418825	1418825	1418825	1418825	1418825	1418825	1418825	1418825	1418825	1418825
Parameter	Units	SQROs[a] SSRO[b]	SQROs[a] CCME[c]	Analytical Results											
Volatile Organic Compounds															
Ethylbenzene surface	µg/g		300	<0.05	0.15	<0.05	0.08	1	0.07	0.11	<0.05	0.18	0.1	0.23	<0.05
Ethylbenzene subsoil	µg/g		600												
Toluene surface	µg/g		250	<0.20	0.23	<0.20	<0.20	1.22	<0.20	0.28	<0.20	0.44	0.71	0.38	<0.20
Toluene subsoil	µg/g		500												
Benzene surface	µg/g		110	<0.02	<0.02	<0.02	<0.02	0.05	0.02	0.03	<0.02	0.04	0.09	0.05	<0.02
Benzene subsoil	µg/g		360												
Xylenes (Total) surface	µg/g		350	0.21	0.95	<0.14	0.41	9.1	0.67	1.15	0.22	1.21	0.97	3.97	<0.16
Xylenes (Total) subsoil	µg/g		700												
Extractable Hydrocarbons															
F1 (C6-C10) surface[d,e]	µg/g		320	<10	40	<10	30	**480**	20	60	20	<10	<10	180	10
F1 (C6-C10) subsoil[d,e]	µg/g		700												
F2 (C10-C16) surface[d,e]	µg/g	410	260	90	**420**	20	220	200	60	110	230	20	20	80	30
F2 (C10-C16) subsoil[d,e]	µg/g		1000												
F3 (C10-C16) surface[d,e]	µg/g		1700	<20	20	<20	20	<20	<20	<20	20	<20	<20	<20	<20
F3 (C16-C34) subsoil[d,e]	µg/g		3500												
F4 (C34-C50) surface[d,e]	µg/g		3300	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
F4 (C34-C50) subsoil[d,e]	µg/g		10000												

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d) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth).

e) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

Table 4: In situ Remediation Confirmation Soil Samples

Location:				Excavation Limits of Area 4										
Sample ID:				14422-F-C	14423-F-C	14424-F-C	14425-F-C	14426-W-C	14427-W-C	14429-W-C	14780-W-D	14781-W-D	14782-W-D	14785-W-C	14786-W-Q
Sample Date:				8/22/2013	8/22/2013	8/22/2013	8/22/2013	8/22/2013	8/22/2013	8/22/2013	discrete for	discrete for	discrete for	7/15/2014	duplicate of
Sample Depth (m):				1.6	1.6	1.6	1.6	1.2	1.2	1.2	14785-W-C	14785-W-C	14785-W-C	1.2	14785-W-C
Field Screen (ppm):				10	20	10	30	10	10	10	0	25	20	0	-
Moisture				8.2	10.6	27	9.5	5.6	6.7	5.9	7.7	5.6	7.6	8.3	8.3
Exova File #				1318569	1318569	1318569	1318569	1318569	1318569	1318569	1415011	1415011	1415011	1415011	1415011
Parameter	Units	SQROs[a] SSRO[b]	SQROs[a] CCME[c]	Analytical Results											
Volatile Organic Compounds															
Ethylbenzene surface	µg/g		300								-	-	-	-	-
Ethylbenzene subsoil	µg/g		600	-	-	-	-	-	-	-					
Toluene surface	µg/g		250								-	-	-	-	-
Toluene subsoil	µg/g		500	-	-	-	-	-	-	-					
Benzene surface	µg/g		110								-	-	-	-	-
Benzene subsoil	µg/g		360	-	-	-	-	-	-	-					
Xylenes (Total) surface	µg/g		350								-	-	-	-	-
Xylenes (Total) subsoil	µg/g		700	-	-	-	-	-	-	-					
Extractable Hydrocarbons															
F1 (C6-C10) surface[d,e]	µg/g		320								-	-	-	-	-
F1 (C6-C10) subsoil[d,e]	µg/g		700	-	-	-	-	-	-	-					
F2 (C10-C16) surface[d,e]	µg/g	410	260					20	240	<10	80	80	90	70	60
F2 (C10-C16) subsoil[d,e]	µg/g		1000	50	160	290	120								
F3 (C10-C16) surface[d,e]	µg/g		1700					<20	<20	<20	<20	<20	<20	<20	<20
F3 (C16-C34) subsoil[d,e]	µg/g		3500	40	140	<20	<20								
F4 (C34-C50) surface[d,e]	µg/g		3300					<20	<20	<20	<20	<20	<20	<20	<20
F4 (C34-C50) subsoil[d,e]	µg/g		10000	<20	<20	<20	<20								

