MGM Energy Corporation – 2015 Environmental Site Monitoring Report

Site Umiak N-16 Sump

March 2016

Prepared for:
MGM Energy Corporation
Calgary, Alberta

Prepared by:
KAVIK-STANTEC Inc.
Inuvik, NWT

Project Number: 123511463

KAVIK-STANTEC


KAVIK-STANTEC

Executive Summary

The Umiak N-16 remote drilling sump (N-16 sump) is located on Richards Island in the Inuvialuit Settlement Region of the Northwest Territories, approximately 120 km north from Inuvik. EnCana Corporation (EnCana) constructed the N-16 sump, which is approximately 20 m wide, 60 m long and 5.4 m deep, during the 2004 operating season. Drilling wastes related to the Umiak N-16 drilling program were disposed of in this sump. In 2007, ownership of the Umiak N-16 assets was transferred from EnCana to MGM Energy Corporation (MGM). The N-16 sump was operated under Northwest Territories Water Board (currently the Inuvialuit Water Board) Water License N7L1-1797 (NWTWB 2003) and Indian and Northern Affairs Canada (INAC) (currently the Government of the Northwest Territories Department of Lands) Land Use Permit N2003A0035 (INAC 2004).

Previous observations of the site have noted the following:

- The 2014 monitoring noted good vegetation cover with grasses predominating on the sump. Natural ice-wedge polygon features were also observed.
- The Government of the Northwest Territories (GNWT) Department of Lands inspector stated that the sump had good slope for drainage and vegetation. The Inspector also noted that polygons at the base of the sump had water in them.
- Elevated conductivity values were observed during the Electromagnetic Survey conducted in 2014.

KAVIK-STANTEC Inc. (KAVIK-STANTEC) was retained by MGM in 2015 to conduct environmental monitoring of the N-16 sump. Two site visits were conducted during the summer of 2015: one overall observation and one detailed sump monitoring. The overall observation was conducted on July 11, 2015 with a crew of two KAVIK- STANTEC personnel and a wildlife monitor. An MGM representative was present for the July 11th site visit to carry out wellhead monitoring and maintenance. The detailed sump monitoring was conducted on August 18, 2015 with a crew of two KAVIK- STANTEC personnel and a wildlife monitor. The following observations were made regarding the N-16 sump during the time of the site visits:

- PVC tubing, thermistor cables and metal protective casings that used to host the data loggers are still present at the sump site. The thermistor cables currently present at the N-16 sump were observed to be in poor condition and assumed to be unrepairable. No other structures, wastes or spills were observed.
- The sump cap was observed to be in good overall condition. No visual evidence of recent surface erosion, stress or new tension cracks on the sump cap or along the perimeter of the sump cap was observed.
- No conditions that warranted soil sampling were observed (GNWT inspection results from 2014 indicated that restoration of the sump site was acceptable).
- Water ponding above ice-wedges was observed at several locations in contact with the perimeter of the sump. Although no major signs of melting were observed, ground subsidence and/or active tension cracks were noted along the ice-wedges.

- Ponded water was observed. Two water samples had pH values below the CCME guideline, including the control sample. The control sample had a pH of 5.7 and was considered to be common for the poorly drained organic soils found at the site. The sample taken from the area of affected vegetation in a low depression, below the ridge-line south of the sump, had a pH value of 3.3. Elevated electrical conductivity (EC), chloride and potassium values were present in four samples taken from ponded water accumulating in ice-wedge troughs found along the perimeter of the sump.
- The ponded water in contact with the perimeter of the sump displayed a distinctive sheen as well as some minor foam, but the sheen was found not to be of petrogenic origin. It is unclear as to what is causing the sheen. However, laboratory results indicate that surface water samples collected at this site had the highest concentrations of total dissolved solids (TDS) of all the samples collected.
- Vegetation cover (primarily of native grasses which were applied in previous reclamation treatments) is approximately 95%, which is sufficient to stabilize the sump cap and meets Land Use Permit N2003A0035 (INAC 2004) requirements. No invasive plant species were observed at the time of monitoring.
- Birds (including ptarmigan and gulls) were observed on and adjacent to the N-16 sump. No signs of nesting were observed on the sump and surrounding area. An inactive fox den was also observed on the top of the sump at the northeast end.

No remediation and reclamation activities are recommended in 2016; however continued site monitoring is recommended to monitor soil and water salinity concentrations in impacted areas north and south of the sump, verify the re-establishment of vegetation species into areas where vegetation was observed to be potentially affected from salinity, and monitor the stability of the various ice-wedges located in contact with the perimeter of the sump cap.

Table of Contents

List of Tables

Appendices

Abbreviations

BTEX	benzene, toluene, ethylbenzene and xylene
CCME	Canadian Council of the Ministers of the Environment
CEQG	Canadian Environmental Quality Guidelines
cm	centimetre
CSQG	Canadian Soil Quality Guidelines
CWQG	Canadian Water Quality Guidelines
CWS	Canada-Wide Standards
EC	electrical conductivity
EM	electromagnetic survey
EnCana	EnCana Corporation
ERT	electrical resistivity tomography
GNWT	Government of the Northwest Territories
GPR	ground penetrating radar
GPS	global positioning system
INAC	Indian and Northern Affairs Canada
ISR	Inuvialuit Settlement Region
KAVIK-STANTEC	KAVIK-STANTEC Inc.
KCl	potassium chloride
km	kilometre
m	metre
m^2	square metre
MAXXAM	MAXXAM Analytics Laboratory
MGM	MGM Energy Corporation
N-16 sump	Umiak N-16 remote drilling sump
NEB	National Energy Board
NWT	Northwest Territories
NWTWB	Northwest Territories Water Board
PHC	Petroleum Hydrocarbon
Priddis	Priddis Environmental Solutions Ltd.
QA/QC	quality assurance/quality control
RDL	reported detection limit
TDS	total dissolved solids

1 INTRODUCTION

1.1 Background

The Umiak N-16 remote drilling sump (N-16 sump) is located on Richards Island in the Inuvialuit Settlement Region (ISR) of Northwest Territories (NWT) (69° 25' 53.096" N - 134° 19' 6.016" W) approximately 120 km north from Inuvik (Appendix A, Figure 1). EnCana Corporation (EnCana) constructed the N-16 sump, which is approximately 20 m wide, 60 m long and 5.4 m deep, during the 2004 operating season. Drilling wastes related to the Umiak N-16 drilling program (N-16 wellsite) were disposed of in this sump. In 2007, ownership of the Umiak N-16 assets and sump was transferred from EnCana to MGM Energy Corporation (MGM).

1.1.1 Previous Activities and Observations

Table 1-1 provides a summary of the key activities and observations for the I-25 sump as documented in the Priddis Environmental Solutions Ltd. (Priddis) report titled *Environmental Inspection Report: Umiak N-16 Sump* (Priddis 2014) as well as government agencies and past consulting firm monitoring programs.

KAVIK-STANTEC has been involved in monitoring the N-16 sump since the inception of the monitoring program after the closure of the sump in 2004; however KAVIK-STANTEC was not involved in the field activities conducted in the summer of 2014.

Table 1-1 Summary of Activities and Observations for the Umiak N-16 Sump

Agency	Information Summary
Priddis Environmental Solutions Ltd. (2014)	• Environmental monitoring was carried out. No waste or debris was noted, but natural ice-wedge polygon features observed. The monitoring noted good vegetation cover with grasses predominating on the sump.
Government of the Northwest Territories (GNWT) - Department of Lands - Inspection Report (2014)	• An environmental inspection was carried out. The inspection stated that the sump had good slope for drainage and vegetation. It was noted that polygons at the base of the sump had water in them. Restoration activities were rated as acceptable.

Worley Parsons Canada Services Ltd (2014)	• Three types of geophysical surveys: Electromagnetic Survey (EM); electrical resistivity tomography (ERT); and ground penetrating radar (GPR).
	  • Elevated conductivity values noted south of the ridgeline, as well as north and south of the ridge line
	  • The 2013 EM38 results show a larger elevated conductivity zone than the 2014 EM38 data
	  • GPR data successfully delineated the edge of the sump cap

1.1.2 2015 Scope of Work

KAVIK-STANTEC Inc. (KAVIK-STANTEC) was retained by MGM in 2015 to conduct environmental monitoring of the N-16 sump. The scope of the 2015 program consisted of the following activities:

- Observation of conditions at the sump
- Measurement of active-layer depths on the sump cap, along the perimeter of the sump cap and in an undisturbed control area
- Soil and water sample collection (if required)
- Laboratory analysis and interpretation
- Preparation of a report outlining key observations and recommendations for future remediation and reclamation.

1.2 Permitting Requirements

1.2.1 Site Monitoring

The Umiak N-16 drilling sump was operated under Northwest Territories Water Board (currently the Inuvialuit Water Board) Water License N7L1-1797 (NWTWB 2003) and Indian and Northern Affairs Canada (INAC) (currently the Government of the Northwest Territories Department of Lands) Land Use Permit N2003A0035 (INAC20 04). Annual reporting of site conditions is submitted to the Inuvialuit Water Board.

As part of Water Board License N7L1-1797, EnCana was required to monitor the N-16 sump for a minimum period of five years. This is the sixth subsequent monitoring year after the conclusion of the required five-year monitoring program as per Part H - *Conditions Applying to Abandonment and Restoration of the Northwest Territories Water Board Licence N7L1-1797* (NWTWB 2003) issued for the Umiak N-16 Drilling Program.

1.2.2 Soil Quality

REGULATORY FRAMEWORK

In April 2014, the Government of the Northwest Territories (GNWT) assumed the responsibility for the regulation of oil and gas activities within the NWT. The National Energy Board (NEB) remains the regulator of oil and gas activities within the ISR; however, legislation and regulations are to remain in effect for a period of 20 years post-devolution (GNWT 2013).

For parameters and media where territorial criteria do not exist, KAVIK-STANTEC presented criteria from other jurisdictions for comparison. In previous monitoring programs, KAVIK-STANTEC applied criteria from various jurisdictions for other programs where no applicable territorial criteria exist, and has obtained regulatory acceptance.

The Canadian Council of the Ministers of the Environment (CCME) *Canadian Environmental Quality Guidelines* (CEQG) are nationally-endorsed, scientifically-based criteria for the quality of atmospheric, aquatic and terrestrial ecosystems (CCME 1999a). The CEQG integrates national environmental quality guidelines for soil under *the Canadian Soil Quality Guidelines* (CSQG) which are risk based guidelines and typically used as a preliminary means of evaluating soil.

CSQG were developed considering land use; with different guidelines available for agricultural, residential/parkland, commercial and industrial lands uses. Based on the current and future uses of the site, KAVIK-STANTEC has compared the analytical results to the parkland guidelines. In addition to land use, the guidelines for some parameters differentiate between soil grain size (i.e., coarse versus fine grained) and depth.

The CCME Canada Wide Standards for Petroleum Hydrocarbons in Soil (PHC CWS) were established as a remedial standard for contaminated soil and subsoil in four land use categories (CCME 2008). The land use category most applicable to the site is residential/parkland. Tier 1 levels are generic criteria and are used when accepting the base assumptions and parameters in the Tier-1 exposure scenario (CCME 2008). One exposure scenario for PHC fractions F1 and F2 considers protection of potable groundwater. However, given the remoteness of the site, groundwater is considered an unlikely potable water source, and therefore this pathway was excluded. The most applicable pathway for the site was determined to be ecological soil contact as this pathway considers invertebrates and plants as receptors (CCME 2008).

In 2001, the Government of Alberta issued the *Salt Contamination Assessment and Remediation Guidelines* to address the concerns related to releases of salt, which are associated with sites where oil and gas production has occurred (similar to the N-16 sump) (AENV 2001). The guidelines applying to a given site are dependent on the land use and sample depth. The unrestricted land use guidelines are considered applicable to the site.

1.2.3 Surface Water Quality

REGULATORY FRAMEWORK

KAVIK-STANTEC evaluated surface water analytical results using the CCME *Canadian Water Quality Guidelines for the Protection of Aquatic Life* (CCME 1999b). The CWQG apply Canada-wide, are risk-based, and are typically used as a preliminary means of evaluating surface water quality results. These guidelines are not regulatory criteria or limits and, consequently, any guideline comparisons in this document are provided for context only. Guidelines protective of aquatic habitats were used in evaluating concentrations of potential contaminants in ponded water. Only limited conclusions can be made concerning the environmental quality of ponded water, which is a temporary feature with limited surface area and volume.

2 METHODS

2.1 Site Monitoring

Two separate site visits were conducted at the N-16 sump site during the summer of 2015: one for an overall lease observation and the other to conduct detailed sump monitoring. The site was accessed each time via helicopter from Inuvik, NWT. An aerial, visual reconnaissance of the site was also completed in the helicopter during both site visits.

The overall observation (Appendix A, Figure 2) was conducted on July 11, 2015 with a crew of two KAVIK- STANTEC personnel and a wildlife monitor. An MGM representative was present for the July 11th site visit to carry out carry wellhead monitoring and maintenance. The detailed sump monitoring was conducted on August 18, 2015 with a crew of two KAVIK- STANTEC personnel and a wildlife monitor.

Field monitoring of the wellsite was carried out following the Northern Land Use Guidelines (INAC 2003) as well as The Protocol for the Monitoring of Drilling Waste Disposal Sumps, Inuvialuit Settlement Region, Northwest Territories (NWTWB 2006). The site monitoring program reported the status of the following items:

- Presence of surface wastes (i.e. fuel/lubricant containers, lumber, plastics, scrap metal, etc.)
- Presence of surface spills
- Condition of permafrost
- Presence of surface water
- Vegetation establishment, cover and condition
- Invasive plant (weed) presence
- Wildlife signs or use at site
- Soil conditions (physical and chemical) (i.e., physical signs of erosion, surficial staining, salt crusts)
- Erosion or drainage issues
- Erosion control methods in place and effectiveness.

The site visit also documented areas that required further assessment, remediation, or reclamation.

Once on the ground, the monitoring team traversed within the lease boundary (Appendix A, Figure 2) to visually assess for the above listed features and observe the conditions of the drilling operation disturbances, including the wellsite. Monitoring observations were recorded on field forms, sampling site locations were recorded with global positioning system (GPS), and site photographs taken (Appendix B, Photos 1 to 11). Conditions related to the overall reclamation of the site were assessed, measured and documented on field forms; these methods are detailed in Section 2.5.

The lease was also visually assessed for evidence of potential surface contamination. Observations that could indicate potential contamination included sheen on the surface of ponded water, crust formation on exposed soil surfaces, discolored vegetation, lack of vegetation, and discolored soil surfaces (e.g. staining). If areas of potential contamination were observed in 2015, in previous site visits conducted on behalf of MGM, or by GNWT Department of Lands inspectors, soil and/or surface water samples were collected for laboratory analysis (see Appendix C for sampling methods). Potential contaminants of concern for the site include, but are not limited to:

- Drilling fluids and muds that were previously used on the site (e.g., potassium chloride)
- Petroleum hydrocarbons that could have been released from machinery used at the site during site operations (e.g., diesel fuel)
- Barite used as drilling mud weighting material, and
- Salts for stripping the drilling muds (e.g., calcium nitrate).

2.2 Terrain and Permafrost

The presence of permafrost and periglacial-related features (e.g., the presence of frost heave, thaw settlement, slumping) was also observed and recorded. Active-layer depths were recorded to characterize the layer of soil that is subject to seasonal thawing. Additional details are provided below.

2.2.1 Active-layer Measurements

One of the parameters measured to characterize local permafrost ground condition is the thickness of the active layer. The active layer is defined as the near surface region of soil or organic material subject to annual freezing and thawing. Generally, active layer thickness varies in response to air temperature, snow cover, summer rainfall, soil characteristics, and vegetation (Nelson et al. 1998). It is also influenced by differential thermal conductivity, ground moisture content and meteorological events (Romanovsky and Osterkamp 1995).

Using a specially designed probe, active-layer depths were measured during the August 18, 2015 site visit. Measurements were taken on the sump cap, around the sump perimeter and along a control transect located in undisturbed terrain 100 m east from the sump.

2.3 Soil

The N-16 sump was observed for potential soil contamination as described in Section 2.1. In general during the site visits, if the soil observed on the lease appeared stained, contained white crusting or contained stressed vegetation, soil samples would have been collected. The number of samples collected at a particular site was site-dependent, as were the depth intervals. Soil samples were also collected depending on previous field work; for instance, if contaminated soil remained on the site from 2014, then samples would have been collected.

2.4 Surface Water

The N-16 sump was observed for potential issues related to ponded water as described in Section 2.1. In general, during site visits, if ponded water was observed on the site, and had a sheen that appeared non-biogenic, or the ponded water was located in an area where there were potential contaminants of concern (as outlined in Section 2.1), a sample would have been collected. If a surface sheen was observed, then a stick test would have been performed. A stick is used to break up the sheen in order to determine if it is biogenic or petrogenic (DEC 2015). If the sheen does not recoalesce after being broken up, the sheen is likely not related to a petroleum hydrocarbon effect, but more likely due to natural biodegradation processes in the water (DEC 2015).

In addition, the *Protocol for the Management of Drilling-Waste Disposal Sumps* (NWTWB 2006) requires sampling and routine salinity analysis if there is water ponding within 50 m of the sump cap.

2.5 Reclamation Assessment

The reclamation assessment recorded the following visual data for the N-16 sump:

- Physiographic and vegetation features
- The current condition of vegetation
- The presence of invasive plant species
- Wildlife use of the site
- The assessment of any erosion issues or the condition of any installed erosion control structures.

Table D-1 (Appendix D) provides a summary of the reclamation assessment methods used for assessment of the site features, and Figure 2 (Appendix A) illustrates the area observed.

2.6 Remediation Assessment

KAVIK-STANTEC developed a decision tree to assist in identifying appropriate remediation recommendations. Inputs included parameter concentrations from laboratory testing (if available) and site observations, as well as previous activities completed at the site. The decision tree can be found in Appendix F.

3 ENVIRONMENTAL SETTING AND RESULTS

3.1 Site Monitoring

The Umiak N-16 sump was monitored on July 11 and August 18, 2015. Detailed below are the observations and results of the two site visits. Site figures are provided as Figures 1 and 2 (Appendix A). Aerial photographs showing current site conditions are provided as Photos 1 and 2 (Appendix B).

3.1.1 On-Site Structures, Wastes, and/or Spills

PVC tubing, thermistor cables and metal protective casings that use to host the data loggers were observed at the sump site (Appendix B, Photo 8). Four thermistors were originally installed at the site in 2004 to monitor thermal characteristics within the sump and at an undisturbed area (control location) surrounding the sump. During the August 18, 2015 site visit, it was discovered that the thermistors had been forcefully removed from the data loggers, with some of the connectors torn from the thermistor strings. Local wildlife is assumed to be responsible for the damaged equipment. As a result, no data could be retrieved from these data loggers either at the time of the assessment or once the data loggers were removed from the site. Data on Thermistor 1728 has not been able to be retrieved since 2008 due to an unknown data logger malfunction.

No other structures, materials, or wastes were observed at the site.

3.2 Terrain and Permafrost

The N-16 sump is located on the north central portion of Richards Island in undulating terrain approximately 10 km west from the Mackenzie Delta's East Channel (Appendix A, Figure 1). The area is part of the Kittigazuit Low Hills, a physiographic subdivision of the Tuktoyaktuk Coastland Ecoregion characterized by deeply inset lakes with moderately steep slopes on adjacent well drained ridges. Thin surface till deposits are found capping brown fine-grained sand, which form most hill and ridges (Rampton 1988).

The N-16 sump is located within the continuous permafrost zone (Heginbottom et al. 1995). The N-16 sump was constructed in an area where freeze-thaw action is common and a series of well-developed ice-wedge polygons exist in the topographical low areas immediately north and south of the sump cap. These high-centered polygons commonly range in size from 5 m to 15 m and are estimated to reach depth of about 3.0 m to 5.0 m. A schematic figure of ice-wedges forming a network of polygons is provided in Figure 5 (Appendix A). A review of available aerial imagery for the site suggests that several ice-wedges were either fully or partially excavated during the construction of the sump. Portions of remaining ice-wedges present along the perimeter of the sump were partly covered by soil used to cap the sump.

SUMP CONDITIONS

Drilling wastes generated from the exploratory well were disposed in the N-16 sump. A schematic figure of a drilling mud sump is provided in Figure 6 (Appendix A). The surface of the sump was observed to be flat to gently undulating with less than a 2% slope; while the slopes marking the perimeter of the sump range from approximately 20% to 60%. The exact depth of the sump is unknown. The sump cap itself appeared stable with no visual signs of erosion and/or evidence of subsidence or settling. The slope marking the perimeter of the sump also appeared stable, with no new visual signs of soil erosion and or ground subsidence.

3.2.1 Active-layer Measurements

A total of 25 measurements were taken on the top of the sump cap, 32 around the perimeter of the sump cap, and 10 were taken along a control transect located in undisturbed terrain adjacent to the sump. Active-layer depths on the sump cap ranged from 88 cm to 120 cm and averaged 103 cm. Active-layer depths around the perimeter of the sump cap ranged from 32 cm to 106 cm and averaged 58 cm. Active-layer depths measured along the control transect ranged from 34 cm to 44 cm and averaged 38 cm.

Figure 4 (Appendix A) shows the location and value of each individual measurement. Maximum, minimum and average active-layer measurements taken in 2015 are summarized in Table D-2 (Appendix D). Note that the active-layer data represents active-layer depths specific to August 18, 2015 and may not indicate the maximum active-layer depths which may be obtained during the year (generally occurring in the fall).

3.3 Soils

Soils in the Richards Island Coastal Plain Low Arctic North Ecoregion are generally Turbic Cryosols associated with weakly to moderately calcareous fine loamy glacial till, marine clays and fine loamy alluvial soils (ECG 2012). At the N-16 sump, the material found at the surface of the sump cap consists mainly of silt with gravel (Appendix B, Photo 9). There were areas on top of the sump on the south side that were relatively sandy (Appendix B, Photo 10). The undisturbed area off the sump is covered by peat and mainly underlain by a wet grey silty material. There were some small (less than 1.0 m^2) bare areas on the sump, but the surface of the sump was mainly covered in grass and other vegetation.

Soil sampling, water sampling and an electromagnetic (EM) survey had been conducted in 2012 (KAVIK-STANTEC 2012). Soil and water samples were collected from an area south of the sump where stressed vegetation and high apparent conductivities in the EM38 survey were observed (KAVIK-STANTEC 2012). The water and soil results indicated that levels of potassium and chloride appeared to be elevated within this area, suggesting that the sump could be the cause of these high values, given the historical use of potassium based drilling fluids (KAVIK-STANTEC 2012).

At the time of both site visits, no conditions that warranted sampling were observed (e.g., observations of the soil contamination criteria outlined in Section 2.1); therefore soil samples were not collected and laboratory analysis was not conducted.

3.4 Surface Water

A total of eight water samples were collected at the N-16 sump during the August 18, 2015 monitoring (no water samples were collected in July). Six samples were taken from ponded water accumulating in ice-wedge troughs found along the perimeter of the sump (samples N16-15-01 to N16-15-06), one sample was taken from the area of effected vegetation in a low depression, below the ridge-line, south of the sump (samples N16-15-07) and one control sample was taken from an area located 100 m east from the sump (sample N16-15-08). See Figure 3 (Appendix A) for the location of the samples collected. A summary of the water analysis results is presented in Table D-3, Appendix D; complete laboratory results are located in Appendix E.

