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March 25, 2019

Bonnie Bergsma
Sahtu Land and Water Board
Regulatory Specialist
P.O. Box 1
Fort Good Hope, NT
X0E 0H0

**Re: 2018 Annual Water Use Report**
**Type A Water Licence S13L1-007, Part B, Item 13**
**Imperial Oil Resources N.W.T. Limited (Imperial)**

Dear Ms. Bergsma,

Imperial is submitting the 2018 Annual Water Use Report as per Part B, Item 13 of the Sahtu Land and Water Board Water Licence, S13L1-007.

If you require further information please contact Christine Wickens at 587-476-5007 or christine.a.wickens@exxonmobil.com.

Sincerely,



Christine Wickens
Environment and Regulatory Advisor
Imperial

# Norman Wells Operations 2018 Annual Water Use Report

Operations Authorization 1210-001
Report No. 35

March 2019

Imperial Oil Resources NWT Limited
Bag 5000, 745 Mackenzie Drive
Norman Wells, NT X0E 0V0
Switch Board: (867) 587-3100



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# 1.0 Introduction

As required by Licence S13L1-007 (Part B: Item 11), the Licensee shall file an Annual Report with the Board not later than March 31st for the previous calendar year. Details on the licence requirements and corresponding applicable section(s) within the report can be found below.

**Table 1-1: Concordance Table**

| Licence Requirement | Section of Report |
|---|---|
| a) The monthly and annual quantities in cubic meters of freshwater obtained from all sources | 3.0 |
| b) The monthly and annual quantities in cubic meters of each and all Waste discharged | 3.0– 5.0 |
| c) The monthly and annual quantity in cubic meters of Waste discharged to the Mackenzie River at SNP station S13L1-007-2 | 3.0 |
| d) The monthly and annual quantities in cubic meters of freshwater and produced water injected to the Waterflood | 4.0 |
| e) The monthly and annual quantities in cubic meters of Waters contained and discharged from the Surface Water Run-off Facilities | 5.0 |
| f) The monthly and annual quantity in cubic meters of Produced Water recovered from the oilfield reservoir | 4.0 |
| g) Tabular summaries of all data generated under the Surveillance Network Program (SNP) | Appendix A & B |
| h) A list of unauthorized discharges, identification of waterbodies affected and the current status of mitigation measures | 7.0 |
| i) An annual drilling schedule for the upcoming year to the Board | 8.0 |
| j) The annual amounts in cubic meters of water and Waste generated from all drilling activities | 8.0 |
| k) A summary of measures taken to minimize net water withdrawals from the hydrological cycle as required in Part D, Item 4 of the licence | 3.0– 5.0 |
| l) Details on the handling, storage, treatment and disposal of Waste from the Norman Wells Proven Area | 9.0 |
| m) A review of spill training and communication exercises of the previous year, including the success and failure, as well as recommendations for improvement | 10.0 |
| n) A general schedule for any planned oil spill exercises for the following year | 10.0 |
| o) A summary of any Modification(s) and / or major maintenance work carried out as per Part G of the licence | 11.0 |
| p) Any other details on Water(s) use or Waste(s) disposal requested by the Board no later than March 31st of the following calendar year reported | 6.0 |
| q) A summary of all spills and Unauthorized Discharges and follow up actions taken that occurred during the previous calendar year | 7.0 |

# 2.0 Site Summary

Imperial Oil Resources Northwest Territories (N.W.T.) Limited (Imperial) is an upstream oil and gas facility located approximately 700 km northwest of Yellowknife, N.W.T. Operations include a central processing facility, which receives production from the mainland (along the north-eastern shore of the Mackenzie River), natural islands (Bear and Goose Island), and six artificial islands.

Imperial holds a Type A Water Licence S13L1-007 which was issued by the Sahtu Land and Water Board (SLWB) on March 5, 2015 and valid for 10 years. The licence serves to regulate the use of water and the deposits of waste as it relates to Imperial's site. Imperial also holds a National Energy Board (NEB) Operations Authorization (OA) 1210-001 issued December 31, 2014 and also valid for 10 years. This authorization serves to regulate the oil and gas activity on Imperial's federally regulated site.

A key piece of Imperial's Norman Wells operations (NWO) and the Type A licence is the Surveillance Network Program (SNP). The SNP is detailed in Annex A of the licence and sets out the requirements for the three branches of the SNP program including but not limited to sampling expectations, water quality release limits and reporting. The three branches of the SNP are listed below:

- Freshwater – Mackenzie River water
- Surface Water – snow and rainwater
- Groundwater – below surface water

For more information on the SNP please refer to the Water Licence S13L1-007, Annex A. All other conditions are described above in Section 1.0.

In November 2016, Imperial was notified of Enbridge's Line 21 being temporarily suspended due to a slope instability concern at a Mackenzie River pipeline crossing near the Fort Simpson, N.W.T. area. As a result, in late November 2016 Imperial initiated efforts to reduce crude oil production to ensure that storage tanks would not exceed capacity. During this time, options for long term operations were being evaluated and in February/early March 2017, Imperial safely completed a temporary shutdown.

Throughout the beginning of 2018, Imperial worked with the NEB and local stakeholders to keep them informed of startup progress. On October 13, 2018 Enbridge's Line 21 was re-opened and Imperial safely restarted the NWO. Post startup activities continued throughout the remainder of 2018.

# 3.0 SNP – Freshwater

The SNP - Freshwater covers the testing and analysis of the river water entering and leaving the central processing facility (CPF). There are two sampling locations, referred to as SNP Stations, included in this SNP program. The stations are S13L-007-1 (CPF inlet) and S13L1-007-2 (CPF outlet). The CPF inlet is the point at which the freshwater from the Mackenzie River enters the facility and the CPF outlet (or effluent) is the last point before it returns back to the Mackenzie River. This is described in more detail in Section 3.3.

## 3.1 Mackenzie River Withdrawal and Return Volumes

In 2018, Imperial withdrew approximately 463 thousand cubic metres ($m^3$) of water from the Mackenzie River (maximum licence allowable limit is 3.5 million $m^3$). All of this water was used for cooling in the CPF (Figure 3-1). Once the water was used for cooling, all the water was returned to the Mackenzie River due to the fresh water injection system being shut down.




**Figure 3-1: Mackenzie River Water Uses**

Details on the monthly quantities of freshwater withdrawn and discharged to the Mackenzie River can be found below in Table 3-1. All injection volumes can be found in Table 4-1. Figure 3-2 depicts the volume of water withdrawn from and returned to the Mackenzie River each year over a five year period. Freshwater intake and demand for cooling water will generally decline over time as production volumes decline.

**Table 3-1: 2018 CPF Inlet and Outlet Volumes**

| Month | CPF Inlet (S13L1 007 1) ($m^3$) | CPF Outlet (S13L1 007 2) ($m^3$) |
|---|---|---|
| Jan | 0 | 0 |
| Feb | 0 | 0 |
| Mar | 0 | 0 |
| Apr | 0 | 0 |
| May | 0 | 0 |
| Jun | 0 | 0 |
| Jul | 0 | 0 |
| Aug | 0 | 0 |
| Sep | 0 | 0 |
| Oct | 142,977 | 142,977 |
| Nov | 156,888 | 156,888 |
| Dec | 163,064 | 163,064 |
| **Total** | **462,928** | **462,928** |

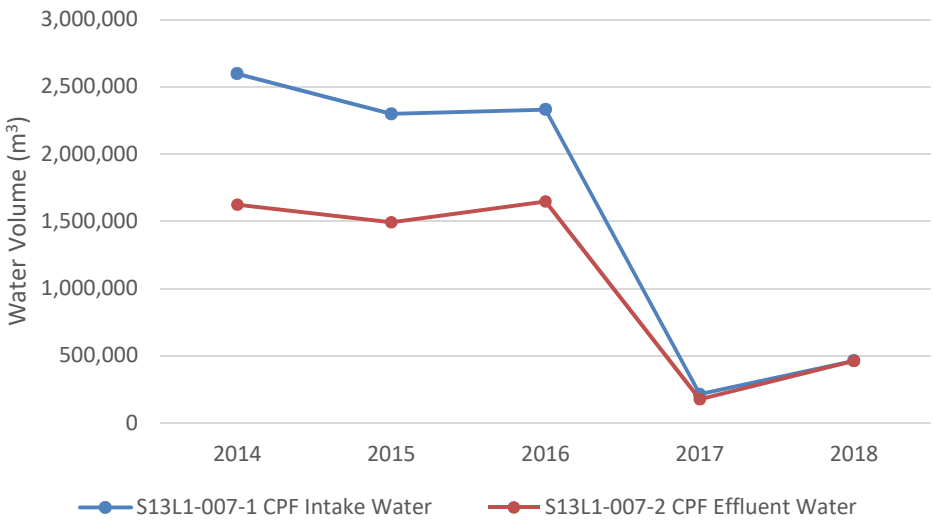



**Figure 3-2: Mackenzie River Withdrawal and Return Volumes (2014 – 2018)**

## 3.2 Volumes of Water Withdrawn from Other Sources

In 2018, Imperial did not withdraw any water from other sources.

## 3.3 Freshwater Cooling Loop Explained

As water enters the CPF facility it is tested as per licence conditions at the CPF inlet (Figure 3-3). After testing, chlorine is added to kill bacteria in the piping and prevent damage to the equipment. This is the same type of chlorine used to disinfect drinking water systems. No other chemicals are added to the cooling water. In 2018, chloride injection was not in operation. No chlorine was added to the cooling water.

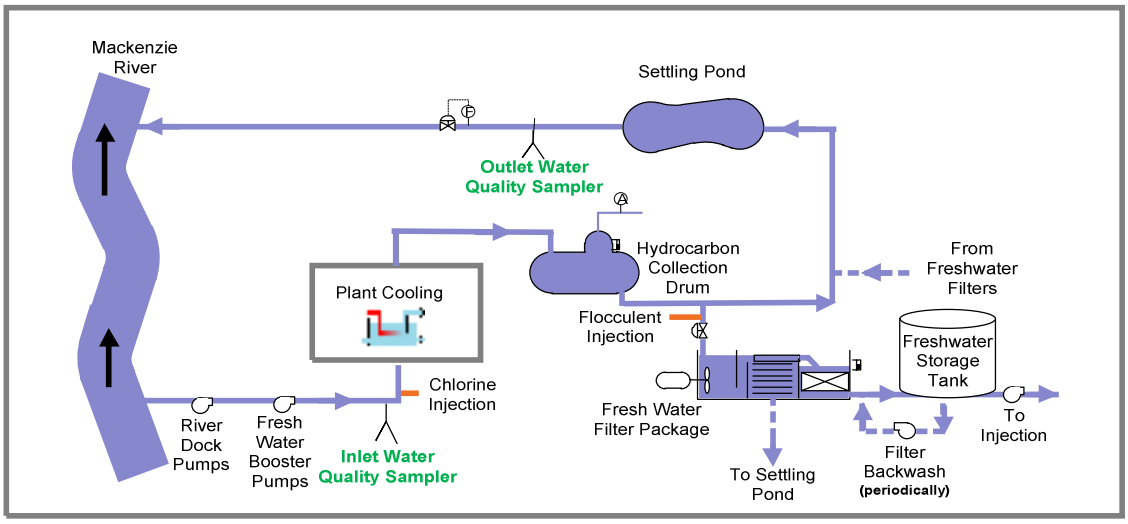



**Figure 3-3: Freshwater Cooling Loop Flow Diagram**

Once a water sample has been taken and chlorine is added, the water then flows through heat exchangers within the plant for the sole purposes of cooling. The Mackenzie River water does not come into contact

with any process fluids during cooling. There is no chance for the water to become contaminated because the water and oil are separated by a steel barrier (Figure 3-4). After cooling, the water passes through the hydrocarbon collection drum. This hydrocarbon collection drum is engineer designed with sensors that can detect light hydrocarbons. It is also equipped with automatic shut in valves as a preventative measure in the unlikely event that light hydrocarbons were to be detected in the freshwater (e.g., exchanger failure).

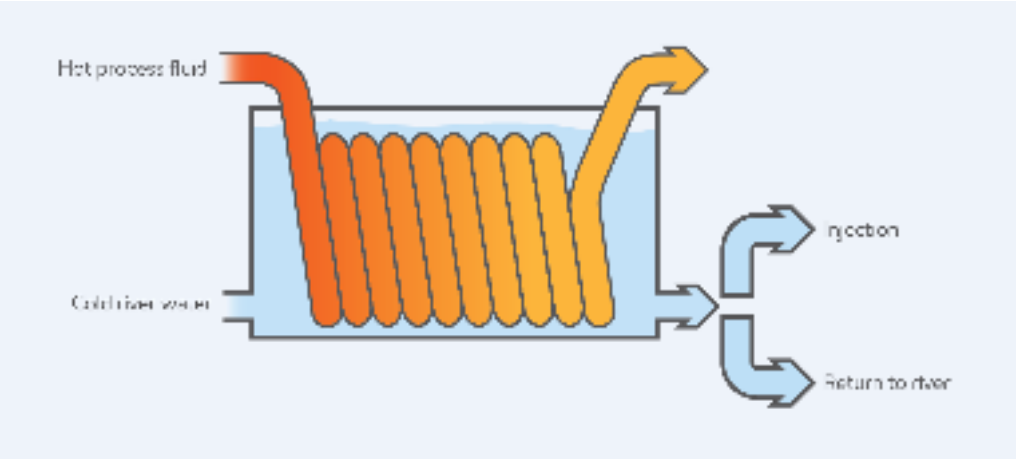



**Figure 3-4: Simple Heat Exchanger**

Once the water has passed through the hydrocarbon collection drum it either goes to the field for injection into the reservoir or to the settling pond where it is returned to the Mackenzie River. As the water is released from the settling pond it is tested as per licence conditions at a testing location referred to as the CPF outlet (Figure 3-3).

## 3.4 SNP – Freshwater Data Summary

All water results are reported to the SLWB as per licence conditions in the Monthly Water Use Report and are provided annually in this report (Appendix A).

In 2018, there were no exceedances of any of the water licence requirements

# 4.0 Freshwater and Produced Water Injection

In order to maintain a constant pressure in the reservoir, all volumes removed from the producing reservoir must be replaced. Pressure is maintained by injecting fluid (such as produced water or freshwater) into the reservoir through injection wells. This is referred to as a waterflood. Without water injection the reservoir pressure would fall and production would quickly decline.

Water that is generated with the production of oil is called produced water and is re-injected into the reservoir. The volume of produced water is not enough to replace the amount of oil recovered; therefore, freshwater is used to supplement injection volumes required. The total volume of water injected in 2018 was approximately 455 thousand $m^3$ and was made up of produced water (Table 4-1).

**Table 4-1: 2018 Freshwater and Produced Water Injection Volumes**

| Month | Freshwater Injection ($m^3$) | Produced Water Injection ($m^3$) | Total Water Injection ($m^3$) |
|---|---|---|---|
| Jan | 0 | 0 | 0 |
| Feb | 0 | 0 | 0 |
| Mar | 0 | 0 | 0 |
| Apr | 0 | 0 | 0 |
| May | 0 | 0 | 0 |
| Jun | 0 | 0 | 0 |
| Jul | 0 | 0 | 0 |
| Aug | 0 | 0 | 0 |
| Sep | 0 | 0 | 0 |
| Oct | 0 | 97,538 | 97,538 |
| Nov | 0 | 179,165 | 179,165 |
| Dec | 0 | 178,007 | 178,007 |
| **Total** | **0** | **454,711** | **454,711** |

As waterfloods mature, the produced water to oil ratio from the wells typically increase resulting in increased produced water volumes with time. As a result, the volume of produced water injection increases and the demand for freshwater injection decreases. This is shown in Figure 4-1.

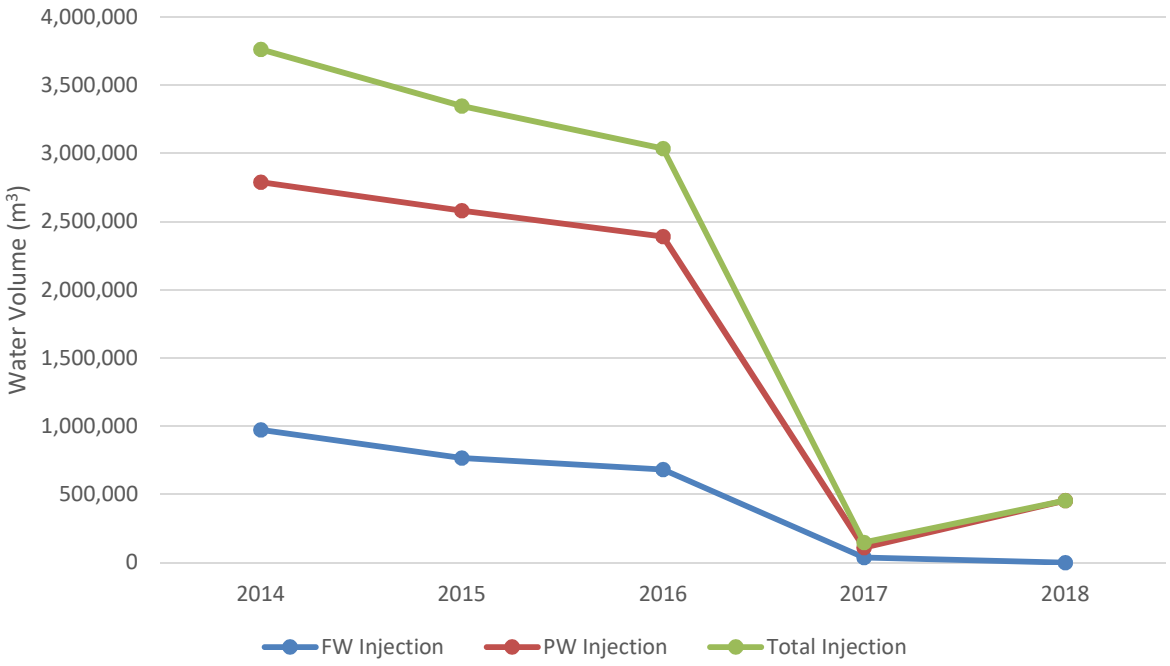



**Figure 4-1: Freshwater and Produced Water Injection Volumes (2014 – 2018)**

# 5.0 Facility Integrity Verification and Repairs

The SNP - Surface Water covers the testing and analysis of surface water run-off facilities. The major elements of the program include:

- collecting representative samples from surface water runoff facilities for field testing and/or laboratory analysis
- performing controlled releases of surface water from runoff facilities that meets the guidelines in the Water Licence

## 5.1 Surface Water Runoff Facilities (SWROF) Release Volumes

In 2018, 12,164 $m^3$ of surface water was released from impound basins back to the environment (Table 5-1).

Another 7,221 $m^3$ of surface water was released back to the environment from ditches and bunkers on Goose Island and the Mainland (Table 5-1).

**Table 5-1: 2018 SWROF Release Volumes**

| Month | CPF Impound ($m^3$) | Mainland / Bear / Goose Island ($m^3$) | LT11 Impound ($m^3$) | Refinery Impound ($m^3$) | Refinery Waterflood Impound ($m^3$) | Drilling Sumps ($m^3$) | Other SWROF ($m^3$) |
|---|---|---|---|---|---|---|---|
| Jan | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Feb | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mar | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Apr | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| May | 580 | 190 | 660 | 6,516 | 0 | 0 | 0 |
| Jun | 0 | 192 | 0 | 0 | 320 | 0 | 0 |
| Jul | 0 | 3,042 | 0 | 1,476 | 294 | 0 | 0 |
| Aug | 0 | 3,797 | 0 | 1,935 | 0 | 0 | 0 |
| Sep | 0 | 0 | 0 | 383 | 0 | 0 | 0 |
| Oct | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nov | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dec | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **580** | **7,221** | **660** | **10,310** | **614** | **0** | **0** |

## 5.2 SNP – Surface Water Data Summary

There were no exceedances of water quality or uncontrolled releases in 2018.

All water results are reported to the SLWB as per licence conditions in the Monthly Water Use Report and are provided annually in this report (Appendix B).

# 6.0 SNP - Groundwater

A summary of the 2018 Groundwater Monitoring program and the results can be found in Appendix C.

# 7.0 Reportable Releases

Imperial reported all 2018 government reportable releases to the NEB and the Northwest Territories – Nunavut (NT - NU) Spill Report Line.

## 7.1 Incident Prevention and Reduction

Imperial's integrity and reliability processes utilize a structured approach of prevention, detection, response and recovery. A variety of activities related to release prevention, reduction, mitigation, response and training is undertaken annually. These activities are designed to eliminate potential releases, detect releases should they occur and if they do occur, ensure an effective and timely clean up. Key elements for achieving this strategy include:

- awareness training for employees and contractors
- pre-job preparation and hazard recognition
- surveillance and monitoring
- flowline leak detection
- routine integrity testing and maintenance
- regularly scheduled emergency response training and exercises and;
- incident reporting processes

For any new to site workers (both employees and contractors) a safety and environmental training package is reviewed covering environmental topics such as release prevention, reporting, waste management, and wildlife. Other tools such as Environmental Alerts, a one page bulletin intended as a high level overview of key topics, may be used to communicate to workers specific environmental information on an as needed basis.

Release reduction initiatives and target areas are continuously evaluated based on existing trends. In 2018, the focus areas were chemical releases and near misses (such as small leaks and drips). Similar to safety incidents, environmental incidents and associated learnings are reviewed real-time with the general workforce in daily operations and stewardship meetings.

## 7.2 Spill Summary

In 2018, Imperial reported five releases into the NEB's Event Reporting System (ERS) and the Northwest Territories – Nunavut (NT-NU) Spill Report Line (Table 7-1). The five incidents were either partially or completely contained (e.g., inside building, bermed area or into containment trays). The incidents were responded to immediately, cleaned up until no visual impacts remained, and the incident investigation closed. Incident investigation details and clean up status is provided to the NEB through the Monthly Release Report and the ERS, and to the SLWB in a Supplemental Release Report (30 Day Report).

**Table 7-1: Details on 2018 NT-NU Reportable Releases**

| Date Occurred | NEB INC Number | NT/NU Spill Number | Location of Incident | Product Released | Volume Released ($m^3$) | Volume Contained ($m^3$) | Volume Reaching the Environment ($m^3$) | Executive Summary | Direct Cause | Status of Clean Up |
|---|---|---|---|---|---|---|---|---|---|---|
| **18-02-04** | INC2018-014 | 18-032 | Mainland | Sewage | 0.003 | 0 | 0.003 | Operator discovered a sewage release from the sewage piping leading to the contractor office trailer. Approximately 3 litres (L) of sewage released from the piping onto the ground. Cause was determined to be a coupling failure due to heaving ground conditions. Cleanup was initiated and completed immediately. | Equipment Degradation | Complete |
| **18-05-29** | INC2018 | 18-202 | Mainland | Methanol-Water Mix | 3.96 | 0 | 3.96 | Approximately 3.96 $m^3$ of methanol water mix released from the D-42 flowline into a ditch on Mainland. The product was being flushed through the flowline as part of the pressure testing program for start-up. Cause of the release was a pinhole leak. Cleanup was initiated and is on-going. | Equipment Degradation | Complete |
| **18-10-13** | INC2018-115 | 18-429 | Mainland | Propane | 0.4 | 0 | 0.4 | At ~ 10:15 am on October 13th a **heating, ventilation, and air conditioning** tech responded to a boiler down at the F-31x facility. Upon further investigation they determined that ~400L of propane had vented off through a failed check valve on the tank load line. Site wide confirmed if there were other tanks that had similar setups, and implemented additional barriers for the tanks that did. | Equipment Degradation | Complete |
| **18-11-20** | INC2018-164 | 18-458 | Plant | Produced Water | 3.5 | 3.5 | 0 | Opening a bypass to do maintenance on a controller valve. When operations opened the valve the valve stem broke. The operator felt the stem give way and immediately got containment trays and a vac truck to assist before removing the stem. 100% of the volume was contained. | Equipment Degradation | Complete |
| **18-12-05** | INC2018-179 | 18-482 | Plant | Glycol | 0.4 | 0.4 | 0 | A slow release started at 4:00 pm on Dec 5 with a low level alarm triggering at 7:00 am on Dec 6. Initial estimate of volume is that 13% tank capacity was lost which approximately equates to 4 barrels which was later refined to 400L. This was a 60-40 mix meaning 240L were glycol and 160L was freshwater. Cleanup was initiated and is complete. | Equipment Degradation | Complete |
| **Total Volume (less freshwater) ($m^3$)** | | | | | 8.263 | 3.9 | 4.363 | | | |

$m^3$– cubic metres

# 8.0 Drilling Activity Summary

There was no drilling activity in 2018 nor are there plans to drill in 2019. All drilling sumps have been capped and are in the remediation process. There were no drilling fluid releases in 2018.

# 9.0 Waste

Waste generated on-site is collected and disposed of at appropriate waste facilities both on and off-site. In 2018, approximately 17 tonnes of hazardous waste and 623 tonnes of non-hazardous waste was transported to approved facilities outside of Norman Wells.

Two Imperial owned soil treatment facilities (bio cell) continue to operate, treating impacted material for reuse on-site. In 2018, no additional soil was added into or removed from the bio cell.

An active Waste Management Plan serves as a resource document and field guide for waste management on-site, and includes additional details about the bio cell and other waste facilities at the NWO. As updates to this plan are made, the plan is filed with the SLWB.

# 10.0 Emergency Response

Imperial's Emergency Response Plan (ERP) includes set objectives for responding to emergencies in an effective and timely manner. These objectives include the following:

- manage risks, inherent in all operations to minimize releases
- ensure that all employees understand their responsibility as it relates to emergencies and preventing them from occurring
- develop and maintain emergency response capabilities locally and have the ability to quickly expand and leverage other resources
- initiate appropriate response measures immediately and take all reasonable measures to ensure the safety of our workforce and the public and for the protection of the community and the environment

In addition to the ERP mentioned above, a Spill Contingency and Response Plan (SCARP) also exists as a supplement the ERP. The SCARP is a more detailed field level strategy guide. Copies of both the ERP and SCARP are filed with the SLWB and NEB and other agencies as appropriate.

The local Norman Wells workforce, in the event of an emergency, would be known as the emergency response team (ERT). The ERT completes regular training on roles and responsibilities, the structure and organization of the incident command system, emergency response equipment, as well as various response techniques (e.g., ice slot recovery). Within the scope of any training, the objectives of the exercise, learnings and any improvement areas are discussed throughout and followed up as required.

A summary of the exercises completed in 2018 are included in Table 10-1.

**Table 10-1: 2018 Emergency Response Exercises**

| Date | Description |
|---|---|
| 2-Mar-18 | Plant tank fire |
| 6-Mar-18 | Chlorine release / man down |
| 28-Mar-18 | Ice road third party |
| 18-May-18 | Helicopter man down |
| 29-May-18 | Pipeline rupture / spill response |
| 3-Jun-18 | Gas release / well / heli-port |
| 26-Jun-18 | Well out of control |
| 28-Jun-18 | Transportation of dangerous goods release/ fire onboard |
| 5-Jul-18 | Fire drill |
| 18-Jul-18 | Search and rescue |
| 1-Nov-18 | Emergency callout |
| 22-Nov-18 | Blocked flare / gas release |
| 21-Dec-18 | Fire and explosion / brittle fracture |

# 11.0 Work Summary

Below is a list of modification(s) and maintenance work carried out as per Part G of the licence in 2018:

- soil washing facility – on-going

The project is still on-going and includes the construction of a treatment pad, process water holding pond, a freshwater storage tank and access to freshwater from an on-site surface water runoff facility (SNP location). This work is being executed and managed through the closure and reclamation department but since it falls under Part G of the licence it is being included in this report as well as, the Annual Closure and Reclamation Report.

All of the above work was submitted to the SLWB in a proposed plan and approved prior to commencing activities.

# Acronyms

| Acronym | Definition |
|---|---|
| CPF | central processing facility |
| EC | specific conductivity |
| ERP | Emergency Response Plan |
| ERS | Event Reporting System |
| ERT | emergency response team |
| Imperial | Imperial Oil Resources N.W.T. Limited |
| L | litres |
| $m^3$ | cubic metres |
| mg/l | milligrams per litre |
| NEB | National Energy Board |
| NWO | Norman Wells Operations |
| N.W.T. | Northwest Territories |
| NT-NU | Northwest Territories – Nunavut |
| SCARP | Spill Contingency and Response Plan |
| SLWB | Sahtu Land and Water Board |
| SNP | Surveillance Network Program |
| SWROF | Surface water runoff facilities |
| TSS | total suspended solids |
| uS/cm | micro Siemens per centimetre |

# 12.0 Glossary

| Term | Description |
|---|---|
| **Acute lethality** | An effluent is deemed acutely lethal if the undiluted (100%) effluent kills 50% or more of the fish or *Daphnia magna* in the test. Biological test method: Acute Lethality Test Using Rainbow Trout Report EPS 1/RM/9 July 1990 (with May 1996 and May 2007 amendments) and Acute Lethality of Effluents to *Daphnia magna* EPS 1/RM/14 Second Edition December 2000, or as may be amended from time to time. |
| **Average concentration** | The running average of any four consecutive analytical results submitted to the Board in accordance with the sampling and analysis requirements specified in the "Surveillance Network Program". |
| **Bathymetric survey** | A survey used to measure the topography on the bottom of a waterbody. Imperial conducts these surveys on the Mackenzie River to help identify and understand what changes have occurred on the river bottom. |
| **Central processing facility (CPF)** | The plant where oil, gas, and produced water, are collected from the oilfield and separated. |
| **Exceedance** | Results are above the maximum concentrations listed in Water Licence S13L1-007 |
| **Flowline** | A line that is used to transport fluids from a well to a production facility or vice versa, and includes intrafield export and all gathering lines |
| **Phenols** | Any of a family of organic compounds characterized by a hydroxyl (-OH) group attached to a carbon atom that is part of an aromatic ring. Phenols are widely used in household products such as cleaners and mouthwash. They are commonly found in nature and can be obtained from essential oils of plants. Phenols can also be obtained from the distillation of coal tar or crude petroleum. (Source: www.britannica.com). |
| **Produced water** | Water extracted from the reservoir as a mixture with oil and gas |
| **SNP Station S13L1-007-1** | The Surveillance Network Station for the CPF intake water. |
| **SNP Station S13L1-007-2** | The Surveillance Network Station for the CPF cooling flow return. |
| **Surface water run-off facilities** | The Refinery Impounding basin, Battery 3 impounding basin (also known as LT 11), Refinery waterflood Basin, CPF impounding area (also known as LT 2), miscellaneous Mainland impounding areas, miscellaneous Bear Island impounding areas, miscellaneous Goose Island impounding areas, and associated ditches provided for the collection, storage, and discharge of surface run-off waters from the NWO. |
| **Surveillance network program** | A network of devices or sampling points designed to test environmental conditions for comparison against baseline data obtained from a point or area designated as a control. This is a method of tracking and identifying the spread of deleterious substances in the environment. |
| **Waste** | Waste as defined by Section 2 of the *Northwest Territories Waters Act* |
| **Waterflood** | The injections of water into the Norman Wells oilfield reservoir for pressure maintenance and enhanced oil production |
| **Water intake** | The wetwell pump and associated facilities installed in the Mackenzie River and the water line to the CPF |

# Appendix A CPF Inlet and Outlet Water Data

**Table A-1: Total Petroleum Hydrocarbons and Phenols**

| | CPF Inlet Total Petroleum Hydrocarbons (mg/L) | CPF Inlet Phenols (mg/L) | CPF Outlet Total Petroleum Hydrocarbons (mg/L) | CPF Outlet Phenols (mg/L) |
|---|---|---|---|---|
| **SNP Station** | **S13L1-007-1** | **S13L1-007-1** | **S13L1-007-2** | **S13L1-007-2** |
| **Water Licence Criteria** | **n/a** | **n/a** | **5.0 mg/L** | **0.14mg/L** |
| 24-Sep | <2.0 | <0.0020 | <2.0 | <0.0020 |
| 4-Oct | <2.0 | <0.0020 | <2.0 | <0.0020 |
| 12-Oct | <2.0 | <0.0020 | <2.0 | <0.0020 |
| 18-Oct | <2.0 | <0.0020 | <2.0 | <0.0020 |
| 25-Oct | <2.0 | <0.0020 | <2.0 | <0.0020 |
| 5-Nov | <2.0 | <0.0020 | <2.0 | <0.0020 |
| 12-Nov | <2.0 | <0.0020 | <2.0 | 0.0021 |
| 19-Nov | <2.0 | <0.0020 | <2.0 | <0.0020 |
| 26-Nov | <2.0 | <0.0020 | <2.0 | 0.0022 |
| 3-Dec | <2.0 | <0.0020 | <2.0 | <0.0020 |
| 10-Dec | <2.0 | <0.0020 | <2.0 | <0.0020 |
| 17-Dec | <2.0 | <0.0020 | <2.0 | <0.0020 |
| 24-Dec | <2.0 | <0.0020 | <2.0 | <0.0020 |
| 31-Dec | <2.0 | <0.0020 | <2.0 | <0.0020 |

mg/l – milligrams per litre; n/a – not applicable

**Table A-2: Total Suspended Solids (TSS), pH and Specific Conductivity (EC)**

| | CPF Inlet Total TSS (mg/L) | CPF Inlet Total pH (mg/L) | CPF Inlet Total EC (mg/L) | CPF Outlet Total TSS (mg/L) | CPF Outlet Total pH (mg/L) | CPF Outlet Total EC (mg/L) |
|---|---|---|---|---|---|---|
| SNP Station | S13L1-007-1 | S13L1-007-1 | S13L1-007-1 | S13L1-007-2 | S13L1-007-2 | S13L1-007-2 |
| Water Licence Criteria | n/a | n/a | n/a | n/a | Between 6 – 9 | n/a |
| 24-Sep | 93.00 | 7.71 | 290 | 5.30 | 8.12 | 280 |
| 1-Oct | 120.00 | 7.89 | 280 | 3.30 | 8.00 | 270 |
| 4-Oct | 3.30 | 7.92 | 290 | 8.00 | 8.01 | 330 |
| 9-Oct | 2.00 | 7.97 | 290 | 2.70 | 8.02 | 280 |
| 12-Oct | 21.00 | 7.94 | 280 | 4.70 | 7.97 | 280 |
| 15-Oct | 21.00 | 7.94 | 290 | 6.70 | 7.96 | 280 |
| 18-Oct | 2.00 | 7.97 | 280 | 2.70 | 8.02 | 280 |
| 22-Oct | 4.00 | 7.95 | 280 | 1.30 | 8.02 | 270 |
| 25-Oct | 17.00 | 8.05 | 280 | 7.30 | 8.04 | 280 |
| 29-Oct | 32.00 | 7.95 | 280 | 2.00 | 8.00 | 280 |

| | CPF Inlet Total TSS (mg/L) | CPF Inlet Total pH (mg/L) | CPF Inlet Total EC (mg/L) | CPF Outlet Total TSS (mg/L) | CPF Outlet Total pH (mg/L) | CPF Outlet Total EC (mg/L) |
|---|---|---|---|---|---|---|
| 1-Nov | 6.70 | 8.09 | 300 | 3.30 | 8.08 | 280 |
| 5-Nov | 3.30 | 8.03 | 280 | 4.00 | 8.08 | 280 |
| 8-Nov | 4.70 | 8.05 | 310 | 1.30 | 8.10 | 310 |
| 12-Nov | 1.30 | 8.11 | 330 | 3.30 | 8.12 | 330 |
| 15-Nov | 8.00 | 8.02 | 320 | 2.70 | 8.00 | 310 |
| 19-Nov | 2.00 | 8.04 | 320 | 2.00 | 8.12 | 320 |
| 22-Nov | <1.0 | 8.02 | 300 | <1.0 | 8.07 | 300 |
| 26-Nov | 2.00 | 8.05 | 300 | 2.70 | 8.08 | 310 |
| 29-Nov | 2.00 | 8.13 | 290 | 2.70 | 8.03 | 290 |
| 3-Dec | <1.0 | 8.10 | 280 | 1.00 | 8.10 | 280 |
| 6-Dec | 1.00 | 8.01 | 280 | 2.00 | 7.99 | 280 |
| 10-Dec | <1.0 | 8.07 | 270 | <1.0 | 7.99 | 270 |
| 13-Dec | 1.30 | 8.06 | 270 | <1.0 | 8.08 | 270 |
| 17-Dec | 1.30 | 8.04 | 260 | 1.30 | 8.07 | 270 |
| 20-Dec | <1.0 | 8.02 | 260 | 2.00 | 8.07 | 260 |
| 24-Dec | <1.0 | 8.13 | 250 | <1.0 | 8.11 | 250 |
| 27-Dec | <1.0 | 8.16 | 250 | <1.0 | 8.12 | 250 |
| 31-Dec | 2.00 | 8.09 | 250 | 2.70 | 8.06 | 250 |

**Table A-3: Average Daily Chlorine and Temperature**

| | Daily Chlorine (mg/L) | CPF Outlet Temperature (°C) |
|---|---|---|
| **SNP Station** | **S13L1-007-1** | **S13L1-007-2** |
| **Water Licence Criteria** | **n/a** | **n/a** |
| 4-Oct | * | - |
| 12-Oct | * | - |
| 18-Oct | * | 10.5 |
| 25-Oct | * | 14.9 |
| 5-Nov | * | 14.6 |
| 12-Nov | * | 18.4 |
| 19-Nov | * | 15.8 |
| 26-Nov | * | 16.7 |
| 3-Dec | * | 17.5 |
| 10-Dec | * | 17.4 |
| 17-Dec | * | 17.5 |
| 24-Dec | * | 19.3 |
| 31-Dec | * | 18.5 |

C - Celsius

*chlorine injection offline

**Table A-4: Four Week Rolling Average (S13L1-007-02)**

| | TPH (mg/L) | Phenols (mg/L) | TSS (mg/L) | pH | Specific Conductivity (uS/cm) | Daily Chlorine (mg/L) | Temperature (°C) |
|---|---|---|---|---|---|---|---|
| **Water Licence Criteria** | **(5 mg/L)** | **0.014** | **n/a** | **6.0-9.0** | **n/a** | **n/a** | **n/a** |
| Oct 4 - 31 | <2.0 | <0.0020 | 4.3 | 8.00 | 283 | * | 8 |
| Nov 1 - 29 | 1.0 | 0.0016 | 2.5 | 8.10 | 303 | * | 17 |
| Dec 1 - 31 | 1.0 | 0.0010 | 1.2 | 8.07 | 264 | * | 18 |

uS/cm – micro Siemens per centimetre

*chlorine injection offline

**Table A-5: Quarterly Acute Lethality Data**

| CPF Outlet (S13L1 007 2) | | |
|---|---|---|
| | **Rainbow Trout (% Survival)** | **Daphnia Magna (% Survival)** |
| **Licence Criteria** | **> 50% Survival** | **> 50% Survival** |
| Q1 – January | n/a | n/a |
| Q2 – April | n/a | n/a |
| Q3 – July | n/a | n/a |
| Q4 – October | 100% | 100% |

**Table A-6: Quarterly Inlet Data**

| SNP S13L1 007 1 (Inlet) | | | | | |
|---|---|---|---|---|---|
| | **Q1 (mg/L)** | **Q2 (mg/L)** | **Q3 (mg/L)** | **Q4 (mg/L)** | **YTD Average (mg/L)** |
| pH | n/a | n/a | n/a | 7.96 | 7.96 |
| Phenols | | | | 0.0018 | 0.0018 |
| Dissolved Sodium | | | | 9.65 | 9.65 |
| Total Sodium | | | | 8.5 | 8.5 |
| Dissolved Potassium | | | | 48.5 | 48.5 |
| Total Potassium | | | | 0.88 | 0.88 |
| Dissolved Sulphate | | | | 34 | 34 |
| Dissolved Chloride | | | | 11.0 | 11.0 |
| Dissolved Calcium | | | | 31.0 | 31.0 |
| Total Calcium | | | | 29 | 29 |
| Dissolved Magnesium | | | | 9.8 | 9.8 |
| Total Magnesium | | | | 9.7 | 9.7 |
| Total Alkalinity | | | | 85 | 85 |
| Specific Conductivity | | | | 260 | 260 |
| Total Suspended Solids | | | | 27.8 | 27.8 |

| SNP S13L1 007 1 (Inlet) | | | | | |
|---|---|---|---|---|---|
| | Q1 (mg/L) | Q2 (mg/L) | Q3 (mg/L) | Q4 (mg/L) | YTD Average (mg/L) |
| Total Dissolved Solids | | | | 145 | 145 |
| Total Petroleum Hydrocarbons | | | | 1.00 | 1.00 |
| Total Phosphorus | | | | 0.05 | 0.05 |
| Total Hardness | | | | 120 | 120 |

**Table A-7: Quarterly Outlet Data**

| SNP S13L1 007 2 (Outlet) | | | | | |
|---|---|---|---|---|---|
| | Q1 (mg/L) | Q2 (mg/L) | Q3 (mg/L) | Q4 (mg/L) | YTD Average (mg/L) |
| pH | | | | 7.95 | 7.95 |
| Phenols | | | | 0.0016 | 0.0016 |
| Dissolved Sodium | | | | 9.40 | 9.40 |
| Total Sodium | | | | 8.6 | 8.60 |
| Dissolved Potassium | | | | 0.95 | 0.95 |
| Total Potassium | | | | 0.89 | 0.89 |
| Dissolved Sulphate | | | | 33.5 | 33.50 |
| Dissolved Chloride | | | | 11 | 11.00 |
| Dissolved Calcium | | | | 30.5 | 30.50 |
| Total Calcium | n/a | n/a | n/a | 28.5 | 28.50 |
| Dissolved Magnesium | | | | 10 | 10.00 |
| Total Magnesium | | | | 9.40 | 9.40 |
| Total Alkalinity | | | | 84.00 | 84.00 |
| Specific Conductivity | | | | 265 | 265.00 |
| Total Suspended Solids | | | | 1.90 | 1.90 |
| Total Dissolved Solids | | | | 145 | 145.00 |
| Total Petroleum Hydrocarbons | | | | 1 | 1.00 |
| Total Phosphorus | | | | 0.05 | 0.05 |
| Total Hardness | | | | 115 | 115.00 |

# Appendix B Surface Water Runoff Data

**Table B-1: 2018 Surface Water Discharge Analytical Results for Category A Locations**

| | Date | Total Discharge Volume ($m^3$) | Chlorides (mg/L) | pH | Sheen Y/N |
|---|---|---|---|---|---|
| **Sample Limits** | | | **< 500** | **6.0 9.0** | **N** |
| **Mainland** | | | | | |
| F-28 | 30-Apr | 10 | 0 | 6 | N |
| | | | 0 | 6 | N |
| | 1-May | 2 | 0 | 6 | N |
| D-42 | 1-May | 30 | 0 | 6 | N |
| | | | 0 | 6 | N |
| | | | 0 | 6 | N |
| | 3-May | 10 | 0 | 6 | N |
| | | | 0 | 6 | N |
| | | | 0 | 6 | N |
| | 4-May | 5 | 0 | 6 | N |
| | 5-May | 10 | 0 | 6 | N |
| | | | 0 | 6 | N |
| | | | 0 | 6 | N |
| | 6-May | 12 | 0 | 6 | N |
| | | | 0 | 6 | N |
| | | | 0 | 6 | N |
| | 14-May | 8 | 0 | 6 | N |
| | 15-May | 6 | 0 | 6 | N |
| Lower Bosworth Ditch | 7-May | 9 | 0 | 6 | N |
| LT-11 | 7-May | 20 | 0 | 6 | N |
| | | | 0 | 6 | N |
| | | | 0 | 6 | N |
| River Dock Pump | 13-Jul | 202 | 0 | 7.5 | N |
| | 14-Jul | 71 | 0 | 7.5 | N |
| **Goose Island** | | | | | |
| L-15 | 15-Jun | 4 | 0 | 7 | N |
| | 24-Jul | 3 | 0 | 6 | N |
| M-13 | 15-Jun | 8 | 0 | 6 | N |
| M-15 | 15-Jun | 6 | 0 | 7 | N |
| M-19 | 14-Jun | 3 | 0 | 7 | N |
| N-11 | 26-Aug | 1 | 30 | 7 | N |
| N-13 | 26-Aug | 2 | 30 | 7 | N |

| | Date | Total Discharge Volume ($m^3$) | Chlorides (mg/L) | pH | Sheen Y/N |
|---|---|---|---|---|---|
| **Sample Limits** | | | **< 500** | **6.0 9.0** | **N** |
| N-14 | 15-Jun | 8 | 0 | 7 | N |
| | 25-Jul | 7 | 0 | 6 | N |
| N-15 | 15-Jun | 8 | 0 | 7 | N |
| | 25-Aug | 1 | 30 | 6 | N |
| | 28-Aug | 1 | 30 | 6 | N |
| | 25-Jul | 3 | 0 | 7 | N |
| N-17 | 15-Jun | 4 | 0 | 7 | N |
| N-18 | 14-Jun | 6 | 0 | 7 | N |
| N-19 | 14-Jun | 6 | 0 | 7 | N |
| N-21 | 14-Jun | 6 | 0 | 6 | N |
| N-22 | 14-Jun | 6 | 0 | 6 | N |
| N-23 | 14-Jun | 5 | 0 | 7 | N |
| N-27 | 14-Jun | 6 | 0 | 6 | N |
| N-29 | 14-Jun | 6 | 0 | 6 | N |
| N-31 | 14-Jun | 4 | 0 | 6 | N |
| O-07X | 25-Jul | 6 | 0 | 6 | N |
| O-08 | 19-Aug | 2 | 0 | 7 | N |
| O-10 | 12-Aug | 4 | 0 | 0 | N |
| O-14 | 15-Jun | 8 | 0 | 6 | N |
| O-15 | 16-Jun | 8 | 0 | 7 | N |
| | 29-Aug | 3 | 0 | 0 | N |
| O-16 | 14-Jun | 6 | 0 | 7 | N |
| O-17 | 15-Jun | 4 | 0 | 7 | N |
| O-18X | 25-Jul | 4 | 0 | 6 | N |
| O-19 | 14-Jun | 5 | 0 | 7 | N |
| | 26-Aug | 1 | 30 | 6 | N |
| O-23X | 24-Jul | 4 | 0 | 6 | N |
| O-26 | 26-Aug | 1 | 30 | 7 | N |
| P-11 | 16-Jun | 6 | 0 | 7 | N |
| P-12 | 16-Jun | 3 | 0 | 6 | N |
| P-13 | 16-Jun | 3 | 0 | 6 | N |
| | 11-Aug | 2 | 29 | 6.5 | N |
| P-15 | 29-Aug | 4 | 0 | 0 | N |
| | 29-Aug | 3 | 0 | 0 | N |
| P-19X | 21-Jul | 7 | 0 | 6.5 | N |
| P-21X | 24-Jul | 3 | 0 | 6 | N |

| | Date | Total Discharge Volume ($m^3$) | Chlorides (mg/L) | pH | Sheen Y/N |
|---|---|---|---|---|---|
| **Sample Limits** | | | **< 500** | **6.0 9.0** | **N** |
| P-22 | 29-Aug | 2 | 0 | 0 | N |
| Q-08 | 11-Aug | 2 | 0 | 7 | N |
| Q-10 | 19-Aug | 2 | 0 | 6 | N |
| Q-12 | 17-Jun | 4 | 0 | 7 | N |
| | 12-Aug | 6 | 0 | 0 | N |
| | 20-Aug | 3 | 0 | 7 | N |
| Q-14 | 29-Aug | 2 | 0 | 0 | N |
| Q-15 | 11-Aug | 2 | 29 | 6.5 | N |
| | 29-Aug | 3 | 0 | 0 | N |
| R-05X | 21-Jul | 1 | 0 | 6.5 | N |
| R-09X | 23-Jul | 6 | 0 | 7 | N |
| R-11 | 20-Aug | 3 | 0 | 7 | N |
| | 23-Jul | 5 | 0 | 6 | N |
| R-13 | 18-Jun | 3 | 0 | 6 | N |
| R-O7X | 21-Jul | 1 | 0 | 6.5 | N |
| S-08 | 17-Jun | 5 | 0 | 6 | N |
| | 25-Jul | 2 | 0 | 6 | N |
| S-10 | 18-Jun | 7 | 0 | 7 | N |
| S-12 | 18-Jun | 6 | 0 | 7 | N |
| T-07 | 17-Jun | 4 | 0 | 7 | N |
| | 25-Jul | 6 | 0 | 6 | N |
| T-08 | 17-Jun | 4 | 0 | 6 | N |
| | 29-Aug | 3 | 0 | 0 | N |
| T-09 | 17-Jun | 8 | 0 | 6 | N |
| T-11 | 18-Jun | 8 | 0 | 6 | N |
| | 17-Aug | 2 | 0 | 7 | N |
| T-13 | 18-Jun | 6 | 0 | 7 | N |
| T-14 | 19-Jun | 8 | 0 | 7 | N |
| T-15 | 19-Aug | 2 | 0 | 7 | N |
| | 23-Jul | 3 | 0 | 6 | N |
| T-19 | 17-Aug | 2 | 0 | 7 | N |
| | 19-Aug | 2 | 0 | 7 | N |
| T-21X | 23-Jul | 4 | 0 | 6 | N |

**Table B-2: 2018 Surface Water Discharge Analytical Results for Category B Locations**

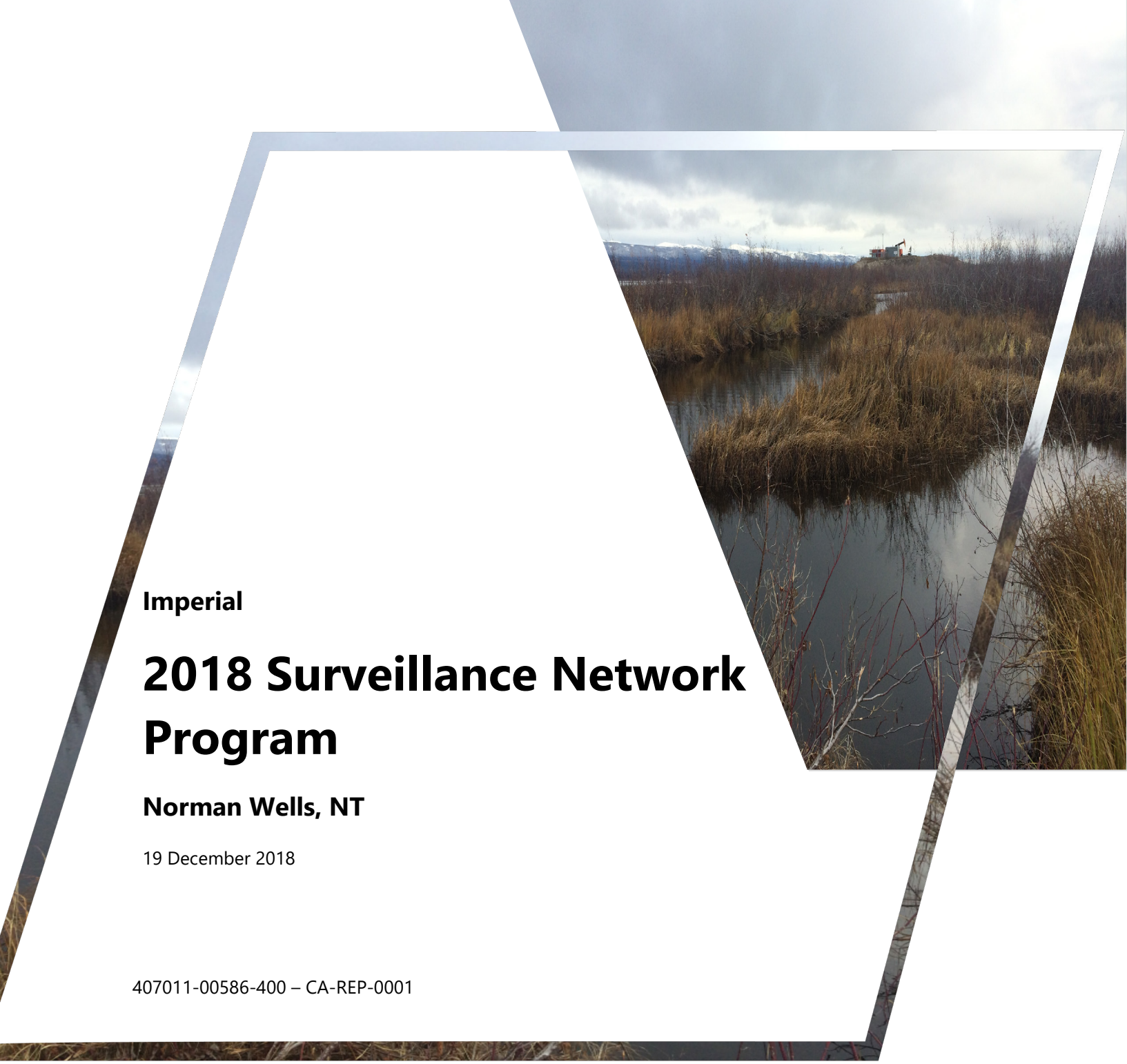
| | Date | Start/ Middle/ End | Total Discharge Volume ($m^3$) | Total Petroleum Hydrocarbons (mg/L) | Phenols (mg/L) | Chlorides (mg/L) | pH | Total Suspended Solids (mg/L) | Total Dissolved Solids (mg/L) | Specific Conductivity (uS/cm) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Max Grab Sample Limit** | | | | **5** | **0.14** | **<500** | **6.0 9.0** | | | |
| Mainland Areas | | | | | | | | | | |
| CPF Impound | 9-May | Start | 1,597 | <2.0 | 0.0110 | 3.2 | 7.79 | 5.3 | 180 | 280 |
| | 16-May | Mid 1 | | <2.0 | 0.0021 | 4.6 | 7.99 | 2.7 | 310 | 460 |
| | 23-May | Mid 2 | | <2.0 | 0.0039 | 5.0 | 7.90 | 43.0 | 680 | 920 |
| | 30-May | End | | <2.0 | 0.0024 | 9.4 | 7.93 | 86.0 | 750 | 1000 |
| LT-11 Impound | 2-May | Start | 6,262 | <2.0 | 0.0093 | 2.3 | 7.23 | 5.3 | 88 | 120 |
| | 9-May | Mid 1 | | <2.0 | 0.0085 | 5.1 | 7.59 | 1.3 | 140 | 240 |
| | 16-May | Mid 2 | | <2.0 | 0.0047 | 4.0 | 7.87 | 2.0 | 320 | 430 |
| | 23-May | End | | <2.0 | 0.0045 | 3.7 | 8.01 | 37.0 | 480 | 680 |
| Refinery Impound | 30-Apr | Start | 2,196 | <2.0 | 0.0140 | 12.0 | 7.79 | 4.0 | 270 | 450 |
| | 7-May | Mid 1 | | <2.0 | 0.0091 | 3.8 | 7.7 | 4.7 | 180 | 310 |
| | 14-May | Mid 2 | | <2.0 | 0.0042 | 5.7 | 7.97 | 3.3 | 270 | 410 |
| | 16-May | Mid 3 | | <2.0 | 0.0033 | 6.0 | 8.06 | 5.3 | 300 | 430 |
| | 23-May | Mid 4 | | <2.0 | 0.0058 | 8.7 | 8.05 | 4.0 | 330 | 520 |
| | 30-May | Mid 5 | | <2.0 | 0.0047 | 12.0 | 8.18 | 2.7 | 380 | 590 |
| | 6-Jun | End | 0 | <2.0 | 0.0047 | 22 | 8.05 | 26 | 540 | 860 |
| | 27-Jun | Start | | <2.0 | 0.0059 | 28 | 8.15 | 2.7 | 540 | 860 |
| | 4-Jul | Mid 1 | 1,476 | <2.0 | 0.0022 | 30 | 8.63 | 2 | 540 | 950 |
| | 11-Jul | Mid 2 | | <2.0 | <0.0020 | 25 | 8.18 | 13 | 530 | 810 |
| | 18-Jul | Mid 3 | | <2.0 | 0.0052 | 27 | 8.24 | 3.3 | 490 | 800 |

| | Date | Start/ Middle/ End | Total Discharge Volume ($m^3$) | Total Petroleum Hydrocarbons (mg/L) | Phenols (mg/L) | Chlorides (mg/L) | pH | Total Suspended Solids (mg/L) | Total Dissolved Solids (mg/L) | Specific Conductivity (uS/cm) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Max Grab Sample Limit** | | | | **5** | **0.14** | **<500** | **6.0 9.0** | | | |
| | 25-Jul | Mid 4 | | <2.0 | 0.0029 | 32 | 8.69 | <1.0 | 530 | 940 |
| | 1-Aug | Mid 4 | 1,935 | <2.0 | 0.0035 | 28 | 8.16 | 3.3 | 490 | 790 |
| | 8-Aug | Mid 5 | | <2.0 | 0.0058 | 29 | 8.3 | 2.7 | 440 | 760 |
| | 15-Aug | Mid 6 | | <2.0 | 0.0067 | 30 | 8.15 | 2.7 | 500 | 800 |
| | 22-Aug | Mid 7 | | <2.0 | 0.0087 | 28 | 8.14 | 3.3 | 530 | 800 |
| | 5-Sep | Mid 9 | 383 | <2.0 | 0.0037 | 33 | 8.44 | <1.0 | 580 | 980 |
| | 13-Sep | Mid 10 | | <2.0 | 0.0054 | 28 | 8.1 | 9.3 | 650 | 1000 |
| | 20-Sep | Mid 11 | | <2.0 | 0.0025 | 34 | 8.59 | 2.7 | 580 | 1000 |
| | 26-Sep | End | | <2.0 | 0.0051 | 27 | 8.01 | 37 | 580 | 970 |
| Refinery Waterflood | 7-May | Start | 154 | <2.0 | <0.0020 | 4.4 | 8.2 | 39.0 | 100 | 200 |
| | 14-May | Mid 1 | | <2.0 | <0.0020 | 16.0 | 8.28 | 4.7 | 320 | 590 |
| | 16-May | Mid 2 | | <2.0 | 0.0027 | 20.0 | 8.32 | 2.7 | 400 | 700 |
| | 23-May | Mid 3 | | <2.0 | 0.0050 | 24.0 | 8.42 | <1.0 | 480 | 840 |
| | 30-May | Mid 4 | | <2.0 | <0.0020 | 28.0 | 8.37 | 3.3 | 520 | 930 |
| | 6-Jun | Mid 5 | 320 | <2.0 | 0.0029 | 29 | 8.39 | <1.0 | 530 | 950 |
| | 13-Jun | Mid 6 | | <2.0 | 0.0024 | 29 | 8.46 | 6 | 560 | 950 |
| | 20-Jun | Mid 7 | | <2.0 | <0.0020 | 30 | 8.68 | 1.3 | 520 | 950 |
| | 27-Jun | Mid 8 | | <2.0 | 0.0027 | 30 | 8.46 | <1.0 | 530 | 970 |
| | 4-Jul | Mid 10 | 294 | <2.0 | 0.0045 | 28 | 8.16 | 2.7 | 540 | 840 |
| | 11-Jul | Mid 11 | | <2.0 | <0.0020 | 30 | 8.64 | 2.7 | 550 | 940 |
| | 18-Jul | Mid 12 | | <2.0 | 0.0036 | 32 | 8.6 | <1.0 | 520 | 930 |
| | 25-Jul | Mid 13 | | <2.0 | 0.0053 | 28 | 8.27 | 2 | 490 | 790 |
| | 1-Aug | Mid14 | 0 | <2.0 | 0.0030 | 32 | 8.74 | 17 | 540 | 940 |
| | 8-Aug | Mid 15 | | <2.0 | 0.0037 | 33 | 8.57 | 33 | 380 | 930 |

| | Date | Start/ Middle/ End | Total Discharge Volume ($m^3$) | Total Petroleum Hydrocarbons (mg/L) | Phenols (mg/L) | Chlorides (mg/L) | pH | Total Suspended Solids (mg/L) | Total Dissolved Solids (mg/L) | Specific Conductivity (uS/cm) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Max Grab Sample Limit** | | | | **5** | **0.14** | **<500** | **6.0 9.0** | | | |
| | 15-Aug | Mid 16 | | <2.0 | 0.0021 | 33 | 8.41 | <1.0 | 550 | 940 |
| | 22-Aug | Mid 17 | | <2.0 | 0.0043 | 32 | 8.48 | 1.3 | 570 | 950 |
| | 5-Sep | Mid 19 | | <2.0 | 0.0041 | 28 | 8.05 | 4.7 | 600 | 910 |
| | 13-Sep | Mid 20 | | <2.0 | 0.0022 | 33 | 8.54 | <1.0 | 590 | 1000 |
| | 20-Sep | End | | <2.0 | 0.0035 | 28 | 8.2 | 2.7 | 660 | 1000 |
| Misc. Mainland Impound Areas | 30-Jul | Start | 0 | <2.0 | 0.0073 | 6.1 | 7.82 | 6 | 610 | 920 |
| C-38X | 6-Aug | End | 2322 | 2.5 | 0.015 | 25 | 7.69 | 110 | 730 | 1100 |
| | 21-Jun | Start | 0 | <2.0 | 0.0020 | 6.6 | 8.19 | 3.3 | 380 | 550 |
| RTK 105-107 | 28-Jun | Mid 1 | | <2.0 | 0.0035 | 5.3 | 8.02 | 13 | 340 | 560 |
| | 4-Jul | Mid 2 | 1704 | <2.0 | 0.0081 | 8.5 | 8.20 | 4 | 520 | 770 |
| | 11-Jul | End | | <2.0 | 0.0058 | 6.7 | 8.13 | 15 | 550 | 780 |
| | 17-Jul | Start | | <2.0 | 0.0020 | 5.6 | 8.05 | 4 | 510 | 780 |
| | 24-Jul | Mid 1 | | <2.0 | 0.0058 | 4.4 | 7.77 | 2.7 | 500 | 780 |
| | 30-Jul | Mid 2 | | <2.0 | 0.0075 | 33 | 8.05 | 2 | 800 | 1100 |
| | 6-Aug | Mid 3 | 0 | <2.0 | 0.0095 | 9.4 | 8.00 | 1.9 | 560 | 850 |
| | 13-Aug | Mid 4 | | <2.0 | 0.010 | 6.0 | 8.06 | <1.0 | 440 | 650 |
| | 20-Aug | Mid 5 | | <2.0 | 0.0097 | 7.1 | 7.92 | 2.0 | 460 | 730 |
| | 27-Aug | Mid 6 | | ,2.0 | 0.0098 | 7.0 | 8.03 | 2.0 | 470 | 790 |
| | 3-Sep | Mid 7 | | <2.0 | 0.0048 | 29 | 8.14 | 69 | 740 | 1100 |
| | 10-Sep | Mid 8 | | <2.0 | 0.0080 | 7.6 | 8.05 | 2.7 | 500 | 760 |
| | 17-Sep | Mid 9 | | <2.0 | 0.0076 | 10 | 7.78 | 4.7 | 620 | 940 |
| | 24-Sep | End | | <2.0 | 0.0060 | 31 | 8.09 | 51 | 690 | 1100 |
| | 21-Jun | Start | 0 | <2.0 | <0.0020 | 4.2 | 8.21 | <1.0 | 340 | 460 |

| | Date | Start/ Middle/ End | Total Discharge Volume ($m^3$) | Total Petroleum Hydrocarbons (mg/L) | Phenols (mg/L) | Chlorides (mg/L) | pH | Total Suspended Solids (mg/L) | Total Dissolved Solids (mg/L) | Specific Conductivity (uS/cm) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Max Grab Sample Limit** | | | | **5** | **0.14** | **<500** | **6.0 9.0** | | | |
| RTK 109-111 | 27-Jun | Mid 1 | | <2.0 | 0.0074 | 5.4 | 8.10 | 27 | 320 | 550 |
| | 4-Jul | End | | <2.0 | 0.0086 | 7.2 | 8.25 | 9.3 | 520 | 610 |
| RTK 112-115 | 21-Jun | Start | 0 | <2.0 | <0.0020 | 8.2 | 8.16 | 47 | 250 | 420 |
| | 28-Jun | Mid 1 | | <2.0 | <0.0020 | 7.7 | 7.96 | 4 | 240 | 450 |
| | 4-Jul | End | | <2.0 | 0.0062 | 19 | 7.87 | 300 | 460 | 760 |
| RTK 116-118 | 21-Jun | Start | 0 | <2.0 | <0.0020 | 11 | 7.99 | 9.3 | 280 | 450 |
| | 27-Jun | Mid 1 | | <2.0 | 0.0082 | 11 | 7.80 | 2.7 | 280 | 490 |
| | 4-Jul | End | | <2.0 | 0.0074 | 10 | 8.18 | 1.3 | 380 | 590 |
| RTK 119 | 21-Jun | Start | 0 | <2.0 | <0.0020 | 8.6 | 8.17 | 3.3 | 270 | 360 |
| | 28-Jun | Mid 1 | | <2.0 | 0.0077 | 10 | 8.06 | 3.3 | 270 | 560 |
| | 4-Jul | End | | <2.0 | 0.0059 | 2 | 8.20 | <1.0 | 280 | 410 |
| Settling Pond | 18-Jun | Start | 0 | <2.0 | 0.0026 | ** | 8.21 | 630 | 570 | 850 |
| | 25-Jun | Mid 1 | | <2.0 | <0.0020 | 540 | 8.21 | 33 | 540 | 810 |
| | 2-Jul | Mid 2 | 1000 | <2.0 | 0.0027 | 9.9 | 8.26 | 7.3 | 540 | 780 |
| | 9-Jul | Mid 3 | | <2.0 | 0.0039 | 10 | 8.27 | 10 | 510 | 780 |
| | 16-Jul | Mid 4 | | <2.0 | <0.0020 | 10 | 8.24 | 9.3 | 530 | 760 |
| | 23-Jul | Mid 5 | | <2.0 | <0.0020 | 9.5 | 8.29 | 2.7 | 500 | 740 |
| | 30-Jul | Mid 6 | | <2.0 | 0.0088 | 10 | 8.26 | 5.3 | 510 | 730 |
| | 30-Jul | Mid 6 | 1475 | <2.0 | 0.0088 | 10 | 8.26 | 5.3 | 510 | 730 |
| | 6-Aug | Mid 7 | | <2.0 | <0.0020 | 9.9 | 8.28 | 6.7 | 480 | 710 |
| | 13-Aug | Mid 8 | | <2.0 | <0.0020 | 9.9 | 8.23 | 6.0 | 460 | 670 |
| | 20-Aug | Mid 9 | | <2.0 | <0.0020 | 11 | 8.03 | 21 | 320 | 530 |
| | 27-Aug | Mid 10 | | <2.0 | <0.0020 | 10 | 8.16 | 10 | 190 | 350 |

# Appendix C SNP - Groundwater



**Imperial**

# 2018 Surveillance Network Program

## Norman Wells, NT

19 December 2018

407011-00586-400 – CA-REP-0001

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***THIS REPORT CONTAINS PROVISIONS LIMITING LIABILITY, THE SCOPE OF THE REPORT AND THIRD PARTY RELIANCE***

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Advisian
WorleyParsons Group

## Project No. 407011-00586-400-CA-REP-0001 - 2018 Surveillance Network Program: Norman Wells, NT

| Rev | Description | Originator Approval | Reviewer Approval | Project Manager Approval | Date |
|---|---|---|---|---|---|
| 0 | Issued as final | M. Lord | L. Glatiotis | S. Gibb | 19-Dec-18 |
| | | | | | |
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# 1. Introduction

The Imperial Oil Resources N.W.T. Limited (Imperial) Norman Wells Operation is an upstream oil and gas field located 700 km northwest of Yellowknife, Northwest Territories (Latitude 65° 17′ N, Longitude 126°51 W; the "Site"). Operations include a Central Processing Facility (CPF) on the northeastern shore of the Mackenzie River which receives production from wells on the mainland, three natural islands (Goose Island, Bear Island and Frenchy's Island) and six artificial islands (Figure 1). Work was conducted for Imperial under Imperial Oil Limited Contract A2275233.

Limitations of Liability, Scope of Report and Third Party Reliance for this report are provided in Appendix A.

## 1.1 Background

The Norman Wells Operations Groundwater Management Plan (GMP) was created in September 2014 as part of Imperial's Water License Renewal Application submitted to the Sahtu Land and Water Board (Imperial 2014). A key component of the GMP is the sampling of a select subset of existing groundwater monitoring wells installed at strategic locations between operating facilities and potential receptors across the Site, referred to as the Groundwater Surveillance Network Program (SNP). These wells are sampled twice annually in accordance with the GMP, in order to provide ongoing monitoring of groundwater conditions adjacent to Site activities. The goal of the SNP is to identify existing groundwater quality issues and to provide early detection of groundwater changes across the Site.

# 2. Scope of Work

WorleyParsons Canada Services Ltd., operating as Advisian, was retained by Imperial to conduct groundwater monitoring and sampling activities for the established sentinel network. The scope of work for the 2018 groundwater monitoring program at the Site included the following:

- check monitoring well integrity and measure static groundwater levels of 15 groundwater wells;
- collect groundwater samples for laboratory analysis of dissolved chloride and benzene, toluene, ethylbenzene and total xylenes (BTEX), as well as petroleum hydrocarbon fractions F1 and F2; and
- provide a summary report presenting the results of the 2018 groundwater sampling program.

The GMP lists chloride, benzene, toluene and ethylbenzene as the primary indicator parameters. Due to established laboratory analytical packages, additional analyses were also completed. The scope of this report is to review the primary indicator parameters per the GMP.

# 3. Environmental Assessment Guidelines

At present, no specific groundwater quality guidelines exist for the Northwest Territories. As a conservative measure, groundwater quality assessment parameters in this report are compared to the Canadian Council of Ministers of the Environment (CCME) Canadian Environmental Quality Guidelines (CEQG) for the Protection of Freshwater Aquatic Life (FWAL; CCME 2018), as surface water bodies (e.g. Bosworth Creek and the Mackenzie River) are potential receptors of groundwater in most areas of interest for this program.

Background concentrations of key geochemical parameters were calculated in 2018 for different geographical areas and geological units using data collected primarily between 1998 and 2016 (Appendix F). Background groundwater geochemical parameters were characterized throughout the Site, based on the hydrogeological zone where the monitoring well is completed, as well as evidence for the presence or absence of natural seepage in the vicinity. Applicable background concentrations are also provided in the analytical tables for convenience.

It should be emphasized that the aforementioned guidelines are used for comparative purposes only in the context of this report.

# 4. Groundwater Monitoring Network

Twelve monitoring wells and three contingency wells according to Imperial's Water License S13L1-007 make up the SNP. These wells were selected based on proximity to operating facilities and potential receptors, historical groundwater quality, well completion information, and overall Site coverage. The contingency wells serve as replacement sampling locations in the event that a primary SNP monitoring well is dry, damaged, frozen, or otherwise cannot produce water during a scheduled sampling event.

The main receptors identified during the development of the SNP were the Mackenzie River, Bosworth Creek, and the Town of Norman Wells. A summary of the selected monitoring wells is provided below as Table A.

**Table A SNP Monitoring Locations**

| Monitoring Well | Location | Rationale for Selection |
|---|---|---|
| CPF 97-7-5 | Mainland West | Situated between CPF and Bosworth Creek |
| CPF 98-8-3 | Mainland West | Situated between CPF and Mackenzie River |
| WSY 97-1-5 | Mainland East | Situated between Well Services Yard and Bosworth Creek |
| ARB-12-3-3 | Mainland East | Adjacent Biocell 1 |
| C38 08-1-4 | Mainland East | Situated between known historical well issues (C-36X) and Mackenzie River |
| TF 03-12-3 | Mainland East | Situated between Tank Farm and Mackenzie River; downgradient of known hydrocarbon source |
| MTF 97-1-5 | Mainland East | Situated between Tank Farm and Town of Norman Wells |
| BIS 97-1-3 | Bear Island | Situated between Bear Island Sump #5 and the Mackenzie River |
| BI-13-3-4.5 | Bear Island | Situated near Bear Island Sump #6 and the Mackenzie River |
| BIBG-12-1-7 | Bear Island | Situated at western edge of development on Bear Island, near Mackenzie River |
| GIBG-10-2-3 | Goose Island | Situated between well pads and Mackenzie River |
| GIQ8-10-2-4 | Goose Island | Situated between fuel storage/handling area and the Mackenzie River |

| Monitoring Well | Location | Rationale for Selection |
|---|---|---|
| **Contingency Wells*** | | |
| MEBG-10-1-3 | Mainland East | Situated between Mainland Sumps and Mackenzie River |
| GIP11 09-1-4 | Goose Island | Situated between a sump and the Mackenzie River – well was abandoned in 2018 and reinstalled as GIP11 09-1-4-R |
| GIP11 09-1-4-R | Goose Island | Reinstallation of destroyed well GIP11 09-1-4 |
| BI-13-1-4 | Bear Island | Situated near Bear Island Sump #6 and the Mackenzie River |
| **Spatial Coverage Well**** | | |
| BIBG-10-1-4 | Bear Island | Situated at western edge of Bear Island, south of the Mackenzie River – meant to replace damaged SNP well BIBG-12-1-7 |

* Wells serve as contingency monitoring locations in the event that a sample cannot be collected from all primary SNP locations.
** Wells not specified as primary or contingency SNP monitoring locations but included in this report to provide spatial coverage at damaged well.

In 2018, GIP11 09-1-4 was abandoned and reinstalled as GIP11 09-1-4-R in the same location at the same depth, as the original location was damaged and could not be sampled.

BIBG-10-1-4 was sampled instead of BIBG-12-1-7 which was damaged and could not be sampled. Historical data for GIP11 09-1-4 and BIBG-12-1-7 has been included in the report for comparison purposes.

# 5. Sampling and Methodology

## 5.1 Field Methodology

The SNP groundwater sampling was conducted by Advisian personnel in July and September 2018.

Groundwater samples were collected using HydraSleeves™, dedicated Waterra™ tubing, or dedicated/disposable bailers following no-purge methodology. A total of 41 samples, including 30 groundwater samples, 4 field duplicate samples, 4 field blank samples and 3 trip blank samples, were collected in pre-cleaned laboratory-provided bottles as part of the SNP. Results were compared to the CCME FWAL guidelines, background chemistry, and historical records, as applicable.

All groundwater samples were submitted for laboratory analysis at an accredited third party laboratory in Edmonton (Maxxam Analytics) in accordance with standard packaging, preservation, and chain-of-custody (COC) procedures.

The methodology for measuring field parameters and collecting groundwater samples is summarized in Appendix B.

## 5.2 Statistical Analyses

### 5.2.1 Shewhart-Cumulative Sum Trend Analyses

Combined Shewhart-Cumulative Sum (CUSUM) control charts provide a common means of statistical trend evaluation in many environmental monitoring programs and are in fact the only statistical procedure that is directly recommended for use in intra-well monitoring by the United States Environmental Protection Agency (U.S. EPA 1989, 1992). The Shewhart control chart is designed to detect an immediate increase over the background distribution for a particular monitoring constituent, whereas the CUSUM control chart is designed to detect more gradual increases over background (Gibbons 1999).

### 5.2.2 Mann-Kendall Statistical Analyses

The non-parametric Mann-Kendall test for trend can be used in combination with a modified version of Sen's non-parametric slope estimator (Gibbons 1994). In both tests, four or more points of data are placed in chronological order, and the sign of the differences between all forward combinations of data pairs are used to compute the Mann-Kendall statistic (S). The Mann-Kendall statistic (S), along with the number of the data points (n), is used for the normal approximation test, and the results yield a probability from 0 to 1.

Sen's slope is used to provide an approximate magnitude of change on trend lines. Sen's slope is calculated by evaluating the slope between all forward combinations of data pairs. The slopes are then ranked, and the median slope value is selected. Unlike least squares regression, the Sen's slope is not greatly affected by gross outliers, which are occasionally encountered in groundwater chemistry data. Slopes are presented in absolute terms [milligrams per litre (mg/L) per year] and/or normalized relative to the median concentration (% change per year).

In each case, trend analyses are conducted using the available data series collected following installation of the monitoring wells. The Mann-Kendall statistics are evaluated only on datasets where at least four data points exist. It is important to note that some parameters returned "below detection" results for part or all of the location's sampling history.

To indicate potentially significant temporal trends, results are screened according to three criteria:

- the probability of a trend;
- slope (e.g. in mg/L per year); and
- normalized slope (in % per year).

Location-specific discussions of statistical trend details and results are provided in Section 6.3.

# 6. Results and Interpretation

Water samples were collected from all sampling locations, except for GIP11 09-1-4 and BIBG-12-1-7. Well GIP11 09-1-4 was observed to be damaged in 2016 and was abandoned/reinstalled as GIP11 09-1-4-R in 2018. Well BIBG-12-1-7 was observed to be damaged in 2015. Samples were collected from nearby monitoring well BIBG-10-1-4. A partial sample was collected from WSY 97-1-5 in September 2018 due to limited sample recovery.

## 6.1 Site Hydrogeology

Monitoring well datum and groundwater surface elevations are presented in Table 1 and Figures 2A/B to 3A/B. Elevations are provided in metres above sea level (masl).

### 6.1.1 Mainland

Groundwater surface elevations do not indicate a consistent groundwater flow direction for the Mainland area. This is due, in part, to sparsity of the monitoring network for the SNP program, and to the presence of discontinuous permafrost beneath the Site. Ice lenses in the subsurface act as barriers to groundwater movement, due to the comparatively low hydraulic conductivity associated with frozen soil. As a result, groundwater flow conditions beneath the Site are complex, and small scale local variations are inferred to be present in many areas.