Bold Concentration greater than or equal to the recommended SQROs

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d) Guidelines are dependant upon depth of sample (surface, subsoil >1.5m depth).

e) Guideline is dependant on medium grain size of soil analyzed (Fine <75 µm, Coarse >75 µm). Median grain size of soil sampled is coarse.

Table 5: Polycyclic Aromatic Hydrocarbon Samples Various Locations

		Location:	UTA-1-3	UTA-2-2	UTA-3-2	UTA-5-3	UTA-5-3	LTA-6-3	Pad-2-4	Pad-2-7	Pad-4-5	Area 3
		Sample ID:	14860-C	15038-C	15039-C	15060-C	15066-D	14837-C	15045-C	15057-C	15298-C	15429-W-D
		Sample Date:	7/16/2014	8/10/2014	8/10/2014	8/10/2014	8/10/2014	7/15/2014	8/10/2014	8/10/2014	8/27/2014	8/28/2014
		Moisture :	8.5	10.1	8.2	6.8	7.3	7.4	9.2	7.8	5.2	7
		Exova File #:	1415011	1417256	1417256	1417256	1417256	1415011	1417256	1417256	1418825	1418825
PARAMETER	UNITS	SQROs CCME CL										
Polycyclic Aromatic Hydrocarbons												
1-methylnaphthalene	ug/g	-	3.32	0.20	0.2	1.04	1.75	0.16	0.34	0.35	0.08	1.32
2-methylnaphthalene	ug/g	-	3.19	0.27	0.29	1.17	2.47	0.27	0.44	0.44	0.11	2.47
Acenaphthene	ug/g	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Acenaphthylene	ug/g	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Anthracene	ug/g	32	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(a)anthracene	ug/g	10[b]	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(a)pyrene	ug/g	72	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(b)fluoranthene	ug/g	10[b]	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(g,h,i)perylene	ug/g	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(k)fluoranthene	ug/g	10[b]	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Chrysene	ug/g	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Dibenzo(a,h)anthracene	ug/g	10[b]	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Fluoranthene	ug/g	180	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Fluorene	ug/g	-	0.12	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	ug/g	10	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Naphthalene	ug/g	22[c]	0.76	0.17	0.09	0.42	0.92	0.11	0.18	0.2	<0.05	1.39
Phenanthrene	ug/g	50[b,c]	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Pyrene	ug/g	100[b]	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Bold *Concentration greater than or equal to the CCME soil guideline for commercial (CL) land use.*

Notes:
"<" = Less than analytical method detection limit.
"-" = Analysis not conducted, or no guideline.

a) Canadian Environmental Quality Guidelines (CEQG). The site-specific factors used for determining the soil quality guideline include: soil ingestion, soil contact and nutrient cycling. The human health guidelines based on carcinogenic effects of PAHs were not calculated.
b) Guideline is an interim remediation criteria and are considered generally protective of human and environmental health. Guideline based on the CCME soil protocol has not yet been developed.
c) The 2010 CEQG for PAHs states that where surface water impact is not a concern, it is recommended to revert to the 1997 provisional SQGE for naphthalene and the 1991 Interim Soil Quality Criteria for phenanthrene.