Two of the water samples (including the control sample) returned pH values outside of the CCME guideline. The control sample (N16-15-08) also had a pH less than the CCME guideline at 5.7. This pH is considered to be common for the type of soils found at the site (i.e., poorly drained organic). Sample N-16-15-07, however, had a pH reading of 3.3.

Results from samples taken around the perimeter of the sump returned elevated EC values. Those samples were taken from flooded ice-wedges located along both the north and south perimeter of the sump. Water sampled at four of the six locations characterized by ponding water immediately surrounding the sump perimeter had chloride levels above control values. Elevated EC, chloride and potassium values were present in four of the seven samples; with the most affected areas corresponding to sample N16-15-04 and N16-15-07.

During the time of the site visit, the ponded water in contact with the perimeter of the sump had a distinctive sheen as well as some minor foam (Appendix B, Photo 7). A stick test was conducted to assess the potential presence of petroleum hydrocarbon. The test was negative indicating that the sheen was not of petrogenic origin. However, it is unclear as to what is causing the sheen. Sheen from natural biodegradation or plant and organic water is common in the area but the distinctive grayish-brown color of the sheen observed at the site appear different when compared to other sheens at nearby sites. Sample N16-15-04 was collected from ponded water displaying this distinctive sheen. Laboratory results indicate the most elevated level of total dissolved solids (TDS) of all samples taken at the site. TDS includes inorganic salts (principally calcium, magnesium, potassium, sodium, bicarbonates, chlorides, and sulfates) and some small amounts of organic matter that are dissolved in water. The TDS concentration of sample N16-15-04 was 3,300 mg/L, nearly 100 times higher than the control sample N16-15-08 at 35 mg/L.

3.4.1 Drainage

Site visit observations found the surface of the sump to be well drained (i.e. the water is removed from the soil readily but not rapidly[1]); however the drainage of the surrounding terrain ranges from imperfect to poor.

Water ponding above ice-wedges (i.e., within narrow linear depressions commonly referred as ice-wedge troughs or polygon cracks) was observed at several locations in contact with the perimeter of the sump (Appendix B, Photos 6 and 7). Some of the depressions correspond to a single ice-wedge, while others correspond to the contact between two or three ice-wedges. The width, length and depth of the ice-wedge troughs are variable and the amount of ponding water appear directly related to the topographic position of each gully (note that some of the ice-wedges have no water). The presence of ponding water above some ice-wedges was reported in previous monitoring reports. Although no major visual signs of melting, ground subsidence and/or active tension cracks were observed along the ice-wedges during the 2015 site visits; some progressive deepening of some of the ice wedges troughs in contact with the perimeter of the sump could be occurring (i.e. there are no monitoring systems or topographic benchmarks in place).

3.5 Reclamation Assessment

3.5.1 Vegetation Establishment

Vegetation at the N-16 sump was observed to consist primarily of native grasses which were applied in previous reclamation treatments (MGM 2007; Priddis 2014) and a minor component of native forbs and shrubs. The sump capping material consists of a silty sand material which is supporting good vegetation establishment and growth. Vegetation cover at the sump, consisting of vegetation foliage and plant litter, is approximately 95% (Appendix B, Photos 3 to 5). The grass species observed growing on the sump included tufted hairgrass (*Deschampsia caespitosa*), creeping red fescue (*Festuca rubra*), rocky mountain fescue (*Festuca saximontana*), alpine bluegrass (*Poa alpina*) and bluegrass (*Poa sp*.). Trace amounts of native shrub and forb species observed in the sump vegetation monitoring plots included alpine bearberry (*Arctostaphylos alpina*), broad leaved willowherb (*Epilobium latifolium*), small bog cranberry (*Oxycoccus microcarpus*), cloudberry (*Rubus chamaemorus)*, net veined willow (*Salix reticulata),*and willows (*Salix sp.*)

Vegetation in the undisturbed terrain surrounding the N-16 sump consisted of native vegetation species typically found in the Richards Island Coastal Plain Lan Ecoregion (ECG 2012). Species observed included dwarf birch (*Betula glandulosa*), crowberry (*Empetrum nigrum*), cottongrass (*Eriophorum sp*.), narrow leaved Labrador tea (*Ledum palustre*), small bog cranberry (*Oxycoccus microcarpus*), net veined willow (*Salix reticulata),* willows (*Salix sp.*), and mosses. Vegetation cover in the undisturbed area was approximately 95%.

[1] Soil Drainage Classes, Agriculture and Agri-Food Canada http://sis.agr.gc.ca/cansis/nsdb/soil/v2/snt/drainage.html

Table D-4 (Appendix D) summarizes the vegetation coverage found in the sump vegetation monitoring plots; Table D-5 (Appendix D) lists the plant species composition in the monitoring plots.

3.5.2 Vegetation Health/Condition

Overall, vegetation health and condition was considered good at the surface of the N-16 sump cap as well as along the perimeter of the sump. There was no visual evidence of affected vegetation and plant foliage was green and robust. On the N-16 sump that underwent reclamation treatments, the site did have a large accumulation of leaf/stem litter from previous years' grass plant growth (Appendix B, Photos 1 to 5).

The condition of the affected vegetation in the depression area below the ridge-line, south of the sump, has appeared to not have changed, and the size of the affected vegetation area did not appear to have increased since 2011. The area has been correlated with the highest elevated apparent conductivities in historical EM38 surveys and confirmed through laboratory analysis.

3.5.3 Invasive Plant Species

No invasive plant species were observed in the N-16 sump at the time of the 2015 site visits.

3.5.4 Wildlife

Birds were observed on and adjacent to the N-16 sump. Species observed included ptarmigan (*Lagopus sp.*) and gulls (*Laridae sp.*). No signs of nesting were observed on the sump and surrounding area. A fox (*Vulpes sp*.) den was observed on the top of the sump at the northeast end; it did not appear to be an actively used den (Appendix B, Photo 11).

3.5.5 On-Site Erosion Issues and Erosion Control Measures

No erosion issues were observed on the N-16 sump at the time of the site visits. The overall terrain was observed to be flat, with only the perimeter of the sump cap being characterized by moderate to steep slopes (approximately 20% to 60%). The ground surface appears stable and at the time of the 2015 monitoring and there was no visual evidence of surface erosion such as sheet erosion, deflation erosion, rilling, gully formation, ground thermal contraction or slumping.

4 DISCUSSION

4.1 Site Monitoring

4.1.1 On-Site Structures, Wastes and/or Spills

The thermistor cables currently present at the N-16 sump are in poor condition and assumed to be unrepairable.

The PVC tubing and the steel pipes supporting the protective casings are frozen in the permafrost. Removing them would require digging down to the base of the active-layer (approximately 70 cm) and cutting up the uppermost section of the pipes (three in total). The lower portions of the PVC tubing and steel pipes would remain on site. Very minor to no ground disturbance will be generated by removing the equipment.

4.1.2 Terrain and Permafrost

4.1.2.1 Sump Cap and Perimeter

Visual assessment of the N-16 sump observed that the sump cap appears to be in good overall condition. No physical evidence of recent surface erosion, stress or new large tension cracks of the sump or along the slope marking the perimeter of the sump cap was observed.

Both aerial and ground observations show that the sump was excavated in an area characterized by the presence of well-developed ice-wedge polygons. The presence of ice-rich permafrost at close proximity to the ground surface makes the local terrain highly susceptible to thaw degradation, especially following ground disturbance. The stability, growth or decay of an ice-wedge is related to numerous factors. Recent changes in the local site conditions (e.g., ground topography, soil moisture, vegetation conditions, snow accumulation, etc.) have the potential to affect the local thermal regime and therefore affect the stability of an ice-wedge.

An important factor that may affect the stability of the terrain immediately surrounding the N-16 sump is the increase of the active-layer depth around the perimeter of the sump. An increase in local active-layer depth would translate into further melting of ground ice found at near surface. The melting of the upper portion of some of the ice-wedges could lead to the progressive deepening of the ice-wedge troughs, which may affect the integrity of the sump.

4.1.2.2 Active-Layer Measurements

Results from the 2014 geophysical investigation conducted at the N-16 sump indicate that the sump cap material is approximately 0.7 m to 1.0 m thick, and thins toward the edges 2014 (Worley Parsons 2015). Review of historical active-layer data available for the N-16 sump shows annual average thaw depth

varies between 1.0 cm and 28 cm. The average thaw depth at the surface of the sump cap reduced to 103 cm in 2015 from an average of 114 cm for 2011 and 2012; however the average active-layer depth increased 3.0 cm to 7.0 cm compared to 2011 and 2012. It is predicted that this variability is a result of:

- Site-specific factors affecting active-layer depth (e.g. air temperature, snow cover, summer rainfall, soil characteristics, vegetation, etc.);
- Seasonal variations and the timing of the survey; and
- The number of active-layer measurements and the specific location of each measurement.

A potential deepening of the active-layer at the surface of the sump is not considered problematic, provided that the maximum seasonal thawing depth does not reach the upper limit of the drilling fluid currently kept frozen within the center of the sump. No information is provided on the actual depth of the drilling fluid; however, based on typical drilling sump design (KAVIK-AXYS 2004), the thickness of the frozen freeboard (i.e., native soils found between the frozen sump fluids and the sump cap) is between 4.0 m and 5.0 m.

4.1.3 Soil

At the time of both site visits, no conditions that warranted sampling were observed (e.g., observations of the soil contamination criteria outlined in Section 2.1). Previous soil sample results did show elevated saline conditions south of the sump, which could have been due to effects from the sump. The monitoring results from 2014 indicated that restoration of the sump site was acceptable (GNWT 2014). Further soil sampling in 2016 could indicate whether saline conditions have decreased from natural attenuation processes.

4.1.4 Surface Water

Results from the 2015 surface water sampling program are consistent with results from previous water sampling programs (KAVIK-AXYS, 2009, 2010, 2012, KAVIK-STANTEC 2011, 2012, 2013) and indicate that the areas with the higher ECs, located both north and south of the sump, were likely the result of a migration of ions from drilling fluid. The key indicator for the presence of sump-impacted water outside the sump perimeter is the presence of potassium chloride (KCl) in some of the water samples. The exact nature of the materials contained in the N-16 sump is not documented, but typically the constituents of brine-based drilling mud are potassium chloride, bentonite, cellulose polymers, lignosulphonates and sodium hydroxide (Piteau Engineering Ltd., 1988; Kokelj and GeoNorth, 2002).

Review of surface water laboratory data available for the site indicates that the potassium concentration measured from the affected area located south from the sump have peaked in 2009 and 2010 (at over 2,000 mg/L), then decreased in 2011 (~1,000 mg/L) and 2012 (~800 mg/L). Although still higher than in the control sample (i.e., N16-15-08 at 0.3 mg/L), the potassium concentration measured in 2015 south from the sump has continued to decrease (currently 490 mg/L). Fewer water samples were taken over the years to characterize surface water accumulating along the northern perimeter of the sump; however,

comparison of available data suggest an increased concentration of potassium at the location of sample N16-15-04 (~50 mg/L in 2006 and 2007; 7.5 mg/L in 2010; 150 mg/L in 2011; 600 mg/L in 2015).

The elevated concentrations of potassium and chloride in the N-16 sump annual water samples do suggest some effect from the material contained within the sump; confirmation is recommended. Annual variation in potassium and chloride concentrations can nevertheless be influenced by a host of factors, including variations in sampling locations and fluctuations in the amount of surface water issued from recent precipitations, etc. based on:

- The overall physical settings of the sump
- The presence of flooded ice-wedges or water-saturated depressions in contact with the perimeter of the sumps; and
- The locations of water samples with elevated potassium chloride values.

It is predicted that seepage of sump-effected water has occurred somewhere through the ice-wedge troughs. Although the scenario of ice-wedge degradation and seepage of sump-impacted water is likely, there is no visual evidence supporting the theory that the sump is leaking, or that drilling waste and associated ions are migrating to the areas surrounding the sump.

4.1.5 Vegetation

Vegetation growing on the N-16 sump was observed to be dominated by a dense stand of grasses growing throughout the site; the grass cover is well established and in good condition and can be considered sufficient. The vegetation species are predominantly native grasses applied in previous reclamation treatments; the plants have put on significant growth since vegetation surveys began in 2007 (MGM 2007), and growth appears to be self-sustaining.

The vegetation cover on the sump area also contains a significant proportion of grass leaf/stem litter build up throughout the site; estimated to be approximately 35%. This leaf/stem litter build up from previous years' growth appeared to be partially obstructing the current year's grass growth; however, it is providing benefits by adding biomass material to the sump capping thereby contributing to soil development and providing coverage of the sump capping surface for erosion control.

The presence of stressed and/or dead vegetation away from the sump has been previously noted and investigated at the site. Impacted vegetation present south of the sump, below the ridge-line is still present and does not appear to have improved since our last visit in the 2013. The area has typically been correlated with the highest elevated apparent conductivities in historical EM38 surveys and correlated through laboratory analysis. Results from the vegetation survey conducted in the summer of 2013 indicate that the species most affected are moss, black crowberry and tussock cottongrass (KAVIK-STANTEC 2014); based on field observations in July 2015, the aforementioned species were still present in the impacted area. Although no obvious visual improvements in vegetation health was noted in the area, the presence of non-affected species within the impacted zone tend to indicates that the vegetation should re-establish over time with a successional community of adjacent native species.

4.1.6 Wildlife

The N-16 sump appears to have limited wildlife use; two birds were observed in the site and a fox den was present, however no signs of recent den use were observed. In addition, at the time of the site visit there were no visual signs of use by ungulates such as hoof prints, droppings, grazed vegetation, or bare areas caused by wallowing or rutting.

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 On-Site Structures, Wastes and/or Spills

Remains from four thermistor cables are present at the site and are assumed to be unrepairable. The presence of the equipment on site is not anticipated to pose concern to the stability of the sump or to the local wildlife. If not replaced, it is recommended to remove the remaining ground temperature equipment that is presently on site (i.e. the top portion of the thermistor cables and PVC tubing, steel pipe supporting the data logger and the metal protective casings).

At the time of the site visits, there were no observed wastes or spills at the site. As such no further treatments in 2016 are recommended.

5.2 Subsidence and Erosion

The sump cap itself appeared stable with visual no signs of surface erosion and/or evidences of subsidence or settling. The slope marking the perimeter of the sump also appeared stable, with no visual signs of surface soil erosion and or ground subsidence.

Water ponding above ice-wedges was observed at several locations in contact with the perimeter of the sump. Continued site monitoring in 2016 is recommended to observe the stability of the various ice-wedges located in contact with the perimeter of the sump cap, and to further assess the potential migration of sump-impacted water primarily north of the sump.

5.3 Remediation

Based on KAVIK-STANTEC's remediation/reclamation treatments decision tree (Appendix F), and site observations, no remediation work is required at the N-16 sump in 2016. Vegetation growth on the site was higher than the required reclamation objective of 70% and meets the restoration requirements in Land Use Permit N2003A0035 (INAC 2004).However, continued monitoring is recommended; more specifically, monitoring with respect to the cause of elevated salinity measurements. Additional soil and water sampling extended north and south of the sump is also recommended to determine if salinity issues have naturally attenuated.

5.4 Reclamation

Based on KAVIK-STANTEC's remediation/reclamation treatments decision tree (Appendix F), no further reclamation treatments are recommended for the N-16 sump in 2016. Vegetation growth on the site was higher than the required reclamation objective of 70% and meets the restoration requirements in Land Use Permit N2003A0035 (INAC 2004). However, vegetation monitoring is recommended to continue in 2016 on the sump to monitor the effects of plant litter build up on the grass cover and natural establishment of native plants.

5.5 Possibility for Site Closure in 2016

No further remediation and reclamation activities are required in 2016; however, Site closure for the N-16 sump is not recommended in 2016.Continued site monitoring is recommended to monitor soil and water salinity concentrations in impacted areas north and south of the sump, verify the re-establishment of vegetation species into areas where vegetation was observed to be potentially affected from salinity and monitor the stability of the various ice-wedges located in contact with the perimeter of the sump cap.

Recommendations for future monitoring activities at the N-16 sump are as follows:

- Observe the conditions of the sump surface including observations of ponding, settling, subsidence, tension cracks, vegetation health, etc. Special attention to be paid to describe the areas north of the sump where ponding water was observed and south of the sump where the vegetation was observed to be potentially affected from salinity.
- Measure active-layer depths on the sump cap, along the perimeter of the sump cap and in an undisturbed control area.
- Soil and water sampling in the impacted vegetation areas north and south of the sump.
- Water sampling of surface water ponding on, or directly adjacent to the sump cap, as well as areas where the degradation of ice-wedges could potentially cause the seepage of drilling fluids.
- Considerations should be made to remove the remaining monitoring equipment located on-site (i.e., thermistor cable tubing and data logger casings).

6 CLOSURE AND LIMITATIONS

This monitoring report documents work that was performed in accordance with generally accepted professional standards at the time and location in which the services were provided. No other representations, warranties or guarantees are made concerning the accuracy or completeness of the data or conclusions contained within this report, including no assurance that this work has uncovered all potential liabilities associated with the identified property.

This monitoring report provides an evaluation of environmental conditions associated with the property that was assessed at the time the work was conducted and is based on information obtained by and/or provided to KAVIK-STANTEC at that time. There are no assurances regarding the accuracy and completeness of this information. All information received from the client or third parties in the preparation of this report has been assumed by KAVIK-STANTEC to be correct. KAVIK-STANTEC assumes no responsibility for any deficiency or inaccuracy in information received from others.

The opinions in this monitoring report can only be relied upon as they relate to the condition of the identified property that was assessed at the time the work was conducted. Activities at the property subsequent to KAVIK-STANTEC's assessment may have significantly altered the property's condition which KAVIK-STANTEC cannot comment on, or provide opinions. KAVIK-STANTEC cannot comment on other areas outside of the property that were not assessed, and were not part of the project's scope of work.

Conclusions made within this report consist of KAVIK-STANTEC's professional opinion as of the time of the writing of this report, and are based solely on the scope of work described in the report, the limited data available and the results of the work. This report should not be construed as legal advice.

This report has been prepared for the exclusive use of the client identified herein and any use by any third party is prohibited. KAVIK-STANTEC assumes no responsibility for losses, damages, liabilities or claims, howsoever arising, from third party use of this report.

The locations of any surface or sub-surface structures and property boundaries illustrated in or described within this report are not guaranteed. Before starting work, the exact location of all such structures should be confirmed and KAVIK-STANTEC assumes no liability for damage to them.

The conclusions are based on the site conditions encountered by KAVIK-STANTEC at the time the work was performed at the specific soil and water sampling and vegetation monitoring locations, and conditions may vary among sampling/monitoring locations. Factors such as areas of potential concern identified in previous studies, site conditions and cost may have constrained the sampling/monitoring locations used in this assessment. In addition, analysis has been carried out for only a limited number of chemical parameters, and it should not be inferred that other chemical species are not present. Due to the nature of the investigation and the limited data available, KAVIK-STANTEC does not warrant against undiscovered environmental liabilities nor that the sampling / monitoring results are indicative of the condition of the entire site. Since the purpose of this monitoring report is to assess if the reclamation

objectives outlined in the land use permit and/or water licence have been met and assess the stability of the sites; the identification of non-environmental risks to structures or people on the site is beyond the scope of this assessment.

Should additional information become available which differs significantly from our understanding of conditions presented in this report, KAVIK-STANTEC specifically disclaims any responsibility to update the conclusions in this report.

This report entitled was prepared by KAVIK-STANTEC. We trust this meets with your current requirements. Please feel free to contact the undersigned if you have any questions.

Respectfully Submitted,

KAVIK-STANTEC INC.

REGISTERED PROFESSIONAL GEOSCIENTIST
R.H. GUTHRIE
LICENSEE
NTNU
JAN 14 2016

Richard Guthrie, MSc, PhD, PGeo
Senior Principal, Geohazards and Geomorphology

Signing on behalf of sections related to terrain, permafrost conditions, erosion and erosion control.

BRITISH COLUMBIA INSTITUTE OF AGROLOGISTS
1857
Sara Duncan
P.Ag.
Jan. 15, 2016

Sara Duncan, M.Sc., P.Ag.
Environmental Scientist

Signing on behalf of sections related to soil, reclamation and remediation.

7 REFERENCES

AENV (Alberta Environment). 2001. Salt Contamination Assessment and Remediation Guidelines. Environmental Sciences Division, Pub No. T/606, May 2001

CCME (Canadian Council of Ministers of the Environment). 1999a. Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health. Canadian Council of Ministers of the Environment, Winnipeg. Retrieved from: http://st-ts.ccme.ca/en/index.html

CCME. 1999b. Canadian water quality guidelines for the protection of aquatic life: as updated in the online summary accessed September 2011. Canadian Council of Ministers of the Environment, Winnipeg.

CCME. 2008. Canada-Wide Standards for Petroleum Hydrocarbons in Soil. Retrieved from: http://www.ccme.ca/files/Resources/csm/phc_cws/phc_standard_1.0_e.pdf.

DEC (Alaska Department of Environmental Conservation). 2015. Listing Methodology for Determining Water Quality Impairments from Petroleum Hydrocarbons, Oils and Grease – Guidance. Public Notice Draft. Division of Water.

Dyke, L.D. 2001. Contaminant migration through the permafrost active-layer, Mackenzie Delta Area, Northwest Territories, Canada. Polar Record, 37 (202) pp. 215-228

ECG (Ecosystem Classification Group). 2012. Ecological Regions of the Northwest Territories – Southern Arctic. Department of Environment and Natural Resources, Government of the Northwest Territories, Yellowknife, NWT, Canada. x + 170 pp. + insert map.

GNWT – Department of Lands. Umiak Sump. Environmental Inspection Report. 2014.

Government of Northwest Territories (GNWT). 2013. Northwest Territories Lands and Resources Devolution Agreement. June 25, 2013.

Heginbottom, J.A., M.A. Dubreuil and P.A. Harker. 1995. Canada - Permafrost, in: National Atlas of Canada, 5th Edition, National Atlas Information Service, Natural Resources Canada, MCR 4177

INAC (Indian and Northern Affairs Canada). 2004. Land Use Permit N2003A0035

INAC. 2003. Northern Land Use Guidelines. Ministry of Indian Affairs and Northern Development. Ottawa, ON. Catalogue No. R2-226/2003-1E. ISBN 0-662-32738-1

KAVIK-AXYS (KAVIK-AXYS Inc.). 2004. EnCana Corporation Umiak 2004/2005 N-05 Drilling Program – Project Description submitted to the Inuvialuit Environmental Impact Screening Committee Inuvik, Northwest Territories.

KAVIK-AXYS. 2009. 2009 Umiak N-16 Annual Sump Monitoring Report. Submitted to the Northwest Territories Water Board Under Water License N7L1-1797. Calgary, Alberta.

KAVIK-AXYS. 2010. Umiak N-16 2010 Annual Sump Monitoring Report. Submitted to the Northwest Territories Water Board Under Water License N7L1-1797. Calgary, Alberta.