Generally speaking, groundwater is inferred to flow predominantly towards the Mackenzie River, with localized flow towards Bosworth Creek. More extensive monitoring events at the Site confirm this interpretation (Advisian 2018).

Groundwater surface elevations ranged from 56.81 to 63.58 masl in July (Figure 2A) and from 56.86 to 63.54 masl in September (Figure 2B). In general, hydraulic head is higher towards the north end of the Site and decreases with proximity to the Mackenzie River.

### 6.1.2 Bear Island and Goose Island

Generally, groundwater surface elevations on Bear Island and Goose Island mimic the surface topography, with local flow directions inferred to be from high ground towards the closest surface water body. In most cases, the closest water body is the Mackenzie River; however, a number of unnamed surface water bodies also exist on both Islands (Figure 1).

Groundwater surface elevations on Bear Island ranged from 47.50 to 50.14 masl in July (Figure 3A) and from 48.70 to 50.24 masl in September (Figure 3B).

Groundwater surface elevations on Goose Island ranged from 42.04 to 45.19 masl in July (Figure 3A) and from 42.06 to 45.51 masl in September (Figure 3B).

## 6.2 Groundwater Analytical Results

Current groundwater chemistry data for chloride and petroleum hydrocarbon parameters are presented in Tables 2 and 3. Analytical exceedances, as compared to the CCME FWAL guidelines and background chemistry, are presented in Figures 4A/B and 5A/B.

The 2018 laboratory analytical reports, including both key indicator parameters and other associated chemistry data, are compiled in Appendix C. A description and summary of the quality assurance and quality control program is provided in Appendix D.

The background geochemistry for the Norman Wells field was revised in 2018 (Appendix F). Estimated natural background geochemistry for shallow groundwater has been provided in Tables 2 and 3. These background values are referred to periodically in the discussion below.

### 6.2.1 Chloride

An above guideline chloride concentration was reported for monitoring well TF 03-12-3 in 2018 in July 2018. This concentration also exceeded the background concentration (Figure 4A and Table 2). This monitoring location has historically yielded above-guideline concentrations of dissolved chloride. As it is installed downgradient of the Mainland Tank Farm, it is possible that these elevated chloride concentrations are indicative of anthropogenic impacts.

Seven monitoring wells (ARB-12-3-3, C38 08-1-4, WSY 97-1-5, BIS 97-1-3, BIBG-10-1-4, GIP11 09-1-4-R and GIQ8-10-2-4) had dissolved chloride concentrations below the CCME FWAL guideline but above the anticipated background concentrations for Mainland or Island surficial sediments (Table 2).

All remaining 2018 analytical results were below the CCME FWAL guideline and the anticipated background concentrations for Mainland and Island surficial sediments (Figures 4A/B and Table 2).

### 6.2.2 Petroleum Hydrocarbon Parameters

All petroleum hydrocarbon parameter concentrations were below the applied guidelines and method detection limits (Figures 5A/B and Table 3).

## 6.3 Mann-Kendall Statistical Analyses

Mann-Kendall statistical analyses have been performed for all parameters having both an applied CCME FWAL guideline and four or more historical data points.

Locations were identified as exhibiting statistically-notable trends if the following criteria were met:

- >95% probability of occurrence (two-sided p-value <0.05); and
- significant rate of change (normalized slope > ±10% per year).

A decreasing trend indicates concentrations are decreasing over time while an increasing trend indicates concentrations are increasing over time. Statistical analyses, trend charts and a summary table are presented in Appendix E, and relevant trends are summarized in Table B below.

**Table B Statistically-Notable Groundwater Hydrochemical Trends**

| Monitoring Location | Parameter | Trend | N* |
|---|---|---|---|
| MEBG-10-1-3 | Chloride | ↓ | 13 |

*Note: N = Number of supporting data points in historical dataset.

# 7. Field and Laboratory Quality Assurance/Quality Control

A quality assurance/quality control (QA/QC) program was followed to manage and quantify the quality of the investigation results. The program included field procedures, laboratory procedures and the use of QC samples to quantify the results of the program.

Field QC sampling included four duplicate samples, four groundwater field blank samples, and three groundwater trip blank samples.

The laboratory QA/QC analyses are provided in the laboratory certificates of analysis, presented in Appendix C. The laboratory QA/QC program included calibration checks, surrogate matrix spikes, blanks and laboratory duplicates during analyses. Any data quality issues are discussed in the laboratory data checklists provided in Appendix C.

The results of the field QA/QC sample analyses are presented in Appendix D. All field and trip blank results were below the laboratory reportable detection limits (Table D-1).

Based on the QA/QC analyses, the data are considered fit for the purpose of this report.

# 8. Summary

Groundwater quality monitoring for the SNP was completed in July and September 2018. Activities included measurement of hydraulic head and collection of groundwater samples for laboratory analyses including key indicator parameters (dissolved chloride, benzene, toluene and ethylbenzene). A summary of the general conclusions from the sampling program is as follows:

- Due to the areal variability of permafrost presence across the Site and the wide spatial distribution of SNP wells, groundwater surface elevations cannot be used to interpret a consistent flow direction. Based on more extensive monitoring programs at the Site, groundwater on the Mainland is generally inferred to flow predominantly towards the Mackenzie River, with localized flow towards Bosworth Creek. Groundwater surface elevations on Bear and Goose Island reflect the surface topography, with local flow directions inferred to be from high ground towards the closest surface water body;
- Dissolved chloride concentrations at one monitoring well exceeded the applied CCME FWAL guideline and the background concentration for surficial sediments;
- All analyzed petroleum hydrocarbon parameters results were below the applied guidelines, background concentrations and reportable detection limits; and
- Mann-Kendall trend analyses indicated one statistically-significant decreasing trend (dissolved chloride at MEBG-10-1-3).

# 9. Closure

We trust that this report satisfies your current requirements and provides suitable documentation for your records. If you have any questions or require further details, please contact the undersigned at any time.

Report Prepared by:

**Melissa Lord, C.E.T.**
Environmental Technologist

Senior Review by:

REGISTERED PROFESSIONAL GEOLOGIST
M.D. BROWN
LICENSEE
NWT/NU

Dec. 20 2018

**Michael Brown, M.Sc., P.Geol. (AB, NT)**
Principal Hydrogeologist

**Lorian Glatiotis, B.Sc., P.Geo. (AB)**
Hydrogeologist

**Advisian, Americas**

# 10. References

Advisian 2018. DRAFT 2018 Groundwater and Surface Water Quality Monitoring Report – E&PS Areas – Norman Wells, NT. Prepared for Imperial. December 2018.

CCME (Canadian Council of Ministers of the Environment) 2018. Canadian Environmental Quality Guidelines – Water Quality Guidelines for the Protection of Freshwater Aquatic Life. Canadian Council of Ministers of the Environment. September 2018.

Gibbons, R.D. 1994. Statistical Methods for Groundwater Monitoring. Wiley Interscience. pp. 286.

Gibbons, R.D. 1999. Use of Combined Shewhart-CUSUM Control Charts for Ground Water Monitoring Applications. Ground Water Journal, Vol. 37, No. 5, pp. 682-691. September-October 1999.

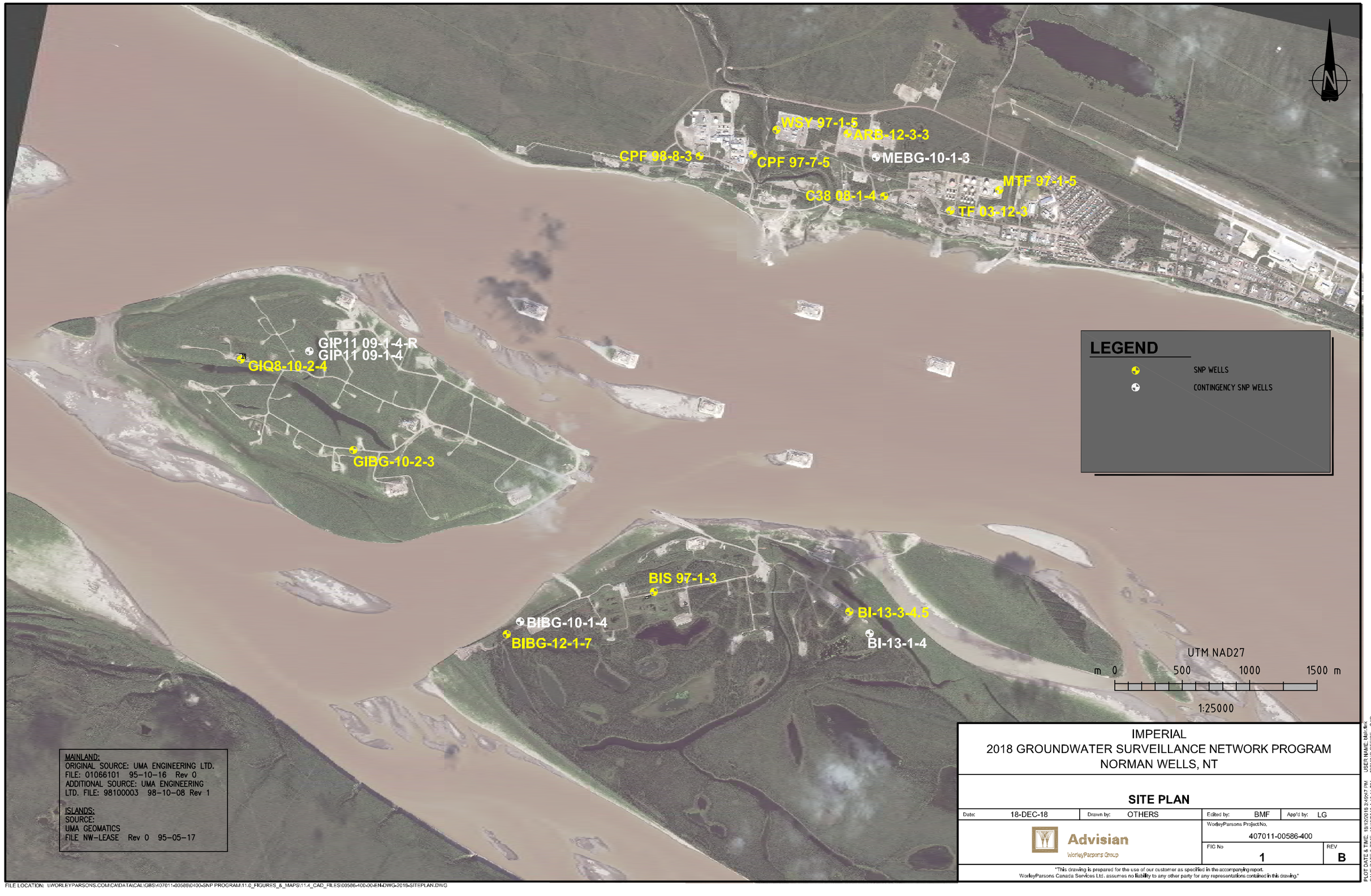
Imperial (Imperial Oil Resources) 2014. Norman Wells Operations Groundwater Management Plan. Report prepared for the Mackenzie Valley Land and Water Board. September 2014.

U.S. EPA (United States Environmental Protection Agency) 1989. Interim Final Guidance Document: Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities. April 1989.

U.S. EPA (United States Environmental Protection Agency) 1992. Addendum to Interim Final Guidance Document: Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities. July 1992.

# Figures






MAINLAND:
ORIGINAL SOURCE: UMA ENGINEERING LTD.
FILE: 01066101 95-10-16 Rev 0
ADDITIONAL SOURCE: UMA ENGINEERING LTD. FILE: 98100003 98-10-08 Rev 1

ISLANDS:
SOURCE:
UMA GEOMATICS
FILE NW-LEASE Rev 0 95-05-17

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2018 GROUNDWATER SURVEILLANCE NETWORK PROGRAM
NORMAN WELLS, NT

**SITE PLAN**

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|---|---|---|---|
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## LEGEND

- INJECTION WELL LOCATION
- PRODUCTION WELL LOCATION
- ESSO LEASE BOUNDARY
- PIPELINES
- UTILIDOR LOCATION
- MONITORING WELL LOCATION
- (63.51) GROUNDWATER SURFACE ELEVATION (m.a.s.l.) (JULY 2018)

SOURCES:
1. SITE PLAN AS PER UMA ENGINEERING LTD. FILES 010166101 (REV 0 DATED 95-10-16) AND 98100003 (REV 1 DATED 98-10-08).

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NORMAN WELLS, NT

**GROUNDWATER SURFACE ELEVATIONS - MAINLAND (JULY 2018)**

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|---|---|---|---|
| 18-DEC-18 | OTHERS | B.M.F. | LG |

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## LEGEND

| | | | |
|---|---|---|---|
| ⊙ | INJECTION WELL LOCATION | ⊕ | MONITORING WELL LOCATION |
| ⊙ | PRODUCTION WELL LOCATION | (63.54) | GROUNDWATER SURFACE ELEVATION (m.a.s.l.) (SEPTEMBER 2018) |
| | ESSO LEASE BOUNDARY | | |
| | PIPELINES | | |
| | UTILIDOR LOCATION | | |

SOURCES:
1. SITE PLAN AS PER UMA ENGINEERING LTD. FILES 010166101 (REV 0 DATED 95-10-16) AND 98100003 (REV 1 DATED 98-10-08).

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IMPERIAL
2018 GROUNDWATER SURVEILLANCE NETWORK PROGRAM
NORMAN WELLS, NT

**GROUNDWATER SURFACE ELEVATIONS - MAINLAND (SEPTEMBER 2018)**

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| | | FIG No 2B | REV B |

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FILE LOCATION: \\WORLEYPARSONS.COM\CAIDATA\CALGBS\407011-00586\400-SNP PROGRAM\11.0_FIGURES_&_MAPS\11.4_CAD_FILES\00586-400-00-EN-DWG-2018-MAINLAND.DWG

PLOT DATE & TIME: 19/12/2018 4:30:29 PM
SAVE DATE & TIME: 10/12/2018 4:30:48 PM
USER NAME: bfurlong
ISSUING OFFICE: CALGARY




## LEGEND

| | | | |
|---|---|---|---|
| ◎ | INJECTION WELL LOCATION | ◓ | MONITORING WELL LOCATION |
| ◎ | PRODUCTION WELL LOCATION | (47.32) | GROUNDWATER SURFACE ELEVATION (m.a.s.l.) (JULY 2018) |
| -·-·- | ESSO LEASE BOUNDARY | (NM) | NOT MEASURED - WELL ABANDONED OR DAMAGED |
| ——— | PIPELINES | (NA) | SURVEY DATA NOT AVAILABLE |
| ——— | UTILIDOR LOCATION | (DRY) | WELL DRY |

SOURCES:
1. SITE PLAN AS PER UMA ENGINEERING LTD. FILES 010166101 (REV 0 DATED 95-10-16) AND 98100003 (REV 1 DATED 98-10-08).

m 0 100 200 300 400 m

1:7500

IMPERIAL
2018 GROUNDWATER SURVEILLANCE NETWORK PROGRAM
NORMAN WELLS, NT

**GROUNDWATER SURFACE ELEVATIONS -
GOOSE ISLAND AND BEAR ISLAND (JULY 2018)**

| Date: | Drawn by: | Edited by: | App'd by: |
|---|---|---|---|
| 18-DEC-18 | OTHERS | B.M.F. | LG |

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WorleyParsons Group

WorleyParsons Project No.
407011-00586-400

FIG No: 3A
REV: B

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PLOT DATE & TIME: 18/12/2018 4:32:47 PM
SAVE DATE & TIME: 10/12/2018 4:50:48 PM
USER NAME: bfisher
ISSUING OFFICE: CALGARY




## LEGEND

| | | | |
|---|---|---|---|
| ◎ | INJECTION WELL LOCATION | ◉ | MONITORING WELL LOCATION |
| ◎ | PRODUCTION WELL LOCATION | (45.51) | GROUNDWATER SURFACE ELEVATION (m.a.s.l.) (SEPTEMBER 2018) |
| -·-·- | ESSO LEASE BOUNDARY | (NM) | NOT MEASURED - WELL ABANDONED OR DAMAGED |
| ——— | PIPELINES | (NA) | SURVEY DATA NOT AVAILABLE |
| ——— | UTILIDOR LOCATION | | |

SOURCES:
1. SITE PLAN AS PER UMA ENGINEERING LTD. FILES 010166101 (REV 0 DATED 95-10-16) AND 98100003 (REV 1 DATED 98-10-08).

m 0 100 200 300 400 m

1:7500

IMPERIAL
2018 GROUNDWATER SURVEILLANCE NETWORK PROGRAM
NORMAN WELLS, NT

**GROUNDWATER SURFACE ELEVATIONS -
GOOSE ISLAND AND BEAR ISLAND (SEPTEMBER 2018)**

| Date: | 18-DEC-18 | Drawn by: | OTHERS | Edited by: | B.M.F. | App'd by: | LG |
|---|---|---|---|---|---|---|---|

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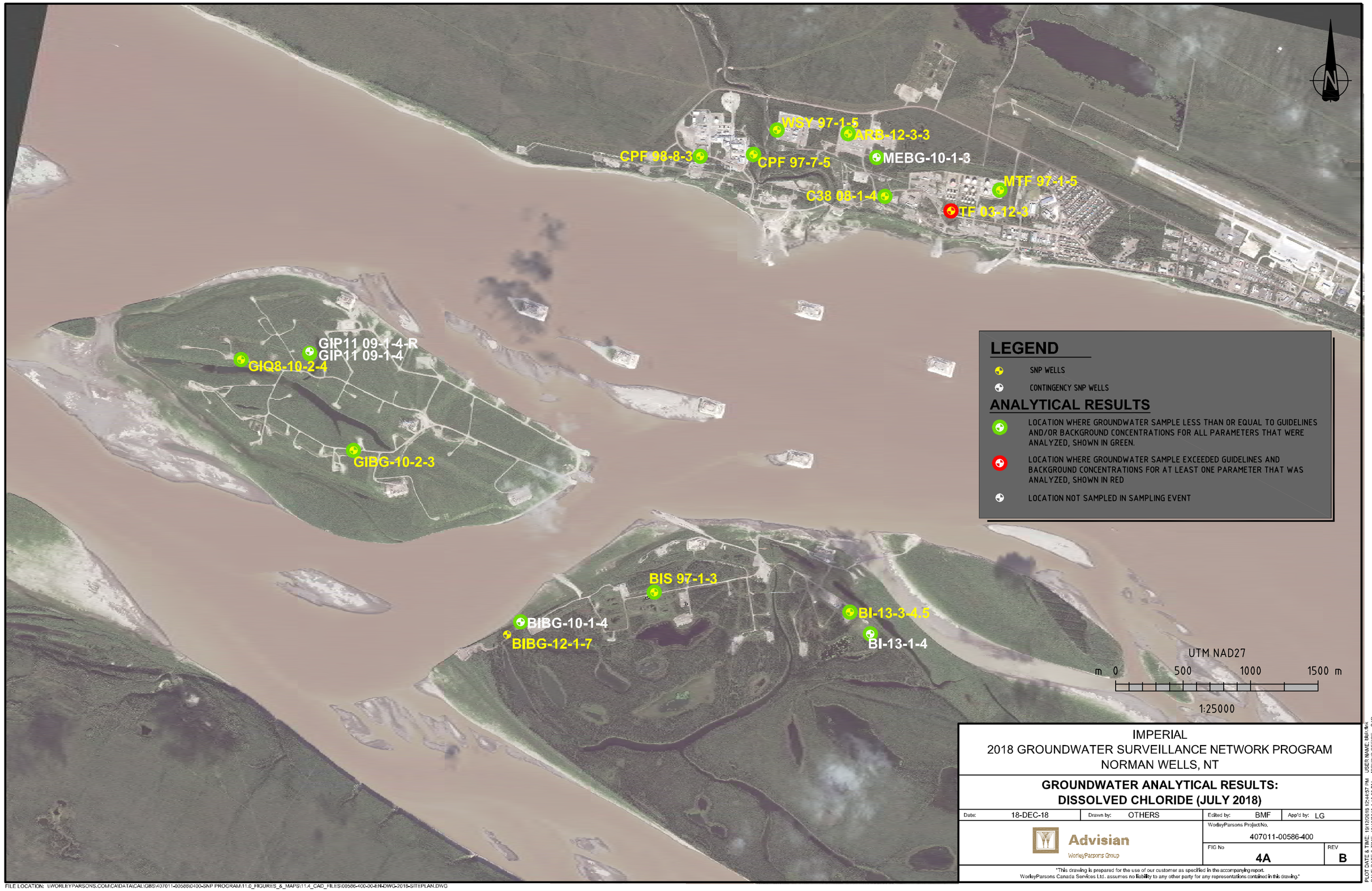
WorleyParsons Project No.
407011-00586-400

FIG No: 3B | REV: B

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FILE LOCATION: \\WORLEYPARSONS.COM\CA\DATA\CAL\GBS\407011-00586\0400-SNP PROGRAM\11.0_FIGURES_&_MAPS\11.4_CAD_FILES\00586-400-00-EN-DWG-2018-MAINLAND.DWG

PLOT DATE & TIME: 19/12/2018 1:10:45 PM
SAVE DATE & TIME: 18/12/2018 4:33:40 PM
USER NAME: bfisher
ISSUING OFFICE: CALGARY




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2018 GROUNDWATER SURVEILLANCE NETWORK PROGRAM
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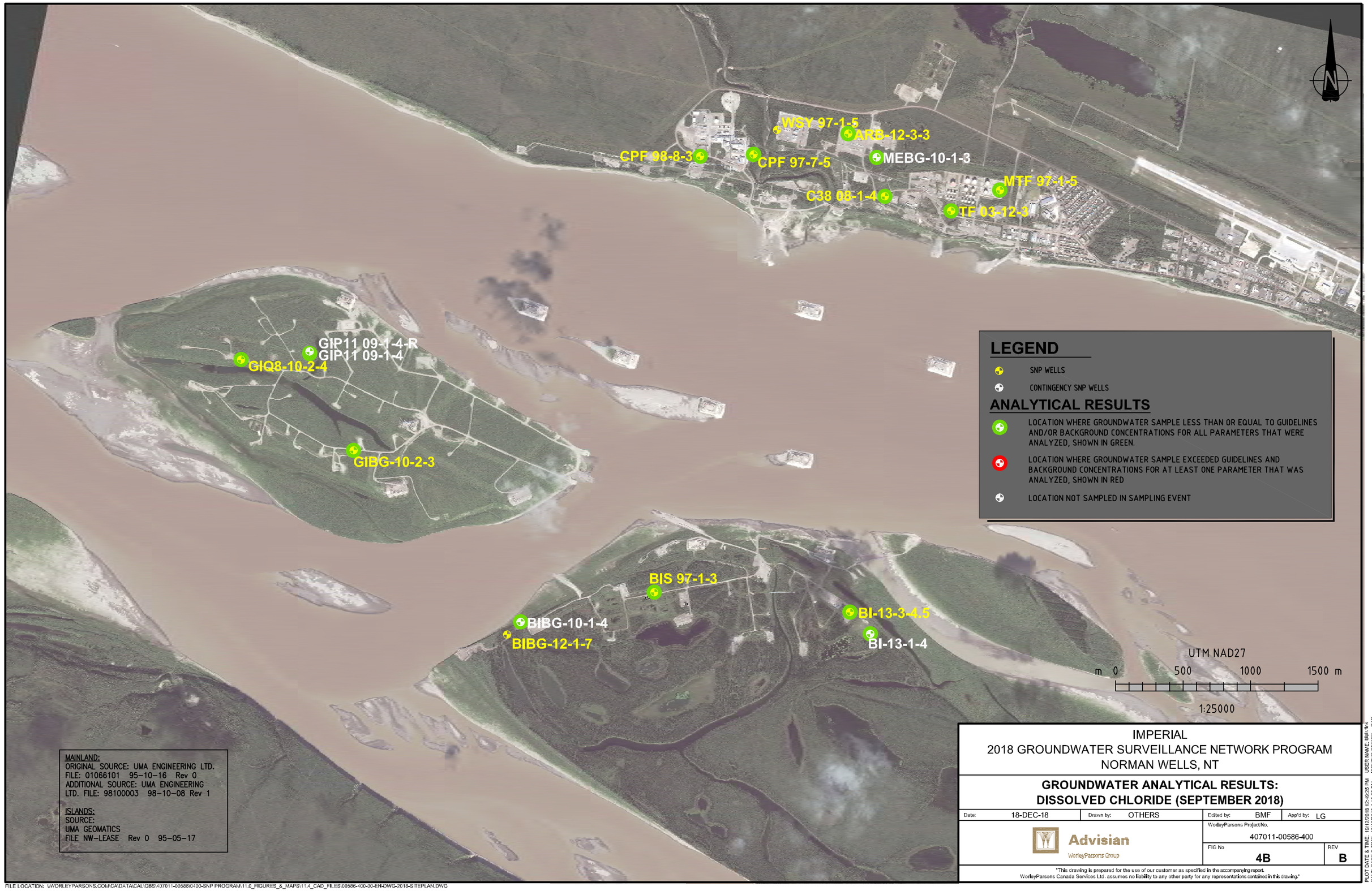
**GROUNDWATER ANALYTICAL RESULTS:**
**DISSOLVED CHLORIDE (JULY 2018)**

| Date: 18-DEC-18 | Drawn by: OTHERS | Edited by: BMF | App'd by: LG |
|---|---|---|---|
| Advisian WorleyParsons Group | | WorleyParsons Project No. 407011-00586-400 | |
| | | FIG No 4A | REV B |

"This drawing is prepared for the use of our customer as specified in the accompanying report. WorleyParsons Canada Services Ltd. assumes no liability to any other party for any representations contained in this drawing."

PLOT DATE & TIME: 19/12/2018 12:44:57 PM USER NAME: bmfleck
SAVE DATE & TIME: 18/12/2018 4:10:22 PM ISSUING OFFICE: eCAD

FILE LOCATION: \\WORLEYPARSONS.COM\CAIDATA\CAL\GBS\407011-00586\0400-SNP PROGRAM\11.0_FIGURES_&_MAPS\11.4_CAD_FILES\00586-400-00-EN-DWG-2018-SITEPLAN.DWG




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## GROUNDWATER ANALYTICAL RESULTS: DISSOLVED CHLORIDE (SEPTEMBER 2018)

| Date: | Drawn by: | Edited by: | App'd by: |
|---|---|---|---|
| 18-DEC-18 | OTHERS | BMF | LG |

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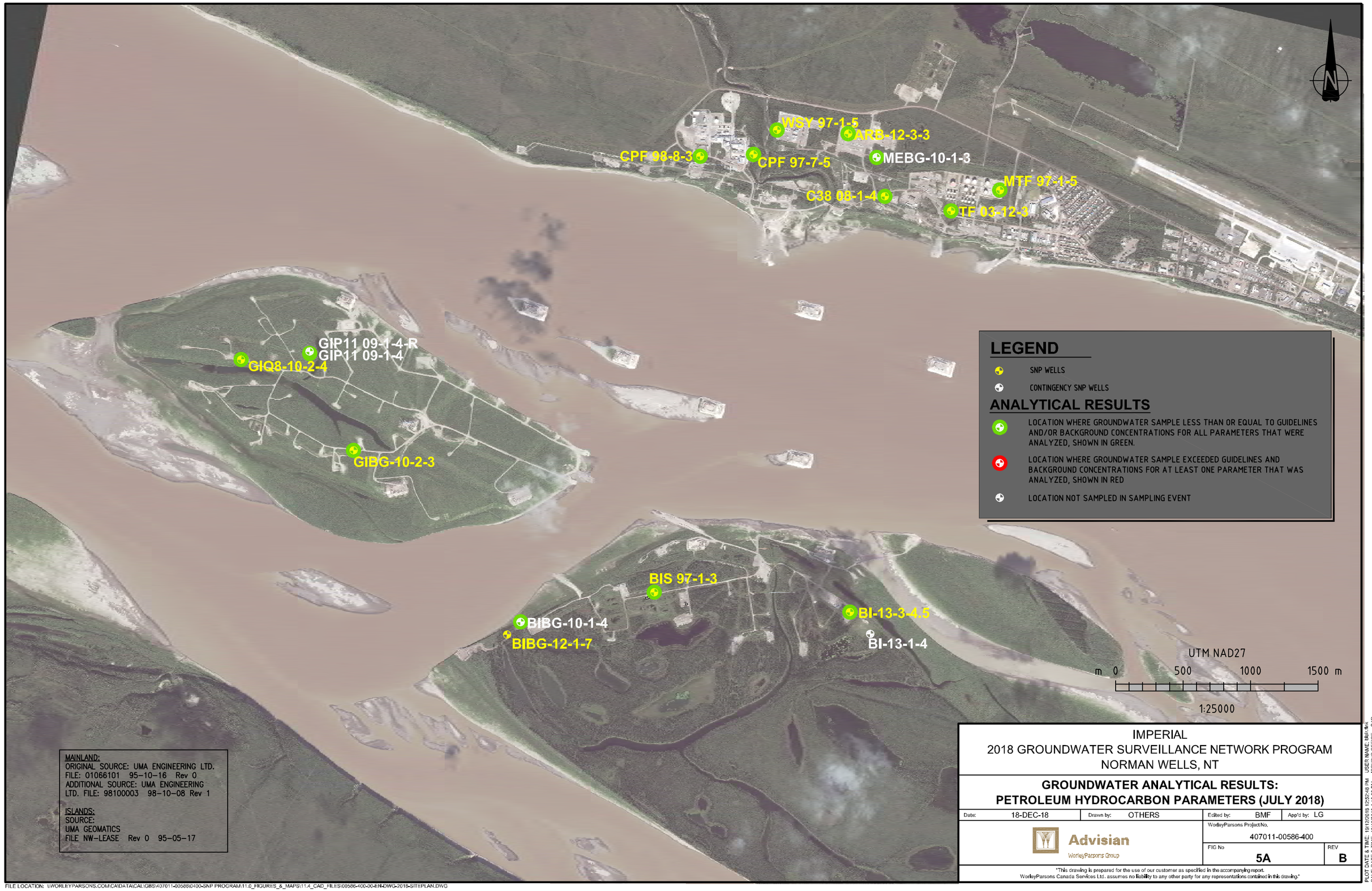
WorleyParsons Project No.
407011-00586-400

FIG No. 4B | REV B

"This drawing is prepared for the use of our customer as specified in the accompanying report. WorleyParsons Canada Services Ltd. assumes no liability to any other party for any representations contained in this drawing."

PLOT DATE & TIME: 19/12/2018 12:49:25 PM USER NAME: bfisher
SAVE DATE & TIME: 18/12/2018 4:10:22 PM ISSUING OFFICE: eCAD

FILE LOCATION: \\WORLEYPARSONS.COM\CA\DATA\CAL\GBS\407011-00586\0400-SNP PROGRAM\11.0_FIGURES_&_MAPS\11.4_CAD_FILES\00586-400-00-EN-DWG-2018-SITEPLAN.DWG




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2018 GROUNDWATER SURVEILLANCE NETWORK PROGRAM

NORMAN WELLS, NT

## GROUNDWATER ANALYTICAL RESULTS: PETROLEUM HYDROCARBON PARAMETERS (JULY 2018)

| Date: | Drawn by: | Edited by: | App'd by: |
|---|---|---|---|
| 18-DEC-18 | OTHERS | BMF | LG |

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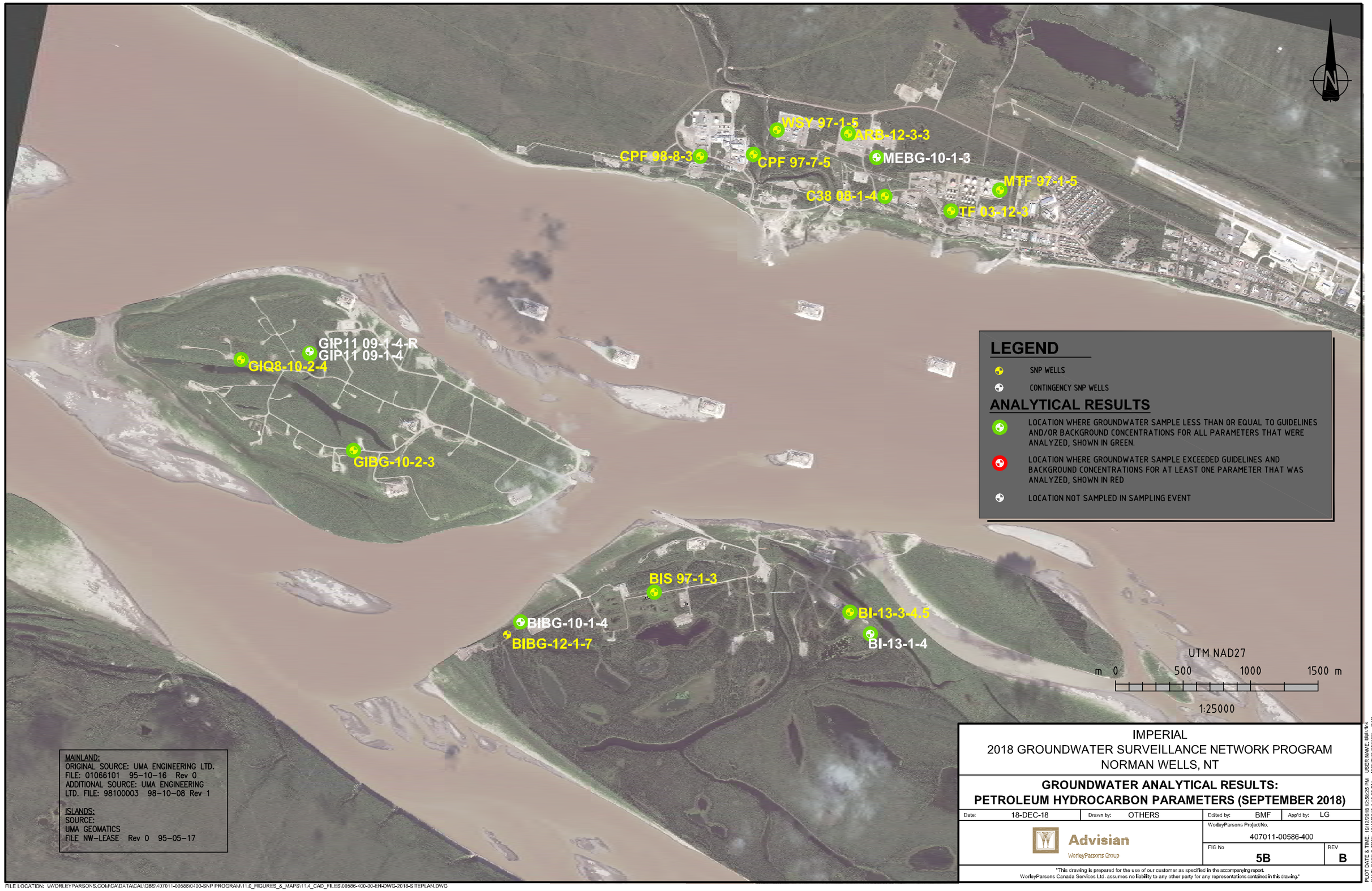
FIG No. 5A

REV B

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FILE LOCATION: \\WORLEYPARSONS.COM\CA\DATA\CAL\GBS\407011-00586\0400-SNP PROGRAM\11.0_FIGURES_&_MAPS\11.4_CAD_FILES\00586-400-00-EN-DWG-2018-SITEPLAN.DWG

PLOT DATE & TIME: 19/12/2018 12:52:48 PM USER NAME: bmfleck
SAVE DATE & TIME: 18/12/2018 4:10:22 PM ISSUING OFFICE: eaCAD




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2018 GROUNDWATER SURVEILLANCE NETWORK PROGRAM

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## GROUNDWATER ANALYTICAL RESULTS: PETROLEUM HYDROCARBON PARAMETERS (SEPTEMBER 2018)

| Date: | Drawn by: | Edited by: | App'd by: |
|---|---|---|---|
| 18-DEC-18 | OTHERS | BMF | LG |

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FIG No. 5B | REV B

"This drawing is prepared for the use of our customer as specified in the accompanying report. WorleyParsons Canada Services Ltd. assumes no liability to any other party for any representations contained in this drawing."

PLOT DATE & TIME: 19/12/2018 12:58:25 PM USER NAME: bmf-lec
SAVE DATE & TIME: 18/12/2018 4:10:22 PM ISSUING OFFICE: eaCAD

FILE LOCATION: \\WORLEYPARSONS.COM\CA\DATA\CAL\GBS\407011-00586\0400-SNP PROGRAM\11.0_FIGURES_&_MAPS\11.4_CAD_FILES\00586-400-00-EN-DWG-2018-SITEPLAN.DWG

# Tables



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# Table 1

## Groundwater Results: Datum/Groundwater Surface Elevations and Hydraulic Conductivities

PROJECT No.: 407011-00586-400

| Monitoring Station | Status | Background Cateogry | Easting (m) | Northing (m) | Ground Elevation (masl) | Datum Elevation (masl) | Surveyed Stickup (m) | Total Depth of Piezometer (mbgs) | Bottom of Piezometer Elevation (masl) | Depth Interval of Screen (mbgs) | Depth Interval of Sand (mbgs) | Date (dd-mmm-yyyy) | Depth to Groundwater (mbtoc) | Depth to Groundwater (mbgs) | Groundwater Surface Elevation (masl) | Hydraulic Conductivity (m/s) | Lithology | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Surveillance Network Program Mainland Locations** | | | | | | | | | | | | | | | | | | |
| **ARB-12-3-3** | **Active** | **W-CAT-1** | 599801.144 | 7242007.048 | 65.33 | 66.02 | 0.69 | 2.70 | 62.63 | 1.20 - 2.70 | 0.80 - 2.70 | 07-Aug-2015 | 2.79 | 2.10 | 63.23 | N/M | Gravel fill/Sand/Peat | |
| | | | | | | | | | | | | 14-Sep-2015 | 2.57 | 1.88 | 63.45 | | | |
| | | | | | | | | | | | | 05-Aug-2016 | 2.71 | 2.02 | 63.31 | | | Replaced waterra with dedicated bailer |
| | | | | | | | | | | | | 02-Oct-2016 | 2.54 | 1.85 | 63.48 | | | |
| | | | | | | | | | | | | 04-Nov-2016 | 2.79 | 2.10 | 63.23 | | | |
| | | | | | | | | | | | | 12-Aug-2017 | 2.62 | 1.93 | 63.40 | | | |
| | | | | | | | | | | | | 12-Sep-2017 | 2.45 | 1.76 | 63.57 | | | |
| | | | | | | | | | | | | 11-Jul-2018 | 2.44 | 1.75 | 63.58 | | | |
| | | | | | | | | | | | | 15-Sep-2018 | 2.48 | 1.79 | 63.54 | | | |
| **C38 08-1-4** | **Active** | **W-CAT-1** | 600072.804 | 7241542.767 | 60.48 | 61.23 | 0.75 | 3.80 | 56.68 | 1.80 - 3.80 | 1.50 - 3.80 | 06-Aug-2015 | 1.82 | 1.07 | 59.41 | 5.9e-006 | Sandy silt/peat/silty clay | |
| | | | | | | | | | | | | 14-Sep-2015 | 1.65 | 0.90 | 59.58 | | | |
| | | | | | | | | | | | | 05-Aug-2016 | 1.92 | 1.17 | 59.31 | | | |
| | | | | | | | | | | | | 02-Oct-2016 | 1.83 | 1.08 | 59.40 | | | |
| | | | | | | | | | | | | 04-Nov-2016 | 2.17 | 1.42 | 59.06 | | | |
| | | | | | | | | | | | | 12-Aug-2017 | 1.97 | 1.22 | 59.26 | | | Frost jacked |
| | | | | | | | | | | | | 12-Sep-2017 | 1.74 | 0.99 | 59.49 | | | |
| | | | | | | | | | | | | 13-Jul-2018 | 1.90 | 1.15 | 59.33 | | | |
| | | | | | | | | | | | | 15-Sep-2018 | 1.97 | 1.22 | 59.26 | | | |
| **CPF 97-7-5** | **Active** | **W-CAT-1** | 599100.347 | 7241852.827 | 58.64 | 59.49 | 0.84 | 4.90 | 53.87 | N/A | 1.20 - 4.90 | 07-Aug-2015 | 1.37 | 0.53 | 58.12 | 1.1e-008 | Silt/siltstone | |
| | | | | | | | | | | | | 14-Sep-2015 | 1.42 | 0.58 | 58.07 | | | |
| | | | | | | | | | | | | 06-Aug-2016 | 1.35 | 0.51 | 58.14 | | | Replaced lock |
| | | | | | | | | | | | | 02-Oct-2016 | 1.76 | 0.92 | 57.73 | | | |
| | | | | | | | | | | | | 04-Nov-2016 | 4.71 | 3.87 | 54.78 | | | |
| | | | | | | | | | | | | 17-Aug-2017 | 1.25 | 0.41 | 58.24 | | | |
| | | | | | | | | | | | | 12-Sep-2017 | 1.39 | 0.55 | 58.10 | | | |
| | | | | | | | | | | | | 20-Jul-2018 | 1.43 | 0.59 | 58.06 | | | |
| | | | | | | | | | | | | 15-Sep-2018 | 1.56 | 0.72 | 57.93 | | | |
| **CPF 98-8-3** | **Active** | **W-CAT-1** | 598705.553 | 7241839.552 | 58.79 | 59.54 | 0.75 | 2.70 | 55.95 | 1.40 - 2.90 | 0.80 - 2.90 | 07-Aug-2015 | 1.39 | 0.64 | 58.15 | 1.7e-006 | Clay silt | |
| | | | | | | | | | | | | 14-Sep-2015 | 1.27 | 0.52 | 58.27 | | | |
| | | | | | | | | | | | | 06-Aug-2016 | 1.72 | 0.97 | 57.82 | | | |
| | | | | | | | | | | | | 02-Oct-2016 | 1.35 | 0.60 | 58.19 | | | |
| | | | | | | | | | | | | 04-Nov-2016 | 1.89 | 1.14 | 57.65 | | | |
| | | | | | | | | | | | | 17-Aug-2017 | 1.66 | 0.91 | 57.88 | | | |
| | | | | | | | | | | | | 12-Sep-2017 | 1.31 | 0.56 | 58.23 | | | |
| | | | | | | | | | | | | 22-Jul-2018 | 1.53 | 0.78 | 58.01 | | | |
| | | | | | | | | | | | | 16-Sep-2018 | 1.31 | 0.56 | 58.23 | | | |
| **MEBG-10-1-3** | **Active** | **W-CAT-1** | 600011.383 | 7241831.078 | 63.73 | 64.47 | 0.75 | 3.00 | 60.73 | 1.50 - 3.00 | 1.00 - 3.00 | 06-Aug-2015 | 0.89 | 0.14 | 63.58 | 9.012e-007 | Silty Sand / Clayey Silt | |
| | | | | | | | | | | | | 14-Sep-2015 | 0.88 | 0.13 | 63.59 | | | |
| | | | | | | | | | | | | 03-Aug-2016 | 1.00 | 0.25 | 63.47 | | | Clear |
| | | | | | | | | | | | | 02-Oct-2016 | 0.96 | 0.21 | 63.51 | | | |
| | | | | | | | | | | | | 04-Nov-2016 | 1.10 | 0.35 | 63.37 | | | |
| | | | | | | | | | | | | 12-Aug-2017 | 1.02 | 0.27 | 63.45 | | | |
| | | | | | | | | | | | | 12-Sep-2017 | 0.92 | 0.17 | 63.55 | | | |
| | | | | | | | | | | | | 16-Jul-2018 | 0.96 | 0.21 | 63.51 | | | |
| | | | | | | | | | | | | 15-Sep-2018 | 0.93 | 0.18 | 63.54 | | | |
| **MTF 97-1-5** | **Active** | **W-CAT-1** | 600924.768 | 7241588.497 | 63.49 | 64.39 | 0.91 | 4.70 | 58.76 | 1.70 - 4.70 | 1.10 - 4.70 | 08-Aug-2015 | 4.21 | 3.30 | 60.18 | >1.0E-05 | Silt | |
| | | | | | | | | | | | | 15-Sep-2015 | 4.04 | 3.13 | 60.35 | | | |
| | | | | | | | | | | | | 02-Oct-2016 | 4.36 | 3.45 | 60.03 | | | |
| | | | | | | | | | | | | 04-Nov-2016 | > 5.61 | > 4.70 | < 58.79 | | | Dry |
| | | | | | | | | | | | | 17-Aug-2017 | 4.30 | 3.39 | 60.09 | | | |
| | | | | | | | | | | | | 14-Sep-2017 | 4.13 | 3.22 | 60.26 | | | |
| | | | | | | | | | | | | 16-Jul-2018 | 4.25 | 3.34 | 60.14 | | | |
| | | | | | | | | | | | | 16-Sep-2018 | 4.14 | 3.24 | 60.25 | | | |

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# Table 1

## Groundwater Results: Datum/Groundwater Surface Elevations and Hydraulic Conductivities

PROJECT No.: 407011-00586-400

| Monitoring Station | Status | Background Cateogry | Easting (m) | Northing (m) | Ground Elevation (masl) | Datum Elevation (masl) | Surveyed Stickup (m) | Total Depth of Piezometer (mbgs) | Bottom of Piezometer Elevation (masl) | Depth Interval of Screen (mbgs) | Depth Interval of Sand (mbgs) | Date (dd-mmm-yyyy) | Depth to Groundwater (mbtoc) | Depth to Groundwater (mbgs) | Groundwater Surface Elevation (masl) | Hydraulic Conductivity (m/s) | Lithology | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **TF 03-12-3** | **Active** | **W-CAT-1** | 600562.552 | 7241435.321 | 57.08 | 58.63 | 1.55 | 2.80 | 54.28 | 1.00 - 2.80 | 0.90 - 2.90 | 08-Aug-2015 | 1.74 | 0.19 | 56.89 | >1.0E-05 | Silty clay and shale fill | Frost jacked 15cm |
| | | | | | | | | | | | | 15-Sep-2015 | 1.74 | 0.19 | 56.89 | | | |
| | | | | | | | | | | | | 06-Aug-2016 | 1.78 | 0.23 | 56.85 | | | Frost jacked |
| | | | | | | | | | | | | 02-Oct-2016 | 1.78 | 0.23 | 56.85 | | | |
| | | | | | | | | | | | | 04-Nov-2016 | 1.87 | 0.32 | 56.76 | | | |
| | | | | | | | | | | | | 17-Aug-2017 | 1.72 | 0.17 | 56.91 | | | |
| | | | | | | | | | | | | 13-Sep-2017 | 1.73 | 0.18 | 56.90 | | | |
| | | | | | | | | | | | | 16-Jul-2018 | 1.82 | 0.27 | 56.81 | | | |
| | | | | | | | | | | | | 16-Sep-2018 | 1.77 | 0.22 | 56.86 | | | |
| **WSY 97-1-5** | **Active** | **W-CAT-1** | 599274.168 | 7242034.279 | 62.61 | 63.40 | 0.79 | 4.70 | 57.96 | 1.70 - 4.70 | 1.10 - 4.70 | 06-Aug-2015 | 4.26 | 3.47 | 59.14 | 1.7e-007 | Silt | Frost jacked, cannot clean red casing |
| | | | | | | | | | | | | 14-Sep-2015 | 4.12 | 3.33 | 59.28 | | | |
| | | | | | | | | | | | | 05-Aug-2016 | 5.24 | 4.45 | 58.16 | | | Well bent downhole, hard to get bailer down |
| | | | | | | | | | | | | 02-Oct-2016 | 4.15 | 3.36 | 59.25 | | | |
| | | | | | | | | | | | | 04-Nov-2016 | 5.48 | 4.69 | 57.92 | | | |
| | | | | | | | | | | | | 18-Aug-2017 | 2.69 | 1.90 | 60.71 | | | |
| | | | | | | | | | | | | 12-Sep-2017 | 2.86 | 2.07 | 60.54 | | | |
| | | | | | | | | | | | | 11-Jul-2018 | 5.15 | 4.36 | 58.25 | | | |
| | | | | | | | | | | | | 18-Sep-2018 | 4.32 | 3.53 | 59.08 | | | |
| **Surveillance Network Program Bear Island Locations** | | | | | | | | | | | | | | | | | | |
| **BI-13-1-4** | **Active** | **W-CAT-2** | 599964.584 | 7238301.752 | 49.70 | 49.70 | 0.00 | N/A | N/A | 1.30 - 4.30 | 1.00 - 4.60 | 07-Aug-2015 | 1.02 | 1.02 | 48.68 | 2.60E-06 | Sandy silt/Clayey silt | |
| | | | | | | | | | | | | 07-Aug-2016 | 1.13 | 1.13 | 48.57 | | | |
| | | | | | | | | | | | | 15-Aug-2017 | 1.30 | 1.30 | 48.40 | | | |
| | | | | | | | | | | | | 22-Nov-2017 | 1.89 | 1.89 | 47.81 | | | |
| | | | | | | | | | | | | 18-Jul-2018 | 1.08 | 1.08 | 48.62 | | | casing loose |
| | | | | | | | | | | | | 20-Sep-2018 | 1.00 | 1.00 | 48.70 | | | |
| **BI-13-3-4.5** | **Active** | **W-CAT-2** | 599813.864 | 7238463.124 | 50.62 | 51.57 | 0.95 | N/A | N/A | 1.50 - 4.50 | 1.20 - 4.80 | 07-Aug-2015 | 1.65 | 0.70 | 49.92 | 1.40E-06 | Sandy silt/Clayey silt | |
| | | | | | | | | | | | | 08-Aug-2016 | 1.74 | 0.79 | 49.83 | | | |
| | | | | | | | | | | | | 15-Aug-2017 | 1.81 | 0.86 | 49.76 | | | |
| | | | | | | | | | | | | 22-Nov-2017 | N/M | N/M | N/A | | | Froze @ 0.99m |
| | | | | | | | | | | | | 18-Jul-2018 | 1.67 | 0.72 | 49.90 | | | |
| | | | | | | | | | | | | 20-Sep-2018 | 1.69 | 0.74 | 49.88 | | | |
| **BIBG-10-1-4** | **Active** | **W-CAT-2** | 597436.110 | 7238366.063 | 50.11 | 50.89 | 0.78 | 4.10 | 46.01 | 1.10 - 4.10 | 0.78 - 4.10 | 09-Aug-2015 | 1.22 | 0.44 | 49.67 | 1.90E-06 | Silty Clay / Sand | |
| | | | | | | | | | | | | 08-Aug-2016 | 1.87 | 1.09 | 49.02 | | | |
| | | | | | | | | | | | | 11-Aug-2017 | 3.57 | 2.79 | 47.32 | | | |
| | | | | | | | | | | | | 17-Jul-2018 | 3.39 | 2.61 | 47.50 | | | |
| | | | | | | | | | | | | 20-Sep-2018 | 1.63 | 0.85 | 49.26 | | | |
| **BIBG-12-1-7** | **Active** | **W-CAT-2** | 597275.824 | 7238297.135 | 49.40 | 50.20 | 0.80 | 7.50 | 41.90 | 4.20 - 7.20 | 3.80 - 7.50 | 09-Aug-2015 | 1.20 | 0.40 | 49.00 | N/M | Silty Sand/Sandy Silt | |
| | | | | | | | | | | | | 17-Sep-2015 | N/M | N/M | N/A | | | Blocked at approximately 1.5 mbtoc. Bentonite on water level probe. |
| | | | | | | | | | | | | 07-Aug-2016 | 1.35 | 0.55 | 48.85 | | | Bentonite on WL tape and bailer when sampling. Well appears broken downhole. |
| | | | | | | | | | | | | 02-Oct-2016 | N/M | N/M | N/A | | | WELL NOT ACCESSIBLE. Well previously noted as damaged |
| | | | | | | | | | | | | 04-Nov-2016 | 1.83 | 1.03 | 48.37 | | | |
| | | | | | | | | | | | | 15-Aug-2017 | > 1.31 | > 0.51 | < 48.89 | | | Dry, Compromised, bentonite on water level tape |
| **BIS 97-1-3** | **Active** | **W-CAT-2** | 598365.067 | 7238610.352 | 51.00 | 51.93 | 0.93 | 2.60 | 48.47 | N/A | 0.60 - 2.60 | 22-Nov-2017 | 1.82 | 0.89 | 50.11 | 6.5e-005 | Silty peat/silt | |
| | | | | | | | | | | | | 20-Jul-2018 | 1.79 | 0.86 | 50.14 | | | |
| | | | | | | | | | | | | 20-Sep-2018 | 1.69 | 0.76 | 50.24 | | | |

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# Table 1

## Groundwater Results: Datum/Groundwater Surface Elevations and Hydraulic Conductivities

PROJECT No.: 407011-00586-400

| Monitoring Station | Status | Background Cateogry | Easting (m) | Northing (m) | Ground Elevation (masl) | Datum Elevation (masl) | Surveyed Stickup (m) | Total Depth of Piezometer (mbgs) | Bottom of Piezometer Elevation (masl) | Depth Interval of Screen (mbgs) | Depth Interval of Sand (mbgs) | Date (dd-mmm-yyyy) | Depth to Groundwater (mbtoc) | Depth to Groundwater (mbgs) | Groundwater Surface Elevation (masl) | Hydraulic Conductivity (m/s) | Lithology | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Surveillance Network Program Goose Island Locations** | | | | | | | | | | | | | | | | | | |
| **GIBG-10-2-3** | **Active** | **W-CAT-2** | 596138.596 | 7239661.038 | 43.66 | 44.20 | 0.54 | 3.00 | 40.66 | 1.43 - 3.00 | 1.30 - 3.00 | 10-Aug-2015 | 2.05 | 1.52 | 42.15 | 1.7e-005 | Sand | Frost jacked |
| | | | | | | | | | | | | 16-Sep-2015 | 2.13 | 1.59 | 42.07 | | | |
| | | | | | | | | | | | | 06-Aug-2016 | 1.99 | 1.45 | 42.21 | | | |
| | | | | | | | | | | | | 02-Oct-2016 | 2.24 | 1.70 | 41.96 | | | |
| | | | | | | | | | | | | 04-Nov-2016 | 2.38 | 1.84 | 41.82 | | | |
| | | | | | | | | | | | | 20-Aug-2017 | 1.84 | 1.30 | 42.36 | | | Fished out bailer |
| | | | | | | | | | | | | 12-Sep-2017 | 1.65 | 1.11 | 42.55 | | | |
| | | | | | | | | | | | | 14-Jul-2018 | 2.16 | 1.62 | 42.04 | | | |
| | | | | | | | | | | | | 20-Sep-2018 | 2.14 | 1.60 | 42.06 | | | |
| **GIP11 09-1-4** | **Active** | **W-CAT-2** | 595813.546 | 7240393.423 | 45.55 | 45.90 | 0.35 | 4.00 | 41.55 | 1.00 - 4.00 | 0.72 - 4.00 | 10-Aug-2015 | 3.17 | 2.82 | 42.73 | 1.6e-005 | Silty sand/sandy silt and clay/sand | |
| | | | | | | | | | | | | 16-Sep-2015 | 3.29 | 2.94 | 42.61 | | | |
| | | | | | | | | | | | | 02-Oct-2016 | > 1.32 | > 0.97 | < 44.58 | | | Dry |
| **GIP11 09-1-4-R** | **Active** | **W-CAT-2** | N/M | N/M | N/M | N/M | N/A | 4.00 | N/A | 1.00 - 4.00 | 0.72 - 4.00 | 14-Jul-2018 | 3.39 | N/A | N/A | N/M | Silty sand | |
| | | **W-CAT-2** | | | | | | | | | | 20-Sep-2018 | 3.51 | N/A | N/A | N/M | | |
| **GIQ8-10-2-4** | **Active** | **W-CAT-2** | 595306.125 | 7240333.425 | 47.50 | 47.72 | 0.22 | 3.95 | 43.55 | 0.95 - 3.95 | 0.75 - 3.70 | 10-Aug-2015 | > 5.67 | > 5.45 | < 42.05 | 3.3e-006 | Sandy Silt | Dry |
| | | | | | | | | | | | | 16-Sep-2015 | 2.11 | 1.89 | 45.61 | | | |
| | | | | | | | | | | | | 07-Aug-2016 | 1.72 | 1.50 | 46.00 | | | |
| | | | | | | | | | | | | 02-Oct-2016 | 2.48 | 2.26 | 45.24 | | | |
| | | | | | | | | | | | | 04-Nov-2016 | 2.66 | 2.44 | 45.06 | | | |
| | | | | | | | | | | | | 20-Aug-2017 | 2.43 | 2.21 | 45.29 | | | |
| | | | | | | | | | | | | 12-Sep-2017 | 2.25 | 2.03 | 45.47 | | | |
| | | | | | | | | | | | | 14-Jul-2018 | 2.53 | 2.31 | 45.19 | | | |
| | | | | | | | | | | | | 20-Sep-2018 | 2.21 | 1.99 | 45.51 | | | |

**NOTES:** 1. Data may be entered to the nearest mm, but are reported above to the nearest cm.
Apparent rounding errors may occasionally occur in calculated fields (e.g. Groundwater Surface Elevation).
2. All coordinates are provided in the UTM Zone 9N referenced to North American Datum of 1927 coordinate system.
3. N/M - Denotes not measured.
4. N/A - Denotes not available.
5. masl - Denotes metres above sea level.
6. mbgs - Denotes metres below ground surface.
7. mbtoc - Denotes metres below top of PVC casing.
8. Where a measurement is not available due to the source being dry, depths and elevations are displayed as greater than the measured depth of well, where available, and where not the installed depth is used.
9. Background 95th Percentile Statistical Category:
W-CAT-1: Mainland Locations - Surficial Sediments - 95th Percentile Background
W-CAT-2: Bear, Goose, and Frenchy's Islands - Surficial Sediments - 95th Percentile Background

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# Table 2

## Groundwater Analytical Results: Dissolved Chloride

**PROJECT No.: 407011-00586-400**

| Sampling Location | Date (dd-mmm-yyyy) | Background Category | Chloride (mg/L) |
|---|---|---|---|
| **CCME CEQG Freshwater Aquatic Life** | | | **120** |
| **W-CAT-1** | | | **18** |
| **W-CAT-2** | | | **18** |
| **Surveillance Network Program Mainland Locations** | | | |
| **ARB-12-3-3** | 07-Aug-2015 | **W-CAT-1** | 16 |
| | 14-Sep-2015 | | 8.7 |
| | 05-Aug-2016 | | 19 |
| | 02-Oct-2016 | | 12 |
| | 12-Aug-2017 | | 12 |
| | 12-Sep-2017 | | 22 |
| | 11-Jul-2018 | | 27 |
| | 15-Sep-2018 | | 16 |
| **C38 08-1-4** | 06-Aug-2015 | **W-CAT-1** | 19 |
| | 14-Sep-2015 | | 20 |
| | 05-Aug-2016 | | 23 |
| | 02-Oct-2016 | | 21 |
| | 12-Aug-2017 | | 19 |
| | 12-Sep-2017 | | 14 #1 |
| | 13-Jul-2018 | | 21 |
| | 16-Sep-2018 | | 18 |
| **CPF 97-7-5** | 07-Aug-2015 | **W-CAT-1** | 11 |
| | 14-Sep-2015 | | 11 |
| | 06-Aug-2016 | | 22 |
| **(Duplicate)** | 06-Aug-2016 | | 22 |
| | 02-Oct-2016 | | 23 |
| | 17-Aug-2017 | | 19 |
| **(Duplicate)** | 17-Aug-2017 | | 19 |
| | 12-Sep-2017 | | 18 |
| | 20-Jul-2018 | | 16 |
| **(Duplicate)** | 20-Jul-2018 | | 16 |
| | 15-Sep-2018 | | 15 |
| **CPF 98-8-3** | 07-Aug-2015 | **W-CAT-1** | 7.1 |
| | 14-Sep-2015 | | 8.7 |
| | 06-Aug-2016 | | 13 |
| | 02-Oct-2016 | | 12 |
| | 17-Aug-2017 | | 9.4 |
| | 12-Sep-2017 | | 9.1 |
| | 22-Jul-2018 | | 6.8 |
| | 16-Sep-2018 | | 8.5 |
| **MEBG-10-1-3** | 06-Aug-2015 | **W-CAT-1** | 3.0 |
| | 14-Sep-2015 | | 2.4 |
| | 03-Aug-2016 | | 2.2 |
| | 02-Oct-2016 | | 2.3 |
| | 12-Aug-2017 | | 2.4 |
| | 12-Sep-2017 | | 2.4 |
| | 16-Jul-2018 | | 1.9 |
| | 15-Sep-2018 | | 2.3 |
| **MTF 97-1-5** | 08-Aug-2015 | **W-CAT-1** | 1.2 |
| | 15-Sep-2015 | | < 1.0 |
| | 03-Oct-2016 | | 1.2 |
| | 17-Aug-2017 | | 1.5 |
| | 14-Sep-2017 | | 1.0 |
| | 16-Jul-2018 | | 1.9 |
| | 16-Sep-2018 | | < 1.0 |

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# Table 2

## Groundwater Analytical Results: Dissolved Chloride

**PROJECT No.: 407011-00586-400**

| Sampling Location | Date (dd-mmm-yyyy) | Background Category | Chloride (mg/L) |
|---|---|---|---|
| **CCME CEQG Freshwater Aquatic Life** | | | **120** |
| **W-CAT-1** | | | **18** |
| **W-CAT-2** | | | **18** |
| **TF 03-12-3** | 08-Aug-2015 | **W-CAT-1** | 140 |
| | 15-Sep-2015 | | 140 |
| | 06-Aug-2016 | | 130 |
| | 02-Oct-2016 | | 120 |
| | 17-Aug-2017 | | 160 |
| | 13-Sep-2017 | | 190 |
| **(Duplicate)** | 13-Sep-2017 | | 160 |
| | 16-Jul-2018 | | 170 |
| **(Duplicate)** | 16-Jul-2018 | | 170 |
| | 16-Sep-2018 | | 110 |
| **WSY 97-1-5** | 06-Aug-2015 | **W-CAT-1** | 14 |
| | 14-Sep-2015 | | 13 |
| | 05-Aug-2016 | | 11 |
| | 03-Oct-2016 | | 6.5 |
| | 18-Aug-2017 | | 15 |
| | 12-Sep-2017 | | 26 |
| | 11-Jul-2018 | | 24 |
| **Surveillance Network Program Bear Island Locations** | | | |
| **BI-13-1-4** | 07-Aug-2015 | **W-CAT-2** | 7.7 |
| | 07-Aug-2016 | | 7.9 |
| | 15-Aug-2017 | | 6.2 |
| | 18-Jul-2018 | | 4.6 |
| | 20-Sep-2018 | | 8.3 |
| **BI-13-3-4.5** | 07-Aug-2015 | **W-CAT-2** | 11 |
| | 08-Aug-2016 | | 8.5 |
| | 15-Aug-2017 | | 8.7 |
| | 22-Nov-2017 | | 6.5 |
| | 18-Jul-2018 | | 7.2 |
| | 20-Sep-2018 | | 10 |
| **BIBG-10-1-4** | 09-Aug-2015 | **W-CAT-2** | 12 |
| | 10-Aug-2016 | | 25 |
| | 11-Aug-2017 | | 18 |
| | 17-Jul-2018 | | 16 |
| | 20-Sep-2018 | | 23 |
| **BIBG-12-1-7** | 09-Aug-2015 | | 8.1 |
| | 07-Aug-2016 | | 7.5 |
| **BIS 97-1-3** | 22-Nov-2017 | | 20 |
| | 20-Jul-2018 | | 16 |
| | 20-Sep-2018 | | 22 |
| **Surveillance Network Program Goose Island Locations** | | | |
| **GIBG-10-2-3** | 10-Aug-2015 | **W-CAT-2** | 1.9 |
| | 16-Sep-2015 | | 3.1 |
| | 07-Aug-2016 | | < 1.0 |
| **(Duplicate)** | 07-Aug-2016 | | < 1.0 |
| | 03-Oct-2016 | | 2.3 |
| | 20-Aug-2017 | | 2.4 |
| **(Duplicate)** | 20-Aug-2017 | | 2.3 |
| | 12-Sep-2017 | | 2.9 |
| | 14-Jul-2018 | | 6.9 |
| **(Duplicate)** | 14-Jul-2018 | | 6.8 |
| | 20-Sep-2018 | | 6.9 |

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# Table 2

## Groundwater Analytical Results: Dissolved Chloride

**PROJECT No.: 407011-00586-400**

| Sampling Location | Date (dd-mmm-yyyy) | Background Category | Chloride (mg/L) |
|---|---|---|---|
| **CCME CEQG Freshwater Aquatic Life** | | | **120** |
| **W-CAT-1** | | | **18** |
| **W-CAT-2** | | | **18** |
| **GIP11 09-1-4** | 10-Aug-2015 | **W-CAT-2** | 4.5 |
| | 16-Sep-2015 | | 6.3 |
| **GIP11 09-1-4-R** | 14-Jul-2018 | **W-CAT-2** | 50 |
| | 20-Sep-2018 | | 14 |
| **GIQ8-10-2-4** | 16-Sep-2015 | **W-CAT-2** | 20 |
| | 07-Aug-2016 | | 14 |
| | 03-Oct-2016 | | 18 |
| **(Duplicate)** | 03-Oct-2016 | | 19 |
| | 20-Aug-2017 | | 5.8 |
| | 12-Sep-2017 | | 9.4 |
| | 14-Jul-2018 | | 21 |
| | 20-Sep-2018 | | 21 |
| **(Duplicate)** | 20-Sep-2018 | | 21 |
| **Relative Percent Difference (RPD) Report** | | | |
| **CPF 97-7-5** | 20-Jul-2018 | **W-CAT-1** | 16 |
| **(Duplicate)** | 20-Jul-2018 | | 16 |
| **RPD(%)** | | | **0.0%** |
| **TF 03-12-3** | 16-Jul-2018 | **W-CAT-1** | **170** |
| **(Duplicate)** | 16-Jul-2018 | | **170** |
| **RPD(%)** | | | **0.0%** |
| **GIBG-10-2-3** | 14-Jul-2018 | **W-CAT-2** | 6.9 |
| **(Duplicate)** | 14-Jul-2018 | | 6.8 |
| **RPD(%)** | | | **1.5%** |
| **GIQ8-10-2-4** | 20-Sep-2018 | **W-CAT-2** | 21 |
| **(Duplicate)** | 20-Sep-2018 | | 21 |
| **RPD(%)** | | | **0.0%** |

**NOTES:**

1. --- in guideline row(s) denotes no criteria for that parameter.
2. --- in detail data row(s) denotes parameter not analyzed.

**Bold** 3. Denotes values exceeding applied background concentrations and CCME guidelines
(CCME 2018. Canadian Environmental Quality Guidelines Summary Table.
Water Quality Guidelines for the Protection of Freshwater Aquatic Life.
http://st-ts.ccme.ca/?chems=all&chapters=1 accessed Sept, 2018).

**Bold** 4. Denotes non-detect values where reportable detection limit exceeds applied background concentrations and CCME guidelines
(CCME 2018. Canadian Environmental Quality Guidelines Summary Table.
Water Quality Guidelines for the Protection of Freshwater Aquatic Life.
http://st-ts.ccme.ca/?chems=all&chapters=1 accessed Sept, 2018).

5. Background 95th Percentile Statistical Category:
W-CAT-1: Mainland Locations - Surficial Sediments - 95th Percentile Background
W-CAT-2: Bear, Goose, and Frenchy's Islands - Surficial Sediments - 95th Percentile Background

6. Superscript #1 - Detection limits raised due to sample matrix.

# Table 3

## Groundwater Analytical Results: Petroleum Hydrocarbons (PHCs)

**PROJECT No.: 407011-00586-400**

| Sampling Location | Date (dd-mmm-yyyy) | Background Category | Benzene (mg/L) | Toluene (mg/L) | Ethylbenzene (mg/L) | Xylenes-Total (mg/L) |
|---|---|---|---|---|---|---|
| **CCME CEQG Freshwater Aquatic Life** | | | **0.37** | **0.002** | **0.09** | **---** |
| **W-CAT-1** | | | **0.0005** | **0.0005** | **0.0005** | **0.0010** |
| **W-CAT-2** | | | **0.0004** | **0.0004** | **0.0004** | **0.0008** |
| **Surveillance Network Program Mainland Locations** | | | | | | |
| **ARB-12-3-3** | 07-Aug-2015 | **W-CAT-1** | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 14-Sep-2015 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 05-Aug-2016 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 02-Oct-2016 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 12-Aug-2017 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 12-Sep-2017 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 11-Jul-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| | 15-Sep-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| **C38 08-1-4** | 06-Aug-2015 | **W-CAT-1** | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 14-Sep-2015 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 05-Aug-2016 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 02-Oct-2016 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 12-Aug-2017 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 12-Sep-2017 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 13-Jul-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| | 16-Sep-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| **CPF 97-7-5** | 07-Aug-2015 | **W-CAT-1** | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| **(Duplicate)** | 07-Aug-2015 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 14-Sep-2015 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 06-Aug-2016 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| **(Duplicate)** | 06-Aug-2016 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 02-Oct-2016 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 17-Aug-2017 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| **(Duplicate)** | 17-Aug-2017 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 12-Sep-2017 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 20-Jul-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| **(Duplicate)** | 20-Jul-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| | 15-Sep-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| **CPF 98-8-3** | 07-Aug-2015 | **W-CAT-1** | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 14-Sep-2015 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| **(Duplicate)** | 14-Sep-2015 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 06-Aug-2016 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 02-Oct-2016 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 17-Aug-2017 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 12-Sep-2017 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 22-Jul-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| | 16-Sep-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| **MEBG-10-1-3** | 06-Aug-2015 | **W-CAT-1** | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 14-Sep-2015 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 03-Aug-2016 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 02-Oct-2016 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 12-Aug-2017 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 12-Sep-2017 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 16-Jul-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| | 15-Sep-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| **MTF 97-1-5** | 08-Aug-2015 | **W-CAT-1** | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 15-Sep-2015 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 03-Oct-2016 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 17-Aug-2017 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 14-Sep-2017 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 16-Jul-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| | 16-Sep-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |

# Table 3

## Groundwater Analytical Results: Petroleum Hydrocarbons (PHCs)

**PROJECT No.: 407011-00586-400**

| Sampling Location | Date (dd-mmm-yyyy) | Background Category | Benzene (mg/L) | Toluene (mg/L) | Ethylbenzene (mg/L) | Xylenes-Total (mg/L) |
|---|---|---|---|---|---|---|
| **CCME CEQG Freshwater Aquatic Life** | | | **0.37** | **0.002** | **0.09** | **---** |
| **W-CAT-1** | | | **0.0005** | **0.0005** | **0.0005** | **0.0010** |
| **W-CAT-2** | | | **0.0004** | **0.0004** | **0.0004** | **0.0008** |
| **TF 03-12-3** | 08-Aug-2015 | **W-CAT-1** | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 15-Sep-2015 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 06-Aug-2016 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 02-Oct-2016 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 17-Aug-2017 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 13-Sep-2017 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| **(Duplicate)** | 13-Sep-2017 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 16-Jul-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| **(Duplicate)** | 16-Jul-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| | 16-Sep-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| **WSY 97-1-5** | 06-Aug-2015 | **W-CAT-1** | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 14-Sep-2015 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 05-Aug-2016 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 03-Oct-2016 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 18-Aug-2017 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 12-Sep-2017 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 11-Jul-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| | 18-Sep-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| **Surveillance Network Program Bear Island Locations** | | | | | | |
| **BI-13-1-4** | 07-Aug-2015 | **W-CAT-2** | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 07-Aug-2016 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 15-Aug-2017 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 20-Sep-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| **BI-13-3-4.5** | 07-Aug-2015 | **W-CAT-2** | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 08-Aug-2016 | | 0.00042 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 15-Aug-2017 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 22-Nov-2017 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 18-Jul-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| | 20-Sep-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| **BIBG-10-1-4** | 09-Aug-2015 | **W-CAT-2** | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 10-Aug-2016 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 11-Aug-2017 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 17-Jul-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| | 20-Sep-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| **BIBG-12-1-7** | 09-Aug-2015 | **W-CAT-2** | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 07-Aug-2016 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| **BIS 97-1-3** | 22-Nov-2017 | **W-CAT-2** | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 20-Jul-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| | 20-Sep-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| **Surveillance Network Program Goose Island Locations** | | | | | | |
| **GIBG-10-2-3** | 10-Aug-2015 | **W-CAT-2** | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| **(Duplicate)** | 10-Aug-2015 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 16-Sep-2015 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 07-Aug-2016 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| **(Duplicate)** | 07-Aug-2016 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 03-Oct-2016 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 20-Aug-2017 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| **(Duplicate)** | 20-Aug-2017 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 12-Sep-2017 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 14-Jul-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| **(Duplicate)** | 14-Jul-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| | 20-Sep-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |

Advisian
WorleyParsons Group

# Table 3

## Groundwater Analytical Results: Petroleum Hydrocarbons (PHCs)

**PROJECT No.: 407011-00586-400**

| Sampling Location | Date (dd-mmm-yyyy) | Background Category | Benzene (mg/L) | Toluene (mg/L) | Ethylbenzene (mg/L) | Xylenes-Total (mg/L) |
|---|---|---|---|---|---|---|
| **CCME CEQG Freshwater Aquatic Life** | | | **0.37** | **0.002** | **0.09** | **---** |
| **W-CAT-1** | | | **0.0005** | **0.0005** | **0.0005** | **0.0010** |
| **W-CAT-2** | | | **0.0004** | **0.0004** | **0.0004** | **0.0008** |
| **GIP11 09-1-4** | 10-Aug-2015 | **W-CAT-2** | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 16-Sep-2015 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| **GIP11 09-1-4-R** | 14-Jul-2018 | **W-CAT-2** | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| | 20-Sep-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| **GIQ8-10-2-4** | 16-Sep-2015 | **W-CAT-2** | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| **(Duplicate)** | 16-Sep-2015 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 07-Aug-2016 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 03-Oct-2016 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| **(Duplicate)** | 03-Oct-2016 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 20-Aug-2017 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 12-Sep-2017 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00080 |
| | 14-Jul-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| | 20-Sep-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| **(Duplicate)** | 20-Sep-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| **Relative Percent Difference (RPD) Report** | | | | | | |
| **CPF 97-7-5** | 20-Jul-2018 | **W-CAT-1** | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| **(Duplicate)** | 20-Jul-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| **RPD(%)** | | | --- | --- | --- | --- |
| **GIBG-110-2-3** | 14-Jul-2018 | **W-CAT-1** | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| **(Duplicate)** | 14-Jul-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| **RPD(%)** | | | --- | --- | --- | --- |
| **GIQ8-10-2-4** | 20-Sep-2018 | **W-CAT-2** | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| **(Duplicate)** | 20-Sep-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| **RPD(%)** | | | --- | --- | --- | --- |
| **TF 03-12-3** | 16-Jul-2018 | **W-CAT-2** | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| **(Duplicate)** | 16-Jul-2018 | | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 |
| **RPD(%)** | | | --- | --- | --- | --- |

**NOTES:**

1. --- in guideline row(s) denotes no criteria for that parameter.
2. --- in detail data row(s) denotes parameter not analyzed.

**Bold** 3. Denotes values exceeding applied background concentrations and CCME guidelines
(CCME 2018. Canadian Environmental Quality Guidelines Summary Table.
Water Quality Guidelines for the Protection of Freshwater Aquatic Life.
http://st-ts.ccme.ca/?chems=all&chapters=1 accessed Sept, 2018).

**Bold** 4. Denotes non-detect values where reportable detection limit exceeds applied background concentrations and CCME guidelines
(CCME 2018. Canadian Environmental Quality Guidelines Summary Table.
Water Quality Guidelines for the Protection of Freshwater Aquatic Life.
http://st-ts.ccme.ca/?chems=all&chapters=1 accessed Sept, 2018).

5. Background 95th Percentile Statistical Category:
W-CAT-1: Mainland Locations - Surficial Sediments - 95th Percentile Background
W-CAT-2: Bear, Goose, and Frenchy's Islands - Surficial Sediments - 95th Percentile Background

# Appendices



# Appendix A Limitation of Liability, Scope of Report, and Third Party Reliance



# Limitation of Liability, Scope of Report, and Third Party Reliance

*This report has been prepared and the work referred to in this report has been undertaken by WorleyParsons Canada Services Ltd., operating as Advisian (Advisian) for Imperial Oil Limited. It is intended for the sole and exclusive use of Imperial Oil Limited, its affiliated companies and partners and their respective [insurers], agents, employees, and advisors (collectively, "Imperial Oil"). Any use, reliance on or decision made by any person other than Imperial Oil based on this report is the sole responsibility of such other person. Imperial Oil and Advisian make no representation or warranty to any other person with regard to this report and the work referred to in this report and they accept no duty of care to any other person or any liability or responsibility whatsoever for any losses, expenses, damages, fines, penalties or other harm that may be suffered or incurred by any other person as a result of the use of, reliance on, any decision made or any action taken based on this report or the work referred to in this report.*

*The investigation undertaken by Advisian with respect to this report and any conclusions or recommendations made in this report reflect Advisian' s judgment based on the site conditions observed at the time of the site inspection on the date(s) set out in this report and on information available at the time of preparation of this report. This report has been prepared for the specific application to this site and it is based, in part, upon visual observation of the site, subsurface investigation at discrete locations and depths, and specific analysis of specific chemical parameters and materials during a specific time interval, all as described in this report. Unless otherwise stated, the findings cannot be extended to previous or future site conditions, portions of the site which were unavailable for direct investigation, subsurface locations which were not investigated directly, or chemical parameters, materials or analysis which were not addressed. Substances other than those addressed by the investigation described in this report may exist within the site, substances addressed by the investigation may exist in areas of the site not investigated and concentrations of substances addressed which are different than those reported may exist in areas other than the locations from which samples were taken.*

*If site conditions or applicable standards change or if any additional information becomes available at a future date, modifications to the findings, conclusions, and recommendations in this report may be necessary.*

*Other than by Imperial Oil, copying or distribution of this report or use of or reliance on the information contained herein, in whole or in part, is not permitted without the express written permission of Advisian. Nothing in this report is intended to constitute or provide a legal opinion.*

# Appendix B Field Methodologies



# Groundwater Sampling Methods

## Field Measurements, Sampling and Handling

Prior to collection of groundwater samples, the water and/or hydrocarbon level was measured from the top of the piezometer casing using a commercially-available electric water level meter.