Table 6: Quality Assurance and Quality Control Soil Samples

Location:				LTA-4-4				LTA-6-3				UTA-1-3			
Sample Parent:				15266-C				14693-C				14860-C			
Duplicate ID:				15243-D	15244-D	15244-D	15267-Q	14680-D	14682-D	14683-D	14684-Q	14848-D	14850-D	14852-D	14861-Q
Parameter	Units	MRL	PQL												
PHC Fraction 1				Analytical Results											
Sample Result	µg/g	10	50	20	20	20	20	90	90	90	90	110	110	110	110
Duplicate Result	µg/g	10	50	20	30	20	30	160	100	110	100	-	-	-	-
RpD	%			na	na	na	na	56%	11%	20%	11%	na	na	na	na
PHC Fraction 2															
Sample Result	µg/g	10	50	410	410	410	410	10	10	10	10	570	570	570	570
Duplicate Result	µg/g	10	50	910	600	450	560	70	220	<10	40	560	600	1120	730
RpD	%			76%	38%	9%	31%	na	na	na	na	2%	5%	65%	25%
PHC Fraction 3															
Sample Result	µg/g	20	100	30	30	30	30	<20	<20	<20	<20	40	40	40	40
Duplicate Result	µg/g	20	100	170	130	60	130	<20	<20	<20	<20	20	50	80	40
RpD	%			na	na	na	na	na	na	na	na	na	na	na	na
PHC Fraction 4															
Sample Result	µg/g	20	100	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Duplicate Result	µg/g	20	100	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
RpD	%			na	na	na	na	na	na	na	na	na	na	na	na

Bold RpD value is greater than or equal to 40% and the concentrations of both samples are greater than the PQL.

Notes:

na *RpD value is not applicable because one or both results are less than the PQL.*

RpD *Relative Percent Difference = (Difference/Average)*100.*

PQL *Practical Quantitation Limit = 5 * Method Reporting Limit (MRL)*

MRL *Method Reporting Limit*

Table 6: Quality Assurance and Quality Control Soil Samples

Location:				UTA-3-2								Area 1 Floor			
Sample Parent:				14661-C				15354-C				14792-C			
Duplicate ID:				14636-D	14637-D	14638-D	14662-Q	15320-D	15320-D	15320-D	15355-Q	14787-D	14789-D	14791-D	14834-Q
Parameter	Units	MRL	PQL	Analytical Results											
PHC Fraction 1															
Sample Result	µg/g	10	50	20	20	20	20	20	20	20	20	-	-	-	-
Duplicate Result	µg/g	10	50	30	30	30	-	20	20	40	<10	-	-	-	-
RpD	%			na	na	na	na	na	na	na	na	na	na	na	na
PHC Fraction 2															
Sample Result	µg/g	10	50	310	310	310	310	190	190	190	190	<10	<10	<10	<10
Duplicate Result	µg/g	10	50	450	650	570	440	220	250	490	380	<10	<10	<10	10
RpD	%			37%	71%	59%	35%	15%	27%	88%	67%	na	na	na	na
PHC Fraction 3															
Sample Result	µg/g	20	100	20	20	20	20	20	20	20	20	<20	<20	<20	<20
Duplicate Result	µg/g	20	100	40	<20	<20	<20	40	60	110	50	<20	<20	<20	<20
RpD	%			na	na	na	na	na	na	na	na	na	na	na	na
PHC Fraction 4															
Sample Result	µg/g	20	100	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Duplicate Result	µg/g	20	100	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
RpD	%			na	na	na	na	na	na	na	na	na	na	na	na

Bold RpD value is greater than or equal to 40% and the concentrations of both samples are greater than the PQL.

Notes:

na *RpD value is not applicable because one or both results are less than the PQL.*