KAVIK-STANTEC (KAVIK-STANTEC Inc.). 2011. Umiak N-16 2011 Annual Sump Monitoring Report. Submitted to the Northwest Territories Water Board Under Water License N7L1-1797. Calgary, Alberta.

KAVIK-STANTEC. 2012. Umiak N-16 2012 Annual Sump Monitoring Report. For Submission to the Northwest Territories Water Board Under License N7L1-1797. Prepared for: MGM Energy Corp. November, 2012.

KAVIK-STANTEC. 2013. Umiak N-16 2012 Annual Sump Monitoring Report. For Submission to the Northwest Territories Water Board Under License N7L1-1797. Prepared for: MGM Energy Corp. January, 2013.

KAVIK-STANTEC. 2014. Umiak N-16 2013 Sump Monitoring Data Interpretation Report completed by Kavik-Stantec

Kokelj, S.V., and GeoNorth Limited. 2002. Drilling mud sumps in the Mackenzie Delta region: Construction, abandonment and past performance. Yellowknife, Northwest Territories: Water Resources Division, Indian and Northern Affairs Canada.

MGM (MGM Energy Corp.). 2007. Umiak N16 Annual Sump Monitoring Report. Submitted to the Northwest Territories Water Board Under Water License N7L1-1797. Prepared for: Northwest Territories Water Board Yellowknife, Northwest Territories. Prepared by: MGM Energy Corp.. November 2007.

Nelson, F.E., Hinkel K.M., Shiklomanov N.I., Muller G.R., Miller L.L. and D.A. Walker. 1998. Active-layer thickness in north-central Alaska: systematic sampling, scale and spatial autocorrelation. Journal of Geophysical Research 103: 28963-28973.

NWTWB (Northwest Territories Water Board). 2003. *Water License Type 'B' N7L1-1797.* Yellowknife, Northwest Territories.

NWTWB. 2006. *Protocol for the Monitoring of Drilling-Waste Disposal Sumps*. Yellowknife, Northwest Territories.

Piteau (Piteau Engineering Ltd.). 1988. Environmental Studies No 62: Groundwater Resources Protection From Drilling Waste, Northwest Territories and Yukon. Prepared for Water Resources Division, Natural Resources and Economic Development Branch, DIAND. 93p. ISBN 0-662-17183-7

Priddis (Priddis Environmental Solutions Ltd.). 2014. Environmental Inspection Report: Umiak N-16 Sump- 2014 Delta Program. Prepared for: MGM Energy Corp. December 2014.

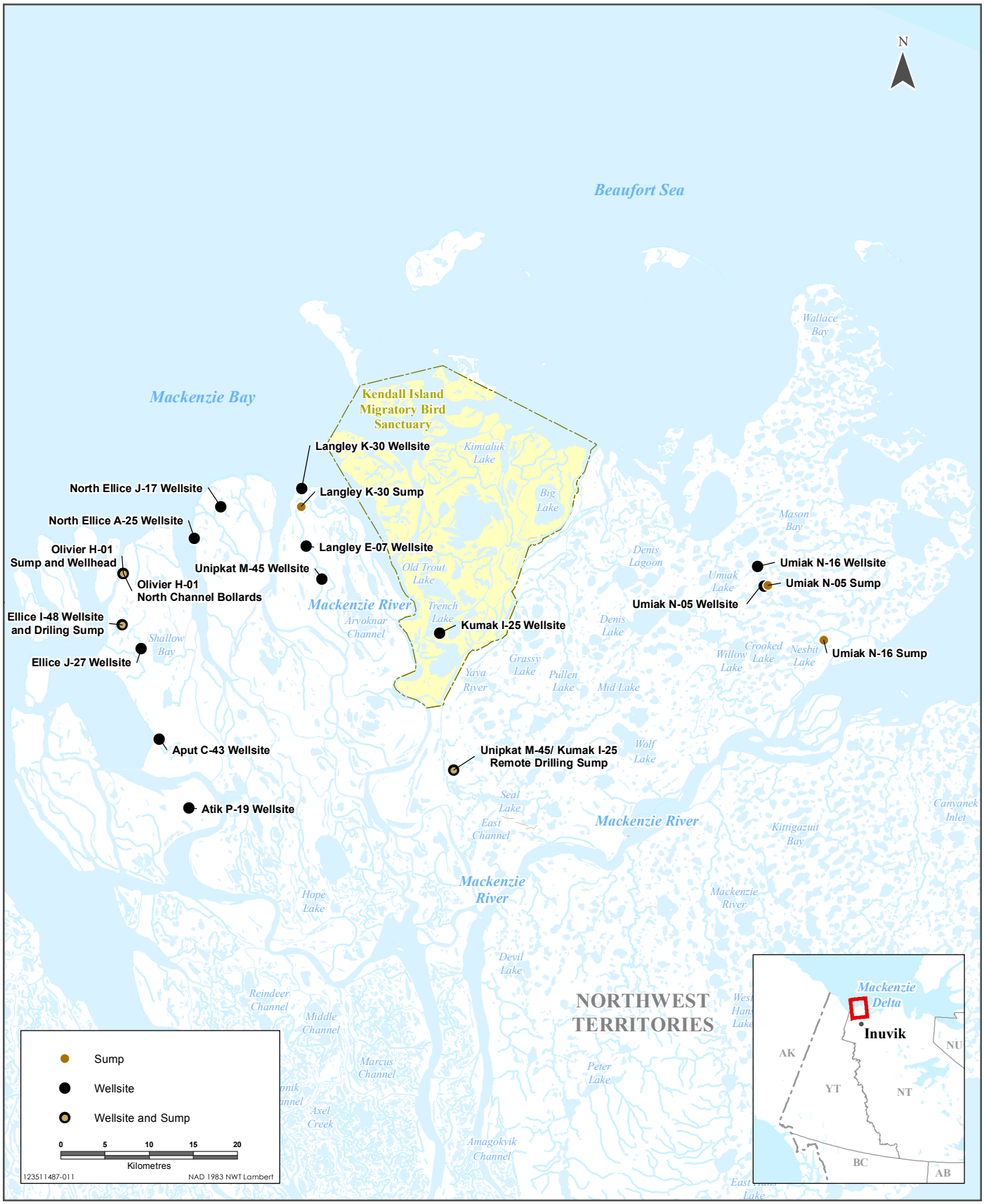
Rampton, V.N. 1988. Quaternary Geology of the Tuktoyaktuk Coastlands, Northwest Territories. Geological Survey of Canada, Memoir 423, 1988; 98 pages. Available at : http://geoscan.nrcan.gc.ca/starweb/geoscan/servlet.starweb?path=geoscan/downloade.web&search1=R=126937

Romanovsky VE and Osterkamp TE. 1995. Interannual variations of the thermal regime in the active-layer and near-surface permafrost in northern Alaska. Permafrost and Periglacial Processes 6: 313-335.

Worley Parsons. 2015. 2014 Geophysical Investigation Using EM, ERT and GPR. Umiak N-16 Sump. 23 January, 2015.

Zeiner, S.T. 1994. Realistic criteria for the evaluation of field duplicate sample results, Proceedings of Superfund XV: Washington, D.C., 29 November thru 1 December 1994. Available at internet site http://www.envstd.com/MANUS.HTM

APPENDIX A Site Figures



Sources: Base Data - Natural Earth. Thematic Data - ERBC

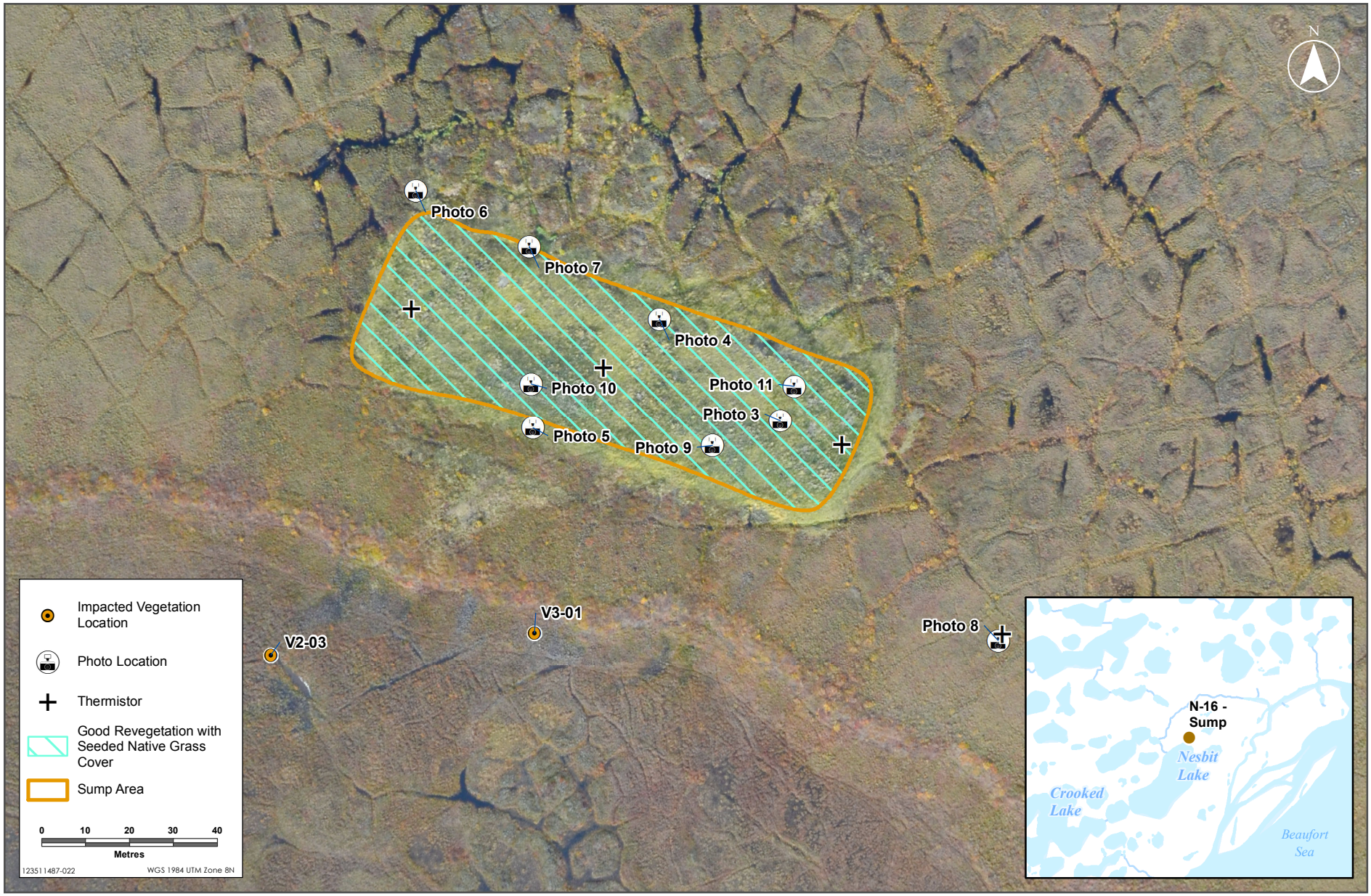
Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.

Wellsite, Sump, and Bollard Locations within the Inuvialuit Settlement Region

KAVIK-STANTEC

WELLSITE AND SUMP LOCATION OVERVIEW

Figure 1



Sources: Thematic data from Stantec Consulting Ltd.

Imagery: Aerial photos taken August 2004 and August 2012.

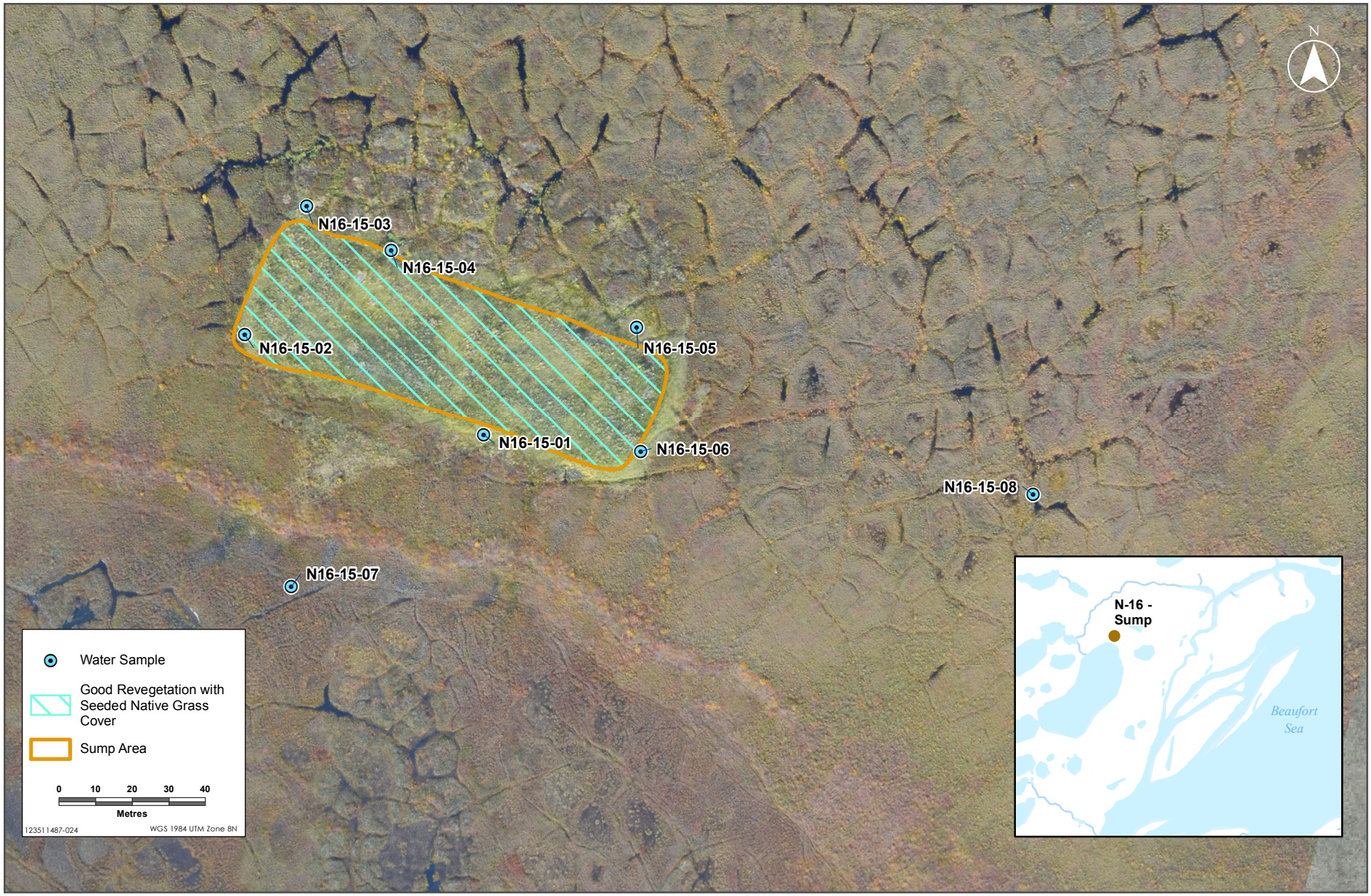
Photo locations 1 and 2 were taken outside the extents of this figure.

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.

Umiak N-16 Sump
Site Figure

KAVIK-STANTEC

Figure 2



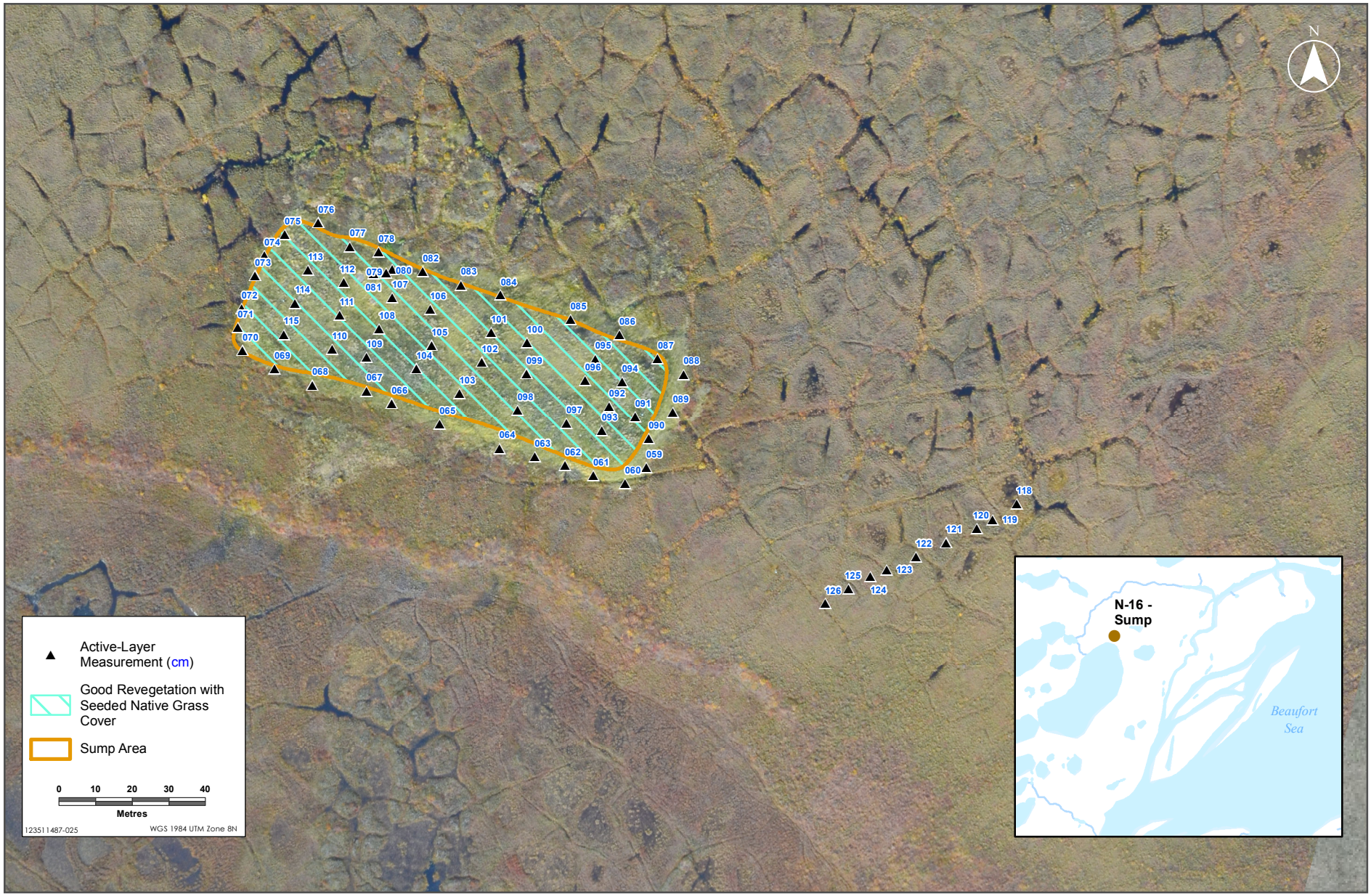
Sources: Base Data - Natural Earth. Thematic Data - ERBC; Imagery - Aerial photos taken August 2012 and August 2004.

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.

Umiak N-16 Sump
Site Figure

KAVIK-STANTEC

Figure 3



Sources: Base Data - Natural Earth. Thematic Data - ERBC; Imagery - Aerial photos taken August 2012 and August 2004.

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.

Umiak N-16 Sump
Site Figure

KAVIK-STANTEC

Figure 4

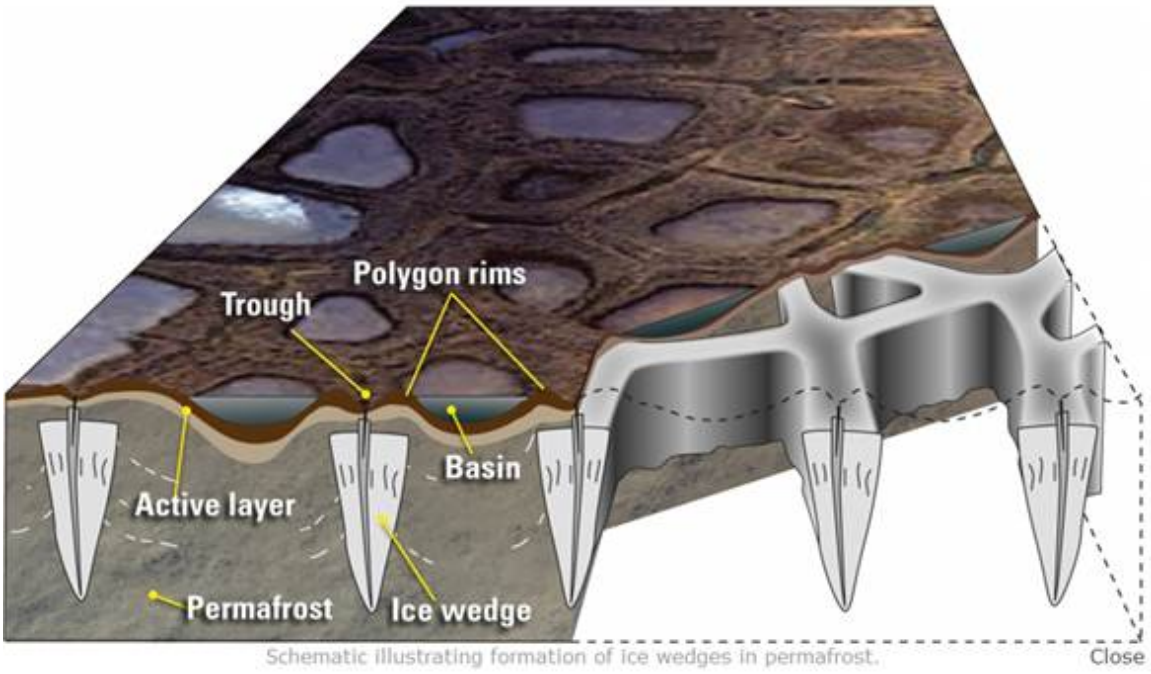


Figure 5 **Schematic illustrating formation of ice wedges in permafrost. Figure by R. Mitchell/Inkworks for U.S. Fish and Wildlife Service.**