Subsequently, groundwater from each monitoring well was collected for field-measured parameters and laboratory analysis, using either dedicated or disposable bailers, Waterra™, or HydraSleeves™ with no-purge methodology.

Field measurements of the following time-sensitive water quality parameters were conducted during the field sampling program:

**Temperature**: measured at surface using the pH meter temperature probe.

**pH**: measured with a WTW pH 3150i meter equipped with a SenTix 41 probe, an HI 9024 pH meter equipped with an HI 76302 probe, or an Oakton PC 300 joint pH and EC meter, calibrated using buffer solutions of pH 4, pH 7 and/or pH 10.

**EC**: electrical conductivity (temperature-corrected) measured with a WTW Cond 3150i meter equipped with a TetraCon 325 probe, an HI 9033 EC meter equipped with an HI 1230 probe, or an Oakton PC 300 joint pH and EC meter, calibrated with standard KCl solution (≈1,413 µS/cm @ 25°C).

All meters were calibrated on site. Immediately following collection of the above readings, all equipment was rinsed thoroughly with deionized water.

Once field parameters had been measured, samples were collected for the following analyses per the GMP:

**Dissolved Chloride**: 1 x 500 mL aliquot (unfiltered and chemically unpreserved) for analysis of major ions.

**BTEX**: 3 x 44 mL aliquots (placed in glass vials containing $NaHSO_4$ preservative, no headspace) for analysis of BTEX compounds (benzene, toluene, ethylbenzene and total xylenes).

Upon completion of sampling at each location, all equipment was thoroughly rinsed with deionized water. New bailing rope (as required) and clean disposable nitrile gloves were used at each piezometer to reduce the potential for cross-contamination. Samples were stored in iced coolers to maintain approximate in situ temperatures, and were promptly shipped to Maxxam Analytics Inc., in Edmonton, Alberta. Standard chain-of-custody procedures were followed.

# Appendix C Laboratory Analytical Results



# DATA QUALITY REVIEW CHECKLIST - IMPERIAL OIL PROJECTS

Consultant: Advisian

Sampling Date: 11-Jul-18

Location: Norman Wells

Laboratory : Maxxam Edmonton

Consultant Project Number: 407011-00586-400

Sample Submission Number: B857638

Are All Laboratory QC Within Acceptance Criteria (Yes, No, Not Applicable)?

| | Yes | No | NA | Comments |
|---|---|---|---|---|
| Instrument Surrogate Recovery | x | | | All laboratory QC met acceptance criteria. |
| Extraction Surrogate Recovery | x | | | |
| Method Blank Concentration | x | | | |
| Matrix Duplicate RPD | x | | | |
| Matrix Spike Recovery | x | | | |
| Lab Control Sample Recovery | x | | | |

Are All Field QC Samples Within Alert Limits (Yes, No, Not Applicable)?

| | Yes | No | NA | Comments |
|---|---|---|---|---|
| Field Blank Concentration | | | x | No field QC samples submitted. |
| Trip Blank Concentration | | | x | |
| Equipment Blank Concentration | | | x | |
| Field Duplicate RPD | | | x | |

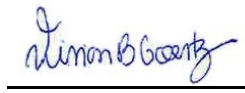
| | |
|---|---|
| Has CoA been signed off (Yes/No)?: | Yes |
| Has lab warranted all tests were analyzed following SOP's in CoA (Yes/No)?: | Yes |
| Were all samples analyzed within hold times (Yes/No)?: | Yes |
| All volatiles samples methanol extracted (if required) within 48 hours (Yes/No)?: | n/a |
| Is Chain of Custody completed and signed (Yes/No)?: | Yes |
| Were sample temperatures acceptable when they reached lab (Yes/No)?: | Yes |

| | |
|---|---|
| Was a Data Quality Overview (DQO) issued (Yes/No)?: | No |
| Date DQO was received: | n/a |

Is data considered to be reliable (Yes/No)?: Yes

If answer is "No", describe and provide rationale:

Data Reviewed by (Print): Vivian Baptista

Data Reviewed by (Signature): 

Date: 30-Jul-18

Maxxam
A Bureau Veritas Group Company

Success Through Science®

Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400
Your C.O.C. #: 298586

**Attention: Stacy Gibb**

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

**Report Date: 2018/07/20**
Report #: R2592527
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B857638**
**Received: 2018/07/13, 09:23**

Sample Matrix: Water
# Samples Received: 1

| Analyses | Quantity | Laboratory Method | Primary Reference |
|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | 1 | AB SOP-00005 | SM 22 2320 B m |
| BTEX/F1 in Water by HS GC/MS/FID | 1 | AB SOP-00039 | CCME CWS/EPA 8260d m |
| F1-BTEX | 1 | AB SOP-00039 | Auto Calc |
| Cadmium - low level CCME - Dissolved | 1 | AB WI-00065 | Auto Calc |
| Chloride by Automated Colourimetry | 1 | AB SOP-00020 | SM 22 4500-Cl-E m |
| Conductivity @25C | 1 | AB SOP-00005 | SM 22 2510 B m |
| CCME Hydrocarbons in Water (F2; C10-C16) (1) | 1 | AB SOP-00037 / AB SOP-00040 | CCME PHC-CWS m |
| Hardness | 1 | AB WI-00065 | Auto Calc |
| Mercury - Low Level (Dissolved) (2) | 1 | EENVSOP-00031 | EPA 1631E/245.1 R3 m |
| Elements by ICP - Dissolved (2) | 1 | AB SOP-00042 | EPA 6010d R4 m |
| Elements by ICPMS - Dissolved (2) | 1 | AB SOP-00043 | EPA 6020b R2 m |
| Ion Balance | 1 | AB WI-00065 | Auto Calc |
| Nitrate and Nitrite | 1 | AB WI-00065 | Auto Calc |
| Nitrate + Nitrite-N (calculated) | 1 | AB WI-00065 | Auto Calc |
| Nitrogen (Nitrite - Nitrate) by IC | 1 | AB SOP-00023 | SM 23 4110 B m |
| Phenols (4-AAP) | 1 | EENVSOP-00061 | MMCW 154 1996 m |
| Sulphate by Automated Colourimetry | 1 | AB SOP-00018 | SM 22 4500-SO4 E m |
| Total Dissolved Solids (Filt. Residue) | 1 | AB SOP-00065 | SM 22 2540 C m |

**Remarks:**

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. All samples were analyzed within hold time unless otherwise flagged.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.



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

Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400
Your C.O.C. #: 298586

**Attention: Stacy Gibb**

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

**Report Date: 2018/07/20**
Report #: R2592527
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B857638**
**Received: 2018/07/13, 09:23**

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
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) Silica gel clean up employed.
(2) Dissolved > Total Imbalance: Whenever applicable, Dissolved >Total for any parameter that falls within method uncertainty for duplicates is likely equivalent. If RPD is >20% samples were reanalyzed and confirmed.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Jenna Chernuka, Project Manager
Email: JChernuka@maxxam.ca
Phone# (780)577-7178
==========
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

Maxxam Job #: B857638
Report Date: 2018/07/20

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## AT1 BTEX AND F1-F2 IN WATER (WATER)

| Maxxam ID | | TV7999 | | |
|---|---|---|---|---|
| Sampling Date | | 2018/07/11 12:55 | | |
| COC Number | | 298586 | | |
| | **UNITS** | **ARB-12-3-3** | **RDL** | **QC Batch** |
| **Ext. Pet. Hydrocarbon** | | | | |
| F2 (C10-C16 Hydrocarbons) | mg/L | <0.10 | 0.10 | 9063118 |
| **Volatiles** | | | | |
| Benzene | mg/L | <0.00040 | 0.00040 | 9063454 |
| Toluene | mg/L | <0.00040 | 0.00040 | 9063454 |
| Ethylbenzene | mg/L | <0.00040 | 0.00040 | 9063454 |
| m & p-Xylene | mg/L | <0.00080 | 0.00080 | 9063454 |
| o-Xylene | mg/L | <0.00040 | 0.00040 | 9063454 |
| Xylenes (Total) | mg/L | <0.00089 | 0.00089 | 9061719 |
| F1 (C6-C10) - BTEX | mg/L | <0.10 | 0.10 | 9061719 |
| F1 (C6-C10) | mg/L | <0.10 | 0.10 | 9063454 |
| **Extraction Surrogate Recovery (%)** | | | | |
| O-TERPHENYL (sur.) | % | 86 | | 9063118 |
| **Instrument Surrogate Recovery (%)** | | | | |
| 1,4-Difluorobenzene (sur.) | % | 102 | | 9063454 |
| 4-Bromofluorobenzene (sur.) | % | 101 | | 9063454 |
| D4-1,2-Dichloroethane (sur.) | % | 99 | | 9063454 |
| 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 #: B857638
Report Date: 2018/07/20

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## REGULATED METALS INCLUDING MERCURY-DISS (WATER)

| Maxxam ID | | TV7999 | | | TV7999 | | |
|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/07/11 12:55 | | | 2018/07/11 12:55 | | |
| COC Number | | 298586 | | | 298586 | | |
| | **UNITS** | **ARB-12-3-3** | **RDL** | **QC Batch** | **ARB-12-3-3 Lab-Dup** | **RDL** | **QC Batch** |
| **Low Level Elements** | | | | | | | |
| Dissolved Cadmium (Cd) | mg/L | 0.000065 | 0.000020 | 9062475 | | | |
| **Elements** | | | | | | | |
| Dissolved Aluminum (Al) | mg/L | 0.20 | 0.0030 | 9062864 | | | |
| Dissolved Antimony (Sb) | mg/L | <0.00060 | 0.00060 | 9062864 | | | |
| Dissolved Arsenic (As) | mg/L | 0.0011 | 0.00020 | 9062864 | | | |
| Dissolved Barium (Ba) | mg/L | 0.11 | 0.010 | 9065648 | 0.11 | 0.010 | 9065648 |
| Dissolved Beryllium (Be) | mg/L | <0.0010 | 0.0010 | 9062864 | | | |
| Dissolved Boron (B) | mg/L | <0.020 | 0.020 | 9065648 | <0.020 | 0.020 | 9065648 |
| Dissolved Calcium (Ca) | mg/L | 150 | 0.30 | 9065648 | 150 | 0.30 | 9065648 |
| Dissolved Chromium (Cr) | mg/L | <0.0010 | 0.0010 | 9062864 | | | |
| Dissolved Cobalt (Co) | mg/L | 0.00073 | 0.00030 | 9062864 | | | |
| Dissolved Copper (Cu) | mg/L | 0.0046 | 0.00020 | 9062864 | | | |
| Dissolved Iron (Fe) | mg/L | 0.49 | 0.060 | 9065648 | 0.49 | 0.060 | 9065648 |
| Dissolved Lead (Pb) | mg/L | 0.00070 | 0.00020 | 9062864 | | | |
| Dissolved Lithium (Li) | mg/L | <0.020 | 0.020 | 9065648 | <0.020 | 0.020 | 9065648 |
| Dissolved Magnesium (Mg) | mg/L | 49 | 0.20 | 9065648 | 49 | 0.20 | 9065648 |
| Dissolved Manganese (Mn) | mg/L | 0.064 | 0.0040 | 9065648 | 0.063 | 0.0040 | 9065648 |
| Dissolved Molybdenum (Mo) | mg/L | 0.0018 | 0.00020 | 9062864 | | | |
| Dissolved Nickel (Ni) | mg/L | 0.0039 | 0.00050 | 9062864 | | | |
| Dissolved Phosphorus (P) | mg/L | 0.38 | 0.10 | 9065648 | 0.38 | 0.10 | 9065648 |
| Dissolved Potassium (K) | mg/L | 2.5 | 0.30 | 9065648 | 2.5 | 0.30 | 9065648 |
| Dissolved Selenium (Se) | mg/L | 0.00039 | 0.00020 | 9062864 | | | |
| Dissolved Silicon (Si) | mg/L | 5.5 | 0.10 | 9065648 | 5.5 | 0.10 | 9065648 |
| Dissolved Silver (Ag) | mg/L | <0.00010 | 0.00010 | 9062864 | | | |
| Dissolved Sodium (Na) | mg/L | 31 | 0.50 | 9065648 | 31 | 0.50 | 9065648 |
| Dissolved Strontium (Sr) | mg/L | 0.45 | 0.020 | 9065648 | 0.45 | 0.020 | 9065648 |
| Dissolved Sulphur (S) | mg/L | 68 | 0.20 | 9065648 | 68 | 0.20 | 9065648 |
| Dissolved Thallium (Tl) | mg/L | <0.00020 | 0.00020 | 9062864 | | | |
| Dissolved Tin (Sn) | mg/L | <0.0010 | 0.0010 | 9062864 | | | |
| Dissolved Titanium (Ti) | mg/L | 0.0049 | 0.0010 | 9062864 | | | |

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate



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Maxxam Job #: B857638
Report Date: 2018/07/20

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## REGULATED METALS INCLUDING MERCURY-DISS (WATER)

| Maxxam ID | | TV7999 | | | TV7999 | | |
|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/07/11 12:55 | | | 2018/07/11 12:55 | | |
| COC Number | | 298586 | | | 298586 | | |
| | **UNITS** | **ARB-12-3-3** | **RDL** | **QC Batch** | **ARB-12-3-3 Lab-Dup** | **RDL** | **QC Batch** |
| Dissolved Uranium (U) | mg/L | 0.0070 | 0.00010 | 9062864 | | | |
| Dissolved Vanadium (V) | mg/L | 0.0014 | 0.0010 | 9062864 | | | |
| Dissolved Zinc (Zn) | mg/L | 0.010 | 0.0030 | 9062864 | | | |
| **Low Level Elements** | | | | | | | |
| Dissolved Mercury (Hg) | mg/L | 0.0000065 | 0.0000020 | 9063853 | | | |

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate



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Maxxam Job #: B857638
Report Date: 2018/07/20

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## RESULTS OF CHEMICAL ANALYSES OF WATER

| Maxxam ID | | TV7999 | | |
|---|---|---|---|---|
| Sampling Date | | 2018/07/11 12:55 | | |
| COC Number | | 298586 | | |
| | **UNITS** | **ARB-12-3-3** | **RDL** | **QC Batch** |
| **Calculated Parameters** | | | | |
| Hardness (CaCO3) | mg/L | 580 | 0.50 | 9062477 |
| Ion Balance (% Difference) | % | 3.3 | N/A | 9062478 |
| Dissolved Nitrate (NO3) | mg/L | 4.7 | 0.044 | 9062231 |
| Nitrate plus Nitrite (N) | mg/L | 1.1 | 0.014 | 9062232 |
| Dissolved Nitrite (NO2) | mg/L | 0.043 | 0.033 | 9062231 |
| **Misc. Inorganics** | | | | |
| Conductivity | uS/cm | 1100 | 2.0 | 9065985 |
| Total Dissolved Solids | mg/L | 760 | 10 | 9063450 |
| **Anions** | | | | |
| Alkalinity (PP as CaCO3) | mg/L | <1.0 | 1.0 | 9065983 |
| Alkalinity (Total as CaCO3) | mg/L | 380 | 1.0 | 9065983 |
| Bicarbonate (HCO3) | mg/L | 460 | 1.0 | 9065983 |
| Carbonate (CO3) | mg/L | <1.0 | 1.0 | 9065983 |
| Hydroxide (OH) | mg/L | <1.0 | 1.0 | 9065983 |
| Dissolved Sulphate (SO4) | mg/L | 180 (1) | 2.0 | 9065945 |
| Dissolved Chloride (Cl) | mg/L | 27 | 1.0 | 9065944 |
| **Nutrients** | | | | |
| Dissolved Nitrite (N) | mg/L | 0.013 | 0.010 | 9063626 |
| Dissolved Nitrate (N) | mg/L | 1.1 | 0.010 | 9063626 |
| **Misc. Organics** | | | | |
| Phenols | mg/L | 0.0044 | 0.0020 | 9066093 |

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limits raised due to matrix interference.



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Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## TEST SUMMARY

**Maxxam ID:** TV7999
**Sample ID:** ARB-12-3-3
**Matrix:** Water

**Collected:** 2018/07/11
**Relinquished:** 2018/07/12
**Received:** 2018/07/13

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | AT/ALK | 9065983 | N/A | 2018/07/18 | Malina Alamyar |
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9063454 | N/A | 2018/07/15 | Hetul Patel |
| F1-BTEX | CALC/MS | 9061719 | N/A | 2018/07/18 | Automated Statchk |
| Cadmium - low level CCME - Dissolved | CALC/MS | 9062475 | N/A | 2018/07/16 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 9065944 | N/A | 2018/07/18 | Chelsea Harmatys |
| Conductivity @25C | COND | 9065985 | N/A | 2018/07/18 | Malina Alamyar |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9063118 | 2018/07/18 | 2018/07/18 | Grace Guo |
| Hardness | CALC | 9062477 | N/A | 2018/07/19 | Automated Statchk |
| Mercury - Low Level (Dissolved) | CV/AF | 9063853 | 2018/07/19 | 2018/07/19 | Mahboubeh Bahadori |
| Elements by ICP - Dissolved | ICPA | 9065648 | N/A | 2018/07/18 | Jonathan Kuprowsky |
| Elements by ICPMS - Dissolved | ICPM | 9062864 | N/A | 2018/07/14 | Andrew Payne |
| Ion Balance | CALC | 9062478 | N/A | 2018/07/16 | Automated Statchk |
| Nitrate and Nitrite | CALC | 9062231 | N/A | 2018/07/16 | Automated Statchk |
| Nitrate + Nitrite-N (calculated) | CALC | 9062232 | N/A | 2018/07/16 | Automated Statchk |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9063626 | N/A | 2018/07/14 | Krista Dawe |
| Phenols (4-AAP) | TECH/4AAP | 9066093 | N/A | 2018/07/18 | Ashley Fedoriuk |
| Sulphate by Automated Colourimetry | KONE | 9065945 | N/A | 2018/07/18 | Chelsea Harmatys |
| Total Dissolved Solids (Filt. Residue) | BAL | 9063450 | 2018/07/14 | 2018/07/17 | Luminita Chiosa |

**Maxxam ID:** TV7999 Dup
**Sample ID:** ARB-12-3-3
**Matrix:** Water

**Collected:** 2018/07/11
**Relinquished:** 2018/07/12
**Received:** 2018/07/13

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Elements by ICP - Dissolved | ICPA | 9065648 | N/A | 2018/07/18 | Jonathan Kuprowsky |



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Site Location: Norman Wells, NT
Project #: 407011-00586-400

## GENERAL COMMENTS

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

| | |
|---|---|
| Package 1 | 4.7°C |

Sample TV7999 [ARB-12-3-3] : Client supplied DM bottle contained particulate.

**Results relate only to the items tested.**



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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| 9062864 | APY | Method Blank | Dissolved Aluminum (Al) | 2018/07/14 | <0.0030 | | mg/L | |
| | | | Dissolved Chromium (Cr) | 2018/07/14 | <0.0010 | | mg/L | |
| | | | Dissolved Cobalt (Co) | 2018/07/14 | <0.00030 | | mg/L | |
| | | | Dissolved Copper (Cu) | 2018/07/14 | <0.00020 | | mg/L | |
| | | | Dissolved Lead (Pb) | 2018/07/14 | <0.00020 | | mg/L | |
| | | | Dissolved Antimony (Sb) | 2018/07/14 | <0.00060 | | mg/L | |
| | | | Dissolved Molybdenum (Mo) | 2018/07/14 | <0.00020 | | mg/L | |
| | | | Dissolved Nickel (Ni) | 2018/07/14 | <0.00050 | | mg/L | |
| | | | Dissolved Selenium (Se) | 2018/07/14 | <0.00020 | | mg/L | |
| | | | Dissolved Silver (Ag) | 2018/07/14 | <0.00010 | | mg/L | |
| | | | Dissolved Arsenic (As) | 2018/07/14 | <0.00020 | | mg/L | |
| | | | Dissolved Thallium (Tl) | 2018/07/14 | <0.00020 | | mg/L | |
| | | | Dissolved Tin (Sn) | 2018/07/14 | <0.0010 | | mg/L | |
| | | | Dissolved Titanium (Ti) | 2018/07/14 | <0.0010 | | mg/L | |
| | | | Dissolved Uranium (U) | 2018/07/14 | <0.00010 | | mg/L | |
| | | | Dissolved Vanadium (V) | 2018/07/14 | <0.0010 | | mg/L | |
| | | | Dissolved Zinc (Zn) | 2018/07/14 | <0.0030 | | mg/L | |
| | | | Dissolved Beryllium (Be) | 2018/07/14 | <0.0010 | | mg/L | |
| 9063118 | GG3 | Method Blank | O-TERPHENYL (sur.) | 2018/07/18 | | 94 | % | 60 - 140 |
| | | | F2 (C10-C16 Hydrocarbons) | 2018/07/18 | <0.10 | | mg/L | |
| 9063450 | LCA | Method Blank | Total Dissolved Solids | 2018/07/17 | <10 | | mg/L | |
| 9063454 | HP5 | Method Blank | 1,4-Difluorobenzene (sur.) | 2018/07/16 | | 101 | % | 50 - 140 |
| | | | 4-Bromofluorobenzene (sur.) | 2018/07/16 | | 100 | % | 50 - 140 |
| | | | D4-1,2-Dichloroethane (sur.) | 2018/07/16 | | 96 | % | 50 - 140 |
| | | | Benzene | 2018/07/16 | <0.00040 | | mg/L | |
| | | | Toluene | 2018/07/16 | <0.00040 | | mg/L | |
| | | | Ethylbenzene | 2018/07/16 | <0.00040 | | mg/L | |
| | | | m & p-Xylene | 2018/07/16 | <0.00080 | | mg/L | |
| | | | o-Xylene | 2018/07/16 | <0.00040 | | mg/L | |
| | | | F1 (C6-C10) | 2018/07/16 | <0.10 | | mg/L | |
| 9063626 | KD5 | Method Blank | Dissolved Nitrite (N) | 2018/07/14 | <0.010 | | mg/L | |
| | | | Dissolved Nitrate (N) | 2018/07/14 | <0.010 | | mg/L | |
| 9063853 | BAH | Method Blank | Dissolved Mercury (Hg) | 2018/07/19 | <0.0000020 | | mg/L | |
| 9065648 | JK9 | Method Blank | Dissolved Iron (Fe) | 2018/07/18 | <0.060 | | mg/L | |
| | | | Dissolved Lithium (Li) | 2018/07/18 | <0.020 | | mg/L | |
| | | | Dissolved Magnesium (Mg) | 2018/07/18 | <0.20 | | mg/L | |
| | | | Dissolved Manganese (Mn) | 2018/07/18 | <0.0040 | | mg/L | |
| | | | Dissolved Potassium (K) | 2018/07/18 | <0.30 | | mg/L | |
| | | | Dissolved Sodium (Na) | 2018/07/18 | <0.50 | | mg/L | |
| | | | Dissolved Strontium (Sr) | 2018/07/18 | <0.020 | | mg/L | |
| | | | Dissolved Sulphur (S) | 2018/07/18 | <0.20 | | mg/L | |
| | | | Dissolved Phosphorus (P) | 2018/07/18 | <0.10 | | mg/L | |
| | | | Dissolved Barium (Ba) | 2018/07/18 | <0.010 | | mg/L | |
| | | | Dissolved Silicon (Si) | 2018/07/18 | <0.10 | | mg/L | |
| | | | Dissolved Boron (B) | 2018/07/18 | <0.020 | | mg/L | |
| | | | Dissolved Calcium (Ca) | 2018/07/18 | <0.30 | | mg/L | |
| 9065944 | CH7 | Method Blank | Dissolved Chloride (Cl) | 2018/07/18 | <1.0 | | mg/L | |
| 9065945 | CH7 | Method Blank | Dissolved Sulphate (SO4) | 2018/07/18 | <1.0 | | mg/L | |
| 9065983 | MA4 | Method Blank | Alkalinity (Total as CaCO3) | 2018/07/18 | <1.0 | | mg/L | |
| | | | Alkalinity (PP as CaCO3) | 2018/07/18 | <1.0 | | mg/L | |
| | | | Bicarbonate (HCO3) | 2018/07/18 | <1.0 | | mg/L | |



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Maxxam Job #: B857638
Report Date: 2018/07/20

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT(CONT'D)

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| | | | Carbonate (CO3) | 2018/07/18 | <1.0 | | mg/L | |
| | | | Hydroxide (OH) | 2018/07/18 | <1.0 | | mg/L | |
| 9065985 | MA4 | Method Blank | Conductivity | 2018/07/18 | <2.0 | | uS/cm | |
| 9066093 | AF6 | Method Blank | Phenols | 2018/07/18 | <0.0020 | | mg/L | |
| 9065648 | JK9 | RPD [TV7999-03] | Dissolved Iron (Fe) | 2018/07/18 | 0.52 | | % | 20 |
| | | | Dissolved Lithium (Li) | 2018/07/18 | NC | | % | 20 |
| | | | Dissolved Magnesium (Mg) | 2018/07/18 | 0.42 | | % | 20 |
| | | | Dissolved Manganese (Mn) | 2018/07/18 | 0.49 | | % | 20 |
| | | | Dissolved Potassium (K) | 2018/07/18 | 1.3 | | % | 20 |
| | | | Dissolved Sodium (Na) | 2018/07/18 | 0.44 | | % | 20 |
| | | | Dissolved Strontium (Sr) | 2018/07/18 | 0.047 | | % | 20 |
| | | | Dissolved Sulphur (S) | 2018/07/18 | 0.073 | | % | 20 |
| | | | Dissolved Phosphorus (P) | 2018/07/18 | 0.037 | | % | 20 |
| | | | Dissolved Barium (Ba) | 2018/07/18 | 0.20 | | % | 20 |
| | | | Dissolved Silicon (Si) | 2018/07/18 | 0.27 | | % | 20 |
| | | | Dissolved Boron (B) | 2018/07/18 | NC | | % | 20 |
| | | | Dissolved Calcium (Ca) | 2018/07/18 | 0.30 | | % | 20 |
| 9065648 | JK9 | Matrix Spike [TV7999-03] | Dissolved Iron (Fe) | 2018/07/18 | | 98 | % | 80 - 120 |
| | | | Dissolved Lithium (Li) | 2018/07/18 | | 96 | % | 80 - 120 |
| | | | Dissolved Magnesium (Mg) | 2018/07/18 | | 99 | % | 80 - 120 |
| | | | Dissolved Manganese (Mn) | 2018/07/18 | | 99 | % | 80 - 120 |
| | | | Dissolved Potassium (K) | 2018/07/18 | | 101 | % | 80 - 120 |
| | | | Dissolved Sodium (Na) | 2018/07/18 | | 95 | % | 80 - 120 |
| | | | Dissolved Strontium (Sr) | 2018/07/18 | | 93 | % | 80 - 120 |
| | | | Dissolved Phosphorus (P) | 2018/07/18 | | 106 | % | 80 - 120 |
| | | | Dissolved Barium (Ba) | 2018/07/18 | | 100 | % | 80 - 120 |
| | | | Dissolved Silicon (Si) | 2018/07/18 | | 94 | % | 80 - 120 |
| | | | Dissolved Boron (B) | 2018/07/18 | | 103 | % | 80 - 120 |
| | | | Dissolved Calcium (Ca) | 2018/07/18 | | NC | % | 80 - 120 |
| 9062864 | APY | LCS | Dissolved Aluminum (Al) | 2018/07/14 | | 98 | % | 80 - 120 |
| | | | Dissolved Chromium (Cr) | 2018/07/14 | | 96 | % | 80 - 120 |
| | | | Dissolved Cobalt (Co) | 2018/07/14 | | 95 | % | 80 - 120 |
| | | | Dissolved Copper (Cu) | 2018/07/14 | | 96 | % | 80 - 120 |
| | | | Dissolved Lead (Pb) | 2018/07/14 | | 95 | % | 80 - 120 |
| | | | Dissolved Antimony (Sb) | 2018/07/14 | | 92 | % | 80 - 120 |
| | | | Dissolved Molybdenum (Mo) | 2018/07/14 | | 83 | % | 80 - 120 |
| | | | Dissolved Nickel (Ni) | 2018/07/14 | | 94 | % | 80 - 120 |
| | | | Dissolved Selenium (Se) | 2018/07/14 | | 91 | % | 80 - 120 |
| | | | Dissolved Silver (Ag) | 2018/07/14 | | 95 | % | 80 - 120 |
| | | | Dissolved Arsenic (As) | 2018/07/14 | | 92 | % | 80 - 120 |
| | | | Dissolved Thallium (Tl) | 2018/07/14 | | 95 | % | 80 - 120 |
| | | | Dissolved Tin (Sn) | 2018/07/14 | | 92 | % | 80 - 120 |
| | | | Dissolved Titanium (Ti) | 2018/07/14 | | 92 | % | 80 - 120 |
| | | | Dissolved Uranium (U) | 2018/07/14 | | 94 | % | 80 - 120 |
| | | | Dissolved Vanadium (V) | 2018/07/14 | | 98 | % | 80 - 120 |
| | | | Dissolved Zinc (Zn) | 2018/07/14 | | 95 | % | 80 - 120 |
| | | | Dissolved Beryllium (Be) | 2018/07/14 | | 90 | % | 80 - 120 |
| 9063118 | GG3 | LCS | O-TERPHENYL (sur.) | 2018/07/18 | | 91 | % | 60 - 140 |
| | | | F2 (C10-C16 Hydrocarbons) | 2018/07/18 | | 96 | % | 60 - 140 |
| 9063450 | LCA | LCS | Total Dissolved Solids | 2018/07/17 | | 99 | % | 80 - 120 |
| 9063454 | HP5 | LCS | 1,4-Difluorobenzene (sur.) | 2018/07/15 | | 95 | % | 50 - 140 |



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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT(CONT'D)

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| | | | 4-Bromofluorobenzene (sur.) | 2018/07/15 | | 99 | % | 50 - 140 |
| | | | D4-1,2-Dichloroethane (sur.) | 2018/07/15 | | 99 | % | 50 - 140 |
| | | | Benzene | 2018/07/15 | | 85 | % | 60 - 130 |
| | | | Toluene | 2018/07/15 | | 88 | % | 60 - 130 |
| | | | Ethylbenzene | 2018/07/15 | | 94 | % | 60 - 130 |
| | | | m & p-Xylene | 2018/07/15 | | 91 | % | 60 - 130 |
| | | | o-Xylene | 2018/07/15 | | 92 | % | 60 - 130 |
| | | | F1 (C6-C10) | 2018/07/15 | | 92 | % | 60 - 140 |
| 9063626 | KD5 | LCS | Dissolved Nitrite (N) | 2018/07/14 | | 101 | % | 80 - 120 |
| | | | Dissolved Nitrate (N) | 2018/07/14 | | 101 | % | 80 - 120 |
| 9063853 | BAH | LCS | Dissolved Mercury (Hg) | 2018/07/19 | | 100 | % | 80 - 120 |
| 9065648 | JK9 | LCS | Dissolved Iron (Fe) | 2018/07/18 | | 97 | % | 80 - 120 |
| | | | Dissolved Lithium (Li) | 2018/07/18 | | 96 | % | 80 - 120 |
| | | | Dissolved Magnesium (Mg) | 2018/07/18 | | 102 | % | 80 - 120 |
| | | | Dissolved Manganese (Mn) | 2018/07/18 | | 98 | % | 80 - 120 |
| | | | Dissolved Potassium (K) | 2018/07/18 | | 102 | % | 80 - 120 |
| | | | Dissolved Sodium (Na) | 2018/07/18 | | 101 | % | 80 - 120 |
| | | | Dissolved Strontium (Sr) | 2018/07/18 | | 96 | % | 80 - 120 |
| | | | Dissolved Phosphorus (P) | 2018/07/18 | | 105 | % | 80 - 120 |
| | | | Dissolved Barium (Ba) | 2018/07/18 | | 99 | % | 80 - 120 |
| | | | Dissolved Silicon (Si) | 2018/07/18 | | 97 | % | 80 - 120 |
| | | | Dissolved Boron (B) | 2018/07/18 | | 100 | % | 80 - 120 |
| | | | Dissolved Calcium (Ca) | 2018/07/18 | | 100 | % | 80 - 120 |
| 9065944 | CH7 | LCS | Dissolved Chloride (Cl) | 2018/07/18 | | 108 | % | 80 - 120 |
| 9065945 | CH7 | LCS | Dissolved Sulphate (SO4) | 2018/07/18 | | 104 | % | 80 - 120 |
| 9065983 | MA4 | LCS | Alkalinity (Total as CaCO3) | 2018/07/18 | | 100 | % | 80 - 120 |
| 9065985 | MA4 | LCS | Conductivity | 2018/07/18 | | 102 | % | 90 - 110 |
| 9066093 | AF6 | LCS | Phenols | 2018/07/18 | | 89 | % | 80 - 120 |
| 9063853 | BAH | SRM | Dissolved Mercury (Hg) | 2018/07/19 | | 99 | % | 80 - 120 |

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.

LCS: 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.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

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



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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## VALIDATION SIGNATURE PAGE

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

Justin Geisel, B.Sc., Organics Supervisor

Poonam Sharma, cCT, Organics Supervisor

Winnie Au, B.Sc., QP, 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.



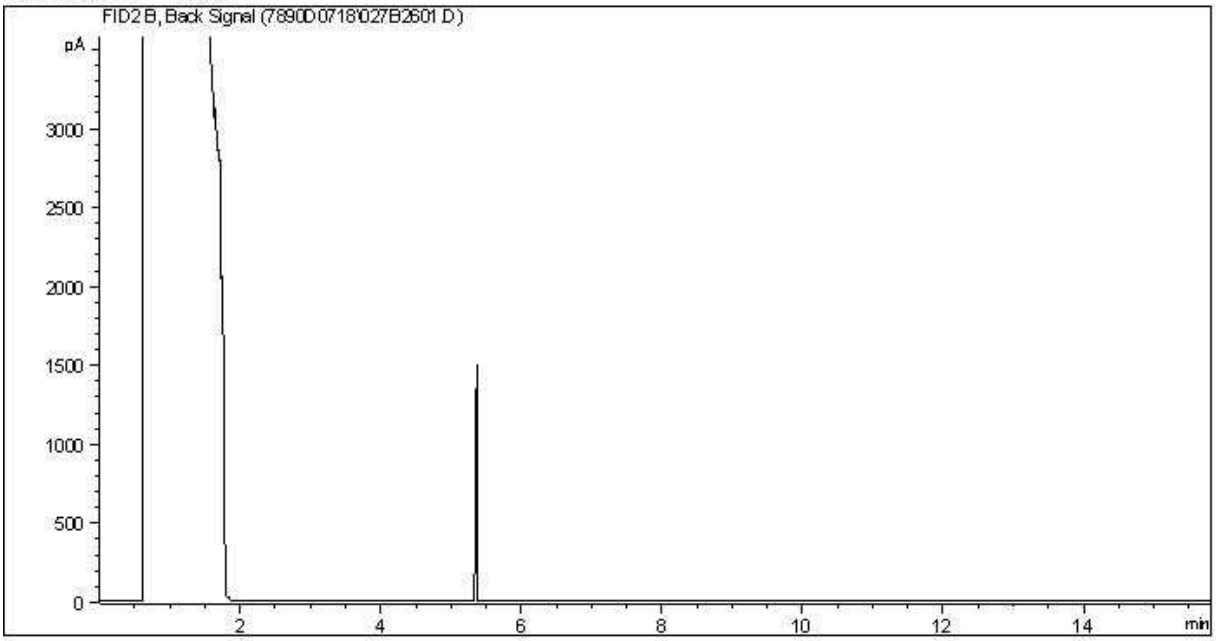
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Maxxam Job #: B857638
Report Date: 2018/07/20
Maxxam Sample: TV7999

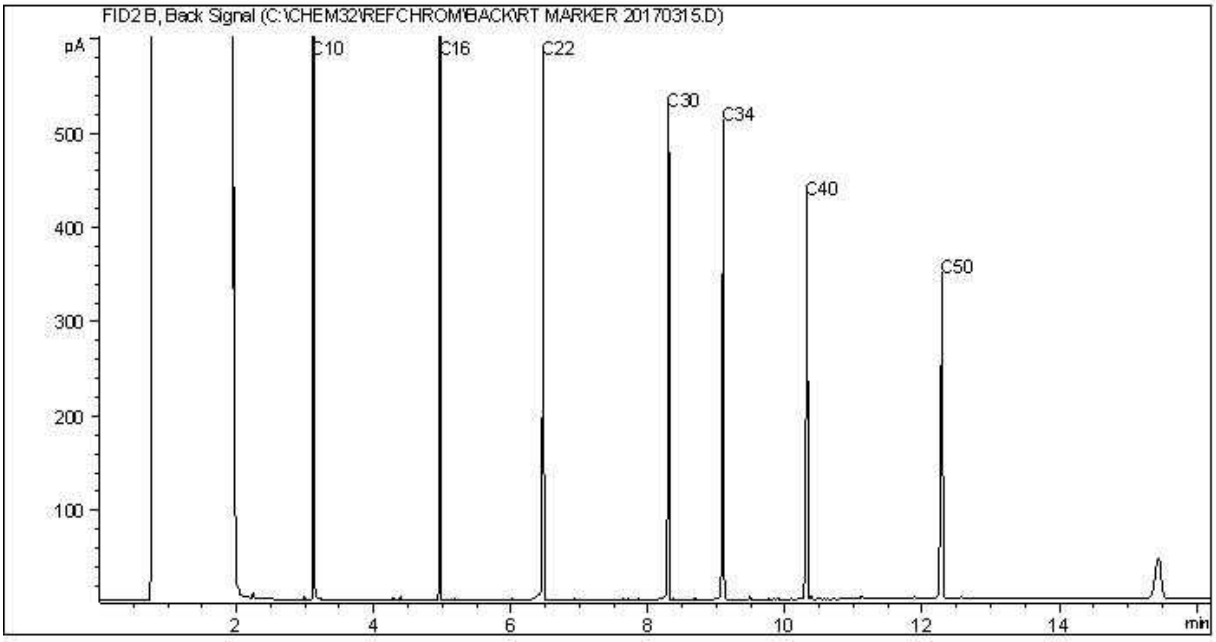
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: ARB-12-3-3

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890D




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam
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Fax: (780) 450-4187
Toll Free: (800) 386-7247

# EXXON MOBIL/IMPERIAL OIL - MAXXAM CHAIN-OF-CUSTODY RECORD



C of C # 298586

| INVOICE INFORMATION | REPORT INFORMATION |
|---|---|
| Company Name: ☒ Imperial Oil ☐ ExxonMobil | Company Name: WorleyParsons |
| Contact Name: WorleyParsons | Contact Name: Stacy Gibb |
| Address: 500, 151 Canada Olympic Rd SW Calgary, AB T3B 6B7 | Address: 500, 151 Canada Olympic Rd SW Calgary, AB T3B 6B7 |
| Email: Sanj.perera@advisian.com | Email: stacy.gibb@advisian.com |
| Ph: 587-952-1490 | Ph: 403-247-0700 |
| Sampler Name (Print): Michelle Vokaty, Melanie Jones | Consultant Project #: 407011-~~0001~~ mw 00586-400 |

| FIELD SAMPLE ID | MATRIX: GROUND WATER | SURFACE WATER | SOIL | OTHER | # CONTAINERS | SAMPLING: DATE (YYYY/MM/DD) | TIME (24 HR) | FIELD FILTERED & PRESERVED | LAB FILTRATION REQUIRED | ANALYSIS REQUESTED: VOC | PAH | PHCs (FRACTIONS 1-2 PLUS BTEX) | PHCs (FRACTIONS 1-4 PLUS BTEX) | PHCs (FRACTIONS 2-4) | PHCs (FRACTION 1 PLUS BTEX) | GRAIN SIZE (75 MICRON) | TEXTURE (% SAND, SILT, CLAY) | PARTICLE SIZE DISTRIBUTION WITH GRAPH | REGULATED METALS TOT ☐ DIS ☒ | MERCURY TOTAL ☐ DISSOLVED ☒ | SALINITY SOIL | FERTILIZER SOIL | FERTILIZER WATER | NUTRIENTS SOIL | ROUTINE POTABILITY | pH ☐ EC ☐ ALKALINITY ☐ | BASIC CLASS II LANDFILL PKG | Phenols by 4AAP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 ARB-12-3-3 | X | | | | 10 | 2018/07/11 | 12:55 | X | | | | X | | | | | | | X | X | | | | | X | | | X |
| 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

IOL SITE LOCATION: Norman Wells, NT

IOL PROJECT # (if applicable): N/A

MAXXAM TASK ORDER # OR SERVICE ORDER # + LINE ITEM: 407011-~~0001~~ mw 00586-400

REGULATORY CRITERIA / DETECTION LIMITS:
☐ Alberta Tier 1 ☐ CDWG
☐ SEQG (SK) ☐ NoSC (SK)
☒ CCME (incl. level) FAL ☐ Other

SPECIAL INSTRUCTIONS
also email:
- Standard Norman Wells list
- melissa.lord@advisian.com
IES A2601436

# JARS USED & NOT SUBMITTED (Enter N/A for Water): N/A

TURNAROUND TIME
Standard (5 days) ☒
Rush (3 days) ☐
(2 days) ☐
(1 day) ☐
(same day) ☐
Date Required

| | YES | NO | COOLER ID # | TEMP °C 1 | 2 | 3 |
|---|---|---|---|---|---|---|
| SEAL PRESENT | ✓ | | | 4 | 5 | 5 |
| SEAL INTACT | ✓ | | | | | |
| COOLING MEDIA PRESENT | ✓ | | | | | |

| | YES | NO | COOLER ID # | TEMP °C 1 | 2 | 3 |
|---|---|---|---|---|---|---|
| SEAL PRESENT | | | | | | |
| SEAL INTACT | | | | | | |
| COOLING MEDIA PRESENT | | | | | | |

| | YES | NO | COOLER ID # | TEMP °C 1 | 2 | 3 |
|---|---|---|---|---|---|---|
| SEAL PRESENT | | | | | | |
| SEAL INTACT | | | | | | |
| COOLING MEDIA PRESENT | | | | | | |

| RELINQUISHED BY: | | DATE: | TIME (24 HR) | RECEIVED BY: | | DATE: | TIME (24 HR) |
|---|---|---|---|---|---|---|---|
| 1. | Melissa Lord | 2018/07/12 | 08:00 | 1. | Kyle VanThournout | 2018/07/13 | 09:23 |
| 2. | | | | 2. | | | |
| 3. | | | | 3. | | | |

LAB USE ONLY
MAXXAM JOB # B85-7638

SAMPLES
LABELED BY: SK
VERIFIED BY: DT

COC-1010 (06/2016) IOL-AB

White: Maxxam Yellow: Client

# DATA QUALITY REVIEW CHECKLIST - IMPERIAL OIL PROJECTS

Consultant: Advisian

Sampling Date: 11-Jul-18

Location: Norman Wells

Laboratory : Maxxam Edmonton

Consultant Project Number: 407011-00586-400

Sample Submission Number: B857696

Are All Laboratory QC Within Acceptance Criteria (Yes, No, Not Applicable)?

| | Yes | No | NA | Comments |
|---|---|---|---|---|
| Instrument Surrogate Recovery | x | | | All laboratory QC met acceptance criteria. |
| Extraction Surrogate Recovery | x | | | |
| Method Blank Concentration | x | | | |
| Matrix Duplicate RPD | | | x | |
| Matrix Spike Recovery | | | x | |
| Lab Control Sample Recovery | x | | | |

Are All Field QC Samples Within Alert Limits (Yes, No, Not Applicable)?

| | Yes | No | NA | Comments |
|---|---|---|---|---|
| Field Blank Concentration | | | x | No field QC samples submitted. |
| Trip Blank Concentration | | | x | |
| Equipment Blank Concentration | | | x | |
| Field Duplicate RPD | | | x | |

| | |
|---|---|
| Has CoA been signed off (Yes/No)?: | Yes |
| Has lab warranted all tests were analyzed following SOP's in CoA (Yes/No)?: | Yes |
| Were all samples analyzed within hold times (Yes/No)?: | Yes |
| All volatiles samples methanol extracted (if required) within 48 hours (Yes/No)?: | n/a |
| Is Chain of Custody completed and signed (Yes/No)?: | Yes |
| Were sample temperatures acceptable when they reached lab (Yes/No)?: | Yes |

Was a Data Quality Overview (DQO) issued (Yes/No)?: No

Date DQO was received: n/a

Is data considered to be reliable (Yes/No)?: Yes

If answer is "No", describe and provide rationale:

Data Reviewed by (Print): Vivian Baptista

Data Reviewed by (Signature): 

Date: 30-Jul-18

Maxxam
A Bureau Veritas Group Company

Success Through Science®

Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400
Your C.O.C. #: 298588

**Attention: Stacy Gibb**

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

**Report Date: 2018/07/20**
Report #: R2592535
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B857696**
**Received: 2018/07/13, 09:23**

Sample Matrix: Water
# Samples Received: 1

| Analyses | Quantity | Laboratory Method | Primary Reference |
|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | 1 | AB SOP-00005 | SM 22 2320 B m |
| BTEX/F1 in Water by HS GC/MS/FID | 1 | AB SOP-00039 | CCME CWS/EPA 8260d m |
| F1-BTEX | 1 | AB SOP-00039 | Auto Calc |
| Cadmium - low level CCME - Dissolved | 1 | AB WI-00065 | Auto Calc |
| Chloride by Automated Colourimetry | 1 | AB SOP-00020 | SM 22 4500-Cl-E m |
| Conductivity @25C | 1 | AB SOP-00005 | SM 22 2510 B m |
| CCME Hydrocarbons in Water (F2; C10-C16) (1) | 1 | AB SOP-00037 / AB SOP-00040 | CCME PHC-CWS m |
| Hardness | 1 | AB WI-00065 | Auto Calc |
| Mercury - Low Level (Dissolved) (2) | 1 | EENVSOP-00031 | EPA 1631E/245.1 R3 m |
| Elements by ICP - Dissolved (2) | 1 | AB SOP-00042 | EPA 6010d R4 m |
| Elements by ICPMS - Dissolved (2) | 1 | AB SOP-00043 | EPA 6020b R2 m |
| Ion Balance | 1 | AB WI-00065 | Auto Calc |
| Nitrate and Nitrite | 1 | AB WI-00065 | Auto Calc |
| Nitrate + Nitrite-N (calculated) | 1 | AB WI-00065 | Auto Calc |
| Nitrogen (Nitrite - Nitrate) by IC | 1 | AB SOP-00023 | SM 23 4110 B m |
| Phenols (4-AAP) | 1 | EENVSOP-00061 | MMCW 154 1996 m |
| Sulphate by Automated Colourimetry | 1 | AB SOP-00018 | SM 22 4500-SO4 E m |
| Total Dissolved Solids (Filt. Residue) | 1 | AB SOP-00065 | SM 22 2540 C m |

**Remarks:**

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. All samples were analyzed within hold time unless otherwise flagged.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.



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

Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400
Your C.O.C. #: 298588

**Attention: Stacy Gibb**

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

**Report Date: 2018/07/20**
Report #: R2592535
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B857696**
**Received: 2018/07/13, 09:23**

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
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) Silica gel clean up employed.
(2) Dissolved > Total Imbalance: Whenever applicable, Dissolved >Total for any parameter that falls within method uncertainty for duplicates is likely equivalent. If RPD is >20% samples were reanalyzed and confirmed.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Jenna Chernuka, Project Manager
Email: JChernuka@maxxam.ca
Phone# (780)577-7178
==========
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.


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Maxxam Job #: B857696
Report Date: 2018/07/20

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## AT1 BTEX AND F1-F2 IN WATER (WATER)

| Maxxam ID | | TV8241 | | |
|---|---|---|---|---|
| Sampling Date | | 2018/07/11 10:42 | | |
| COC Number | | 298588 | | |
| | **UNITS** | **WSY 97-1-5** | **RDL** | **QC Batch** |
| **Ext. Pet. Hydrocarbon** | | | | |
| F2 (C10-C16 Hydrocarbons) | mg/L | <0.10 | 0.10 | 9063118 |
| **Volatiles** | | | | |
| Benzene | mg/L | <0.00040 | 0.00040 | 9063454 |
| Toluene | mg/L | <0.00040 | 0.00040 | 9063454 |
| Ethylbenzene | mg/L | <0.00040 | 0.00040 | 9063454 |
| m & p-Xylene | mg/L | <0.00080 | 0.00080 | 9063454 |
| o-Xylene | mg/L | <0.00040 | 0.00040 | 9063454 |
| Xylenes (Total) | mg/L | <0.00089 | 0.00089 | 9061719 |
| F1 (C6-C10) - BTEX | mg/L | <0.10 | 0.10 | 9061719 |
| F1 (C6-C10) | mg/L | <0.10 | 0.10 | 9063454 |
| **Extraction Surrogate Recovery (%)** | | | | |
| O-TERPHENYL (sur.) | % | 86 | | 9063118 |
| **Instrument Surrogate Recovery (%)** | | | | |
| 1,4-Difluorobenzene (sur.) | % | 101 | | 9063454 |
| 4-Bromofluorobenzene (sur.) | % | 101 | | 9063454 |
| D4-1,2-Dichloroethane (sur.) | % | 105 | | 9063454 |
| RDL = Reportable Detection Limit | | | | |



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Maxxam Job #: B857696
Report Date: 2018/07/20

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## REGULATED METALS INCLUDING MERCURY-DISS (WATER)

| Maxxam ID | | TV8241 | | |
|---|---|---|---|---|
| Sampling Date | | 2018/07/11 10:42 | | |
| COC Number | | 298588 | | |
| | **UNITS** | **WSY 97-1-5** | **RDL** | **QC Batch** |
| **Low Level Elements** | | | | |
| Dissolved Cadmium (Cd) | mg/L | 0.000066 | 0.000020 | 9062475 |
| **Elements** | | | | |
| Dissolved Aluminum (Al) | mg/L | 0.021 | 0.0030 | 9062853 |
| Dissolved Antimony (Sb) | mg/L | <0.00060 | 0.00060 | 9062853 |
| Dissolved Arsenic (As) | mg/L | 0.00059 | 0.00020 | 9062853 |
| Dissolved Barium (Ba) | mg/L | 0.070 | 0.010 | 9065648 |
| Dissolved Beryllium (Be) | mg/L | <0.0010 | 0.0010 | 9062853 |
| Dissolved Boron (B) | mg/L | 0.13 | 0.020 | 9065648 |
| Dissolved Calcium (Ca) | mg/L | 310 | 0.30 | 9065648 |
| Dissolved Chromium (Cr) | mg/L | <0.0010 | 0.0010 | 9062853 |
| Dissolved Cobalt (Co) | mg/L | 0.0012 | 0.00030 | 9062853 |
| Dissolved Copper (Cu) | mg/L | 0.0015 | 0.00020 | 9062853 |
| Dissolved Iron (Fe) | mg/L | 0.44 | 0.060 | 9065648 |
| Dissolved Lead (Pb) | mg/L | <0.00020 | 0.00020 | 9062853 |
| Dissolved Lithium (Li) | mg/L | <0.020 | 0.020 | 9065648 |
| Dissolved Magnesium (Mg) | mg/L | 70 | 0.20 | 9065648 |
| Dissolved Manganese (Mn) | mg/L | 0.51 | 0.0040 | 9065648 |
| Dissolved Molybdenum (Mo) | mg/L | 0.0029 | 0.00020 | 9062853 |
| Dissolved Nickel (Ni) | mg/L | 0.0033 | 0.00050 | 9062853 |
| Dissolved Phosphorus (P) | mg/L | <0.10 | 0.10 | 9065648 |
| Dissolved Potassium (K) | mg/L | 2.4 | 0.30 | 9065648 |
| Dissolved Selenium (Se) | mg/L | 0.00087 | 0.00020 | 9062853 |
| Dissolved Silicon (Si) | mg/L | 4.7 | 0.10 | 9065648 |
| Dissolved Silver (Ag) | mg/L | <0.00010 | 0.00010 | 9062853 |
| Dissolved Sodium (Na) | mg/L | 13 | 0.50 | 9065648 |
| Dissolved Strontium (Sr) | mg/L | 0.84 | 0.020 | 9065648 |
| Dissolved Sulphur (S) | mg/L | 200 | 0.20 | 9065648 |
| Dissolved Thallium (Tl) | mg/L | <0.00020 | 0.00020 | 9062853 |
| Dissolved Tin (Sn) | mg/L | <0.0010 | 0.0010 | 9062853 |
| Dissolved Titanium (Ti) | mg/L | <0.0010 | 0.0010 | 9062853 |
| RDL = Reportable Detection Limit | | | | |



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Maxxam Job #: B857696
Report Date: 2018/07/20

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## REGULATED METALS INCLUDING MERCURY-DISS (WATER)

| Maxxam ID | | TV8241 | | |
|---|---|---|---|---|
| Sampling Date | | 2018/07/11 10:42 | | |
| COC Number | | 298588 | | |
| | **UNITS** | **WSY 97-1-5** | **RDL** | **QC Batch** |
| Dissolved Uranium (U) | mg/L | 0.0044 | 0.00010 | 9062853 |
| Dissolved Vanadium (V) | mg/L | <0.0010 | 0.0010 | 9062853 |
| Dissolved Zinc (Zn) | mg/L | 0.019 | 0.0030 | 9062853 |
| **Low Level Elements** | | | | |
| Dissolved Mercury (Hg) | mg/L | <0.0000020 | 0.0000020 | 9069626 |
| RDL = Reportable Detection Limit | | | | |



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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## RESULTS OF CHEMICAL ANALYSES OF WATER

| Maxxam ID | | TV8241 | | |
|---|---|---|---|---|
| Sampling Date | | 2018/07/11 10:42 | | |
| COC Number | | 298588 | | |
| | **UNITS** | **WSY 97-1-5** | **RDL** | **QC Batch** |
| **Calculated Parameters** | | | | |
| Hardness (CaCO3) | mg/L | 1100 | 0.50 | 9062673 |
| Ion Balance (% Difference) | % | 1.6 | N/A | 9062478 |
| Dissolved Nitrate (NO3) | mg/L | 0.27 | 0.044 | 9062674 |
| Nitrate plus Nitrite (N) | mg/L | 0.078 | 0.014 | 9062675 |
| Dissolved Nitrite (NO2) | mg/L | 0.061 | 0.033 | 9062674 |
| **Misc. Inorganics** | | | | |
| Conductivity | uS/cm | 1700 | 2.0 | 9065985 |
| Total Dissolved Solids | mg/L | 1400 | 10 | 9064367 |
| **Anions** | | | | |
| Alkalinity (PP as CaCO3) | mg/L | <1.0 | 1.0 | 9065983 |
| Alkalinity (Total as CaCO3) | mg/L | 440 | 1.0 | 9065983 |
| Bicarbonate (HCO3) | mg/L | 540 | 1.0 | 9065983 |
| Carbonate (CO3) | mg/L | <1.0 | 1.0 | 9065983 |
| Hydroxide (OH) | mg/L | <1.0 | 1.0 | 9065983 |
| Dissolved Sulphate (SO4) | mg/L | 570 (1) | 5.0 | 9065945 |
| Dissolved Chloride (Cl) | mg/L | 24 | 1.0 | 9065944 |
| **Nutrients** | | | | |
| Dissolved Nitrite (N) | mg/L | 0.018 | 0.010 | 9063626 |
| Dissolved Nitrate (N) | mg/L | 0.060 | 0.010 | 9063626 |
| **Misc. Organics** | | | | |
| Phenols | mg/L | 0.0083 | 0.0020 | 9067714 |

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



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Maxxam Job #: B857696
Report Date: 2018/07/20

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## TEST SUMMARY

**Maxxam ID:** TV8241
**Sample ID:** WSY 97-1-5
**Matrix:** Water

**Collected:** 2018/07/11
**Relinquished:** 2018/07/12
**Received:** 2018/07/13

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | AT/ALK | 9065983 | N/A | 2018/07/18 | Malina Alamyar |
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9063454 | N/A | 2018/07/15 | Hetul Patel |
| F1-BTEX | CALC/MS | 9061719 | N/A | 2018/07/18 | Automated Statchk |
| Cadmium - low level CCME - Dissolved | CALC/MS | 9062475 | N/A | 2018/07/16 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 9065944 | N/A | 2018/07/18 | Chelsea Harmatys |
| Conductivity @25C | COND | 9065985 | N/A | 2018/07/18 | Malina Alamyar |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9063118 | 2018/07/18 | 2018/07/18 | Grace Guo |
| Hardness | CALC | 9062673 | N/A | 2018/07/19 | Automated Statchk |
| Mercury - Low Level (Dissolved) | CV/AF | 9069626 | 2018/07/19 | 2018/07/19 | Mahboubeh Bahadori |
| Elements by ICP - Dissolved | ICPA | 9065648 | N/A | 2018/07/18 | Jonathan Kuprowsky |
| Elements by ICPMS - Dissolved | ICPM | 9062853 | N/A | 2018/07/14 | Andrew Payne |
| Ion Balance | CALC | 9062478 | N/A | 2018/07/16 | Automated Statchk |
| Nitrate and Nitrite | CALC | 9062674 | N/A | 2018/07/16 | Automated Statchk |
| Nitrate + Nitrite-N (calculated) | CALC | 9062675 | N/A | 2018/07/16 | Automated Statchk |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9063626 | N/A | 2018/07/14 | Krista Dawe |
| Phenols (4-AAP) | TECH/4AAP | 9067714 | N/A | 2018/07/18 | Ashley Fedoriuk |
| Sulphate by Automated Colourimetry | KONE | 9065945 | N/A | 2018/07/18 | Chelsea Harmatys |
| Total Dissolved Solids (Filt. Residue) | BAL | 9064367 | 2018/07/16 | 2018/07/18 | Luminita Chiosa |



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Maxxam Job #: B857696
Report Date: 2018/07/20

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## GENERAL COMMENTS

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

| | |
|---|---|
| Package 1 | 5.3°C |

**Results relate only to the items tested.**



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Report Date: 2018/07/20

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| 9062853 | APY | Method Blank | Dissolved Aluminum (Al) | 2018/07/14 | <0.0030 | | mg/L | |
| | | | Dissolved Chromium (Cr) | 2018/07/14 | <0.0010 | | mg/L | |
| | | | Dissolved Cobalt (Co) | 2018/07/14 | <0.00030 | | mg/L | |
| | | | Dissolved Copper (Cu) | 2018/07/14 | <0.00020 | | mg/L | |
| | | | Dissolved Lead (Pb) | 2018/07/14 | <0.00020 | | mg/L | |
| | | | Dissolved Antimony (Sb) | 2018/07/14 | <0.00060 | | mg/L | |
| | | | Dissolved Molybdenum (Mo) | 2018/07/14 | <0.00020 | | mg/L | |
| | | | Dissolved Nickel (Ni) | 2018/07/14 | <0.00050 | | mg/L | |
| | | | Dissolved Selenium (Se) | 2018/07/14 | <0.00020 | | mg/L | |
| | | | Dissolved Silver (Ag) | 2018/07/14 | <0.00010 | | mg/L | |
| | | | Dissolved Arsenic (As) | 2018/07/14 | <0.00020 | | mg/L | |
| | | | Dissolved Thallium (Tl) | 2018/07/14 | <0.00020 | | mg/L | |
| | | | Dissolved Tin (Sn) | 2018/07/14 | <0.0010 | | mg/L | |
| | | | Dissolved Titanium (Ti) | 2018/07/14 | <0.0010 | | mg/L | |
| | | | Dissolved Uranium (U) | 2018/07/14 | <0.00010 | | mg/L | |
| | | | Dissolved Vanadium (V) | 2018/07/14 | <0.0010 | | mg/L | |
| | | | Dissolved Zinc (Zn) | 2018/07/14 | <0.0030 | | mg/L | |
| | | | Dissolved Beryllium (Be) | 2018/07/14 | <0.0010 | | mg/L | |
| 9063118 | GG3 | Method Blank | O-TERPHENYL (sur.) | 2018/07/18 | | 94 | % | 60 - 140 |
| | | | F2 (C10-C16 Hydrocarbons) | 2018/07/18 | <0.10 | | mg/L | |
| 9063454 | HP5 | Method Blank | 1,4-Difluorobenzene (sur.) | 2018/07/16 | | 101 | % | 50 - 140 |
| | | | 4-Bromofluorobenzene (sur.) | 2018/07/16 | | 100 | % | 50 - 140 |
| | | | D4-1,2-Dichloroethane (sur.) | 2018/07/16 | | 96 | % | 50 - 140 |
| | | | Benzene | 2018/07/16 | <0.00040 | | mg/L | |
| | | | Toluene | 2018/07/16 | <0.00040 | | mg/L | |
| | | | Ethylbenzene | 2018/07/16 | <0.00040 | | mg/L | |
| | | | m & p-Xylene | 2018/07/16 | <0.00080 | | mg/L | |
| | | | o-Xylene | 2018/07/16 | <0.00040 | | mg/L | |
| | | | F1 (C6-C10) | 2018/07/16 | <0.10 | | mg/L | |
| 9063626 | KD5 | Method Blank | Dissolved Nitrite (N) | 2018/07/14 | <0.010 | | mg/L | |
| | | | Dissolved Nitrate (N) | 2018/07/14 | <0.010 | | mg/L | |
| 9064367 | LCA | Method Blank | Total Dissolved Solids | 2018/07/18 | <10 | | mg/L | |
| 9065648 | JK9 | Method Blank | Dissolved Iron (Fe) | 2018/07/18 | <0.060 | | mg/L | |
| | | | Dissolved Lithium (Li) | 2018/07/18 | <0.020 | | mg/L | |
| | | | Dissolved Magnesium (Mg) | 2018/07/18 | <0.20 | | mg/L | |
| | | | Dissolved Manganese (Mn) | 2018/07/18 | <0.0040 | | mg/L | |
| | | | Dissolved Potassium (K) | 2018/07/18 | <0.30 | | mg/L | |
| | | | Dissolved Sodium (Na) | 2018/07/18 | <0.50 | | mg/L | |
| | | | Dissolved Strontium (Sr) | 2018/07/18 | <0.020 | | mg/L | |
| | | | Dissolved Sulphur (S) | 2018/07/18 | <0.20 | | mg/L | |
| | | | Dissolved Phosphorus (P) | 2018/07/18 | <0.10 | | mg/L | |
| | | | Dissolved Barium (Ba) | 2018/07/18 | <0.010 | | mg/L | |
| | | | Dissolved Silicon (Si) | 2018/07/18 | <0.10 | | mg/L | |
| | | | Dissolved Boron (B) | 2018/07/18 | <0.020 | | mg/L | |
| | | | Dissolved Calcium (Ca) | 2018/07/18 | <0.30 | | mg/L | |
| 9065944 | CH7 | Method Blank | Dissolved Chloride (Cl) | 2018/07/18 | <1.0 | | mg/L | |
| 9065945 | CH7 | Method Blank | Dissolved Sulphate (SO4) | 2018/07/18 | <1.0 | | mg/L | |
| 9065983 | MA4 | Method Blank | Alkalinity (Total as CaCO3) | 2018/07/18 | <1.0 | | mg/L | |
| | | | Alkalinity (PP as CaCO3) | 2018/07/18 | <1.0 | | mg/L | |
| | | | Bicarbonate (HCO3) | 2018/07/18 | <1.0 | | mg/L | |
| | | | Carbonate (CO3) | 2018/07/18 | <1.0 | | 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 #: B857696
Report Date: 2018/07/20

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT(CONT'D)

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| | | | Hydroxide (OH) | 2018/07/18 | <1.0 | | mg/L | |
| 9065985 | MA4 | Method Blank | Conductivity | 2018/07/18 | <2.0 | | uS/cm | |
| 9067714 | AF6 | Method Blank | Phenols | 2018/07/18 | <0.0020 | | mg/L | |
| 9069626 | BAH | Method Blank | Dissolved Mercury (Hg) | 2018/07/19 | <0.0000020 | | mg/L | |
| 9062853 | APY | LCS | Dissolved Aluminum (Al) | 2018/07/15 | | 104 | % | 80 - 120 |
| | | | Dissolved Chromium (Cr) | 2018/07/15 | | 99 | % | 80 - 120 |
| | | | Dissolved Cobalt (Co) | 2018/07/15 | | 98 | % | 80 - 120 |
| | | | Dissolved Copper (Cu) | 2018/07/15 | | 98 | % | 80 - 120 |
| | | | Dissolved Lead (Pb) | 2018/07/15 | | 100 | % | 80 - 120 |
| | | | Dissolved Antimony (Sb) | 2018/07/15 | | 97 | % | 80 - 120 |
| | | | Dissolved Molybdenum (Mo) | 2018/07/15 | | 87 | % | 80 - 120 |
| | | | Dissolved Nickel (Ni) | 2018/07/15 | | 98 | % | 80 - 120 |
| | | | Dissolved Selenium (Se) | 2018/07/15 | | 93 | % | 80 - 120 |
| | | | Dissolved Silver (Ag) | 2018/07/15 | | 100 | % | 80 - 120 |
| | | | Dissolved Arsenic (As) | 2018/07/15 | | 94 | % | 80 - 120 |
| | | | Dissolved Thallium (Tl) | 2018/07/15 | | 102 | % | 80 - 120 |
| | | | Dissolved Tin (Sn) | 2018/07/15 | | 96 | % | 80 - 120 |
| | | | Dissolved Titanium (Ti) | 2018/07/15 | | 101 | % | 80 - 120 |
| | | | Dissolved Uranium (U) | 2018/07/15 | | 99 | % | 80 - 120 |
| | | | Dissolved Vanadium (V) | 2018/07/15 | | 97 | % | 80 - 120 |
| | | | Dissolved Zinc (Zn) | 2018/07/15 | | 101 | % | 80 - 120 |
| | | | Dissolved Beryllium (Be) | 2018/07/15 | | 98 | % | 80 - 120 |
| 9063118 | GG3 | LCS | O-TERPHENYL (sur.) | 2018/07/18 | | 91 | % | 60 - 140 |
| | | | F2 (C10-C16 Hydrocarbons) | 2018/07/18 | | 96 | % | 60 - 140 |
| 9063454 | HP5 | LCS | 1,4-Difluorobenzene (sur.) | 2018/07/15 | | 95 | % | 50 - 140 |
| | | | 4-Bromofluorobenzene (sur.) | 2018/07/15 | | 99 | % | 50 - 140 |
| | | | D4-1,2-Dichloroethane (sur.) | 2018/07/15 | | 99 | % | 50 - 140 |
| | | | Benzene | 2018/07/15 | | 85 | % | 60 - 130 |
| | | | Toluene | 2018/07/15 | | 88 | % | 60 - 130 |
| | | | Ethylbenzene | 2018/07/15 | | 94 | % | 60 - 130 |
| | | | m & p-Xylene | 2018/07/15 | | 91 | % | 60 - 130 |
| | | | o-Xylene | 2018/07/15 | | 92 | % | 60 - 130 |
| | | | F1 (C6-C10) | 2018/07/15 | | 92 | % | 60 - 140 |
| 9063626 | KD5 | LCS | Dissolved Nitrite (N) | 2018/07/14 | | 101 | % | 80 - 120 |
| | | | Dissolved Nitrate (N) | 2018/07/14 | | 101 | % | 80 - 120 |
| 9064367 | LCA | LCS | Total Dissolved Solids | 2018/07/18 | | 105 | % | 80 - 120 |
| 9065648 | JK9 | LCS | Dissolved Iron (Fe) | 2018/07/18 | | 97 | % | 80 - 120 |
| | | | Dissolved Lithium (Li) | 2018/07/18 | | 96 | % | 80 - 120 |
| | | | Dissolved Magnesium (Mg) | 2018/07/18 | | 102 | % | 80 - 120 |
| | | | Dissolved Manganese (Mn) | 2018/07/18 | | 98 | % | 80 - 120 |
| | | | Dissolved Potassium (K) | 2018/07/18 | | 102 | % | 80 - 120 |
| | | | Dissolved Sodium (Na) | 2018/07/18 | | 101 | % | 80 - 120 |
| | | | Dissolved Strontium (Sr) | 2018/07/18 | | 96 | % | 80 - 120 |
| | | | Dissolved Phosphorus (P) | 2018/07/18 | | 105 | % | 80 - 120 |
| | | | Dissolved Barium (Ba) | 2018/07/18 | | 99 | % | 80 - 120 |
| | | | Dissolved Silicon (Si) | 2018/07/18 | | 97 | % | 80 - 120 |
| | | | Dissolved Boron (B) | 2018/07/18 | | 100 | % | 80 - 120 |
| | | | Dissolved Calcium (Ca) | 2018/07/18 | | 100 | % | 80 - 120 |
| 9065944 | CH7 | LCS | Dissolved Chloride (Cl) | 2018/07/18 | | 108 | % | 80 - 120 |
| 9065945 | CH7 | LCS | Dissolved Sulphate (SO4) | 2018/07/18 | | 104 | % | 80 - 120 |
| 9065983 | MA4 | LCS | Alkalinity (Total as CaCO3) | 2018/07/18 | | 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 #: B857696
Report Date: 2018/07/20

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT(CONT'D)

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| 9065985 | MA4 | LCS | Conductivity | 2018/07/18 | | 102 | % | 90 - 110 |
| 9067714 | AF6 | LCS | Phenols | 2018/07/18 | | 89 | % | 80 - 120 |
| 9069626 | BAH | LCS | Dissolved Mercury (Hg) | 2018/07/19 | | 99 | % | 80 - 120 |
| 9069626 | BAH | SRM | Dissolved Mercury (Hg) | 2018/07/19 | | 94 | % | 80 - 120 |

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

LCS: 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.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.



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Maxxam Job #: B857696
Report Date: 2018/07/20

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## VALIDATION SIGNATURE PAGE

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

Justin Geisel, B.Sc., Organics Supervisor

Poonam Sharma, cCT, Organics Supervisor

Winnie Au, B.Sc., QP, 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.