RpD *Relative Percent Difference = (Difference/Average)*100.*

PQL *Practical Quantitation Limit = 5 * Method Reporting Limit (MRL)*

MRL *Method Reporting Limit*

Table 6: Quality Assurance and Quality Control Soil Samples

Location:				Area 1 Wall								Area 2 Floor			
Sample Parent:				14821-C				15427-C			15426-D	15397-C			
Duplicate ID:				14816-D	14818-D	14820-D	14836-Q	15423-D	15424-D	15426-D	15428-Q	15366-D	15378-D	15379-D	15384-D
Parameter	Units	MRL	PQL	Analytical Results											
PHC Fraction 1															
Sample Result	µg/g	10	50	-	-	-	-	-	-	-	-	<10	<10	<10	<10
Duplicate Result	µg/g	10	50	-	-	-	-	-	-	-	-	20	<10	<10	20
RpD	%			na	na	na	na	na	na	na	na	na	na	na	na
PHC Fraction 2															
Sample Result	µg/g	10	50	330	330	330	330	230	230	230	530	110	110	110	110
Duplicate Result	µg/g	10	50	60	620	60	880	1290	50	530	410	280	160	60	20
RpD	%			138%	61%	138%	91%	139%	na	79%	26%	87%	37%	59%	na
PHC Fraction 3															
Sample Result	µg/g	20	100	<20	<20	<20	<20	<20	<20	<20	50	<20	<20	<20	<20
Duplicate Result	µg/g	20	100	<20	30	<20	<20	<20	<20	50	40	30	<20	<20	<20
RpD	%			na	na	na	na	na	na	na	na	na	na	na	na
PHC Fraction 4															
Sample Result	µg/g	20	100	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Duplicate Result	µg/g	20	100	<20	<20	<20	<20	<20	<20	<20	30	<20	<20	<20	<20
RpD	%			na	na	na	na	na	na	na	na	na	na	na	na

Bold RpD value is greater than or equal to 40% and the concentrations of both samples are greater than the PQL.

Notes:

na *RpD value is not applicable because one or both results are less than the PQL.*

RpD *Relative Percent Difference = (Difference/Average)*100.*

PQL *Practical Quantitation Limit = 5 * Method Reporting Limit (MRL)*

MRL *Method Reporting Limit*

Table 6: Quality Assurance and Quality Control Soil Samples

Location:				Area 2 Floor											
Sample Parent:				15397-C	15398-C					15399-C					
Duplicate ID:				15385-D	15367-D	15368-D	15375-D	15382-D	15383-D	15369-D	15370-D	15373-D	15380-D	15381-D
Parameter	Units	MRL	PQL	Analytical Results											
PHC Fraction 1															
Sample Result	µg/g	10	50	<10	30	30	30	30	30	20	20	20	20	20
Duplicate Result	µg/g	10	50	20	<10	<10	20	30	<10	20	20	<10	<10	<10
RpD	%			na	na	na	na	na	na	na	na	na	na	na
PHC Fraction 2															
Sample Result	µg/g	10	50	110	220	220	220	220	220	80	80	80	80	80
Duplicate Result	µg/g	10	50	150	200	160	240	420	<10	250	120	400	<10	40
RpD	%			31%	10%	32%	9%	63%	na	103%	40%	133%	na	na
PHC Fraction 3															
Sample Result	µg/g	20	100	<20	20	20	20	20	20	<20	<20	<20	<20	<20
Duplicate Result	µg/g	20	100	<20	20	<10	<20	60	<20	30	<20	100	<10	<10
RpD	%			na	na	na	na	na	na	na	na	na	na	na
PHC Fraction 4															
Sample Result	µg/g	20	100	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Duplicate Result	µg/g	20	100	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
RpD	%			na	na	na	na	na	na	na	na	na	na	na

Bold RpD value is greater than or equal to 40% and the concentrations of both samples are greater than the P

Notes:

na *RpD value is not applicable because one or both results are less than the PQL.*

RpD *Relative Percent Difference = (Difference/Average)*100.*

PQL *Practical Quantitation Limit = 5 * Method Reporting Limit (MRL)*

MRL *Method Reporting Limit*

Table 6: Quality Assurance and Quality Control Soil Samples

Location:				A3 Wall									A4 Wall			
Sample Parent:				15389-C			15433-C						14785-W-C			
Duplicate ID:				15387-D	15387-D	15387-D	15429-D	15430-D	15431-D	15432-D	15433-D	15436-Q	14781-D	14782-D	14785-D	14786-Q
Parameter	Units	MRL	PQL	Analytical Results												
PHC Fraction 1																
Sample Result	µg/g	10	50	30	30	30	180	180	180	180	180	<10	-	-	-	-
Duplicate Result	µg/g	10	50	<10	40	<10	480	20	60	20	<10	<10	-	-	-	-
RpD	%			na	na	na	91%	na	100%	na	na	na	na	na	na	na
PHC Fraction 2																
Sample Result	µg/g	10	50	220	220	220	80	80	80	80	80	20	70	70	70	70
Duplicate Result	µg/g	10	50	90	420	20	200	60	110	230	20	20	80	90	70	60
RpD	%			84%	63%	na	86%	29%	32%	97%	na	na	13%	25%	0%	15%
PHC Fraction 3																
Sample Result	µg/g	20	100	20	20	20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Duplicate Result	µg/g	20	100	<20	20	<20	<20	<20	<20	20	<20	<20	<20	<20	<20	<20
RpD	%			na	na	na	na	na	na	na	na	na	na	na	na	na
PHC Fraction 4																
Sample Result	µg/g	20	100	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Duplicate Result	µg/g	20	100	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
RpD	%			na	na	na	na	na	na	na	na	na	na	na	na	na

Bold RpD value is greater than or equal to 40% and the concentrations of both samples are greater than the PQL.