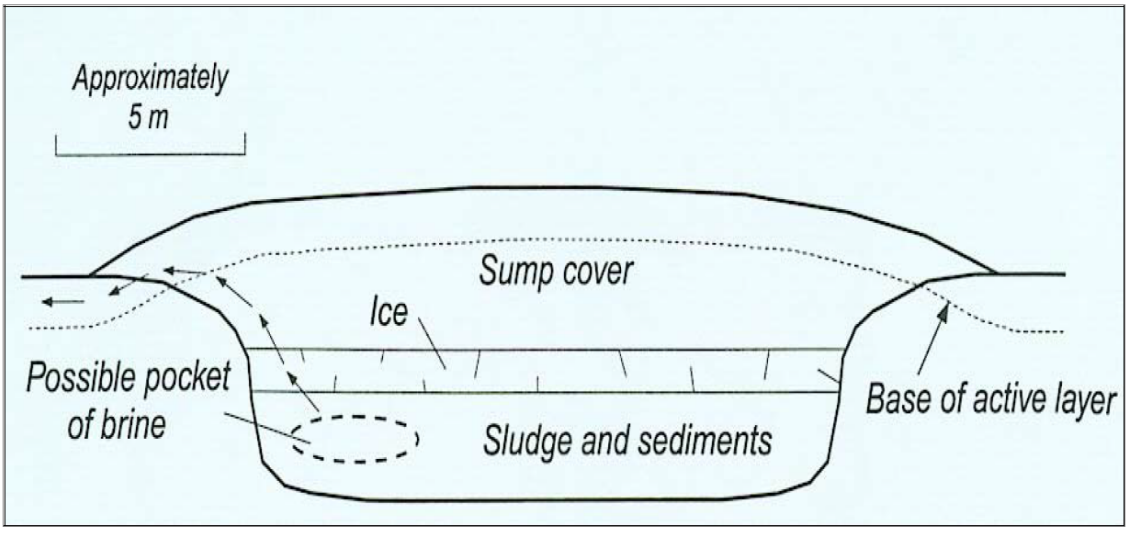


Figure 6 **Schematic cross-section of a drilling mud sump (Dyke 2001)**

APPENDIX B Aerial and Ground Photographs

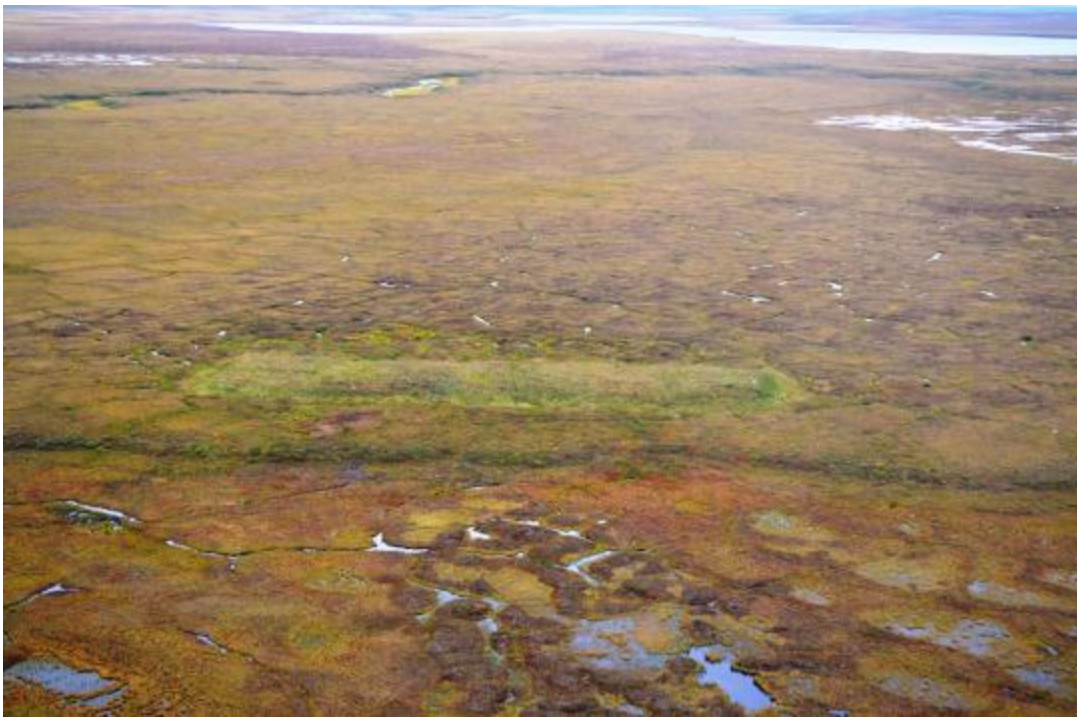


Photo 1 **Aerial overview of Umiak N-16 sump looking south. August 2015.**

Photo 2 **Aerial overview of Umiak N-16 sump looking east. August 2015.**

Photo 3 **Native grass growth on top of the N-16 sump (photo facing west). July 2015.**

Photo 4 **Native grass and shrub growth along the north slope of the sump (photo facing east). July 2015.**

Photo 5 **Native grass growth on south slope of sump (photo facing west). July 2015.**

Photo 6 **Water ponding at the intersection between two ice-wedges; northwest corner of the sump. August 2015.**

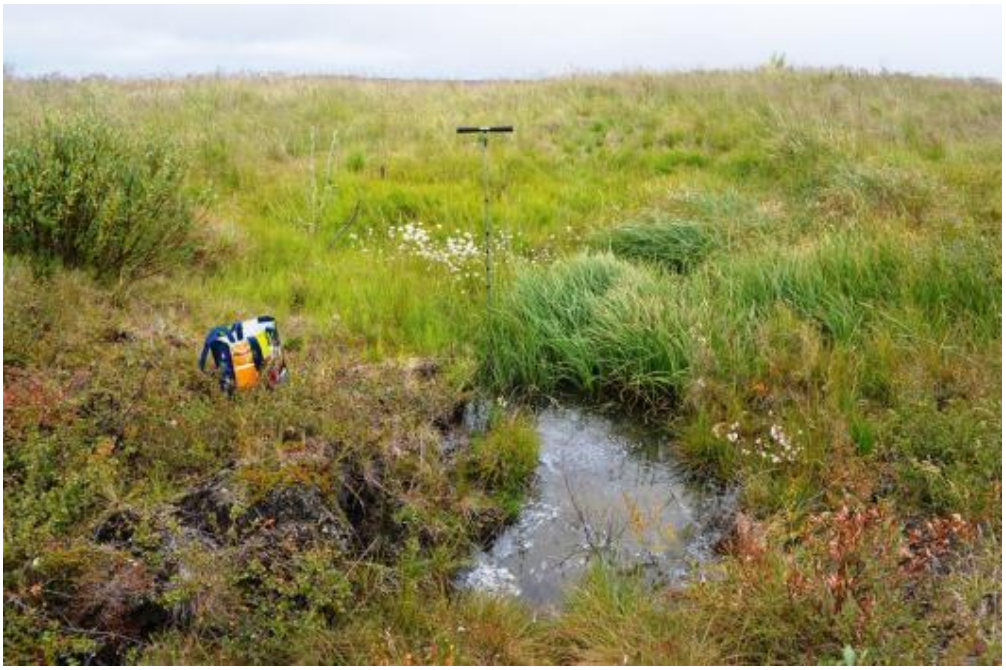


Photo 7 **Apparent sump-impacted water above an ice-wedge along the north perimeter of the sump (water sample N16-05-04) August 2015.**

Photo 8 **Empty protective casing previously used to store the thermistor cable's data logger.**

Photo 9 **Umiak N-16 Sump – south side of the sump. Typical silt with gravel material on the sump. July 2015.**

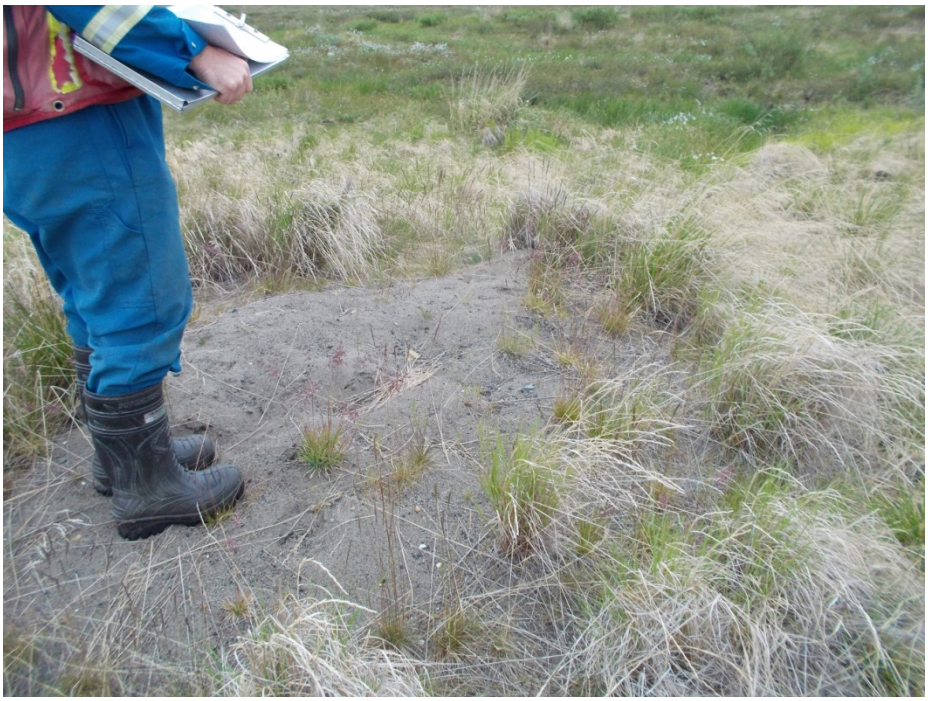


Photo 10 **Umiak N-16 Sump – south side of the sump. Bare sand areas on the top of the sump. July 2015.**

Photo 11 **Umiak N-16 Sump – Fox den located on top of sump at northeast end. July 2015.**

APPENDIX C

Sampling Methods and Quality Assurance and Quality Control (QA/QC)

KAVIK-STANTEC followed standardized procedures for field activities to maintain consistency in data collection and to reduce the potential for cross-contamination. The procedures were in general accordance with Stantec's Safe Work Practices and Standard Operating Procedures where applicable, and adopted based on generally accepted industry practices.

SURFACE WATER SAMPLING METHODOLOGY

Surface water samples were collected using a dedicated unpreserved plastic 500 mL laboratory supplied bottled. The bottle was lowered horizontally into the water with the mouth of the bottle intercepting the surface of the water. The surface water was then immediately decanted into the laboratory supplied sample bottles. For dissolved metals (if analyzed), the samples were filtered in the laboratory and not in the field.

SAMPLE HANDLING AND ANALYSIS

Samples for laboratory analyses were placed in coolers with ice and shipped to Maxxam in Yellowknife for analysis. A chain of custody form was completed and included with each sample shipment specifying the analyses required.

QUALITY ASSURANCE/QUALITY CONTROL

Efforts were made during sampling to reduce the potential for contamination so as to obtain representative samples. Accordingly, sampling was completed using a new pair of disposable nitrile gloves for each sample and dedicated sampling bottles were used to collect

SURFACE WATER SAMPLING

As a check on the laboratory analytical methods and on sample precision, the Maxxam internal laboratory QA/QC results were assessed. The results of the tests were compared with the laboratory's control limits.

APPENDIX D

2015 Site Monitoring Report Tables

Table D-1 Reclamation Assessment Methods

Site Feature	Assessment Method
Presence of wastes	• Visual observation and recording of waste material features. • Mapping to delineate waste material location and extent using GPS and field drawing. • Photos were taken of waste materials on the site. • Soil and water samples were collected for analyses.
Presence of spills	• Visual observation and recording of spill features. • Mapping to delineate spill location and extent using GPS and field drawing. • Photos were taken of spill site(s). • Soil and water samples were collected for analyses.
Site topography and surface expression	• Measurement of lease area slope angle (in degrees) and aspect (in degrees). • Assessment of overall surface expression of lease area: inclined, fan, level, undulating, rolling, steep or terraced.
Permafrost conditions	• Visual observation and recording of any permafrost issues within lease area: cryoturbation, polygon effect, slumping, subsidence, frost heaving. • Mapping to delineate location and extent using GPS and field drawing. • Photos were taken of location.
Water presence	• Visual observation and recording of any ponded water, particularly at sumps and wellhead areas. • Mapping to delineate location and extent using GPS and field drawing. • Photos were taken of location.
Vegetation establishment and condition	• Visual assessment and recording of overall vegetation species, coverage and health conditions within lease area and revegetated drilling operation disturbances. • Within lease area, selected locations with typical vegetation cover and set up 100 m^2 circular plot(s) to measure and record vegetation percent cover and species present. • For revegetated drilling operation disturbances, set up 100 m^2 circular plots and recorded same parameters; for small sites, the entire area was assessed. • Plot locations were recorded with GPS and on field diagrams • Photos of plot locations and vegetation cover.
Invasive plant (weed) presence	• Visual observation of lease area and revegetated drilling operation disturbances for presence of weed species. • Weed infestation locations were recorded for species present, plant growth stage, percent cover and area extent. • Infestation locations were recorded with GPS and on field diagrams. • Photos were taken of infestation location.
Wildlife use or presence	• Recorded any wildlife present at time of monitoring or previous presence or use in lease area and revegetated drilling operation disturbances.
Erosion or drainage issues	• Visual observation and recording of any erosion/drainage problems occurring within lease area and revegetated drilling operation disturbances. • Mapped location and extent using GPS and field drawing. • Photos were taken of location.
Erosion control methods in place	• Observation and recording of any erosion control structures/materials installed within lease area and revegetated drilling operation disturbances. • Assessment of current condition of structures and degree of effectiveness controlling erosion. • Mapped location(s) using GPS and field drawing. • Photos were taken of structure(s) and location(s) of interest.

Table D-2 Active-layer measurements on August 18, 2015

	Umiak N-16 Sump		
	Sump Cap	**Sump Perimeter**	**Control Transect**
Measurements collected	25	32	10
Minimum thawing depth (cm)	80	34	34
Maximum thawing depth (cm)	120	106	44
2015 Average thawing depth (cm)	103	58	38
Sept 13, 2013 average (cm)	-	-	-
Sept 6, 2012 average (cm)	114	55	42
August 23, 2011 average (cm)	114	51	36
August 24, 2010 average (cm)	108	48	31
August 17, 2009 average (cm)	82	36	25
August 18, 2008 average (cm)	110	34	33

Table D-3 Water Analysis Results

Location Description	Units	Criteria	N16	N16	N16	N16	N16	N16	N16	N16
Sample Date			**2015/08/18**	**2015/08/18**	**2015/08/18**	**2015/08/18**	**2015/08/18**	**2015/08/18**	**2015/08/18**	**2015/08/18**
Sample ID			N16-15-01	N16-15-02	N16-15-03	N16-15-04	N16-15-05	N16-15-06	N16-15-07	N16-15-08
Laboratory		**CCME PAL**	Maxxam	Maxxam	Maxxam	Maxxam	Maxxam	Maxxam	Maxxam	Maxxam
Laboratory Work Order			B573450V1	B573450V1	B573450V1	B573450V1	B573450V1	B573450V1	B573450V1	B573450V1
Laboratory Sample ID			MZ0279	MZ0280	MZ0281	MZ0288	MZ0289	MZ0290	MZ0291	MZ0292
Sample Type			Water	Water	Water	Water	Water	Water	Water	Water
General Chemistry										
Anion Sum	meq/L	n/v	24	7.3	20	54	14	3.8	42	0.48
Cation Sum	meq/L	n/v	26	8.2	23	55	15	4.3	43	0.96
Hardness (CaCO3)	mg/L	n/v	990	320	850	1700	720	150	1200	32
Ion Balance	none	n/v	1.1	1.1	1.1	1	1.1	1.1	1	2
Dissolved Nitrate (NO3)	mg/L	n/v	0.42	<0.044	<0.044	0.054	0.051	<0.044	<0.044	<0.044
Nitrate plus Nitrite (N)	mg/L	n/v	0.16	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Dissolved Nitrite (NO2)	mg/L	n/v	0.23	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033
Total Dissolved Solids	mg/L	n/v	1500	420	1300	3300	780	230	2600	35
Misc. Inorganics										
Conductivity	uS/cm	n/v	2500	770	2000	5800	1200	460	5000	75
pH Final	S.U.	6.5-9.0	6.64	7.24	7.15	7.07	7.19	6.55	3.28	5.69
Anions										
Alkalinity (P as CaCO3)	mg/L	n/v	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Alkalinity (Total as CaCO3)	mg/L	n/v	140	130	380	330	450	40	<0.50	5.8
Bicarbonate (HCO3)	mg/L	n/v	170	160	460	400	550	49	<0.50	7
Carbonate (CO3)	mg/L	n/v	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Hydroxide (OH)	mg/L	n/v	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Dissolved Sulphate (SO4)	mg/L	n/v	410 (1)	46 (1)	300 (1)	370 (1)	190 (1)	16	31	<1.0
Dissolved Chloride (Cl)	mg/L	n/v	460 (1)	130	230 (1)	1400 (1)	28	94	1500 (1)	13
Nutrients										
Dissolved Nitrite (N)	mg/L	n/v	0.07	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Dissolved Nitrate (N)	mg/L	n/v	0.095	<0.010	<0.010	0.012	0.012	<0.010	<0.010	<0.010
Dissolved Metals										
Dissolved Calcium (Ca)	mg/L	n/v	260	83	250	450	220	40	350	7.1
Dissolved Iron (Fe)	mg/L	n/v	7.1	1.5	1.3	1.5	0.76	2	42	1.5
Dissolved Magnesium (Mg)	mg/L	n/v	84	27	58	140	40	12	88	3.5
Dissolved Manganese (Mn)	mg/L	n/v	1.2	0.053	2.3	13	4	0.071	2.1	0.031
Dissolved Potassium (K)	mg/L	n/v	150	36	140	600 (1)	1.3	24	490	0.31
Dissolved Sodium (Na)	mg/L	n/v	59	20	41	120	15	14	87	5.7

Notes:

CCME PAL	Canadian Environmental Quality Guidelines, Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (PAL)
<0.03	Analyte was not detected at a concentration greater than the laboratory reporting limit.
6.64	Measured concentration was less than the applicable standard.
n/v	No standard/guideline value.
(1)	Detection limits raised due to dilution to bring analyte within the calibrated range.

Table D-4 Vegetation Monitoring Plots- N-16 Sump (Remote Drilling Sump): Percent Ground Coverage

Total % Cover (Individual values cannot exceed 100%, sum cannot exceed 100%):					
Seeded grass	**Naturally Established Native Vegetation**	**Invasive Plants**	**Bare Ground**	**Wood Debris**	**Vegetation Litter**
45	15	0	5	0	35
Note: Percent cover estimates are composite visual estimates over large scale area, not from individual plots.					

Table D-5 Vegetation Monitoring Plots- N-16 Sump (Remote Drilling Sump): Species Composition Percent Cover

Species	% Cover
tufted hairgrass (*Deschampsia caespitosa*)	5
creeping red fescue (*Festuca* rubra)	25
Rocky Mountain fescue (*Festuca saximontana*)	5
alpine bluegrass (*Poa alpina*)	5
bluegrass (*Poa* sp.)	5
alpine bearberry (*Arctostaphylos alpina*)	<1
broad leaved willowherb (*Epilobium latifolium*)	10
small bog cranberry (*Oxycoccus microcarpus*),	<1
cloudberry (*Rubus chamaemorus*)	<1
net veined willow (*Salix reticulata*)	<1
willows (*Salix* sp.)	5

APPENDIX E

Certificate of Analysis

Your Project #: 123511463
Site Location: INUVIK

Attention:OLIVIER PIRAUX

STANTEC CONSULTING LTD
Quebec
110-100 BLVD Alexis Nihon
St Laurent, AB
Canada H4M 2N6

Your C.O.C. #: a170149, A170150, A170151, A170152

Report Date: 2015/09/02
Report #: R2034470
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B573450
Received: 2015/08/24, 12:00

Sample Matrix: Soil
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Cation/EC Ratio (1)	3	N/A	2015/08/31	AB WI-00065	Auto Calc
Chloride (Soluble) (1)	3	2015/08/29	2015/08/30	AB SOP-00033 / AB SOP-00020	SM 22-4500-Cl G m
Conductivity @25C (Soluble) (1)	3	2015/08/30	2015/08/31	AB SOP-00033 / AB SOP-00004	SM 22 2510 B m
Elements by ICP -Soils (1)	3	2015/08/30	2015/09/01	AB SOP-00001 / AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICPMS - Soils (1)	3	2015/08/30	2015/08/31	AB SOP-00001 / AB SOP-00043	EPA 200.8 R5.4 m
Ion Balance (1)	3	N/A	2015/08/28	AB WI-00065	Auto Calc
Sum of Cations, Anions (1)	3	N/A	2015/08/31	AB WI-00065	Auto Calc
pH @25C (1:2 Calcium Chloride Extract) (1)	3	2015/08/28	2015/08/28	AB SOP-00033 / AB SOP-00006	SM 22 4500 H+B m
Sodium Adsorption Ratio (1)	3	N/A	2015/08/31	AB WI-00065	Auto Calc
Ca,Mg,Na,K,SO4 (Soluble) (1)	3	2015/08/29	2015/08/30	AB SOP-00033 / AB SOP-00042	EPA 200.7 CFR 2012 m
Soluble Paste (1)	3	2015/08/29	2015/08/29	AB SOP-00033	Carter 2nd ed 15.2 m
Soluble Ions Calculation (1)	3	N/A	2015/08/28	AB WI-00065	Auto Calc
Theoretical Gypsum Requirement (1, 2)	3	N/A	2015/08/31	AB WI-00065	Auto Calc

Sample Matrix: Water
Samples Received: 38

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO3,HCO3,OH (1)	8	N/A	2015/08/25	AB SOP-00005	SM 22 2320 B m
Alkalinity @25C (pp, total), CO3,HCO3,OH (1)	30	N/A	2015/08/26	AB SOP-00005	SM 22 2320 B m
Chloride by Automated Colourimetry (1)	16	N/A	2015/09/01	AB SOP-00020	SM 22-4500-Cl G m
Chloride by Automated Colourimetry (1)	22	N/A	2015/09/02	AB SOP-00020	SM 22-4500-Cl G m

Your Project #: 123511463
Site Location: INUVIK

Attention:OLIVIER PIRAUX

STANTEC CONSULTING LTD
Quebec
110-100 BLVD Alexis Nihon
St Laurent, AB
Canada H4M 2N6

Your C.O.C. #: a170149, A170150, A170151, A170152

Report Date: 2015/09/02
Report #: R2034470
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B573450
Received: 2015/08/24, 12:00

Sample Matrix: Water
Samples Received: 38

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Conductivity @25C (1)	8	N/A	2015/08/25	AB SOP-00005	SM 22 2510 B m
Conductivity @25C (1)	30	N/A	2015/08/26	AB SOP-00005	SM 22 2510 B m
Hardness (1)	38	N/A	2015/09/01	AB WI-00065	Auto Calc
Elements by ICP-Dissolved-Lab Filtered (1)	34	N/A	2015/08/31	AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICP-Dissolved-Lab Filtered (1)	4	N/A	2015/09/02	AB SOP-00042	EPA 200.7 CFR 2012 m
Ion Balance (1)	38	N/A	2015/08/26	AB WI-00065	Auto Calc
Sum of cations, anions (1)	38	N/A	2015/09/01	AB WI-00065	Auto Calc
Nitrate and Nitrite (1)	38	N/A	2015/08/28	AB WI-00065	Auto Calc
Nitrate + Nitrite-N (calculated) (1)	38	N/A	2015/08/28	AB WI-00065	Auto Calc
Nitrogen, (Nitrite, Nitrate) by IC (1)	24	N/A	2015/08/26	AB SOP-00023	SM 22 4110 B m
Nitrogen, (Nitrite, Nitrate) by IC (1)	14	N/A	2015/08/27	AB SOP-00023	SM 22 4110 B m
pH @25°C (Alkalinity titrator) (1)	8	N/A	2015/08/25	AB SOP-00005	SM 22 4500-H+B m
pH @25°C (Alkalinity titrator) (1)	30	N/A	2015/08/26	AB SOP-00005	SM 22 4500-H+B m
Sulphate by Automated Colourimetry (1)	16	N/A	2015/09/01	AB SOP-00018	SM 22 4500-SO4 E m
Sulphate by Automated Colourimetry (1)	22	N/A	2015/09/02	AB SOP-00018	SM 22 4500-SO4 E m
Total Dissolved Solids (Calculated) (1)	18	N/A	2015/09/01	AB WI-00065	Auto Calc
Total Dissolved Solids (Calculated) (1)	20	N/A	2015/09/02	AB WI-00065	Auto Calc