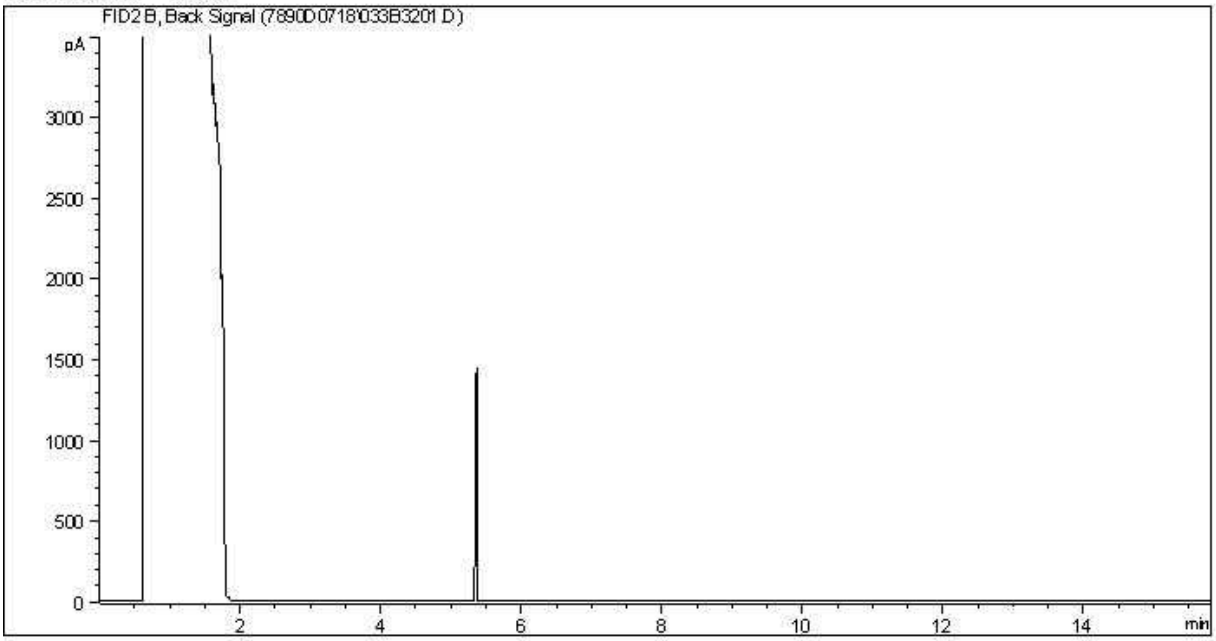
Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B857696
Report Date: 2018/07/20
Maxxam Sample: TV8241

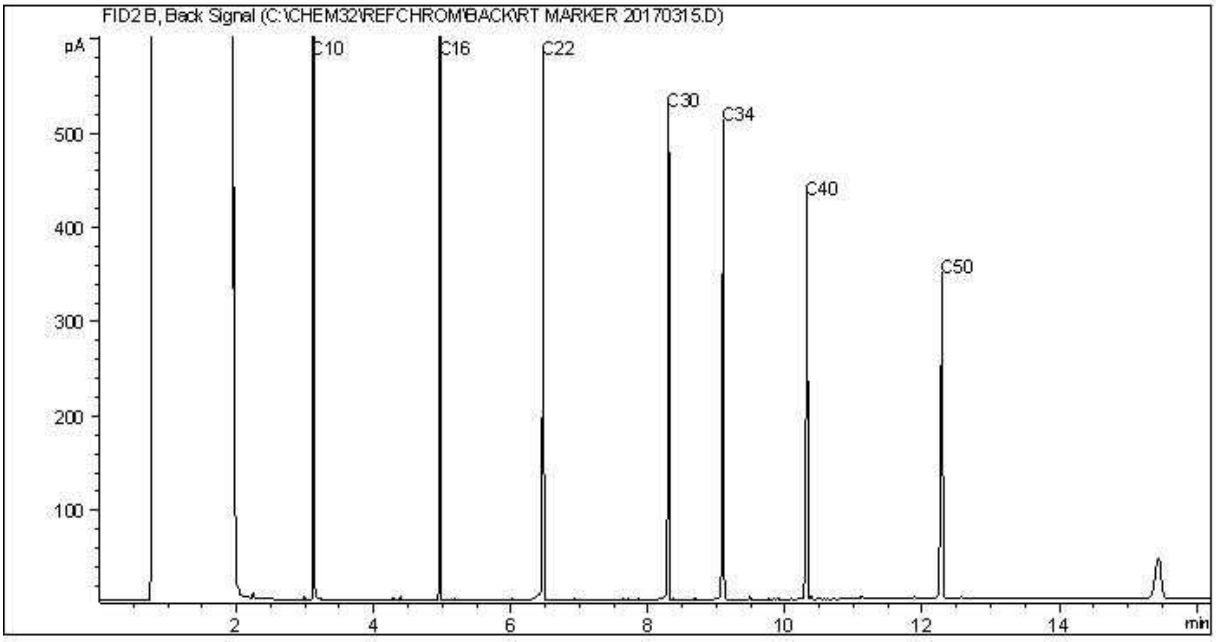
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: WSY 97-1-5

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890D




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam
A Bureau Veritas Group Company

☐ Calgary
4000 19th St. NE, T2E 6P8
Phone: (403) 291-3077
Fax: (403) 735-2240
Toll Free: (800) 386-7247

☒ Edmonton
9331 - 48 Street, T6B 2R4
Phone: (780) 577-7100
Fax: (780) 450-4187
Toll Free: (800) 386-7247

# EXXON MOBIL/IMPERIAL OIL - MAXXAM
# CHAIN-OF-CUSTODY RECORD

KVT



C of C # 298588

| INVOICE INFORMATION | REPORT INFORMATION |
|---|---|
| Company Name: ☒ Imperial Oil ☐ ExxonMobil | Company Name: Worley Parsons |
| Contact Name: Worley Parsons | Contact Name: Stacy Gibb |
| Address: 500, 151 Canada Olympic Rd SW Calgary, AB T3B 6B7 | Address: 500, 151 Canada Olympic Rd SW Calgary, AB T3B 6B7 |
| Email: sanj.perera@advisian.com | Email: stacy.gibb@advisian.com |
| Ph: 587-952-1490 | Ph: 403-247-0200 |
| Sampler Name (Print): Melissa Lord, Ekaterina Yakushina | Consultant Project #: mw 407011-00586-400 |

| FIELD SAMPLE ID | MATRIX: GROUND WATER | MATRIX: SURFACE WATER | MATRIX: SOIL | MATRIX: OTHER | # CONTAINERS | SAMPLING: DATE (YYYY/MM/DD) | SAMPLING: TIME (24 HR) | FIELD FILTERED & PRESERVED | LAB FILTRATION REQUIRED | VOC | PAH | PHCs (FRACTIONS 1-2 PLUS BTEX) | PHCs (FRACTIONS 1-4 PLUS BTEX) | PHCs (FRACTIONS 2-4) | PHCs (FRACTION 1 PLUS BTEX) | GRAIN SIZE (75 MICRON) | TEXTURE (% SAND, SILT, CLAY) | PARTICLE SIZE DISTRIBUTION WITH GRAPH | REGULATED METALS: TOT ☐ DIS ☒ | MERCURY: TOTAL ☐ DISSOLVED ☒ | SALINITY SOIL | FERTILIZER SOIL | FERTILIZER WATER | NUTRIENTS SOIL | ROUTINE POTABILITY | pH ☐ EC ☐ ALKALINITY ☐ | BASIC CLASS II LANDFILL PKG | Phenols by 4AAP | Limited Sample - contact Melissa | Lord for priority analysis (partial/missing bottles) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 WSY 97-1-5 | X | | | | 8 | 2018/07/11 | 10:42 | X | | | | X | | | | | | | X | X | | | | | X | | | X | X | |
| 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

IOL SITE LOCATION: Norman Wells, NT

IOL PROJECT # (if applicable): N/A

MAXXAM TASK ORDER # OR SERVICE ORDER # + LINE ITEM: mw 407011-~~00586~~ 00586-400

REGULATORY CRITERIA / DETECTION LIMITS:
☐ Alberta Tier 1 ☐ CDWG
☐ SEQG (SK) ☐ NoSC (SK)
☒ CCME (incl. level) FAL ☐ Other

SPECIAL INSTRUCTIONS:
also email:
- standard Norman Wells list
- melissa.lord@advisian.com

IES A2601436

# JARS USED & NOT SUBMITTED (Enter N/A for Water): N/A

TURNAROUND TIME
Standard (5 days) ☒
Rush (3 days) ☐
(2 days) ☐
(1 day) ☐
(same day) ☐
Date Required

| | YES | NO | COOLER ID # | | | | YES | NO | COOLER ID # | | | | YES | NO | COOLER ID # | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SEAL PRESENT | ✓ | | TEMP °C | 6 | 5 | 5 | SEAL PRESENT | | TEMP °C | 1 | 2 | 3 | SEAL PRESENT | | TEMP °C | 1 | 2 | 3 |
| SEAL INTACT | ✓ | | | 1 | 2 | 3 | SEAL INTACT | | | | | | SEAL INTACT | | | | | |
| COOLING MEDIA PRESENT | ✓ | | | | | | COOLING MEDIA PRESENT | | | | | | COOLING MEDIA PRESENT | | | | | |

LAB USE ONLY
MAXXAM JOB # 3857696

| RELINQUISHED BY: | | DATE: | TIME (24 HR) | RECEIVED BY: | | DATE: | TIME (24 HR) |
|---|---|---|---|---|---|---|---|
| 1. | Melissa Lord | 2018/07/12 | 08:00 | 1. | Kyle VanThournout | 2018/07/13 | 09:23 |
| 2. | | | | 2. | | | |
| 3. | | | | 3. | | | |

SAMPLES
LABELED BY: KVT
VERIFIED BY: ALK

COC-1010 (06/2016) IOL-AB White: Maxxam Yellow: Client

# DATA QUALITY REVIEW CHECKLIST - IMPERIAL OIL PROJECTS

Consultant: Advisian

Sampling Date: 13-Jul-18

Location: Norman Wells

Laboratory : Maxxam Edmonton

Consultant Project Number: 407011-00586-400

Sample Submission Number: B858056

Are All Laboratory QC Within Acceptance Criteria (Yes, No, Not Applicable)?

| | Yes | No | NA | Comments |
|---|---|---|---|---|
| Instrument Surrogate Recovery | x | | | All laboratory QC met acceptance criteria. |
| Extraction Surrogate Recovery | x | | | |
| Method Blank Concentration | x | | | |
| Matrix Duplicate RPD | | | x | |
| Matrix Spike Recovery | | | x | |
| Lab Control Sample Recovery | x | | | |

Are All Field QC Samples Within Alert Limits (Yes, No, Not Applicable)?

| | Yes | No | NA | Comments |
|---|---|---|---|---|
| Field Blank Concentration | x | | | All field QC samples met alert limits. |
| Trip Blank Concentration | x | | | |
| Equipment Blank Concentration | | | x | |
| Field Duplicate RPD | | | x | |

| | |
|---|---|
| Has CoA been signed off (Yes/No)?: | Yes |
| Has lab warranted all tests were analyzed following SOP's in CoA (Yes/No)?: | Yes |
| Were all samples analyzed within hold times (Yes/No)?: | Yes |
| All volatiles samples methanol extracted (if required) within 48 hours (Yes/No)?: | n/a |
| Is Chain of Custody completed and signed (Yes/No)?: | Yes |
| Were sample temperatures acceptable when they reached lab (Yes/No)?: | Yes |

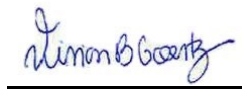
Was a Data Quality Overview (DQO) issued (Yes/No)?: No

Date DQO was received: n/a

Is data considered to be reliable (Yes/No)?: Yes

If answer is "No", describe and provide rationale:

Data Reviewed by (Print): Vivian Baptista

Data Reviewed by (Signature): 

Date: 23-Aug-18

Task Order#: 407011-00586-400
Site#: N/A
Site Location: NORMAN WELLS, NT
Project #: 407011-00586-400
Your C.O.C. #: 298577

**Attention: Stacy Gibb**

Imperial Oil Ltd - Worley Parsons
IES A2601436
Suite 300, 8615 51 Ave
Edmonton, AB
CANADA T6E 6A8

**Report Date: 2018/07/23**
Report #: R2592963
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B858056**
**Received: 2018/07/15, 10:40**

Sample Matrix: Water
# Samples Received: 3

| Analyses | Quantity | Laboratory Method | Primary Reference |
|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | 1 | AB SOP-00005 | SM 22 2320 B m |
| BTEX/F1 in Water by HS GC/MS/FID | 3 | AB SOP-00039 | CCME CWS/EPA 8260d m |
| F1-BTEX | 3 | AB SOP-00039 | Auto Calc |
| Cadmium - low level CCME - Dissolved | 1 | AB WI-00065 | Auto Calc |
| Chloride by Automated Colourimetry | 1 | AB SOP-00020 | SM 22 4500-Cl-E m |
| Conductivity @25C | 1 | AB SOP-00005 | SM 22 2510 B m |
| CCME Hydrocarbons in Water (F2; C10-C16) (1) | 3 | AB SOP-00037 / AB SOP-00040 | CCME PHC-CWS m |
| Hardness | 1 | AB WI-00065 | Auto Calc |
| Mercury - Low Level (Dissolved) (2) | 1 | EENVSOP-00031 | EPA 1631E/245.1 R3 m |
| Elements by ICP - Dissolved (2) | 1 | AB SOP-00042 | EPA 6010d R4 m |
| Elements by ICPMS - Dissolved (2) | 1 | AB SOP-00043 | EPA 6020b R2 m |
| Ion Balance | 1 | AB WI-00065 | Auto Calc |
| Nitrate and Nitrite | 1 | AB WI-00065 | Auto Calc |
| Nitrate + Nitrite-N (calculated) | 1 | AB WI-00065 | Auto Calc |
| Nitrogen (Nitrite - Nitrate) by IC | 1 | AB SOP-00023 | SM 23 4110 B m |
| Phenols (4-AAP) | 1 | EENVSOP-00061 | MMCW 154 1996 m |
| Sulphate by Automated Colourimetry | 1 | AB SOP-00018 | SM 22 4500-SO4 E m |
| Total Dissolved Solids (Filt. Residue) | 1 | AB SOP-00065 | SM 22 2540 C m |

**Remarks:**

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. All samples were analyzed within hold time unless otherwise flagged.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise

Task Order#: 407011-00586-400
Site#: N/A
Site Location: NORMAN WELLS, NT
Project #: 407011-00586-400
Your C.O.C. #: 298577

**Attention: Stacy Gibb**

Imperial Oil Ltd - Worley Parsons
IES A2601436
Suite 300, 8615 51 Ave
Edmonton, AB
CANADA T6E 6A8

**Report Date: 2018/07/23**
Report #: R2592963
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B858056**
**Received: 2018/07/15, 10:40**
agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

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) Silica gel clean up employed.
(2) Dissolved > Total Imbalance: Whenever applicable, Dissolved >Total for any parameter that falls within method uncertainty for duplicates is likely equivalent. If RPD is >20% samples were reanalyzed and confirmed.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Jenna Chernuka, Project Manager
Email: JChernuka@maxxam.ca
Phone# (780)577-7178

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Maxxam Job #: B858056
Report Date: 2018/07/23

Imperial Oil Ltd - Worley Parsons
Task Order#: 407011-00586-400
Site#: N/A
Site Location: NORMAN WELLS, NT
Project #: 407011-00586-400

## AT1 BTEX AND F1-F2 IN WATER (WATER)

| Maxxam ID | | TW0508 | TW0509 | TW0510 | | |
|---|---|---|---|---|---|---|
| Sampling Date | | 2018/07/13 14:25 | 2018/07/13 17:00 | 2018/07/13 16:45 | | |
| COC Number | | 298577 | 298577 | 298577 | | |
| | **UNITS** | **C38 08-1-4** | **NWD 18-03** | **NWD 18-13** | **RDL** | **QC Batch** |
| **Ext. Pet. Hydrocarbon** | | | | | | |
| F2 (C10-C16 Hydrocarbons) | mg/L | <0.10 | <0.10 | <0.10 | 0.10 | 9066088 |
| **Volatiles** | | | | | | |
| Benzene | mg/L | <0.00040 | <0.00040 | <0.00040 | 0.00040 | 9064176 |
| Toluene | mg/L | <0.00040 | <0.00040 | <0.00040 | 0.00040 | 9064176 |
| Ethylbenzene | mg/L | <0.00040 | <0.00040 | <0.00040 | 0.00040 | 9064176 |
| m & p-Xylene | mg/L | <0.00080 | <0.00080 | <0.00080 | 0.00080 | 9064176 |
| o-Xylene | mg/L | <0.00040 | <0.00040 | <0.00040 | 0.00040 | 9064176 |
| Xylenes (Total) | mg/L | <0.00089 | <0.00089 | <0.00089 | 0.00089 | 9063900 |
| F1 (C6-C10) - BTEX | mg/L | <0.10 | <0.10 | <0.10 | 0.10 | 9063900 |
| F1 (C6-C10) | mg/L | <0.10 | <0.10 | <0.10 | 0.10 | 9064176 |
| **Extraction Surrogate Recovery (%)** | | | | | | |
| O-TERPHENYL (sur.) | % | 81 | 87 | 88 | | 9066088 |
| **Instrument Surrogate Recovery (%)** | | | | | | |
| 1,4-Difluorobenzene (sur.) | % | 100 | 102 | 101 | | 9064176 |
| 4-Bromofluorobenzene (sur.) | % | 99 | 101 | 99 | | 9064176 |
| D4-1,2-Dichloroethane (sur.) | % | 103 | 98 | 101 | | 9064176 |

RDL = Reportable Detection Limit



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Imperial Oil Ltd - Worley Parsons
Task Order#: 407011-00586-400
Site#: N/A
Site Location: NORMAN WELLS, NT
Project #: 407011-00586-400

## REGULATED METALS (CCME/AT1) - DISSOLVED

| Maxxam ID | | TW0508 | | |
|---|---|---|---|---|
| Sampling Date | | 2018/07/13 14:25 | | |
| COC Number | | 298577 | | |
| | **UNITS** | **C38 08-1-4** | **RDL** | **QC Batch** |
| **Low Level Elements** | | | | |
| Dissolved Cadmium (Cd) | mg/L | 0.000020 | 0.000020 | 9063901 |
| **Elements** | | | | |
| Dissolved Aluminum (Al) | mg/L | 0.055 | 0.0030 | 9064823 |
| Dissolved Antimony (Sb) | mg/L | <0.00060 | 0.00060 | 9064823 |
| Dissolved Arsenic (As) | mg/L | 0.0074 | 0.00020 | 9064823 |
| Dissolved Barium (Ba) | mg/L | 0.49 | 0.010 | 9068442 |
| Dissolved Beryllium (Be) | mg/L | <0.0010 | 0.0010 | 9064823 |
| Dissolved Boron (B) | mg/L | 0.026 | 0.020 | 9068442 |
| Dissolved Calcium (Ca) | mg/L | 150 | 0.30 | 9068442 |
| Dissolved Chromium (Cr) | mg/L | <0.0010 | 0.0010 | 9064823 |
| Dissolved Cobalt (Co) | mg/L | 0.0034 | 0.00030 | 9064823 |
| Dissolved Copper (Cu) | mg/L | 0.00030 | 0.00020 | 9064823 |
| Dissolved Iron (Fe) | mg/L | 24 | 0.060 | 9068442 |
| Dissolved Lead (Pb) | mg/L | <0.00020 | 0.00020 | 9064823 |
| Dissolved Lithium (Li) | mg/L | 0.023 | 0.020 | 9068442 |
| Dissolved Magnesium (Mg) | mg/L | 46 | 0.20 | 9068442 |
| Dissolved Manganese (Mn) | mg/L | 1.7 | 0.0040 | 9068442 |
| Dissolved Molybdenum (Mo) | mg/L | <0.00020 | 0.00020 | 9064823 |
| Dissolved Nickel (Ni) | mg/L | 0.0058 | 0.00050 | 9064823 |
| Dissolved Phosphorus (P) | mg/L | 0.36 | 0.10 | 9068442 |
| Dissolved Potassium (K) | mg/L | 3.0 | 0.30 | 9068442 |
| Dissolved Selenium (Se) | mg/L | 0.00083 | 0.00020 | 9064823 |
| Dissolved Silicon (Si) | mg/L | 9.1 | 0.10 | 9068442 |
| Dissolved Silver (Ag) | mg/L | <0.00010 | 0.00010 | 9064823 |
| Dissolved Sodium (Na) | mg/L | 56 | 0.50 | 9068442 |
| Dissolved Strontium (Sr) | mg/L | 0.58 | 0.020 | 9068442 |
| Dissolved Sulphur (S) | mg/L | 11 | 0.20 | 9068442 |
| Dissolved Thallium (Tl) | mg/L | <0.00020 | 0.00020 | 9064823 |
| Dissolved Tin (Sn) | mg/L | <0.0010 | 0.0010 | 9064823 |
| Dissolved Titanium (Ti) | mg/L | 0.0012 | 0.0010 | 9064823 |
| RDL = Reportable Detection Limit | | | | |



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Maxxam Job #: B858056
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Imperial Oil Ltd - Worley Parsons
Task Order#: 407011-00586-400
Site#: N/A
Site Location: NORMAN WELLS, NT
Project #: 407011-00586-400

## REGULATED METALS (CCME/AT1) - DISSOLVED

| Maxxam ID | | TW0508 | | |
|---|---|---|---|---|
| Sampling Date | | 2018/07/13 14:25 | | |
| COC Number | | 298577 | | |
| | **UNITS** | **C38 08-1-4** | **RDL** | **QC Batch** |
| Dissolved Uranium (U) | mg/L | 0.00089 | 0.00010 | 9064823 |
| Dissolved Vanadium (V) | mg/L | 0.0011 | 0.0010 | 9064823 |
| Dissolved Zinc (Zn) | mg/L | 0.0090 | 0.0030 | 9064823 |
| RDL = Reportable Detection Limit | | | | |



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Imperial Oil Ltd - Worley Parsons
Task Order#: 407011-00586-400
Site#: N/A
Site Location: NORMAN WELLS, NT
Project #: 407011-00586-400

## RESULTS OF CHEMICAL ANALYSES OF WATER

| Maxxam ID | | TW0508 | | |
|---|---|---|---|---|
| Sampling Date | | 2018/07/13 14:25 | | |
| COC Number | | 298577 | | |
| | **UNITS** | **C38 08-1-4** | **RDL** | **QC Batch** |
| **Calculated Parameters** | | | | |
| Hardness (CaCO3) | mg/L | 560 | 0.50 | 9063903 |
| Ion Balance (% Difference) | % | 5.7 | N/A | 9063904 |
| Dissolved Nitrate (NO3) | mg/L | <0.044 | 0.044 | 9063906 |
| Nitrate plus Nitrite (N) | mg/L | <0.014 | 0.014 | 9063907 |
| Dissolved Nitrite (NO2) | mg/L | <0.033 | 0.033 | 9063906 |
| **Misc. Inorganics** | | | | |
| Conductivity | uS/cm | 1400 | 2.0 | 9065981 |
| Total Dissolved Solids | mg/L | 900 (1) | 50 | 9068094 |
| **Anions** | | | | |
| Alkalinity (PP as CaCO3) | mg/L | <1.0 | 1.0 | 9065973 |
| Alkalinity (Total as CaCO3) | mg/L | 750 | 1.0 | 9065973 |
| Bicarbonate (HCO3) | mg/L | 920 | 1.0 | 9065973 |
| Carbonate (CO3) | mg/L | <1.0 | 1.0 | 9065973 |
| Hydroxide (OH) | mg/L | <1.0 | 1.0 | 9065973 |
| Dissolved Sulphate (SO4) | mg/L | 39 (2) | 2.0 | 9068596 |
| Dissolved Chloride (Cl) | mg/L | 21 | 1.0 | 9068595 |
| **Nutrients** | | | | |
| Dissolved Nitrite (N) | mg/L | <0.010 | 0.010 | 9064840 |
| Dissolved Nitrate (N) | mg/L | <0.010 | 0.010 | 9064840 |
| **Misc. Organics** | | | | |
| Phenols | mg/L | 0.023 | 0.0020 | 9071008 |

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limit raised based on sample volume used for analysis.

(2) Detection limits raised due to matrix interference.



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Imperial Oil Ltd - Worley Parsons
Task Order#: 407011-00586-400
Site#: N/A
Site Location: NORMAN WELLS, NT
Project #: 407011-00586-400

## ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

| Maxxam ID | | TW0508 | | |
|---|---|---|---|---|
| Sampling Date | | 2018/07/13 14:25 | | |
| COC Number | | 298577 | | |
| | **UNITS** | **C38 08-1-4** | **RDL** | **QC Batch** |
| **Low Level Elements** | | | | |
| Dissolved Mercury (Hg) | mg/L | <0.0000020 | 0.0000020 | 9071408 |
| RDL = Reportable Detection Limit | | | | |



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Maxxam Job #: B858056
Report Date: 2018/07/23

Imperial Oil Ltd - Worley Parsons
Task Order#: 407011-00586-400
Site#: N/A
Site Location: NORMAN WELLS, NT
Project #: 407011-00586-400

## TEST SUMMARY

**Maxxam ID:** TW0508
**Sample ID:** C38 08-1-4
**Matrix:** Water

**Collected:** 2018/07/13
**Relinquished:** 2018/07/13
**Received:** 2018/07/15

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | AT/ALK | 9065973 | N/A | 2018/07/17 | Malina Alamyar |
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9064176 | N/A | 2018/07/19 | Hetul Patel |
| F1-BTEX | CALC/MS | 9063900 | N/A | 2018/07/20 | Automated Statchk |
| Cadmium - low level CCME - Dissolved | CALC/MS | 9063901 | N/A | 2018/07/17 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 9068595 | N/A | 2018/07/19 | Chelsea Harmatys |
| Conductivity @25C | COND | 9065981 | N/A | 2018/07/17 | Malina Alamyar |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9066088 | 2018/07/19 | 2018/07/20 | Grace Guo |
| Hardness | CALC | 9063903 | N/A | 2018/07/20 | Automated Statchk |
| Mercury - Low Level (Dissolved) | CV/AF | 9071408 | 2018/07/20 | 2018/07/20 | Mahboubeh Bahadori |
| Elements by ICP - Dissolved | ICPA | 9068442 | N/A | 2018/07/20 | Jonathan Kuprowsky |
| Elements by ICPMS - Dissolved | ICPM | 9064823 | N/A | 2018/07/16 | Andrew Payne |
| Ion Balance | CALC | 9063904 | N/A | 2018/07/17 | Automated Statchk |
| Nitrate and Nitrite | CALC | 9063906 | N/A | 2018/07/18 | Automated Statchk |
| Nitrate + Nitrite-N (calculated) | CALC | 9063907 | N/A | 2018/07/18 | Automated Statchk |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9064840 | N/A | 2018/07/16 | Krista Dawe |
| Phenols (4-AAP) | TECH/4AAP | 9071008 | N/A | 2018/07/20 | Ying Yang |
| Sulphate by Automated Colourimetry | KONE | 9068596 | N/A | 2018/07/19 | Chelsea Harmatys |
| Total Dissolved Solids (Filt. Residue) | BAL | 9068094 | 2018/07/18 | 2018/07/19 | Luminita Chiosa |

**Maxxam ID:** TW0509
**Sample ID:** NWD 18-03
**Matrix:** Water

**Collected:** 2018/07/13
**Relinquished:** 2018/07/13
**Received:** 2018/07/15

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9064176 | N/A | 2018/07/19 | Hetul Patel |
| F1-BTEX | CALC/MS | 9063900 | N/A | 2018/07/20 | Automated Statchk |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9066088 | 2018/07/19 | 2018/07/20 | Grace Guo |

**Maxxam ID:** TW0510
**Sample ID:** NWD 18-13
**Matrix:** Water

**Collected:** 2018/07/13
**Relinquished:** 2018/07/13
**Received:** 2018/07/15

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9064176 | N/A | 2018/07/19 | Hetul Patel |
| F1-BTEX | CALC/MS | 9063900 | N/A | 2018/07/20 | Automated Statchk |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9066088 | 2018/07/19 | 2018/07/20 | Grace Guo |



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Imperial Oil Ltd - Worley Parsons
Task Order#: 407011-00586-400
Site#: N/A
Site Location: NORMAN WELLS, NT
Project #: 407011-00586-400

## GENERAL COMMENTS

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

| | |
|---|---|
| Package 1 | 3.0°C |

**Results relate only to the items tested.**



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Imperial Oil Ltd - Worley Parsons
Task Order#: 407011-00586-400
Site#: N/A
Site Location: NORMAN WELLS, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| 9064176 | HP5 | Method Blank | 1,4-Difluorobenzene (sur.) | 2018/07/19 | | 102 | % | 50 - 140 |
| | | | 4-Bromofluorobenzene (sur.) | 2018/07/19 | | 100 | % | 50 - 140 |
| | | | D4-1,2-Dichloroethane (sur.) | 2018/07/19 | | 95 | % | 50 - 140 |
| | | | Benzene | 2018/07/19 | <0.00040 | | mg/L | |
| | | | Toluene | 2018/07/19 | <0.00040 | | mg/L | |
| | | | Ethylbenzene | 2018/07/19 | <0.00040 | | mg/L | |
| | | | m & p-Xylene | 2018/07/19 | <0.00080 | | mg/L | |
| | | | o-Xylene | 2018/07/19 | <0.00040 | | mg/L | |
| | | | F1 (C6-C10) | 2018/07/19 | <0.10 | | mg/L | |
| 9064823 | APY | Method Blank | Dissolved Aluminum (Al) | 2018/07/16 | <0.0030 | | mg/L | |
| | | | Dissolved Chromium (Cr) | 2018/07/16 | <0.0010 | | mg/L | |
| | | | Dissolved Cobalt (Co) | 2018/07/16 | <0.00030 | | mg/L | |
| | | | Dissolved Copper (Cu) | 2018/07/16 | <0.00020 | | mg/L | |
| | | | Dissolved Lead (Pb) | 2018/07/16 | <0.00020 | | mg/L | |
| | | | Dissolved Antimony (Sb) | 2018/07/16 | <0.00060 | | mg/L | |
| | | | Dissolved Molybdenum (Mo) | 2018/07/16 | <0.00020 | | mg/L | |
| | | | Dissolved Nickel (Ni) | 2018/07/16 | <0.00050 | | mg/L | |
| | | | Dissolved Selenium (Se) | 2018/07/16 | <0.00020 | | mg/L | |
| | | | Dissolved Silver (Ag) | 2018/07/16 | <0.00010 | | mg/L | |
| | | | Dissolved Arsenic (As) | 2018/07/16 | <0.00020 | | mg/L | |
| | | | Dissolved Thallium (Tl) | 2018/07/16 | <0.00020 | | mg/L | |
| | | | Dissolved Tin (Sn) | 2018/07/16 | <0.0010 | | mg/L | |
| | | | Dissolved Titanium (Ti) | 2018/07/16 | <0.0010 | | mg/L | |
| | | | Dissolved Uranium (U) | 2018/07/16 | <0.00010 | | mg/L | |
| | | | Dissolved Vanadium (V) | 2018/07/16 | <0.0010 | | mg/L | |
| | | | Dissolved Zinc (Zn) | 2018/07/16 | <0.0030 | | mg/L | |
| | | | Dissolved Beryllium (Be) | 2018/07/16 | <0.0010 | | mg/L | |
| 9064840 | KD5 | Method Blank | Dissolved Nitrite (N) | 2018/07/16 | <0.010 | | mg/L | |
| | | | Dissolved Nitrate (N) | 2018/07/16 | <0.010 | | mg/L | |
| 9065973 | MA4 | Method Blank | Alkalinity (Total as CaCO3) | 2018/07/17 | <1.0 | | mg/L | |
| | | | Alkalinity (PP as CaCO3) | 2018/07/17 | <1.0 | | mg/L | |
| | | | Bicarbonate (HCO3) | 2018/07/17 | <1.0 | | mg/L | |
| | | | Carbonate (CO3) | 2018/07/17 | <1.0 | | mg/L | |
| | | | Hydroxide (OH) | 2018/07/17 | <1.0 | | mg/L | |
| 9065981 | MA4 | Method Blank | Conductivity | 2018/07/17 | <2.0 | | uS/cm | |
| 9066088 | GG3 | Method Blank | O-TERPHENYL (sur.) | 2018/07/20 | | 94 | % | 60 - 140 |
| | | | F2 (C10-C16 Hydrocarbons) | 2018/07/20 | <0.10 | | mg/L | |
| 9068094 | LCA | Method Blank | Total Dissolved Solids | 2018/07/19 | <10 | | mg/L | |
| 9068442 | JK9 | Method Blank | Dissolved Iron (Fe) | 2018/07/20 | <0.060 | | mg/L | |
| | | | Dissolved Lithium (Li) | 2018/07/20 | <0.020 | | mg/L | |
| | | | Dissolved Magnesium (Mg) | 2018/07/20 | <0.20 | | mg/L | |
| | | | Dissolved Manganese (Mn) | 2018/07/20 | <0.0040 | | mg/L | |
| | | | Dissolved Potassium (K) | 2018/07/20 | <0.30 | | mg/L | |
| | | | Dissolved Sodium (Na) | 2018/07/20 | <0.50 | | mg/L | |
| | | | Dissolved Strontium (Sr) | 2018/07/20 | <0.020 | | mg/L | |
| | | | Dissolved Sulphur (S) | 2018/07/20 | <0.20 | | mg/L | |
| | | | Dissolved Phosphorus (P) | 2018/07/20 | <0.10 | | mg/L | |
| | | | Dissolved Barium (Ba) | 2018/07/20 | <0.010 | | mg/L | |
| | | | Dissolved Silicon (Si) | 2018/07/20 | <0.10 | | mg/L | |
| | | | Dissolved Boron (B) | 2018/07/20 | <0.020 | | mg/L | |
| | | | Dissolved Calcium (Ca) | 2018/07/20 | <0.30 | | mg/L | |



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Task Order#: 407011-00586-400
Site#: N/A
Site Location: NORMAN WELLS, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT(CONT'D)

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| 9068595 | CH7 | Method Blank | Dissolved Chloride (Cl) | 2018/07/19 | <1.0 | | mg/L | |
| 9068596 | CH7 | Method Blank | Dissolved Sulphate (SO4) | 2018/07/19 | <1.0 | | mg/L | |
| 9071008 | YY | Method Blank | Phenols | 2018/07/20 | <0.0020 | | mg/L | |
| 9071408 | BAH | Method Blank | Dissolved Mercury (Hg) | 2018/07/20 | <0.0000020 | | mg/L | |
| 9064176 | HP5 | LCS | 1,4-Difluorobenzene (sur.) | 2018/07/19 | | 96 | % | 50 - 140 |
| | | | 4-Bromofluorobenzene (sur.) | 2018/07/19 | | 98 | % | 50 - 140 |
| | | | D4-1,2-Dichloroethane (sur.) | 2018/07/19 | | 98 | % | 50 - 140 |
| | | | Benzene | 2018/07/19 | | 89 | % | 60 - 130 |
| | | | Toluene | 2018/07/19 | | 91 | % | 60 - 130 |
| | | | Ethylbenzene | 2018/07/19 | | 97 | % | 60 - 130 |
| | | | m & p-Xylene | 2018/07/19 | | 96 | % | 60 - 130 |
| | | | o-Xylene | 2018/07/19 | | 94 | % | 60 - 130 |
| | | | F1 (C6-C10) | 2018/07/19 | | 95 | % | 60 - 140 |
| 9064823 | APY | LCS | Dissolved Aluminum (Al) | 2018/07/16 | | 107 | % | 80 - 120 |
| | | | Dissolved Chromium (Cr) | 2018/07/16 | | 97 | % | 80 - 120 |
| | | | Dissolved Cobalt (Co) | 2018/07/16 | | 98 | % | 80 - 120 |
| | | | Dissolved Copper (Cu) | 2018/07/16 | | 98 | % | 80 - 120 |
| | | | Dissolved Lead (Pb) | 2018/07/16 | | 98 | % | 80 - 120 |
| | | | Dissolved Antimony (Sb) | 2018/07/16 | | 99 | % | 80 - 120 |
| | | | Dissolved Molybdenum (Mo) | 2018/07/16 | | 87 | % | 80 - 120 |
| | | | Dissolved Nickel (Ni) | 2018/07/16 | | 96 | % | 80 - 120 |
| | | | Dissolved Selenium (Se) | 2018/07/16 | | 91 | % | 80 - 120 |
| | | | Dissolved Silver (Ag) | 2018/07/16 | | 99 | % | 80 - 120 |
| | | | Dissolved Arsenic (As) | 2018/07/16 | | 95 | % | 80 - 120 |
| | | | Dissolved Thallium (Tl) | 2018/07/16 | | 99 | % | 80 - 120 |
| | | | Dissolved Tin (Sn) | 2018/07/16 | | 98 | % | 80 - 120 |
| | | | Dissolved Titanium (Ti) | 2018/07/16 | | 98 | % | 80 - 120 |
| | | | Dissolved Uranium (U) | 2018/07/16 | | 97 | % | 80 - 120 |
| | | | Dissolved Vanadium (V) | 2018/07/16 | | 97 | % | 80 - 120 |
| | | | Dissolved Zinc (Zn) | 2018/07/16 | | 100 | % | 80 - 120 |
| | | | Dissolved Beryllium (Be) | 2018/07/16 | | 101 | % | 80 - 120 |
| 9064840 | KD5 | LCS | Dissolved Nitrite (N) | 2018/07/16 | | 100 | % | 80 - 120 |
| | | | Dissolved Nitrate (N) | 2018/07/16 | | 101 | % | 80 - 120 |
| 9065973 | MA4 | LCS | Alkalinity (Total as CaCO3) | 2018/07/17 | | 99 | % | 80 - 120 |
| 9065981 | MA4 | LCS | Conductivity | 2018/07/17 | | 100 | % | 90 - 110 |
| 9066088 | GG3 | LCS | O-TERPHENYL (sur.) | 2018/07/20 | | 94 | % | 60 - 140 |
| | | | F2 (C10-C16 Hydrocarbons) | 2018/07/20 | | 105 | % | 60 - 140 |
| 9068094 | LCA | LCS | Total Dissolved Solids | 2018/07/19 | | 100 | % | 80 - 120 |
| 9068442 | JK9 | LCS | Dissolved Iron (Fe) | 2018/07/20 | | 103 | % | 80 - 120 |
| | | | Dissolved Lithium (Li) | 2018/07/20 | | 106 | % | 80 - 120 |
| | | | Dissolved Magnesium (Mg) | 2018/07/20 | | 104 | % | 80 - 120 |
| | | | Dissolved Manganese (Mn) | 2018/07/20 | | 104 | % | 80 - 120 |
| | | | Dissolved Potassium (K) | 2018/07/20 | | 104 | % | 80 - 120 |
| | | | Dissolved Sodium (Na) | 2018/07/20 | | 106 | % | 80 - 120 |
| | | | Dissolved Strontium (Sr) | 2018/07/20 | | 105 | % | 80 - 120 |
| | | | Dissolved Phosphorus (P) | 2018/07/20 | | 103 | % | 80 - 120 |
| | | | Dissolved Barium (Ba) | 2018/07/20 | | 107 | % | 80 - 120 |
| | | | Dissolved Silicon (Si) | 2018/07/20 | | 101 | % | 80 - 120 |
| | | | Dissolved Boron (B) | 2018/07/20 | | 107 | % | 80 - 120 |
| | | | Dissolved Calcium (Ca) | 2018/07/20 | | 103 | % | 80 - 120 |
| 9068595 | CH7 | LCS | Dissolved Chloride (Cl) | 2018/07/19 | | 106 | % | 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 #: B858056
Report Date: 2018/07/23

Imperial Oil Ltd - Worley Parsons
Task Order#: 407011-00586-400
Site#: N/A
Site Location: NORMAN WELLS, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT(CONT'D)

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| 9068596 | CH7 | LCS | Dissolved Sulphate (SO4) | 2018/07/19 | | 107 | % | 80 - 120 |
| 9071008 | YY | LCS | Phenols | 2018/07/20 | | 90 | % | 80 - 120 |
| 9071408 | BAH | LCS | Dissolved Mercury (Hg) | 2018/07/20 | | 100 | % | 80 - 120 |
| 9071408 | BAH | SRM | Dissolved Mercury (Hg) | 2018/07/20 | | 93 | % | 80 - 120 |

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

LCS: 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.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.



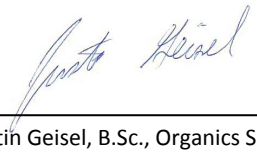
Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B858056
Report Date: 2018/07/23

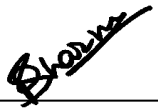
Imperial Oil Ltd - Worley Parsons
Task Order#: 407011-00586-400
Site#: N/A
Site Location: NORMAN WELLS, NT
Project #: 407011-00586-400

## VALIDATION SIGNATURE PAGE

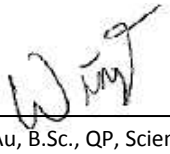
The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Justin Geisel, B.Sc., Organics Supervisor



Poonam Sharma, cCT, Organics Supervisor



Winnie Au, B.Sc., QP, 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.



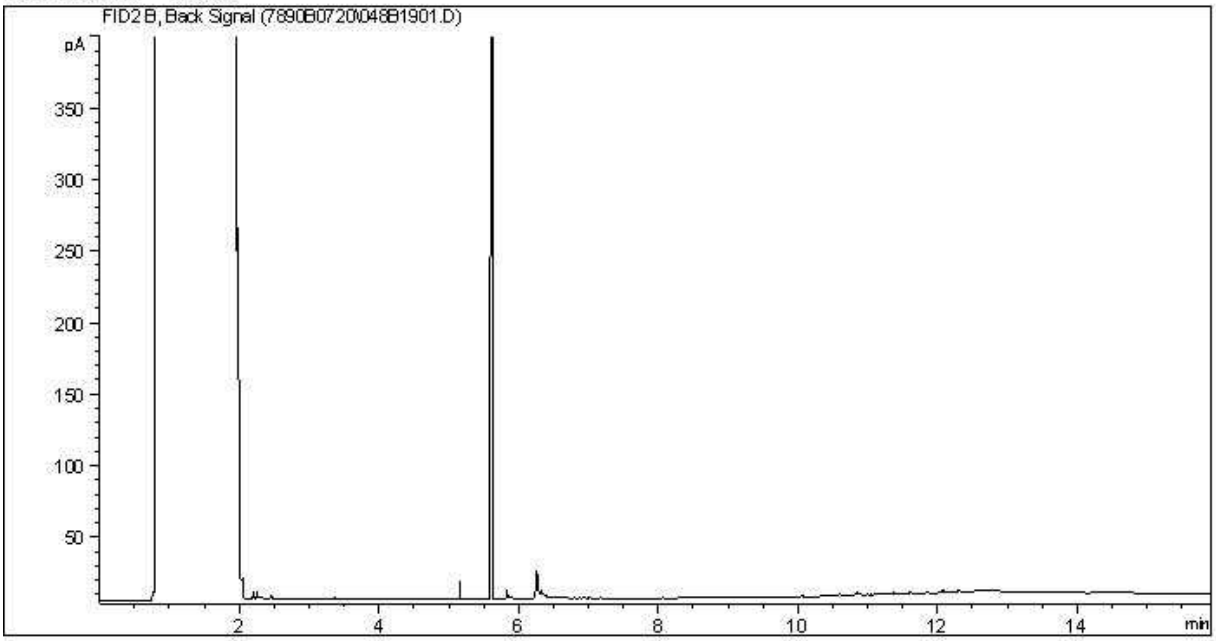
Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B858056
Report Date: 2018/07/23
Maxxam Sample: TW0508

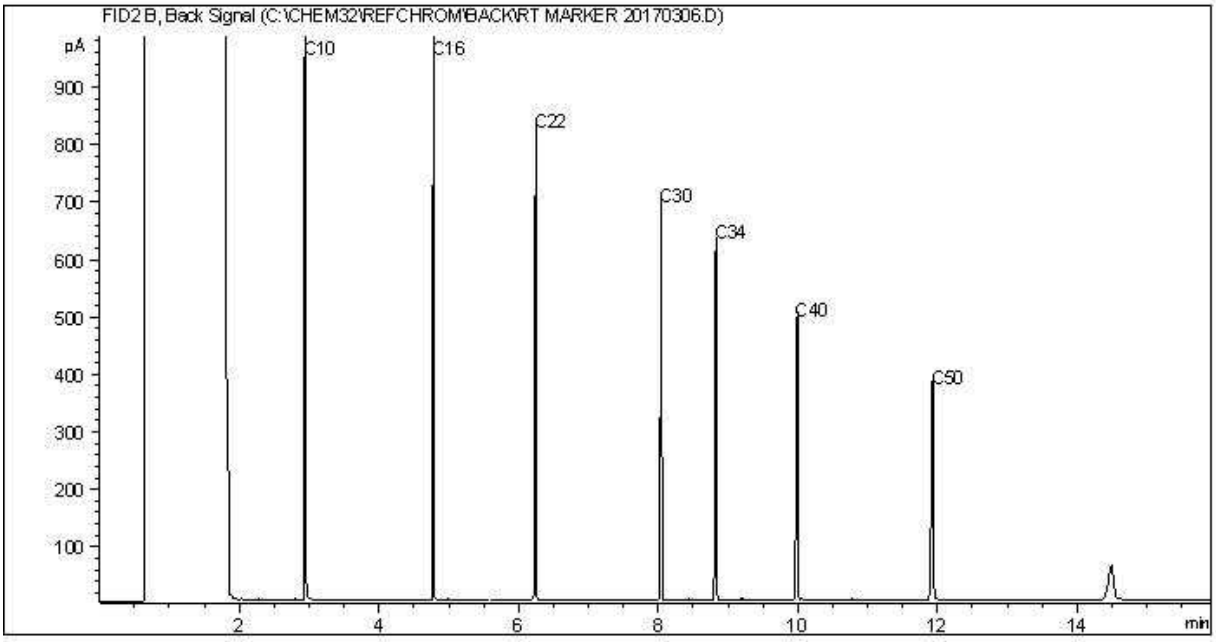
Imperial Oil Ltd - Worley Parsons
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: NORMAN WELLS, NT
Client ID: C38 08-1-4

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890B




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

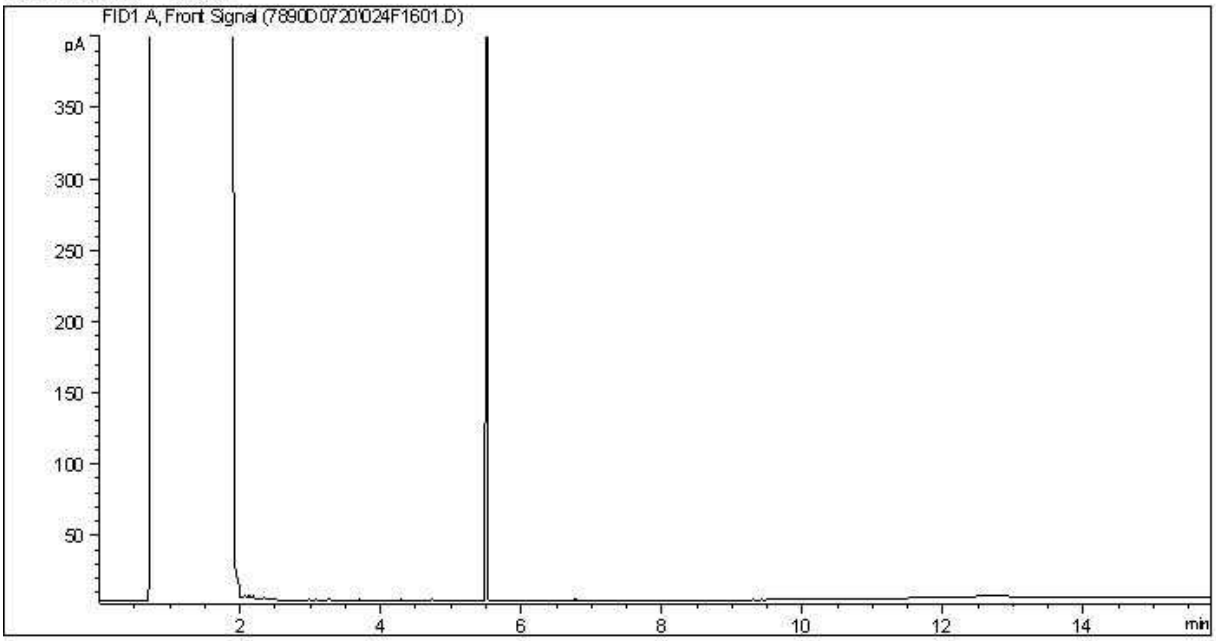
**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam Job #: B858056
Report Date: 2018/07/23
Maxxam Sample: TW0509

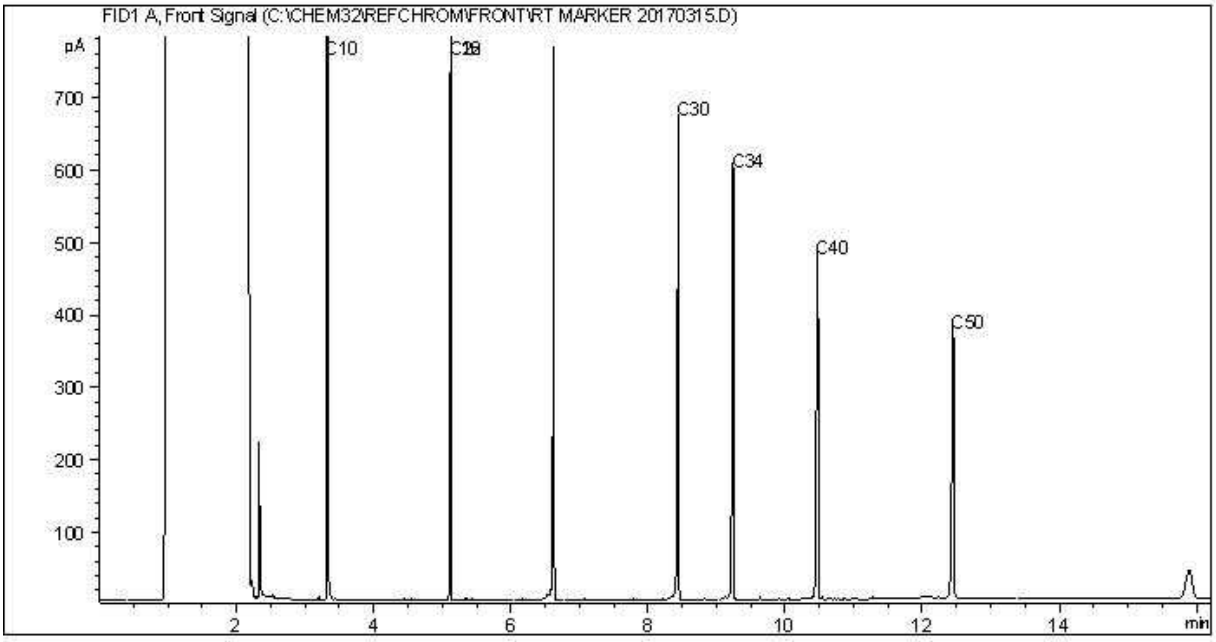
Imperial Oil Ltd - Worley Parsons
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: NORMAN WELLS, NT
Client ID: NWD 18-03

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890D




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

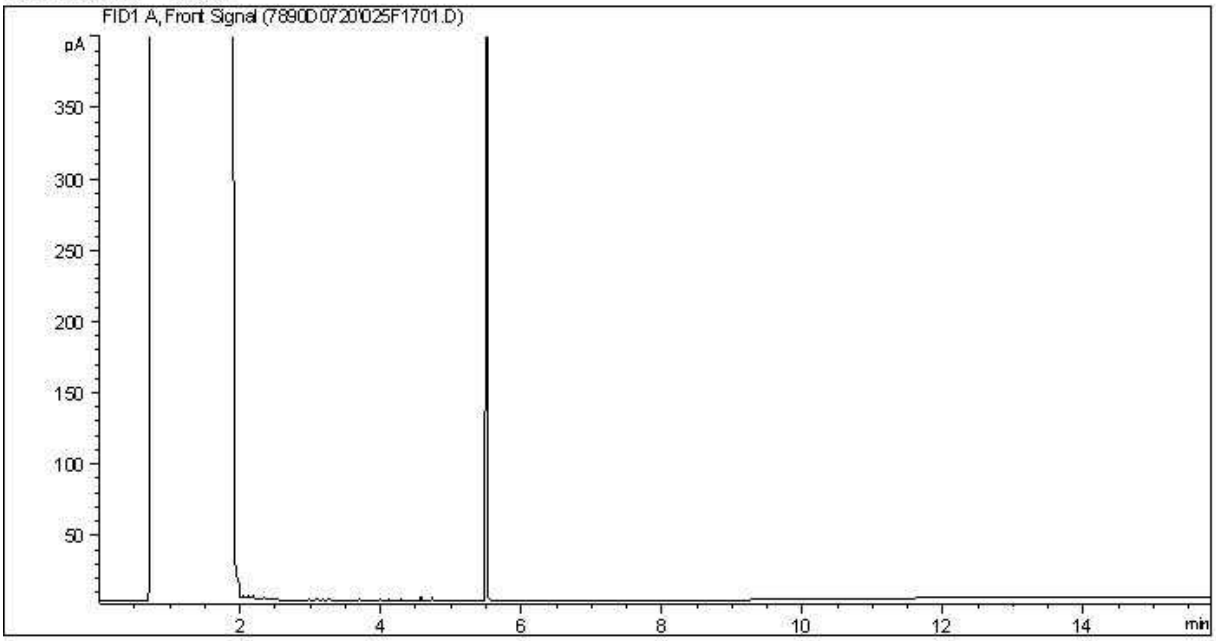
**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam Job #: B858056
Report Date: 2018/07/23
Maxxam Sample: TW0510

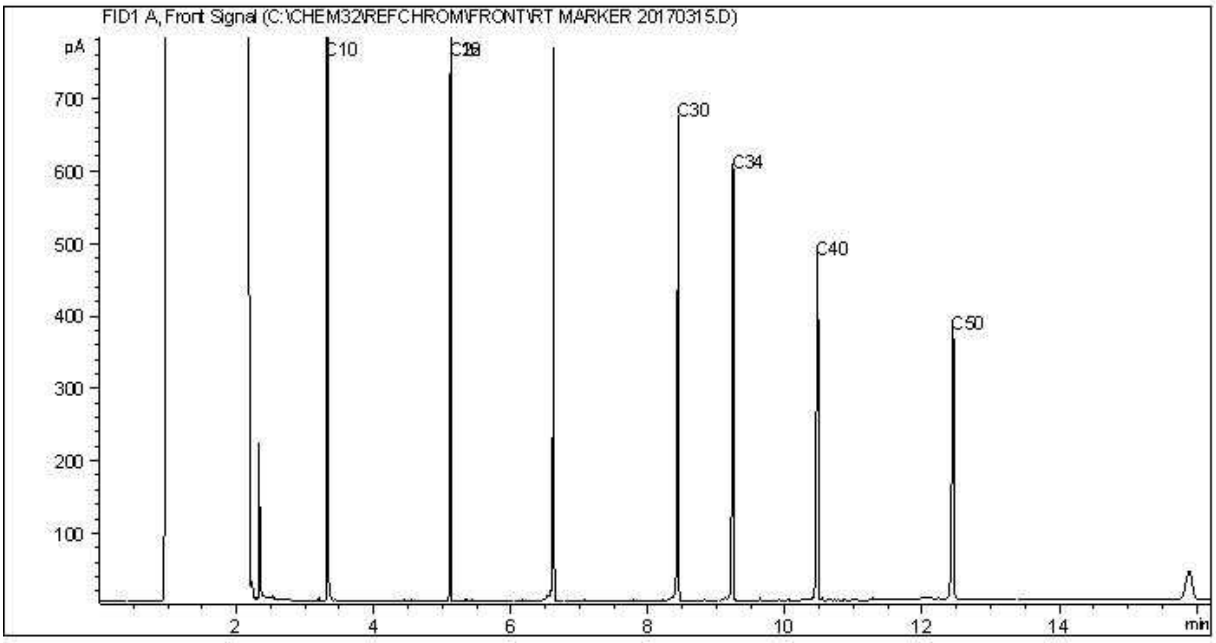
Imperial Oil Ltd - Worley Parsons
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: NORMAN WELLS, NT
Client ID: NWD 18-13

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890D




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam
A Bureau Veritas Group Company

☐ Calgary
4000 19th St. NE, T2E 6P8
Phone: (403) 291-3077
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Toll Free: (800) 386-7247

☒ Edmonton
9331 - 48 Street, T6B 2R4
Phone: (780) 577-7100
Fax: (780) 450-4187
Toll Free: (800) 386-7247

804 GAN

# EXXON MOBIL/IMPERIAL OIL - MAXXAM CHAIN-OF-CUSTODY RECORD

Page 1 of 1

C of C # 298577

| INVOICE INFORMATION | REPORT INFORMATION |
|---|---|
| Company Name: ☒ Imperial Oil ☐ ExxonMobil | Company Name: WorleyParsons |
| Contact Name: WorleyParsons | Contact Name: Stacy Gibb |
| Address: 500, 151 Canada Olympic Rd SW Calgary, AB T3B 6B7 | Address: 500, 151 Canada Olympic Rd SW Calgary, AB T3B 6B7 |
| Email: sanj.pereva@advisian.com | Email: stacy.gibb@advisian.com |
| Ph: 587-952-1490 | Ph: 403-247-0200 |
| Sampler Name (Print): Melanie Jones, Ekaterina Yakushina | Consultant Project #: 00586-400 407011 - [redacted] |

| FIELD SAMPLE ID | MATRIX: GROUND WATER | MATRIX: SURFACE WATER | MATRIX: SOIL | MATRIX: OTHER | # CONTAINERS | SAMPLING: DATE (YYYY/MM/DD) | SAMPLING: TIME (24 HR) | FIELD FILTERED & PRESERVED | LAB FILTRATION REQUIRED |
|---|---|---|---|---|---|---|---|---|---|
| 1 C38 08-1-4 | X | | | | 10 | 2018/07/13 | 14:25 | X | |
| 2 NWD 18-03 | | | | X | 4 | ↓ | 17:00 | | |
| 3 NWD 18-13 | | | | X | 5 mL | ↓ | 16:45 | | |
| 4 | | | | | | | | | |
| 5 | | | | | | | | | |
| 6 | | | | | | | | | |
| 7 | | | | | | | | | |
| 8 | | | | | | | | | |
| 9 | | | | | | | | | |
| 10 | | | | | | | | | |

ANALYSIS REQUESTED

| VOC | PAH | PHCs (FRACTIONS 1-2 PLUS BTEX) | PHCs (FRACTIONS 1-4 PLUS BTEX) | PHCs (FRACTIONS 2-4) | PHCs (FRACTION 1 PLUS BTEX) | GRAIN SIZE (75 MICRON) | TEXTURE (% SAND, SILT, CLAY) | PARTICLE SIZE DISTRIBUTION WITH GRAPH | REGULATED METALS ☐ TOT ☒ DIS | MERCURY ☐ TOTAL ☒ DISSOLVED | SALINITY SOIL | FERTILIZER SOIL | FERTILIZER WATER | NUTRIENTS SOIL | ROUTINE POTABILITY | pH ☐ EC ☐ ALKALINITY ☐ | BASIC CLASS II LANDFILL PKG | Phenols by 4AAP | Sediment in BTEX/FI vials ≤1cm, do not decant | Limited sample/missing bottle | Headspace present in BTEX vials |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | X | | | | | | | X | X | | | | | X | | | X | X | | |
| | | X | | | | | | | | | | | | | | | | | | X | X |
| | | X | | | | | | | | | | | | | | | | | | | |

IOL SITE LOCATION: Norman Wells, NT

IOL PROJECT # (if applicable): N/A

MAXXAM TASK ORDER # OR SERVICE ORDER # + LINE ITEM: 407011 - [redacted] 00586-400

REGULATORY CRITERIA / DETECTION LIMITS:
☐ Alberta Tier 1 ☐ CDWG
☐ SEQG (SK) ☐ NoSC (SK)
☒ CCME (incl. level) FAL ☐ Other

SPECIAL INSTRUCTIONS:
also email
- Standard Norman Wells list
- melissa.lord@advisian.com
IES 12601436

# JARS USED & NOT SUBMITTED (Enter N/A for Water): N/A

TURNAROUND TIME
Standard (5 days) ☒
Rush (3 days) ☐
(2 days) ☐
(1 day) ☐
(same day) ☐
Date Required

| | YES | NO | COOLER ID # | | | |
|---|---|---|---|---|---|---|
| SEAL PRESENT | ✓ | | | | | |
| SEAL INTACT | ✓ | | | | | |
| COOLING MEDIA PRESENT | ✓ | | | | | |
| TEMP °C | | | 3 (1) | 3 (2) | 3 (3) | |

| | YES | NO | COOLER ID # | | | |
|---|---|---|---|---|---|---|
| SEAL PRESENT | | | | | | |
| SEAL INTACT | | | | | | |
| COOLING MEDIA PRESENT | | | | | | |
| TEMP °C | | | (1) | (2) | (3) | |

| | YES | NO | COOLER ID # | | | |
|---|---|---|---|---|---|---|
| SEAL PRESENT | | | | | | |
| SEAL INTACT | | | | | | |
| COOLING MEDIA PRESENT | | | | | | |
| TEMP °C | | | (1) | (2) | (3) | |

| RELINQUISHED BY: | | DATE: | TIME (24 HR) | RECEIVED BY: | | DATE: | TIME (24 HR) |
|---|---|---|---|---|---|---|---|
| 1. | Melissa Lord | 2018/07/14 | 08:00 | Gina Antonucci | Gina Antonucci | 20180715 | 1040 |
| 2. | | | | 2. | | | |
| 3. | | | | 3. | | | |

LAB USE ONLY 20180715 LMW
MAXXAM JOB # B85805[illegible]6

SAMPLES
LABELED BY: LMW
VERIFIED BY: GAN

COC-1010 (06/2016) IOL-AB

White: Maxxam Yellow: Client

# DATA QUALITY REVIEW CHECKLIST - IMPERIAL OIL PROJECTS

Consultant: Advisian

Sampling Date: 14-Jul-18

Location: Norman Wells

Laboratory : Maxxam Edmonton

Consultant Project Number: 407011-00586-400

Sample Submission Number: B858174

Are All Laboratory QC Within Acceptance Criteria (Yes, No, Not Applicable)?

| | Yes | No | NA | Comments |
|---|---|---|---|---|
| Instrument Surrogate Recovery | x | | | Laboratory control sample recovery of Pyrene (132%) and Fluoranthene (136%) did not meet acceptance criteria (50-130%). All other laboratory QC met acceptance criteria. |
| Extraction Surrogate Recovery | x | | | |
| Method Blank Concentration | x | | | |
| Matrix Duplicate RPD | | | x | |
| Matrix Spike Recovery | | | x | |
| Lab Control Sample Recovery | | x | | |

Are All Field QC Samples Within Alert Limits (Yes, No, Not Applicable)?

| | Yes | No | NA | Comments |
|---|---|---|---|---|
| Field Blank Concentration | x | | | All field QC samples met alert limits. |
| Trip Blank Concentration | x | | | |
| Equipment Blank Concentration | | | x | |
| Field Duplicate RPD | x | | | |

| | |
|---|---|
| Has CoA been signed off (Yes/No)?: | Yes |
| Has lab warranted all tests were analyzed following SOP's in CoA (Yes/No)?: | Yes |
| Were all samples analyzed within hold times (Yes/No)?: | Yes |
| All volatiles samples methanol extracted (if required) within 48 hours (Yes/No)?: | n/a |
| Is Chain of Custody completed and signed (Yes/No)?: | Yes |
| Were sample temperatures acceptable when they reached lab (Yes/No)?: | Yes |

| | |
|---|---|
| Was a Data Quality Overview (DQO) issued (Yes/No)?: | No |
| Date DQO was received: | n/a |

Is data considered to be reliable (Yes/No)?: Yes

If answer is "No", describe and provide rationale:

Data Reviewed by (Print): Vivian Baptista

Data Reviewed by (Signature): 

Date: 23-Aug-18

Maxxam
A Bureau Veritas Group Company

Success Through Science®

Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400
Your C.O.C. #: 298576

**Attention: Stacy Gibb**

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

**Report Date: 2018/07/23**
Report #: R2593411
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B858174**
**Received: 2018/07/16, 09:56**

Sample Matrix: Water
# Samples Received: 6

| Analyses | Quantity | Laboratory Method | Primary Reference |
|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | 4 | AB SOP-00005 | SM 22 2320 B m |
| BTEX/F1 in Water by HS GC/MS/FID | 6 | AB SOP-00039 | CCME CWS/EPA 8260d m |
| F1-BTEX | 6 | AB SOP-00039 | Auto Calc |
| Cadmium - low level CCME - Dissolved | 4 | AB WI-00065 | Auto Calc |
| Chloride by Automated Colourimetry | 4 | AB SOP-00020 | SM 22 4500-Cl-E m |
| Conductivity @25C | 4 | AB SOP-00005 | SM 22 2510 B m |
| CCME Hydrocarbons in Water (F2; C10-C16) (1) | 6 | AB SOP-00037 / AB SOP-00040 | CCME PHC-CWS m |
| Hardness | 4 | AB WI-00065 | Auto Calc |
| Mercury - Low Level (Dissolved) (2) | 4 | EENVSOP-00031 | EPA 245.7 R2 m |
| Elements by ICP - Dissolved (2) | 4 | AB SOP-00042 | EPA 6010d R4 m |
| Elements by ICPMS - Dissolved (2) | 4 | AB SOP-00043 | EPA 6020b R2 m |
| Ion Balance | 4 | AB WI-00065 | Auto Calc |
| Nitrate and Nitrite | 4 | AB WI-00065 | Auto Calc |
| Nitrate + Nitrite-N (calculated) | 4 | AB WI-00065 | Auto Calc |
| Nitrogen (Nitrite - Nitrate) by IC | 4 | AB SOP-00023 | SM 23 4110 B m |
| Benzo[a]pyrene Equivalency (3) | 2 | AB SOP-00003 | Auto Calc |
| PAH in Water by GC/MS | 2 | AB SOP-00037 / AB SOP-00003 | EPA 3510C/8270E m |
| Phenols (4-AAP) | 4 | EENVSOP-00061 | MMCW 154 1996 m |
| Sulphate by Automated Colourimetry | 4 | AB SOP-00018 | SM 22 4500-SO4 E m |
| Total Dissolved Solids (Filt. Residue) | 4 | AB SOP-00065 | SM 22 2540 C m |

**Remarks:**

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. All samples were analyzed within hold time unless otherwise flagged.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report.



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

Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400
Your C.O.C. #: 298576

**Attention: Stacy Gibb**

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

**Report Date: 2018/07/23**
Report #: R2593411
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B858174**
**Received: 2018/07/16, 09:56**

Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

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) Silica gel clean up employed.
(2) Dissolved > Total Imbalance: Whenever applicable, Dissolved >Total for any parameter that falls within method uncertainty for duplicates is likely equivalent. If RPD is >20% samples were reanalyzed and confirmed.
(3) B[a]P TPE is calculated using 1/2 of the RDL for non detect results as per Alberta Environment instructions. This protocol may not apply in other jurisdictions.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Jenna Chernuka, Project Manager
Email: JChernuka@maxxam.ca
Phone# (780)577-7178

==========

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 #: B858174
Report Date: 2018/07/23

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## AT1 BTEX AND F1-F2 IN WATER (WATER)

| Maxxam ID | | TW1591 | TW1592 | | TW1593 | TW1594 | TW1595 | | |
|---|---|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/07/14 09:30 | 2018/07/14 09:25 | | 2018/07/14 09:40 | 2018/07/14 09:50 | 2018/07/14 13:00 | | |
| COC Number | | 298576 | 298576 | | 298576 | 298576 | 298576 | | |
| | **UNITS** | **NWD 18-47** | **GIBG-10-2-3** | **QC Batch** | **GIQ8-10-2-4** | **NWD 18-14** | **NWD 18-04** | **RDL** | **QC Batch** |
| **Ext. Pet. Hydrocarbon** | | | | | | | | | |
| F2 (C10-C16 Hydrocarbons) | mg/L | <0.10 | <0.10 | 9065963 | <0.10 | <0.10 | <0.10 | 0.10 | 9066088 |
| **Volatiles** | | | | | | | | | |
| Benzene | mg/L | <0.00040 | <0.00040 | 9065228 | <0.00040 | <0.00040 | <0.00040 | 0.00040 | 9066395 |
| Toluene | mg/L | <0.00040 | <0.00040 | 9065228 | <0.00040 | <0.00040 | <0.00040 | 0.00040 | 9066395 |
| Ethylbenzene | mg/L | <0.00040 | <0.00040 | 9065228 | <0.00040 | <0.00040 | <0.00040 | 0.00040 | 9066395 |
| m & p-Xylene | mg/L | <0.00080 | <0.00080 | 9065228 | <0.00080 | <0.00080 | <0.00080 | 0.00080 | 9066395 |
| o-Xylene | mg/L | <0.00040 | <0.00040 | 9065228 | <0.00040 | <0.00040 | <0.00040 | 0.00040 | 9066395 |
| Xylenes (Total) | mg/L | <0.00089 | <0.00089 | 9064350 | <0.00089 | <0.00089 | <0.00089 | 0.00089 | 9064350 |
| F1 (C6-C10) - BTEX | mg/L | <0.10 | <0.10 | 9064350 | <0.10 | <0.10 | <0.10 | 0.10 | 9064350 |
| F1 (C6-C10) | mg/L | <0.10 | <0.10 | 9065228 | <0.10 | <0.10 | <0.10 | 0.10 | 9066395 |
| **Extraction Surrogate Recovery (%)** | | | | | | | | | |
| O-TERPHENYL (sur.) | % | 92 | 91 | 9065963 | 87 | 85 | 90 | | 9066088 |
| **Instrument Surrogate Recovery (%)** | | | | | | | | | |
| 1,4-Difluorobenzene (sur.) | % | 100 | 100 | 9065228 | 99 | 98 | 100 | | 9066395 |
| 4-Bromofluorobenzene (sur.) | % | 102 | 100 | 9065228 | 104 | 104 | 103 | | 9066395 |
| D4-1,2-Dichloroethane (sur.) | % | 101 | 100 | 9065228 | 101 | 100 | 99 | | 9066395 |

RDL = Reportable Detection Limit



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Maxxam Job #: B858174
Report Date: 2018/07/23

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## AT1 BTEX AND F1-F2 IN WATER (WATER)

| | | | | |
|---|---|---|---|---|
| Maxxam ID | | TW1596 | | |
| Sampling Date | | 2018/07/14 10:30 | | |
| COC Number | | 298576 | | |
| | **UNITS** | **GIP11 09-1-4R** | **RDL** | **QC Batch** |
| **Ext. Pet. Hydrocarbon** | | | | |
| F2 (C10-C16 Hydrocarbons) | mg/L | <0.10 | 0.10 | 9066088 |
| **Volatiles** | | | | |
| Benzene | mg/L | <0.00040 | 0.00040 | 9066395 |
| Toluene | mg/L | <0.00040 | 0.00040 | 9066395 |
| Ethylbenzene | mg/L | <0.00040 | 0.00040 | 9066395 |
| m & p-Xylene | mg/L | <0.00080 | 0.00080 | 9066395 |
| o-Xylene | mg/L | <0.00040 | 0.00040 | 9066395 |
| Xylenes (Total) | mg/L | <0.00089 | 0.00089 | 9064350 |
| F1 (C6-C10) - BTEX | mg/L | <0.10 | 0.10 | 9064350 |
| F1 (C6-C10) | mg/L | <0.10 | 0.10 | 9066395 |
| **Extraction Surrogate Recovery (%)** | | | | |
| O-TERPHENYL (sur.) | % | 85 | | 9066088 |
| **Instrument Surrogate Recovery (%)** | | | | |
| 1,4-Difluorobenzene (sur.) | % | 98 | | 9066395 |
| 4-Bromofluorobenzene (sur.) | % | 106 | | 9066395 |
| D4-1,2-Dichloroethane (sur.) | % | 101 | | 9066395 |
| RDL = Reportable Detection Limit | | | | |



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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## REGULATED METALS INCLUDING MERCURY-DISS (WATER)

| Maxxam ID | | TW1591 | TW1592 | TW1593 | TW1596 | | |
|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/07/14 09:30 | 2018/07/14 09:25 | 2018/07/14 09:40 | 2018/07/14 10:30 | | |
| COC Number | | 298576 | 298576 | 298576 | 298576 | | |
| | **UNITS** | **NWD 18-47** | **GIBG-10-2-3** | **GIQ8-10-2-4** | **GIP11 09-1-4R** | **RDL** | **QC Batch** |
| **Low Level Elements** | | | | | | | |
| Dissolved Cadmium (Cd) | mg/L | 0.00017 | 0.00018 | 0.00037 | 0.00036 | 0.000020 | 9064437 |
| **Elements** | | | | | | | |
| Dissolved Aluminum (Al) | mg/L | 0.0052 | 0.0053 | 0.0048 | 0.0034 | 0.0030 | 9064907 |
| Dissolved Antimony (Sb) | mg/L | <0.00060 | <0.00060 | <0.00060 | <0.00060 | 0.00060 | 9064907 |
| Dissolved Arsenic (As) | mg/L | 0.00032 | 0.00038 | 0.00050 | 0.00069 | 0.00020 | 9064907 |
| Dissolved Barium (Ba) | mg/L | 0.16 | 0.16 | 0.13 | 0.087 | 0.010 | 9068442 |
| Dissolved Beryllium (Be) | mg/L | <0.0010 | <0.0010 | <0.0010 | <0.0010 | 0.0010 | 9064907 |
| Dissolved Boron (B) | mg/L | 0.022 | 0.024 | 0.027 | 0.050 | 0.020 | 9068442 |
| Dissolved Calcium (Ca) | mg/L | 120 | 120 | 340 | 270 | 0.30 | 9068442 |
| Dissolved Chromium (Cr) | mg/L | <0.0010 | <0.0010 | <0.0010 | <0.0010 | 0.0010 | 9064907 |
| Dissolved Cobalt (Co) | mg/L | 0.0025 | 0.0025 | 0.0096 | 0.0082 | 0.00030 | 9064907 |
| Dissolved Copper (Cu) | mg/L | 0.0016 | 0.0016 | 0.0025 | 0.0030 | 0.00020 | 9064907 |
| Dissolved Iron (Fe) | mg/L | 0.15 | 0.16 | 2.2 | <0.060 | 0.060 | 9068442 |
| Dissolved Lead (Pb) | mg/L | <0.00020 | <0.00020 | <0.00020 | <0.00020 | 0.00020 | 9064907 |
| Dissolved Lithium (Li) | mg/L | <0.020 | <0.020 | 0.022 | 0.031 | 0.020 | 9068442 |
| Dissolved Magnesium (Mg) | mg/L | 22 | 22 | 83 | 51 | 0.20 | 9068442 |
| Dissolved Manganese (Mn) | mg/L | 0.65 | 0.66 | 3.5 | 1.6 | 0.0040 | 9068442 |
| Dissolved Molybdenum (Mo) | mg/L | 0.00070 | 0.00063 | 0.00049 | 0.00072 | 0.00020 | 9064907 |
| Dissolved Nickel (Ni) | mg/L | 0.0055 | 0.0053 | 0.021 | 0.022 | 0.00050 | 9064907 |
| Dissolved Phosphorus (P) | mg/L | <0.10 | <0.10 | <0.10 | <0.10 | 0.10 | 9068442 |
| Dissolved Potassium (K) | mg/L | 2.3 | 2.3 | 3.1 | 4.0 | 0.30 | 9068442 |
| Dissolved Selenium (Se) | mg/L | <0.00020 | <0.00020 | <0.00020 | 0.0044 | 0.00020 | 9064907 |
| Dissolved Silicon (Si) | mg/L | 3.7 | 3.7 | 5.3 | 5.4 | 0.10 | 9068442 |
| Dissolved Silver (Ag) | mg/L | <0.00010 | <0.00010 | <0.00010 | <0.00010 | 0.00010 | 9064907 |
| Dissolved Sodium (Na) | mg/L | 30 | 30 | 21 | 8.8 | 0.50 | 9068442 |
| Dissolved Strontium (Sr) | mg/L | 0.63 | 0.63 | 1.6 | 1.0 | 0.020 | 9068442 |
| Dissolved Sulphur (S) | mg/L | 37 | 37 | 200 | 64 | 0.20 | 9068442 |
| Dissolved Thallium (Tl) | mg/L | <0.00020 | <0.00020 | <0.00020 | <0.00020 | 0.00020 | 9064907 |
| Dissolved Tin (Sn) | mg/L | <0.0010 | <0.0010 | <0.0010 | <0.0010 | 0.0010 | 9064907 |
| Dissolved Titanium (Ti) | mg/L | <0.0010 | <0.0010 | <0.0010 | <0.0010 | 0.0010 | 9064907 |

RDL = Reportable Detection Limit



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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## REGULATED METALS INCLUDING MERCURY-DISS (WATER)

| Maxxam ID | | TW1591 | TW1592 | TW1593 | TW1596 | | |
|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/07/14 09:30 | 2018/07/14 09:25 | 2018/07/14 09:40 | 2018/07/14 10:30 | | |
| COC Number | | 298576 | 298576 | 298576 | 298576 | | |
| | **UNITS** | **NWD 18-47** | **GIBG-10-2-3** | **GIQ8-10-2-4** | **GIP11 09-1-4R** | **RDL** | **QC Batch** |
| Dissolved Uranium (U) | mg/L | 0.0030 | 0.0030 | 0.0081 | 0.0090 | 0.00010 | 9064907 |
| Dissolved Vanadium (V) | mg/L | <0.0010 | <0.0010 | <0.0010 | <0.0010 | 0.0010 | 9064907 |
| Dissolved Zinc (Zn) | mg/L | 0.0082 | 0.0080 | 0.024 | 0.012 | 0.0030 | 9064907 |
| **Low Level Elements** | | | | | | | |
| Dissolved Mercury (Hg) | mg/L | <0.0000020 | <0.0000020 | <0.0000020 | <0.0000020 | 0.0000020 | 9071414 |
| RDL = Reportable Detection Limit | | | | | | | |



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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## RESULTS OF CHEMICAL ANALYSES OF WATER

| Maxxam ID | | TW1591 | TW1592 | | | TW1593 | | TW1596 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/07/14 09:30 | 2018/07/14 09:25 | | | 2018/07/14 09:40 | | 2018/07/14 10:30 | | |
| COC Number | | 298576 | 298576 | | | 298576 | | 298576 | | |
| | **UNITS** | **NWD 18-47** | **GIBG-10-2-3** | **RDL** | **QC Batch** | **GIQ8-10-2-4** | **RDL** | **GIP11 09-1-4R** | **RDL** | **QC Batch** |
| **Calculated Parameters** | | | | | | | | | | |
| Hardness (CaCO3) | mg/L | 390 | 390 | 0.50 | 9065120 | 1200 | 0.50 | 890 | 0.50 | 9064352 |
| Ion Balance (% Difference) | % | 1.6 | 1.5 | N/A | 9064353 | 5.5 | N/A | 0.94 | N/A | 9064353 |
| Dissolved Nitrate (NO3) | mg/L | 0.32 | 0.29 | 0.044 | 9065125 | <0.044 | 0.044 | 0.60 | 0.044 | 9065125 |
| Nitrate plus Nitrite (N) | mg/L | 0.072 | 0.066 | 0.014 | 9065126 | <0.014 | 0.014 | 0.13 | 0.014 | 9065126 |
| Dissolved Nitrite (NO2) | mg/L | <0.033 | <0.033 | 0.033 | 9065125 | <0.033 | 0.033 | <0.033 | 0.033 | 9065125 |
| **Misc. Inorganics** | | | | | | | | | | |
| Conductivity | uS/cm | 840 | 830 | 2.0 | 9067939 | 2200 | 2.0 | 1600 | 2.0 | 9067939 |
| Total Dissolved Solids | mg/L | 590 (1) | 570 (1) | 25 | 9068094 | 1700 | 10 | 1100 | 10 | 9068593 |
| **Anions** | | | | | | | | | | |
| Alkalinity (PP as CaCO3) | mg/L | <1.0 | <1.0 | 1.0 | 9067937 | <1.0 | 1.0 | <1.0 | 1.0 | 9067937 |
| Alkalinity (Total as CaCO3) | mg/L | 330 | 330 | 1.0 | 9067937 | 660 | 1.0 | 660 | 1.0 | 9067937 |
| Bicarbonate (HCO3) | mg/L | 400 | 400 | 1.0 | 9067937 | 800 | 1.0 | 800 | 1.0 | 9067937 |
| Carbonate (CO3) | mg/L | <1.0 | <1.0 | 1.0 | 9067937 | <1.0 | 1.0 | <1.0 | 1.0 | 9067937 |
| Hydroxide (OH) | mg/L | <1.0 | <1.0 | 1.0 | 9067937 | <1.0 | 1.0 | <1.0 | 1.0 | 9067937 |
| Dissolved Sulphate (SO4) | mg/L | 130 | 130 | 1.0 | 9068603 | 680 (2) | 5.0 | 200 (3) | 2.0 | 9068603 |
| Dissolved Chloride (Cl) | mg/L | 6.8 | 6.9 | 1.0 | 9068600 | 21 | 1.0 | 50 | 1.0 | 9068600 |
| **Nutrients** | | | | | | | | | | |
| Dissolved Nitrite (N) | mg/L | <0.010 | <0.010 | 0.010 | 9064840 | <0.010 | 0.010 | <0.010 | 0.010 | 9064840 |
| Dissolved Nitrate (N) | mg/L | 0.072 | 0.066 | 0.010 | 9064840 | <0.010 | 0.010 | 0.13 | 0.010 | 9064840 |
| **Misc. Organics** | | | | | | | | | | |
| Phenols | mg/L | 0.0034 | 0.0042 | 0.0020 | 9071008 | 0.0056 | 0.0020 | 0.0025 | 0.0020 | 9071008 |

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limit raised based on sample volume used for analysis.
(2) Detection limits raised due to dilution to bring analyte within the calibrated range.
(3) Detection limits raised due to matrix interference.