Notes:

na *RpD value is not applicable because one or both results are less than the PQL.*

RpD *Relative Percent Difference = (Difference/Average)*100.*

PQL *Practical Quantitation Limit = 5 * Method Reporting Limit (MRL)*

MRL *Method Reporting Limit*

Table 6: Quality Assurance and Quality Control Soil Samples

Location:				Pad-2-6				Pad-3-2				Pad-4-2			
Sample Parent:				15014-C				15259-C				15111-C			
Duplicate ID:				15011-D	15012-D	15013-D	15016-Q	15206-D	15208-D	15210-D	15260-Q	15181-D	15182-D	15184-D	15112-Q
Parameter	Units	MRL	PQL	Analytical Results											
PHC Fraction 1															
Sample Result	µg/g	10	50	-	-	-	-	-	-	-	-	-	-	-	-
Duplicate Result	µg/g	10	50	-	-	-	-	-	-	-	-	40	-	-	-
RpD	%			na	na	na	na	na	na	na	na	na	na	na	na
PHC Fraction 2															
Sample Result	µg/g	10	50	380	380	380	380	240	240	240	240	420	420	420	420
Duplicate Result	µg/g	10	50	330	380	370	290	300	400	530	420	670	660	690	630
RpD	%			14%	0%	3%	27%	22%	50%	75%	55%	46%	44%	49%	40%
PHC Fraction 3															
Sample Result	µg/g	20	100	40	40	40	40	40	40	40	40	40	40	40	40
Duplicate Result	µg/g	20	100	40	50	40	40	50	140	70	90	70	120	110	50
RpD	%			na	na	na	na	na	na	na	na	na	na	na	na
PHC Fraction 4															
Sample Result	µg/g	20	100	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Duplicate Result	µg/g	20	100	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
RpD	%			na	na	na	na	na	na	na	na	na	na	na	na

Bold RpD value is greater than or equal to 40% and the concentrations of both samples are greater than the PQL.

Notes:

na *RpD value is not applicable because one or both results are less than the PQL.*