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) This test was performed by Maxxam Calgary Environmental
(2) Units for TGR have changed from tons/acre to tonnes/ha

Your Project #: 123511463
Site Location: INUVIK

Attention:OLIVIER PIRAUX

STANTEC CONSULTING LTD
Quebec
110-100 BLVD Alexis Nihon
St Laurent, AB
Canada H4M 2N6

Your C.O.C. #: a170149, A170150, A170151, A170152

Report Date: 2015/09/02
Report #: R2034470
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B573450
Received: 2015/08/24, 12:00

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Wendy Sears, Project manager
Email: WSears@maxxam.ca
Phone# (403)735-2277
==========
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B573450
Report Date: 2015/09/02

STANTEC CONSULTING LTD
Client Project #: 123511463
Site Location: INUVIK
Sampler Initials: OP

ROUTINE WATER - FILTERED (WATER)

Maxxam ID		MZ0233		MZ0234			MZ0235		
Sampling Date		2015/08/17 14:00		2015/08/17 14:15			2015/08/17 15:00		
COC Number		a170149		a170149			a170149		
	UNITS	KUMAK-15-01	RDL	KUMAK-15-02	RDL	QC Batch	KUMAK-15-03	RDL	QC Batch
Calculated Parameters									
Anion Sum	meq/L	0.48	N/A	38	N/A	8015249	5.9	N/A	8015249
Cation Sum	meq/L	0.88	N/A	36	N/A	8015249	6.6	N/A	8015249
Hardness (CaCO3)	mg/L	34	0.50	1700	0.50	8015271	300	0.50	8015271
Ion Balance	N/A	1.8	0.010	0.95	0.010	8015248	1.1	0.010	8015248
Dissolved Nitrate (NO3)	mg/L	<0.044	0.044	<0.044	0.044	8014813	<0.044	0.044	8014813
Nitrate plus Nitrite (N)	mg/L	<0.020	0.020	<0.020	0.020	8014814	<0.020	0.020	8014814
Dissolved Nitrite (NO2)	mg/L	<0.033	0.033	<0.033	0.033	8014813	<0.033	0.033	8014813
Total Dissolved Solids	mg/L	31	10	2300	10	8015020	390	10	8015020
Misc. Inorganics									
Conductivity	uS/cm	76	1.0	2500	1.0	8016165	620	1.0	8016165
pH	pH	6.12 (1)	N/A	7.39 (1)	N/A	8016164	5.56 (1)	N/A	8016164
Anions									
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	<0.50	0.50	8016037	<0.50	0.50	8016037
Alkalinity (Total as CaCO3)	mg/L	14	0.50	340	0.50	8016037	8.5	0.50	8016037
Bicarbonate (HCO3)	mg/L	18	0.50	420	0.50	8016037	10	0.50	8016037
Carbonate (CO3)	mg/L	<0.50	0.50	<0.50	0.50	8016037	<0.50	0.50	8016037
Hydroxide (OH)	mg/L	<0.50	0.50	<0.50	0.50	8016037	<0.50	0.50	8016037
Dissolved Sulphate (SO4)	mg/L	<1.0	1.0	1500 (2)	10	8023999	260 (2)	2.0	8024969
Dissolved Chloride (Cl)	mg/L	6.6	1.0	1.6	1.0	8023989	8.2	1.0	8024968
Nutrients									
Dissolved Nitrite (N)	mg/L	<0.010 (3)	0.010	<0.010 (3)	0.010	8016643	<0.010 (3)	0.010	8016643
Dissolved Nitrate (N)	mg/L	<0.010 (3)	0.010	<0.010 (3)	0.010	8016643	<0.010 (3)	0.010	8016643
Lab Filtered Elements									
Dissolved Calcium (Ca)	mg/L	7.1	0.30	450	0.30	8020938	59	0.30	8024193
Dissolved Iron (Fe)	mg/L	0.77	0.060	<0.060	0.060	8020938	2.5	0.060	8024193
Dissolved Magnesium (Mg)	mg/L	3.9	0.20	150	0.20	8020938	37	0.20	8024193
Dissolved Manganese (Mn)	mg/L	0.18	0.0040	<0.0040	0.0040	8020938	1.2	0.0040	8024193
Dissolved Potassium (K)	mg/L	0.68	0.30	5.4	0.30	8020938	3.7	0.30	8024193
Dissolved Sodium (Na)	mg/L	3.4	0.50	27	0.50	8020938	9.5	0.50	8024193

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Sample was analyzed after holding time expired.
(2) Detection limits raised due to dilution to bring analyte within the calibrated range.
(3) Sample received past method-specified hold time.

Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B573450
Report Date: 2015/09/02

STANTEC CONSULTING LTD
Client Project #: 123511463
Site Location: INUVIK
Sampler Initials: OP

ROUTINE WATER - FILTERED (WATER)

Maxxam ID		MZ0236			MZ0237			MZ0238		
Sampling Date		2015/08/17 16:30			2015/08/19 15:00			2015/08/19 15:00		
COC Number		a170149			a170149			a170149		
	UNITS	KUMAK-15-04	RDL	QC Batch	I48-15-01	RDL	QC Batch	I48-15-02	RDL	QC Batch
Calculated Parameters										
Anion Sum	meq/L	52	N/A	8015249	39	N/A	8015249	31	N/A	8015249
Cation Sum	meq/L	54	N/A	8015249	37	N/A	8015249	29	N/A	8015249
Hardness (CaCO3)	mg/L	2600	0.50	8015271	830	0.50	8015271	690	0.50	8015271
Ion Balance	N/A	1.0	0.010	8015248	0.97	0.010	8015248	0.94	0.010	8015248
Dissolved Nitrate (NO3)	mg/L	<0.044	0.044	8014813	<0.044	0.044	8014813	<0.044	0.044	8014813
Nitrate plus Nitrite (N)	mg/L	<0.020	0.020	8014814	<0.020	0.020	8014814	<0.020	0.020	8014814
Dissolved Nitrite (NO2)	mg/L	<0.033	0.033	8014813	<0.033	0.033	8014813	<0.033	0.033	8014813
Total Dissolved Solids	mg/L	3300	10	8015020	2100	10	8015020	1700	10	8015020
Misc. Inorganics										
Conductivity	uS/cm	3400	1.0	8016165	3900	1.0	8016165	3100	1.0	8016165
pH	pH	7.44 (1)	N/A	8016164	7.57	N/A	8016164	7.59	N/A	8016164
Anions										
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	8016037	<0.50	0.50	8016037	<0.50	0.50	8016037
Alkalinity (Total as CaCO3)	mg/L	250	0.50	8016037	300	0.50	8016037	330	0.50	8016037
Bicarbonate (HCO3)	mg/L	310	0.50	8016037	360	0.50	8016037	400	0.50	8016037
Carbonate (CO3)	mg/L	<0.50	0.50	8016037	<0.50	0.50	8016037	<0.50	0.50	8016037
Hydroxide (OH)	mg/L	<0.50	0.50	8016037	<0.50	0.50	8016037	<0.50	0.50	8016037
Dissolved Sulphate (SO4)	mg/L	2200 (2)	20	8023943	77	1.0	8023999	72	1.0	8023999
Dissolved Chloride (Cl)	mg/L	<1.0	1.0	8023940	1100 (2)	10	8023989	810 (2)	5.0	8023989
Nutrients										
Dissolved Nitrite (N)	mg/L	<0.010 (3)	0.010	8016643	<0.010	0.010	8016643	<0.010	0.010	8016643
Dissolved Nitrate (N)	mg/L	<0.010 (3)	0.010	8016643	<0.010	0.010	8016643	<0.010	0.010	8016643
Lab Filtered Elements										
Dissolved Calcium (Ca)	mg/L	550 (2)	1.5	8022656	180	0.30	8022656	160	0.30	8020938
Dissolved Iron (Fe)	mg/L	0.35	0.060	8022656	0.22	0.060	8022656	0.077	0.060	8020938
Dissolved Magnesium (Mg)	mg/L	300	0.20	8022656	93	0.20	8022656	73	0.20	8020938
Dissolved Manganese (Mn)	mg/L	1.1	0.0040	8022656	0.22	0.0040	8022656	0.053	0.0040	8020938
Dissolved Potassium (K)	mg/L	5.1	0.30	8022656	2.7	0.30	8022656	1.3	0.30	8020938
Dissolved Sodium (Na)	mg/L	42	0.50	8022656	470	0.50	8022656	350	0.50	8020938

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Sample was analyzed after holding time expired.
(2) Detection limits raised due to dilution to bring analyte within the calibrated range.
(3) Sample received past method-specified hold time.

Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B573450
Report Date: 2015/09/02

STANTEC CONSULTING LTD
Client Project #: 123511463
Site Location: INUVIK
Sampler Initials: OP

ROUTINE WATER - FILTERED (WATER)

Maxxam ID		MZ0239		MZ0240		MZ0241		MZ0242		
Sampling Date		2015/08/19 15:00		2015/08/19 16:00		2015/08/19 16:00		2015/08/19 16:00		
COC Number		a170149		a170149		a170149		a170149		
	UNITS	I48-15-03	RDL	I48-15-04	RDL	I48-15-05	RDL	I48-15-06	RDL	QC Batch
Calculated Parameters										
Anion Sum	meq/L	130	N/A	31	N/A	97	N/A	93	N/A	8015249
Cation Sum	meq/L	130	N/A	29	N/A	94	N/A	91	N/A	8015249
Hardness (CaCO3)	mg/L	3100	0.50	830	0.50	2100	0.50	2000	0.50	8015271
Ion Balance	N/A	1.0	0.010	0.95	0.010	0.97	0.010	0.97	0.010	8015248
Dissolved Nitrate (NO3)	mg/L	<0.044	0.044	<0.044	0.044	<0.044	0.044	<0.044	0.044	8014813
Nitrate plus Nitrite (N)	mg/L	<0.020	0.020	<0.020	0.020	<0.020	0.020	<0.020	0.020	8014814
Dissolved Nitrite (NO2)	mg/L	<0.033	0.033	<0.033	0.033	<0.033	0.033	<0.033	0.033	8014813
Total Dissolved Solids	mg/L	7400	10	1700	10	5400	10	5100	10	8015277
Misc. Inorganics										
Conductivity	uS/cm	13000	1.0	3000	1.0	9500	1.0	9200	1.0	8016165
pH	pH	7.60	N/A	7.45	N/A	7.81	N/A	7.64	N/A	8016164
Anions										
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	<0.50	0.50	<0.50	0.50	<0.50	0.50	8016037
Alkalinity (Total as CaCO3)	mg/L	380	0.50	510	0.50	170	0.50	490	0.50	8016037
Bicarbonate (HCO3)	mg/L	470	0.50	620	0.50	210	0.50	600	0.50	8016037
Carbonate (CO3)	mg/L	<0.50	0.50	<0.50	0.50	<0.50	0.50	<0.50	0.50	8016037
Hydroxide (OH)	mg/L	<0.50	0.50	<0.50	0.50	<0.50	0.50	<0.50	0.50	8016037
Dissolved Sulphate (SO4)	mg/L	620 (1)	5.0	180	1.0	520 (1)	5.0	200 (1)	2.0	8023632
Dissolved Chloride (Cl)	mg/L	3900 (1)	25	610 (1)	5.0	2900 (1)	20	2800 (1)	20	8023626
Nutrients										
Dissolved Nitrite (N)	mg/L	<0.010	0.010	<0.010	0.010	<0.010	0.010	<0.010	0.010	8017771
Dissolved Nitrate (N)	mg/L	<0.010	0.010	<0.010	0.010	<0.010	0.010	<0.010	0.010	8017771
Lab Filtered Elements										
Dissolved Calcium (Ca)	mg/L	720 (1)	3.0	190	0.30	420	0.30	390	0.30	8020938
Dissolved Iron (Fe)	mg/L	0.073	0.060	<0.060	0.060	<0.060	0.060	0.14	0.060	8020938
Dissolved Magnesium (Mg)	mg/L	330	0.20	87	0.20	250	0.20	240	0.20	8020938
Dissolved Manganese (Mn)	mg/L	0.28	0.0040	0.0056	0.0040	<0.0040	0.0040	0.15	0.0040	8020938
Dissolved Potassium (K)	mg/L	6.0	0.30	1.7	0.30	9.4	0.30	8.5	0.30	8020938
Dissolved Sodium (Na)	mg/L	1600 (1)	5.0	300	0.50	1200 (1)	5.0	1200 (1)	5.0	8020938

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B573450
Report Date: 2015/09/02

STANTEC CONSULTING LTD
Client Project #: 123511463
Site Location: INUVIK
Sampler Initials: OP

ROUTINE WATER - FILTERED (WATER)

Maxxam ID		MZ0243		MZ0244			MZ0245		MZ0246		
Sampling Date		2015/08/19 16:15		2015/08/19 16:15			2015/08/19 16:20		2015/08/19 16:20		
COC Number		a170149		a170149			A170150		A170150		
	UNITS	I48-15-07	QC Batch	I48-15-08	RDL	QC Batch	I48-15-09	RDL	I48-15-10	RDL	QC Batch
Calculated Parameters											
Anion Sum	meq/L	32	8015249	33	N/A	8015249	14	N/A	19	N/A	8015249
Cation Sum	meq/L	31	8015249	34	N/A	8015249	14	N/A	18	N/A	8015249
Hardness (CaCO3)	mg/L	730	8015271	830	0.50	8015271	270	0.50	340	0.50	8015271
Ion Balance	N/A	0.97	8015248	1.0	0.010	8015248	0.99	0.010	0.95	0.010	8015248
Dissolved Nitrate (NO3)	mg/L	<0.044	8014813	0.38	0.044	8014813	<0.044	0.044	<0.044	0.044	8014813
Nitrate plus Nitrite (N)	mg/L	<0.020	8014814	0.086	0.020	8014814	<0.020	0.020	<0.020	0.020	8014814
Dissolved Nitrite (NO2)	mg/L	<0.033	8014813	<0.033	0.033	8014813	<0.033	0.033	<0.033	0.033	8014813
Total Dissolved Solids	mg/L	1800	8015277	1900	10	8015277	800	10	1100	10	8015277
Misc. Inorganics											
Conductivity	uS/cm	3400	8016165	3500	1.0	8016165	1600	1.0	2100	1.0	8016165
pH	pH	7.79	8016164	7.97	N/A	8016164	8.29	N/A	7.54	N/A	8016164
Anions											
Alkalinity (PP as CaCO3)	mg/L	<0.50	8016037	<0.50	0.50	8016037	<0.50	0.50	<0.50	0.50	8016037
Alkalinity (Total as CaCO3)	mg/L	280	8016037	260	0.50	8016037	150	0.50	120	0.50	8016037
Bicarbonate (HCO3)	mg/L	340	8016037	310	0.50	8016037	180	0.50	150	0.50	8016037
Carbonate (CO3)	mg/L	<0.50	8016037	<0.50	0.50	8016037	<0.50	0.50	<0.50	0.50	8016037
Hydroxide (OH)	mg/L	<0.50	8016037	<0.50	0.50	8016037	<0.50	0.50	<0.50	0.50	8016037
Dissolved Sulphate (SO4)	mg/L	51	8023632	76	1.0	8023999	39 (1)	2.0	27	1.0	8023632
Dissolved Chloride (Cl)	mg/L	920 (1)	8023626	950 (1)	10	8023989	380 (1)	5.0	580 (1)	5.0	8023626
Nutrients											
Dissolved Nitrite (N)	mg/L	<0.010	8017771	<0.010	0.010	8016643	<0.010	0.010	<0.010	0.010	8016647
Dissolved Nitrate (N)	mg/L	<0.010	8017771	0.086	0.010	8016643	<0.010	0.010	<0.010	0.010	8016647
Lab Filtered Elements											
Dissolved Calcium (Ca)	mg/L	160	8020938	190	0.30	8022656	56	0.30	81	0.30	8020938
Dissolved Iron (Fe)	mg/L	0.080	8020938	0.23	0.060	8022656	<0.060	0.060	<0.060	0.060	8020938
Dissolved Magnesium (Mg)	mg/L	79	8020938	86	0.20	8022656	31	0.20	34	0.20	8020938
Dissolved Manganese (Mn)	mg/L	0.0088	8020938	0.0074	0.0040	8022656	<0.0040	0.0040	0.016	0.0040	8020938
Dissolved Potassium (K)	mg/L	23	8020938	27	0.30	8022656	5.9	0.30	1.2	0.30	8020938
Dissolved Sodium (Na)	mg/L	370	8020938	400	0.50	8022656	200	0.50	260	0.50	8020938

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B573450
Report Date: 2015/09/02

STANTEC CONSULTING LTD
Client Project #: 123511463
Site Location: INUVIK
Sampler Initials: OP

ROUTINE WATER - FILTERED (WATER)

Maxxam ID		MZ0247			MZ0248			MZ0249		
Sampling Date		2015/08/20 12:00			2015/08/20 12:00			2015/08/20 12:00		
COC Number		A170150			A170150			A170150		
	UNITS	K30-15-01	RDL	QC Batch	K30-15-02	RDL	QC Batch	K30-15-03	RDL	QC Batch
Calculated Parameters										
Anion Sum	meq/L	14	N/A	8015249	71	N/A	8015249	49	N/A	8015249
Cation Sum	meq/L	14	N/A	8015249	74	N/A	8015249	49	N/A	8015249
Hardness (CaCO3)	mg/L	420	0.50	8015271	2500	0.50	8015271	1600	0.50	8015271
Ion Balance	N/A	1.0	0.010	8015248	1.0	0.010	8015248	1.0	0.010	8015248
Dissolved Nitrate (NO3)	mg/L	<0.044	0.044	8014813	<0.044	0.044	8014813	<0.044	0.044	8014813
Nitrate plus Nitrite (N)	mg/L	<0.020	0.020	8014814	<0.020	0.020	8014814	<0.020	0.020	8014814
Dissolved Nitrite (NO2)	mg/L	<0.033	0.033	8014813	<0.033	0.033	8014813	<0.033	0.033	8014813
Total Dissolved Solids	mg/L	770	10	8015277	4200	10	8015277	2900	10	8015277
Misc. Inorganics										
Conductivity	uS/cm	1400	1.0	8016165	7100	1.0	8016165	4800	1.0	8016165
pH	pH	7.96	N/A	8016164	7.34	N/A	8016164	7.87	N/A	8016164
Anions										
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	8016037	<0.50	0.50	8016037	<0.50	0.50	8016037
Alkalinity (Total as CaCO3)	mg/L	280	0.50	8016037	320	0.50	8016037	180	0.50	8016037
Bicarbonate (HCO3)	mg/L	350	0.50	8016037	390	0.50	8016037	220	0.50	8016037
Carbonate (CO3)	mg/L	<0.50	0.50	8016037	<0.50	0.50	8016037	<0.50	0.50	8016037
Hydroxide (OH)	mg/L	<0.50	0.50	8016037	<0.50	0.50	8016037	<0.50	0.50	8016037
Dissolved Sulphate (SO4)	mg/L	90	1.0	8023632	520 (1)	5.0	8023632	540 (1)	5.0	8023999
Dissolved Chloride (Cl)	mg/L	230 (1)	2.0	8023626	1900 (1)	10	8023626	1200 (1)	10	8023989
Nutrients										
Dissolved Nitrite (N)	mg/L	<0.010	0.010	8016647	<0.010	0.010	8016643	<0.010	0.010	8016643
Dissolved Nitrate (N)	mg/L	<0.010	0.010	8016647	<0.010	0.010	8016643	<0.010	0.010	8016643
Lab Filtered Elements										
Dissolved Calcium (Ca)	mg/L	110	0.30	8020938	740 (1)	3.0	8020938	440	0.30	8022656
Dissolved Iron (Fe)	mg/L	<0.060	0.060	8020938	<0.060	0.060	8020938	0.18	0.060	8022656
Dissolved Magnesium (Mg)	mg/L	34	0.20	8020938	170	0.20	8020938	110	0.20	8022656
Dissolved Manganese (Mn)	mg/L	<0.0040	0.0040	8020938	2.2	0.0040	8020938	0.0043	0.0040	8022656
Dissolved Potassium (K)	mg/L	4.1	0.30	8020938	280	0.30	8020938	200	0.30	8022656
Dissolved Sodium (Na)	mg/L	130	0.50	8020938	370	0.50	8020938	300	0.50	8022656

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B573450
Report Date: 2015/09/02

STANTEC CONSULTING LTD
Client Project #: 123511463
Site Location: INUVIK
Sampler Initials: OP

ROUTINE WATER - FILTERED (WATER)

Maxxam ID		MZ0250			MZ0254		MZ0255		
Sampling Date		2015/08/20 12:30			2015/08/20 15:00		2015/08/20 15:00		
COC Number		A170150			A170150		A170150		
	UNITS	K30-15-04	RDL	QC Batch	N05-15-01	RDL	N05-15-02	RDL	QC Batch
Calculated Parameters									
Anion Sum	meq/L	3.3	N/A	8015249	29	N/A	35	N/A	8015249
Cation Sum	meq/L	3.5	N/A	8015249	31	N/A	38	N/A	8015249
Hardness (CaCO3)	mg/L	150	0.50	8015271	1300	0.50	1500	0.50	8015271
Ion Balance	N/A	1.0	0.010	8015248	1.1	0.010	1.1	0.010	8015248
Dissolved Nitrate (NO3)	mg/L	0.16	0.044	8014813	0.051	0.044	0.054	0.044	8014813
Nitrate plus Nitrite (N)	mg/L	0.037	0.020	8014814	<0.020	0.020	<0.020	0.020	8015276
Dissolved Nitrite (NO2)	mg/L	<0.033	0.033	8014813	<0.033	0.033	<0.033	0.033	8014813
Total Dissolved Solids	mg/L	180	10	8015277	1800	10	2300	10	8015277
Misc. Inorganics									
Conductivity	uS/cm	330	1.0	8016165	2400	1.0	3200	1.0	8015952
pH	pH	8.17	N/A	8016164	6.20	N/A	6.40	N/A	8015951
Anions									
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	8016037	<0.50	0.50	<0.50	0.50	8015945
Alkalinity (Total as CaCO3)	mg/L	100	0.50	8016037	120	0.50	80	0.50	8015945
Bicarbonate (HCO3)	mg/L	120	0.50	8016037	140	0.50	97	0.50	8015945
Carbonate (CO3)	mg/L	<0.50	0.50	8016037	<0.50	0.50	<0.50	0.50	8015945
Hydroxide (OH)	mg/L	<0.50	0.50	8016037	<0.50	0.50	<0.50	0.50	8015945
Dissolved Sulphate (SO4)	mg/L	50	1.0	8023632	1000 (1)	10	940 (1)	10	8023999
Dissolved Chloride (Cl)	mg/L	9.2	1.0	8023626	170	1.0	500 (1)	5.0	8023989
Nutrients									
Dissolved Nitrite (N)	mg/L	<0.010	0.010	8017771	<0.010	0.010	<0.010	0.010	8016643
Dissolved Nitrate (N)	mg/L	0.037	0.010	8017771	0.012	0.010	0.012	0.010	8016643
Lab Filtered Elements									
Dissolved Calcium (Ca)	mg/L	42	0.30	8020938	320	0.30	420	0.30	8022656
Dissolved Iron (Fe)	mg/L	<0.060	0.060	8020938	2.1	0.060	0.23	0.060	8022656
Dissolved Magnesium (Mg)	mg/L	12	0.20	8020938	120	0.20	110	0.20	8022656
Dissolved Manganese (Mn)	mg/L	<0.0040	0.0040	8020938	8.0	0.0040	6.7	0.0040	8022656
Dissolved Potassium (K)	mg/L	0.78	0.30	8020938	11	0.30	120	0.30	8022656
Dissolved Sodium (Na)	mg/L	8.5	0.50	8020938	120	0.50	110	0.50	8022656