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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## SEMIVOLATILE ORGANICS BY GC-MS (WATER)

| Maxxam ID | | TW1591 | TW1592 | | |
|---|---|---|---|---|---|
| Sampling Date | | 2018/07/14 09:30 | 2018/07/14 09:25 | | |
| COC Number | | 298576 | 298576 | | |
| | **UNITS** | **NWD 18-47** | **GIBG-10-2-3** | **RDL** | **QC Batch** |
| **Polycyclic Aromatics** | | | | | |
| Benzo[a]pyrene equivalency | mg/L | <0.000010 | <0.000010 | 0.000010 | 9064587 |
| Acenaphthene | mg/L | <0.00010 | <0.00010 | 0.00010 | 9065955 |
| Acenaphthylene | mg/L | <0.00010 | <0.00010 | 0.00010 | 9065955 |
| Acridine | mg/L | <0.000050 | <0.000050 | 0.000050 | 9065955 |
| Anthracene | mg/L | <0.000010 | <0.000010 | 0.000010 | 9065955 |
| Benzo(a)anthracene | mg/L | <0.0000085 | <0.0000085 | 0.0000085 | 9065955 |
| Benzo(b&j)fluoranthene | mg/L | <0.0000085 | <0.0000085 | 0.0000085 | 9065955 |
| Benzo(k)fluoranthene | mg/L | <0.0000085 | <0.0000085 | 0.0000085 | 9065955 |
| Benzo(g,h,i)perylene | mg/L | <0.0000085 | <0.0000085 | 0.0000085 | 9065955 |
| Benzo(c)phenanthrene | mg/L | <0.000050 | <0.000050 | 0.000050 | 9065955 |
| Benzo(a)pyrene | mg/L | <0.0000075 | <0.0000075 | 0.0000075 | 9065955 |
| Benzo[e]pyrene | mg/L | <0.000050 | <0.000050 | 0.000050 | 9065955 |
| Chrysene | mg/L | <0.0000085 | <0.0000085 | 0.0000085 | 9065955 |
| Dibenz(a,h)anthracene | mg/L | <0.0000075 | <0.0000075 | 0.0000075 | 9065955 |
| Fluoranthene | mg/L | <0.000010 | <0.000010 | 0.000010 | 9065955 |
| Fluorene | mg/L | <0.000050 | <0.000050 | 0.000050 | 9065955 |
| Indeno(1,2,3-cd)pyrene | mg/L | <0.0000085 | <0.0000085 | 0.0000085 | 9065955 |
| 1-Methylnaphthalene | mg/L | <0.00010 | <0.00010 | 0.00010 | 9065955 |
| 2-Methylnaphthalene | mg/L | <0.00010 | <0.00010 | 0.00010 | 9065955 |
| Naphthalene | mg/L | <0.00010 | <0.00010 | 0.00010 | 9065955 |
| Phenanthrene | mg/L | <0.000050 | <0.000050 | 0.000050 | 9065955 |
| Perylene | mg/L | <0.000050 | <0.000050 | 0.000050 | 9065955 |
| Pyrene | mg/L | <0.000020 | <0.000020 | 0.000020 | 9065955 |
| Quinoline | mg/L | <0.00020 | <0.00020 | 0.00020 | 9065955 |
| **Extraction Surrogate Recovery (%)** | | | | | |
| D10-ANTHRACENE (sur.) | % | 84 | 91 | | 9065955 |
| D8-ACENAPHTHYLENE (sur.) | % | 81 | 82 | | 9065955 |
| D8-NAPHTHALENE (sur.) | % | 68 | 68 | | 9065955 |
| TERPHENYL-D14 (sur.) | % | 80 | 74 | | 9065955 |
| RDL = Reportable Detection Limit | | | | | |



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Report Date: 2018/07/23

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## TEST SUMMARY

**Maxxam ID:** TW1591
**Sample ID:** NWD 18-47
**Matrix:** Water

**Collected:** 2018/07/14
**Relinquished:** 2018/07/15
**Received:** 2018/07/16

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | AT/ALK | 9067937 | N/A | 2018/07/18 | Malina Alamyar |
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9065228 | N/A | 2018/07/17 | Seema Singh |
| F1-BTEX | CALC/MS | 9064350 | N/A | 2018/07/17 | Automated Statchk |
| Cadmium - low level CCME - Dissolved | CALC/MS | 9064437 | N/A | 2018/07/17 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 9068600 | N/A | 2018/07/19 | Chelsea Harmatys |
| Conductivity @25C | COND | 9067939 | N/A | 2018/07/18 | Malina Alamyar |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9065963 | 2018/07/17 | 2018/07/19 | Jana Rychlikova |
| Hardness | CALC | 9065120 | N/A | 2018/07/20 | Automated Statchk |
| Mercury - Low Level (Dissolved) | CV/AF | 9071414 | 2018/07/20 | 2018/07/20 | Mahboubeh Bahadori |
| Elements by ICP - Dissolved | ICPA | 9068442 | N/A | 2018/07/20 | Jonathan Kuprowsky |
| Elements by ICPMS - Dissolved | ICPM | 9064907 | N/A | 2018/07/16 | Julie Harrison |
| Ion Balance | CALC | 9064353 | N/A | 2018/07/17 | Automated Statchk |
| Nitrate and Nitrite | CALC | 9065125 | N/A | 2018/07/18 | Automated Statchk |
| Nitrate + Nitrite-N (calculated) | CALC | 9065126 | N/A | 2018/07/18 | Automated Statchk |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9064840 | N/A | 2018/07/16 | Krista Dawe |
| Benzo[a]pyrene Equivalency | GC/MSD | 9064587 | N/A | 2018/07/23 | Automated Statchk |
| PAH in Water by GC/MS | GC/MS | 9065955 | 2018/07/17 | 2018/07/20 | Bert Chi |
| Phenols (4-AAP) | TECH/4AAP | 9071008 | N/A | 2018/07/20 | Ying Yang |
| Sulphate by Automated Colourimetry | KONE | 9068603 | N/A | 2018/07/19 | Chelsea Harmatys |
| Total Dissolved Solids (Filt. Residue) | BAL | 9068094 | 2018/07/18 | 2018/07/19 | Luminita Chiosa |

**Maxxam ID:** TW1592
**Sample ID:** GIBG-10-2-3
**Matrix:** Water

**Collected:** 2018/07/14
**Relinquished:** 2018/07/15
**Received:** 2018/07/16

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | AT/ALK | 9067937 | N/A | 2018/07/18 | Malina Alamyar |
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9065228 | N/A | 2018/07/17 | Seema Singh |
| F1-BTEX | CALC/MS | 9064350 | N/A | 2018/07/17 | Automated Statchk |
| Cadmium - low level CCME - Dissolved | CALC/MS | 9064437 | N/A | 2018/07/17 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 9068600 | N/A | 2018/07/19 | Chelsea Harmatys |
| Conductivity @25C | COND | 9067939 | N/A | 2018/07/18 | Malina Alamyar |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9065963 | 2018/07/17 | 2018/07/19 | Jana Rychlikova |
| Hardness | CALC | 9065120 | N/A | 2018/07/20 | Automated Statchk |
| Mercury - Low Level (Dissolved) | CV/AF | 9071414 | 2018/07/20 | 2018/07/20 | Mahboubeh Bahadori |
| Elements by ICP - Dissolved | ICPA | 9068442 | N/A | 2018/07/20 | Jonathan Kuprowsky |
| Elements by ICPMS - Dissolved | ICPM | 9064907 | N/A | 2018/07/16 | Julie Harrison |
| Ion Balance | CALC | 9064353 | N/A | 2018/07/17 | Automated Statchk |
| Nitrate and Nitrite | CALC | 9065125 | N/A | 2018/07/18 | Automated Statchk |
| Nitrate + Nitrite-N (calculated) | CALC | 9065126 | N/A | 2018/07/18 | Automated Statchk |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9064840 | N/A | 2018/07/16 | Krista Dawe |
| Benzo[a]pyrene Equivalency | GC/MSD | 9064587 | N/A | 2018/07/23 | Automated Statchk |
| PAH in Water by GC/MS | GC/MS | 9065955 | 2018/07/17 | 2018/07/20 | Bert Chi |



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Maxxam Job #: B858174
Report Date: 2018/07/23

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## TEST SUMMARY

**Maxxam ID:** TW1592
**Sample ID:** GIBG-10-2-3
**Matrix:** Water

**Collected:** 2018/07/14
**Relinquished:** 2018/07/15
**Received:** 2018/07/16

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Phenols (4-AAP) | TECH/4AAP | 9071008 | N/A | 2018/07/20 | Ying Yang |
| Sulphate by Automated Colourimetry | KONE | 9068603 | N/A | 2018/07/19 | Chelsea Harmatys |
| Total Dissolved Solids (Filt. Residue) | BAL | 9068094 | 2018/07/18 | 2018/07/19 | Luminita Chiosa |

**Maxxam ID:** TW1593
**Sample ID:** GIQ8-10-2-4
**Matrix:** Water

**Collected:** 2018/07/14
**Relinquished:** 2018/07/15
**Received:** 2018/07/16

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | AT/ALK | 9067937 | N/A | 2018/07/18 | Malina Alamyar |
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9066395 | N/A | 2018/07/18 | Sandra Wilson |
| F1-BTEX | CALC/MS | 9064350 | N/A | 2018/07/19 | Automated Statchk |
| Cadmium - low level CCME - Dissolved | CALC/MS | 9064437 | N/A | 2018/07/17 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 9068600 | N/A | 2018/07/19 | Chelsea Harmatys |
| Conductivity @25C | COND | 9067939 | N/A | 2018/07/18 | Malina Alamyar |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9066088 | 2018/07/19 | 2018/07/20 | Grace Guo |
| Hardness | CALC | 9064352 | N/A | 2018/07/20 | Automated Statchk |
| Mercury - Low Level (Dissolved) | CV/AF | 9071414 | 2018/07/20 | 2018/07/20 | Mahboubeh Bahadori |
| Elements by ICP - Dissolved | ICPA | 9068442 | N/A | 2018/07/20 | Jonathan Kuprowsky |
| Elements by ICPMS - Dissolved | ICPM | 9064907 | N/A | 2018/07/16 | Julie Harrison |
| Ion Balance | CALC | 9064353 | N/A | 2018/07/17 | Automated Statchk |
| Nitrate and Nitrite | CALC | 9065125 | N/A | 2018/07/18 | Automated Statchk |
| Nitrate + Nitrite-N (calculated) | CALC | 9065126 | N/A | 2018/07/18 | Automated Statchk |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9064840 | N/A | 2018/07/16 | Krista Dawe |
| Phenols (4-AAP) | TECH/4AAP | 9071008 | N/A | 2018/07/20 | Ying Yang |
| Sulphate by Automated Colourimetry | KONE | 9068603 | N/A | 2018/07/19 | Chelsea Harmatys |
| Total Dissolved Solids (Filt. Residue) | BAL | 9068593 | 2018/07/18 | 2018/07/19 | Luminita Chiosa |

**Maxxam ID:** TW1594
**Sample ID:** NWD 18-14
**Matrix:** Water

**Collected:** 2018/07/14
**Relinquished:** 2018/07/15
**Received:** 2018/07/16

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9066395 | N/A | 2018/07/18 | Sandra Wilson |
| F1-BTEX | CALC/MS | 9064350 | N/A | 2018/07/19 | Automated Statchk |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9066088 | 2018/07/19 | 2018/07/20 | Grace Guo |

**Maxxam ID:** TW1595
**Sample ID:** NWD 18-04
**Matrix:** Water

**Collected:** 2018/07/14
**Relinquished:** 2018/07/15
**Received:** 2018/07/16

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9066395 | N/A | 2018/07/18 | Sandra Wilson |
| F1-BTEX | CALC/MS | 9064350 | N/A | 2018/07/19 | Automated Statchk |



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Report Date: 2018/07/23

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## TEST SUMMARY

**Maxxam ID:** TW1595
**Sample ID:** NWD 18-04
**Matrix:** Water

**Collected:** 2018/07/14
**Relinquished:** 2018/07/15
**Received:** 2018/07/16

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9066088 | 2018/07/19 | 2018/07/20 | Grace Guo |

**Maxxam ID:** TW1596
**Sample ID:** GIP11 09-1-4R
**Matrix:** Water

**Collected:** 2018/07/14
**Relinquished:** 2018/07/15
**Received:** 2018/07/16

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | AT/ALK | 9067937 | N/A | 2018/07/18 | Malina Alamyar |
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9066395 | N/A | 2018/07/18 | Sandra Wilson |
| F1-BTEX | CALC/MS | 9064350 | N/A | 2018/07/19 | Automated Statchk |
| Cadmium - low level CCME - Dissolved | CALC/MS | 9064437 | N/A | 2018/07/17 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 9068600 | N/A | 2018/07/19 | Chelsea Harmatys |
| Conductivity @25C | COND | 9067939 | N/A | 2018/07/18 | Malina Alamyar |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9066088 | 2018/07/19 | 2018/07/20 | Grace Guo |
| Hardness | CALC | 9064352 | N/A | 2018/07/20 | Automated Statchk |
| Mercury - Low Level (Dissolved) | CV/AF | 9071414 | 2018/07/20 | 2018/07/20 | Mahboubeh Bahadori |
| Elements by ICP - Dissolved | ICPA | 9068442 | N/A | 2018/07/20 | Jonathan Kuprowsky |
| Elements by ICPMS - Dissolved | ICPM | 9064907 | N/A | 2018/07/16 | Julie Harrison |
| Ion Balance | CALC | 9064353 | N/A | 2018/07/17 | Automated Statchk |
| Nitrate and Nitrite | CALC | 9065125 | N/A | 2018/07/18 | Automated Statchk |
| Nitrate + Nitrite-N (calculated) | CALC | 9065126 | N/A | 2018/07/18 | Automated Statchk |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9064840 | N/A | 2018/07/16 | Krista Dawe |
| Phenols (4-AAP) | TECH/4AAP | 9071008 | N/A | 2018/07/20 | Ying Yang |
| Sulphate by Automated Colourimetry | KONE | 9068603 | N/A | 2018/07/19 | Chelsea Harmatys |
| Total Dissolved Solids (Filt. Residue) | BAL | 9068593 | 2018/07/18 | 2018/07/19 | Luminita Chiosa |



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Advisian
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Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## GENERAL COMMENTS

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

| | |
|---|---|
| Package 1 | 5.7°C |

**Results relate only to the items tested.**



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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| 9064840 | KD5 | Method Blank | Dissolved Nitrite (N) | 2018/07/16 | <0.010 | | mg/L | |
| | | | Dissolved Nitrate (N) | 2018/07/16 | <0.010 | | mg/L | |
| 9064907 | JHS | Method Blank | Dissolved Aluminum (Al) | 2018/07/16 | <0.0030 | | mg/L | |
| | | | Dissolved Chromium (Cr) | 2018/07/16 | <0.0010 | | mg/L | |
| | | | Dissolved Cobalt (Co) | 2018/07/16 | <0.00030 | | mg/L | |
| | | | Dissolved Copper (Cu) | 2018/07/16 | <0.00020 | | mg/L | |
| | | | Dissolved Lead (Pb) | 2018/07/16 | <0.00020 | | mg/L | |
| | | | Dissolved Antimony (Sb) | 2018/07/16 | <0.00060 | | mg/L | |
| | | | Dissolved Molybdenum (Mo) | 2018/07/16 | <0.00020 | | mg/L | |
| | | | Dissolved Nickel (Ni) | 2018/07/16 | <0.00050 | | mg/L | |
| | | | Dissolved Selenium (Se) | 2018/07/16 | <0.00020 | | mg/L | |
| | | | Dissolved Silver (Ag) | 2018/07/16 | <0.00010 | | mg/L | |
| | | | Dissolved Arsenic (As) | 2018/07/16 | <0.00020 | | mg/L | |
| | | | Dissolved Thallium (Tl) | 2018/07/16 | <0.00020 | | mg/L | |
| | | | Dissolved Tin (Sn) | 2018/07/16 | <0.0010 | | mg/L | |
| | | | Dissolved Titanium (Ti) | 2018/07/16 | <0.0010 | | mg/L | |
| | | | Dissolved Uranium (U) | 2018/07/16 | <0.00010 | | mg/L | |
| | | | Dissolved Vanadium (V) | 2018/07/16 | <0.0010 | | mg/L | |
| | | | Dissolved Zinc (Zn) | 2018/07/16 | <0.0030 | | mg/L | |
| | | | Dissolved Beryllium (Be) | 2018/07/16 | <0.0010 | | mg/L | |
| 9065228 | SES | Method Blank | 1,4-Difluorobenzene (sur.) | 2018/07/16 | | 101 | % | 50 - 140 |
| | | | 4-Bromofluorobenzene (sur.) | 2018/07/16 | | 100 | % | 50 - 140 |
| | | | D4-1,2-Dichloroethane (sur.) | 2018/07/16 | | 99 | % | 50 - 140 |
| | | | Benzene | 2018/07/16 | <0.00040 | | mg/L | |
| | | | Toluene | 2018/07/16 | <0.00040 | | mg/L | |
| | | | Ethylbenzene | 2018/07/16 | <0.00040 | | mg/L | |
| | | | m & p-Xylene | 2018/07/16 | <0.00080 | | mg/L | |
| | | | o-Xylene | 2018/07/16 | <0.00040 | | mg/L | |
| | | | F1 (C6-C10) | 2018/07/16 | <0.10 | | mg/L | |
| 9065955 | BC5 | Method Blank | D10-ANTHRACENE (sur.) | 2018/07/19 | | 106 | % | 50 - 130 |
| | | | TERPHENYL-D14 (sur.) | 2018/07/19 | | 111 | % | 50 - 130 |
| | | | D8-ACENAPHTHYLENE (sur.) | 2018/07/19 | | 97 | % | 50 - 130 |
| | | | D8-NAPHTHALENE (sur.) | 2018/07/19 | | 77 | % | 50 - 130 |
| | | | Acenaphthene | 2018/07/19 | <0.00010 | | mg/L | |
| | | | Acenaphthylene | 2018/07/19 | <0.00010 | | mg/L | |
| | | | Acridine | 2018/07/19 | <0.000050 | | mg/L | |
| | | | Anthracene | 2018/07/19 | <0.000010 | | mg/L | |
| | | | Benzo(a)anthracene | 2018/07/19 | <0.0000085 | | mg/L | |
| | | | Benzo(b&j)fluoranthene | 2018/07/19 | <0.0000085 | | mg/L | |
| | | | Benzo(k)fluoranthene | 2018/07/19 | <0.0000085 | | mg/L | |
| | | | Benzo(g,h,i)perylene | 2018/07/19 | <0.0000085 | | mg/L | |
| | | | Benzo(c)phenanthrene | 2018/07/19 | <0.000050 | | mg/L | |
| | | | Benzo(a)pyrene | 2018/07/19 | <0.0000075 | | mg/L | |
| | | | Benzo[e]pyrene | 2018/07/19 | <0.000050 | | mg/L | |
| | | | Chrysene | 2018/07/19 | <0.0000085 | | mg/L | |
| | | | Dibenz(a,h)anthracene | 2018/07/19 | <0.0000075 | | mg/L | |
| | | | Fluoranthene | 2018/07/19 | <0.000010 | | mg/L | |
| | | | Fluorene | 2018/07/19 | <0.000050 | | mg/L | |
| | | | Indeno(1,2,3-cd)pyrene | 2018/07/19 | <0.0000085 | | mg/L | |
| | | | 1-Methylnaphthalene | 2018/07/19 | <0.00010 | | mg/L | |
| | | | 2-Methylnaphthalene | 2018/07/19 | <0.00010 | | mg/L | |



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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT(CONT'D)

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| | | | Naphthalene | 2018/07/19 | <0.00010 | | mg/L | |
| | | | Phenanthrene | 2018/07/19 | <0.000050 | | mg/L | |
| | | | Perylene | 2018/07/19 | <0.000050 | | mg/L | |
| | | | Pyrene | 2018/07/19 | <0.000020 | | mg/L | |
| | | | Quinoline | 2018/07/19 | <0.00020 | | mg/L | |
| 9065963 | JR1 | Method Blank | O-TERPHENYL (sur.) | 2018/07/19 | | 93 | % | 60 - 140 |
| | | | F2 (C10-C16 Hydrocarbons) | 2018/07/19 | <0.10 | | mg/L | |
| 9066088 | GG3 | Method Blank | O-TERPHENYL (sur.) | 2018/07/20 | | 94 | % | 60 - 140 |
| | | | F2 (C10-C16 Hydrocarbons) | 2018/07/20 | <0.10 | | mg/L | |
| 9066395 | SB8 | Method Blank | 1,4-Difluorobenzene (sur.) | 2018/07/18 | | 100 | % | 50 - 140 |
| | | | 4-Bromofluorobenzene (sur.) | 2018/07/18 | | 105 | % | 50 - 140 |
| | | | D4-1,2-Dichloroethane (sur.) | 2018/07/18 | | 94 | % | 50 - 140 |
| | | | Benzene | 2018/07/18 | <0.00040 | | mg/L | |
| | | | Toluene | 2018/07/18 | <0.00040 | | mg/L | |
| | | | Ethylbenzene | 2018/07/18 | <0.00040 | | mg/L | |
| | | | m & p-Xylene | 2018/07/18 | <0.00080 | | mg/L | |
| | | | o-Xylene | 2018/07/18 | <0.00040 | | mg/L | |
| | | | F1 (C6-C10) | 2018/07/18 | <0.10 | | mg/L | |
| 9067937 | MA4 | Method Blank | Alkalinity (Total as CaCO3) | 2018/07/18 | <1.0 | | mg/L | |
| | | | Alkalinity (PP as CaCO3) | 2018/07/18 | <1.0 | | mg/L | |
| | | | Bicarbonate (HCO3) | 2018/07/18 | <1.0 | | mg/L | |
| | | | Carbonate (CO3) | 2018/07/18 | <1.0 | | mg/L | |
| | | | Hydroxide (OH) | 2018/07/18 | <1.0 | | mg/L | |
| 9067939 | MA4 | Method Blank | Conductivity | 2018/07/18 | <2.0 | | uS/cm | |
| 9068094 | LCA | Method Blank | Total Dissolved Solids | 2018/07/19 | <10 | | mg/L | |
| 9068442 | JK9 | Method Blank | Dissolved Iron (Fe) | 2018/07/20 | <0.060 | | mg/L | |
| | | | Dissolved Lithium (Li) | 2018/07/20 | <0.020 | | mg/L | |
| | | | Dissolved Magnesium (Mg) | 2018/07/20 | <0.20 | | mg/L | |
| | | | Dissolved Manganese (Mn) | 2018/07/20 | <0.0040 | | mg/L | |
| | | | Dissolved Potassium (K) | 2018/07/20 | <0.30 | | mg/L | |
| | | | Dissolved Sodium (Na) | 2018/07/20 | <0.50 | | mg/L | |
| | | | Dissolved Strontium (Sr) | 2018/07/20 | <0.020 | | mg/L | |
| | | | Dissolved Sulphur (S) | 2018/07/20 | <0.20 | | mg/L | |
| | | | Dissolved Phosphorus (P) | 2018/07/20 | <0.10 | | mg/L | |
| | | | Dissolved Barium (Ba) | 2018/07/20 | <0.010 | | mg/L | |
| | | | Dissolved Silicon (Si) | 2018/07/20 | <0.10 | | mg/L | |
| | | | Dissolved Boron (B) | 2018/07/20 | <0.020 | | mg/L | |
| | | | Dissolved Calcium (Ca) | 2018/07/20 | <0.30 | | mg/L | |
| 9068593 | LCA | Method Blank | Total Dissolved Solids | 2018/07/19 | <10 | | mg/L | |
| 9068600 | CH7 | Method Blank | Dissolved Chloride (Cl) | 2018/07/19 | <1.0 | | mg/L | |
| 9068603 | CH7 | Method Blank | Dissolved Sulphate (SO4) | 2018/07/19 | <1.0 | | mg/L | |
| 9071008 | YY | Method Blank | Phenols | 2018/07/20 | <0.0020 | | mg/L | |
| 9071414 | BAH | Method Blank | Dissolved Mercury (Hg) | 2018/07/20 | <0.0000020 | | mg/L | |
| 9064840 | KD5 | LCS | Dissolved Nitrite (N) | 2018/07/16 | | 100 | % | 80 - 120 |
| | | | Dissolved Nitrate (N) | 2018/07/16 | | 101 | % | 80 - 120 |
| 9064907 | JHS | LCS | Dissolved Aluminum (Al) | 2018/07/16 | | 106 | % | 80 - 120 |
| | | | Dissolved Chromium (Cr) | 2018/07/16 | | 100 | % | 80 - 120 |
| | | | Dissolved Cobalt (Co) | 2018/07/16 | | 97 | % | 80 - 120 |
| | | | Dissolved Copper (Cu) | 2018/07/16 | | 99 | % | 80 - 120 |
| | | | Dissolved Lead (Pb) | 2018/07/16 | | 96 | % | 80 - 120 |
| | | | Dissolved Antimony (Sb) | 2018/07/16 | | 89 | % | 80 - 120 |



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Site Location: Norman Wells, NT
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## QUALITY ASSURANCE REPORT(CONT'D)

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| | | | Dissolved Molybdenum (Mo) | 2018/07/16 | | 85 | % | 80 - 120 |
| | | | Dissolved Nickel (Ni) | 2018/07/16 | | 100 | % | 80 - 120 |
| | | | Dissolved Selenium (Se) | 2018/07/16 | | 92 | % | 80 - 120 |
| | | | Dissolved Silver (Ag) | 2018/07/16 | | 96 | % | 80 - 120 |
| | | | Dissolved Arsenic (As) | 2018/07/16 | | 96 | % | 80 - 120 |
| | | | Dissolved Thallium (Tl) | 2018/07/16 | | 97 | % | 80 - 120 |
| | | | Dissolved Tin (Sn) | 2018/07/16 | | 94 | % | 80 - 120 |
| | | | Dissolved Titanium (Ti) | 2018/07/16 | | 110 | % | 80 - 120 |
| | | | Dissolved Uranium (U) | 2018/07/16 | | 98 | % | 80 - 120 |
| | | | Dissolved Vanadium (V) | 2018/07/16 | | 100 | % | 80 - 120 |
| | | | Dissolved Zinc (Zn) | 2018/07/16 | | 96 | % | 80 - 120 |
| | | | Dissolved Beryllium (Be) | 2018/07/16 | | 97 | % | 80 - 120 |
| 9065228 | SES | LCS | 1,4-Difluorobenzene (sur.) | 2018/07/18 | | 94 | % | 50 - 140 |
| | | | 4-Bromofluorobenzene (sur.) | 2018/07/18 | | 98 | % | 50 - 140 |
| | | | D4-1,2-Dichloroethane (sur.) | 2018/07/18 | | 96 | % | 50 - 140 |
| | | | Benzene | 2018/07/18 | | 83 | % | 60 - 130 |
| | | | Toluene | 2018/07/18 | | 86 | % | 60 - 130 |
| | | | Ethylbenzene | 2018/07/18 | | 92 | % | 60 - 130 |
| | | | m & p-Xylene | 2018/07/18 | | 89 | % | 60 - 130 |
| | | | o-Xylene | 2018/07/18 | | 89 | % | 60 - 130 |
| | | | F1 (C6-C10) | 2018/07/18 | | 92 | % | 60 - 140 |
| 9065955 | BC5 | LCS | D10-ANTHRACENE (sur.) | 2018/07/19 | | 104 | % | 50 - 130 |
| | | | TERPHENYL-D14 (sur.) | 2018/07/19 | | 109 | % | 50 - 130 |
| | | | D8-ACENAPHTHYLENE (sur.) | 2018/07/19 | | 102 | % | 50 - 130 |
| | | | D8-NAPHTHALENE (sur.) | 2018/07/19 | | 90 | % | 50 - 130 |
| | | | Acenaphthene | 2018/07/19 | | 93 | % | 50 - 130 |
| | | | Acenaphthylene | 2018/07/19 | | 99 | % | 50 - 130 |
| | | | Acridine | 2018/07/19 | | 102 | % | 50 - 130 |
| | | | Anthracene | 2018/07/19 | | 99 | % | 50 - 130 |
| | | | Benzo(a)anthracene | 2018/07/19 | | 120 | % | 50 - 130 |
| | | | Benzo(b&j)fluoranthene | 2018/07/19 | | 108 | % | 50 - 130 |
| | | | Benzo(k)fluoranthene | 2018/07/19 | | 113 | % | 50 - 130 |
| | | | Benzo(g,h,i)perylene | 2018/07/19 | | 108 | % | 50 - 130 |
| | | | Benzo(c)phenanthrene | 2018/07/19 | | 121 | % | 50 - 130 |
| | | | Benzo(a)pyrene | 2018/07/19 | | 118 | % | 50 - 130 |
| | | | Benzo[e]pyrene | 2018/07/19 | | 112 | % | 50 - 130 |
| | | | Chrysene | 2018/07/19 | | 110 | % | 50 - 130 |
| | | | Dibenz(a,h)anthracene | 2018/07/19 | | 111 | % | 50 - 130 |
| | | | Fluoranthene | 2018/07/19 | | 136 (1) | % | 50 - 130 |
| | | | Fluorene | 2018/07/19 | | 100 | % | 50 - 130 |
| | | | Indeno(1,2,3-cd)pyrene | 2018/07/19 | | 111 | % | 50 - 130 |
| | | | 1-Methylnaphthalene | 2018/07/19 | | 89 | % | 50 - 130 |
| | | | 2-Methylnaphthalene | 2018/07/19 | | 92 | % | 50 - 130 |
| | | | Naphthalene | 2018/07/19 | | 91 | % | 50 - 130 |
| | | | Phenanthrene | 2018/07/19 | | 96 | % | 50 - 130 |
| | | | Perylene | 2018/07/19 | | 91 | % | 50 - 130 |
| | | | Pyrene | 2018/07/19 | | 132 (1) | % | 50 - 130 |
| | | | Quinoline | 2018/07/19 | | 105 | % | 50 - 130 |
| 9065963 | JR1 | LCS | O-TERPHENYL (sur.) | 2018/07/19 | | 87 | % | 60 - 140 |
| | | | F2 (C10-C16 Hydrocarbons) | 2018/07/19 | | 82 | % | 60 - 140 |
| 9066088 | GG3 | LCS | O-TERPHENYL (sur.) | 2018/07/20 | | 94 | % | 60 - 140 |



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Site Location: Norman Wells, NT
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## QUALITY ASSURANCE REPORT(CONT'D)

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| | | | F2 (C10-C16 Hydrocarbons) | 2018/07/20 | | 105 | % | 60 - 140 |
| 9066395 | SB8 | LCS | 1,4-Difluorobenzene (sur.) | 2018/07/18 | | 87 | % | 50 - 140 |
| | | | 4-Bromofluorobenzene (sur.) | 2018/07/18 | | 104 | % | 50 - 140 |
| | | | D4-1,2-Dichloroethane (sur.) | 2018/07/18 | | 98 | % | 50 - 140 |
| | | | Benzene | 2018/07/18 | | 91 | % | 60 - 130 |
| | | | Toluene | 2018/07/18 | | 82 | % | 60 - 130 |
| | | | Ethylbenzene | 2018/07/18 | | 96 | % | 60 - 130 |
| | | | m & p-Xylene | 2018/07/18 | | 88 | % | 60 - 130 |
| | | | o-Xylene | 2018/07/18 | | 92 | % | 60 - 130 |
| | | | F1 (C6-C10) | 2018/07/18 | | 106 | % | 60 - 140 |
| 9067937 | MA4 | LCS | Alkalinity (Total as CaCO3) | 2018/07/18 | | 100 | % | 80 - 120 |
| 9067939 | MA4 | LCS | Conductivity | 2018/07/18 | | 100 | % | 90 - 110 |
| 9068094 | LCA | LCS | Total Dissolved Solids | 2018/07/19 | | 100 | % | 80 - 120 |
| 9068442 | JK9 | LCS | Dissolved Iron (Fe) | 2018/07/20 | | 103 | % | 80 - 120 |
| | | | Dissolved Lithium (Li) | 2018/07/20 | | 106 | % | 80 - 120 |
| | | | Dissolved Magnesium (Mg) | 2018/07/20 | | 104 | % | 80 - 120 |
| | | | Dissolved Manganese (Mn) | 2018/07/20 | | 104 | % | 80 - 120 |
| | | | Dissolved Potassium (K) | 2018/07/20 | | 104 | % | 80 - 120 |
| | | | Dissolved Sodium (Na) | 2018/07/20 | | 106 | % | 80 - 120 |
| | | | Dissolved Strontium (Sr) | 2018/07/20 | | 105 | % | 80 - 120 |
| | | | Dissolved Phosphorus (P) | 2018/07/20 | | 103 | % | 80 - 120 |
| | | | Dissolved Barium (Ba) | 2018/07/20 | | 107 | % | 80 - 120 |
| | | | Dissolved Silicon (Si) | 2018/07/20 | | 101 | % | 80 - 120 |
| | | | Dissolved Boron (B) | 2018/07/20 | | 107 | % | 80 - 120 |
| | | | Dissolved Calcium (Ca) | 2018/07/20 | | 103 | % | 80 - 120 |
| 9068593 | LCA | LCS | Total Dissolved Solids | 2018/07/19 | | 96 | % | 80 - 120 |
| 9068600 | CH7 | LCS | Dissolved Chloride (Cl) | 2018/07/19 | | 103 | % | 80 - 120 |
| 9068603 | CH7 | LCS | Dissolved Sulphate (SO4) | 2018/07/19 | | 106 | % | 80 - 120 |
| 9071008 | YY | LCS | Phenols | 2018/07/20 | | 90 | % | 80 - 120 |
| 9071414 | BAH | LCS | Dissolved Mercury (Hg) | 2018/07/20 | | 97 | % | 80 - 120 |
| 9071414 | BAH | SRM | Dissolved Mercury (Hg) | 2018/07/20 | | 92 | % | 80 - 120 |

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

LCS: 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.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.



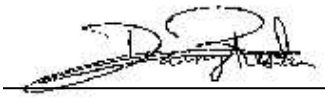
Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B858174
Report Date: 2018/07/23

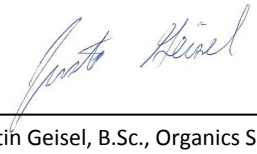
Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## VALIDATION SIGNATURE PAGE

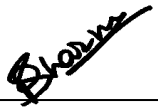
The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



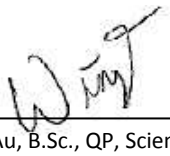
Daniel Reslan, cCT, QP, Organics Manager



Justin Geisel, B.Sc., Organics Supervisor



Poonam Sharma, cCT, Organics Supervisor



Winnie Au, B.Sc., QP, 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.



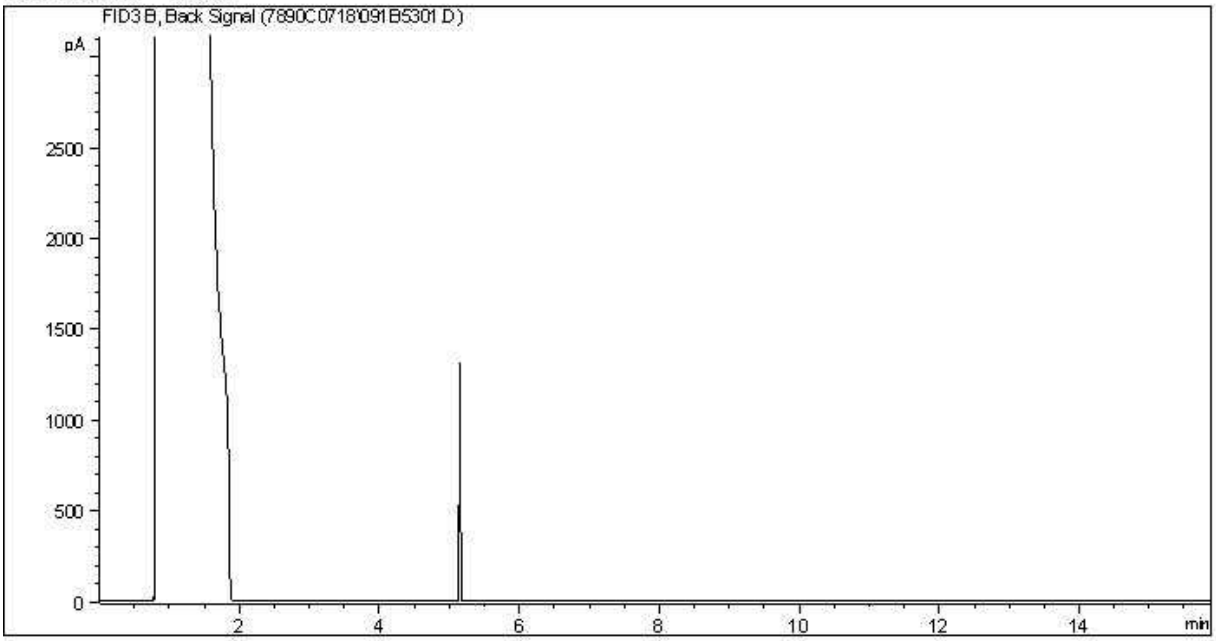
Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B858174
Report Date: 2018/07/23
Maxxam Sample: TW1591

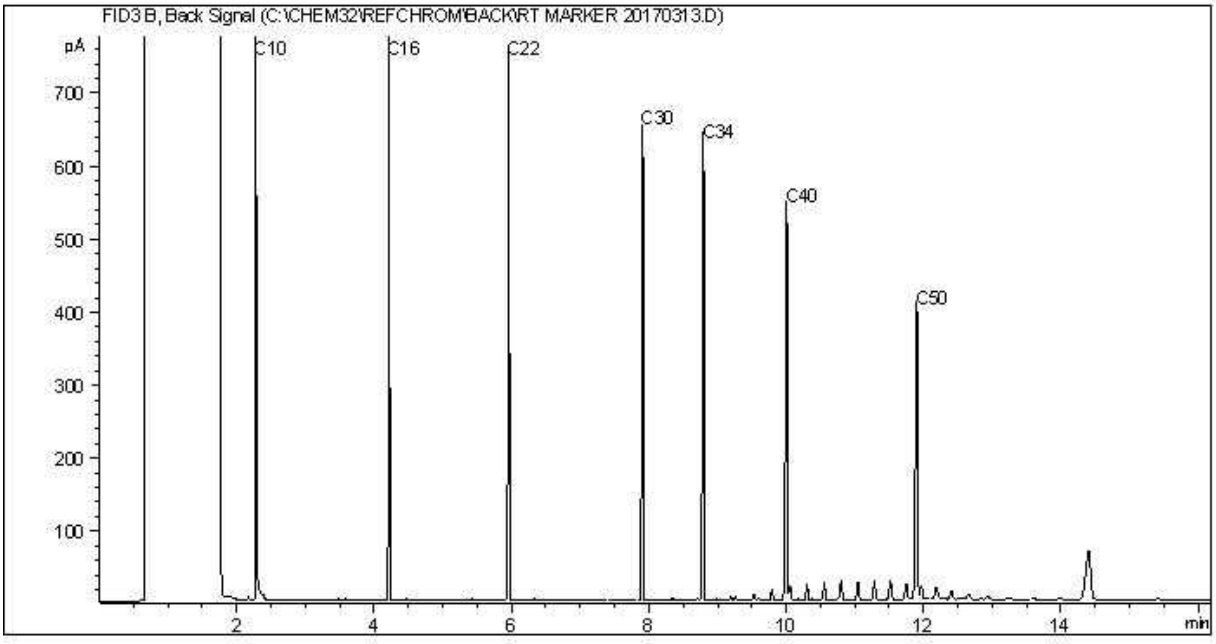
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: NWD 18-47

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890C




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

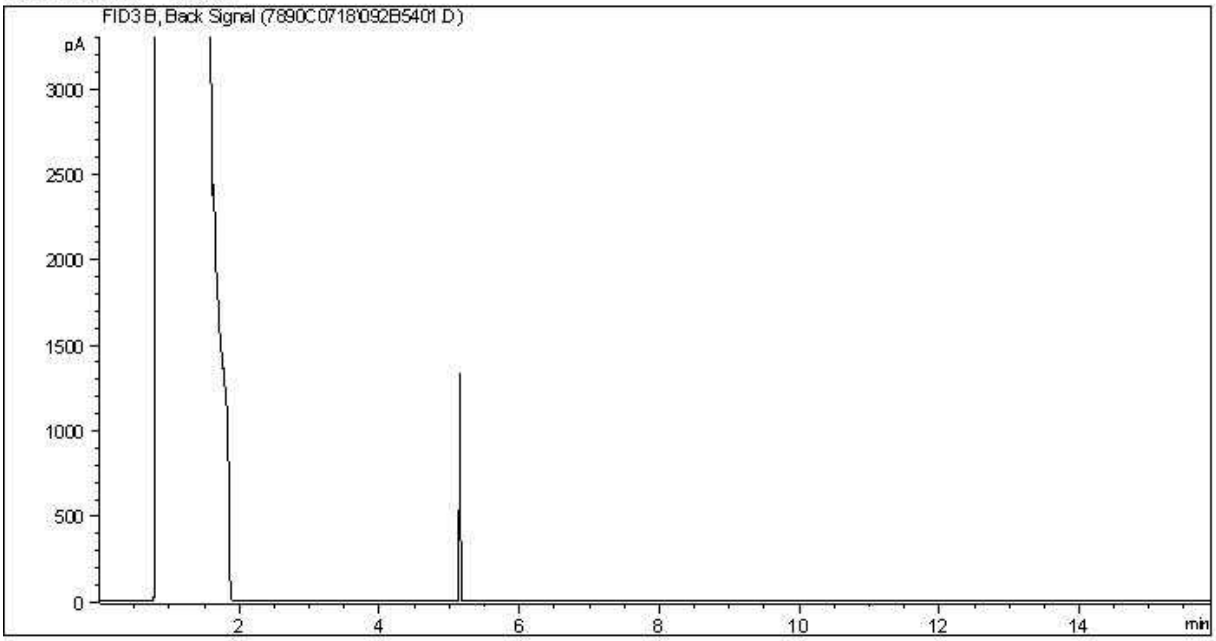
**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam Job #: B858174
Report Date: 2018/07/23
Maxxam Sample: TW1592

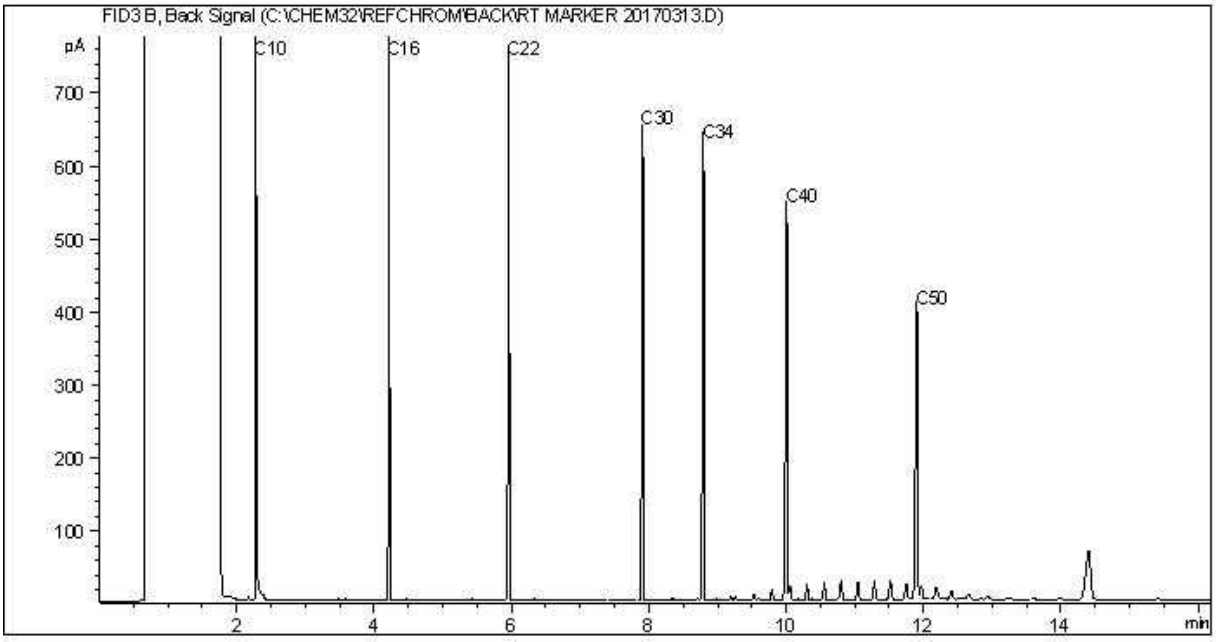
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: GIBG-10-2-3

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890C




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

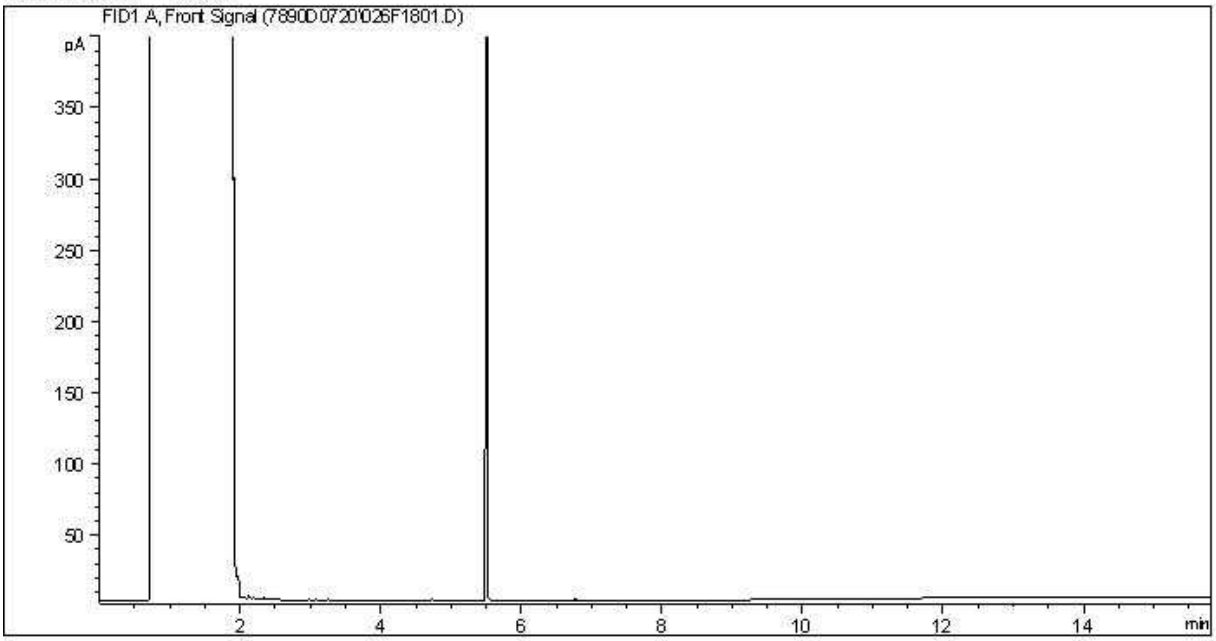
**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam Job #: B858174
Report Date: 2018/07/23
Maxxam Sample: TW1593

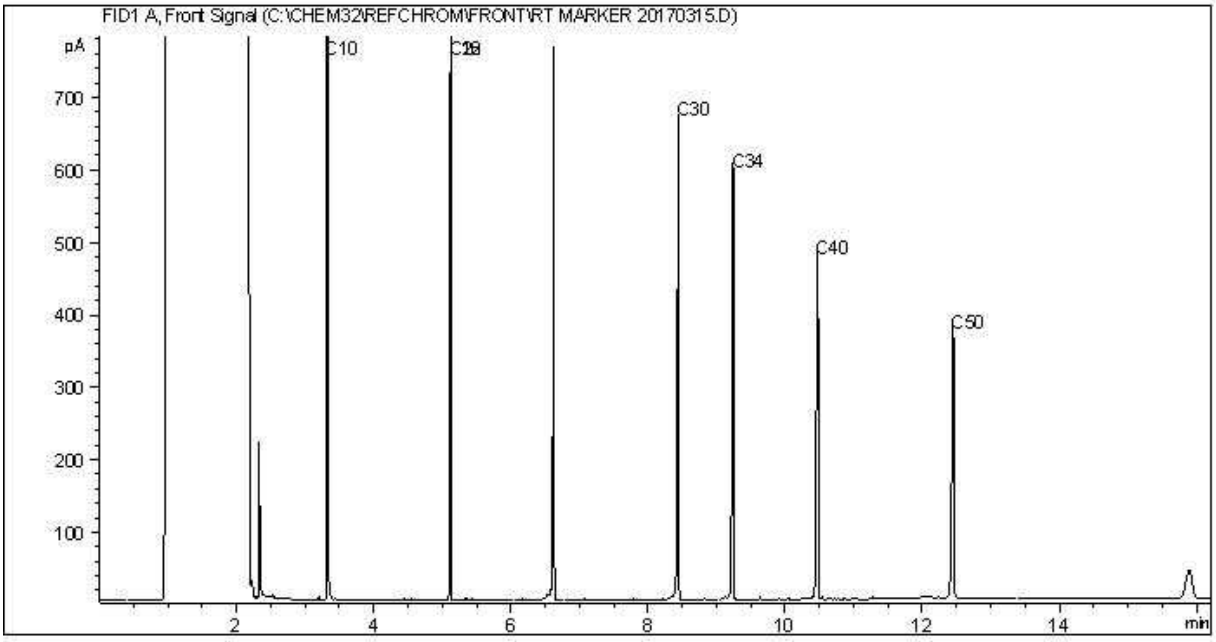
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: GIQ8-10-2-4

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890D




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

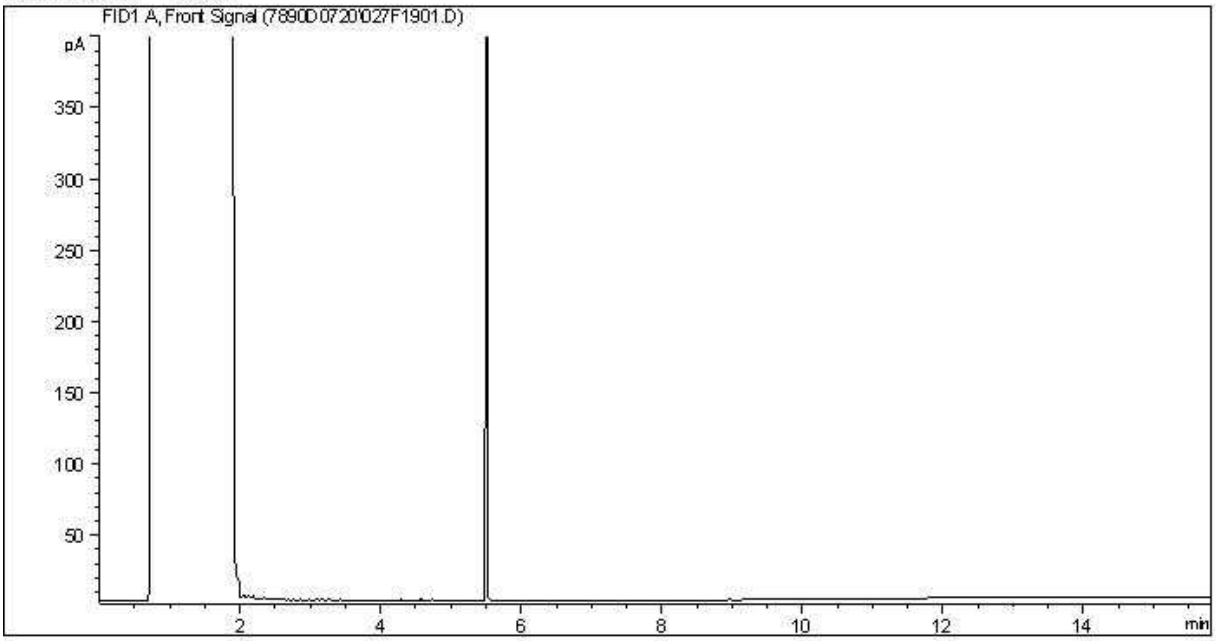
**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam Job #: B858174
Report Date: 2018/07/23
Maxxam Sample: TW1594

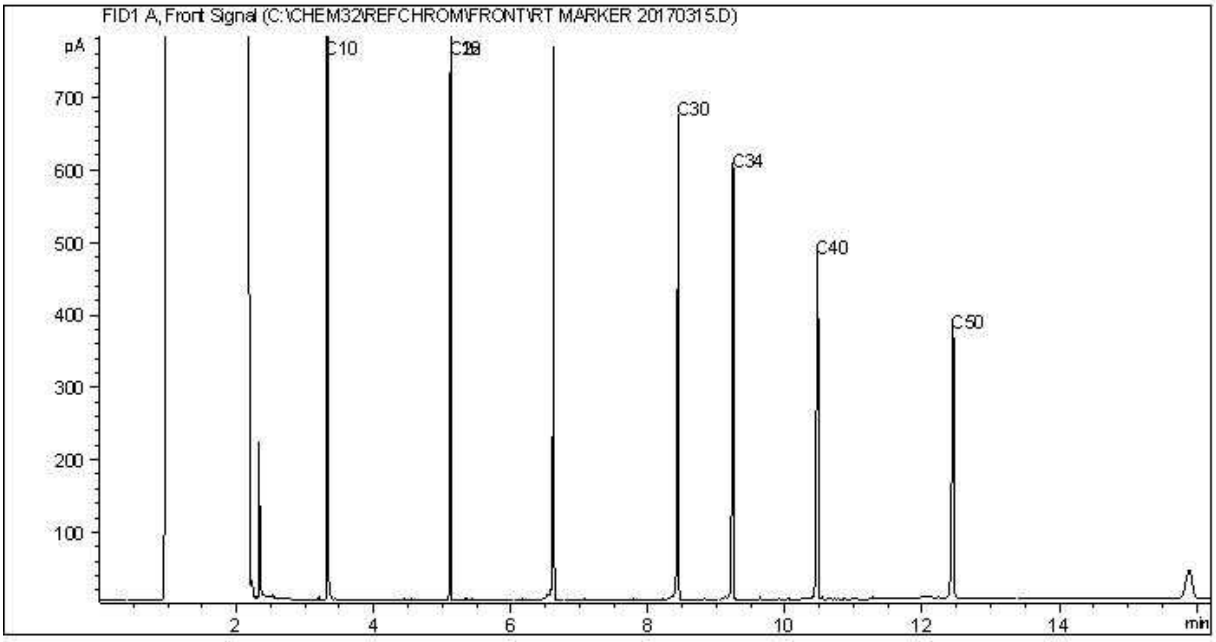
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: NWD 18-14

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890D




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

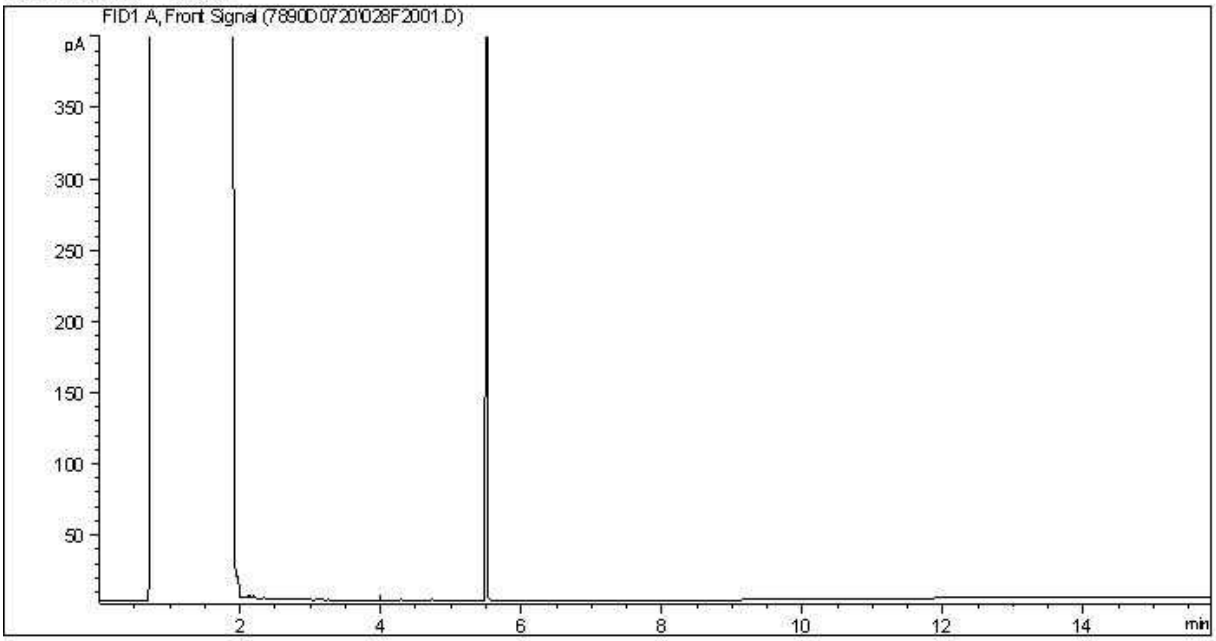
**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam Job #: B858174
Report Date: 2018/07/23
Maxxam Sample: TW1595

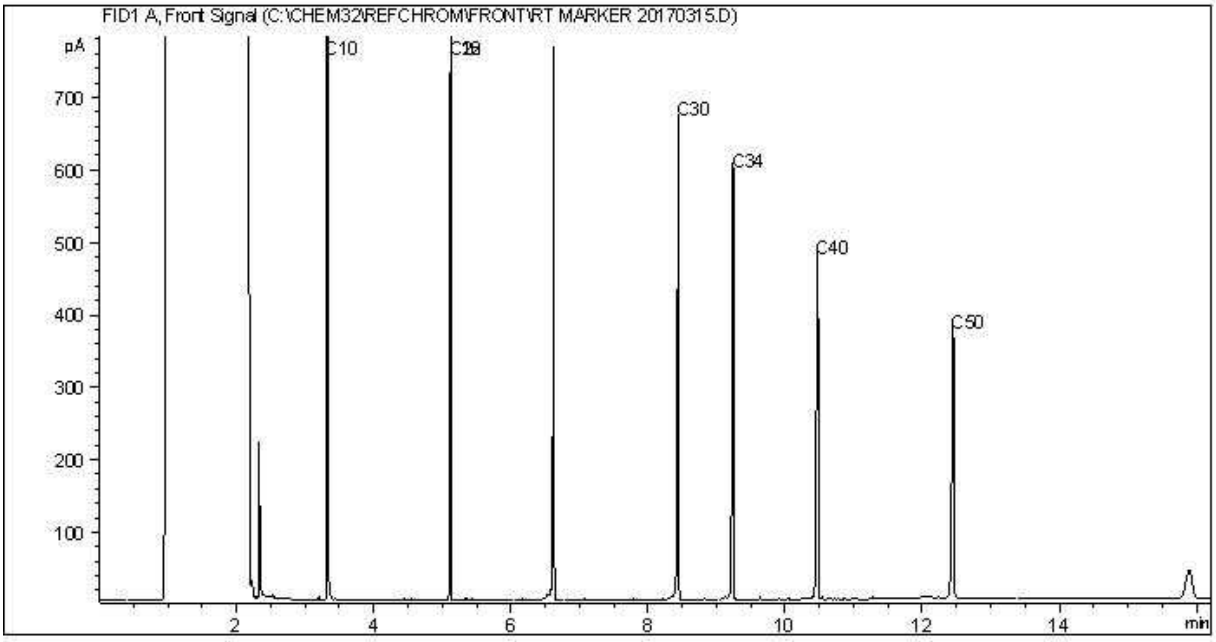
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: NWD 18-04

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890D




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

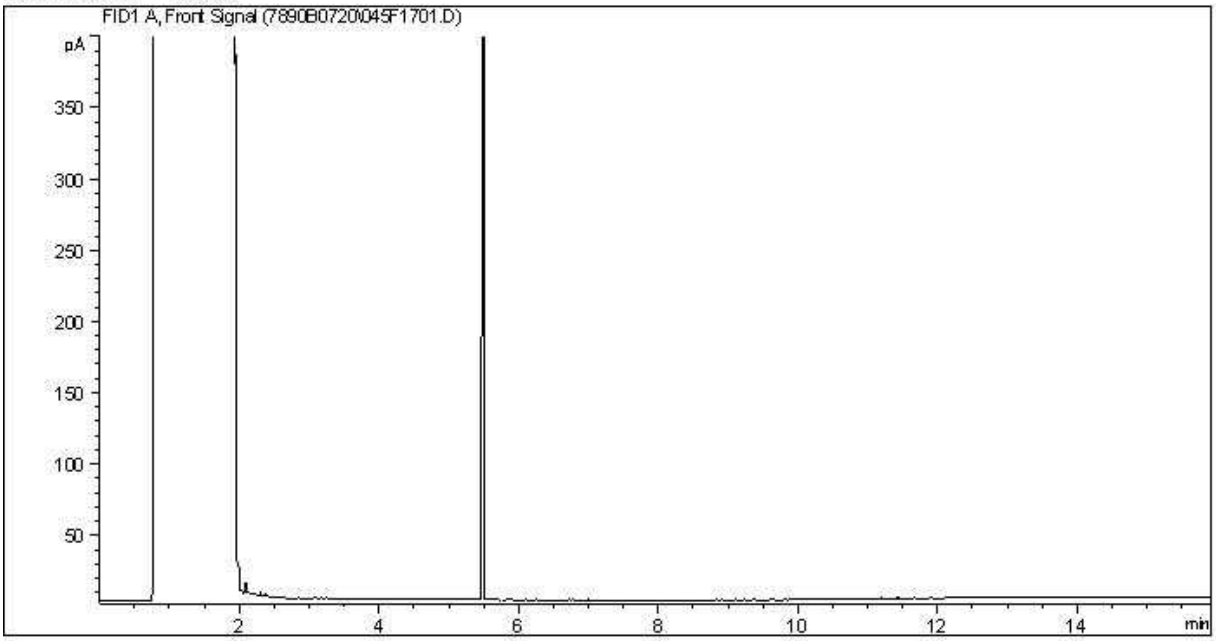
**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam Job #: B858174
Report Date: 2018/07/23
Maxxam Sample: TW1596

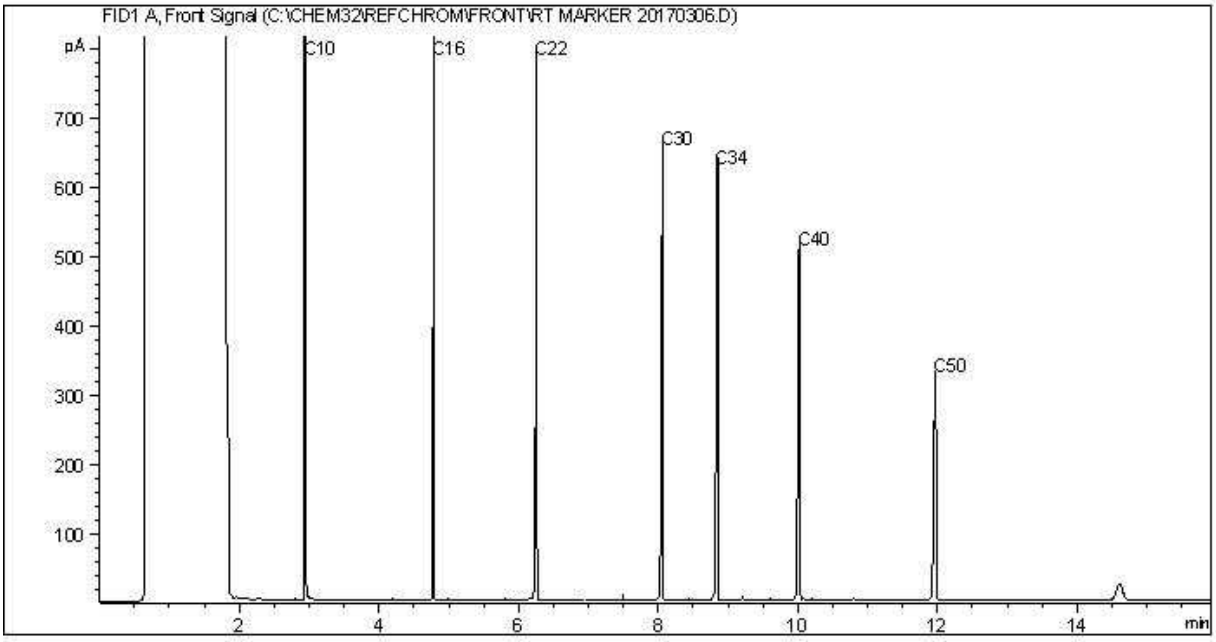
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: GIP11 09-1-4R

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890B




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam
A Bureau Veritas Group Company

☐ Calgary
4000 19th St. NE, T2E 6P8
Phone: (403) 291-3077
Fax: (403) 735-2240
Toll Free: (800) 386-7247

☒ Edmonton
9331 - 48 Street, T6B 2R4
Phone: (780) 577-7100
Fax: (780) 450-4187
Toll Free: (800) 386-7247

816 D-T

# EXXON MOBIL/IMPERIAL OIL - MAXXAM CHAIN-OF-CUSTODY RECORD



C of C # 298576

| INVOICE INFORMATION | REPORT INFORMATION |
|---|---|
| Company Name: ☒ Imperial Oil ☐ ExxonMobil | Company Name: Worley Parsons |
| Contact Name: WorleyParsons | Contact Name: Stacy Gibb |
| Address: 500, 151 Canada Olympic Rd SW Calgary, AB T3B 6B7 | Address: 500, 151 Canada Olympic Rd SW Calgary, AB T3B 6B7 |
| Email: Sanj.perera@advisian.com | Email: stacy.gibb@advisian.com |
| Ph: 587-952-1490 | Ph: 403-247-0200 |
| Sampler Name (Print): Michelle Vokaty, Melanie Jones | Consultant Project #: 00586-400 407011 - [redacted] mv |

| FIELD SAMPLE ID | MATRIX: GROUND WATER | SURFACE WATER | SOIL | OTHER | # CONTAINERS | SAMPLING: DATE (YYYY/MM/DD) | TIME (24 HR) | FIELD FILTERED & PRESERVED | LAB FILTRATION REQUIRED | VOC | PAH | PHCs (FRACTIONS 1-2 PLUS BTEX) | PHCs (FRACTIONS 1-4 PLUS BTEX) | PHCs (FRACTIONS 2-4) | PHCs (FRACTION 1 PLUS BTEX) | GRAIN SIZE (75 MICRON) | TEXTURE (% SAND, SILT, CLAY) | PARTICLE SIZE DISTRIBUTION WITH GRAPH | REGULATED METALS TOT ☐ DIS ☒ | MERCURY TOTAL ☐ DISSOLVED ☒ | SALINITY SOIL | FERTILIZER SOIL | FERTILIZER WATER | NUTRIENTS SOIL | ROUTINE POTABILITY | pH ☐ EC ☐ ALKALINITY ☐ | BASIC CLASS II LANDFILL PKG | Phenols by 4AAP | Limited sample/missing bottles | Headspace present in BTEX vials |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 NWD 18-47 | X | | | | 8 | 2018/07/14 | 09:30 | X | | | X | X | | | | | | | X | X | | | | | X | | | X | X | |
| 2 GIBG-10-2-3 | X | | | | 8 | ↓ | 09:25 | X | | | X | X | | | | | | | X | X | | | | | X | | | X | X | |
| 3 GIQ8-10-2-4 | X | | | | 10 | | 09:40 | X | | | | X | | | | | | | X | X | | | | | X | | | X | | |
| 4 NWD 18-14 | | | | X | 5 | | 09:50 | | | | | X | | | | | | | | | | | | | | | | | | |
| 5 NWD 18-04 | | | | X | 4 | ↓ mv | 13:00 | | | | | X | | | | | | | | | | | | | | | | X | X | |
| 6 GIP11 09-1-4R | X | | | | 10 | ↓ | 10:30 | X | | | | X | | | | | | | X | X | | | | | X | | | X | | |
| 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

IOL SITE LOCATION: Norman Wells, NT

IOL PROJECT # (if applicable): N/A

MAXXAM TASK ORDER # OR SERVICE ORDER # + LINE ITEM: 407011 - 00586-400 mv

REGULATORY CRITERIA / DETECTION LIMITS:
☐ Alberta Tier 1 ☐ CDWG
☐ SEQG (SK) ☐ NoSC (SK)
☒ CCME (incl. level) FAL ☐ Other

SPECIAL INSTRUCTIONS:
also email:
- standard Norman Wells list
- melissa.lord@advisian.com
IES A26014136

# JARS USED & NOT SUBMITTED Enter N/A for Water: N/A

TURNAROUND TIME
Standard (5 days) ☒
Rush (3 days) ☐
(2 days) ☐
(1 day) ☐
(same day) ☐
Date Required

| | YES | NO | COOLER ID # | | | |
|---|---|---|---|---|---|---|
| SEAL PRESENT | ✓ | | | | | |
| SEAL INTACT | ✓ | | | | | |
| COOLING MEDIA PRESENT | ✓ | | TEMP °C | 6 (1) | 5 (2) | 6 (3) |

| | YES | NO | COOLER ID # | | | |
|---|---|---|---|---|---|---|
| SEAL PRESENT | | | | | | |
| SEAL INTACT | | | | | | |
| COOLING MEDIA PRESENT | | | TEMP °C | (1) | (2) | (3) |

| | YES | NO | COOLER ID # | | | |
|---|---|---|---|---|---|---|
| SEAL PRESENT | | | | | | |
| SEAL INTACT | | | | | | |
| COOLING MEDIA PRESENT | | | TEMP °C | (1) | | |

LAB USE ONLY
MAXXAM JOB # B858174

| RELINQUISHED BY: | | DATE: | TIME (24 HR) | RECEIVED BY: | | DATE: | TIME (24 HR) |
|---|---|---|---|---|---|---|---|
| 1. Michelle Vokaty | Michelle Vokaty | 2018/07/15 | 08:00 | 1. Alyssa Leister | Alyssa Leister | 2018/07/16 | 09:56 |
| 2. | | | | 2. | | | |
| 3. | | | | 3. | | | |

SAMPLES
LABELED BY: ALK
VERIFIED BY: GAN.

COC-1010 (06/2016) IOL-AB White: Maxxam Yellow: Client

# DATA QUALITY REVIEW CHECKLIST - IMPERIAL OIL PROJECTS

Consultant: Advisian | Sampling Date: 16-Jul-18

Location: Norman Wells | Laboratory : Maxxam Edmonton

Consultant Project Number: 407011-00586-400 | Sample Submission Number: B859059

Are All Laboratory QC Within Acceptance Criteria (Yes, No, Not Applicable)?

| | Yes | No | NA | Comments |
|---|---|---|---|---|
| Instrument Surrogate Recovery | x | | | Laboratory control sample recovery of pyrene (132%) and fluoranthene (136%) did not meet acceptance criteria (50-130%). All other laboratory QC met acceptance criteria. |
| Extraction Surrogate Recovery | x | | | |
| Method Blank Concentration | x | | | |
| Matrix Duplicate RPD | | | x | |
| Matrix Spike Recovery | x | | | |
| Lab Control Sample Recovery | | x | | |

Are All Field QC Samples Within Alert Limits (Yes, No, Not Applicable)?