RpD *Relative Percent Difference = (Difference/Average)*100.*

PQL *Practical Quantitation Limit = 5 * Method Reporting Limit (MRL)*

MRL *Method Reporting Limit*

Appendix A: Photographic Record

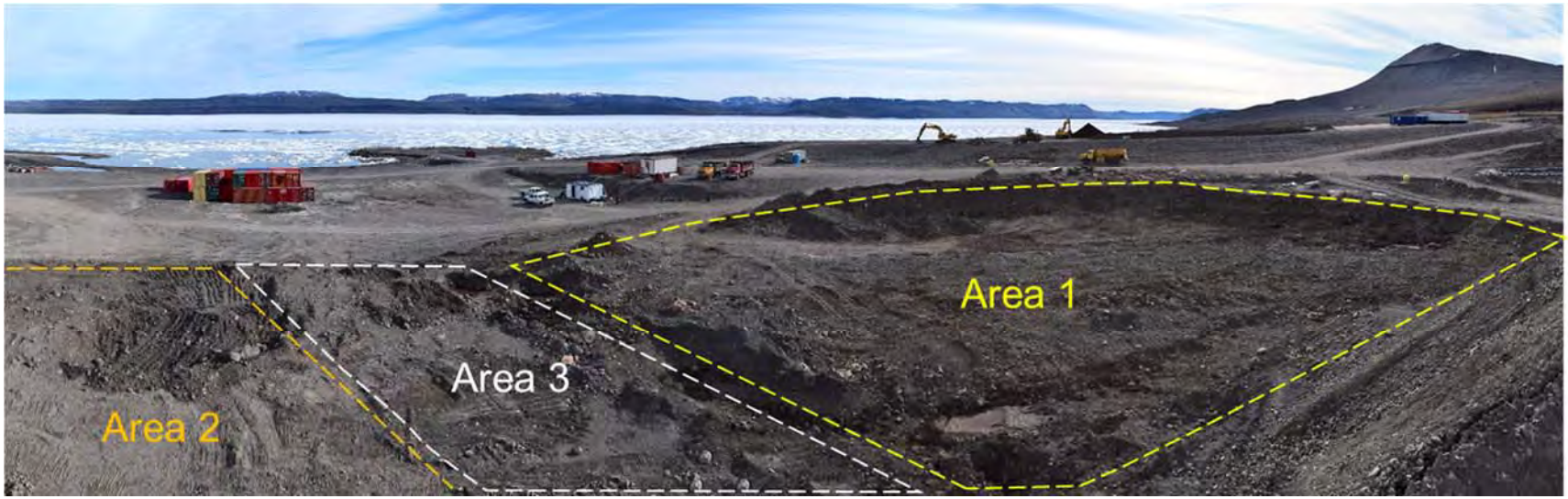

Photo 1: Excavation area photo stitch showing Areas 1, 2, and 3 (July 9, 2014).

Photo 2: Area 1 excavation photo stitch showing East and South Walls and Floor (July 9, 2014).

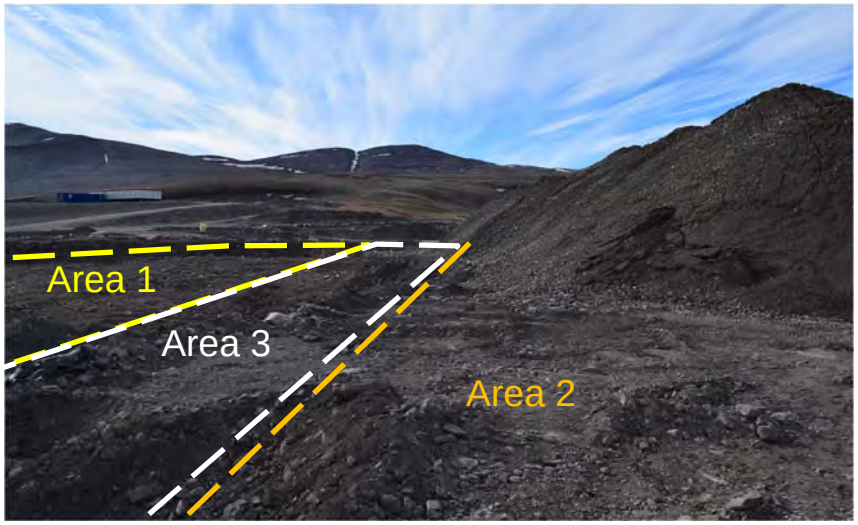

Photo 3: Excavation area photo showing Areas 1, 2 and 3 (July 9, 2014).

Photo 4: Relocating the stockpile from Area 2 to the concrete pad (August 14, 2014).

Photo 5: Base of stockpile on Area 2 (August 23, 2014).

Photo 6: Waste concrete being placed in Area 4 (July 12, 2014).

Photo 7: Relocation of remediated soil to the former secondary containment area.

Photo 8: Coarse rock stockpile and unscreened soil stockpile in the north laydown yard.

Photo 9: Contaminated soil management on concrete pad (August 15, 2014).

Photo 10: Soil management at the south side of the concrete pad.

Photo 11: Upper Treatment Area.

Photo 12: Lower Treatment Area

Photo 13: Aeration of biopile.

Photo 14: Nutrient amendment application process.

Photo 15: Vegetation plots were constructed within a moist area in the Upper Treatment Area in early July.

Photo 16: Vegetation Plot VPL (July 11, 2014).

Photo 17: Vegetation Plot VPL (July 16, 2014).

Photo 18: Vegetation Plot VMP (July 11, 2014).

Photo 19: Vegetation Plot VMP (July 16, 2014).

Photo 20: Vegetation Plot VMH (July 11, 2014).

Photo 21: Vegetation Plot VMH (July 16, 2014).