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B573450
Report Date: 2015/09/02

STANTEC CONSULTING LTD
Client Project #: 123511463
Site Location: INUVIK
Sampler Initials: OP

ROUTINE WATER - FILTERED (WATER)

Maxxam ID		MZ0256			MZ0270			MZ0271		
Sampling Date		2015/08/20 15:00			2015/08/20 15:00			2015/08/20 15:00		
COC Number		A170150			A170151			A170151		
	UNITS	N05-15-03	RDL	QC Batch	N05-15-04	RDL	QC Batch	N05-15-05	RDL	QC Batch
Calculated Parameters										
Anion Sum	meq/L	3.2	N/A	8015249	16	N/A	8015249	6.9	N/A	8015249
Cation Sum	meq/L	3.9	N/A	8015249	16	N/A	8015249	7.1	N/A	8015249
Hardness (CaCO3)	mg/L	140	0.50	8015271	320	0.50	8015271	290	0.50	8015271
Ion Balance	N/A	1.2	0.010	8015248	1.0	0.010	8015248	1.0	0.010	8015248
Dissolved Nitrate (NO3)	mg/L	<0.044	0.044	8015275	<0.044	0.044	8015275	<0.044	0.044	8015275
Nitrate plus Nitrite (N)	mg/L	<0.020	0.020	8015276	<0.020	0.020	8015276	<0.020	0.020	8015276
Dissolved Nitrite (NO2)	mg/L	<0.033	0.033	8015275	<0.033	0.033	8015275	<0.033	0.033	8015275
Total Dissolved Solids	mg/L	200	10	8015277	970	10	8015277	400	10	8015277
Misc. Inorganics										
Conductivity	uS/cm	370	1.0	8015952	2000	1.0	8015952	770	1.0	8015952
pH	pH	6.33	N/A	8015951	3.64	N/A	8015951	6.25	N/A	8015951
Anions										
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	8015945	<0.50	0.50	8015945	<0.50	0.50	8015945
Alkalinity (Total as CaCO3)	mg/L	32	0.50	8015945	<0.50	0.50	8015945	11	0.50	8015945
Bicarbonate (HCO3)	mg/L	39	0.50	8015945	<0.50	0.50	8015945	13	0.50	8015945
Carbonate (CO3)	mg/L	<0.50	0.50	8015945	<0.50	0.50	8015945	<0.50	0.50	8015945
Hydroxide (OH)	mg/L	<0.50	0.50	8015945	<0.50	0.50	8015945	<0.50	0.50	8015945
Dissolved Sulphate (SO4)	mg/L	47	1.0	8025474	65	1.0	8023999	110	1.0	8025474
Dissolved Chloride (Cl)	mg/L	56	1.0	8025472	510 (1)	5.0	8023989	150	1.0	8025472
Nutrients										
Dissolved Nitrite (N)	mg/L	<0.010	0.010	8016643	<0.010	0.010	8016643	<0.010	0.010	8016643
Dissolved Nitrate (N)	mg/L	<0.010	0.010	8016643	<0.010	0.010	8016643	<0.010	0.010	8016643
Lab Filtered Elements										
Dissolved Calcium (Ca)	mg/L	35	0.30	8024193	77	0.30	8022656	73	0.30	8024193
Dissolved Iron (Fe)	mg/L	6.2	0.060	8024193	3.3	0.060	8022656	0.29	0.060	8024193
Dissolved Magnesium (Mg)	mg/L	13	0.20	8024193	31	0.20	8022656	26	0.20	8024193
Dissolved Manganese (Mn)	mg/L	0.77	0.0040	8024193	4.7	0.0040	8022656	2.7	0.0040	8024193
Dissolved Potassium (K)	mg/L	12	0.30	8024193	150	0.30	8022656	4.7	0.30	8024193
Dissolved Sodium (Na)	mg/L	13	0.50	8024193	120	0.50	8022656	24	0.50	8024193

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Job #: B573450
Report Date: 2015/09/02

STANTEC CONSULTING LTD
Client Project #: 123511463
Site Location: INUVIK
Sampler Initials: OP

ROUTINE WATER - FILTERED (WATER)

Maxxam ID		MZ0272			MZ0273		MZ0274		MZ0275		
Sampling Date		2015/08/20 17:00			2015/08/20 17:00		2015/08/20 17:00		2015/08/20 17:00		
COC Number		A170151			A170151		A170151		A170151		
	UNITS	N05-15-06	RDL	QC Batch	N05-15-07	RDL	N05-15-08	RDL	N05-15-09	RDL	QC Batch
Calculated Parameters											
Anion Sum	meq/L	9.2	N/A	8015249	31	N/A	70	N/A	28	N/A	8015249
Cation Sum	meq/L	10	N/A	8015249	31	N/A	70	N/A	28	N/A	8015249
Hardness (CaCO3)	mg/L	440	0.50	8015271	1100	0.50	2500	0.50	1200	0.50	8015271
Ion Balance	N/A	1.1	0.010	8015248	1.0	0.010	1.0	0.010	1.0	0.010	8015248
Dissolved Nitrate (NO3)	mg/L	<0.044	0.044	8015275	<0.044	0.044	<0.044	0.044	0.080	0.044	8015275
Nitrate plus Nitrite (N)	mg/L	<0.020	0.020	8015276	<0.020	0.020	<0.020	0.020	<0.020	0.020	8015276
Dissolved Nitrite (NO2)	mg/L	<0.033	0.033	8015275	<0.033	0.033	<0.033	0.033	<0.033	0.033	8015275
Total Dissolved Solids	mg/L	540	10	8015277	1900	10	4300	10	1800	10	8015277
Misc. Inorganics											
Conductivity	uS/cm	910	1.0	8016165	2800	1.0	5900	1.0	2200	1.0	8015952
pH	pH	7.32	N/A	8016164	6.59	N/A	6.56	N/A	6.08	N/A	8015951
Anions											
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	8016037	<0.50	0.50	<0.50	0.50	<0.50	0.50	8015945
Alkalinity (Total as CaCO3)	mg/L	140	0.50	8016037	73	0.50	180	0.50	34	0.50	8015945
Bicarbonate (HCO3)	mg/L	170	0.50	8016037	89	0.50	220	0.50	42	0.50	8015945
Carbonate (CO3)	mg/L	<0.50	0.50	8016037	<0.50	0.50	<0.50	0.50	<0.50	0.50	8015945
Hydroxide (OH)	mg/L	<0.50	0.50	8016037	<0.50	0.50	<0.50	0.50	<0.50	0.50	8015945
Dissolved Sulphate (SO4)	mg/L	170	1.0	8023999	760 (1)	5.0	1600 (1)	20	1200 (1)	10	8023999
Dissolved Chloride (Cl)	mg/L	100	1.0	8023989	480 (1)	5.0	1200 (1)	10	98	1.0	8023989
Nutrients											
Dissolved Nitrite (N)	mg/L	<0.010	0.010	8016643	<0.010	0.010	<0.010	0.010	<0.010	0.010	8016643
Dissolved Nitrate (N)	mg/L	<0.010	0.010	8016643	<0.010	0.010	<0.010	0.010	0.018	0.010	8016643
Lab Filtered Elements											
Dissolved Calcium (Ca)	mg/L	120	0.30	8022656	320	0.30	680 (1)	1.5	280	0.30	8022656
Dissolved Iron (Fe)	mg/L	1.3	0.060	8022656	0.61	0.060	0.66	0.060	0.77	0.060	8022656
Dissolved Magnesium (Mg)	mg/L	36	0.20	8022656	85	0.20	200	0.20	130	0.20	8022656
Dissolved Manganese (Mn)	mg/L	1.4	0.0040	8022656	5.6	0.0040	12	0.0040	3.0	0.0040	8022656
Dissolved Potassium (K)	mg/L	4.1	0.30	8022656	160	0.30	140	0.30	1.8	0.30	8022656
Dissolved Sodium (Na)	mg/L	26	0.50	8022656	93	0.50	380	0.50	76	0.50	8022656

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B573450
Report Date: 2015/09/02

STANTEC CONSULTING LTD
Client Project #: 123511463
Site Location: INUVIK
Sampler Initials: OP

ROUTINE WATER - FILTERED (WATER)

Maxxam ID		MZ0276			MZ0277			MZ0278		
Sampling Date		2015/08/20 17:00			2015/08/20 17:00			2015/08/20 17:00		
COC Number		A170151			A170151			A170151		
	UNITS	N05-15-10	RDL	QC Batch	N05-15-11	RDL	QC Batch	N05-15-12	RDL	QC Batch
Calculated Parameters										
Anion Sum	meq/L	1.3	N/A	8015249	23	N/A	8015249	2.5	N/A	8015274
Cation Sum	meq/L	1.5	N/A	8015249	26	N/A	8015249	3.0	N/A	8015274
Hardness (CaCO3)	mg/L	60	0.50	8015271	1100	0.50	8015271	130	0.50	8015271
Ion Balance	N/A	1.2	0.010	8015248	1.1	0.010	8015248	1.2	0.010	8015273
Dissolved Nitrate (NO3)	mg/L	0.56	0.044	8015275	<0.044	0.044	8015275	<0.044	0.044	8015275
Nitrate plus Nitrite (N)	mg/L	0.13	0.020	8015276	<0.020	0.020	8015276	<0.020	0.020	8015276
Dissolved Nitrite (NO2)	mg/L	<0.033	0.033	8015275	<0.033	0.033	8015275	<0.033	0.033	8015275
Total Dissolved Solids	mg/L	70	10	8015277	1500	10	8015277	160	10	8015277
Misc. Inorganics										
Conductivity	uS/cm	130	1.0	8015952	2100	1.0	8015952	270	1.0	8015952
pH	pH	7.59	N/A	8015951	6.02	N/A	8015951	6.51	N/A	8015951
Anions										
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	8015945	<0.50	0.50	8015945	<0.50	0.50	8015945
Alkalinity (Total as CaCO3)	mg/L	41	0.50	8015945	67	0.50	8015945	28	0.50	8015945
Bicarbonate (HCO3)	mg/L	50	0.50	8015945	82	0.50	8015945	34	0.50	8015945
Carbonate (CO3)	mg/L	<0.50	0.50	8015945	<0.50	0.50	8015945	<0.50	0.50	8015945
Hydroxide (OH)	mg/L	<0.50	0.50	8015945	<0.50	0.50	8015945	<0.50	0.50	8015945
Dissolved Sulphate (SO4)	mg/L	7.3	1.0	8023999	840 (1)	10	8023632	81	1.0	8024969
Dissolved Chloride (Cl)	mg/L	10	1.0	8023989	150	1.0	8023626	8.7	1.0	8024968
Nutrients										
Dissolved Nitrite (N)	mg/L	<0.010	0.010	8016647	<0.010	0.010	8016643	<0.010	0.010	8016643
Dissolved Nitrate (N)	mg/L	0.13	0.010	8016647	<0.010	0.010	8016643	<0.010	0.010	8016643
Lab Filtered Elements										
Dissolved Calcium (Ca)	mg/L	16	0.30	8022660	260	0.30	8022656	37	0.30	8022656
Dissolved Iron (Fe)	mg/L	<0.060	0.060	8022660	0.98	0.060	8022656	0.38	0.060	8022656
Dissolved Magnesium (Mg)	mg/L	5.2	0.20	8022660	100	0.20	8022656	10	0.20	8022656
Dissolved Manganese (Mn)	mg/L	<0.0040	0.0040	8022660	12	0.0040	8022656	0.12	0.0040	8022656
Dissolved Potassium (K)	mg/L	0.76	0.30	8022660	5.4	0.30	8022656	0.46	0.30	8022656
Dissolved Sodium (Na)	mg/L	6.2	0.50	8022660	94	0.50	8022656	6.7	0.50	8022656

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B573450
Report Date: 2015/09/02

STANTEC CONSULTING LTD
Client Project #: 123511463
Site Location: INUVIK
Sampler Initials: OP

ROUTINE WATER - FILTERED (WATER)

Maxxam ID		MZ0279			MZ0280			MZ0281		
Sampling Date		2015/08/18 14:00			2015/08/18 14:00			2015/08/18 14:00		
COC Number		A170151			A170151			A170151		
	UNITS	N16-15-01	RDL	QC Batch	N16-15-02	RDL	QC Batch	N16-15-03	RDL	QC Batch
Calculated Parameters										
Anion Sum	meq/L	24	N/A	8015274	7.3	N/A	8015274	20	N/A	8015274
Cation Sum	meq/L	26	N/A	8015274	8.2	N/A	8015274	23	N/A	8015274
Hardness (CaCO3)	mg/L	990	0.50	8015272	320	0.50	8015272	850	0.50	8015272
Ion Balance	N/A	1.1	0.010	8015273	1.1	0.010	8015273	1.1	0.010	8015273
Dissolved Nitrate (NO3)	mg/L	0.42	0.044	8015275	<0.044	0.044	8015275	<0.044	0.044	8015275
Nitrate plus Nitrite (N)	mg/L	0.16	0.020	8015276	<0.020	0.020	8015276	<0.020	0.020	8015276
Dissolved Nitrite (NO2)	mg/L	0.23	0.033	8015275	<0.033	0.033	8015275	<0.033	0.033	8015275
Total Dissolved Solids	mg/L	1500	10	8015277	420	10	8015277	1300	10	8015277
Misc. Inorganics										
Conductivity	uS/cm	2500	1.0	8015318	770	1.0	8015318	2000	1.0	8015318
pH	pH	6.64	N/A	8015299	7.24	N/A	8015299	7.15	N/A	8015299
Anions										
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	8015298	<0.50	0.50	8015298	<0.50	0.50	8015298
Alkalinity (Total as CaCO3)	mg/L	140	0.50	8015298	130	0.50	8015298	380	0.50	8015298
Bicarbonate (HCO3)	mg/L	170	0.50	8015298	160	0.50	8015298	460	0.50	8015298
Carbonate (CO3)	mg/L	<0.50	0.50	8015298	<0.50	0.50	8015298	<0.50	0.50	8015298
Hydroxide (OH)	mg/L	<0.50	0.50	8015298	<0.50	0.50	8015298	<0.50	0.50	8015298
Dissolved Sulphate (SO4)	mg/L	410 (1)	5.0	8023422	46 (1)	2.0	8023999	300 (1)	2.0	8023422
Dissolved Chloride (Cl)	mg/L	460 (1)	5.0	8023414	130	1.0	8023989	230 (1)	2.0	8023414
Nutrients										
Dissolved Nitrite (N)	mg/L	0.070	0.010	8017771	<0.010	0.010	8017771	<0.010	0.010	8017771
Dissolved Nitrate (N)	mg/L	0.095	0.010	8017771	<0.010	0.010	8017771	<0.010	0.010	8017771
Lab Filtered Elements										
Dissolved Calcium (Ca)	mg/L	260	0.30	8022656	83	0.30	8022656	250	0.30	8022656
Dissolved Iron (Fe)	mg/L	7.1	0.060	8022656	1.5	0.060	8022656	1.3	0.060	8022656
Dissolved Magnesium (Mg)	mg/L	84	0.20	8022656	27	0.20	8022656	58	0.20	8022656
Dissolved Manganese (Mn)	mg/L	1.2	0.0040	8022656	0.053	0.0040	8022656	2.3	0.0040	8022656
Dissolved Potassium (K)	mg/L	150	0.30	8022656	36	0.30	8022656	140	0.30	8022656
Dissolved Sodium (Na)	mg/L	59	0.50	8022656	20	0.50	8022656	41	0.50	8022656

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B573450
Report Date: 2015/09/02

STANTEC CONSULTING LTD
Client Project #: 123511463
Site Location: INUVIK
Sampler Initials: OP

ROUTINE WATER - FILTERED (WATER)

Maxxam ID		MZ0288			MZ0289			MZ0290		
Sampling Date		2015/08/18 14:10			2015/08/18 14:10			2015/08/18 14:15		
COC Number		A170152			A170152			A170152		
	UNITS	N16-15-04	RDL	QC Batch	N16-15-05	RDL	QC Batch	N16-15-06	RDL	QC Batch
Calculated Parameters										
Anion Sum	meq/L	54	N/A	8015274	14	N/A	8015274	3.8	N/A	8015274
Cation Sum	meq/L	55	N/A	8015274	15	N/A	8015274	4.3	N/A	8015274
Hardness (CaCO3)	mg/L	1700	0.50	8015272	720	0.50	8015272	150	0.50	8015272
Ion Balance	N/A	1.0	0.010	8015273	1.1	0.010	8015273	1.1	0.010	8015273
Dissolved Nitrate (NO3)	mg/L	0.054	0.044	8015275	0.051	0.044	8015275	<0.044	0.044	8015275
Nitrate plus Nitrite (N)	mg/L	<0.020	0.020	8015276	<0.020	0.020	8015276	<0.020	0.020	8015276
Dissolved Nitrite (NO2)	mg/L	<0.033	0.033	8015275	<0.033	0.033	8015275	<0.033	0.033	8015275
Total Dissolved Solids	mg/L	3300	10	8015277	780	10	8015277	230	10	8015277
Misc. Inorganics										
Conductivity	uS/cm	5800	1.0	8015318	1200	1.0	8015318	460	1.0	8015318
pH	pH	7.07	N/A	8015299	7.19	N/A	8015299	6.55	N/A	8015299
Anions										
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	8015298	<0.50	0.50	8015298	<0.50	0.50	8015298
Alkalinity (Total as CaCO3)	mg/L	330	0.50	8015298	450	0.50	8015298	40	0.50	8015298
Bicarbonate (HCO3)	mg/L	400	0.50	8015298	550	0.50	8015298	49	0.50	8015298
Carbonate (CO3)	mg/L	<0.50	0.50	8015298	<0.50	0.50	8015298	<0.50	0.50	8015298
Hydroxide (OH)	mg/L	<0.50	0.50	8015298	<0.50	0.50	8015298	<0.50	0.50	8015298
Dissolved Sulphate (SO4)	mg/L	370 (1)	5.0	8023422	190 (1)	2.0	8023422	16	1.0	8025474
Dissolved Chloride (Cl)	mg/L	1400 (1)	10	8023414	28	1.0	8023414	94	1.0	8025472
Nutrients										
Dissolved Nitrite (N)	mg/L	<0.010	0.010	8017771	<0.010	0.010	8017771	<0.010	0.010	8017771
Dissolved Nitrate (N)	mg/L	0.012	0.010	8017771	0.012	0.010	8017771	<0.010	0.010	8017771
Lab Filtered Elements										
Dissolved Calcium (Ca)	mg/L	450	0.30	8022656	220	0.30	8022660	40	0.30	8024193
Dissolved Iron (Fe)	mg/L	1.5	0.060	8022656	0.76	0.060	8022660	2.0	0.060	8024193
Dissolved Magnesium (Mg)	mg/L	140	0.20	8022656	40	0.20	8022660	12	0.20	8024193
Dissolved Manganese (Mn)	mg/L	13	0.0040	8022656	4.0	0.0040	8022660	0.071	0.0040	8024193
Dissolved Potassium (K)	mg/L	600 (1)	1.5	8022656	1.3	0.30	8022660	24	0.30	8024193
Dissolved Sodium (Na)	mg/L	120	0.50	8022656	15	0.50	8022660	14	0.50	8024193

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Job #: B573450
Report Date: 2015/09/02

STANTEC CONSULTING LTD
Client Project #: 123511463
Site Location: INUVIK
Sampler Initials: OP

ROUTINE WATER - FILTERED (WATER)

Maxxam ID		MZ0291		MZ0292		
Sampling Date		2015/08/18 14:30		2015/08/18 14:30		
COC Number		A170152		A170152		
	UNITS	N16-15-07	RDL	N16-15-08	RDL	QC Batch
Calculated Parameters						
Anion Sum	meq/L	42	N/A	0.48	N/A	8015274
Cation Sum	meq/L	43	N/A	0.96	N/A	8015274
Hardness (CaCO3)	mg/L	1200	0.50	32	0.50	8015272
Ion Balance	N/A	1.0	0.010	2.0	0.010	8015273
Dissolved Nitrate (NO3)	mg/L	<0.044	0.044	<0.044	0.044	8015275
Nitrate plus Nitrite (N)	mg/L	<0.020	0.020	<0.020	0.020	8015276
Dissolved Nitrite (NO2)	mg/L	<0.033	0.033	<0.033	0.033	8015275
Total Dissolved Solids	mg/L	2600	10	35	10	8015278
Misc. Inorganics						
Conductivity	uS/cm	5000	1.0	75	1.0	8015318
pH	pH	3.28	N/A	5.69	N/A	8015299
Anions						
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	<0.50	0.50	8015298
Alkalinity (Total as CaCO3)	mg/L	<0.50	0.50	5.8	0.50	8015298
Bicarbonate (HCO3)	mg/L	<0.50	0.50	7.0	0.50	8015298
Carbonate (CO3)	mg/L	<0.50	0.50	<0.50	0.50	8015298
Hydroxide (OH)	mg/L	<0.50	0.50	<0.50	0.50	8015298
Dissolved Sulphate (SO4)	mg/L	31	1.0	<1.0	1.0	8023999
Dissolved Chloride (Cl)	mg/L	1500 (1)	10	13	1.0	8023989
Nutrients						
Dissolved Nitrite (N)	mg/L	<0.010	0.010	<0.010	0.010	8017771
Dissolved Nitrate (N)	mg/L	<0.010	0.010	<0.010	0.010	8017771
Lab Filtered Elements						
Dissolved Calcium (Ca)	mg/L	350	0.30	7.1	0.30	8022660
Dissolved Iron (Fe)	mg/L	42	0.060	1.5	0.060	8022660
Dissolved Magnesium (Mg)	mg/L	88	0.20	3.5	0.20	8022660
Dissolved Manganese (Mn)	mg/L	2.1	0.0040	0.031	0.0040	8022660
Dissolved Potassium (K)	mg/L	490	0.30	0.31	0.30	8022660
Dissolved Sodium (Na)	mg/L	87	0.50	5.7	0.50	8022660

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B573450
Report Date: 2015/09/02

STANTEC CONSULTING LTD
Client Project #: 123511463
Site Location: INUVIK
Sampler Initials: OP