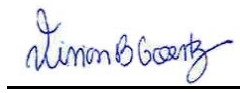
| | Yes | No | NA | Comments |
|---|---|---|---|---|
| Field Blank Concentration | | | x | No field QC samples submitted. |
| Trip Blank Concentration | | | x | |
| Equipment Blank Concentration | | | x | |
| Field Duplicate RPD | | | x | |

| | |
|---|---|
| Has CoA been signed off (Yes/No)?: | Yes |
| Has lab warranted all tests were analyzed following SOP's in CoA (Yes/No)?: | Yes |
| Were all samples analyzed within hold times (Yes/No)?: | Yes |
| All volatiles samples methanol extracted (if required) within 48 hours (Yes/No)?: | n/a |
| Is Chain of Custody completed and signed (Yes/No)?: | Yes |
| Were sample temperatures acceptable when they reached lab (Yes/No)?: | Yes |

| | |
|---|---|
| Was a Data Quality Overview (DQO) issued (Yes/No)?: | No |
| Date DQO was received: | n/a |

Is data considered to be reliable (Yes/No)?: Yes

If answer is "No", describe and provide rationale:

Data Reviewed by (Print): Vivian Baptista | Data Reviewed by (Signature): 

Date: 30-Jul-18

Maxxam
A Bureau Veritas Group Company

Success Through Science®

Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400
Your C.O.C. #: 299249

**Attention: Stacy Gibb**

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

**Report Date: 2018/07/25**
Report #: R2594402
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B859059**
**Received: 2018/07/18, 09:45**

Sample Matrix: Water
# Samples Received: 1

| Analyses | Quantity | Laboratory Method | Primary Reference |
|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | 1 | AB SOP-00005 | SM 22 2320 B m |
| BTEX/F1 in Water by HS GC/MS/FID | 1 | AB SOP-00039 | CCME CWS/EPA 8260d m |
| F1-BTEX | 1 | AB SOP-00039 | Auto Calc |
| Cadmium - low level CCME - Dissolved | 1 | AB WI-00065 | Auto Calc |
| Chloride by Automated Colourimetry | 1 | AB SOP-00020 | SM 22 4500-Cl-E m |
| Conductivity @25C | 1 | AB SOP-00005 | SM 22 2510 B m |
| CCME Hydrocarbons in Water (F2; C10-C16) (1, 2) | 1 | AB SOP-00037<br>AB SOP-00040 | CCME PHC-CWS m |
| Hardness | 1 | AB WI-00065 | Auto Calc |
| Mercury - Low Level (Dissolved) (3) | 1 | EENVSOP-00031 | EPA 245.7 R2 m |
| Elements by ICP - Dissolved (3) | 1 | AB SOP-00042 | EPA 6010d R4 m |
| Elements by ICPMS - Dissolved (3) | 1 | AB SOP-00043 | EPA 6020b R2 m |
| Ion Balance | 1 | AB WI-00065 | Auto Calc |
| Nitrate and Nitrite | 1 | AB WI-00065 | Auto Calc |
| Nitrate + Nitrite-N (calculated) | 1 | AB WI-00065 | Auto Calc |
| Nitrogen (Nitrite - Nitrate) by IC | 1 | AB SOP-00023 | SM 23 4110 B m |
| Benzo[a]pyrene Equivalency (4) | 1 | AB SOP-00003 | Auto Calc |
| PAH in Water by GC/MS | 1 | AB SOP-00037 / AB SOP-00003 | EPA 3510C/8270E m |
| Phenols (4-AAP) | 1 | EENVSOP-00061 | MMCW 154 1996 m |
| Sulphate by Automated Colourimetry | 1 | AB SOP-00018 | SM 22 4500-SO4 E m |
| Total Dissolved Solids (Filt. Residue) | 1 | AB SOP-00065 | SM 22 2540 C m |

**Remarks:**

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. All samples were analyzed within hold time unless otherwise flagged.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed



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

Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400
Your C.O.C. #: 299249

**Attention: Stacy Gibb**

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

**Report Date: 2018/07/25**
Report #: R2594402
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B859059**
**Received: 2018/07/18, 09:45**

or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

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) Silica gel clean up employed.
(3) Dissolved > Total Imbalance: Whenever applicable, Dissolved >Total for any parameter that falls within method uncertainty for duplicates is likely equivalent. If RPD is >20% samples were reanalyzed and confirmed.
(4) B[a]P TPE is calculated using 1/2 of the RDL for non detect results as per Alberta Environment instructions. This protocol may not apply in other jurisdictions.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Jenna Chernuka, Project Manager
Email: JChernuka@maxxam.ca
Phone# (780)577-7178

==========

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 #: B859059
Report Date: 2018/07/25

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## AT1 BTEX AND F1-F2 IN WATER (WATER)

| | | | | |
|---|---|---|---|---|
| Maxxam ID | | TW6415 | | |
| Sampling Date | | 2018/07/16 09:50 | | |
| COC Number | | 299249 | | |
| | **UNITS** | **MEBG-10-1-3** | **RDL** | **QC Batch** |
| **Ext. Pet. Hydrocarbon** | | | | |
| F2 (C10-C16 Hydrocarbons) | mg/L | <0.10 | 0.10 | 9066054 |
| **Volatiles** | | | | |
| Benzene | mg/L | <0.00040 | 0.00040 | 9069739 |
| Toluene | mg/L | <0.00040 | 0.00040 | 9069739 |
| Ethylbenzene | mg/L | <0.00040 | 0.00040 | 9069739 |
| m & p-Xylene | mg/L | <0.00080 | 0.00080 | 9069739 |
| o-Xylene | mg/L | <0.00040 | 0.00040 | 9069739 |
| Xylenes (Total) | mg/L | <0.00089 | 0.00089 | 9067590 |
| F1 (C6-C10) - BTEX | mg/L | <0.10 | 0.10 | 9067590 |
| F1 (C6-C10) | mg/L | <0.10 | 0.10 | 9069739 |
| **Extraction Surrogate Recovery (%)** | | | | |
| O-TERPHENYL (sur.) | % | 87 | | 9066054 |
| **Instrument Surrogate Recovery (%)** | | | | |
| 1,4-Difluorobenzene (sur.) | % | 101 | | 9069739 |
| 4-Bromofluorobenzene (sur.) | % | 91 | | 9069739 |
| D4-1,2-Dichloroethane (sur.) | % | 73 | | 9069739 |
| RDL = Reportable Detection Limit | | | | |



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Maxxam Job #: B859059
Report Date: 2018/07/25

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## REGULATED METALS INCLUDING MERCURY-DISS (WATER)

| Maxxam ID | | TW6415 | | |
|---|---|---|---|---|
| Sampling Date | | 2018/07/16 09:50 | | |
| COC Number | | 299249 | | |
| | **UNITS** | **MEBG-10-1-3** | **RDL** | **QC Batch** |
| **Low Level Elements** | | | | |
| Dissolved Cadmium (Cd) | mg/L | 0.000067 | 0.000020 | 9067591 |
| **Elements** | | | | |
| Dissolved Aluminum (Al) | mg/L | <0.0030 | 0.0030 | 9068796 |
| Dissolved Antimony (Sb) | mg/L | <0.00060 | 0.00060 | 9068796 |
| Dissolved Arsenic (As) | mg/L | 0.00045 | 0.00020 | 9068796 |
| Dissolved Barium (Ba) | mg/L | 0.26 | 0.010 | 9070910 |
| Dissolved Beryllium (Be) | mg/L | <0.0010 | 0.0010 | 9068796 |
| Dissolved Boron (B) | mg/L | 0.024 | 0.020 | 9070910 |
| Dissolved Calcium (Ca) | mg/L | 230 | 0.30 | 9070910 |
| Dissolved Chromium (Cr) | mg/L | <0.0010 | 0.0010 | 9068796 |
| Dissolved Cobalt (Co) | mg/L | 0.00052 | 0.00030 | 9068796 |
| Dissolved Copper (Cu) | mg/L | 0.0021 | 0.00020 | 9068796 |
| Dissolved Iron (Fe) | mg/L | 0.57 | 0.060 | 9070910 |
| Dissolved Lead (Pb) | mg/L | <0.00020 | 0.00020 | 9068796 |
| Dissolved Lithium (Li) | mg/L | <0.020 | 0.020 | 9070910 |
| Dissolved Magnesium (Mg) | mg/L | 44 | 0.20 | 9070910 |
| Dissolved Manganese (Mn) | mg/L | 0.45 | 0.0040 | 9070910 |
| Dissolved Molybdenum (Mo) | mg/L | 0.0015 | 0.00020 | 9068796 |
| Dissolved Nickel (Ni) | mg/L | 0.0047 | 0.00050 | 9068796 |
| Dissolved Phosphorus (P) | mg/L | <0.10 | 0.10 | 9070910 |
| Dissolved Potassium (K) | mg/L | 1.3 | 0.30 | 9070910 |
| Dissolved Selenium (Se) | mg/L | 0.00036 | 0.00020 | 9068796 |
| Dissolved Silicon (Si) | mg/L | 4.1 | 0.10 | 9070910 |
| Dissolved Silver (Ag) | mg/L | <0.00010 | 0.00010 | 9068796 |
| Dissolved Sodium (Na) | mg/L | 22 | 0.50 | 9070910 |
| Dissolved Strontium (Sr) | mg/L | 0.70 | 0.020 | 9070910 |
| Dissolved Sulphur (S) | mg/L | 84 | 0.20 | 9070910 |
| Dissolved Thallium (Tl) | mg/L | <0.00020 | 0.00020 | 9068796 |
| Dissolved Tin (Sn) | mg/L | <0.0010 | 0.0010 | 9068796 |
| Dissolved Titanium (Ti) | mg/L | 0.0013 | 0.0010 | 9068796 |
| RDL = Reportable Detection Limit | | | | |



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Maxxam Job #: B859059
Report Date: 2018/07/25

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## REGULATED METALS INCLUDING MERCURY-DISS (WATER)

| Maxxam ID | | TW6415 | | |
|---|---|---|---|---|
| Sampling Date | | 2018/07/16 09:50 | | |
| COC Number | | 299249 | | |
| | **UNITS** | **MEBG-10-1-3** | **RDL** | **QC Batch** |
| Dissolved Uranium (U) | mg/L | 0.0068 | 0.00010 | 9068796 |
| Dissolved Vanadium (V) | mg/L | <0.0010 | 0.0010 | 9068796 |
| Dissolved Zinc (Zn) | mg/L | 0.0069 | 0.0030 | 9068796 |
| **Low Level Elements** | | | | |
| Dissolved Mercury (Hg) | mg/L | <0.0000020 | 0.0000020 | 9076113 |
| RDL = Reportable Detection Limit | | | | |



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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## RESULTS OF CHEMICAL ANALYSES OF WATER

| Maxxam ID | | TW6415 | | |
|---|---|---|---|---|
| Sampling Date | | 2018/07/16 09:50 | | |
| COC Number | | 299249 | | |
| | **UNITS** | **MEBG-10-1-3** | **RDL** | **QC Batch** |
| **Calculated Parameters** | | | | |
| Hardness (CaCO3) | mg/L | 750 | 0.50 | 9067593 |
| Ion Balance (% Difference) | % | 1.8 | N/A | 9067594 |
| Dissolved Nitrate (NO3) | mg/L | 0.38 | 0.044 | 9067429 |
| Nitrate plus Nitrite (N) | mg/L | 0.087 | 0.014 | 9067430 |
| Dissolved Nitrite (NO2) | mg/L | <0.033 | 0.033 | 9067429 |
| **Misc. Inorganics** | | | | |
| Conductivity | uS/cm | 1300 | 2.0 | 9070105 |
| Total Dissolved Solids | mg/L | 900 | 10 | 9069570 |
| **Anions** | | | | |
| Alkalinity (PP as CaCO3) | mg/L | <1.0 | 1.0 | 9070104 |
| Alkalinity (Total as CaCO3) | mg/L | 500 | 1.0 | 9070104 |
| Bicarbonate (HCO3) | mg/L | 610 | 1.0 | 9070104 |
| Carbonate (CO3) | mg/L | <1.0 | 1.0 | 9070104 |
| Hydroxide (OH) | mg/L | <1.0 | 1.0 | 9070104 |
| Dissolved Sulphate (SO4) | mg/L | 250 (1) | 5.0 | 9070101 |
| Dissolved Chloride (Cl) | mg/L | 1.9 | 1.0 | 9070099 |
| **Nutrients** | | | | |
| Dissolved Nitrite (N) | mg/L | <0.010 | 0.010 | 9070020 |
| Dissolved Nitrate (N) | mg/L | 0.087 | 0.010 | 9070020 |
| **Misc. Organics** | | | | |
| Phenols | mg/L | <0.0020 | 0.0020 | 9072263 |

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



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Report Date: 2018/07/25

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## SEMIVOLATILE ORGANICS BY GC-MS (WATER)

| Maxxam ID | | TW6415 | | |
|---|---|---|---|---|
| Sampling Date | | 2018/07/16 09:50 | | |
| COC Number | | 299249 | | |
| | **UNITS** | **MEBG-10-1-3** | **RDL** | **QC Batch** |
| **Polycyclic Aromatics** | | | | |
| Benzo[a]pyrene equivalency | mg/L | <0.000010 | 0.000010 | 9068705 |
| Acenaphthene | mg/L | <0.00010 | 0.00010 | 9065955 |
| Acenaphthylene | mg/L | <0.00010 | 0.00010 | 9065955 |
| Acridine | mg/L | <0.000050 | 0.000050 | 9065955 |
| Anthracene | mg/L | <0.000010 | 0.000010 | 9065955 |
| Benzo(a)anthracene | mg/L | <0.0000085 | 0.0000085 | 9065955 |
| Benzo(b&j)fluoranthene | mg/L | <0.0000085 | 0.0000085 | 9065955 |
| Benzo(k)fluoranthene | mg/L | <0.0000085 | 0.0000085 | 9065955 |
| Benzo(g,h,i)perylene | mg/L | <0.0000085 | 0.0000085 | 9065955 |
| Benzo(c)phenanthrene | mg/L | <0.000050 | 0.000050 | 9065955 |
| Benzo(a)pyrene | mg/L | <0.0000075 | 0.0000075 | 9065955 |
| Benzo[e]pyrene | mg/L | <0.000050 | 0.000050 | 9065955 |
| Chrysene | mg/L | <0.0000085 | 0.0000085 | 9065955 |
| Dibenz(a,h)anthracene | mg/L | <0.0000075 | 0.0000075 | 9065955 |
| Fluoranthene | mg/L | 0.000027 | 0.000010 | 9065955 |
| Fluorene | mg/L | <0.000050 | 0.000050 | 9065955 |
| Indeno(1,2,3-cd)pyrene | mg/L | <0.0000085 | 0.0000085 | 9065955 |
| 1-Methylnaphthalene | mg/L | <0.00010 | 0.00010 | 9065955 |
| 2-Methylnaphthalene | mg/L | <0.00010 | 0.00010 | 9065955 |
| Naphthalene | mg/L | <0.00010 | 0.00010 | 9065955 |
| Phenanthrene | mg/L | <0.000050 | 0.000050 | 9065955 |
| Perylene | mg/L | <0.000050 | 0.000050 | 9065955 |
| Pyrene | mg/L | 0.000024 | 0.000020 | 9065955 |
| Quinoline | mg/L | <0.00020 | 0.00020 | 9065955 |
| **Extraction Surrogate Recovery (%)** | | | | |
| D10-ANTHRACENE (sur.) | % | 94 | | 9065955 |
| D8-ACENAPHTHYLENE (sur.) | % | 88 | | 9065955 |
| D8-NAPHTHALENE (sur.) | % | 82 | | 9065955 |
| TERPHENYL-D14 (sur.) | % | 55 | | 9065955 |
| RDL = Reportable Detection Limit | | | | |



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Maxxam Job #: B859059
Report Date: 2018/07/25

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## TEST SUMMARY

**Maxxam ID:** TW6415
**Sample ID:** MEBG-10-1-3
**Matrix:** Water

**Collected:** 2018/07/16
**Relinquished:** 2018/07/17
**Received:** 2018/07/18

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | AT/ALK | 9070104 | N/A | 2018/07/19 | Malina Alamyar |
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9069739 | N/A | 2018/07/19 | Sandra Wilson |
| F1-BTEX | CALC/MS | 9067590 | N/A | 2018/07/20 | Automated Statchk |
| Cadmium - low level CCME - Dissolved | CALC/MS | 9067591 | N/A | 2018/07/19 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 9070099 | N/A | 2018/07/20 | Chelsea Harmatys |
| Conductivity @25C | COND | 9070105 | N/A | 2018/07/19 | Malina Alamyar |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9066054 | 2018/07/18 | 2018/07/24 | Grace Guo |
| Hardness | CALC | 9067593 | N/A | 2018/07/20 | Automated Statchk |
| Mercury - Low Level (Dissolved) | CV/AF | 9076113 | 2018/07/24 | 2018/07/24 | Andrew Payne |
| Elements by ICP - Dissolved | ICPA | 9070910 | N/A | 2018/07/19 | Queen Acharya |
| Elements by ICPMS - Dissolved | ICPM | 9068796 | N/A | 2018/07/19 | Andrew Payne |
| Ion Balance | CALC | 9067594 | N/A | 2018/07/19 | Automated Statchk |
| Nitrate and Nitrite | CALC | 9067429 | N/A | 2018/07/21 | Automated Statchk |
| Nitrate + Nitrite-N (calculated) | CALC | 9067430 | N/A | 2018/07/21 | Automated Statchk |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9070020 | N/A | 2018/07/19 | Mahesh Ranjan |
| Benzo[a]pyrene Equivalency | GC/MSD | 9068705 | N/A | 2018/07/22 | Automated Statchk |
| PAH in Water by GC/MS | GC/MS | 9065955 | 2018/07/19 | 2018/07/22 | Bert Chi |
| Phenols (4-AAP) | TECH/4AAP | 9072263 | N/A | 2018/07/20 | Ying Yang |
| Sulphate by Automated Colourimetry | KONE | 9070101 | N/A | 2018/07/20 | Chelsea Harmatys |
| Total Dissolved Solids (Filt. Residue) | BAL | 9069570 | 2018/07/19 | 2018/07/23 | Luminita Chiosa |



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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## GENERAL COMMENTS

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

| | |
|---|---|
| Package 1 | 4.3°C |

**Results relate only to the items tested.**



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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| 9065955 | BC5 | Method Blank | D10-ANTHRACENE (sur.) | 2018/07/19 | | 106 | % | 50 - 130 |
| | | | TERPHENYL-D14 (sur.) | 2018/07/19 | | 111 | % | 50 - 130 |
| | | | D8-ACENAPHTHYLENE (sur.) | 2018/07/19 | | 97 | % | 50 - 130 |
| | | | D8-NAPHTHALENE (sur.) | 2018/07/19 | | 77 | % | 50 - 130 |
| | | | Acenaphthene | 2018/07/19 | <0.00010 | | mg/L | |
| | | | Acenaphthylene | 2018/07/19 | <0.00010 | | mg/L | |
| | | | Acridine | 2018/07/19 | <0.000050 | | mg/L | |
| | | | Anthracene | 2018/07/19 | <0.000010 | | mg/L | |
| | | | Benzo(a)anthracene | 2018/07/19 | <0.0000085 | | mg/L | |
| | | | Benzo(b&j)fluoranthene | 2018/07/19 | <0.0000085 | | mg/L | |
| | | | Benzo(k)fluoranthene | 2018/07/19 | <0.0000085 | | mg/L | |
| | | | Benzo(g,h,i)perylene | 2018/07/19 | <0.0000085 | | mg/L | |
| | | | Benzo(c)phenanthrene | 2018/07/19 | <0.000050 | | mg/L | |
| | | | Benzo(a)pyrene | 2018/07/19 | <0.0000075 | | mg/L | |
| | | | Benzo[e]pyrene | 2018/07/19 | <0.000050 | | mg/L | |
| | | | Chrysene | 2018/07/19 | <0.0000085 | | mg/L | |
| | | | Dibenz(a,h)anthracene | 2018/07/19 | <0.0000075 | | mg/L | |
| | | | Fluoranthene | 2018/07/19 | <0.000010 | | mg/L | |
| | | | Fluorene | 2018/07/19 | <0.000050 | | mg/L | |
| | | | Indeno(1,2,3-cd)pyrene | 2018/07/19 | <0.0000085 | | mg/L | |
| | | | 1-Methylnaphthalene | 2018/07/19 | <0.00010 | | mg/L | |
| | | | 2-Methylnaphthalene | 2018/07/19 | <0.00010 | | mg/L | |
| | | | Naphthalene | 2018/07/19 | <0.00010 | | mg/L | |
| | | | Phenanthrene | 2018/07/19 | <0.000050 | | mg/L | |
| | | | Perylene | 2018/07/19 | <0.000050 | | mg/L | |
| | | | Pyrene | 2018/07/19 | <0.000020 | | mg/L | |
| | | | Quinoline | 2018/07/19 | <0.00020 | | mg/L | |
| 9066054 | GG3 | Method Blank | O-TERPHENYL (sur.) | 2018/07/19 | | 81 | % | 60 - 140 |
| | | | F2 (C10-C16 Hydrocarbons) | 2018/07/19 | <0.10 | | mg/L | |
| 9068796 | APY | Method Blank | Dissolved Aluminum (Al) | 2018/07/19 | <0.0030 | | mg/L | |
| | | | Dissolved Chromium (Cr) | 2018/07/19 | <0.0010 | | mg/L | |
| | | | Dissolved Cobalt (Co) | 2018/07/19 | <0.00030 | | mg/L | |
| | | | Dissolved Copper (Cu) | 2018/07/19 | <0.00020 | | mg/L | |
| | | | Dissolved Lead (Pb) | 2018/07/19 | <0.00020 | | mg/L | |
| | | | Dissolved Antimony (Sb) | 2018/07/19 | <0.00060 | | mg/L | |
| | | | Dissolved Molybdenum (Mo) | 2018/07/19 | <0.00020 | | mg/L | |
| | | | Dissolved Nickel (Ni) | 2018/07/19 | <0.00050 | | mg/L | |
| | | | Dissolved Selenium (Se) | 2018/07/19 | <0.00020 | | mg/L | |
| | | | Dissolved Silver (Ag) | 2018/07/19 | <0.00010 | | mg/L | |
| | | | Dissolved Arsenic (As) | 2018/07/19 | <0.00020 | | mg/L | |
| | | | Dissolved Thallium (Tl) | 2018/07/19 | <0.00020 | | mg/L | |
| | | | Dissolved Tin (Sn) | 2018/07/19 | <0.0010 | | mg/L | |
| | | | Dissolved Titanium (Ti) | 2018/07/19 | <0.0010 | | mg/L | |
| | | | Dissolved Uranium (U) | 2018/07/19 | <0.00010 | | mg/L | |
| | | | Dissolved Vanadium (V) | 2018/07/19 | <0.0010 | | mg/L | |
| | | | Dissolved Zinc (Zn) | 2018/07/19 | <0.0030 | | mg/L | |
| | | | Dissolved Beryllium (Be) | 2018/07/19 | <0.0010 | | mg/L | |
| 9069570 | LCA | Method Blank | Total Dissolved Solids | 2018/07/23 | <10 | | mg/L | |
| 9069739 | SB8 | Method Blank | 1,4-Difluorobenzene (sur.) | 2018/07/19 | | 103 | % | 50 - 140 |
| | | | 4-Bromofluorobenzene (sur.) | 2018/07/19 | | 91 | % | 50 - 140 |
| | | | D4-1,2-Dichloroethane (sur.) | 2018/07/19 | | 72 | % | 50 - 140 |



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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT(CONT'D)

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| | | | Benzene | 2018/07/19 | <0.00040 | | mg/L | |
| | | | Toluene | 2018/07/19 | <0.00040 | | mg/L | |
| | | | Ethylbenzene | 2018/07/19 | <0.00040 | | mg/L | |
| | | | m & p-Xylene | 2018/07/19 | <0.00080 | | mg/L | |
| | | | o-Xylene | 2018/07/19 | <0.00040 | | mg/L | |
| | | | F1 (C6-C10) | 2018/07/19 | <0.10 | | mg/L | |
| 9070020 | MSD | Method Blank | Dissolved Nitrite (N) | 2018/07/19 | <0.010 | | mg/L | |
| | | | Dissolved Nitrate (N) | 2018/07/19 | <0.010 | | mg/L | |
| 9070099 | CH7 | Method Blank | Dissolved Chloride (Cl) | 2018/07/20 | <1.0 | | mg/L | |
| 9070101 | CH7 | Method Blank | Dissolved Sulphate (SO4) | 2018/07/20 | <1.0 | | mg/L | |
| 9070104 | MA4 | Method Blank | Alkalinity (Total as CaCO3) | 2018/07/19 | <1.0 | | mg/L | |
| | | | Alkalinity (PP as CaCO3) | 2018/07/19 | <1.0 | | mg/L | |
| | | | Bicarbonate (HCO3) | 2018/07/19 | <1.0 | | mg/L | |
| | | | Carbonate (CO3) | 2018/07/19 | <1.0 | | mg/L | |
| | | | Hydroxide (OH) | 2018/07/19 | <1.0 | | mg/L | |
| 9070105 | MA4 | Method Blank | Conductivity | 2018/07/19 | <2.0 | | uS/cm | |
| 9070910 | ACY | Method Blank | Dissolved Iron (Fe) | 2018/07/19 | <0.060 | | mg/L | |
| | | | Dissolved Lithium (Li) | 2018/07/19 | <0.020 | | mg/L | |
| | | | Dissolved Magnesium (Mg) | 2018/07/19 | <0.20 | | mg/L | |
| | | | Dissolved Manganese (Mn) | 2018/07/19 | <0.0040 | | mg/L | |
| | | | Dissolved Potassium (K) | 2018/07/19 | <0.30 | | mg/L | |
| | | | Dissolved Sodium (Na) | 2018/07/19 | <0.50 | | mg/L | |
| | | | Dissolved Strontium (Sr) | 2018/07/19 | <0.020 | | mg/L | |
| | | | Dissolved Sulphur (S) | 2018/07/19 | <0.20 | | mg/L | |
| | | | Dissolved Phosphorus (P) | 2018/07/19 | <0.10 | | mg/L | |
| | | | Dissolved Barium (Ba) | 2018/07/19 | <0.010 | | mg/L | |
| | | | Dissolved Silicon (Si) | 2018/07/19 | <0.10 | | mg/L | |
| | | | Dissolved Boron (B) | 2018/07/19 | <0.020 | | mg/L | |
| | | | Dissolved Calcium (Ca) | 2018/07/19 | <0.30 | | mg/L | |
| 9072263 | YY | Method Blank | Phenols | 2018/07/20 | <0.0020 | | mg/L | |
| 9076113 | APY | Method Blank | Dissolved Mercury (Hg) | 2018/07/24 | <0.0000020 | | mg/L | |
| 9069739 | SB8 | Matrix Spike [TW6415-07] | 1,4-Difluorobenzene (sur.) | 2018/07/19 | | 98 | % | 50 - 140 |
| | | | 4-Bromofluorobenzene (sur.) | 2018/07/19 | | 92 | % | 50 - 140 |
| | | | D4-1,2-Dichloroethane (sur.) | 2018/07/19 | | 72 | % | 50 - 140 |
| | | | Benzene | 2018/07/19 | | 95 | % | 50 - 140 |
| | | | Toluene | 2018/07/19 | | 90 | % | 50 - 140 |
| | | | Ethylbenzene | 2018/07/19 | | 93 | % | 50 - 140 |
| | | | m & p-Xylene | 2018/07/19 | | 94 | % | 50 - 140 |
| | | | o-Xylene | 2018/07/19 | | 98 | % | 50 - 140 |
| | | | F1 (C6-C10) | 2018/07/19 | | 91 | % | 60 - 140 |
| 9065955 | BC5 | LCS | D10-ANTHRACENE (sur.) | 2018/07/19 | | 104 | % | 50 - 130 |
| | | | TERPHENYL-D14 (sur.) | 2018/07/19 | | 109 | % | 50 - 130 |
| | | | D8-ACENAPHTHYLENE (sur.) | 2018/07/19 | | 102 | % | 50 - 130 |
| | | | D8-NAPHTHALENE (sur.) | 2018/07/19 | | 90 | % | 50 - 130 |
| | | | Acenaphthene | 2018/07/19 | | 93 | % | 50 - 130 |
| | | | Acenaphthylene | 2018/07/19 | | 99 | % | 50 - 130 |
| | | | Acridine | 2018/07/19 | | 102 | % | 50 - 130 |
| | | | Anthracene | 2018/07/19 | | 99 | % | 50 - 130 |
| | | | Benzo(a)anthracene | 2018/07/19 | | 120 | % | 50 - 130 |
| | | | Benzo(b&j)fluoranthene | 2018/07/19 | | 108 | % | 50 - 130 |



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

Maxxam Job #: B859059
Report Date: 2018/07/25

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT(CONT'D)

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| | | | Benzo(k)fluoranthene | 2018/07/19 | | 113 | % | 50 - 130 |
| | | | Benzo(g,h,i)perylene | 2018/07/19 | | 108 | % | 50 - 130 |
| | | | Benzo(c)phenanthrene | 2018/07/19 | | 121 | % | 50 - 130 |
| | | | Benzo(a)pyrene | 2018/07/19 | | 118 | % | 50 - 130 |
| | | | Benzo[e]pyrene | 2018/07/19 | | 112 | % | 50 - 130 |
| | | | Chrysene | 2018/07/19 | | 110 | % | 50 - 130 |
| | | | Dibenz(a,h)anthracene | 2018/07/19 | | 111 | % | 50 - 130 |
| | | | Fluoranthene | 2018/07/19 | | 136 (1) | % | 50 - 130 |
| | | | Fluorene | 2018/07/19 | | 100 | % | 50 - 130 |
| | | | Indeno(1,2,3-cd)pyrene | 2018/07/19 | | 111 | % | 50 - 130 |
| | | | 1-Methylnaphthalene | 2018/07/19 | | 89 | % | 50 - 130 |
| | | | 2-Methylnaphthalene | 2018/07/19 | | 92 | % | 50 - 130 |
| | | | Naphthalene | 2018/07/19 | | 91 | % | 50 - 130 |
| | | | Phenanthrene | 2018/07/19 | | 96 | % | 50 - 130 |
| | | | Perylene | 2018/07/19 | | 91 | % | 50 - 130 |
| | | | Pyrene | 2018/07/19 | | 132 (1) | % | 50 - 130 |
| | | | Quinoline | 2018/07/19 | | 105 | % | 50 - 130 |
| 9066054 | GG3 | LCS | O-TERPHENYL (sur.) | 2018/07/19 | | 81 | % | 60 - 140 |
| | | | F2 (C10-C16 Hydrocarbons) | 2018/07/19 | | 85 | % | 60 - 140 |
| 9068796 | APY | LCS | Dissolved Aluminum (Al) | 2018/07/19 | | 95 | % | 80 - 120 |
| | | | Dissolved Chromium (Cr) | 2018/07/19 | | 106 | % | 80 - 120 |
| | | | Dissolved Cobalt (Co) | 2018/07/19 | | 101 | % | 80 - 120 |
| | | | Dissolved Copper (Cu) | 2018/07/19 | | 106 | % | 80 - 120 |
| | | | Dissolved Lead (Pb) | 2018/07/19 | | 96 | % | 80 - 120 |
| | | | Dissolved Antimony (Sb) | 2018/07/19 | | 87 | % | 80 - 120 |
| | | | Dissolved Molybdenum (Mo) | 2018/07/19 | | 88 | % | 80 - 120 |
| | | | Dissolved Nickel (Ni) | 2018/07/19 | | 106 | % | 80 - 120 |
| | | | Dissolved Selenium (Se) | 2018/07/19 | | 96 | % | 80 - 120 |
| | | | Dissolved Silver (Ag) | 2018/07/19 | | 98 | % | 80 - 120 |
| | | | Dissolved Arsenic (As) | 2018/07/19 | | 99 | % | 80 - 120 |
| | | | Dissolved Thallium (Tl) | 2018/07/19 | | 98 | % | 80 - 120 |
| | | | Dissolved Tin (Sn) | 2018/07/19 | | 96 | % | 80 - 120 |
| | | | Dissolved Titanium (Ti) | 2018/07/19 | | 101 | % | 80 - 120 |
| | | | Dissolved Uranium (U) | 2018/07/19 | | 99 | % | 80 - 120 |
| | | | Dissolved Vanadium (V) | 2018/07/19 | | 105 | % | 80 - 120 |
| | | | Dissolved Zinc (Zn) | 2018/07/19 | | 107 | % | 80 - 120 |
| | | | Dissolved Beryllium (Be) | 2018/07/19 | | 99 | % | 80 - 120 |
| 9069570 | LCA | LCS | Total Dissolved Solids | 2018/07/23 | | 100 | % | 80 - 120 |
| 9069739 | SB8 | LCS | 1,4-Difluorobenzene (sur.) | 2018/07/19 | | 102 | % | 50 - 140 |
| | | | 4-Bromofluorobenzene (sur.) | 2018/07/19 | | 90 | % | 50 - 140 |
| | | | D4-1,2-Dichloroethane (sur.) | 2018/07/19 | | 70 | % | 50 - 140 |
| | | | Benzene | 2018/07/19 | | 96 | % | 60 - 130 |
| | | | Toluene | 2018/07/19 | | 92 | % | 60 - 130 |
| | | | Ethylbenzene | 2018/07/19 | | 97 | % | 60 - 130 |
| | | | m & p-Xylene | 2018/07/19 | | 98 | % | 60 - 130 |
| | | | o-Xylene | 2018/07/19 | | 99 | % | 60 - 130 |
| | | | F1 (C6-C10) | 2018/07/19 | | 117 | % | 60 - 140 |
| 9070020 | MSD | LCS | Dissolved Nitrite (N) | 2018/07/19 | | 100 | % | 80 - 120 |
| | | | Dissolved Nitrate (N) | 2018/07/19 | | 101 | % | 80 - 120 |
| 9070099 | CH7 | LCS | Dissolved Chloride (Cl) | 2018/07/20 | | 107 | % | 80 - 120 |
| 9070101 | CH7 | LCS | Dissolved Sulphate (SO4) | 2018/07/20 | | 103 | % | 80 - 120 |



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Maxxam Job #: B859059
Report Date: 2018/07/25

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT(CONT'D)

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| 9070104 | MA4 | LCS | Alkalinity (Total as CaCO3) | 2018/07/19 | | 99 | % | 80 - 120 |
| 9070105 | MA4 | LCS | Conductivity | 2018/07/19 | | 101 | % | 90 - 110 |
| 9070910 | ACY | LCS | Dissolved Iron (Fe) | 2018/07/19 | | 104 | % | 80 - 120 |
| | | | Dissolved Lithium (Li) | 2018/07/19 | | 103 | % | 80 - 120 |
| | | | Dissolved Magnesium (Mg) | 2018/07/19 | | 104 | % | 80 - 120 |
| | | | Dissolved Manganese (Mn) | 2018/07/19 | | 105 | % | 80 - 120 |
| | | | Dissolved Potassium (K) | 2018/07/19 | | 100 | % | 80 - 120 |
| | | | Dissolved Sodium (Na) | 2018/07/19 | | 103 | % | 80 - 120 |
| | | | Dissolved Strontium (Sr) | 2018/07/19 | | 104 | % | 80 - 120 |
| | | | Dissolved Phosphorus (P) | 2018/07/19 | | 101 | % | 80 - 120 |
| | | | Dissolved Barium (Ba) | 2018/07/19 | | 105 | % | 80 - 120 |
| | | | Dissolved Silicon (Si) | 2018/07/19 | | 101 | % | 80 - 120 |
| | | | Dissolved Boron (B) | 2018/07/19 | | 107 | % | 80 - 120 |
| | | | Dissolved Calcium (Ca) | 2018/07/19 | | 105 | % | 80 - 120 |
| 9072263 | YY | LCS | Phenols | 2018/07/20 | | 94 | % | 80 - 120 |
| 9076113 | APY | LCS | Dissolved Mercury (Hg) | 2018/07/24 | | 104 | % | 80 - 120 |
| 9076113 | APY | SRM | Dissolved Mercury (Hg) | 2018/07/24 | | 100 | % | 80 - 120 |

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.

LCS: 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.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.



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Maxxam Job #: B859059
Report Date: 2018/07/25

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## VALIDATION SIGNATURE PAGE

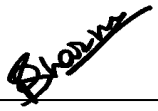
The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



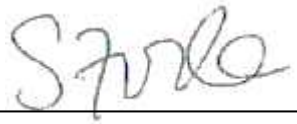
Dennis Ngondu, B.Sc., P.Chem., QP, Supervisor, Organics



Daniel Reslan, cCT, QP, Organics Manager



Poonam Sharma, cCT, Organics Supervisor



Suwan Fock, B.Sc., QP, Inorganics Senior Analyst

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.



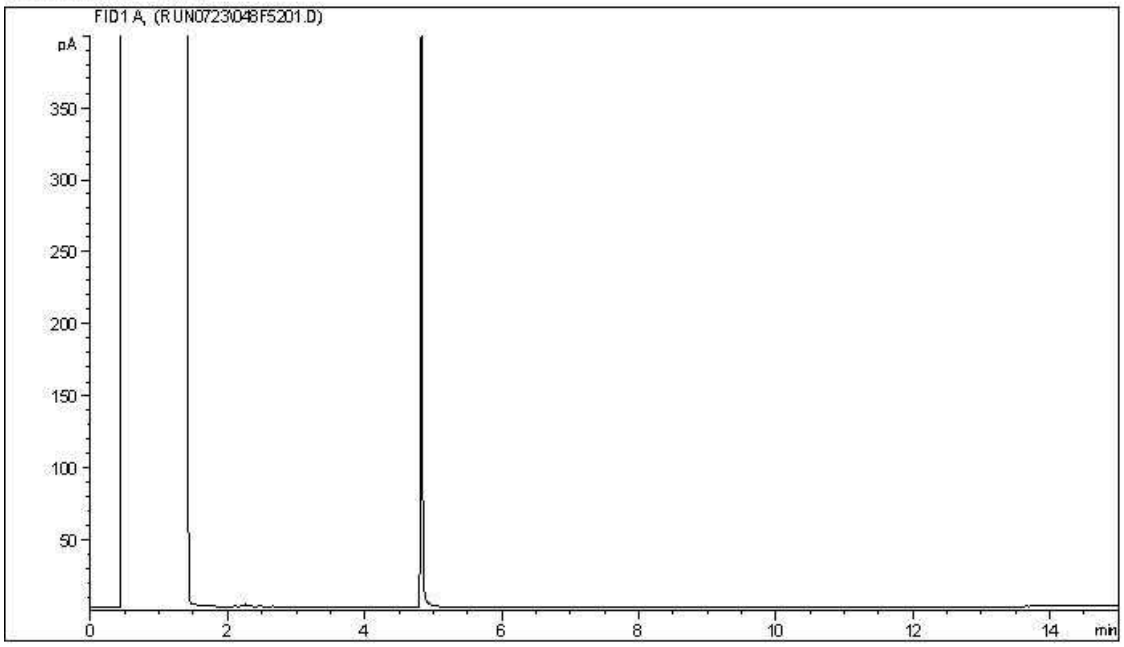
Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B859059
Report Date: 2018/07/25
Maxxam Sample: TW6415

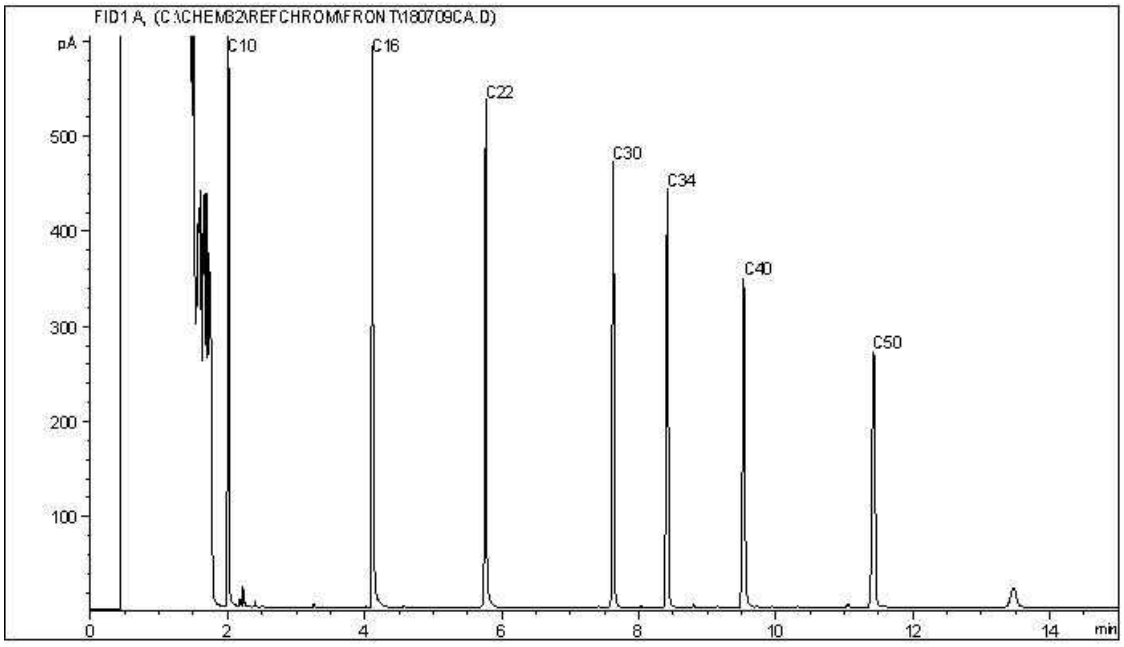
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: MEBG-10-1-3

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: GC12




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam
A Bureau Veritas Group Company

☐ Calgary
4000 19th St. NE, T2E 6P8
Phone: (403) 291-3077
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Toll Free: (800) 386-7247

☒ Edmonton
9331 - 48 Street, T6B 2R4
Phone: (780) 577-7100
Fax: (780) 450-4187
Toll Free: (800) 386-7247

932

# EXXON MOBIL/IMPERIAL OIL - MAXXAM CHAIN-OF-CUSTODY RECORD



C of C # 299249

| INVOICE INFORMATION | REPORT INFORMATION |
|---|---|
| Company Name: ☒ Imperial Oil ☐ ExxonMobil | Company Name: Worley Parsons |
| Contact Name: Worley Parsons | Contact Name: Stacy Gibb |
| Address: 500, 151 Canada Olympic Rd SW Calgary, AB T3B 6B7 | Address: 500, 151 Canada Olympic Rd SW Calgary, AB T3B 6B7 |
| Email: sanj.perera@advisian.com | Email: stacy.gibb@advisian.com |
| Ph: 587-952-1490 | Ph: 403-247-0200 |
| Sampler Name (Print): Melanie Jones | Consultant Project #: 407011-00586-400 |

| FIELD SAMPLE ID | MATRIX: GROUND WATER | SURFACE WATER | SOIL | OTHER | # CONTAINERS | SAMPLING: DATE (YYYY/MM/DD) | TIME (24 HR) | FIELD FILTERED & PRESERVED | LAB FILTRATION REQUIRED | VOC | PAH | PHCs (FRACTIONS 1-2 PLUS BTEX) | PHCs (FRACTIONS 1-4 PLUS BTEX) | PHCs (FRACTIONS 2-4) | PHCs (FRACTION 1 PLUS BTEX) | GRAIN SIZE (75 MICRON) | TEXTURE (% SAND, SILT, CLAY) | PARTICLE SIZE DISTRIBUTION WITH GRAPH | REGULATED METALS DIS ☒ TOT ☐ | MERCURY TOTAL ☐ DISSOLVED ☒ | SALINITY SOIL | FERTILIZER SOIL | FERTILIZER WATER | NUTRIENTS SOIL | ROUTINE POTABILITY | pH ☐ EC ☐ ALKALINITY ☐ | BASIC CLASS II LANDFILL PKG | Phenols by 4AAP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 MEBG-10-1-3 | X | | | | 12 | 2018/07/16 | 09:50 | X | | | X | X | | | | | | | X | X | | | | | X | | | X |
| 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

IOL SITE LOCATION: Norman Wells, NT

IOL PROJECT # (if applicable): N/A

MAXXAM TASK ORDER # OR SERVICE ORDER # + LINE ITEM: 407011-00586-400

REGULATORY CRITERIA / DETECTION LIMITS:
☐ Alberta Tier 1 ☐ CDWG
☐ SEQG (SK) ☐ NoSC (SK)
☒ CCME (incl. level) FAL ☐ Other

SPECIAL INSTRUCTIONS:
also email:
-standard Norman Wells list
-melissa.lord@advisian.com

IES A2601436

# JARS USED & NOT SUBMITTED Enter N/A for Water: N/A

TURNAROUND TIME
Standard (5 days) ☒
Rush (3 days) ☐
(2 days) ☐
(1 day) ☐
(same day) ☐

Date Required

| | YES | NO | COOLER ID # | | | |
|---|---|---|---|---|---|---|
| SEAL PRESENT | ✓ | | TEMP °C | 4 | 4 | 5 |
| SEAL INTACT | ✓ | | | 1 | 2 | 3 |
| COOLING MEDIA PRESENT | ✓ | | | | | |

| | YES | NO | COOLER ID # | | | |
|---|---|---|---|---|---|---|
| SEAL PRESENT | | | TEMP °C | | | |
| SEAL INTACT | | | | 1 | 2 | 3 |
| COOLING MEDIA PRESENT | | | | | | |

| | YES | NO | COOLER ID # | | | |
|---|---|---|---|---|---|---|
| SEAL PRESENT | | | TEMP °C | | | |
| SEAL INTACT | | | | 1 | 2 | 3 |
| COOLING MEDIA PRESENT | | | | | | |

LAB USE ONLY

MAXXAM JOB # B859059

| RELINQUISHED BY: | | DATE: | TIME (24 HR) | RECEIVED BY: | | DATE: | TIME (24 HR) |
|---|---|---|---|---|---|---|---|
| 1. | Melissa Lord | 2018/07/17 | 08:00 | 1. | MICHAEL FABER | 2018/07/18 | 09:45 |
| 2. | | | | 2. | | | |
| 3. | | | | 3. | | | |

SAMPLES
LABELED BY: MLS
VERIFIED BY: ALK

COC-1010 (06/2016) IOL-AB White: Maxxam Yellow: Client

# DATA QUALITY REVIEW CHECKLIST - IMPERIAL OIL PROJECTS

Consultant: Advisian | Sampling Date: 16-Jul-18

Location: Norman Wells | Laboratory : Maxxam Edmonton

Consultant Project Number: 407011-00586-400 | Sample Submission Number: B859119

Are All Laboratory QC Within Acceptance Criteria (Yes, No, Not Applicable)?

| | Yes | No | NA | Comments |
|---|---|---|---|---|
| Instrument Surrogate Recovery | x | | | All laboratory QC met acceptance criteria. |
| Extraction Surrogate Recovery | x | | | |
| Method Blank Concentration | x | | | |
| Matrix Duplicate RPD | | | x | |
| Matrix Spike Recovery | | | x | |
| Lab Control Sample Recovery | x | | | |

Are All Field QC Samples Within Alert Limits (Yes, No, Not Applicable)?

| | Yes | No | NA | Comments |
|---|---|---|---|---|
| Field Blank Concentration | | | x | All field QC samples met alert limits. |
| Trip Blank Concentration | | | x | |
| Equipment Blank Concentration | | | x | |
| Field Duplicate RPD | x | | | |

| | |
|---|---|
| Has CoA been signed off (Yes/No)?: | Yes |
| Has lab warranted all tests were analyzed following SOP's in CoA (Yes/No)?: | Yes |
| Were all samples analyzed within hold times (Yes/No)?: | Yes |
| All volatiles samples methanol extracted (if required) within 48 hours (Yes/No)?: | n/a |
| Is Chain of Custody completed and signed (Yes/No)?: | Yes |
| Were sample temperatures acceptable when they reached lab (Yes/No)?: | Yes |

Was a Data Quality Overview (DQO) issued (Yes/No)?: No

Date DQO was received: n/a

Is data considered to be reliable (Yes/No)?: Yes

If answer is "No", describe and provide rationale:

Data Reviewed by (Print): Vivian Baptista | Data Reviewed by (Signature): 

Date: 23-Aug-18

Maxxam
A Bureau Veritas Group Company

Success Through Science®

Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400
Your C.O.C. #: 298575

**Attention: Stacy Gibb**

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

**Report Date: 2018/07/25**
Report #: R2594551
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B859119**
**Received: 2018/07/18, 09:45**

Sample Matrix: Water
# Samples Received: 3

| Analyses | Quantity | Laboratory Method | Primary Reference |
|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | 3 | AB SOP-00005 | SM 22 2320 B m |
| BTEX/F1 in Water by HS GC/MS/FID | 3 | AB SOP-00039 | CCME CWS/EPA 8260d m |
| F1-BTEX | 3 | AB SOP-00039 | Auto Calc |
| Cadmium - low level CCME - Dissolved | 3 | AB WI-00065 | Auto Calc |
| Chloride by Automated Colourimetry | 3 | AB SOP-00020 | SM 22 4500-Cl-E m |
| Conductivity @25C | 3 | AB SOP-00005 | SM 22 2510 B m |
| CCME Hydrocarbons in Water (F2; C10-C16) (1, 2) | 3 | AB SOP-00037<br>AB SOP-00040 | CCME PHC-CWS m |
| Hardness | 3 | AB WI-00065 | Auto Calc |
| Mercury - Low Level (Dissolved) (3) | 3 | EENVSOP-00031 | EPA 245.7 R2 m |
| Elements by ICP - Dissolved (3) | 3 | AB SOP-00042 | EPA 6010d R4 m |
| Elements by ICPMS - Dissolved (3) | 3 | AB SOP-00043 | EPA 6020b R2 m |
| Ion Balance | 3 | AB WI-00065 | Auto Calc |
| Nitrate and Nitrite | 3 | AB WI-00065 | Auto Calc |
| Nitrate + Nitrite-N (calculated) | 3 | AB WI-00065 | Auto Calc |
| Nitrogen (Nitrite - Nitrate) by IC | 3 | AB SOP-00023 | SM 23 4110 B m |
| Phenols (4-AAP) | 3 | EENVSOP-00061 | MMCW 154 1996 m |
| Sulphate by Automated Colourimetry | 3 | AB SOP-00018 | SM 22 4500-SO4 E m |
| Total Dissolved Solids (Filt. Residue) | 3 | AB SOP-00065 | SM 22 2540 C m |

**Remarks:**

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. All samples were analyzed within hold time unless otherwise flagged.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise



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Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400
Your C.O.C. #: 298575

**Attention: Stacy Gibb**

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

**Report Date: 2018/07/25**
Report #: R2594551
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B859119**
**Received: 2018/07/18, 09:45**
agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
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) Silica gel clean up employed.
(3) Dissolved > Total Imbalance: Whenever applicable, Dissolved >Total for any parameter that falls within method uncertainty for duplicates is likely equivalent. If RPD is >20% samples were reanalyzed and confirmed.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Jenna Chernuka, Project Manager
Email: JChernuka@maxxam.ca
Phone# (780)577-7178
==========
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 #: B859119
Report Date: 2018/07/25

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## AT1 BTEX AND F1-F2 IN WATER (WATER)

| Maxxam ID | | TW6621 | | TW6622 | TW6623 | | |
|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/07/16 11:15 | | 2018/07/16 11:20 | 2018/07/16 09:45 | | |
| COC Number | | 298575 | | 298575 | 298575 | | |
| | **UNITS** | **TF 03-12-3** | **QC Batch** | **NWD 18-46** | **MTF 97-1-5** | **RDL** | **QC Batch** |
| **Ext. Pet. Hydrocarbon** | | | | | | | |
| F2 (C10-C16 Hydrocarbons) | mg/L | <0.10 | 9069732 | <0.10 | <0.10 | 0.10 | 9069732 |
| **Volatiles** | | | | | | | |
| Benzene | mg/L | <0.00040 | 9069739 | <0.00040 | <0.00040 | 0.00040 | 9069739 |
| Toluene | mg/L | <0.00040 | 9069739 | <0.00040 | <0.00040 | 0.00040 | 9069739 |
| Ethylbenzene | mg/L | <0.00040 | 9069739 | <0.00040 | <0.00040 | 0.00040 | 9069739 |
| m & p-Xylene | mg/L | <0.00080 | 9069739 | <0.00080 | <0.00080 | 0.00080 | 9069739 |
| o-Xylene | mg/L | <0.00040 | 9069739 | <0.00040 | <0.00040 | 0.00040 | 9069739 |
| Xylenes (Total) | mg/L | <0.00089 | 9068703 | <0.00089 | <0.00089 | 0.00089 | 9069073 |
| F1 (C6-C10) - BTEX | mg/L | <0.10 | 9068703 | <0.10 | <0.10 | 0.10 | 9069073 |
| F1 (C6-C10) | mg/L | <0.10 | 9069739 | <0.10 | <0.10 | 0.10 | 9069739 |
| **Extraction Surrogate Recovery (%)** | | | | | | | |
| O-TERPHENYL (sur.) | % | 86 | 9069732 | 86 | 80 | | 9069732 |
| **Instrument Surrogate Recovery (%)** | | | | | | | |
| 1,4-Difluorobenzene (sur.) | % | 102 | 9069739 | 102 | 102 | | 9069739 |
| 4-Bromofluorobenzene (sur.) | % | 91 | 9069739 | 92 | 91 | | 9069739 |
| D4-1,2-Dichloroethane (sur.) | % | 73 | 9069739 | 75 | 71 | | 9069739 |
| RDL = Reportable Detection Limit | | | | | | | |



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Maxxam Job #: B859119
Report Date: 2018/07/25

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## REGULATED METALS INCLUDING MERCURY-DISS (WATER)

| Maxxam ID | | TW6621 | TW6622 | TW6623 | | |
|---|---|---|---|---|---|---|
| Sampling Date | | 2018/07/16 11:15 | 2018/07/16 11:20 | 2018/07/16 09:45 | | |
| COC Number | | 298575 | 298575 | 298575 | | |
| | **UNITS** | **TF 03-12-3** | **NWD 18-46** | **MTF 97-1-5** | **RDL** | **QC Batch** |
| **Low Level Elements** | | | | | | |
| Dissolved Cadmium (Cd) | mg/L | 0.000065 | 0.000074 | 0.00011 | 0.000020 | 9068975 |
| **Elements** | | | | | | |
| Dissolved Aluminum (Al) | mg/L | 0.013 | 0.0098 | 0.046 | 0.0030 | 9070007 |
| Dissolved Antimony (Sb) | mg/L | 0.0010 | 0.0011 | <0.00060 | 0.00060 | 9070007 |
| Dissolved Arsenic (As) | mg/L | 0.0042 | 0.0043 | <0.00020 | 0.00020 | 9070007 |
| Dissolved Barium (Ba) | mg/L | 0.090 | 0.088 | 0.027 | 0.010 | 9070910 |
| Dissolved Beryllium (Be) | mg/L | <0.0010 | <0.0010 | <0.0010 | 0.0010 | 9070007 |
| Dissolved Boron (B) | mg/L | 0.038 | 0.038 | 0.023 | 0.020 | 9070910 |
| Dissolved Calcium (Ca) | mg/L | 220 | 220 | 200 | 0.30 | 9070910 |
| Dissolved Chromium (Cr) | mg/L | <0.0010 | <0.0010 | <0.0010 | 0.0010 | 9070007 |
| Dissolved Cobalt (Co) | mg/L | 0.0035 | 0.0034 | <0.00030 | 0.00030 | 9070007 |
| Dissolved Copper (Cu) | mg/L | 0.0013 | 0.0013 | 0.0024 | 0.00020 | 9070007 |
| Dissolved Iron (Fe) | mg/L | 2.8 | 2.6 | 0.081 | 0.060 | 9070910 |
| Dissolved Lead (Pb) | mg/L | <0.00020 | <0.00020 | <0.00020 | 0.00020 | 9070007 |
| Dissolved Lithium (Li) | mg/L | <0.020 | <0.020 | <0.020 | 0.020 | 9070910 |
| Dissolved Magnesium (Mg) | mg/L | 84 | 83 | 52 | 0.20 | 9070910 |
| Dissolved Manganese (Mn) | mg/L | 0.33 | 0.31 | 0.0040 | 0.0040 | 9070910 |
| Dissolved Molybdenum (Mo) | mg/L | 0.22 | 0.22 | 0.015 | 0.00020 | 9070007 |
| Dissolved Nickel (Ni) | mg/L | 0.025 | 0.024 | 0.0041 | 0.00050 | 9070007 |
| Dissolved Phosphorus (P) | mg/L | <0.10 | <0.10 | <0.10 | 0.10 | 9070910 |
| Dissolved Potassium (K) | mg/L | 4.6 | 4.6 | 1.2 | 0.30 | 9070910 |
| Dissolved Selenium (Se) | mg/L | 0.0025 | 0.0028 | 0.12 | 0.00020 | 9070007 |
| Dissolved Silicon (Si) | mg/L | 11 | 11 | 4.1 | 0.10 | 9070910 |
| Dissolved Silver (Ag) | mg/L | <0.00010 | <0.00010 | <0.00010 | 0.00010 | 9070007 |
| Dissolved Sodium (Na) | mg/L | 50 | 50 | 3.5 | 0.50 | 9070910 |
| Dissolved Strontium (Sr) | mg/L | 0.81 | 0.81 | 0.37 | 0.020 | 9070910 |
| Dissolved Sulphur (S) | mg/L | 37 | 36 | 140 | 0.20 | 9070910 |
| Dissolved Thallium (Tl) | mg/L | 0.00099 | 0.00098 | <0.00020 | 0.00020 | 9070007 |
| Dissolved Tin (Sn) | mg/L | <0.0010 | <0.0010 | <0.0010 | 0.0010 | 9070007 |
| Dissolved Titanium (Ti) | mg/L | <0.0010 | 0.0011 | 0.0044 | 0.0010 | 9070007 |
| RDL = Reportable Detection Limit | | | | | | |



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Maxxam Job #: B859119
Report Date: 2018/07/25

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## REGULATED METALS INCLUDING MERCURY-DISS (WATER)

| Maxxam ID | | TW6621 | TW6622 | TW6623 | | |
|---|---|---|---|---|---|---|
| Sampling Date | | 2018/07/16 11:15 | 2018/07/16 11:20 | 2018/07/16 09:45 | | |
| COC Number | | 298575 | 298575 | 298575 | | |
| | **UNITS** | **TF 03-12-3** | **NWD 18-46** | **MTF 97-1-5** | **RDL** | **QC Batch** |
| Dissolved Uranium (U) | mg/L | 0.033 | 0.032 | 0.025 | 0.00010 | 9070007 |
| Dissolved Vanadium (V) | mg/L | 0.0064 | 0.0065 | <0.0010 | 0.0010 | 9070007 |
| Dissolved Zinc (Zn) | mg/L | 0.0094 | 0.0085 | 0.0074 | 0.0030 | 9070007 |
| **Low Level Elements** | | | | | | |
| Dissolved Mercury (Hg) | mg/L | 0.0000023 | 0.0000026 | 0.0000026 | 0.0000020 | 9076113 |
| RDL = Reportable Detection Limit | | | | | | |



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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## RESULTS OF CHEMICAL ANALYSES OF WATER

| Maxxam ID | | TW6621 | | TW6622 | | TW6623 | | |
|---|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/07/16 11:15 | | 2018/07/16 11:20 | | 2018/07/16 09:45 | | |
| COC Number | | 298575 | | 298575 | | 298575 | | |
| | **UNITS** | **TF 03-12-3** | **QC Batch** | **NWD 18-46** | **RDL** | **MTF 97-1-5** | **RDL** | **QC Batch** |
| **Calculated Parameters** | | | | | | | | |
| Hardness (CaCO3) | mg/L | 900 | 9067593 | 900 | 0.50 | 720 | 0.50 | 9068980 |
| Ion Balance (% Difference) | % | 1.7 | 9067594 | 2.1 | N/A | 3.0 | N/A | 9068982 |
| Dissolved Nitrate (NO3) | mg/L | 0.36 | 9068986 | 0.51 | 0.044 | 11 | 0.044 | 9068986 |
| Nitrate plus Nitrite (N) | mg/L | 0.082 | 9067430 | 0.13 | 0.014 | 2.5 | 0.014 | 9068988 |
| Dissolved Nitrite (NO2) | mg/L | <0.033 | 9068986 | 0.035 | 0.033 | <0.033 | 0.033 | 9068986 |
| **Misc. Inorganics** | | | | | | | | |
| Conductivity | uS/cm | 1800 | 9070105 | 1800 | 2.0 | 1200 | 2.0 | 9070105 |
| Total Dissolved Solids | mg/L | 1100 (1) | 9069570 | 1200 (1) | 50 | 920 | 10 | 9069570 |
| **Anions** | | | | | | | | |
| Alkalinity (PP as CaCO3) | mg/L | <1.0 | 9070104 | <1.0 | 1.0 | <1.0 | 1.0 | 9070104 |
| Alkalinity (Total as CaCO3) | mg/L | 610 | 9070104 | 600 | 1.0 | 240 | 1.0 | 9070104 |
| Bicarbonate (HCO3) | mg/L | 740 | 9070104 | 730 | 1.0 | 290 | 1.0 | 9070104 |
| Carbonate (CO3) | mg/L | <1.0 | 9070104 | <1.0 | 1.0 | <1.0 | 1.0 | 9070104 |
| Hydroxide (OH) | mg/L | <1.0 | 9070104 | <1.0 | 1.0 | <1.0 | 1.0 | 9070104 |
| Dissolved Sulphate (SO4) | mg/L | 130 | 9070101 | 130 | 1.0 | 420 (2) | 5.0 | 9070101 |
| Dissolved Chloride (Cl) | mg/L | 170 | 9070099 | 170 | 1.0 | 1.9 | 1.0 | 9070099 |
| **Nutrients** | | | | | | | | |
| Dissolved Nitrite (N) | mg/L | <0.010 | 9070020 | 0.011 | 0.010 | <0.010 | 0.010 | 9070020 |
| Dissolved Nitrate (N) | mg/L | 0.082 | 9070020 | 0.12 | 0.010 | 2.5 | 0.010 | 9070020 |
| **Misc. Organics** | | | | | | | | |
| Phenols | mg/L | 0.0056 | 9072263 | 0.0060 | 0.0020 | <0.0020 | 0.0020 | 9072263 |

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limit raised based on sample volume used for analysis.
(2) Detection limits raised due to dilution to bring analyte within the calibrated range.



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Maxxam Job #: B859119
Report Date: 2018/07/25

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## TEST SUMMARY

**Maxxam ID:** TW6621
**Sample ID:** TF 03-12-3
**Matrix:** Water

**Collected:** 2018/07/16
**Relinquished:** 2018/07/17
**Received:** 2018/07/18

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | AT/ALK | 9070104 | N/A | 2018/07/19 | Malina Alamyar |
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9069739 | N/A | 2018/07/19 | Sandra Wilson |
| F1-BTEX | CALC/MS | 9068703 | N/A | 2018/07/20 | Automated Statchk |
| Cadmium - low level CCME - Dissolved | CALC/MS | 9068975 | N/A | 2018/07/20 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 9070099 | N/A | 2018/07/20 | Chelsea Harmatys |
| Conductivity @25C | COND | 9070105 | N/A | 2018/07/19 | Malina Alamyar |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9069732 | 2018/07/19 | 2018/07/24 | Vian Pereira |
| Hardness | CALC | 9067593 | N/A | 2018/07/20 | Automated Statchk |
| Mercury - Low Level (Dissolved) | CV/AF | 9076113 | 2018/07/24 | 2018/07/24 | Andrew Payne |
| Elements by ICP - Dissolved | ICPA | 9070910 | N/A | 2018/07/19 | Queen Acharya |
| Elements by ICPMS - Dissolved | ICPM | 9070007 | N/A | 2018/07/19 | Julie Harrison |
| Ion Balance | CALC | 9067594 | N/A | 2018/07/19 | Automated Statchk |
| Nitrate and Nitrite | CALC | 9068986 | N/A | 2018/07/21 | Automated Statchk |
| Nitrate + Nitrite-N (calculated) | CALC | 9067430 | N/A | 2018/07/21 | Automated Statchk |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9070020 | N/A | 2018/07/19 | Mahesh Ranjan |
| Phenols (4-AAP) | TECH/4AAP | 9072263 | N/A | 2018/07/20 | Ying Yang |
| Sulphate by Automated Colourimetry | KONE | 9070101 | N/A | 2018/07/20 | Chelsea Harmatys |
| Total Dissolved Solids (Filt. Residue) | BAL | 9069570 | 2018/07/19 | 2018/07/23 | Luminita Chiosa |

**Maxxam ID:** TW6622
**Sample ID:** NWD 18-46
**Matrix:** Water

**Collected:** 2018/07/16
**Relinquished:** 2018/07/17
**Received:** 2018/07/18

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | AT/ALK | 9070104 | N/A | 2018/07/19 | Malina Alamyar |
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9069739 | N/A | 2018/07/19 | Sandra Wilson |
| F1-BTEX | CALC/MS | 9069073 | N/A | 2018/07/20 | Automated Statchk |
| Cadmium - low level CCME - Dissolved | CALC/MS | 9068975 | N/A | 2018/07/20 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 9070099 | N/A | 2018/07/20 | Chelsea Harmatys |
| Conductivity @25C | COND | 9070105 | N/A | 2018/07/19 | Malina Alamyar |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9069732 | 2018/07/19 | 2018/07/24 | Vian Pereira |
| Hardness | CALC | 9068980 | N/A | 2018/07/20 | Automated Statchk |
| Mercury - Low Level (Dissolved) | CV/AF | 9076113 | 2018/07/24 | 2018/07/24 | Andrew Payne |
| Elements by ICP - Dissolved | ICPA | 9070910 | N/A | 2018/07/19 | Queen Acharya |
| Elements by ICPMS - Dissolved | ICPM | 9070007 | N/A | 2018/07/19 | Julie Harrison |
| Ion Balance | CALC | 9068982 | N/A | 2018/07/19 | Automated Statchk |
| Nitrate and Nitrite | CALC | 9068986 | N/A | 2018/07/21 | Automated Statchk |
| Nitrate + Nitrite-N (calculated) | CALC | 9068988 | N/A | 2018/07/21 | Automated Statchk |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9070020 | N/A | 2018/07/19 | Mahesh Ranjan |
| Phenols (4-AAP) | TECH/4AAP | 9072263 | N/A | 2018/07/20 | Ying Yang |
| Sulphate by Automated Colourimetry | KONE | 9070101 | N/A | 2018/07/20 | Chelsea Harmatys |
| Total Dissolved Solids (Filt. Residue) | BAL | 9069570 | 2018/07/19 | 2018/07/23 | Luminita Chiosa |



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Maxxam Job #: B859119
Report Date: 2018/07/25

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## TEST SUMMARY

**Maxxam ID:** TW6623
**Sample ID:** MTF 97-1-5
**Matrix:** Water

**Collected:** 2018/07/16
**Relinquished:** 2018/07/17
**Received:** 2018/07/18

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | AT/ALK | 9070104 | N/A | 2018/07/19 | Malina Alamyar |
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9069739 | N/A | 2018/07/19 | Sandra Wilson |
| F1-BTEX | CALC/MS | 9069073 | N/A | 2018/07/20 | Automated Statchk |
| Cadmium - low level CCME - Dissolved | CALC/MS | 9068975 | N/A | 2018/07/20 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 9070099 | N/A | 2018/07/20 | Chelsea Harmatys |
| Conductivity @25C | COND | 9070105 | N/A | 2018/07/19 | Malina Alamyar |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9069732 | 2018/07/19 | 2018/07/24 | Vian Pereira |
| Hardness | CALC | 9068980 | N/A | 2018/07/20 | Automated Statchk |
| Mercury - Low Level (Dissolved) | CV/AF | 9076113 | 2018/07/24 | 2018/07/24 | Andrew Payne |
| Elements by ICP - Dissolved | ICPA | 9070910 | N/A | 2018/07/19 | Queen Acharya |
| Elements by ICPMS - Dissolved | ICPM | 9070007 | N/A | 2018/07/19 | Julie Harrison |
| Ion Balance | CALC | 9068982 | N/A | 2018/07/19 | Automated Statchk |
| Nitrate and Nitrite | CALC | 9068986 | N/A | 2018/07/21 | Automated Statchk |
| Nitrate + Nitrite-N (calculated) | CALC | 9068988 | N/A | 2018/07/21 | Automated Statchk |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9070020 | N/A | 2018/07/19 | Mahesh Ranjan |
| Phenols (4-AAP) | TECH/4AAP | 9072263 | N/A | 2018/07/20 | Ying Yang |
| Sulphate by Automated Colourimetry | KONE | 9070101 | N/A | 2018/07/20 | Chelsea Harmatys |
| Total Dissolved Solids (Filt. Residue) | BAL | 9069570 | 2018/07/19 | 2018/07/23 | Luminita Chiosa |



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Maxxam Job #: B859119
Report Date: 2018/07/25

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## GENERAL COMMENTS

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

| | |
|---|---|
| Package 1 | 4.0°C |

Temperatures upon receipt at Maxxam Calgary
Package 1: 5.0 degrees C
Each temperature is the average of up to three cooler temperatures taken at receipt.

**Results relate only to the items tested.**



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Maxxam Job #: B859119
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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| 9069570 | LCA | Method Blank | Total Dissolved Solids | 2018/07/23 | <10 | | mg/L | |
| 9069732 | VP4 | Method Blank | O-TERPHENYL (sur.) | 2018/07/24 | | 95 | % | 60 - 140 |
| | | | F2 (C10-C16 Hydrocarbons) | 2018/07/24 | <0.10 | | mg/L | |
| 9069739 | SB8 | Method Blank | 1,4-Difluorobenzene (sur.) | 2018/07/19 | | 103 | % | 50 - 140 |
| | | | 4-Bromofluorobenzene (sur.) | 2018/07/19 | | 91 | % | 50 - 140 |
| | | | D4-1,2-Dichloroethane (sur.) | 2018/07/19 | | 72 | % | 50 - 140 |
| | | | Benzene | 2018/07/19 | <0.00040 | | mg/L | |
| | | | Toluene | 2018/07/19 | <0.00040 | | mg/L | |
| | | | Ethylbenzene | 2018/07/19 | <0.00040 | | mg/L | |
| | | | m & p-Xylene | 2018/07/19 | <0.00080 | | mg/L | |
| | | | o-Xylene | 2018/07/19 | <0.00040 | | mg/L | |
| | | | F1 (C6-C10) | 2018/07/19 | <0.10 | | mg/L | |
| 9070007 | JHS | Method Blank | Dissolved Aluminum (Al) | 2018/07/19 | <0.0030 | | mg/L | |
| | | | Dissolved Chromium (Cr) | 2018/07/19 | <0.0010 | | mg/L | |
| | | | Dissolved Cobalt (Co) | 2018/07/19 | <0.00030 | | mg/L | |
| | | | Dissolved Copper (Cu) | 2018/07/19 | <0.00020 | | mg/L | |
| | | | Dissolved Lead (Pb) | 2018/07/19 | <0.00020 | | mg/L | |
| | | | Dissolved Antimony (Sb) | 2018/07/19 | <0.00060 | | mg/L | |
| | | | Dissolved Molybdenum (Mo) | 2018/07/19 | <0.00020 | | mg/L | |
| | | | Dissolved Nickel (Ni) | 2018/07/19 | <0.00050 | | mg/L | |
| | | | Dissolved Selenium (Se) | 2018/07/19 | <0.00020 | | mg/L | |
| | | | Dissolved Silver (Ag) | 2018/07/19 | <0.00010 | | mg/L | |
| | | | Dissolved Arsenic (As) | 2018/07/19 | <0.00020 | | mg/L | |
| | | | Dissolved Thallium (Tl) | 2018/07/19 | <0.00020 | | mg/L | |
| | | | Dissolved Tin (Sn) | 2018/07/19 | <0.0010 | | mg/L | |
| | | | Dissolved Titanium (Ti) | 2018/07/19 | <0.0010 | | mg/L | |
| | | | Dissolved Uranium (U) | 2018/07/19 | <0.00010 | | mg/L | |
| | | | Dissolved Vanadium (V) | 2018/07/19 | <0.0010 | | mg/L | |
| | | | Dissolved Zinc (Zn) | 2018/07/19 | <0.0030 | | mg/L | |
| | | | Dissolved Beryllium (Be) | 2018/07/19 | <0.0010 | | mg/L | |
| 9070020 | MSD | Method Blank | Dissolved Nitrite (N) | 2018/07/19 | <0.010 | | mg/L | |
| | | | Dissolved Nitrate (N) | 2018/07/19 | <0.010 | | mg/L | |
| 9070099 | CH7 | Method Blank | Dissolved Chloride (Cl) | 2018/07/20 | <1.0 | | mg/L | |
| 9070101 | CH7 | Method Blank | Dissolved Sulphate (SO4) | 2018/07/20 | <1.0 | | mg/L | |
| 9070104 | MA4 | Method Blank | Alkalinity (Total as CaCO3) | 2018/07/19 | <1.0 | | mg/L | |
| | | | Alkalinity (PP as CaCO3) | 2018/07/19 | <1.0 | | mg/L | |
| | | | Bicarbonate (HCO3) | 2018/07/19 | <1.0 | | mg/L | |
| | | | Carbonate (CO3) | 2018/07/19 | <1.0 | | mg/L | |
| | | | Hydroxide (OH) | 2018/07/19 | <1.0 | | mg/L | |
| 9070105 | MA4 | Method Blank | Conductivity | 2018/07/19 | <2.0 | | uS/cm | |
| 9070910 | ACY | Method Blank | Dissolved Iron (Fe) | 2018/07/19 | <0.060 | | mg/L | |
| | | | Dissolved Lithium (Li) | 2018/07/19 | <0.020 | | mg/L | |
| | | | Dissolved Magnesium (Mg) | 2018/07/19 | <0.20 | | mg/L | |
| | | | Dissolved Manganese (Mn) | 2018/07/19 | <0.0040 | | mg/L | |
| | | | Dissolved Potassium (K) | 2018/07/19 | <0.30 | | mg/L | |
| | | | Dissolved Sodium (Na) | 2018/07/19 | <0.50 | | mg/L | |
| | | | Dissolved Strontium (Sr) | 2018/07/19 | <0.020 | | mg/L | |
| | | | Dissolved Sulphur (S) | 2018/07/19 | <0.20 | | mg/L | |
| | | | Dissolved Phosphorus (P) | 2018/07/19 | <0.10 | | mg/L | |
| | | | Dissolved Barium (Ba) | 2018/07/19 | <0.010 | | mg/L | |
| | | | Dissolved Silicon (Si) | 2018/07/19 | <0.10 | | 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 #: B859119
Report Date: 2018/07/25

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT(CONT'D)

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| | | | Dissolved Boron (B) | 2018/07/19 | <0.020 | | mg/L | |
| | | | Dissolved Calcium (Ca) | 2018/07/19 | <0.30 | | mg/L | |
| 9072263 | YY | Method Blank | Phenols | 2018/07/20 | <0.0020 | | mg/L | |
| 9076113 | APY | Method Blank | Dissolved Mercury (Hg) | 2018/07/24 | <0.0000020 | | mg/L | |
| 9069570 | LCA | LCS | Total Dissolved Solids | 2018/07/23 | | 100 | % | 80 - 120 |
| 9069732 | VP4 | LCS | O-TERPHENYL (sur.) | 2018/07/24 | | 86 | % | 60 - 140 |
| | | | F2 (C10-C16 Hydrocarbons) | 2018/07/24 | | 93 | % | 60 - 140 |
| 9069739 | SB8 | LCS | 1,4-Difluorobenzene (sur.) | 2018/07/19 | | 102 | % | 50 - 140 |
| | | | 4-Bromofluorobenzene (sur.) | 2018/07/19 | | 90 | % | 50 - 140 |
| | | | D4-1,2-Dichloroethane (sur.) | 2018/07/19 | | 70 | % | 50 - 140 |
| | | | Benzene | 2018/07/19 | | 96 | % | 60 - 130 |
| | | | Toluene | 2018/07/19 | | 92 | % | 60 - 130 |
| | | | Ethylbenzene | 2018/07/19 | | 97 | % | 60 - 130 |
| | | | m & p-Xylene | 2018/07/19 | | 98 | % | 60 - 130 |
| | | | o-Xylene | 2018/07/19 | | 99 | % | 60 - 130 |
| | | | F1 (C6-C10) | 2018/07/19 | | 117 | % | 60 - 140 |
| 9070007 | JHS | LCS | Dissolved Aluminum (Al) | 2018/07/19 | | 98 | % | 80 - 120 |
| | | | Dissolved Chromium (Cr) | 2018/07/19 | | 97 | % | 80 - 120 |
| | | | Dissolved Cobalt (Co) | 2018/07/19 | | 97 | % | 80 - 120 |
| | | | Dissolved Copper (Cu) | 2018/07/19 | | 99 | % | 80 - 120 |
| | | | Dissolved Lead (Pb) | 2018/07/19 | | 97 | % | 80 - 120 |
| | | | Dissolved Antimony (Sb) | 2018/07/19 | | 96 | % | 80 - 120 |
| | | | Dissolved Molybdenum (Mo) | 2018/07/19 | | 86 | % | 80 - 120 |
| | | | Dissolved Nickel (Ni) | 2018/07/19 | | 97 | % | 80 - 120 |
| | | | Dissolved Selenium (Se) | 2018/07/19 | | 90 | % | 80 - 120 |
| | | | Dissolved Silver (Ag) | 2018/07/19 | | 99 | % | 80 - 120 |
| | | | Dissolved Arsenic (As) | 2018/07/19 | | 91 | % | 80 - 120 |
| | | | Dissolved Thallium (Tl) | 2018/07/19 | | 98 | % | 80 - 120 |
| | | | Dissolved Tin (Sn) | 2018/07/19 | | 96 | % | 80 - 120 |
| | | | Dissolved Titanium (Ti) | 2018/07/19 | | 97 | % | 80 - 120 |
| | | | Dissolved Uranium (U) | 2018/07/19 | | 97 | % | 80 - 120 |
| | | | Dissolved Vanadium (V) | 2018/07/19 | | 98 | % | 80 - 120 |
| | | | Dissolved Zinc (Zn) | 2018/07/19 | | 100 | % | 80 - 120 |
| | | | Dissolved Beryllium (Be) | 2018/07/19 | | 98 | % | 80 - 120 |
| 9070020 | MSD | LCS | Dissolved Nitrite (N) | 2018/07/19 | | 100 | % | 80 - 120 |
| | | | Dissolved Nitrate (N) | 2018/07/19 | | 101 | % | 80 - 120 |
| 9070099 | CH7 | LCS | Dissolved Chloride (Cl) | 2018/07/20 | | 107 | % | 80 - 120 |
| 9070101 | CH7 | LCS | Dissolved Sulphate (SO4) | 2018/07/20 | | 103 | % | 80 - 120 |
| 9070104 | MA4 | LCS | Alkalinity (Total as CaCO3) | 2018/07/19 | | 99 | % | 80 - 120 |
| 9070105 | MA4 | LCS | Conductivity | 2018/07/19 | | 101 | % | 90 - 110 |
| 9070910 | ACY | LCS | Dissolved Iron (Fe) | 2018/07/19 | | 104 | % | 80 - 120 |
| | | | Dissolved Lithium (Li) | 2018/07/19 | | 103 | % | 80 - 120 |
| | | | Dissolved Magnesium (Mg) | 2018/07/19 | | 104 | % | 80 - 120 |
| | | | Dissolved Manganese (Mn) | 2018/07/19 | | 105 | % | 80 - 120 |
| | | | Dissolved Potassium (K) | 2018/07/19 | | 100 | % | 80 - 120 |
| | | | Dissolved Sodium (Na) | 2018/07/19 | | 103 | % | 80 - 120 |
| | | | Dissolved Strontium (Sr) | 2018/07/19 | | 104 | % | 80 - 120 |
| | | | Dissolved Phosphorus (P) | 2018/07/19 | | 101 | % | 80 - 120 |
| | | | Dissolved Barium (Ba) | 2018/07/19 | | 105 | % | 80 - 120 |
| | | | Dissolved Silicon (Si) | 2018/07/19 | | 101 | % | 80 - 120 |
| | | | Dissolved Boron (B) | 2018/07/19 | | 107 | % | 80 - 120 |



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Maxxam Job #: B859119
Report Date: 2018/07/25

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT(CONT'D)

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| | | | Dissolved Calcium (Ca) | 2018/07/19 | | 105 | % | 80 - 120 |
| 9072263 | YY | LCS | Phenols | 2018/07/20 | | 94 | % | 80 - 120 |
| 9076113 | APY | LCS | Dissolved Mercury (Hg) | 2018/07/24 | | 104 | % | 80 - 120 |
| 9076113 | APY | SRM | Dissolved Mercury (Hg) | 2018/07/24 | | 100 | % | 80 - 120 |

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

LCS: 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.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.



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Maxxam Job #: B859119
Report Date: 2018/07/25

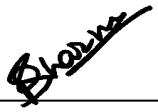
Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## VALIDATION SIGNATURE PAGE

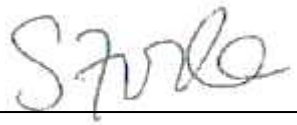
The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Dennis Ngondu, B.Sc., P.Chem., QP, Supervisor, Organics



Poonam Sharma, cCT, Organics Supervisor



Suwan Fock, B.Sc., QP, Inorganics Senior Analyst

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.



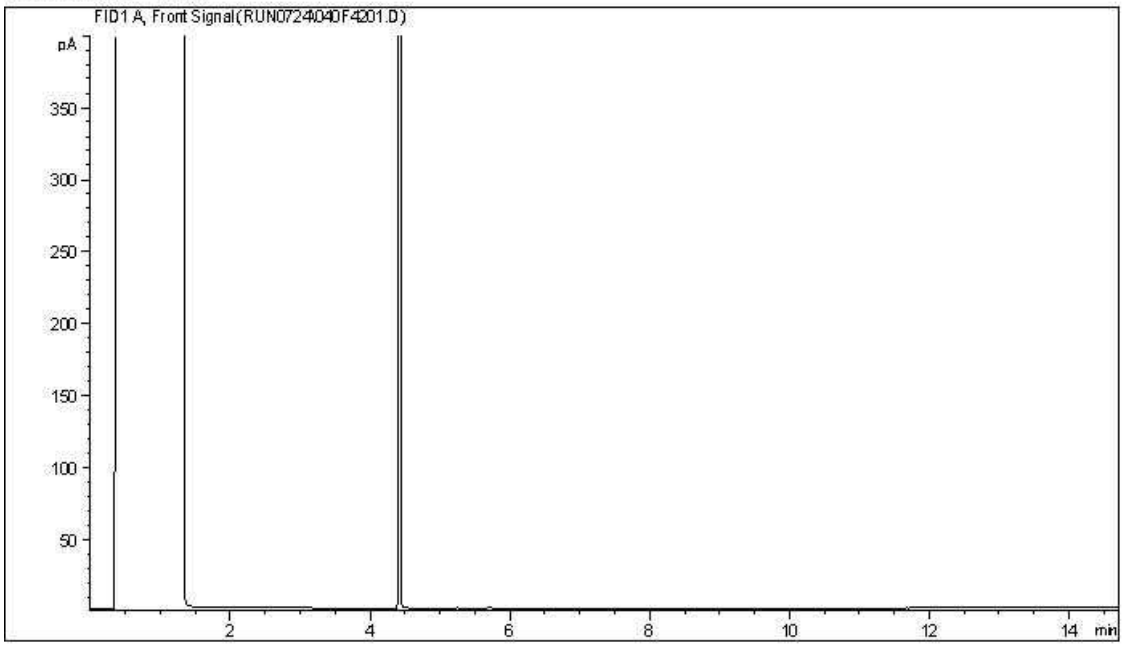
Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B859119
Report Date: 2018/07/25
Maxxam Sample: TW6621

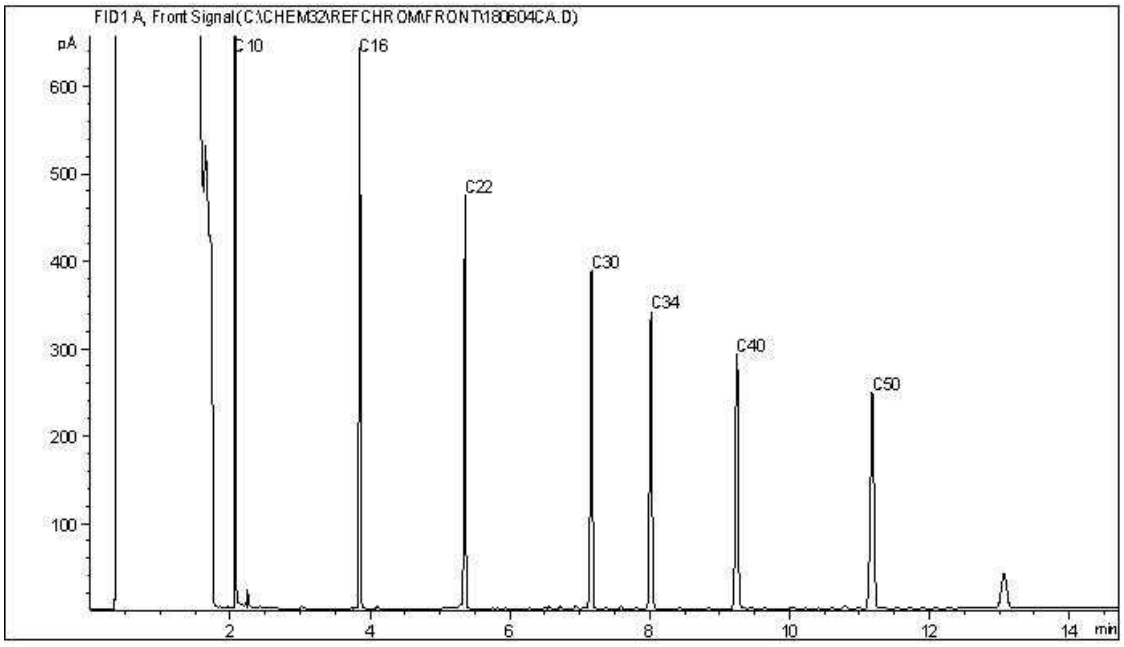
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: TF 03-12-3

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: GC13




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

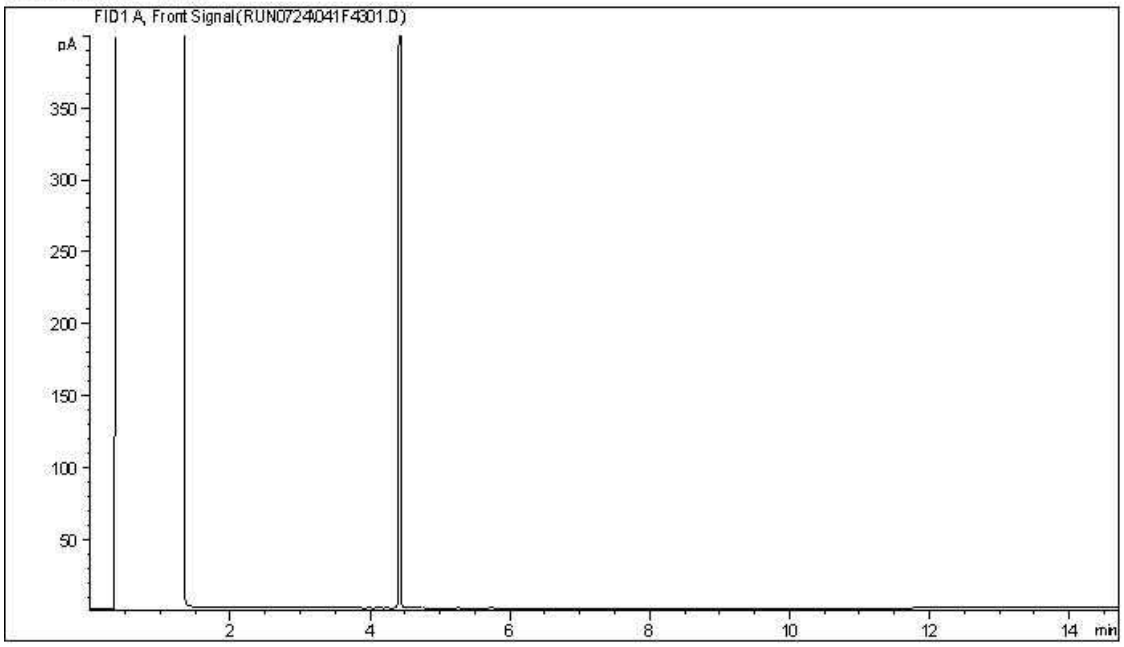
**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam Job #: B859119
Report Date: 2018/07/25
Maxxam Sample: TW6622

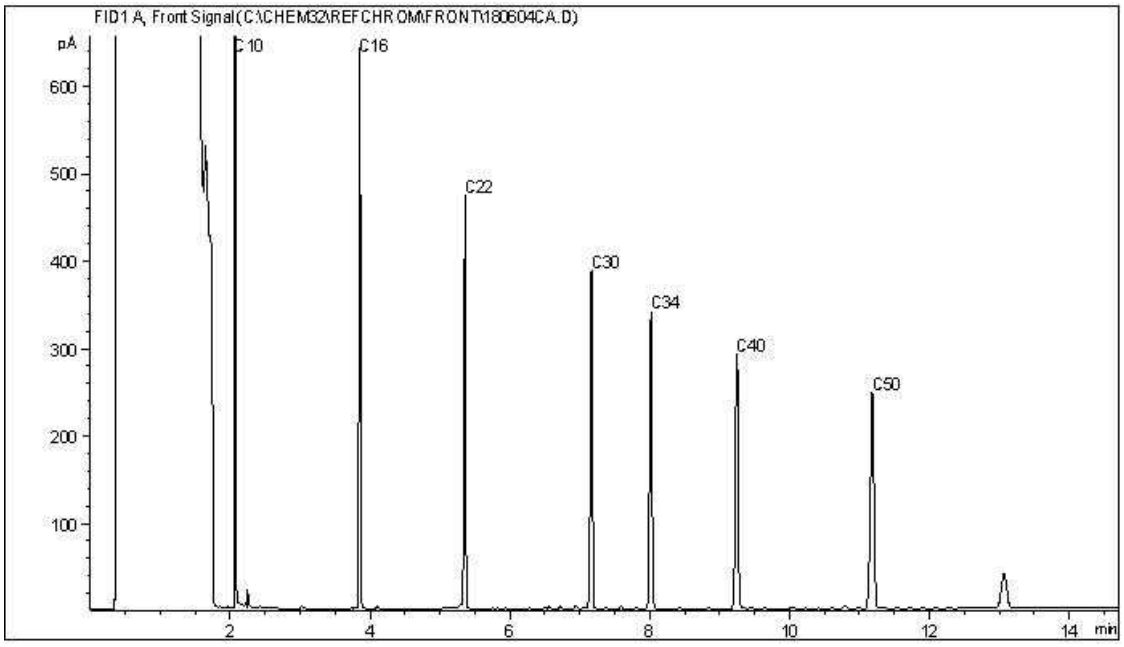
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: NWD 18-46

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: GC13




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

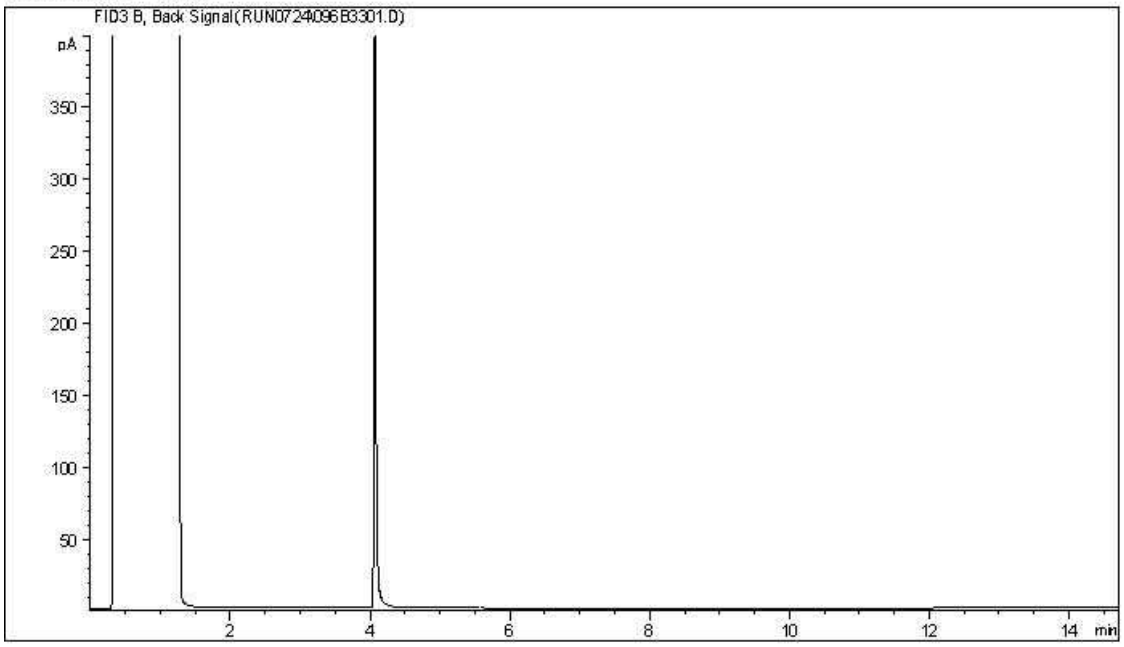
**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam Job #: B859119
Report Date: 2018/07/25
Maxxam Sample: TW6623

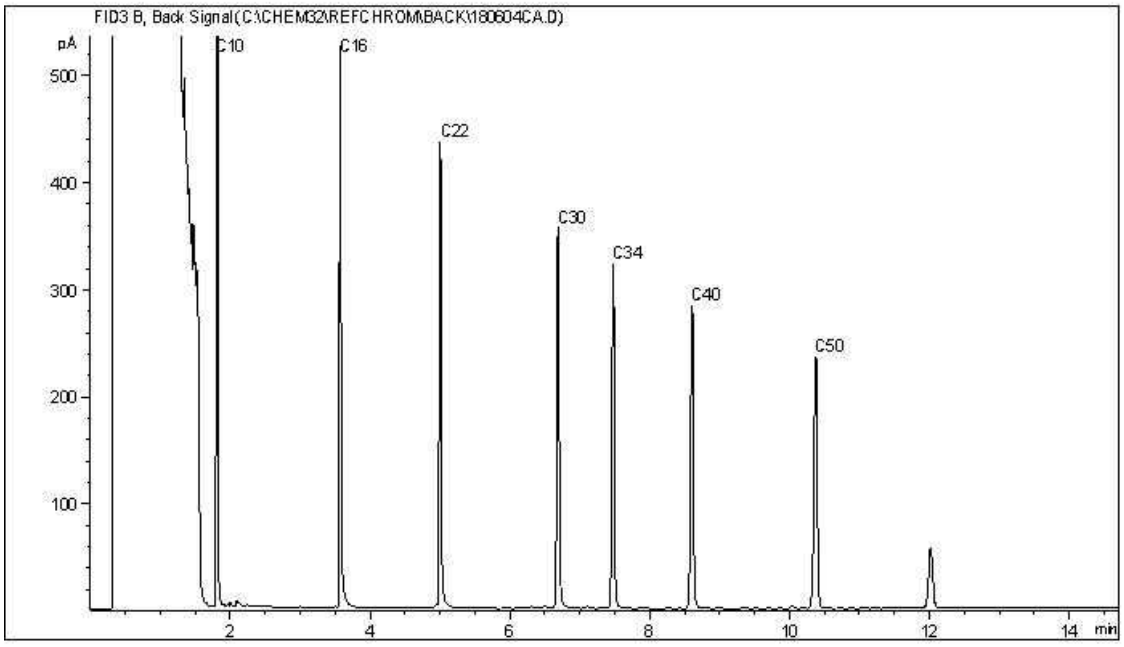
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: MTF 97-1-5

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: GC13




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam
A Bureau Veritas Group Company

☐ Calgary
4000 19th St. NE, T2E 6P8
Phone: (403) 291-3077
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☒ Edmonton
9331 - 48 Street, T6B 2R4
Phone: (780) 577-7100
Fax: (780) 450-4187
Toll Free: (800) 386-7247

MFB 935

# EXXON MOBIL/IMPERIAL OIL - MAXXAM CHAIN-OF-CUSTODY RECORD

Page 1 of 1

C of C # 298575

| INVOICE INFORMATION | REPORT INFORMATION |
|---|---|
| Company Name: ☒ Imperial Oil ☐ ExxonMobil | Company Name: WorleyParsons |
| Contact Name: WorleyParsons | Contact Name: Stacy Gibb |
| Address: 500, 151 Canada Olympic Rd SW Calgary, AB T3B 6B7 | Address: 500, 151 Canada Olympic Rd SW Calgary, AB T3B 6B7 |
| Email: sanj.perera@advisian.com | Email: stacy.gibb@advisian.com |
| Ph: 587-952-1490 | Ph: 403-247-0200 |
| Sampler Name (Print): Melissa Lord Michelle Vokaty, [redacted] ML | Consultant Project #: 00586-400 407011-[redacted] ML |

| FIELD SAMPLE ID | MATRIX: GROUND WATER | SURFACE WATER | SOIL | OTHER | # CONTAINERS | SAMPLING: DATE (YYYY/MM/DD) | TIME (24 HR) | FIELD FILTERED & PRESERVED | LAB FILTRATION REQUIRED | VOC | PAH | PHCs (FRACTIONS 1-2 PLUS BTEX) | PHCs (FRACTIONS 1-4 PLUS BTEX) | PHCs (FRACTIONS 2-4) | PHCs (FRACTION 1 PLUS BTEX) | GRAIN SIZE (75 MICRON) | TEXTURE (% SAND, SILT, CLAY) | PARTICLE SIZE DISTRIBUTION WITH GRAPH | REGULATED METALS ☒ DIS ☐ TOT | MERCURY ☒ DISSOLVED ☐ TOTAL | SALINITY SOIL | FERTILIZER SOIL | FERTILIZER WATER | NUTRIENTS SOIL | ROUTINE POTABILITY ☐ pH ☐ EC ☐ ALKALINITY | BASIC CLASS II LANDFILL PKG | Phenols by 4AAP | Limited sample - partial bottles) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 TF 03-12-3 | X | | | | 10 | 2018/07/16 | 11:15 | X | | | | X | | | | | | | X | X | | | | | X | | X | |
| 2 NWD 18-46 | X | | | | 10 | ↓ | 11:20 | X | | | | X | | | | | | | X | X | | | | | X | | X | |
| 3 MTF 97-1-5 | X | | | | 10 | ↓ | 09:45 | X | | | | X | | | | | | | X | X | | | | | X | | X | X |
| 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

IOL SITE LOCATION: Norman Wells, NT

IOL PROJECT # (if applicable): N/A

MAXXAM TASK ORDER # OR SERVICE ORDER # + LINE ITEM: 407011-00586-400 [redacted] ML

REGULATORY CRITERIA / DETECTION LIMITS:
☐ Alberta Tier 1 ☐ CDWG
☐ SEQG (SK) ☐ NoSC (SK)
☒ CCME (incl. level) FAL ☐ Other

SPECIAL INSTRUCTIONS:
also email:
- standard Norman Wells list
- melissa.lord@advisian.com
IES A2601436

# JARS USED & NOT SUBMITTED (Enter N/A for Water): N/A

TURNAROUND TIME
Standard (5 days) ☒
Rush (3 days) ☐
(2 days) ☐
(1 day) ☐
(same day) ☐
Date Required

| | YES | NO | COOLER ID # | | | |
|---|---|---|---|---|---|---|
| SEAL PRESENT | ✓ | | TEMP °C | 4 | 5 | 3 |
| SEAL INTACT | ✓ | | | 1 | 2 | 3 |
| COOLING MEDIA PRESENT | ✓ | | | | | |

| | YES | NO | COOLER ID # | | | |
|---|---|---|---|---|---|---|
| SEAL PRESENT | | | TEMP °C | | | |
| SEAL INTACT | | | | 1 | 2 | 3 |
| COOLING MEDIA PRESENT | | | | | | |

| | YES | NO | COOLER ID # | | | |
|---|---|---|---|---|---|---|
| SEAL PRESENT | | | TEMP °C | | | |
| SEAL INTACT | | | | 1 | 2 | 3 |
| COOLING MEDIA PRESENT | | | | | | |

LAB USE ONLY
MAXXAM JOB # B859119

| RELINQUISHED BY: | | DATE: | TIME (24 HR) | RECEIVED BY: | | DATE: | TIME (24 HR) |
|---|---|---|---|---|---|---|---|
| 1. [signature] | Melissa Lord | 2018/07/17 | 08:00 | 1. [signature] | MICHAEL FABER | 2018/07/18 | 09:45 |
| 2. | | | | 2. | | | |
| 3. | | | | 3. | | | |

SAMPLES
LABELED BY: RBE
VERIFIED BY: ALK

COC-1010 (06/2016) IOL-AB White: Maxxam Yellow: Client

Maxxam
A Bureau Veritas Group Company

Sent to: **Maxxam Calgary**
**4000 - 19 St.**
**Calgary, AB, T2E 6P8**
**Tel: (403) 291-3077**

# MAXXAM INTERLAB CHAIN OF CUSTODY RECORD



**COC #** B859119-MCAL-01-01

| REPORT INFORMATION | |
|---|---|
| **Company:** | Maxxam |
| **Address:** | 9331 - 48th Street, Edmonton, Alberta, T6B 2R4 |
| **Contact Name:** | Jenna Chernuka |
| **Email:** | JChernuka@maxxam.ca, edmenvirocs@maxxamanalytics.com |
| **Phone:** | (780) 577-7178 |
| **Maxxam Project #:** | B859119 |
| **Client Invoice To:** | Imperial Oil Ltd - Worley Parsons (12794) |
| **Client Report To:** | Advisian (38038) |

**Incl. on Report? Yes / No**

| # | SAMPLE ID | MATRIX | DATE SAMPLED (YYYY/MM/DD) | TIME SAMPLED (HH:MM) | SAMPLER INITIALS | # CONT. | ANALYSIS REQUESTED: CCME Hydrocarbons in Water (F2; C10-C16) | ADDITIONAL SAMPLE INFORMATION |
|---|---|---|---|---|---|---|---|---|
| 1 | TW6621-TF 03-12-3 | GW | 2018/07/16 | 11:15 | ML | 2 | X | (P: 05) |
| 2 | TW6622-NWD 18-46 | GW | 2018/07/16 | 11:20 | MV | 2 | X | (P: 05) |
| 3 | TW6623-MTF 97-1-5 | GW | 2018/07/16 | 09:45 | MV | 2 | X | (P: 05) |
| 4 | | | | | | | | |
| 5 | | | | | | | | |
| 6 | | | | | | | | |
| 7 | | | | | | | | |
| 8 | | | | | | | | |
| 9 | | | | | | | | |
| 10 | | | | | | | | |

*Job Barcode Label*

**SITE LOCATION:** Norman Wells, NT

**SITE #:** N/A

**PROJECT #:** 407011-00586-400

**PO/AFE, TASK ORDER/SERVICE ORDER, LINE ITEM:** A2601436, 407011-00586-400

**REGULATORY CRITERIA:** CCME FAL

**SPECIAL INSTRUCTIONS:** Please inform Maxxam immediately if you are not accredited for the requested test(s).
**Please return a copy of this form with the report.**

**REQUIRED EDDs:** National Excel (N001) Worley Parsons Komex Equis (N026) Standard DBF (Old DBase Names) (A002)

**TURNAROUND TIME**

☐ Rush Required

**2018/07/24**
Date Required

*Please inform us if rush charges will be incurred.*

| COOLER ID: | YES | NO | Temp: (°C) | 1 | 2 | 3 |
|---|---|---|---|---|---|---|
| Custody Seal Present | ✓ | | | | | |
| Custody Seal Intact | ✓ | | | | | |
| Cooling Media Present | ✓ | | | | | |
| | | | | 4 | 6 | 5 |

| COOLER ID: | YES | NO | Temp: (°C) | 1 | 2 | 3 |
|---|---|---|---|---|---|---|
| Custody Seal Present | | | | | | |
| Custody Seal Intact | | | | | | |
| Cooling Media Present | | | | | | |

| COOLER ID: | YES | NO | Temp: (°C) | 1 | 2 | 3 |
|---|---|---|---|---|---|---|
| Custody Seal Present | | | | | | |
| Custody Seal Intact | | | | | | |
| Cooling Media Present | | | | | | |

**RECEIVING LAB USE ONLY**

**Maxxam Job #**

**B859119**

| RELINQUISHED BY: (SIGN & PRINT) | DATE: (YYYY/MM/DD) | TIME: (HH:MM) | RECEIVED BY: (SIGN & PRINT) | DATE: (YYYY/MM/DD) | TIME: (HH:MM) | Samples Labelled By: | Labels Verified By: |
|---|---|---|---|---|---|---|---|
| 1. David Tidmuss | 20180723 | 1050 | 1. Jillamayon ARDRIN VILLAMAYOR | 2018/07/23 | 15:25 | RBE | AV2 |
| 2. | | | 2. | | | | |

# DATA QUALITY REVIEW CHECKLIST - IMPERIAL OIL PROJECTS

Consultant: Advisian | Sampling Date: 17-Jul-18

Location: Norman Wells | Laboratory : Maxxam Edmonton

Consultant Project Number: 407011-00586-400 | Sample Submission Number: B859442

Are All Laboratory QC Within Acceptance Criteria (Yes, No, Not Applicable)?

| | Yes | No | NA | Comments |
|---|---|---|---|---|
| Instrument Surrogate Recovery | x | | | Laboratory control sample recovery of fluoranthene |
| Extraction Surrogate Recovery | x | | | (131%) did not meet acceptance criteria (50-130%). |
| Method Blank Concentration | x | | | All other laboratory QC met acceptance criteria. |
| Matrix Duplicate RPD | x | | | |
| Matrix Spike Recovery | x | | | |
| Lab Control Sample Recovery | | x | | |

Are All Field QC Samples Within Alert Limits (Yes, No, Not Applicable)?

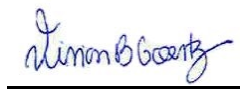
| | Yes | No | NA | Comments |
|---|---|---|---|---|
| Field Blank Concentration | | | x | No field QC samples submitted. |
| Trip Blank Concentration | | | x | |
| Equipment Blank Concentration | | | x | |
| Field Duplicate RPD | | | x | |

| | |
|---|---|
| Has CoA been signed off (Yes/No)?: | Yes |
| Has lab warranted all tests were analyzed following SOP's in CoA (Yes/No)?: | Yes |
| Were all samples analyzed within hold times (Yes/No)?: | Yes |
| All volatiles samples methanol extracted (if required) within 48 hours (Yes/No)?: | n/a |
| Is Chain of Custody completed and signed (Yes/No)?: | Yes |
| Were sample temperatures acceptable when they reached lab (Yes/No)?: | Yes |

| | |
|---|---|
| Was a Data Quality Overview (DQO) issued (Yes/No)?: | No |
| Date DQO was received: | n/a |

Is data considered to be reliable (Yes/No)?: Yes

If answer is "No", describe and provide rationale:

Data Reviewed by (Print): Vivian Baptista | Data Reviewed by (Signature): 

Date: 30-Jul-18

Maxxam
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Success Through Science®

Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400
Your C.O.C. #: 298581

**Attention: Stacy Gibb**

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

**Report Date: 2018/07/26**
Report #: R2594985
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B859442**
**Received: 2018/07/19, 09:35**

Sample Matrix: Water
# Samples Received: 1

| Analyses | Quantity | Laboratory Method | Primary Reference |
|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | 1 | AB SOP-00005 | SM 22 2320 B m |
| BTEX/F1 in Water by HS GC/MS/FID | 1 | AB SOP-00039 | CCME CWS/EPA 8260d m |
| F1-BTEX | 1 | AB SOP-00039 | Auto Calc |
| Cadmium - low level CCME - Dissolved | 1 | AB WI-00065 | Auto Calc |
| Chloride by Automated Colourimetry | 1 | AB SOP-00020 | SM 22 4500-Cl-E m |
| Conductivity @25C | 1 | AB SOP-00005 | SM 22 2510 B m |
| CCME Hydrocarbons in Water (F2; C10-C16) (1, 2) | 1 | AB SOP-00037<br>AB SOP-00040 | CCME PHC-CWS m |
| Hardness | 1 | AB WI-00065 | Auto Calc |
| Mercury - Low Level (Dissolved) (3) | 1 | EENVSOP-00031 | EPA 245.7 R2 m |
| Elements by ICP - Dissolved (3) | 1 | AB SOP-00042 | EPA 6010d R4 m |
| Elements by ICPMS - Dissolved (3) | 1 | AB SOP-00043 | EPA 6020b R2 m |
| Ion Balance | 1 | AB WI-00065 | Auto Calc |
| Nitrate and Nitrite | 1 | AB WI-00065 | Auto Calc |
| Nitrate + Nitrite-N (calculated) | 1 | AB WI-00065 | Auto Calc |
| Nitrogen (Nitrite - Nitrate) by IC | 1 | AB SOP-00023 | SM 23 4110 B m |
| Benzo[a]pyrene Equivalency (4) | 1 | AB SOP-00003 | Auto Calc |
| PAH in Water by GC/MS | 1 | AB SOP-00037 / AB SOP-00003 | EPA 3510C/8270E m |
| Phenols (4-AAP) | 1 | EENVSOP-00061 | MMCW 154 1996 m |
| Sulphate by Automated Colourimetry | 1 | AB SOP-00018 | SM 22 4500-SO4 E m |
| Total Dissolved Solids (Filt. Residue) | 1 | AB SOP-00065 | SM 22 2540 C m |

**Remarks:**

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. All samples were analyzed within hold time unless otherwise flagged.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed



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Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400
Your C.O.C. #: 298581

**Attention: Stacy Gibb**

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

**Report Date: 2018/07/26**
Report #: R2594985
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B859442**
**Received: 2018/07/19, 09:35**

or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

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) Silica gel clean up employed.
(3) Dissolved > Total Imbalance: Whenever applicable, Dissolved >Total for any parameter that falls within method uncertainty for duplicates is likely equivalent. If RPD is >20% samples were reanalyzed and confirmed.
(4) B[a]P TPE is calculated using 1/2 of the RDL for non detect results as per Alberta Environment instructions. This protocol may not apply in other jurisdictions.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Jenna Chernuka, Project Manager
Email: JChernuka@maxxam.ca
Phone# (780)577-7178

==========

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 #: B859442
Report Date: 2018/07/26

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## AT1 BTEX AND F1-F2 IN WATER (WATER)

| Maxxam ID | | TW8513 | | |
|---|---|---|---|---|
| Sampling Date | | 2018/07/17 14:05 | | |
| COC Number | | 298581 | | |
| | **UNITS** | **BIBG-10-1-4** | **RDL** | **QC Batch** |
| **Ext. Pet. Hydrocarbon** | | | | |
| F2 (C10-C16 Hydrocarbons) | mg/L | <0.10 | 0.10 | 9072493 |
| **Volatiles** | | | | |
| Benzene | mg/L | <0.00040 | 0.00040 | 9071597 |
| Toluene | mg/L | <0.00040 | 0.00040 | 9071597 |
| Ethylbenzene | mg/L | <0.00040 | 0.00040 | 9071597 |
| m & p-Xylene | mg/L | <0.00080 | 0.00080 | 9071597 |
| o-Xylene | mg/L | <0.00040 | 0.00040 | 9071597 |
| Xylenes (Total) | mg/L | <0.00089 | 0.00089 | 9070357 |
| F1 (C6-C10) - BTEX | mg/L | <0.10 | 0.10 | 9070357 |
| F1 (C6-C10) | mg/L | <0.10 | 0.10 | 9071597 |
| **Extraction Surrogate Recovery (%)** | | | | |
| O-TERPHENYL (sur.) | % | 88 | | 9072493 |
| **Instrument Surrogate Recovery (%)** | | | | |
| 1,4-Difluorobenzene (sur.) | % | 103 | | 9071597 |
| 4-Bromofluorobenzene (sur.) | % | 99 | | 9071597 |
| D4-1,2-Dichloroethane (sur.) | % | 96 | | 9071597 |
| RDL = Reportable Detection Limit | | | | |



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Maxxam Job #: B859442
Report Date: 2018/07/26

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## REGULATED METALS INCLUDING MERCURY-DISS (WATER)

| Maxxam ID | | TW8513 | | | TW8513 | | |
|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/07/17 14:05 | | | 2018/07/17 14:05 | | |
| COC Number | | 298581 | | | 298581 | | |
| | **UNITS** | **BIBG-10-1-4** | **RDL** | **QC Batch** | **BIBG-10-1-4 Lab-Dup** | **RDL** | **QC Batch** |
| **Low Level Elements** | | | | | | | |
| Dissolved Cadmium (Cd) | mg/L | 0.00021 | 0.000020 | 9069896 | | | |
| **Elements** | | | | | | | |
| Dissolved Aluminum (Al) | mg/L | 0.048 | 0.0030 | 9071903 | 0.048 | 0.0030 | 9071903 |
| Dissolved Antimony (Sb) | mg/L | <0.00060 | 0.00060 | 9071903 | <0.00060 | 0.00060 | 9071903 |
| Dissolved Arsenic (As) | mg/L | 0.00026 | 0.00020 | 9071903 | 0.00025 | 0.00020 | 9071903 |
| Dissolved Barium (Ba) | mg/L | 0.043 | 0.010 | 9072512 | | | |
| Dissolved Beryllium (Be) | mg/L | <0.0010 | 0.0010 | 9071903 | <0.0010 | 0.0010 | 9071903 |
| Dissolved Boron (B) | mg/L | <0.020 | 0.020 | 9072512 | | | |
| Dissolved Calcium (Ca) | mg/L | 220 | 0.30 | 9072512 | | | |
| Dissolved Chromium (Cr) | mg/L | <0.0010 | 0.0010 | 9071903 | <0.0010 | 0.0010 | 9071903 |
| Dissolved Cobalt (Co) | mg/L | <0.00030 | 0.00030 | 9071903 | <0.00030 | 0.00030 | 9071903 |
| Dissolved Copper (Cu) | mg/L | 0.0030 | 0.00020 | 9071903 | 0.0030 | 0.00020 | 9071903 |
| Dissolved Iron (Fe) | mg/L | 0.12 | 0.060 | 9072512 | | | |
| Dissolved Lead (Pb) | mg/L | 0.00025 | 0.00020 | 9071903 | 0.00025 | 0.00020 | 9071903 |
| Dissolved Lithium (Li) | mg/L | <0.020 | 0.020 | 9072512 | | | |
| Dissolved Magnesium (Mg) | mg/L | 46 | 0.20 | 9072512 | | | |
| Dissolved Manganese (Mn) | mg/L | 0.31 | 0.0040 | 9072512 | | | |
| Dissolved Molybdenum (Mo) | mg/L | 0.023 | 0.00020 | 9071903 | 0.023 | 0.00020 | 9071903 |
| Dissolved Nickel (Ni) | mg/L | 0.0056 | 0.00050 | 9071903 | 0.0054 | 0.00050 | 9071903 |
| Dissolved Phosphorus (P) | mg/L | <0.10 | 0.10 | 9072512 | | | |
| Dissolved Potassium (K) | mg/L | 1.7 | 0.30 | 9072512 | | | |
| Dissolved Selenium (Se) | mg/L | 0.00032 | 0.00020 | 9071903 | 0.00030 | 0.00020 | 9071903 |
| Dissolved Silicon (Si) | mg/L | 3.6 | 0.10 | 9072512 | | | |
| Dissolved Silver (Ag) | mg/L | <0.00010 | 0.00010 | 9071903 | <0.00010 | 0.00010 | 9071903 |
| Dissolved Sodium (Na) | mg/L | 6.5 | 0.50 | 9072512 | | | |
| Dissolved Strontium (Sr) | mg/L | 0.60 | 0.020 | 9072512 | | | |
| Dissolved Sulphur (S) | mg/L | 98 | 0.20 | 9072512 | | | |
| Dissolved Thallium (Tl) | mg/L | <0.00020 | 0.00020 | 9071903 | <0.00020 | 0.00020 | 9071903 |
| Dissolved Tin (Sn) | mg/L | <0.0010 | 0.0010 | 9071903 | <0.0010 | 0.0010 | 9071903 |
| Dissolved Titanium (Ti) | mg/L | 0.0017 | 0.0010 | 9071903 | 0.0013 | 0.0010 | 9071903 |

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate



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Maxxam Job #: B859442
Report Date: 2018/07/26

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## REGULATED METALS INCLUDING MERCURY-DISS (WATER)

| Maxxam ID | | TW8513 | | | TW8513 | | |
|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/07/17 14:05 | | | 2018/07/17 14:05 | | |
| COC Number | | 298581 | | | 298581 | | |
| | **UNITS** | **BIBG-10-1-4** | **RDL** | **QC Batch** | **BIBG-10-1-4 Lab-Dup** | **RDL** | **QC Batch** |
| Dissolved Uranium (U) | mg/L | 0.0069 | 0.00010 | 9071903 | 0.0067 | 0.00010 | 9071903 |
| Dissolved Vanadium (V) | mg/L | <0.0010 | 0.0010 | 9071903 | <0.0010 | 0.0010 | 9071903 |
| Dissolved Zinc (Zn) | mg/L | 0.015 | 0.0030 | 9071903 | 0.014 | 0.0030 | 9071903 |
| **Low Level Elements** | | | | | | | |
| Dissolved Mercury (Hg) | mg/L | 0.0000032 | 0.0000020 | 9076117 | 0.0000029 | 0.0000020 | 9076117 |

RDL = Reportable Detection Limit
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Report Date: 2018/07/26

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## RESULTS OF CHEMICAL ANALYSES OF WATER

| Maxxam ID | | TW8513 | | | TW8513 | | |
|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/07/17 14:05 | | | 2018/07/17 14:05 | | |
| COC Number | | 298581 | | | 298581 | | |
| | **UNITS** | **BIBG-10-1-4** | **RDL** | **QC Batch** | **BIBG-10-1-4 Lab-Dup** | **RDL** | **QC Batch** |
| **Calculated Parameters** | | | | | | | |
| Hardness (CaCO3) | mg/L | 730 | 0.50 | 9069579 | | | |
| Ion Balance (% Difference) | % | 4.2 | N/A | 9069583 | | | |
| Dissolved Nitrate (NO3) | mg/L | 0.15 | 0.044 | 9069898 | | | |
| Nitrate plus Nitrite (N) | mg/L | 0.034 | 0.014 | 9070361 | | | |
| Dissolved Nitrite (NO2) | mg/L | <0.033 | 0.033 | 9069898 | | | |
| **Misc. Inorganics** | | | | | | | |
| Conductivity | uS/cm | 1400 | 2.0 | 9072040 | | | |
| Total Dissolved Solids | mg/L | 1000 | 10 | 9071778 | | | |
| **Anions** | | | | | | | |
| Alkalinity (PP as CaCO3) | mg/L | <1.0 | 1.0 | 9072039 | | | |
| Alkalinity (Total as CaCO3) | mg/L | 460 | 1.0 | 9072039 | | | |
| Bicarbonate (HCO3) | mg/L | 560 | 1.0 | 9072039 | | | |
| Carbonate (CO3) | mg/L | <1.0 | 1.0 | 9072039 | | | |
| Hydroxide (OH) | mg/L | <1.0 | 1.0 | 9072039 | | | |
| Dissolved Sulphate (SO4) | mg/L | 320 (1) | 5.0 | 9072394 | | | |
| Dissolved Chloride (Cl) | mg/L | 16 | 1.0 | 9072388 | | | |
| **Nutrients** | | | | | | | |
| Dissolved Nitrite (N) | mg/L | <0.010 | 0.010 | 9072028 | <0.010 | 0.010 | 9072028 |
| Dissolved Nitrate (N) | mg/L | 0.034 | 0.010 | 9072028 | 0.033 | 0.010 | 9072028 |
| **Misc. Organics** | | | | | | | |
| Phenols | mg/L | <0.0020 | 0.0020 | 9076173 | | | |

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



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Maxxam Job #: B859442
Report Date: 2018/07/26

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## SEMIVOLATILE ORGANICS BY GC-MS (WATER)

| Maxxam ID | | TW8513 | | |
|---|---|---|---|---|
| Sampling Date | | 2018/07/17 14:05 | | |
| COC Number | | 298581 | | |
| | **UNITS** | **BIBG-10-1-4** | **RDL** | **QC Batch** |
| **Polycyclic Aromatics** | | | | |
| Benzo[a]pyrene equivalency | mg/L | <0.000010 | 0.000010 | 9070362 |
| Acenaphthene | mg/L | <0.00010 | 0.00010 | 9063109 |
| Acenaphthylene | mg/L | <0.00010 | 0.00010 | 9063109 |
| Acridine | mg/L | <0.000050 | 0.000050 | 9063109 |
| Anthracene | mg/L | <0.000010 | 0.000010 | 9063109 |
| Benzo(a)anthracene | mg/L | <0.0000085 | 0.0000085 | 9063109 |
| Benzo(b&j)fluoranthene | mg/L | <0.0000085 | 0.0000085 | 9063109 |
| Benzo(k)fluoranthene | mg/L | <0.0000085 | 0.0000085 | 9063109 |
| Benzo(g,h,i)perylene | mg/L | <0.0000085 | 0.0000085 | 9063109 |
| Benzo(c)phenanthrene | mg/L | <0.000050 | 0.000050 | 9063109 |
| Benzo(a)pyrene | mg/L | <0.0000075 | 0.0000075 | 9063109 |
| Benzo[e]pyrene | mg/L | <0.000050 | 0.000050 | 9063109 |
| Chrysene | mg/L | <0.0000085 | 0.0000085 | 9063109 |
| Dibenz(a,h)anthracene | mg/L | <0.0000075 | 0.0000075 | 9063109 |
| Fluoranthene | mg/L | <0.000010 | 0.000010 | 9063109 |
| Fluorene | mg/L | <0.000050 | 0.000050 | 9063109 |
| Indeno(1,2,3-cd)pyrene | mg/L | <0.0000085 | 0.0000085 | 9063109 |
| 1-Methylnaphthalene | mg/L | <0.00010 | 0.00010 | 9063109 |
| 2-Methylnaphthalene | mg/L | <0.00010 | 0.00010 | 9063109 |
| Naphthalene | mg/L | <0.00010 | 0.00010 | 9063109 |
| Phenanthrene | mg/L | <0.000050 | 0.000050 | 9063109 |
| Perylene | mg/L | <0.000050 | 0.000050 | 9063109 |
| Pyrene | mg/L | <0.000020 | 0.000020 | 9063109 |
| Quinoline | mg/L | <0.00020 | 0.00020 | 9063109 |
| **Extraction Surrogate Recovery (%)** | | | | |
| D10-ANTHRACENE (sur.) | % | 95 | | 9063109 |
| D8-ACENAPHTHYLENE (sur.) | % | 81 | | 9063109 |
| D8-NAPHTHALENE (sur.) | % | 66 | | 9063109 |
| TERPHENYL-D14 (sur.) | % | 74 | | 9063109 |
| RDL = Reportable Detection Limit | | | | |



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Maxxam Job #: B859442
Report Date: 2018/07/26

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## TEST SUMMARY

**Maxxam ID:** TW8513
**Sample ID:** BIBG-10-1-4
**Matrix:** Water

**Collected:** 2018/07/17
**Relinquished:** 2018/07/18
**Received:** 2018/07/19

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | AT/ALK | 9072039 | N/A | 2018/07/20 | Malina Alamyar |
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9071597 | N/A | 2018/07/21 | Seema Singh |
| F1-BTEX | CALC/MS | 9070357 | N/A | 2018/07/23 | Automated Statchk |
| Cadmium - low level CCME - Dissolved | CALC/MS | 9069896 | N/A | 2018/07/20 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 9072388 | N/A | 2018/07/21 | Chelsea Harmatys |
| Conductivity @25C | COND | 9072040 | N/A | 2018/07/20 | Malina Alamyar |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9072493 | 2018/07/20 | 2018/07/24 | Vian Pereira |
| Hardness | CALC | 9069579 | N/A | 2018/07/21 | Automated Statchk |
| Mercury - Low Level (Dissolved) | CV/AF | 9076117 | 2018/07/24 | 2018/07/24 | Andrew Payne |
| Elements by ICP - Dissolved | ICPA | 9072512 | N/A | 2018/07/21 | Queen Acharya |
| Elements by ICPMS - Dissolved | ICPM | 9071903 | N/A | 2018/07/20 | Julie Harrison |
| Ion Balance | CALC | 9069583 | N/A | 2018/07/20 | Automated Statchk |
| Nitrate and Nitrite | CALC | 9069898 | N/A | 2018/07/21 | Automated Statchk |
| Nitrate + Nitrite-N (calculated) | CALC | 9070361 | N/A | 2018/07/21 | Automated Statchk |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9072028 | N/A | 2018/07/20 | Mahesh Ranjan |
| Benzo[a]pyrene Equivalency | GC/MSD | 9070362 | N/A | 2018/07/22 | Automated Statchk |
| PAH in Water by GC/MS | GC/MS | 9063109 | 2018/07/20 | 2018/07/22 | Bert Chi |
| Phenols (4-AAP) | TECH/4AAP | 9076173 | N/A | 2018/07/24 | Ashley Fedoriuk |
| Sulphate by Automated Colourimetry | KONE | 9072394 | N/A | 2018/07/21 | Chelsea Harmatys |
| Total Dissolved Solids (Filt. Residue) | BAL | 9071778 | 2018/07/20 | 2018/07/23 | Luminita Chiosa |

**Maxxam ID:** TW8513 Dup
**Sample ID:** BIBG-10-1-4
**Matrix:** Water

**Collected:** 2018/07/17
**Relinquished:** 2018/07/18
**Received:** 2018/07/19

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Mercury - Low Level (Dissolved) | CV/AF | 9076117 | 2018/07/24 | 2018/07/24 | Andrew Payne |
| Elements by ICPMS - Dissolved | ICPM | 9071903 | N/A | 2018/07/20 | Julie Harrison |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9072028 | N/A | 2018/07/20 | Mahesh Ranjan |



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Maxxam Job #: B859442
Report Date: 2018/07/26

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## GENERAL COMMENTS

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

| | |
|---|---|
| Package 1 | 4.3°C |

Temperatures upon receipt at Maxxam Calgary
Package 1: 6.0 degrees C
Each temperature is the average of up to three cooler temperatures taken at receipt.

**Results relate only to the items tested.**



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Advisian
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Site#: N/A
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Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| 9063109 | BC5 | Method Blank | D10-ANTHRACENE (sur.) | 2018/07/18 | | 99 | % | 50 - 130 |
| | | | TERPHENYL-D14 (sur.) | 2018/07/18 | | 116 | % | 50 - 130 |
| | | | D8-ACENAPHTHYLENE (sur.) | 2018/07/18 | | 93 | % | 50 - 130 |
| | | | D8-NAPHTHALENE (sur.) | 2018/07/18 | | 76 | % | 50 - 130 |
| | | | Acenaphthene | 2018/07/18 | <0.00010 | | mg/L | |
| | | | Acenaphthylene | 2018/07/18 | <0.00010 | | mg/L | |
| | | | Acridine | 2018/07/18 | <0.000050 | | mg/L | |
| | | | Anthracene | 2018/07/18 | <0.000010 | | mg/L | |
| | | | Benzo(a)anthracene | 2018/07/18 | <0.0000085 | | mg/L | |
| | | | Benzo(b&j)fluoranthene | 2018/07/18 | <0.0000085 | | mg/L | |
| | | | Benzo(k)fluoranthene | 2018/07/18 | <0.0000085 | | mg/L | |
| | | | Benzo(g,h,i)perylene | 2018/07/18 | <0.0000085 | | mg/L | |
| | | | Benzo(c)phenanthrene | 2018/07/18 | <0.000050 | | mg/L | |
| | | | Benzo(a)pyrene | 2018/07/18 | <0.0000075 | | mg/L | |
| | | | Benzo[e]pyrene | 2018/07/18 | <0.000050 | | mg/L | |
| | | | Chrysene | 2018/07/18 | <0.0000085 | | mg/L | |
| | | | Dibenz(a,h)anthracene | 2018/07/18 | <0.0000075 | | mg/L | |
| | | | Fluoranthene | 2018/07/18 | <0.000010 | | mg/L | |
| | | | Fluorene | 2018/07/18 | <0.000050 | | mg/L | |
| | | | Indeno(1,2,3-cd)pyrene | 2018/07/18 | <0.0000085 | | mg/L | |
| | | | 1-Methylnaphthalene | 2018/07/18 | <0.00010 | | mg/L | |
| | | | 2-Methylnaphthalene | 2018/07/18 | <0.00010 | | mg/L | |
| | | | Naphthalene | 2018/07/18 | <0.00010 | | mg/L | |
| | | | Phenanthrene | 2018/07/18 | <0.000050 | | mg/L | |
| | | | Perylene | 2018/07/18 | <0.000050 | | mg/L | |
| | | | Pyrene | 2018/07/18 | <0.000020 | | mg/L | |
| | | | Quinoline | 2018/07/18 | <0.00020 | | mg/L | |
| 9071597 | SES | Method Blank | 1,4-Difluorobenzene (sur.) | 2018/07/21 | | 102 | % | 50 - 140 |
| | | | 4-Bromofluorobenzene (sur.) | 2018/07/21 | | 99 | % | 50 - 140 |
| | | | D4-1,2-Dichloroethane (sur.) | 2018/07/21 | | 97 | % | 50 - 140 |
| | | | Benzene | 2018/07/21 | <0.00040 | | mg/L | |
| | | | Toluene | 2018/07/21 | <0.00040 | | mg/L | |
| | | | Ethylbenzene | 2018/07/21 | <0.00040 | | mg/L | |
| | | | m & p-Xylene | 2018/07/21 | <0.00080 | | mg/L | |
| | | | o-Xylene | 2018/07/21 | <0.00040 | | mg/L | |
| | | | F1 (C6-C10) | 2018/07/21 | <0.10 | | mg/L | |
| 9071778 | LCA | Method Blank | Total Dissolved Solids | 2018/07/23 | <10 | | mg/L | |
| 9071903 | JHS | Method Blank | Dissolved Aluminum (Al) | 2018/07/20 | <0.0030 | | mg/L | |
| | | | Dissolved Chromium (Cr) | 2018/07/20 | <0.0010 | | mg/L | |
| | | | Dissolved Cobalt (Co) | 2018/07/20 | <0.00030 | | mg/L | |
| | | | Dissolved Copper (Cu) | 2018/07/20 | <0.00020 | | mg/L | |
| | | | Dissolved Lead (Pb) | 2018/07/20 | <0.00020 | | mg/L | |
| | | | Dissolved Antimony (Sb) | 2018/07/20 | <0.00060 | | mg/L | |
| | | | Dissolved Molybdenum (Mo) | 2018/07/20 | <0.00020 | | mg/L | |
| | | | Dissolved Nickel (Ni) | 2018/07/20 | <0.00050 | | mg/L | |
| | | | Dissolved Selenium (Se) | 2018/07/20 | <0.00020 | | mg/L | |
| | | | Dissolved Silver (Ag) | 2018/07/20 | <0.00010 | | mg/L | |
| | | | Dissolved Arsenic (As) | 2018/07/20 | <0.00020 | | mg/L | |
| | | | Dissolved Thallium (Tl) | 2018/07/20 | <0.00020 | | mg/L | |
| | | | Dissolved Tin (Sn) | 2018/07/20 | <0.0010 | | mg/L | |
| | | | Dissolved Titanium (Ti) | 2018/07/20 | <0.0010 | | 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 #: B859442
Report Date: 2018/07/26

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT(CONT'D)

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| | | | Dissolved Uranium (U) | 2018/07/20 | <0.00010 | | mg/L | |
| | | | Dissolved Vanadium (V) | 2018/07/20 | <0.0010 | | mg/L | |
| | | | Dissolved Zinc (Zn) | 2018/07/20 | <0.0030 | | mg/L | |
| | | | Dissolved Beryllium (Be) | 2018/07/20 | <0.0010 | | mg/L | |
| 9072028 | MSD | Method Blank | Dissolved Nitrite (N) | 2018/07/20 | <0.010 | | mg/L | |
| | | | Dissolved Nitrate (N) | 2018/07/20 | <0.010 | | mg/L | |
| 9072039 | MA4 | Method Blank | Alkalinity (Total as CaCO3) | 2018/07/20 | <1.0 | | mg/L | |
| | | | Alkalinity (PP as CaCO3) | 2018/07/20 | <1.0 | | mg/L | |
| | | | Bicarbonate (HCO3) | 2018/07/20 | <1.0 | | mg/L | |
| | | | Carbonate (CO3) | 2018/07/20 | <1.0 | | mg/L | |
| | | | Hydroxide (OH) | 2018/07/20 | <1.0 | | mg/L | |
| 9072040 | MA4 | Method Blank | Conductivity | 2018/07/20 | <2.0 | | uS/cm | |
| 9072388 | CH7 | Method Blank | Dissolved Chloride (Cl) | 2018/07/21 | <1.0 | | mg/L | |
| 9072394 | CH7 | Method Blank | Dissolved Sulphate (SO4) | 2018/07/21 | <1.0 | | mg/L | |
| 9072493 | VP4 | Method Blank | O-TERPHENYL (sur.) | 2018/07/24 | | 85 | % | 60 - 140 |
| | | | F2 (C10-C16 Hydrocarbons) | 2018/07/24 | <0.10 | | mg/L | |
| 9072512 | ACY | Method Blank | Dissolved Iron (Fe) | 2018/07/21 | <0.060 | | mg/L | |
| | | | Dissolved Lithium (Li) | 2018/07/21 | <0.020 | | mg/L | |
| | | | Dissolved Magnesium (Mg) | 2018/07/21 | <0.20 | | mg/L | |
| | | | Dissolved Manganese (Mn) | 2018/07/21 | <0.0040 | | mg/L | |
| | | | Dissolved Potassium (K) | 2018/07/21 | <0.30 | | mg/L | |
| | | | Dissolved Sodium (Na) | 2018/07/21 | <0.50 | | mg/L | |
| | | | Dissolved Strontium (Sr) | 2018/07/21 | <0.020 | | mg/L | |
| | | | Dissolved Sulphur (S) | 2018/07/21 | <0.20 | | mg/L | |
| | | | Dissolved Phosphorus (P) | 2018/07/21 | <0.10 | | mg/L | |
| | | | Dissolved Barium (Ba) | 2018/07/21 | <0.010 | | mg/L | |
| | | | Dissolved Silicon (Si) | 2018/07/21 | <0.10 | | mg/L | |
| | | | Dissolved Boron (B) | 2018/07/21 | <0.020 | | mg/L | |
| | | | Dissolved Calcium (Ca) | 2018/07/21 | <0.30 | | mg/L | |
| 9076117 | APY | Method Blank | Dissolved Mercury (Hg) | 2018/07/24 | <0.0000020 | | mg/L | |
| 9076173 | AF6 | Method Blank | Phenols | 2018/07/24 | <0.0020 | | mg/L | |
| 9071903 | JHS | RPD [TW8513-01] | Dissolved Aluminum (Al) | 2018/07/20 | 0.55 | | % | 20 |
| | | | Dissolved Chromium (Cr) | 2018/07/20 | NC | | % | 20 |
| | | | Dissolved Cobalt (Co) | 2018/07/20 | NC | | % | 20 |
| | | | Dissolved Copper (Cu) | 2018/07/20 | 0.37 | | % | 20 |
| | | | Dissolved Lead (Pb) | 2018/07/20 | 0 | | % | 20 |
| | | | Dissolved Antimony (Sb) | 2018/07/20 | NC | | % | 20 |
| | | | Dissolved Molybdenum (Mo) | 2018/07/20 | 0.53 | | % | 20 |
| | | | Dissolved Nickel (Ni) | 2018/07/20 | 3.6 | | % | 20 |
| | | | Dissolved Selenium (Se) | 2018/07/20 | 7.0 | | % | 20 |
| | | | Dissolved Silver (Ag) | 2018/07/20 | NC | | % | 20 |
| | | | Dissolved Arsenic (As) | 2018/07/20 | 0.79 | | % | 20 |
| | | | Dissolved Thallium (Tl) | 2018/07/20 | NC | | % | 20 |
| | | | Dissolved Tin (Sn) | 2018/07/20 | NC | | % | 20 |
| | | | Dissolved Titanium (Ti) | 2018/07/20 | NC | | % | 20 |
| | | | Dissolved Uranium (U) | 2018/07/20 | 4.1 | | % | 20 |
| | | | Dissolved Vanadium (V) | 2018/07/20 | NC | | % | 20 |
| | | | Dissolved Zinc (Zn) | 2018/07/20 | 4.9 | | % | 20 |
| | | | Dissolved Beryllium (Be) | 2018/07/20 | NC | | % | 20 |
| 9072028 | MSD | RPD [TW8513-03] | Dissolved Nitrite (N) | 2018/07/20 | NC | | % | 20 |
| | | | Dissolved Nitrate (N) | 2018/07/20 | 1.6 | | % | 20 |



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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
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## QUALITY ASSURANCE REPORT(CONT'D)

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| 9076117 | APY | RPD [TW8513-05] | Dissolved Mercury (Hg) | 2018/07/24 | 11 | | % | 20 |
| 9071903 | JHS | Matrix Spike [TW8513-01] | Dissolved Aluminum (Al) | 2018/07/20 | | 87 | % | 80 - 120 |
| | | | Dissolved Chromium (Cr) | 2018/07/20 | | 94 | % | 80 - 120 |
| | | | Dissolved Cobalt (Co) | 2018/07/20 | | 93 | % | 80 - 120 |
| | | | Dissolved Copper (Cu) | 2018/07/20 | | 91 | % | 80 - 120 |
| | | | Dissolved Lead (Pb) | 2018/07/20 | | 91 | % | 80 - 120 |
| | | | Dissolved Antimony (Sb) | 2018/07/20 | | 93 | % | 80 - 120 |
| | | | Dissolved Molybdenum (Mo) | 2018/07/20 | | 85 | % | 80 - 120 |
| | | | Dissolved Nickel (Ni) | 2018/07/20 | | 92 | % | 80 - 120 |
| | | | Dissolved Selenium (Se) | 2018/07/20 | | 91 | % | 80 - 120 |
| | | | Dissolved Silver (Ag) | 2018/07/20 | | 94 | % | 80 - 120 |
| | | | Dissolved Arsenic (As) | 2018/07/20 | | 90 | % | 80 - 120 |
| | | | Dissolved Thallium (Tl) | 2018/07/20 | | 93 | % | 80 - 120 |
| | | | Dissolved Tin (Sn) | 2018/07/20 | | 90 | % | 80 - 120 |
| | | | Dissolved Titanium (Ti) | 2018/07/20 | | 95 | % | 80 - 120 |
| | | | Dissolved Uranium (U) | 2018/07/20 | | 92 | % | 80 - 120 |
| | | | Dissolved Vanadium (V) | 2018/07/20 | | 95 | % | 80 - 120 |
| | | | Dissolved Zinc (Zn) | 2018/07/20 | | 92 | % | 80 - 120 |
| | | | Dissolved Beryllium (Be) | 2018/07/20 | | 92 | % | 80 - 120 |
| 9072028 | MSD | Matrix Spike [TW8513-03] | Dissolved Nitrite (N) | 2018/07/20 | | 100 | % | 80 - 120 |
| | | | Dissolved Nitrate (N) | 2018/07/20 | | 101 | % | 80 - 120 |
| 9076117 | APY | Matrix Spike [TW8513-05] | Dissolved Mercury (Hg) | 2018/07/24 | | 95 | % | 80 - 120 |
| 9063109 | BC5 | LCS | D10-ANTHRACENE (sur.) | 2018/07/18 | | 99 | % | 50 - 130 |
| | | | TERPHENYL-D14 (sur.) | 2018/07/18 | | 113 | % | 50 - 130 |
| | | | D8-ACENAPHTHYLENE (sur.) | 2018/07/18 | | 92 | % | 50 - 130 |
| | | | D8-NAPHTHALENE (sur.) | 2018/07/18 | | 88 | % | 50 - 130 |
| | | | Acenaphthene | 2018/07/18 | | 89 | % | 50 - 130 |
| | | | Acenaphthylene | 2018/07/18 | | 94 | % | 50 - 130 |
| | | | Acridine | 2018/07/18 | | 99 | % | 50 - 130 |
| | | | Anthracene | 2018/07/18 | | 94 | % | 50 - 130 |
| | | | Benzo(a)anthracene | 2018/07/18 | | 116 | % | 50 - 130 |
| | | | Benzo(b&j)fluoranthene | 2018/07/18 | | 104 | % | 50 - 130 |
| | | | Benzo(k)fluoranthene | 2018/07/18 | | 115 | % | 50 - 130 |
| | | | Benzo(g,h,i)perylene | 2018/07/18 | | 102 | % | 50 - 130 |
| | | | Benzo(c)phenanthrene | 2018/07/18 | | 121 | % | 50 - 130 |
| | | | Benzo(a)pyrene | 2018/07/18 | | 111 | % | 50 - 130 |
| | | | Benzo[e]pyrene | 2018/07/18 | | 109 | % | 50 - 130 |
| | | | Chrysene | 2018/07/18 | | 113 | % | 50 - 130 |
| | | | Dibenz(a,h)anthracene | 2018/07/18 | | 102 | % | 50 - 130 |
| | | | Fluoranthene | 2018/07/18 | | 131 (1) | % | 50 - 130 |
| | | | Fluorene | 2018/07/18 | | 96 | % | 50 - 130 |
| | | | Indeno(1,2,3-cd)pyrene | 2018/07/18 | | 99 | % | 50 - 130 |
| | | | 1-Methylnaphthalene | 2018/07/18 | | 85 | % | 50 - 130 |
| | | | 2-Methylnaphthalene | 2018/07/18 | | 90 | % | 50 - 130 |
| | | | Naphthalene | 2018/07/18 | | 89 | % | 50 - 130 |
| | | | Phenanthrene | 2018/07/18 | | 93 | % | 50 - 130 |
| | | | Perylene | 2018/07/18 | | 91 | % | 50 - 130 |
| | | | Pyrene | 2018/07/18 | | 126 | % | 50 - 130 |



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## QUALITY ASSURANCE REPORT(CONT'D)

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| | | | Quinoline | 2018/07/18 | | 112 | % | 50 - 130 |
| 9071597 | SES | LCS | 1,4-Difluorobenzene (sur.) | 2018/07/21 | | 97 | % | 50 - 140 |
| | | | 4-Bromofluorobenzene (sur.) | 2018/07/21 | | 98 | % | 50 - 140 |
| | | | D4-1,2-Dichloroethane (sur.) | 2018/07/21 | | 95 | % | 50 - 140 |
| | | | Benzene | 2018/07/21 | | 85 | % | 60 - 130 |
| | | | Toluene | 2018/07/21 | | 88 | % | 60 - 130 |
| | | | Ethylbenzene | 2018/07/21 | | 94 | % | 60 - 130 |
| | | | m & p-Xylene | 2018/07/21 | | 92 | % | 60 - 130 |
| | | | o-Xylene | 2018/07/21 | | 91 | % | 60 - 130 |
| | | | F1 (C6-C10) | 2018/07/21 | | 89 | % | 60 - 140 |
| 9071778 | LCA | LCS | Total Dissolved Solids | 2018/07/23 | | 101 | % | 80 - 120 |
| 9071903 | JHS | LCS | Dissolved Aluminum (Al) | 2018/07/20 | | 100 | % | 80 - 120 |
| | | | Dissolved Chromium (Cr) | 2018/07/20 | | 100 | % | 80 - 120 |
| | | | Dissolved Cobalt (Co) | 2018/07/20 | | 99 | % | 80 - 120 |
| | | | Dissolved Copper (Cu) | 2018/07/20 | | 101 | % | 80 - 120 |
| | | | Dissolved Lead (Pb) | 2018/07/20 | | 98 | % | 80 - 120 |
| | | | Dissolved Antimony (Sb) | 2018/07/20 | | 92 | % | 80 - 120 |
| | | | Dissolved Molybdenum (Mo) | 2018/07/20 | | 84 | % | 80 - 120 |
| | | | Dissolved Nickel (Ni) | 2018/07/20 | | 98 | % | 80 - 120 |
| | | | Dissolved Selenium (Se) | 2018/07/20 | | 90 | % | 80 - 120 |
| | | | Dissolved Silver (Ag) | 2018/07/20 | | 97 | % | 80 - 120 |
| | | | Dissolved Arsenic (As) | 2018/07/20 | | 93 | % | 80 - 120 |
| | | | Dissolved Thallium (Tl) | 2018/07/20 | | 99 | % | 80 - 120 |
| | | | Dissolved Tin (Sn) | 2018/07/20 | | 90 | % | 80 - 120 |
| | | | Dissolved Titanium (Ti) | 2018/07/20 | | 100 | % | 80 - 120 |
| | | | Dissolved Uranium (U) | 2018/07/20 | | 97 | % | 80 - 120 |
| | | | Dissolved Vanadium (V) | 2018/07/20 | | 99 | % | 80 - 120 |
| | | | Dissolved Zinc (Zn) | 2018/07/20 | | 99 | % | 80 - 120 |
| | | | Dissolved Beryllium (Be) | 2018/07/20 | | 93 | % | 80 - 120 |
| 9072028 | MSD | LCS | Dissolved Nitrite (N) | 2018/07/20 | | 99 | % | 80 - 120 |
| | | | Dissolved Nitrate (N) | 2018/07/20 | | 101 | % | 80 - 120 |
| 9072039 | MA4 | LCS | Alkalinity (Total as CaCO3) | 2018/07/20 | | 99 | % | 80 - 120 |
| 9072040 | MA4 | LCS | Conductivity | 2018/07/20 | | 100 | % | 90 - 110 |
| 9072388 | CH7 | LCS | Dissolved Chloride (Cl) | 2018/07/21 | | 104 | % | 80 - 120 |
| 9072394 | CH7 | LCS | Dissolved Sulphate (SO4) | 2018/07/21 | | 107 | % | 80 - 120 |
| 9072493 | VP4 | LCS | O-TERPHENYL (sur.) | 2018/07/24 | | 85 | % | 60 - 140 |
| | | | F2 (C10-C16 Hydrocarbons) | 2018/07/24 | | 95 | % | 60 - 140 |
| 9072512 | ACY | LCS | Dissolved Iron (Fe) | 2018/07/21 | | 97 | % | 80 - 120 |
| | | | Dissolved Lithium (Li) | 2018/07/21 | | 100 | % | 80 - 120 |
| | | | Dissolved Magnesium (Mg) | 2018/07/21 | | 102 | % | 80 - 120 |
| | | | Dissolved Manganese (Mn) | 2018/07/21 | | 96 | % | 80 - 120 |
| | | | Dissolved Potassium (K) | 2018/07/21 | | 106 | % | 80 - 120 |
| | | | Dissolved Sodium (Na) | 2018/07/21 | | 105 | % | 80 - 120 |
| | | | Dissolved Strontium (Sr) | 2018/07/21 | | 98 | % | 80 - 120 |
| | | | Dissolved Phosphorus (P) | 2018/07/21 | | 97 | % | 80 - 120 |
| | | | Dissolved Barium (Ba) | 2018/07/21 | | 99 | % | 80 - 120 |
| | | | Dissolved Silicon (Si) | 2018/07/21 | | 97 | % | 80 - 120 |
| | | | Dissolved Boron (B) | 2018/07/21 | | 101 | % | 80 - 120 |
| | | | Dissolved Calcium (Ca) | 2018/07/21 | | 94 | % | 80 - 120 |
| 9076117 | APY | LCS | Dissolved Mercury (Hg) | 2018/07/24 | | 102 | % | 80 - 120 |
| 9076173 | AF6 | LCS | Phenols | 2018/07/24 | | 87 | % | 80 - 120 |



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Maxxam Job #: B859442
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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT(CONT'D)

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| 9076117 | APY | SRM | Dissolved Mercury (Hg) | 2018/07/24 | | 103 | % | 80 - 120 |

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.

LCS: 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.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

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 (absolute difference <= 2x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.



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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## VALIDATION SIGNATURE PAGE

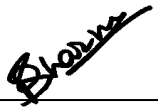
The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



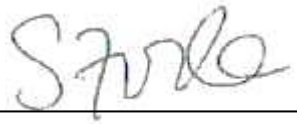
Dennis Ngondu, B.Sc., P.Chem., QP, Supervisor, Organics



Daniel Reslan, cCT, QP, Organics Manager



Poonam Sharma, cCT, Organics Supervisor



Suwan Fock, B.Sc., QP, Inorganics Senior Analyst

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.



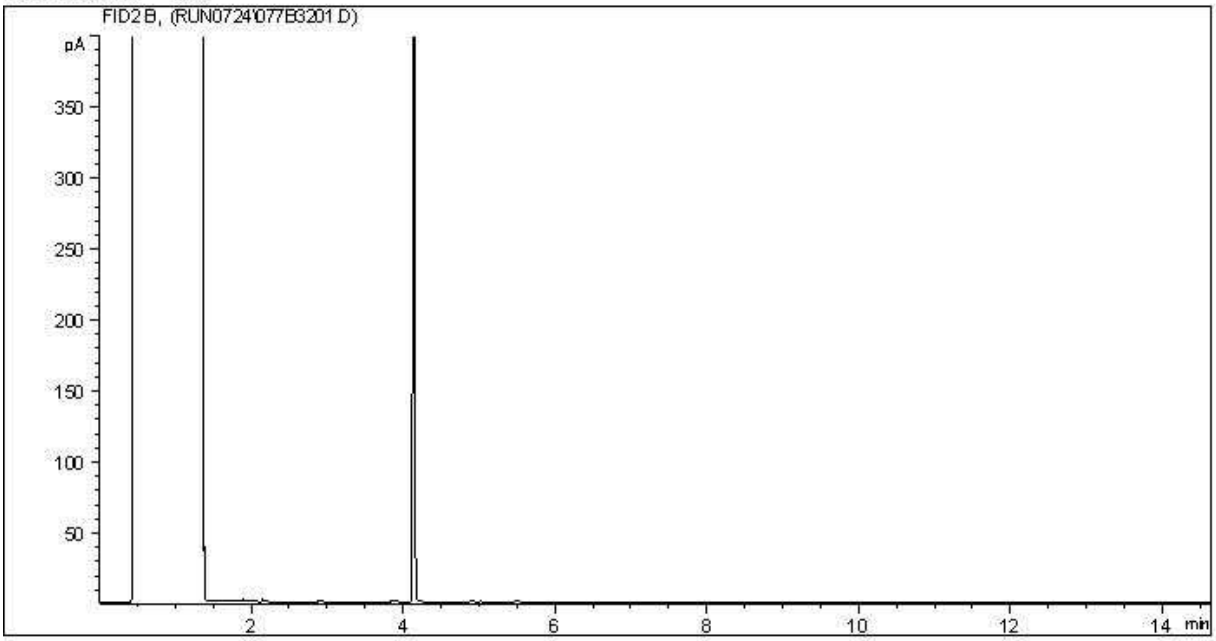
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Maxxam Job #: B859442
Report Date: 2018/07/26
Maxxam Sample: TW8513

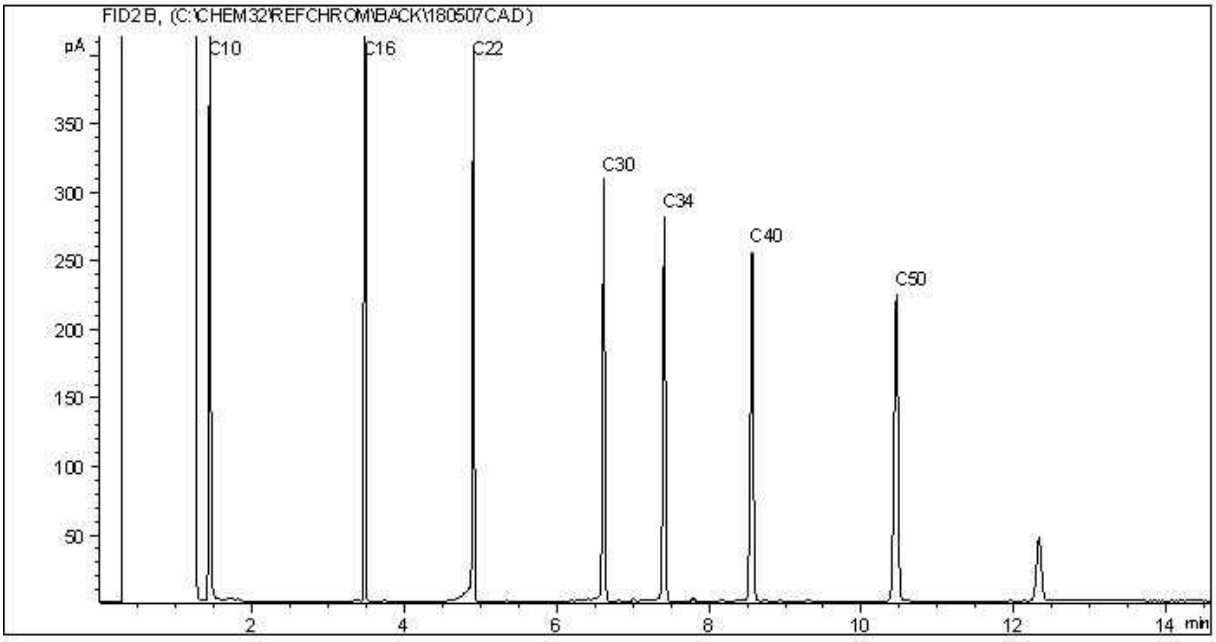
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: BIBG-10-1-4

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: GC6




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam
A Bureau Veritas Group Company

☐ Calgary
4000 19th St. NE, T2E 6P8
Phone: (403) 291-3077
Fax: (403) 735-2240
Toll Free: (800) 386-7247

☒ Edmonton
9331 - 48 Street, T6B 2R4
Phone: (780) 577-7100
Fax: (780) 450-4187
Toll Free: (800) 386-7247

GAN.