SOIL SALINITY 4 (SOIL)

Maxxam ID		MZ0251		MZ0252		MZ0253		
Sampling Date		2015/08/20		2015/08/20		2015/08/20		
COC Number		A170150		A170150		A170150		
	UNITS	K30-15-05 @ 1M	RDL	K30-15-06 @ 1M	RDL	K30-15-07 @ 1M	RDL	QC Batch
Calculated Parameters								
Anion Sum	meq/L	160	N/A	82	N/A	32	N/A	8014871
Cation Sum	meq/L	170	N/A	89	N/A	35	N/A	8014871
Cation/EC Ratio	N/A	8.1	0.10	8.6	0.10	11	0.10	8014865
Ion Balance	N/A	1.0	0.010	1.1	0.010	1.1	0.010	8014870
Calculated Calcium (Ca)	mg/kg	310	0.71	170	0.63	170	0.80	8014873
Calculated Magnesium (Mg)	mg/kg	37	0.47	19	0.42	24	0.53	8014873
Calculated Sodium (Na)	mg/kg	200	1.2	180	1.1	180	1.3	8014873
Calculated Potassium (K)	mg/kg	2000	0.61	750	0.55	6.5	0.70	8014873
Calculated Chloride (Cl)	mg/kg	2700	12	1100	4.2	410	2.7	8014873
Calculated Sulphate (SO4)	mg/kg	33	2.4	150	2.1	280	2.7	8014873
Soluble Parameters								
Soluble Chloride (Cl)	mg/L	5800 (1)	25	2600 (1)	10	760	5.0	8021505
Soluble Conductivity	dS/m	21	0.020	10	0.020	3.2	0.020	8021678
Soluble (CaCl2) pH	pH	7.32	N/A	7.44	N/A	7.32	N/A	8018862
Sodium Adsorption Ratio	N/A	4.2	0.10	5.5	0.10	4.8	0.10	8014872
Soluble Calcium (Ca)	mg/L	660	1.5	410	1.5	310	1.5	8021500
Soluble Magnesium (Mg)	mg/L	79	1.0	46	1.0	46	1.0	8021500
Soluble Sodium (Na)	mg/L	420	2.5	440	2.5	340	2.5	8021500
Soluble Potassium (K)	mg/L	4200	1.3	1800	1.3	12	1.3	8021500
Saturation %	%	47	N/A	42	N/A	53	N/A	8020917
Soluble Sulphate (SO4)	mg/L	69	5.0	370	5.0	520	5.0	8021500
Theoretical Gypsum Requirement	tonnes/ha	0.24	0.20	1.5	0.20	0.77	0.20	8014874

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B573450
Report Date: 2015/09/02

STANTEC CONSULTING LTD
Client Project #: 123511463
Site Location: INUVIK
Sampler Initials: OP

ASSESSMENT ICP METALS (SOIL)

Maxxam ID		MZ0251	MZ0252	MZ0253		
Sampling Date		2015/08/20	2015/08/20	2015/08/20		
COC Number		A170150	A170150	A170150		
	UNITS	K30-15-05 @ 1M	K30-15-06 @ 1M	K30-15-07 @ 1M	RDL	QC Batch
Elements						
Total Aluminum (Al)	mg/kg	7000	6600	8400	10	8021362
Total Boron (B)	mg/kg	6.1	6.8	8.6	2.0	8021362
Total Calcium (Ca)	mg/kg	47000	48000	48000	50	8021362
Total Iron (Fe)	mg/kg	18000	17000	19000	10	8021362
Total Lithium (Li)	mg/kg	12	12	14	10	8021362
Total Magnesium (Mg)	mg/kg	20000	20000	20000	20	8021362
Total Manganese (Mn)	mg/kg	290	270	320	10	8021362
Total Phosphorus (P)	mg/kg	740	680	690	20	8021362
Total Potassium (K)	mg/kg	4900	2700	1200	25	8021362
Total Sodium (Na)	mg/kg	340	320	340	50	8021362
Total Strontium (Sr)	mg/kg	73	72	71	10	8021362
Total Sulphur (S)	mg/kg	750	1300	540	20	8021362
Total Antimony (Sb)	mg/kg	<0.50	<0.50	<0.50	0.50	8021369
Total Arsenic (As)	mg/kg	6.2	6.1	6.3	1.0	8021369
Total Barium (Ba)	mg/kg	1200	2600	410	1.0	8021369
Total Beryllium (Be)	mg/kg	<0.40	<0.40	0.44	0.40	8021369
Total Cadmium (Cd)	mg/kg	0.43	0.31	0.40	0.050	8021369
Total Chromium (Cr)	mg/kg	14	13	15	1.0	8021369
Total Cobalt (Co)	mg/kg	7.0	6.4	7.3	0.50	8021369
Total Copper (Cu)	mg/kg	14	17	15	1.0	8021369
Total Lead (Pb)	mg/kg	7.0	8.2	6.9	0.50	8021369
Total Molybdenum (Mo)	mg/kg	1.1	1.1	1.1	0.40	8021369
Total Nickel (Ni)	mg/kg	21	19	22	1.0	8021369
Total Selenium (Se)	mg/kg	0.50	<0.50	<0.50	0.50	8021369
Total Silver (Ag)	mg/kg	<0.20	<0.20	<0.20	0.20	8021369
Total Thallium (Tl)	mg/kg	<0.10	<0.10	0.12	0.10	8021369
Total Tin (Sn)	mg/kg	<1.0	<1.0	<1.0	1.0	8021369
Total Uranium (U)	mg/kg	0.80	0.75	0.78	0.20	8021369
Total Vanadium (V)	mg/kg	26	25	30	1.0	8021369
Total Zinc (Zn)	mg/kg	70	65	73	10	8021369
RDL = Reportable Detection Limit						

Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B573450
Report Date: 2015/09/02

STANTEC CONSULTING LTD
Client Project #: 123511463
Site Location: INUVIK
Sampler Initials: OP

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	3.7°C

Sample MZ0233-01 : Cation - Anion balance exceed normal acceptance limits, due to the low concentrations of ions being measured.

Sample MZ0251-01 : Cation/ EC ratio exceeds normal acceptance limits, reanalysis yields similar results, possible matrix interference. EC rechecked.

Sample MZ0256-01 : Cation - Anion balance exceeds normal acceptance limits, major ions reanalyzed, possible matrix interference.

Sample MZ0276-01 : Cation - Anion balance exceed normal acceptance limits, due to the low concentrations of ions being measured.

Sample MZ0278-01 : Cation - Anion balance exceeds normal acceptance limits, major ions reanalyzed, possible matrix interference.

Sample MZ0292-01 : Cation - Anion balance exceed normal acceptance limits, due to the low concentrations of ions being measured.

Results relate only to the items tested.

Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B573450
Report Date: 2015/09/02

STANTEC CONSULTING LTD
Client Project #: 123511463
Site Location: INUVIK
Sampler Initials: OP

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8015298	CT6	Spiked Blank	Alkalinity (Total as CaCO3)	2015/08/25		97	%	80 - 120
8015298	CT6	Method Blank	Alkalinity (PP as CaCO3)	2015/08/25	<0.50		mg/L	
			Alkalinity (Total as CaCO3)	2015/08/25	<0.50		mg/L	
			Bicarbonate (HCO3)	2015/08/25	<0.50		mg/L	
			Carbonate (CO3)	2015/08/25	<0.50		mg/L	
			Hydroxide (OH)	2015/08/25	<0.50		mg/L	
8015298	CT6	RPD [MZ0280-01]	Alkalinity (PP as CaCO3)	2015/08/25	NC		%	20
			Alkalinity (Total as CaCO3)	2015/08/25	4.2		%	20
			Bicarbonate (HCO3)	2015/08/25	4.2		%	20
			Carbonate (CO3)	2015/08/25	NC		%	20
			Hydroxide (OH)	2015/08/25	NC		%	20
8015299	CT6	Spiked Blank	pH	2015/08/25		100	%	97 - 103
8015299	CT6	RPD [MZ0280-01]	pH	2015/08/25	0.29		%	N/A
8015318	CT6	Spiked Blank	Conductivity	2015/08/25		101	%	90 - 110
8015318	CT6	Method Blank	Conductivity	2015/08/25	<1.0		uS/cm	
8015318	CT6	RPD [MZ0280-01]	Conductivity	2015/08/25	2.8		%	20
8015945	XLI	Spiked Blank	Alkalinity (Total as CaCO3)	2015/08/26		95	%	80 - 120
8015945	XLI	Method Blank	Alkalinity (PP as CaCO3)	2015/08/26	<0.50		mg/L	
			Alkalinity (Total as CaCO3)	2015/08/26	<0.50		mg/L	
			Bicarbonate (HCO3)	2015/08/26	<0.50		mg/L	
			Carbonate (CO3)	2015/08/26	<0.50		mg/L	
			Hydroxide (OH)	2015/08/26	<0.50		mg/L	
8015945	XLI	RPD [MZ0276-01]	Alkalinity (PP as CaCO3)	2015/08/26	NC		%	20
			Alkalinity (Total as CaCO3)	2015/08/26	2.2		%	20
			Bicarbonate (HCO3)	2015/08/26	2.2		%	20
			Carbonate (CO3)	2015/08/26	NC		%	20
			Hydroxide (OH)	2015/08/26	NC		%	20
8015951	XLI	Spiked Blank	pH	2015/08/26		100	%	97 - 103
8015951	XLI	RPD [MZ0276-01]	pH	2015/08/26	0.42		%	N/A
8015952	XLI	Spiked Blank	Conductivity	2015/08/26		100	%	90 - 110
8015952	XLI	Method Blank	Conductivity	2015/08/26	<1.0		uS/cm	
8015952	XLI	RPD [MZ0276-01]	Conductivity	2015/08/26	0.68		%	20
8016037	XLI	Spiked Blank	Alkalinity (Total as CaCO3)	2015/08/26		95	%	80 - 120
8016037	XLI	Method Blank	Alkalinity (PP as CaCO3)	2015/08/26	<0.50		mg/L	
			Alkalinity (Total as CaCO3)	2015/08/26	<0.50		mg/L	
			Bicarbonate (HCO3)	2015/08/26	<0.50		mg/L	
			Carbonate (CO3)	2015/08/26	<0.50		mg/L	
			Hydroxide (OH)	2015/08/26	<0.50		mg/L	
8016037	XLI	RPD [MZ0237-01]	Alkalinity (PP as CaCO3)	2015/08/26	NC		%	20
			Alkalinity (Total as CaCO3)	2015/08/26	1.1		%	20
			Bicarbonate (HCO3)	2015/08/26	1.1		%	20
			Carbonate (CO3)	2015/08/26	NC		%	20
			Hydroxide (OH)	2015/08/26	NC		%	20
8016164	XLI	Spiked Blank	pH	2015/08/26		100	%	97 - 103
8016164	XLI	RPD [MZ0237-01]	pH	2015/08/26	0.29		%	N/A
8016165	XLI	Spiked Blank	Conductivity	2015/08/26		101	%	90 - 110
8016165	XLI	Method Blank	Conductivity	2015/08/26	<1.0		uS/cm	
8016165	XLI	RPD [MZ0237-01]	Conductivity	2015/08/26	0.26		%	20
8016643	NW4	Matrix Spike [MZ0233-01]	Dissolved Nitrite (N)	2015/08/26		99	%	80 - 120
			Dissolved Nitrate (N)	2015/08/26		99	%	80 - 120
8016643	NW4	Spiked Blank	Dissolved Nitrite (N)	2015/08/26		100	%	80 - 120

Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B573450
Report Date: 2015/09/02

STANTEC CONSULTING LTD
Client Project #: 123511463
Site Location: INUVIK
Sampler Initials: OP

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Nitrate (N)	2015/08/26		100	%	80 - 120
8016643	NW4	Method Blank	Dissolved Nitrite (N)	2015/08/26	<0.010		mg/L	
			Dissolved Nitrate (N)	2015/08/26	<0.010		mg/L	
8016643	NW4	RPD [MZ0233-01]	Dissolved Nitrite (N)	2015/08/26	NC		%	20
			Dissolved Nitrate (N)	2015/08/26	NC		%	20
8016647	NW4	Matrix Spike	Dissolved Nitrite (N)	2015/08/26		97	%	80 - 120
			Dissolved Nitrate (N)	2015/08/26		99	%	80 - 120
8016647	NW4	Spiked Blank	Dissolved Nitrite (N)	2015/08/26		98	%	80 - 120
			Dissolved Nitrate (N)	2015/08/26		99	%	80 - 120
8016647	NW4	Method Blank	Dissolved Nitrite (N)	2015/08/26	<0.010		mg/L	
			Dissolved Nitrate (N)	2015/08/26	<0.010		mg/L	
8016647	NW4	RPD	Dissolved Nitrite (N)	2015/08/26	NC		%	20
			Dissolved Nitrate (N)	2015/08/26	NC		%	20
8017771	NW4	Matrix Spike	Dissolved Nitrite (N)	2015/08/27		101	%	80 - 120
			Dissolved Nitrate (N)	2015/08/27		101	%	80 - 120
8017771	NW4	Spiked Blank	Dissolved Nitrite (N)	2015/08/27		101	%	80 - 120
			Dissolved Nitrate (N)	2015/08/27		101	%	80 - 120
8017771	NW4	Method Blank	Dissolved Nitrite (N)	2015/08/27	<0.010		mg/L	
			Dissolved Nitrate (N)	2015/08/27	<0.010		mg/L	
8017771	NW4	RPD	Dissolved Nitrite (N)	2015/08/27	NC		%	20
			Dissolved Nitrate (N)	2015/08/27	NC		%	20
8018862	EH2	QC Standard	Soluble (CaCl2) pH	2015/08/28		100	%	98 - 102
8018862	EH2	Spiked Blank	Soluble (CaCl2) pH	2015/08/28		100	%	97 - 103
8018862	EH2	RPD	Soluble (CaCl2) pH	2015/08/28	0.52		%	N/A
8020917	YU	QC Standard	Saturation %	2015/08/29		102	%	75 - 125
8020917	YU	RPD	Saturation %	2015/08/29	3.3		%	12
8020938	SRT	Matrix Spike [MZ0248-01]	Dissolved Calcium (Ca)	2015/09/01		NC	%	80 - 120
			Dissolved Iron (Fe)	2015/09/01		98	%	80 - 120
			Dissolved Magnesium (Mg)	2015/09/01		NC	%	80 - 120
			Dissolved Manganese (Mn)	2015/09/01		NC	%	80 - 120
			Dissolved Potassium (K)	2015/09/01		NC	%	80 - 120
			Dissolved Sodium (Na)	2015/09/01		NC	%	80 - 120
8020938	SRT	Spiked Blank	Dissolved Calcium (Ca)	2015/08/31		99	%	80 - 120
			Dissolved Iron (Fe)	2015/08/31		95	%	80 - 120
			Dissolved Magnesium (Mg)	2015/08/31		101	%	80 - 120
			Dissolved Manganese (Mn)	2015/08/31		100	%	80 - 120
			Dissolved Potassium (K)	2015/08/31		101	%	80 - 120
			Dissolved Sodium (Na)	2015/08/31		97	%	80 - 120
8020938	SRT	Method Blank	Dissolved Calcium (Ca)	2015/08/31	<0.30		mg/L	
			Dissolved Iron (Fe)	2015/08/31	<0.060		mg/L	
			Dissolved Magnesium (Mg)	2015/08/31	<0.20		mg/L	
			Dissolved Manganese (Mn)	2015/08/31	<0.0040		mg/L	
			Dissolved Potassium (K)	2015/08/31	<0.30		mg/L	
			Dissolved Sodium (Na)	2015/08/31	<0.50		mg/L	
8020938	SRT	RPD [MZ0248-01]	Dissolved Calcium (Ca)	2015/08/31	2.7		%	20
			Dissolved Iron (Fe)	2015/08/31	NC		%	20
			Dissolved Magnesium (Mg)	2015/08/31	1.0		%	20
			Dissolved Manganese (Mn)	2015/08/31	0.35		%	20
			Dissolved Potassium (K)	2015/08/31	1.2		%	20
			Dissolved Sodium (Na)	2015/08/31	1.0		%	20

Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B573450
Report Date: 2015/09/02

STANTEC CONSULTING LTD
Client Project #: 123511463
Site Location: INUVIK
Sampler Initials: OP

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8021362	PL	Matrix Spike [MZ0253-01]	Total Aluminum (Al)	2015/09/01		NC	%	75 - 125
			Total Boron (B)	2015/09/01		83	%	75 - 125
			Total Calcium (Ca)	2015/09/01		NC	%	75 - 125
			Total Iron (Fe)	2015/09/01		NC	%	75 - 125
			Total Lithium (Li)	2015/09/01		92	%	75 - 125
			Total Magnesium (Mg)	2015/09/01		NC	%	75 - 125
			Total Manganese (Mn)	2015/09/01		NC	%	75 - 125
			Total Phosphorus (P)	2015/09/01		NC	%	75 - 125
			Total Potassium (K)	2015/09/01		NC	%	75 - 125
			Total Sodium (Na)	2015/09/01		89	%	75 - 125
			Total Strontium (Sr)	2015/09/01		NC	%	75 - 125
8021362	PL	QC Standard	Total Aluminum (Al)	2015/09/01		108	%	51 - 149
			Total Calcium (Ca)	2015/09/01		106	%	77 - 123
			Total Iron (Fe)	2015/09/01		115	%	61 - 139
			Total Lithium (Li)	2015/09/01		104	%	75 - 125
			Total Magnesium (Mg)	2015/09/01		112	%	69 - 131
			Total Manganese (Mn)	2015/09/01		113	%	71 - 129
			Total Phosphorus (P)	2015/09/01		104	%	89 - 117
			Total Potassium (K)	2015/09/01		109	%	60 - 140
			Total Sodium (Na)	2015/09/01		111	%	60 - 140
			Total Strontium (Sr)	2015/09/01		100	%	75 - 125
8021362	PL	Spiked Blank	Total Aluminum (Al)	2015/09/01		103	%	75 - 125
			Total Boron (B)	2015/09/01		92	%	75 - 125
			Total Calcium (Ca)	2015/09/01		98	%	75 - 125
			Total Iron (Fe)	2015/09/01		98	%	75 - 125
			Total Lithium (Li)	2015/09/01		97	%	75 - 125
			Total Magnesium (Mg)	2015/09/01		97	%	75 - 125
			Total Manganese (Mn)	2015/09/01		98	%	75 - 125
			Total Phosphorus (P)	2015/09/01		100	%	75 - 125
			Total Potassium (K)	2015/09/01		96	%	75 - 125
			Total Sodium (Na)	2015/09/01		94	%	75 - 125
			Total Strontium (Sr)	2015/09/01		95	%	75 - 125
8021362	PL	Method Blank	Total Aluminum (Al)	2015/09/01	<10		mg/kg	
			Total Boron (B)	2015/09/01	<2.0		mg/kg	
			Total Calcium (Ca)	2015/09/01	<50		mg/kg	
			Total Iron (Fe)	2015/09/01	<10		mg/kg	
			Total Lithium (Li)	2015/09/01	<10		mg/kg	
			Total Magnesium (Mg)	2015/09/01	<20		mg/kg	
			Total Manganese (Mn)	2015/09/01	<10		mg/kg	
			Total Phosphorus (P)	2015/09/01	<20		mg/kg	
			Total Potassium (K)	2015/09/01	41, RDL=25		mg/kg	
			Total Sodium (Na)	2015/09/01	<50		mg/kg	
			Total Strontium (Sr)	2015/09/01	<10		mg/kg	
			Total Sulphur (S)	2015/09/01	<20		mg/kg	
8021362	PL	RPD [MZ0253-01]	Total Aluminum (Al)	2015/09/01	3.1		%	35
			Total Boron (B)	2015/09/01	NC		%	35
			Total Calcium (Ca)	2015/09/01	0.047		%	35
			Total Iron (Fe)	2015/09/01	0.43		%	35
			Total Lithium (Li)	2015/09/01	NC		%	35
			Total Magnesium (Mg)	2015/09/01	0.84		%	35

Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B573450
Report Date: 2015/09/02

STANTEC CONSULTING LTD
Client Project #: 123511463
Site Location: INUVIK
Sampler Initials: OP

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Total Manganese (Mn)	2015/09/01	0.55		%	35
			Total Phosphorus (P)	2015/09/01	5.2		%	35
			Total Potassium (K)	2015/09/01	8.7		%	35
			Total Sodium (Na)	2015/09/01	6.4		%	35
			Total Strontium (Sr)	2015/09/01	0.17		%	35
			Total Sulphur (S)	2015/09/01	3.4		%	35
8021369	STI	Matrix Spike [MZ0253-01]	Total Antimony (Sb)	2015/08/31		87	%	75 - 125
			Total Arsenic (As)	2015/08/31		88	%	75 - 125
			Total Barium (Ba)	2015/08/31		NC	%	75 - 125
			Total Beryllium (Be)	2015/08/31		88	%	75 - 125
			Total Cadmium (Cd)	2015/08/31		86	%	75 - 125
			Total Chromium (Cr)	2015/08/31		88	%	75 - 125
			Total Cobalt (Co)	2015/08/31		81	%	75 - 125
			Total Copper (Cu)	2015/08/31		78	%	75 - 125
			Total Lead (Pb)	2015/08/31		79	%	75 - 125
			Total Molybdenum (Mo)	2015/08/31		89	%	75 - 125
			Total Nickel (Ni)	2015/08/31		81	%	75 - 125
			Total Selenium (Se)	2015/08/31		86	%	75 - 125
			Total Silver (Ag)	2015/08/31		86	%	75 - 125
			Total Thallium (Tl)	2015/08/31		79	%	75 - 125
			Total Tin (Sn)	2015/08/31		87	%	75 - 125
			Total Uranium (U)	2015/08/31		85	%	75 - 125
			Total Vanadium (V)	2015/08/31		NC	%	75 - 125
			Total Zinc (Zn)	2015/08/31		NC	%	75 - 125
8021369	STI	QC Standard	Total Arsenic (As)	2015/08/31		118	%	50 - 150
			Total Barium (Ba)	2015/08/31		107	%	69 - 131
			Total Chromium (Cr)	2015/08/31		105	%	41 - 159
			Total Cobalt (Co)	2015/08/31		101	%	75 - 125
			Total Copper (Cu)	2015/08/31		98	%	73 - 127
			Total Lead (Pb)	2015/08/31		95	%	54 - 146
			Total Nickel (Ni)	2015/08/31		106	%	61 - 139
			Total Vanadium (V)	2015/08/31		119	%	50 - 150
			Total Zinc (Zn)	2015/08/31		105	%	72 - 128
8021369	STI	Spiked Blank	Total Antimony (Sb)	2015/08/31		100	%	75 - 125
			Total Arsenic (As)	2015/08/31		95	%	75 - 125
			Total Barium (Ba)	2015/08/31		94	%	75 - 125
			Total Beryllium (Be)	2015/08/31		92	%	75 - 125
			Total Cadmium (Cd)	2015/08/31		93	%	75 - 125
			Total Chromium (Cr)	2015/08/31		91	%	75 - 125
			Total Cobalt (Co)	2015/08/31		90	%	75 - 125
			Total Copper (Cu)	2015/08/31		91	%	75 - 125
			Total Lead (Pb)	2015/08/31		87	%	75 - 125
			Total Molybdenum (Mo)	2015/08/31		92	%	75 - 125
			Total Nickel (Ni)	2015/08/31		91	%	75 - 125
			Total Selenium (Se)	2015/08/31		97	%	75 - 125
			Total Silver (Ag)	2015/08/31		93	%	75 - 125
			Total Thallium (Tl)	2015/08/31		87	%	75 - 125
			Total Tin (Sn)	2015/08/31		86	%	75 - 125
			Total Uranium (U)	2015/08/31		96	%	75 - 125
			Total Vanadium (V)	2015/08/31		95	%	75 - 125
			Total Zinc (Zn)	2015/08/31		93	%	75 - 125

Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B573450
Report Date: 2015/09/02

STANTEC CONSULTING LTD
Client Project #: 123511463
Site Location: INUVIK
Sampler Initials: OP

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8021369	STI	Method Blank	Total Antimony (Sb)	2015/08/31	<0.50		mg/kg	
			Total Arsenic (As)	2015/08/31	<1.0		mg/kg	
			Total Barium (Ba)	2015/08/31	<1.0		mg/kg	
			Total Beryllium (Be)	2015/08/31	<0.40		mg/kg	
			Total Cadmium (Cd)	2015/08/31	<0.050		mg/kg	
			Total Chromium (Cr)	2015/08/31	<1.0		mg/kg	
			Total Cobalt (Co)	2015/08/31	<0.50		mg/kg	
			Total Copper (Cu)	2015/08/31	<1.0		mg/kg	
			Total Lead (Pb)	2015/08/31	<0.50		mg/kg	
			Total Molybdenum (Mo)	2015/08/31	<0.40		mg/kg	
			Total Nickel (Ni)	2015/08/31	<1.0		mg/kg	
			Total Selenium (Se)	2015/08/31	<0.50		mg/kg	
			Total Silver (Ag)	2015/08/31	<0.20		mg/kg	
			Total Thallium (Tl)	2015/08/31	<0.10		mg/kg	
			Total Tin (Sn)	2015/08/31	<1.0		mg/kg	
			Total Uranium (U)	2015/08/31	<0.20		mg/kg	
			Total Vanadium (V)	2015/08/31	<1.0		mg/kg	
			Total Zinc (Zn)	2015/08/31	<10		mg/kg	
8021369	STI	RPD [MZ0253-01]	Total Antimony (Sb)	2015/08/31	NC		%	35
			Total Arsenic (As)	2015/08/31	7.8		%	35
			Total Barium (Ba)	2015/08/31	3.8		%	35
			Total Beryllium (Be)	2015/08/31	NC		%	35
			Total Cadmium (Cd)	2015/08/31	17		%	35
			Total Chromium (Cr)	2015/08/31	7.5		%	35
			Total Cobalt (Co)	2015/08/31	4.4		%	35
			Total Copper (Cu)	2015/08/31	6.9		%	35
			Total Lead (Pb)	2015/08/31	2.3		%	35
			Total Molybdenum (Mo)	2015/08/31	NC		%	35
			Total Nickel (Ni)	2015/08/31	3.5		%	35
			Total Selenium (Se)	2015/08/31	NC		%	35
			Total Silver (Ag)	2015/08/31	NC		%	35
			Total Thallium (Tl)	2015/08/31	NC		%	35
			Total Tin (Sn)	2015/08/31	NC		%	35
			Total Uranium (U)	2015/08/31	NC		%	35
			Total Vanadium (V)	2015/08/31	9.8		%	35
			Total Zinc (Zn)	2015/08/31	3.5		%	35
8021500	PL	Matrix Spike	Soluble Calcium (Ca)	2015/08/30		103	%	75 - 125
			Soluble Magnesium (Mg)	2015/08/30		100	%	75 - 125
			Soluble Sodium (Na)	2015/08/30		92	%	75 - 125
			Soluble Potassium (K)	2015/08/30		108	%	75 - 125
8021500	PL	QC Standard	Soluble Calcium (Ca)	2015/08/30		95	%	75 - 125
			Soluble Magnesium (Mg)	2015/08/30		90	%	75 - 125
			Soluble Sodium (Na)	2015/08/30		87	%	75 - 125
			Soluble Potassium (K)	2015/08/30		94	%	75 - 125
			Soluble Sulphate (SO4)	2015/08/30		90	%	75 - 125
8021500	PL	Spiked Blank	Soluble Calcium (Ca)	2015/08/30		101	%	80 - 120
			Soluble Magnesium (Mg)	2015/08/30		98	%	80 - 120
			Soluble Sodium (Na)	2015/08/30		92	%	80 - 120
			Soluble Potassium (K)	2015/08/30		105	%	80 - 120
8021500	PL	Method Blank	Soluble Calcium (Ca)	2015/08/30	<1.5		mg/L	
			Soluble Magnesium (Mg)	2015/08/30	<1.0		mg/L	
			Soluble Sodium (Na)	2015/08/30	<2.5		mg/L	

Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B573450
Report Date: 2015/09/02

STANTEC CONSULTING LTD
Client Project #: 123511463
Site Location: INUVIK
Sampler Initials: OP

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Soluble Potassium (K)	2015/08/30	<1.3		mg/L	
			Soluble Sulphate (SO4)	2015/08/30	<5.0		mg/L	
8021500	PL	RPD	Soluble Calcium (Ca)	2015/08/30	1.3		%	35
			Soluble Magnesium (Mg)	2015/08/30	1.3		%	35
			Soluble Sodium (Na)	2015/08/30	2.1		%	35
			Soluble Potassium (K)	2015/08/30	0.44		%	35
			Soluble Sulphate (SO4)	2015/08/30	0.12		%	35
8021505	KP9	Matrix Spike	Soluble Chloride (Cl)	2015/08/30		NC	%	75 - 125
8021505	KP9	QC Standard	Soluble Chloride (Cl)	2015/08/30		81	%	75 - 125
8021505	KP9	Spiked Blank	Soluble Chloride (Cl)	2015/08/30		105	%	75 - 125
8021505	KP9	Method Blank	Soluble Chloride (Cl)	2015/08/30	<5.0		mg/L	
8021505	KP9	RPD	Soluble Chloride (Cl)	2015/08/30	8.1		%	35
8021678	IK0	QC Standard	Soluble Conductivity	2015/08/31		91	%	75 - 125
8021678	IK0	Spiked Blank	Soluble Conductivity	2015/08/31		101	%	90 - 110
8021678	IK0	Method Blank	Soluble Conductivity	2015/08/31	<0.020		dS/m	
8021678	IK0	RPD	Soluble Conductivity	2015/08/31	9.1		%	35
8022656	SRT	Matrix Spike [MZ0254-01]	Dissolved Calcium (Ca)	2015/08/31		NC	%	80 - 120
			Dissolved Iron (Fe)	2015/08/31		NC	%	80 - 120
			Dissolved Magnesium (Mg)	2015/08/31		NC	%	80 - 120
			Dissolved Manganese (Mn)	2015/08/31		NC	%	80 - 120
			Dissolved Potassium (K)	2015/08/31		103	%	80 - 120
			Dissolved Sodium (Na)	2015/08/31		NC	%	80 - 120
8022656	SRT	Spiked Blank	Dissolved Calcium (Ca)	2015/08/31		110	%	80 - 120
			Dissolved Iron (Fe)	2015/08/31		104	%	80 - 120
			Dissolved Magnesium (Mg)	2015/08/31		105	%	80 - 120
			Dissolved Manganese (Mn)	2015/08/31		102	%	80 - 120
			Dissolved Potassium (K)	2015/08/31		101	%	80 - 120
			Dissolved Sodium (Na)	2015/08/31		96	%	80 - 120
8022656	SRT	Method Blank	Dissolved Calcium (Ca)	2015/08/31	<0.30		mg/L	
			Dissolved Iron (Fe)	2015/08/31	<0.060		mg/L	
			Dissolved Magnesium (Mg)	2015/08/31	<0.20		mg/L	
			Dissolved Manganese (Mn)	2015/08/31	<0.0040		mg/L	
			Dissolved Potassium (K)	2015/08/31	<0.30		mg/L	
			Dissolved Sodium (Na)	2015/08/31	<0.50		mg/L	
8022656	SRT	RPD [MZ0254-01]	Dissolved Calcium (Ca)	2015/08/31	0.28		%	20
			Dissolved Iron (Fe)	2015/08/31	1.4		%	20
			Dissolved Magnesium (Mg)	2015/08/31	0.93		%	20
			Dissolved Manganese (Mn)	2015/08/31	0.25		%	20
			Dissolved Potassium (K)	2015/08/31	0.54		%	20
			Dissolved Sodium (Na)	2015/08/31	0.31		%	20
8022660	SRT	Matrix Spike [MZ0276-01]	Dissolved Calcium (Ca)	2015/08/31		116	%	80 - 120
			Dissolved Iron (Fe)	2015/08/31		111	%	80 - 120
			Dissolved Magnesium (Mg)	2015/08/31		115	%	80 - 120
			Dissolved Manganese (Mn)	2015/08/31		110	%	80 - 120
			Dissolved Potassium (K)	2015/08/31		113	%	80 - 120
			Dissolved Sodium (Na)	2015/08/31		104	%	80 - 120
8022660	SRT	Spiked Blank	Dissolved Calcium (Ca)	2015/08/31		105	%	80 - 120
			Dissolved Iron (Fe)	2015/08/31		99	%	80 - 120
			Dissolved Magnesium (Mg)	2015/08/31		101	%	80 - 120
			Dissolved Manganese (Mn)	2015/08/31		98	%	80 - 120

Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B573450
Report Date: 2015/09/02

STANTEC CONSULTING LTD
Client Project #: 123511463
Site Location: INUVIK
Sampler Initials: OP

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Potassium (K)	2015/08/31		99	%	80 - 120
			Dissolved Sodium (Na)	2015/08/31		94	%	80 - 120
8022660	SRT	Method Blank	Dissolved Calcium (Ca)	2015/08/31	<0.30		mg/L	
			Dissolved Iron (Fe)	2015/08/31	<0.060		mg/L	
			Dissolved Magnesium (Mg)	2015/08/31	<0.20		mg/L	
			Dissolved Manganese (Mn)	2015/08/31	<0.0040		mg/L	
			Dissolved Potassium (K)	2015/08/31	<0.30		mg/L	
			Dissolved Sodium (Na)	2015/08/31	<0.50		mg/L	
8022660	SRT	RPD [MZ0276-01]	Dissolved Calcium (Ca)	2015/08/31	1.6		%	20
			Dissolved Iron (Fe)	2015/08/31	NC		%	20
			Dissolved Magnesium (Mg)	2015/08/31	1.4		%	20
			Dissolved Manganese (Mn)	2015/08/31	NC		%	20
			Dissolved Potassium (K)	2015/08/31	NC		%	20
			Dissolved Sodium (Na)	2015/08/31	0.61		%	20
8023414	TN4	Matrix Spike	Dissolved Chloride (Cl)	2015/09/01		100	%	80 - 120
8023414	TN4	Spiked Blank	Dissolved Chloride (Cl)	2015/09/01		101	%	80 - 120
8023414	TN4	Method Blank	Dissolved Chloride (Cl)	2015/09/01	<1.0		mg/L	
8023414	TN4	RPD	Dissolved Chloride (Cl)	2015/09/01	NC		%	20
8023422	TN4	Matrix Spike	Dissolved Sulphate (SO4)	2015/09/01		NC	%	80 - 120
8023422	TN4	Spiked Blank	Dissolved Sulphate (SO4)	2015/09/01		102	%	80 - 120
8023422	TN4	Method Blank	Dissolved Sulphate (SO4)	2015/09/01	<1.0		mg/L	
8023422	TN4	RPD	Dissolved Sulphate (SO4)	2015/09/01	8.4		%	20
8023626	TN4	Matrix Spike	Dissolved Chloride (Cl)	2015/09/01		101	%	80 - 120
8023626	TN4	Spiked Blank	Dissolved Chloride (Cl)	2015/09/01		100	%	80 - 120
8023626	TN4	Method Blank	Dissolved Chloride (Cl)	2015/09/01	<1.0		mg/L	
8023626	TN4	RPD	Dissolved Chloride (Cl)	2015/09/01	NC		%	20
8023632	TN4	Matrix Spike	Dissolved Sulphate (SO4)	2015/09/01		108	%	80 - 120
8023632	TN4	Spiked Blank	Dissolved Sulphate (SO4)	2015/09/01		106	%	80 - 120
8023632	TN4	Method Blank	Dissolved Sulphate (SO4)	2015/09/01	<1.0		mg/L	
8023632	TN4	RPD	Dissolved Sulphate (SO4)	2015/09/01	NC		%	20
8023940	KP9	Matrix Spike	Dissolved Chloride (Cl)	2015/09/01		113	%	80 - 120
8023940	KP9	Spiked Blank	Dissolved Chloride (Cl)	2015/09/01		102	%	80 - 120
8023940	KP9	Method Blank	Dissolved Chloride (Cl)	2015/09/01	<1.0		mg/L	
8023940	KP9	RPD	Dissolved Chloride (Cl)	2015/09/01	NC		%	20
8023943	KP9	Matrix Spike	Dissolved Sulphate (SO4)	2015/09/01		NC	%	80 - 120
8023943	KP9	Spiked Blank	Dissolved Sulphate (SO4)	2015/09/01		105	%	80 - 120
8023943	KP9	Method Blank	Dissolved Sulphate (SO4)	2015/09/01	<1.0		mg/L	
8023943	KP9	RPD	Dissolved Sulphate (SO4)	2015/09/01	2.3		%	20
8023989	TN4	Matrix Spike [MZ0273-01]	Dissolved Chloride (Cl)	2015/09/02		NC	%	80 - 120
8023989	TN4	Spiked Blank	Dissolved Chloride (Cl)	2015/09/02		98	%	80 - 120
8023989	TN4	Method Blank	Dissolved Chloride (Cl)	2015/09/02	<1.0		mg/L	
8023989	TN4	RPD [MZ0273-01]	Dissolved Chloride (Cl)	2015/09/02	2.8		%	20
8023999	TN4	Matrix Spike [MZ0273-01]	Dissolved Sulphate (SO4)	2015/09/02		NC	%	80 - 120
8023999	TN4	Spiked Blank	Dissolved Sulphate (SO4)	2015/09/02		108	%	80 - 120
8023999	TN4	Method Blank	Dissolved Sulphate (SO4)	2015/09/02	<1.0		mg/L	
8023999	TN4	RPD [MZ0273-01]	Dissolved Sulphate (SO4)	2015/09/02	4.3		%	20
8024193	SRT	Matrix Spike	Dissolved Calcium (Ca)	2015/09/02		NC	%	80 - 120
			Dissolved Iron (Fe)	2015/09/02		98	%	80 - 120
			Dissolved Magnesium (Mg)	2015/09/02		95	%	80 - 120
			Dissolved Manganese (Mn)	2015/09/02		97	%	80 - 120

Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B573450
Report Date: 2015/09/02

STANTEC CONSULTING LTD
Client Project #: 123511463
Site Location: INUVIK
Sampler Initials: OP

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Potassium (K)	2015/09/02		98	%	80 - 120
			Dissolved Sodium (Na)	2015/09/02		91	%	80 - 120
8024193	SRT	Spiked Blank	Dissolved Calcium (Ca)	2015/09/02		100	%	80 - 120
			Dissolved Iron (Fe)	2015/09/02		94	%	80 - 120
			Dissolved Magnesium (Mg)	2015/09/02		96	%	80 - 120
			Dissolved Manganese (Mn)	2015/09/02		96	%	80 - 120
			Dissolved Potassium (K)	2015/09/02		92	%	80 - 120
			Dissolved Sodium (Na)	2015/09/02		89	%	80 - 120
8024193	SRT	Method Blank	Dissolved Calcium (Ca)	2015/09/02	<0.30		mg/L	
			Dissolved Iron (Fe)	2015/09/02	<0.060		mg/L	
			Dissolved Magnesium (Mg)	2015/09/02	<0.20		mg/L	
			Dissolved Manganese (Mn)	2015/09/02	<0.0040		mg/L	
			Dissolved Potassium (K)	2015/09/02	<0.30		mg/L	
			Dissolved Sodium (Na)	2015/09/02	<0.50		mg/L	
8024193	SRT	RPD	Dissolved Calcium (Ca)	2015/09/02	0.96		%	20
			Dissolved Iron (Fe)	2015/09/02	NC		%	20
			Dissolved Magnesium (Mg)	2015/09/02	1.6		%	20
			Dissolved Manganese (Mn)	2015/09/02	NC		%	20
			Dissolved Potassium (K)	2015/09/02	0.17		%	20
			Dissolved Sodium (Na)	2015/09/02	0.98		%	20
8024968	ZI	Matrix Spike	Dissolved Chloride (Cl)	2015/09/02		NC	%	80 - 120
8024968	ZI	Spiked Blank	Dissolved Chloride (Cl)	2015/09/02		105	%	80 - 120
8024968	ZI	Method Blank	Dissolved Chloride (Cl)	2015/09/02	<1.0		mg/L	
8024968	ZI	RPD	Dissolved Chloride (Cl)	2015/09/02	4.1		%	20
8024969	ZI	Matrix Spike	Dissolved Sulphate (SO4)	2015/09/02		NC	%	80 - 120
8024969	ZI	Spiked Blank	Dissolved Sulphate (SO4)	2015/09/02		103	%	80 - 120
8024969	ZI	Method Blank	Dissolved Sulphate (SO4)	2015/09/02	<1.0		mg/L	
8024969	ZI	RPD	Dissolved Sulphate (SO4)	2015/09/02	0.13		%	20
8025472	ZI	Matrix Spike	Dissolved Chloride (Cl)	2015/09/02		NC	%	80 - 120
8025472	ZI	Spiked Blank	Dissolved Chloride (Cl)	2015/09/02		101	%	80 - 120
8025472	ZI	Method Blank	Dissolved Chloride (Cl)	2015/09/02	<1.0		mg/L	
8025472	ZI	RPD	Dissolved Chloride (Cl)	2015/09/02	1.9		%	20
8025474	ZI	Matrix Spike	Dissolved Sulphate (SO4)	2015/09/02		NC	%	80 - 120
8025474	ZI	Spiked Blank	Dissolved Sulphate (SO4)	2015/09/02		102	%	80 - 120
8025474	ZI	Method Blank	Dissolved Sulphate (SO4)	2015/09/02	<1.0		mg/L	
8025474	ZI	RPD	Dissolved Sulphate (SO4)	2015/09/02	0.60		%	20

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

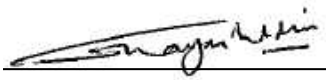
Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B573450
Report Date: 2015/09/02

STANTEC CONSULTING LTD
Client Project #: 123511463
Site Location: INUVIK
Sampler Initials: OP

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



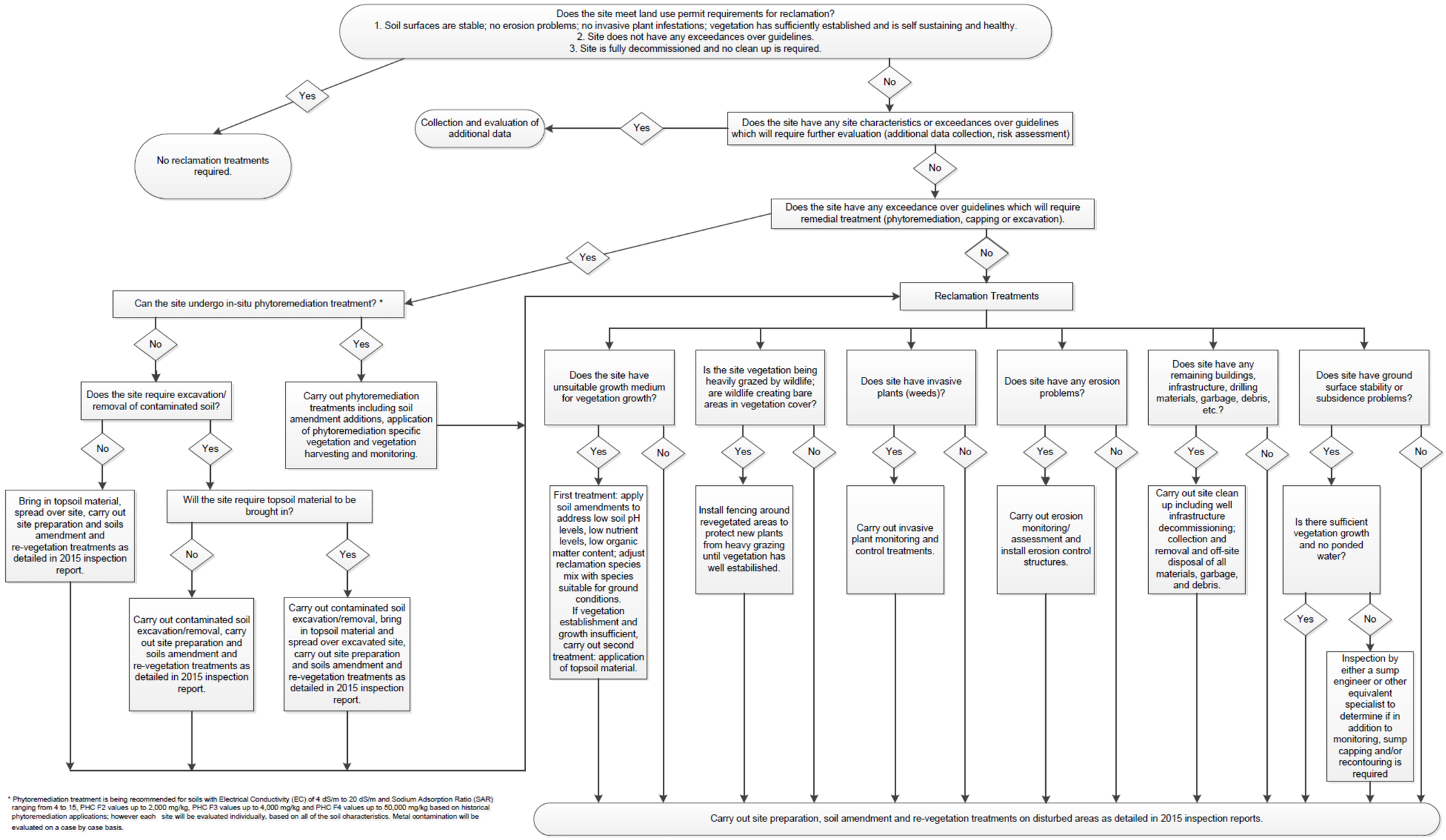
Ghayasuddin Khan, M.Sc., B.Ed., P.Chem, Scientific Specialist

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

APPENDIX F

Remediation/Reclamation Decision Tree



* Phytoremediation treatment is being recommended for soils with Electrical Conductivity (EC) of 4 dS/m to 20 dS/m and Sodium Adsorption Ratio (SAR) ranging from 4 to 15, PHC F2 values up to 2,000 mg/kg, PHC F3 values up to 4,000 mg/kg and PHC F4 values up to 50,000 mg/kg based on historical phytoremediation applications; however each site will be evaluated individually, based on all of the soil characteristics. Metal contamination will be evaluated on a case by case basis.