# EXXON MOBIL/IMPERIAL OIL - MAXXAM CHAIN-OF-CUSTODY RECORD



C of C # 298581

| INVOICE INFORMATION | REPORT INFORMATION |
|---|---|
| Company Name: ☒ Imperial Oil ☐ ExxonMobil | Company Name: WorleyParsons |
| Contact Name: WorleyParsons | Contact Name: Stacy Gibb |
| Address: 500, 151 Canada Olympic Rd SW Calgary, AB T3B 6B7 | Address: 500, 151 Canada Olymic Rd SW Calgary, AB T3B 6B7 |
| Email: sanjo.pereraj@advisian.com | Email: stacy.gibb@advisian.com |
| Ph: 587-952-1490 | Ph: 403-847-0200 |
| Sampler Name (Print): Melanie Jones, Michelle Voloshy | Consultant Project #: 407011-00586-400 |

| FIELD SAMPLE ID | MATRIX: GROUND WATER | SURFACE WATER | SOIL | OTHER | # CONTAINERS | SAMPLING: DATE (YYYY/MM/DD) | TIME (24 HR) | FIELD FILTERED & PRESERVED | LAB FILTRATION REQUIRED | VOC | PAH | PHCs (FRACTIONS 1-2 PLUS BTEX) | PHCs (FRACTIONS 1-4 PLUS BTEX) | PHCs (FRACTIONS 2-4) | PHCs (FRACTION 1 PLUS BTEX) | GRAIN SIZE (75 MICRON) | TEXTURE (% SAND, SILT, CLAY) | PARTICLE SIZE DISTRIBUTION WITH GRAPH | REGULATED METALS: DISS ☒ TOT ☐ | MERCURY: TOTAL ☐ DISSOLVED ☒ | SALINITY SOIL | FERTILIZER SOIL | FERTILIZER WATER | NUTRIENTS SOIL | ROUTINE POTABILITY | pH ☐ EC ☐ ALKALINITY ☐ | BASIC CLASS II LANDFILL PKG | Phenols by 4AAP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 BIBG-10-1-4 | X | | | | 12 | 2018/07/17 | 14:05 | X | | | X | X | | | | | | | X | X | | | | | X | | | X |
| 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

IOL SITE LOCATION: Norman Wells, NT

IOL PROJECT # (if applicable): N/A

MAXXAM TASK ORDER # OR SERVICE ORDER # + LINE ITEM: 407011-00586-400

REGULATORY CRITERIA / DETECTION LIMITS:
☐ Alberta Tier 1 ☐ CDWG
☐ SEQG (SK) ☐ NoSC (SK)
☒ CCME (incl. level) FAL ☐ Other

SPECIAL INSTRUCTIONS:
Also email:
-standard Norman well list
-melissa.lord@advisian.com
IES A2601436

# JARS USED & NOT SUBMITTED (Enter N/A for Water): N/A

TURNAROUND TIME
Standard (5 days) ☒
Rush (3 days) ☐
(2 days) ☐
(1 day) ☐
(same day) ☐
Date Required

| | YES | NO | COOLER ID # | TEMP °C |
|---|---|---|---|---|
| SEAL PRESENT | ✓ | | | |
| SEAL INTACT | ✓ | | | |
| COOLING MEDIA PRESENT | ✓ | | | 4 (1) 3 (2) 6 (3) |

| | YES | NO | COOLER ID # | TEMP °C |
|---|---|---|---|---|
| SEAL PRESENT | | | | |
| SEAL INTACT | | | | |
| COOLING MEDIA PRESENT | | | | 1 2 3 |

| | YES | NO | COOLER ID # | TEMP °C |
|---|---|---|---|---|
| SEAL PRESENT | | | | |
| SEAL INTACT | | | | |
| COOLING MEDIA PRESENT | | | | 1 2 3 |

LAB USE ONLY
MAXXAM JOB # B859442

| RELINQUISHED BY: | | DATE: | TIME (24 HR) | RECEIVED BY: | | DATE: | TIME (24 HR) |
|---|---|---|---|---|---|---|---|
| 1. | Melissa Lord | 2018/07/18 | 08:00 | Elia Antonucci | Gina Antonucci | 20180719 | 0935 |
| 2. | | | | 2. | | | |
| 3. | | | | 3. | | | |

SAMPLES
LABELED BY: DW2
VERIFIED BY: DBC

COC-1010 (06/2016) IOL-AB White: Maxxam Yellow: Client

Maxxam
A Bureau Veritas Group Company

Sent to: **Maxxam Calgary**
**4000 - 19 St.**
**Calgary, AB, T2E 6P8**
**Tel: (403) 291-3077**

# MAXXAM INTERLAB CHAIN OF CUSTODY RECORD



**COC #** B859442-MCAL-01-01

| **REPORT INFORMATION** | |
|---|---|
| **Company:** | Maxxam |
| **Address:** | 9331 - 48th Street, Edmonton, Alberta, T6B 2R4 |
| **Contact Name:** | Jenna Chernuka |
| **Email:** | JChernuka@maxxam.ca, edmenvirocs@maxxamanalytics.com |
| **Phone:** | (780) 577-7178 |
| **Maxxam Project #:** | B859442 |
| **Client Invoice To:** | Imperial Oil Ltd - Worley Parsons (12794) |
| **Client Report To:** | Advisian (38038) **Incl. on Report? Yes / No** |

| # | SAMPLE ID | MATRIX | DATE SAMPLED (YYYY/MM/DD) | TIME SAMPLED (HH:MM) | SAMPLER INITIALS | # CONT. | ANALYSIS REQUESTED: CCME Hydrocarbons in Water (F2; C10-C16) | ADDITIONAL SAMPLE INFORMATION |
|---|---|---|---|---|---|---|---|---|
| 1 | TW8513-BIBG-10-1-4 | GW | 2018/07/17 | 14:05 | MJ | 4 | X | (P: 06) |
| 2 | | | | | | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |
| 6 | | | | | | | | |
| 7 | | | | | | | | |
| 8 | | | | | | | | |
| 9 | | | | | | | | |
| 10 | | | | | | | | |

*Job Barcode Label*




| **SITE LOCATION:** | **REGULATORY CRITERIA** | **SPECIAL INSTRUCTIONS** | **REQUIRED EDDs** | **TURNAROUND TIME** |
|---|---|---|---|---|
| Norman Wells, NT | CCME FAL | Please inform Maxxam immediately if you are not accredited for the requested test(s).<br>**Please return a copy of this form with the report.** | National Excel (N001)<br>Worley Parsons Komex Equis (N026) | ☐ Rush Required |
| **SITE #:** N/A | | | Standard DBF (Old DBase Names) (A002) | **2018/07/25**<br>Date Required |
| **PROJECT #:** 407011-00586-400 | | | | *Please inform us if rush charges will be incurred.* |
| **PO/AFE, TASK ORDER/SERVICE ORDER, LINE ITEM:** A2601436, 407011-00586-400 | | | | |

| **COOLER ID:** | YES | NO | Temp: (°C) | 1 | 2 | 3 |
|---|---|---|---|---|---|---|
| Custody Seal Present | ✓ | | | | | |
| Custody Seal Intact | ✓ | | | | | |
| Cooling Media Present | ✓ | | | | | |
| | | | | 5 | 7 | 6 |

| **COOLER ID:** | YES | NO | Temp: (°C) | 1 | 2 | 3 |
|---|---|---|---|---|---|---|
| Custody Seal Present | | | | | | |
| Custody Seal Intact | | | | | | |
| Cooling Media Present | | | | | | |

| **COOLER ID:** | YES | NO | Temp: (°C) | 1 | 2 | 3 |
|---|---|---|---|---|---|---|
| Custody Seal Present | | | | | | |
| Custody Seal Intact | | | | | | |
| Cooling Media Present | | | | | | |

**RECEIVING LAB USE ONLY**

**Maxxam Job #**

**B859442**

| **RELINQUISHED BY:** (SIGN & PRINT) | **DATE:** (YYYY/MM/DD) | **TIME:** (HH:MM) | **RECEIVED BY:** (SIGN & PRINT) | **DATE:** (YYYY/MM/DD) | **TIME:** (HH:MM) | **Samples Labelled By:** | **Labels Verified By:** |
|---|---|---|---|---|---|---|---|
| 1. Kyle Van Thournout | 2018/07/23 | 22:30 | 1. WENGCHUNG LIU | 2018/07/24 | 07:00 | DW2 | WL2 |
| 2. | | | 2. | | | | |

# DATA QUALITY REVIEW CHECKLIST - IMPERIAL OIL PROJECTS

Consultant: Advisian

Sampling Date: 18-Jul-18

Location: Norman Wells

Laboratory : Maxxam Edmonton

Consultant Project Number: 407011-00586-400

Sample Submission Number: B860210

Are All Laboratory QC Within Acceptance Criteria (Yes, No, Not Applicable)?

| | Yes | No | NA | Comments |
|---|---|---|---|---|
| Instrument Surrogate Recovery | x | | | All laboratory QC met acceptance criteria. |
| Extraction Surrogate Recovery | x | | | |
| Method Blank Concentration | x | | | |
| Matrix Duplicate RPD | x | | | |
| Matrix Spike Recovery | x | | | |
| Lab Control Sample Recovery | x | | | |

Are All Field QC Samples Within Alert Limits (Yes, No, Not Applicable)?

| | Yes | No | NA | Comments |
|---|---|---|---|---|
| Field Blank Concentration | | | x | No field QC samples submitted. |
| Trip Blank Concentration | | | x | |
| Equipment Blank Concentration | | | x | |
| Field Duplicate RPD | | | x | |

| | |
|---|---|
| Has CoA been signed off (Yes/No)?: | Yes |
| Has lab warranted all tests were analyzed following SOP's in CoA (Yes/No)?: | Yes |
| Were all samples analyzed within hold times (Yes/No)?: | Yes |
| All volatiles samples methanol extracted (if required) within 48 hours (Yes/No)?: | n/a |
| Is Chain of Custody completed and signed (Yes/No)?: | Yes |
| Were sample temperatures acceptable when they reached lab (Yes/No)?: | Yes |

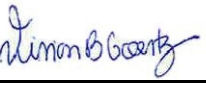
Was a Data Quality Overview (DQO) issued (Yes/No)?: No

Date DQO was received: n/a

Is data considered to be reliable (Yes/No)?: Yes

If answer is "No", describe and provide rationale:

Data Reviewed by (Print): Vivian Baptista

Data Reviewed by (Signature): 

Date: 23-Aug-18

Maxxam
A Bureau Veritas Group Company

Success Through Science®

Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400
Your C.O.C. #: 299266

**Attention: Stacy Gibb**

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

**Report Date: 2018/07/27**
Report #: R2595744
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B860210**
**Received: 2018/07/20, 10:02**

Sample Matrix: Water
# Samples Received: 1

| Analyses | Quantity | Laboratory Method | Primary Reference |
|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | 1 | AB SOP-00005 | SM 22 2320 B m |
| BTEX/F1 in Water by HS GC/MS/FID | 1 | AB SOP-00039 | CCME CWS/EPA 8260d m |
| F1-BTEX | 1 | AB SOP-00039 | Auto Calc |
| Cadmium - low level CCME - Dissolved | 1 | AB WI-00065 | Auto Calc |
| Chloride by Automated Colourimetry | 1 | AB SOP-00020 | SM 22 4500-Cl-E m |
| Conductivity @25C | 1 | AB SOP-00005 | SM 22 2510 B m |
| CCME Hydrocarbons in Water (F2; C10-C16) (1, 2) | 1 | AB SOP-00037<br>AB SOP-00040 | CCME PHC-CWS m |
| Hardness | 1 | AB WI-00065 | Auto Calc |
| Mercury - Low Level (Dissolved) (3) | 1 | EENVSOP-00031 | EPA 245.7 R2 m |
| Elements by ICP - Dissolved (3) | 1 | AB SOP-00042 | EPA 6010d R4 m |
| Elements by ICPMS - Dissolved (3) | 1 | AB SOP-00043 | EPA 6020b R2 m |
| Ion Balance | 1 | AB WI-00065 | Auto Calc |
| Nitrate and Nitrite | 1 | AB WI-00065 | Auto Calc |
| Nitrate + Nitrite-N (calculated) | 1 | AB WI-00065 | Auto Calc |
| Nitrogen (Nitrite - Nitrate) by IC | 1 | AB SOP-00023 | SM 23 4110 B m |
| Phenols (4-AAP) | 1 | EENVSOP-00061 | MMCW 154 1996 m |
| Sulphate by Automated Colourimetry | 1 | AB SOP-00018 | SM 22 4500-SO4 E m |
| Total Dissolved Solids (Filt. Residue) | 1 | AB SOP-00065 | SM 22 2540 C m |

**Remarks:**

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. All samples were analyzed within hold time unless otherwise flagged.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise



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

Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400
Your C.O.C. #: 299266

**Attention: Stacy Gibb**

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

**Report Date: 2018/07/27**
Report #: R2595744
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B860210**
**Received: 2018/07/20, 10:02**
agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
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) Silica gel clean up employed.
(3) Dissolved > Total Imbalance: Whenever applicable, Dissolved >Total for any parameter that falls within method uncertainty for duplicates is likely equivalent. If RPD is >20% samples were reanalyzed and confirmed.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Jenna Chernuka, Project Manager
Email: JChernuka@maxxam.ca
Phone# (780)577-7178
==========
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 #: B860210
Report Date: 2018/07/27

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## AT1 BTEX AND F1-F2 IN WATER (WATER)

| Maxxam ID | | TX2362 | | |
|---|---|---|---|---|
| Sampling Date | | 2018/07/18 13:25 | | |
| COC Number | | 299266 | | |
| | **UNITS** | **BI-13-3-4.5** | **RDL** | **QC Batch** |
| **Ext. Pet. Hydrocarbon** | | | | |
| F2 (C10-C16 Hydrocarbons) | mg/L | <0.10 | 0.10 | 9073208 |
| **Volatiles** | | | | |
| Benzene | mg/L | <0.00040 | 0.00040 | 9073150 |
| Toluene | mg/L | <0.00040 | 0.00040 | 9073150 |
| Ethylbenzene | mg/L | <0.00040 | 0.00040 | 9073150 |
| m & p-Xylene | mg/L | <0.00080 | 0.00080 | 9073150 |
| o-Xylene | mg/L | <0.00040 | 0.00040 | 9073150 |
| Xylenes (Total) | mg/L | <0.00089 | 0.00089 | 9073016 |
| F1 (C6-C10) - BTEX | mg/L | <0.10 | 0.10 | 9073016 |
| F1 (C6-C10) | mg/L | <0.10 | 0.10 | 9073150 |
| **Extraction Surrogate Recovery (%)** | | | | |
| O-TERPHENYL (sur.) | % | 93 | | 9073208 |
| **Instrument Surrogate Recovery (%)** | | | | |
| 1,4-Difluorobenzene (sur.) | % | 101 | | 9073150 |
| 4-Bromofluorobenzene (sur.) | % | 101 | | 9073150 |
| D4-1,2-Dichloroethane (sur.) | % | 104 | | 9073150 |
| 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 #: B860210
Report Date: 2018/07/27

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## REGULATED METALS INCLUDING MERCURY-DISS (WATER)

| Maxxam ID | | TX2362 | | | TX2362 | | |
|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/07/18 13:25 | | | 2018/07/18 13:25 | | |
| COC Number | | 299266 | | | 299266 | | |
| | **UNITS** | **BI-13-3-4.5** | **RDL** | **QC Batch** | **BI-13-3-4.5 Lab-Dup** | **RDL** | **QC Batch** |
| **Low Level Elements** | | | | | | | |
| Dissolved Cadmium (Cd) | mg/L | 0.00030 | 0.000020 | 9072689 | | | |
| **Elements** | | | | | | | |
| Dissolved Aluminum (Al) | mg/L | 0.18 | 0.0030 | 9073151 | | | |
| Dissolved Antimony (Sb) | mg/L | 0.00073 | 0.00060 | 9073151 | | | |
| Dissolved Arsenic (As) | mg/L | 0.0070 | 0.00020 | 9073151 | | | |
| Dissolved Barium (Ba) | mg/L | 0.057 | 0.010 | 9074512 | | | |
| Dissolved Beryllium (Be) | mg/L | <0.0010 | 0.0010 | 9073151 | | | |
| Dissolved Boron (B) | mg/L | <0.020 | 0.020 | 9074512 | | | |
| Dissolved Calcium (Ca) | mg/L | 250 | 0.30 | 9074512 | | | |
| Dissolved Chromium (Cr) | mg/L | 0.0014 | 0.0010 | 9073151 | | | |
| Dissolved Cobalt (Co) | mg/L | 0.0020 | 0.00030 | 9073151 | | | |
| Dissolved Copper (Cu) | mg/L | 0.0091 | 0.00020 | 9073151 | | | |
| Dissolved Iron (Fe) | mg/L | 3.5 | 0.060 | 9074512 | | | |
| Dissolved Lead (Pb) | mg/L | 0.0016 | 0.00020 | 9073151 | | | |
| Dissolved Lithium (Li) | mg/L | <0.020 | 0.020 | 9074512 | | | |
| Dissolved Magnesium (Mg) | mg/L | 140 | 0.20 | 9074512 | | | |
| Dissolved Manganese (Mn) | mg/L | 0.36 | 0.0040 | 9074512 | | | |
| Dissolved Molybdenum (Mo) | mg/L | 0.017 | 0.00020 | 9073151 | | | |
| Dissolved Nickel (Ni) | mg/L | 0.032 | 0.00050 | 9073151 | | | |
| Dissolved Phosphorus (P) | mg/L | 0.16 | 0.10 | 9074512 | | | |
| Dissolved Potassium (K) | mg/L | 3.3 | 0.30 | 9074512 | | | |
| Dissolved Selenium (Se) | mg/L | 0.0025 | 0.00020 | 9073151 | | | |
| Dissolved Silicon (Si) | mg/L | 4.1 | 0.10 | 9074512 | | | |
| Dissolved Silver (Ag) | mg/L | <0.00010 | 0.00010 | 9073151 | | | |
| Dissolved Sodium (Na) | mg/L | 13 | 0.50 | 9074512 | | | |
| Dissolved Strontium (Sr) | mg/L | 0.81 | 0.020 | 9074512 | | | |
| Dissolved Sulphur (S) | mg/L | 280 | 0.20 | 9074512 | | | |
| Dissolved Thallium (Tl) | mg/L | <0.00020 | 0.00020 | 9073151 | | | |
| Dissolved Tin (Sn) | mg/L | <0.0010 | 0.0010 | 9073151 | | | |
| Dissolved Titanium (Ti) | mg/L | 0.0069 | 0.0010 | 9073151 | | | |

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate



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

Maxxam Job #: B860210
Report Date: 2018/07/27

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## REGULATED METALS INCLUDING MERCURY-DISS (WATER)

| Maxxam ID | | TX2362 | | | TX2362 | | |
|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/07/18 13:25 | | | 2018/07/18 13:25 | | |
| COC Number | | 299266 | | | 299266 | | |
| | **UNITS** | **BI-13-3-4.5** | **RDL** | **QC Batch** | **BI-13-3-4.5 Lab-Dup** | **RDL** | **QC Batch** |
| Dissolved Uranium (U) | mg/L | 0.012 | 0.00010 | 9073151 | | | |
| Dissolved Vanadium (V) | mg/L | 0.0025 | 0.0010 | 9073151 | | | |
| Dissolved Zinc (Zn) | mg/L | 0.037 | 0.0030 | 9073151 | | | |
| **Low Level Elements** | | | | | | | |
| Dissolved Mercury (Hg) | mg/L | 0.0000051 | 0.0000020 | 9076120 | 0.0000048 | 0.0000020 | 9076120 |

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate



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Maxxam Job #: B860210
Report Date: 2018/07/27

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## RESULTS OF CHEMICAL ANALYSES OF WATER

| Maxxam ID | | TX2362 | | |
|---|---|---|---|---|
| Sampling Date | | 2018/07/18 13:25 | | |
| COC Number | | 299266 | | |
| | **UNITS** | **BI-13-3-4.5** | **RDL** | **QC Batch** |
| **Calculated Parameters** | | | | |
| Hardness (CaCO3) | mg/L | 1200 | 0.50 | 9072692 |
| Ion Balance (% Difference) | % | 1.1 | N/A | 9073002 |
| Dissolved Nitrate (NO3) | mg/L | 0.18 | 0.044 | 9072695 |
| Nitrate plus Nitrite (N) | mg/L | 0.040 | 0.014 | 9072696 |
| Dissolved Nitrite (NO2) | mg/L | <0.033 | 0.033 | 9072695 |
| **Misc. Inorganics** | | | | |
| Conductivity | uS/cm | 1900 | 2.0 | 9075983 |
| Total Dissolved Solids | mg/L | 1700 | 10 | 9074406 |
| **Anions** | | | | |
| Alkalinity (PP as CaCO3) | mg/L | <1.0 | 1.0 | 9075978 |
| Alkalinity (Total as CaCO3) | mg/L | 340 | 1.0 | 9075978 |
| Bicarbonate (HCO3) | mg/L | 420 | 1.0 | 9075978 |
| Carbonate (CO3) | mg/L | <1.0 | 1.0 | 9075978 |
| Hydroxide (OH) | mg/L | <1.0 | 1.0 | 9075978 |
| Dissolved Sulphate (SO4) | mg/L | 890 (1) | 5.0 | 9073502 |
| Dissolved Chloride (Cl) | mg/L | 7.2 | 1.0 | 9073501 |
| **Nutrients** | | | | |
| Dissolved Nitrite (N) | mg/L | <0.010 | 0.010 | 9073351 |
| Dissolved Nitrate (N) | mg/L | 0.040 | 0.010 | 9073351 |
| **Misc. Organics** | | | | |
| Phenols | mg/L | 0.0023 | 0.0020 | 9076235 |

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



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Maxxam Job #: B860210
Report Date: 2018/07/27

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## TEST SUMMARY

**Maxxam ID:** TX2362
**Sample ID:** BI-13-3-4.5
**Matrix:** Water

**Collected:** 2018/07/18
**Relinquished:** 2018/07/19
**Received:** 2018/07/20

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | AT/ALK | 9075978 | N/A | 2018/07/24 | Malina Alamyar |
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9073150 | N/A | 2018/07/21 | Seema Singh |
| F1-BTEX | CALC/MS | 9073016 | N/A | 2018/07/23 | Automated Statchk |
| Cadmium - low level CCME - Dissolved | CALC/MS | 9072689 | N/A | 2018/07/21 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 9073501 | N/A | 2018/07/22 | Marissa Richard |
| Conductivity @25C | COND | 9075983 | N/A | 2018/07/24 | Malina Alamyar |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9073208 | 2018/07/21 | 2018/07/23 | Vian Pereira |
| Hardness | CALC | 9072692 | N/A | 2018/07/23 | Automated Statchk |
| Mercury - Low Level (Dissolved) | CV/AF | 9076120 | 2018/07/24 | 2018/07/24 | Andrew Payne |
| Elements by ICP - Dissolved | ICPA | 9074512 | N/A | 2018/07/23 | Mahboubeh Bahadori |
| Elements by ICPMS - Dissolved | ICPM | 9073151 | N/A | 2018/07/21 | Julie Harrison |
| Ion Balance | CALC | 9073002 | N/A | 2018/07/21 | Automated Statchk |
| Nitrate and Nitrite | CALC | 9072695 | N/A | 2018/07/23 | Automated Statchk |
| Nitrate + Nitrite-N (calculated) | CALC | 9072696 | N/A | 2018/07/23 | Automated Statchk |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9073351 | N/A | 2018/07/21 | Krista Dawe |
| Phenols (4-AAP) | TECH/4AAP | 9076235 | N/A | 2018/07/24 | Ashley Fedoriuk |
| Sulphate by Automated Colourimetry | KONE | 9073502 | N/A | 2018/07/22 | Marissa Richard |
| Total Dissolved Solids (Filt. Residue) | BAL | 9074406 | 2018/07/23 | 2018/07/24 | Victoria Fedorak |

**Maxxam ID:** TX2362 Dup
**Sample ID:** BI-13-3-4.5
**Matrix:** Water

**Collected:** 2018/07/18
**Relinquished:** 2018/07/19
**Received:** 2018/07/20

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Mercury - Low Level (Dissolved) | CV/AF | 9076120 | 2018/07/24 | 2018/07/24 | Andrew Payne |



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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## GENERAL COMMENTS

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

| | |
|---|---|
| Package 1 | 6.0°C |

Sample TX2362 [BI-13-3-4.5] : Client supplied DM bottle contained particulate.

**Results relate only to the items tested.**



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Maxxam Job #: B860210
Report Date: 2018/07/27

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| 9073150 | SES | Method Blank | 1,4-Difluorobenzene (sur.) | 2018/07/21 | | 100 | % | 50 - 140 |
| | | | 4-Bromofluorobenzene (sur.) | 2018/07/21 | | 101 | % | 50 - 140 |
| | | | D4-1,2-Dichloroethane (sur.) | 2018/07/21 | | 100 | % | 50 - 140 |
| | | | Benzene | 2018/07/21 | <0.00040 | | mg/L | |
| | | | Toluene | 2018/07/21 | <0.00040 | | mg/L | |
| | | | Ethylbenzene | 2018/07/21 | <0.00040 | | mg/L | |
| | | | m & p-Xylene | 2018/07/21 | <0.00080 | | mg/L | |
| | | | o-Xylene | 2018/07/21 | <0.00040 | | mg/L | |
| | | | F1 (C6-C10) | 2018/07/21 | <0.10 | | mg/L | |
| 9073151 | JHS | Method Blank | Dissolved Aluminum (Al) | 2018/07/21 | <0.0030 | | mg/L | |
| | | | Dissolved Chromium (Cr) | 2018/07/21 | <0.0010 | | mg/L | |
| | | | Dissolved Cobalt (Co) | 2018/07/21 | <0.00030 | | mg/L | |
| | | | Dissolved Copper (Cu) | 2018/07/21 | <0.00020 | | mg/L | |
| | | | Dissolved Lead (Pb) | 2018/07/21 | <0.00020 | | mg/L | |
| | | | Dissolved Antimony (Sb) | 2018/07/21 | <0.00060 | | mg/L | |
| | | | Dissolved Molybdenum (Mo) | 2018/07/21 | <0.00020 | | mg/L | |
| | | | Dissolved Nickel (Ni) | 2018/07/21 | <0.00050 | | mg/L | |
| | | | Dissolved Selenium (Se) | 2018/07/21 | <0.00020 | | mg/L | |
| | | | Dissolved Silver (Ag) | 2018/07/21 | <0.00010 | | mg/L | |
| | | | Dissolved Arsenic (As) | 2018/07/21 | <0.00020 | | mg/L | |
| | | | Dissolved Thallium (Tl) | 2018/07/21 | <0.00020 | | mg/L | |
| | | | Dissolved Tin (Sn) | 2018/07/21 | <0.0010 | | mg/L | |
| | | | Dissolved Titanium (Ti) | 2018/07/21 | <0.0010 | | mg/L | |
| | | | Dissolved Uranium (U) | 2018/07/21 | <0.00010 | | mg/L | |
| | | | Dissolved Vanadium (V) | 2018/07/21 | <0.0010 | | mg/L | |
| | | | Dissolved Zinc (Zn) | 2018/07/21 | <0.0030 | | mg/L | |
| | | | Dissolved Beryllium (Be) | 2018/07/21 | <0.0010 | | mg/L | |
| 9073208 | VP4 | Method Blank | O-TERPHENYL (sur.) | 2018/07/23 | | 94 | % | 60 - 140 |
| | | | F2 (C10-C16 Hydrocarbons) | 2018/07/23 | <0.10 | | mg/L | |
| 9073351 | KD5 | Method Blank | Dissolved Nitrite (N) | 2018/07/21 | <0.010 | | mg/L | |
| | | | Dissolved Nitrate (N) | 2018/07/21 | <0.010 | | mg/L | |
| 9073501 | MRD | Method Blank | Dissolved Chloride (Cl) | 2018/07/22 | <1.0 | | mg/L | |
| 9073502 | MRD | Method Blank | Dissolved Sulphate (SO4) | 2018/07/22 | <1.0 | | mg/L | |
| 9074406 | VFE | Method Blank | Total Dissolved Solids | 2018/07/24 | <10 | | mg/L | |
| 9074512 | BAH | Method Blank | Dissolved Iron (Fe) | 2018/07/23 | <0.060 | | mg/L | |
| | | | Dissolved Lithium (Li) | 2018/07/23 | <0.020 | | mg/L | |
| | | | Dissolved Magnesium (Mg) | 2018/07/23 | <0.20 | | mg/L | |
| | | | Dissolved Manganese (Mn) | 2018/07/23 | <0.0040 | | mg/L | |
| | | | Dissolved Potassium (K) | 2018/07/23 | <0.30 | | mg/L | |
| | | | Dissolved Sodium (Na) | 2018/07/23 | <0.50 | | mg/L | |
| | | | Dissolved Strontium (Sr) | 2018/07/23 | <0.020 | | mg/L | |
| | | | Dissolved Sulphur (S) | 2018/07/23 | <0.20 | | mg/L | |
| | | | Dissolved Phosphorus (P) | 2018/07/23 | <0.10 | | mg/L | |
| | | | Dissolved Barium (Ba) | 2018/07/23 | <0.010 | | mg/L | |
| | | | Dissolved Silicon (Si) | 2018/07/23 | <0.10 | | mg/L | |
| | | | Dissolved Boron (B) | 2018/07/23 | <0.020 | | mg/L | |
| | | | Dissolved Calcium (Ca) | 2018/07/23 | <0.30 | | mg/L | |
| 9075978 | MA4 | Method Blank | Alkalinity (Total as CaCO3) | 2018/07/24 | <1.0 | | mg/L | |
| | | | Alkalinity (PP as CaCO3) | 2018/07/24 | <1.0 | | mg/L | |
| | | | Bicarbonate (HCO3) | 2018/07/24 | <1.0 | | mg/L | |
| | | | Carbonate (CO3) | 2018/07/24 | <1.0 | | mg/L | |



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Maxxam Job #: B860210
Report Date: 2018/07/27

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT(CONT'D)

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| | | | Hydroxide (OH) | 2018/07/24 | <1.0 | | mg/L | |
| 9075983 | MA4 | Method Blank | Conductivity | 2018/07/24 | <2.0 | | uS/cm | |
| 9076120 | APY | Method Blank | Dissolved Mercury (Hg) | 2018/07/24 | <0.0000020 | | mg/L | |
| 9076235 | AF6 | Method Blank | Phenols | 2018/07/24 | <0.0020 | | mg/L | |
| 9076120 | APY | RPD [TX2362-06] | Dissolved Mercury (Hg) | 2018/07/24 | 6.7 | | % | 20 |
| 9076120 | APY | Matrix Spike [TX2362-06] | Dissolved Mercury (Hg) | 2018/07/24 | | 94 | % | 80 - 120 |
| 9073150 | SES | LCS | 1,4-Difluorobenzene (sur.) | 2018/07/21 | | 94 | % | 50 - 140 |
| | | | 4-Bromofluorobenzene (sur.) | 2018/07/21 | | 99 | % | 50 - 140 |
| | | | D4-1,2-Dichloroethane (sur.) | 2018/07/21 | | 118 | % | 50 - 140 |
| | | | Benzene | 2018/07/21 | | 87 | % | 60 - 130 |
| | | | Toluene | 2018/07/21 | | 89 | % | 60 - 130 |
| | | | Ethylbenzene | 2018/07/21 | | 96 | % | 60 - 130 |
| | | | m & p-Xylene | 2018/07/21 | | 93 | % | 60 - 130 |
| | | | o-Xylene | 2018/07/21 | | 94 | % | 60 - 130 |
| | | | F1 (C6-C10) | 2018/07/21 | | 91 | % | 60 - 140 |
| 9073151 | JHS | LCS | Dissolved Aluminum (Al) | 2018/07/21 | | 106 | % | 80 - 120 |
| | | | Dissolved Chromium (Cr) | 2018/07/21 | | 100 | % | 80 - 120 |
| | | | Dissolved Cobalt (Co) | 2018/07/21 | | 101 | % | 80 - 120 |
| | | | Dissolved Copper (Cu) | 2018/07/21 | | 102 | % | 80 - 120 |
| | | | Dissolved Lead (Pb) | 2018/07/21 | | 99 | % | 80 - 120 |
| | | | Dissolved Antimony (Sb) | 2018/07/21 | | 95 | % | 80 - 120 |
| | | | Dissolved Molybdenum (Mo) | 2018/07/21 | | 85 | % | 80 - 120 |
| | | | Dissolved Nickel (Ni) | 2018/07/21 | | 100 | % | 80 - 120 |
| | | | Dissolved Selenium (Se) | 2018/07/21 | | 93 | % | 80 - 120 |
| | | | Dissolved Silver (Ag) | 2018/07/21 | | 99 | % | 80 - 120 |
| | | | Dissolved Arsenic (As) | 2018/07/21 | | 96 | % | 80 - 120 |
| | | | Dissolved Thallium (Tl) | 2018/07/21 | | 100 | % | 80 - 120 |
| | | | Dissolved Tin (Sn) | 2018/07/21 | | 93 | % | 80 - 120 |
| | | | Dissolved Titanium (Ti) | 2018/07/21 | | 103 | % | 80 - 120 |
| | | | Dissolved Uranium (U) | 2018/07/21 | | 96 | % | 80 - 120 |
| | | | Dissolved Vanadium (V) | 2018/07/21 | | 100 | % | 80 - 120 |
| | | | Dissolved Zinc (Zn) | 2018/07/21 | | 101 | % | 80 - 120 |
| | | | Dissolved Beryllium (Be) | 2018/07/21 | | 92 | % | 80 - 120 |
| 9073208 | VP4 | LCS | O-TERPHENYL (sur.) | 2018/07/23 | | 93 | % | 60 - 140 |
| | | | F2 (C10-C16 Hydrocarbons) | 2018/07/23 | | 105 | % | 60 - 140 |
| 9073351 | KD5 | LCS | Dissolved Nitrite (N) | 2018/07/21 | | 101 | % | 80 - 120 |
| | | | Dissolved Nitrate (N) | 2018/07/21 | | 100 | % | 80 - 120 |
| 9073501 | MRD | LCS | Dissolved Chloride (Cl) | 2018/07/22 | | 105 | % | 80 - 120 |
| 9073502 | MRD | LCS | Dissolved Sulphate (SO4) | 2018/07/22 | | 102 | % | 80 - 120 |
| 9074406 | VFE | LCS | Total Dissolved Solids | 2018/07/24 | | 101 | % | 80 - 120 |
| 9074512 | BAH | LCS | Dissolved Iron (Fe) | 2018/07/23 | | 99 | % | 80 - 120 |
| | | | Dissolved Lithium (Li) | 2018/07/23 | | 96 | % | 80 - 120 |
| | | | Dissolved Magnesium (Mg) | 2018/07/23 | | 101 | % | 80 - 120 |
| | | | Dissolved Manganese (Mn) | 2018/07/23 | | 99 | % | 80 - 120 |
| | | | Dissolved Potassium (K) | 2018/07/23 | | 99 | % | 80 - 120 |
| | | | Dissolved Sodium (Na) | 2018/07/23 | | 101 | % | 80 - 120 |
| | | | Dissolved Strontium (Sr) | 2018/07/23 | | 97 | % | 80 - 120 |
| | | | Dissolved Phosphorus (P) | 2018/07/23 | | 100 | % | 80 - 120 |
| | | | Dissolved Barium (Ba) | 2018/07/23 | | 97 | % | 80 - 120 |
| | | | Dissolved Silicon (Si) | 2018/07/23 | | 96 | % | 80 - 120 |
| | | | Dissolved Boron (B) | 2018/07/23 | | 101 | % | 80 - 120 |



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Maxxam Job #: B860210
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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT(CONT'D)

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| | | | Dissolved Calcium (Ca) | 2018/07/23 | | 97 | % | 80 - 120 |
| 9075978 | MA4 | LCS | Alkalinity (Total as CaCO3) | 2018/07/24 | | 99 | % | 80 - 120 |
| 9075983 | MA4 | LCS | Conductivity | 2018/07/24 | | 101 | % | 90 - 110 |
| 9076120 | APY | LCS | Dissolved Mercury (Hg) | 2018/07/24 | | 104 | % | 80 - 120 |
| 9076235 | AF6 | LCS | Phenols | 2018/07/24 | | 83 | % | 80 - 120 |
| 9076120 | APY | SRM | Dissolved Mercury (Hg) | 2018/07/24 | | 101 | % | 80 - 120 |

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.

LCS: 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.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.



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Report Date: 2018/07/27

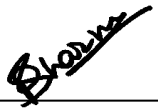
Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## VALIDATION SIGNATURE PAGE

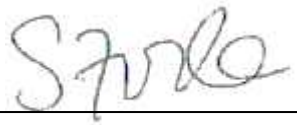
The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Dennis Ngondu, B.Sc., P.Chem., QP, Supervisor, Organics



Poonam Sharma, cCT, Organics Supervisor



Suwan Fock, B.Sc., QP, Inorganics Senior Analyst

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.



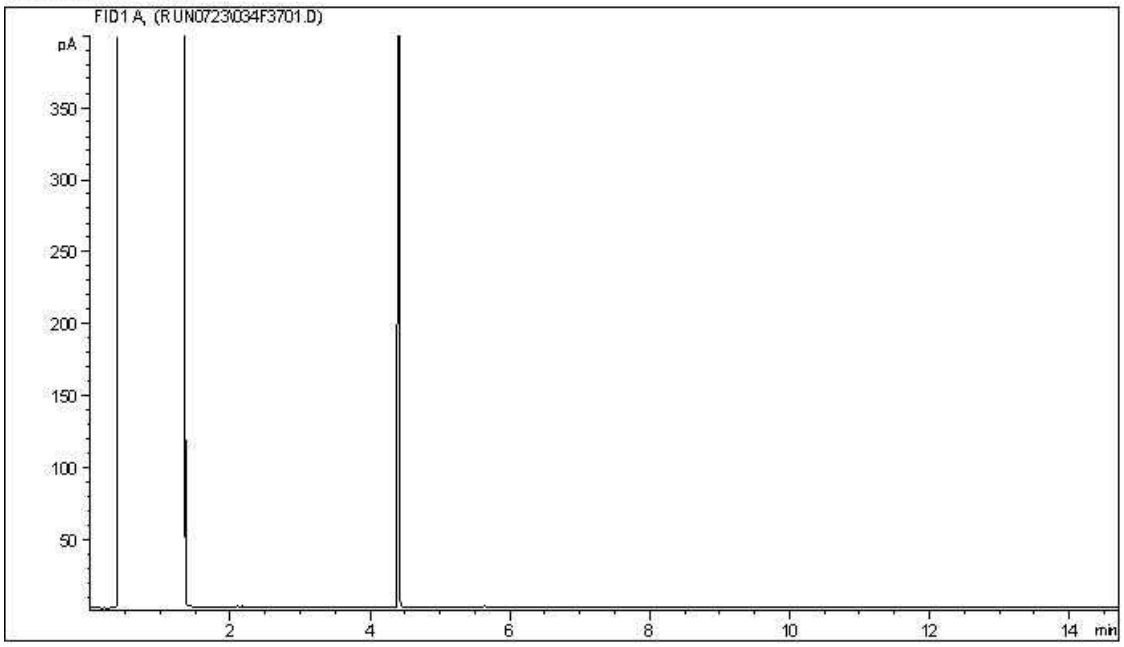
Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B860210
Report Date: 2018/07/27
Maxxam Sample: TX2362

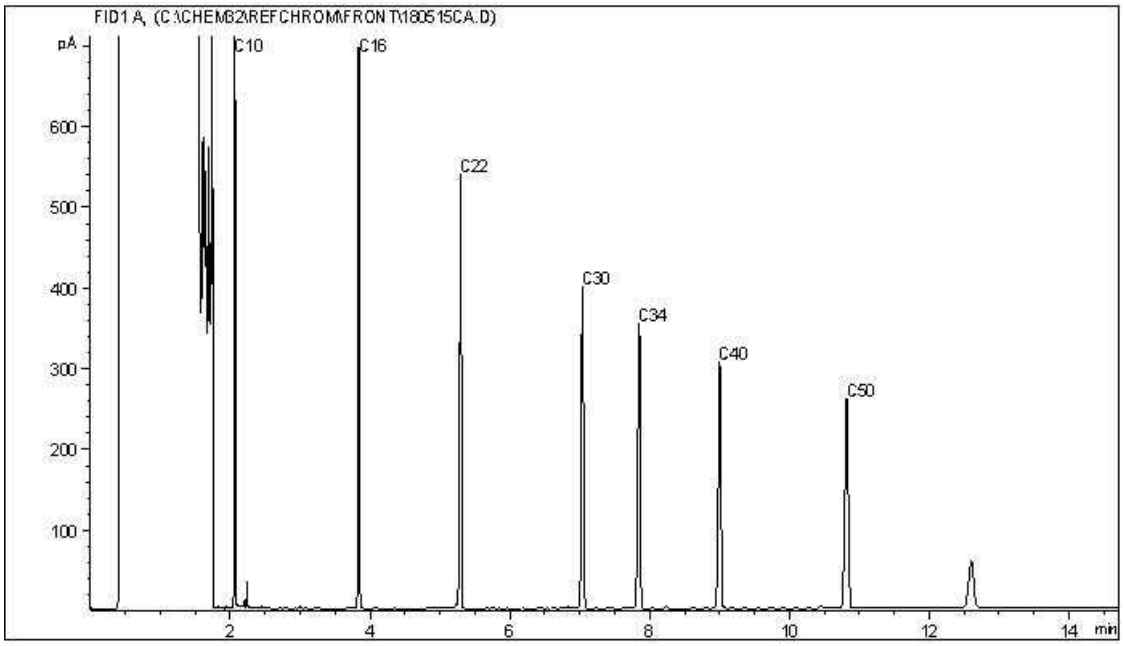
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: BI-13-3-4.5

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: GC7




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam
A Bureau Veritas Group Company

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9331 - 48 Street, T6B 2R4
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Fax: (780) 450-4187
Toll Free: (800) 386-7247

# EXXON MOBIL/IMPERIAL OIL - MAXXAM CHAIN-OF-CUSTODY RECORD

GAIN



C of C # 299266

| INVOICE INFORMATION | REPORT INFORMATION |
|---|---|
| Company Name: ☒ Imperial Oil ☐ ExxonMobil | Company Name: WorleyParsons |
| Contact Name: WorleyParsons | Contact Name: Stacy Gibb |
| Address: 500, 151 Canada Olympic Rd SW Calgary, AB T3B 6B7 | Address: 500, 151 Canada Olympic Rd SW Calgary, AB T3B 6B7 |
| Email: sanj.perera@advisian.com | Email: stacy.gibb@advisian.com |
| Ph: 587-952-1490 | Ph: 403-247-0200 |
| Sampler Name (Print): Melissa Lord / Ekaterina Yakushina | Consultant Project #: 407011-00586-400 |

| FIELD SAMPLE ID | MATRIX: GROUND WATER | MATRIX: SURFACE WATER | MATRIX: SOIL | MATRIX: OTHER | # CONTAINERS | SAMPLING: DATE (YYYY/MM/DD) | SAMPLING: TIME (24 HR) | FIELD FILTERED & PRESERVED | LAB FILTRATION REQUIRED | VOC | PAH | PHCs (FRACTIONS 1-2 PLUS BTEX) | PHCs (FRACTIONS 1-4 PLUS BTEX) | PHCs (FRACTIONS 2-4) | PHCs (FRACTION 1 PLUS BTEX) | GRAIN SIZE (75 MICRON) | TEXTURE (% SAND, SILT, CLAY) | PARTICLE SIZE DISTRIBUTION WITH GRAPH | REGULATED METALS ☒ DIS ☐ TOT | MERCURY ☒ DISSOLVED ☐ TOTAL | SALINITY SOIL | FERTILIZER SOIL | FERTILIZER WATER | NUTRIENTS SOIL | ROUTINE POTABILITY ☐ pH ☐ EC ☐ ALKALINITY | BASIC CLASS II LANDFILL PKG | Phenols |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 B1-13-3-4.5 | X | | | | 10 | 2018/07/18 | 13:25 | X | | | | X | | | | | | | X | X | | | | | X | | X |
| 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | |

IOL SITE LOCATION: Norman Wells, NT

IOL PROJECT # (if applicable): N/A

MAXXAM TASK ORDER # OR SERVICE ORDER # + LINE ITEM: 407011-00586-400

REGULATORY CRITERIA / DETECTION LIMITS:
☐ Alberta Tier 1 ☐ CDWG
☐ SEQG (SK) ☐ NoSC (SK)
☒ CCME (incl. level) FAL ☐ Other

SPECIAL INSTRUCTIONS:
also email:
-standard Norman Wells list
-melissa.lord@advisian.com
IES A2601436

# JARS USED & NOT SUBMITTED (Enter N/A for Water): N/A

TURNAROUND TIME
Standard (5 days) ☒
Rush (3 days) ☐
(2 days) ☐
(1 day) ☐
(same day) ☐
Date Required

| | YES | NO | COOLER ID # | | | |
|---|---|---|---|---|---|---|
| SEAL PRESENT | ✓ | | TEMP °C | 5 (1) | 5 (2) | 8 (3) |
| SEAL INTACT | ✓ | | | | | |
| COOLING MEDIA PRESENT | ✓ | | | | | |

| | YES | NO | COOLER ID # | | | |
|---|---|---|---|---|---|---|
| SEAL PRESENT | | | TEMP °C | 1 | 2 | 3 |
| SEAL INTACT | | | | | | |
| COOLING MEDIA PRESENT | | | | | | |

| | YES | NO | COOLER ID # | | | |
|---|---|---|---|---|---|---|
| SEAL PRESENT | | | TEMP °C | 1 | 2 | 3 |
| SEAL INTACT | | | | | | |
| COOLING MEDIA PRESENT | | | | | | |

LAB USE ONLY
MAXXAM JOB # B860210

| RELINQUISHED BY: | | DATE: | TIME (24 HR) | RECEIVED BY: | | DATE: | TIME (24 HR) |
|---|---|---|---|---|---|---|---|
| 1. | Melissa Lord | 2018/07/19 | 08:00 | 1. Gina Antonucci | Gina Antonucci | 20180720 | 1002 |
| 2. | | | | 2. | | | |
| 3. | | | | 3. | | | |

SAMPLES
LABELED BY: ALK
VERIFIED BY: MLS

COC-1010 (06/2016) IOL-AB White: Maxxam Yellow: Client

# DATA QUALITY REVIEW CHECKLIST - IMPERIAL OIL PROJECTS

Consultant: Advisian | Sampling Date: 20-Jul-18

Location: Norman Wells | Laboratory : Maxxam Edmonton

Consultant Project Number: 407011-00586-400 | Sample Submission Number: B860419

Are All Laboratory QC Within Acceptance Criteria (Yes, No, Not Applicable)?

| | Yes | No | NA | Comments |
|---|---|---|---|---|
| Instrument Surrogate Recovery | x | | | All laboratory QC met acceptance criteria. |
| Extraction Surrogate Recovery | x | | | |
| Method Blank Concentration | x | | | |
| Matrix Duplicate RPD | x | | | |
| Matrix Spike Recovery | x | | | |
| Lab Control Sample Recovery | x | | | |

Are All Field QC Samples Within Alert Limits (Yes, No, Not Applicable)?

| | Yes | No | NA | Comments |
|---|---|---|---|---|
| Field Blank Concentration | x | | | All QC samples met alert limits. |
| Trip Blank Concentration | x | | | |
| Equipment Blank Concentration | | | x | |
| Field Duplicate RPD | x | | | |

| | |
|---|---|
| Has CoA been signed off (Yes/No)?: | Yes |
| Has lab warranted all tests were analyzed following SOP's in CoA (Yes/No)?: | Yes |
| Were all samples analyzed within hold times (Yes/No)?: | Yes |
| All volatiles samples methanol extracted (if required) within 48 hours (Yes/No)?: | n/a |
| Is Chain of Custody completed and signed (Yes/No)?: | Yes |
| Were sample temperatures acceptable when they reached lab (Yes/No)?: | Yes |

| | |
|---|---|
| Was a Data Quality Overview (DQO) issued (Yes/No)?: | No |
| Date DQO was received: | n/a |

Is data considered to be reliable (Yes/No)?: Yes

If answer is "No", describe and provide rationale:

Data Reviewed by (Print): Vivian Baptista | Data Reviewed by (Signature): 

Date: 23-Aug-18

Maxxam
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Success Through Science®

Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400
Your C.O.C. #: 298591

**Attention: Stacy Gibb**

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

**Report Date: 2018/07/30**
Report #: R2596778
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B860419**
**Received: 2018/07/22, 11:35**

Sample Matrix: Water
# Samples Received: 5

| Analyses | Quantity | Laboratory Method | Primary Reference |
|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | 3 | AB SOP-00005 | SM 22 2320 B m |
| BTEX/F1 in Water by HS GC/MS/FID | 5 | AB SOP-00039 | CCME CWS/EPA 8260d m |
| F1-BTEX | 5 | AB SOP-00039 | Auto Calc |
| Cadmium - low level CCME - Dissolved | 3 | AB WI-00065 | Auto Calc |
| Chloride by Automated Colourimetry | 3 | AB SOP-00020 | SM 22 4500-Cl-E m |
| Conductivity @25C | 3 | AB SOP-00005 | SM 22 2510 B m |
| CCME Hydrocarbons in Water (F2; C10-C16) (1) | 5 | AB SOP-00037 / AB SOP-00040 | CCME PHC-CWS m |
| Hardness | 3 | AB WI-00065 | Auto Calc |
| Mercury - Low Level (Dissolved) (2) | 3 | EENVSOP-00031 | EPA 245.7 R2 m |
| Elements by ICP - Dissolved (2) | 3 | AB SOP-00042 | EPA 6010d R4 m |
| Elements by ICPMS - Dissolved (2) | 3 | AB SOP-00043 | EPA 6020b R2 m |
| Ion Balance | 3 | AB WI-00065 | Auto Calc |
| Nitrate and Nitrite | 3 | AB WI-00065 | Auto Calc |
| Nitrate + Nitrite-N (calculated) | 3 | AB WI-00065 | Auto Calc |
| Nitrogen (Nitrite - Nitrate) by IC | 3 | AB SOP-00023 | SM 23 4110 B m |
| Phenols (4-AAP) | 3 | EENVSOP-00061 | MMCW 154 1996 m |
| Sulphate by Automated Colourimetry | 3 | AB SOP-00018 | SM 22 4500-SO4 E m |
| Total Dissolved Solids (Filt. Residue) | 3 | AB SOP-00065 | SM 22 2540 C m |

**Remarks:**

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. All samples were analyzed within hold time unless otherwise flagged.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.



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Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400
Your C.O.C. #: 298591

**Attention: Stacy Gibb**

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

**Report Date: 2018/07/30**
Report #: R2596778
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B860419**
**Received: 2018/07/22, 11:35**

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
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) Silica gel clean up employed.
(2) Dissolved > Total Imbalance: Whenever applicable, Dissolved >Total for any parameter that falls within method uncertainty for duplicates is likely equivalent. If RPD is >20% samples were reanalyzed and confirmed.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Jenna Chernuka, Project Manager
Email: JChernuka@maxxam.ca
Phone# (780)577-7178
==========
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.


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Maxxam Job #: B860419
Report Date: 2018/07/30

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## AT1 BTEX AND F1-F2 IN WATER (WATER)

| Maxxam ID | | TX3741 | | | TX3741 | | | TX3742 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/07/20 13:20 | | | 2018/07/20 13:20 | | | 2018/07/20 15:40 | | |
| COC Number | | 298591 | | | 298591 | | | 298591 | | |
| | **UNITS** | **BIS 97-1-3** | **RDL** | **QC Batch** | **BIS 97-1-3 Lab-Dup** | **RDL** | **QC Batch** | **CPF 97-7-5** | **RDL** | **QC Batch** |
| **Ext. Pet. Hydrocarbon** | | | | | | | | | | |
| F2 (C10-C16 Hydrocarbons) | mg/L | <0.10 | 0.10 | 9075640 | <0.10 | 0.10 | 9075640 | <0.10 | 0.10 | 9075640 |
| **Volatiles** | | | | | | | | | | |
| Benzene | mg/L | <0.00040 | 0.00040 | 9075493 | | | | <0.00040 | 0.00040 | 9075493 |
| Toluene | mg/L | <0.00040 | 0.00040 | 9075493 | | | | <0.00040 | 0.00040 | 9075493 |
| Ethylbenzene | mg/L | <0.00040 | 0.00040 | 9075493 | | | | <0.00040 | 0.00040 | 9075493 |
| m & p-Xylene | mg/L | <0.00080 | 0.00080 | 9075493 | | | | <0.00080 | 0.00080 | 9075493 |
| o-Xylene | mg/L | <0.00040 | 0.00040 | 9075493 | | | | <0.00040 | 0.00040 | 9075493 |
| Xylenes (Total) | mg/L | <0.00089 | 0.00089 | 9074230 | | | | <0.00089 | 0.00089 | 9074230 |
| F1 (C6-C10) - BTEX | mg/L | <0.10 | 0.10 | 9074230 | | | | <0.10 | 0.10 | 9074230 |
| F1 (C6-C10) | mg/L | <0.10 | 0.10 | 9075493 | | | | <0.10 | 0.10 | 9075493 |
| **Extraction Surrogate Recovery (%)** | | | | | | | | | | |
| O-TERPHENYL (sur.) | % | 95 | | 9075640 | 94 | | 9075640 | 92 | | 9075640 |
| **Instrument Surrogate Recovery (%)** | | | | | | | | | | |
| 1,4-Difluorobenzene (sur.) | % | 101 | | 9075493 | | | | 100 | | 9075493 |
| 4-Bromofluorobenzene (sur.) | % | 102 | | 9075493 | | | | 102 | | 9075493 |
| D4-1,2-Dichloroethane (sur.) | % | 106 | | 9075493 | | | | 103 | | 9075493 |

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate



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Maxxam Job #: B860419
Report Date: 2018/07/30

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## AT1 BTEX AND F1-F2 IN WATER (WATER)

| Maxxam ID | | TX3743 | TX3744 | TX3745 | | |
|---|---|---|---|---|---|---|
| Sampling Date | | 2018/07/20 15:50 | 2018/07/20 15:45 | 2018/07/20 17:00 | | |
| COC Number | | 298591 | 298591 | 298591 | | |
| | **UNITS** | **NWD 18-45** | **NWD 18-20** | **NWD 18-10** | **RDL** | **QC Batch** |
| **Ext. Pet. Hydrocarbon** | | | | | | |
| F2 (C10-C16 Hydrocarbons) | mg/L | <0.10 | <0.10 | <0.10 | 0.10 | 9075640 |
| **Volatiles** | | | | | | |
| Benzene | mg/L | <0.00040 | <0.00040 | <0.00040 | 0.00040 | 9075493 |
| Toluene | mg/L | <0.00040 | <0.00040 | <0.00040 | 0.00040 | 9075493 |
| Ethylbenzene | mg/L | <0.00040 | <0.00040 | <0.00040 | 0.00040 | 9075493 |
| m & p-Xylene | mg/L | <0.00080 | <0.00080 | <0.00080 | 0.00080 | 9075493 |
| o-Xylene | mg/L | <0.00040 | <0.00040 | <0.00040 | 0.00040 | 9075493 |
| Xylenes (Total) | mg/L | <0.00089 | <0.00089 | <0.00089 | 0.00089 | 9074230 |
| F1 (C6-C10) - BTEX | mg/L | <0.10 | <0.10 | <0.10 | 0.10 | 9074230 |
| F1 (C6-C10) | mg/L | <0.10 | <0.10 | <0.10 | 0.10 | 9075493 |
| **Extraction Surrogate Recovery (%)** | | | | | | |
| O-TERPHENYL (sur.) | % | 94 | 92 | 91 | | 9075640 |
| **Instrument Surrogate Recovery (%)** | | | | | | |
| 1,4-Difluorobenzene (sur.) | % | 100 | 99 | 102 | | 9075493 |
| 4-Bromofluorobenzene (sur.) | % | 103 | 102 | 100 | | 9075493 |
| D4-1,2-Dichloroethane (sur.) | % | 106 | 104 | 106 | | 9075493 |
| RDL = Reportable Detection Limit | | | | | | |



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Maxxam Job #: B860419
Report Date: 2018/07/30

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## REGULATED METALS INCLUDING MERCURY-DISS (WATER)

| Maxxam ID | | TX3741 | TX3742 | TX3743 | | |
|---|---|---|---|---|---|---|
| Sampling Date | | 2018/07/20 13:20 | 2018/07/20 15:40 | 2018/07/20 15:50 | | |
| COC Number | | 298591 | 298591 | 298591 | | |
| | **UNITS** | **BIS 97-1-3** | **CPF 97-7-5** | **NWD 18-45** | **RDL** | **QC Batch** |
| **Low Level Elements** | | | | | | |
| Dissolved Cadmium (Cd) | mg/L | <0.000020 | 0.00054 | 0.00046 | 0.000020 | 9074231 |
| **Elements** | | | | | | |
| Dissolved Aluminum (Al) | mg/L | 0.0039 | 0.023 | 0.025 | 0.0030 | 9074921 |
| Dissolved Antimony (Sb) | mg/L | <0.00060 | <0.00060 | <0.00060 | 0.00060 | 9074921 |
| Dissolved Arsenic (As) | mg/L | 0.0010 | 0.00030 | 0.00031 | 0.00020 | 9074921 |
| Dissolved Barium (Ba) | mg/L | 0.028 | 0.065 | 0.067 | 0.010 | 9074585 |
| Dissolved Beryllium (Be) | mg/L | <0.0010 | <0.0010 | <0.0010 | 0.0010 | 9074921 |
| Dissolved Boron (B) | mg/L | <0.020 | 0.061 | 0.056 | 0.020 | 9074585 |
| Dissolved Calcium (Ca) | mg/L | 170 | 330 | 310 | 0.30 | 9074585 |
| Dissolved Chromium (Cr) | mg/L | <0.0010 | <0.0010 | <0.0010 | 0.0010 | 9074921 |
| Dissolved Cobalt (Co) | mg/L | 0.0012 | 0.0021 | 0.0021 | 0.00030 | 9074921 |
| Dissolved Copper (Cu) | mg/L | 0.0017 | 0.0015 | 0.0017 | 0.00020 | 9074921 |
| Dissolved Iron (Fe) | mg/L | 1.8 | 0.35 | 0.35 | 0.060 | 9074585 |
| Dissolved Lead (Pb) | mg/L | <0.00020 | <0.00020 | <0.00020 | 0.00020 | 9074921 |
| Dissolved Lithium (Li) | mg/L | <0.020 | <0.020 | <0.020 | 0.020 | 9074585 |
| Dissolved Magnesium (Mg) | mg/L | 77 | 74 | 69 | 0.20 | 9074585 |
| Dissolved Manganese (Mn) | mg/L | 0.46 | 1.5 | 1.5 | 0.0040 | 9074585 |
| Dissolved Molybdenum (Mo) | mg/L | 0.0045 | 0.0024 | 0.0023 | 0.00020 | 9074921 |
| Dissolved Nickel (Ni) | mg/L | 0.0063 | 0.0071 | 0.0074 | 0.00050 | 9074921 |
| Dissolved Phosphorus (P) | mg/L | <0.10 | <0.10 | <0.10 | 0.10 | 9074585 |
| Dissolved Potassium (K) | mg/L | 3.1 | 4.6 | 4.4 | 0.30 | 9074585 |
| Dissolved Selenium (Se) | mg/L | 0.00045 | 0.00079 | 0.00086 | 0.00020 | 9074921 |
| Dissolved Silicon (Si) | mg/L | 5.4 | 4.6 | 4.4 | 0.10 | 9074585 |
| Dissolved Silver (Ag) | mg/L | <0.00010 | <0.00010 | <0.00010 | 0.00010 | 9074921 |
| Dissolved Sodium (Na) | mg/L | 16 | 9.1 | 8.5 | 0.50 | 9074585 |
| Dissolved Strontium (Sr) | mg/L | 0.57 | 1.6 | 1.4 | 0.020 | 9074585 |
| Dissolved Sulphur (S) | mg/L | 53 | 280 | 260 | 0.20 | 9074585 |
| Dissolved Thallium (Tl) | mg/L | <0.00020 | <0.00020 | <0.00020 | 0.00020 | 9074921 |
| Dissolved Tin (Sn) | mg/L | <0.0010 | <0.0010 | <0.0010 | 0.0010 | 9074921 |
| Dissolved Titanium (Ti) | mg/L | <0.0010 | <0.0010 | <0.0010 | 0.0010 | 9074921 |
| 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 #: B860419
Report Date: 2018/07/30

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## REGULATED METALS INCLUDING MERCURY-DISS (WATER)

| Maxxam ID | | TX3741 | TX3742 | TX3743 | | |
|---|---|---|---|---|---|---|
| Sampling Date | | 2018/07/20 13:20 | 2018/07/20 15:40 | 2018/07/20 15:50 | | |
| COC Number | | 298591 | 298591 | 298591 | | |
| | **UNITS** | **BIS 97-1-3** | **CPF 97-7-5** | **NWD 18-45** | **RDL** | **QC Batch** |
| Dissolved Uranium (U) | mg/L | 0.0016 | 0.0033 | 0.0032 | 0.00010 | 9074921 |
| Dissolved Vanadium (V) | mg/L | <0.0010 | <0.0010 | <0.0010 | 0.0010 | 9074921 |
| Dissolved Zinc (Zn) | mg/L | 0.0053 | 0.018 | 0.021 | 0.0030 | 9074921 |
| **Low Level Elements** | | | | | | |
| Dissolved Mercury (Hg) | mg/L | <0.0000020 | <0.0000020 | <0.0000020 | 0.0000020 | 9077973 |
| RDL = Reportable Detection Limit | | | | | | |



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Maxxam Job #: B860419
Report Date: 2018/07/30

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## RESULTS OF CHEMICAL ANALYSES OF WATER

| Maxxam ID | | TX3741 | | | TX3741 | | | TX3742 | TX3743 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/07/20 13:20 | | | 2018/07/20 13:20 | | | 2018/07/20 15:40 | 2018/07/20 15:50 | | |
| COC Number | | 298591 | | | 298591 | | | 298591 | 298591 | | |
| | **UNITS** | **BIS 97-1-3** | **RDL** | **QC Batch** | **BIS 97-1-3 Lab-Dup** | **RDL** | **QC Batch** | **CPF 97-7-5** | **NWD 18-45** | **RDL** | **QC Batch** |
| **Calculated Parameters** | | | | | | | | | | | |
| Hardness (CaCO3) | mg/L | 750 | 0.50 | 9074232 | | | | 1100 | 1100 | 0.50 | 9074232 |
| Ion Balance (% Difference) | % | 0.29 | N/A | 9074233 | | | | 0.30 | 2.4 | N/A | 9074233 |
| Dissolved Nitrate (NO3) | mg/L | 3.7 | 0.044 | 9074234 | | | | 0.15 | <0.044 | 0.044 | 9074234 |
| Nitrate plus Nitrite (N) | mg/L | 0.83 | 0.014 | 9074235 | | | | 0.034 | <0.014 | 0.014 | 9074235 |
| Dissolved Nitrite (NO2) | mg/L | <0.033 | 0.033 | 9074234 | | | | <0.033 | <0.033 | 0.033 | 9074234 |
| **Misc. Inorganics** | | | | | | | | | | | |
| Conductivity | uS/cm | 1300 | 2.0 | 9075990 | | | | 1800 | 1900 | 2.0 | 9075990 |
| Total Dissolved Solids | mg/L | 900 | 10 | 9075987 | | | | 1600 | 1500 | 10 | 9076049 |
| **Anions** | | | | | | | | | | | |
| Alkalinity (PP as CaCO3) | mg/L | <1.0 | 1.0 | 9075986 | | | | <1.0 | <1.0 | 1.0 | 9075986 |
| Alkalinity (Total as CaCO3) | mg/L | 590 | 1.0 | 9075986 | | | | 320 | 300 | 1.0 | 9075986 |
| Bicarbonate (HCO3) | mg/L | 720 | 1.0 | 9075986 | | | | 390 | 370 | 1.0 | 9075986 |
| Carbonate (CO3) | mg/L | <1.0 | 1.0 | 9075986 | | | | <1.0 | <1.0 | 1.0 | 9075986 |
| Hydroxide (OH) | mg/L | <1.0 | 1.0 | 9075986 | | | | <1.0 | <1.0 | 1.0 | 9075986 |
| Dissolved Sulphate (SO4) | mg/L | 160 | 1.0 | 9075662 | | | | 780 (1) | 790 (1) | 5.0 | 9075662 |
| Dissolved Chloride (Cl) | mg/L | 16 | 1.0 | 9075659 | | | | 16 | 16 | 1.0 | 9075659 |
| **Nutrients** | | | | | | | | | | | |
| Dissolved Nitrite (N) | mg/L | <0.010 | 0.010 | 9074591 | <0.010 | 0.010 | 9074591 | <0.010 | <0.010 | 0.010 | 9074591 |
| Dissolved Nitrate (N) | mg/L | 0.83 | 0.010 | 9074591 | 0.83 | 0.010 | 9074591 | 0.034 | <0.010 | 0.010 | 9074591 |
| **Misc. Organics** | | | | | | | | | | | |
| Phenols | mg/L | 0.0065 | 0.0020 | 9077928 | | | | 0.0029 | 0.0041 | 0.0020 | 9077928 |

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



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Maxxam Job #: B860419
Report Date: 2018/07/30

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## TEST SUMMARY

**Maxxam ID:** TX3741
**Sample ID:** BIS 97-1-3
**Matrix:** Water

**Collected:** 2018/07/20
**Relinquished:** 2018/07/21
**Received:** 2018/07/22

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | AT/ALK | 9075986 | N/A | 2018/07/24 | Malina Alamyar |
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9075493 | N/A | 2018/07/24 | Hetul Patel |
| F1-BTEX | CALC/MS | 9074230 | N/A | 2018/07/25 | Automated Statchk |
| Cadmium - low level CCME - Dissolved | CALC/MS | 9074231 | N/A | 2018/07/24 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 9075659 | N/A | 2018/07/25 | Marissa Richard |
| Conductivity @25C | COND | 9075990 | N/A | 2018/07/24 | Malina Alamyar |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9075640 | 2018/07/24 | 2018/07/27 | Jana Rychlikova |
| Hardness | CALC | 9074232 | N/A | 2018/07/23 | Automated Statchk |
| Mercury - Low Level (Dissolved) | CV/AF | 9077973 | 2018/07/25 | 2018/07/25 | Andrew Payne |
| Elements by ICP - Dissolved | ICPA | 9074585 | N/A | 2018/07/23 | Jonathan Kuprowsky |
| Elements by ICPMS - Dissolved | ICPM | 9074921 | N/A | 2018/07/23 | Andrew Payne |
| Ion Balance | CALC | 9074233 | N/A | 2018/07/23 | Automated Statchk |
| Nitrate and Nitrite | CALC | 9074234 | N/A | 2018/07/24 | Automated Statchk |
| Nitrate + Nitrite-N (calculated) | CALC | 9074235 | N/A | 2018/07/24 | Automated Statchk |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9074591 | N/A | 2018/07/23 | Maria Paola Solis Ares |
| Phenols (4-AAP) | TECH/4AAP | 9077928 | N/A | 2018/07/25 | Ashley Fedoriuk |
| Sulphate by Automated Colourimetry | KONE | 9075662 | N/A | 2018/07/25 | Marissa Richard |
| Total Dissolved Solids (Filt. Residue) | BAL | 9075987 | 2018/07/24 | 2018/07/25 | Victoria Fedorak |

**Maxxam ID:** TX3741 Dup
**Sample ID:** BIS 97-1-3
**Matrix:** Water

**Collected:** 2018/07/20
**Relinquished:** 2018/07/21
**Received:** 2018/07/22

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9075640 | 2018/07/24 | 2018/07/27 | Jana Rychlikova |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9074591 | N/A | 2018/07/23 | Maria Paola Solis Ares |

**Maxxam ID:** TX3742
**Sample ID:** CPF 97-7-5
**Matrix:** Water

**Collected:** 2018/07/20
**Relinquished:** 2018/07/21
**Received:** 2018/07/22

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | AT/ALK | 9075986 | N/A | 2018/07/24 | Malina Alamyar |
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9075493 | N/A | 2018/07/24 | Hetul Patel |
| F1-BTEX | CALC/MS | 9074230 | N/A | 2018/07/25 | Automated Statchk |
| Cadmium - low level CCME - Dissolved | CALC/MS | 9074231 | N/A | 2018/07/24 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 9075659 | N/A | 2018/07/25 | Marissa Richard |
| Conductivity @25C | COND | 9075990 | N/A | 2018/07/24 | Malina Alamyar |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9075640 | 2018/07/24 | 2018/07/27 | Jana Rychlikova |
| Hardness | CALC | 9074232 | N/A | 2018/07/23 | Automated Statchk |
| Mercury - Low Level (Dissolved) | CV/AF | 9077973 | 2018/07/25 | 2018/07/25 | Andrew Payne |
| Elements by ICP - Dissolved | ICPA | 9074585 | N/A | 2018/07/23 | Jonathan Kuprowsky |
| Elements by ICPMS - Dissolved | ICPM | 9074921 | N/A | 2018/07/23 | Andrew Payne |



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Maxxam Job #: B860419
Report Date: 2018/07/30

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## TEST SUMMARY

**Maxxam ID:** TX3742
**Sample ID:** CPF 97-7-5
**Matrix:** Water

**Collected:** 2018/07/20
**Relinquished:** 2018/07/21
**Received:** 2018/07/22

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Ion Balance | CALC | 9074233 | N/A | 2018/07/23 | Automated Statchk |
| Nitrate and Nitrite | CALC | 9074234 | N/A | 2018/07/24 | Automated Statchk |
| Nitrate + Nitrite-N (calculated) | CALC | 9074235 | N/A | 2018/07/24 | Automated Statchk |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9074591 | N/A | 2018/07/23 | Maria Paola Solis Ares |
| Phenols (4-AAP) | TECH/4AAP | 9077928 | N/A | 2018/07/25 | Ashley Fedoriuk |
| Sulphate by Automated Colourimetry | KONE | 9075662 | N/A | 2018/07/25 | Marissa Richard |
| Total Dissolved Solids (Filt. Residue) | BAL | 9076049 | 2018/07/24 | 2018/07/25 | Victoria Fedorak |

**Maxxam ID:** TX3743
**Sample ID:** NWD 18-45
**Matrix:** Water

**Collected:** 2018/07/20
**Relinquished:** 2018/07/21
**Received:** 2018/07/22

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | AT/ALK | 9075986 | N/A | 2018/07/24 | Malina Alamyar |
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9075493 | N/A | 2018/07/24 | Hetul Patel |
| F1-BTEX | CALC/MS | 9074230 | N/A | 2018/07/25 | Automated Statchk |
| Cadmium - low level CCME - Dissolved | CALC/MS | 9074231 | N/A | 2018/07/24 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 9075659 | N/A | 2018/07/25 | Marissa Richard |
| Conductivity @25C | COND | 9075990 | N/A | 2018/07/24 | Malina Alamyar |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9075640 | 2018/07/24 | 2018/07/27 | Jana Rychlikova |
| Hardness | CALC | 9074232 | N/A | 2018/07/23 | Automated Statchk |
| Mercury - Low Level (Dissolved) | CV/AF | 9077973 | 2018/07/25 | 2018/07/25 | Andrew Payne |
| Elements by ICP - Dissolved | ICPA | 9074585 | N/A | 2018/07/23 | Jonathan Kuprowsky |
| Elements by ICPMS - Dissolved | ICPM | 9074921 | N/A | 2018/07/23 | Andrew Payne |
| Ion Balance | CALC | 9074233 | N/A | 2018/07/23 | Automated Statchk |
| Nitrate and Nitrite | CALC | 9074234 | N/A | 2018/07/24 | Automated Statchk |
| Nitrate + Nitrite-N (calculated) | CALC | 9074235 | N/A | 2018/07/24 | Automated Statchk |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9074591 | N/A | 2018/07/23 | Maria Paola Solis Ares |
| Phenols (4-AAP) | TECH/4AAP | 9077928 | N/A | 2018/07/25 | Ashley Fedoriuk |
| Sulphate by Automated Colourimetry | KONE | 9075662 | N/A | 2018/07/25 | Marissa Richard |
| Total Dissolved Solids (Filt. Residue) | BAL | 9076049 | 2018/07/24 | 2018/07/25 | Victoria Fedorak |

**Maxxam ID:** TX3744
**Sample ID:** NWD 18-20
**Matrix:** Water

**Collected:** 2018/07/20
**Relinquished:** 2018/07/21
**Received:** 2018/07/22

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9075493 | N/A | 2018/07/24 | Hetul Patel |
| F1-BTEX | CALC/MS | 9074230 | N/A | 2018/07/25 | Automated Statchk |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9075640 | 2018/07/24 | 2018/07/27 | Jana Rychlikova |



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Maxxam Job #: B860419
Report Date: 2018/07/30

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## TEST SUMMARY

**Maxxam ID:** TX3745
**Sample ID:** NWD 18-10
**Matrix:** Water

**Collected:** 2018/07/20
**Relinquished:** 2018/07/21
**Received:** 2018/07/22

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9075493 | N/A | 2018/07/24 | Hetul Patel |
| F1-BTEX | CALC/MS | 9074230 | N/A | 2018/07/25 | Automated Statchk |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9075640 | 2018/07/24 | 2018/07/27 | Jana Rychlikova |



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Advisian
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Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## GENERAL COMMENTS

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

| | |
|---|---|
| Package 1 | 4.3°C |

**Results relate only to the items tested.**



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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| 9074585 | JK9 | Method Blank | Dissolved Iron (Fe) | 2018/07/23 | <0.060 | | mg/L | |
| | | | Dissolved Lithium (Li) | 2018/07/23 | <0.020 | | mg/L | |
| | | | Dissolved Magnesium (Mg) | 2018/07/23 | <0.20 | | mg/L | |
| | | | Dissolved Manganese (Mn) | 2018/07/23 | <0.0040 | | mg/L | |
| | | | Dissolved Potassium (K) | 2018/07/23 | <0.30 | | mg/L | |
| | | | Dissolved Sodium (Na) | 2018/07/23 | <0.50 | | mg/L | |
| | | | Dissolved Strontium (Sr) | 2018/07/23 | <0.020 | | mg/L | |
| | | | Dissolved Sulphur (S) | 2018/07/23 | <0.20 | | mg/L | |
| | | | Dissolved Phosphorus (P) | 2018/07/23 | <0.10 | | mg/L | |
| | | | Dissolved Barium (Ba) | 2018/07/23 | <0.010 | | mg/L | |
| | | | Dissolved Silicon (Si) | 2018/07/23 | <0.10 | | mg/L | |
| | | | Dissolved Boron (B) | 2018/07/23 | <0.020 | | mg/L | |
| | | | Dissolved Calcium (Ca) | 2018/07/23 | <0.30 | | mg/L | |
| 9074591 | MPX | Method Blank | Dissolved Nitrite (N) | 2018/07/23 | <0.010 | | mg/L | |
| | | | Dissolved Nitrate (N) | 2018/07/23 | <0.010 | | mg/L | |
| 9074921 | APY | Method Blank | Dissolved Aluminum (Al) | 2018/07/23 | <0.0030 | | mg/L | |
| | | | Dissolved Chromium (Cr) | 2018/07/23 | <0.0010 | | mg/L | |
| | | | Dissolved Cobalt (Co) | 2018/07/23 | <0.00030 | | mg/L | |
| | | | Dissolved Copper (Cu) | 2018/07/23 | <0.00020 | | mg/L | |
| | | | Dissolved Lead (Pb) | 2018/07/23 | <0.00020 | | mg/L | |
| | | | Dissolved Antimony (Sb) | 2018/07/23 | <0.00060 | | mg/L | |
| | | | Dissolved Molybdenum (Mo) | 2018/07/23 | <0.00020 | | mg/L | |
| | | | Dissolved Nickel (Ni) | 2018/07/23 | <0.00050 | | mg/L | |
| | | | Dissolved Selenium (Se) | 2018/07/23 | <0.00020 | | mg/L | |
| | | | Dissolved Silver (Ag) | 2018/07/23 | <0.00010 | | mg/L | |
| | | | Dissolved Arsenic (As) | 2018/07/23 | <0.00020 | | mg/L | |
| | | | Dissolved Thallium (Tl) | 2018/07/23 | <0.00020 | | mg/L | |
| | | | Dissolved Tin (Sn) | 2018/07/23 | <0.0010 | | mg/L | |
| | | | Dissolved Titanium (Ti) | 2018/07/23 | <0.0010 | | mg/L | |
| | | | Dissolved Uranium (U) | 2018/07/23 | <0.00010 | | mg/L | |
| | | | Dissolved Vanadium (V) | 2018/07/23 | <0.0010 | | mg/L | |
| | | | Dissolved Zinc (Zn) | 2018/07/23 | <0.0030 | | mg/L | |
| | | | Dissolved Beryllium (Be) | 2018/07/23 | <0.0010 | | mg/L | |
| 9075493 | HP5 | Method Blank | 1,4-Difluorobenzene (sur.) | 2018/07/24 | | 102 | % | 50 - 140 |
| | | | 4-Bromofluorobenzene (sur.) | 2018/07/24 | | 101 | % | 50 - 140 |
| | | | D4-1,2-Dichloroethane (sur.) | 2018/07/24 | | 104 | % | 50 - 140 |
| | | | Benzene | 2018/07/24 | <0.00040 | | mg/L | |
| | | | Toluene | 2018/07/24 | <0.00040 | | mg/L | |
| | | | Ethylbenzene | 2018/07/24 | <0.00040 | | mg/L | |
| | | | m & p-Xylene | 2018/07/24 | <0.00080 | | mg/L | |
| | | | o-Xylene | 2018/07/24 | <0.00040 | | mg/L | |
| | | | F1 (C6-C10) | 2018/07/24 | <0.10 | | mg/L | |
| 9075640 | JR1 | Method Blank | O-TERPHENYL (sur.) | 2018/07/27 | | 105 | % | 60 - 140 |
| | | | F2 (C10-C16 Hydrocarbons) | 2018/07/27 | <0.10 | | mg/L | |
| 9075659 | MRD | Method Blank | Dissolved Chloride (Cl) | 2018/07/25 | <1.0 | | mg/L | |
| 9075662 | MRD | Method Blank | Dissolved Sulphate (SO4) | 2018/07/25 | <1.0 | | mg/L | |
| 9075986 | MA4 | Method Blank | Alkalinity (Total as CaCO3) | 2018/07/24 | <1.0 | | mg/L | |
| | | | Alkalinity (PP as CaCO3) | 2018/07/24 | <1.0 | | mg/L | |
| | | | Bicarbonate (HCO3) | 2018/07/24 | <1.0 | | mg/L | |
| | | | Carbonate (CO3) | 2018/07/24 | <1.0 | | mg/L | |
| | | | Hydroxide (OH) | 2018/07/24 | <1.0 | | mg/L | |



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Maxxam Job #: B860419
Report Date: 2018/07/30

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT(CONT'D)

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| 9075987 | VFE | Method Blank | Total Dissolved Solids | 2018/07/25 | <10 | | mg/L | |
| 9075990 | MA4 | Method Blank | Conductivity | 2018/07/24 | <2.0 | | uS/cm | |
| 9076049 | VFE | Method Blank | Total Dissolved Solids | 2018/07/25 | <10 | | mg/L | |
| 9077928 | AF6 | Method Blank | Phenols | 2018/07/25 | <0.0020 | | mg/L | |
| 9077973 | APY | Method Blank | Dissolved Mercury (Hg) | 2018/07/25 | <0.0000020 | | mg/L | |
| 9074591 | MPX | RPD [TX3741-03] | Dissolved Nitrite (N) | 2018/07/23 | NC | | % | 20 |
| | | | Dissolved Nitrate (N) | 2018/07/23 | 0.51 | | % | 20 |
| 9075640 | JR1 | RPD [TX3741-01] | F2 (C10-C16 Hydrocarbons) | 2018/07/27 | NC | | % | 30 |
| 9074591 | MPX | Matrix Spike [TX3741-03] | Dissolved Nitrite (N) | 2018/07/23 | | 99 | % | 80 - 120 |
| | | | Dissolved Nitrate (N) | 2018/07/23 | | 101 | % | 80 - 120 |
| 9075640 | JR1 | Matrix Spike [TX3742-01] | O-TERPHENYL (sur.) | 2018/07/27 | | 97 | % | 60 - 140 |
| | | | F2 (C10-C16 Hydrocarbons) | 2018/07/27 | | 107 | % | 60 - 140 |
| 9074585 | JK9 | LCS | Dissolved Iron (Fe) | 2018/07/23 | | 101 | % | 80 - 120 |
| | | | Dissolved Lithium (Li) | 2018/07/23 | | 97 | % | 80 - 120 |
| | | | Dissolved Magnesium (Mg) | 2018/07/23 | | 103 | % | 80 - 120 |
| | | | Dissolved Manganese (Mn) | 2018/07/23 | | 99 | % | 80 - 120 |
| | | | Dissolved Potassium (K) | 2018/07/23 | | 103 | % | 80 - 120 |
| | | | Dissolved Sodium (Na) | 2018/07/23 | | 100 | % | 80 - 120 |
| | | | Dissolved Strontium (Sr) | 2018/07/23 | | 100 | % | 80 - 120 |
| | | | Dissolved Phosphorus (P) | 2018/07/23 | | 104 | % | 80 - 120 |
| | | | Dissolved Barium (Ba) | 2018/07/23 | | 102 | % | 80 - 120 |
| | | | Dissolved Silicon (Si) | 2018/07/23 | | 100 | % | 80 - 120 |
| | | | Dissolved Boron (B) | 2018/07/23 | | 102 | % | 80 - 120 |
| | | | Dissolved Calcium (Ca) | 2018/07/23 | | 97 | % | 80 - 120 |
| 9074591 | MPX | LCS | Dissolved Nitrite (N) | 2018/07/23 | | 99 | % | 80 - 120 |
| | | | Dissolved Nitrate (N) | 2018/07/23 | | 101 | % | 80 - 120 |
| 9074921 | APY | LCS | Dissolved Aluminum (Al) | 2018/07/23 | | 98 | % | 80 - 120 |
| | | | Dissolved Chromium (Cr) | 2018/07/23 | | 97 | % | 80 - 120 |
| | | | Dissolved Cobalt (Co) | 2018/07/23 | | 98 | % | 80 - 120 |
| | | | Dissolved Copper (Cu) | 2018/07/23 | | 99 | % | 80 - 120 |
| | | | Dissolved Lead (Pb) | 2018/07/23 | | 98 | % | 80 - 120 |
| | | | Dissolved Antimony (Sb) | 2018/07/23 | | 94 | % | 80 - 120 |
| | | | Dissolved Molybdenum (Mo) | 2018/07/23 | | 83 | % | 80 - 120 |
| | | | Dissolved Nickel (Ni) | 2018/07/23 | | 98 | % | 80 - 120 |
| | | | Dissolved Selenium (Se) | 2018/07/23 | | 93 | % | 80 - 120 |
| | | | Dissolved Silver (Ag) | 2018/07/23 | | 96 | % | 80 - 120 |
| | | | Dissolved Arsenic (As) | 2018/07/23 | | 93 | % | 80 - 120 |
| | | | Dissolved Thallium (Tl) | 2018/07/23 | | 99 | % | 80 - 120 |
| | | | Dissolved Tin (Sn) | 2018/07/23 | | 92 | % | 80 - 120 |
| | | | Dissolved Titanium (Ti) | 2018/07/23 | | 92 | % | 80 - 120 |
| | | | Dissolved Uranium (U) | 2018/07/23 | | 96 | % | 80 - 120 |
| | | | Dissolved Vanadium (V) | 2018/07/23 | | 98 | % | 80 - 120 |
| | | | Dissolved Zinc (Zn) | 2018/07/23 | | 98 | % | 80 - 120 |
| | | | Dissolved Beryllium (Be) | 2018/07/23 | | 96 | % | 80 - 120 |
| 9075493 | HP5 | LCS | 1,4-Difluorobenzene (sur.) | 2018/07/25 | | 94 | % | 50 - 140 |
| | | | 4-Bromofluorobenzene (sur.) | 2018/07/25 | | 101 | % | 50 - 140 |
| | | | D4-1,2-Dichloroethane (sur.) | 2018/07/25 | | 97 | % | 50 - 140 |
| | | | Benzene | 2018/07/25 | | 87 | % | 60 - 130 |
| | | | Toluene | 2018/07/25 | | 92 | % | 60 - 130 |
| | | | Ethylbenzene | 2018/07/25 | | 101 | % | 60 - 130 |
| | | | m & p-Xylene | 2018/07/25 | | 96 | % | 60 - 130 |



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Maxxam Job #: B860419
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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT(CONT'D)

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| | | | o-Xylene | 2018/07/25 | | 95 | % | 60 - 130 |
| | | | F1 (C6-C10) | 2018/07/25 | | 88 | % | 60 - 140 |
| 9075640 | JR1 | LCS | O-TERPHENYL (sur.) | 2018/07/27 | | 97 | % | 60 - 140 |
| | | | F2 (C10-C16 Hydrocarbons) | 2018/07/27 | | 108 | % | 60 - 140 |
| 9075659 | MRD | LCS | Dissolved Chloride (Cl) | 2018/07/25 | | 105 | % | 80 - 120 |
| 9075662 | MRD | LCS | Dissolved Sulphate (SO4) | 2018/07/25 | | 109 | % | 80 - 120 |
| 9075986 | MA4 | LCS | Alkalinity (Total as CaCO3) | 2018/07/24 | | 99 | % | 80 - 120 |
| 9075987 | VFE | LCS | Total Dissolved Solids | 2018/07/25 | | 102 | % | 80 - 120 |
| 9075990 | MA4 | LCS | Conductivity | 2018/07/24 | | 100 | % | 90 - 110 |
| 9076049 | VFE | LCS | Total Dissolved Solids | 2018/07/25 | | 102 | % | 80 - 120 |
| 9077928 | AF6 | LCS | Phenols | 2018/07/25 | | 85 | % | 80 - 120 |
| 9077973 | APY | LCS | Dissolved Mercury (Hg) | 2018/07/25 | | 108 | % | 80 - 120 |
| 9077973 | APY | SRM | Dissolved Mercury (Hg) | 2018/07/25 | | 103 | % | 80 - 120 |

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.

LCS: 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.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

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 (absolute difference <= 2x RDL).



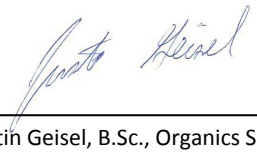
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Maxxam Job #: B860419
Report Date: 2018/07/30

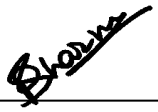
Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## VALIDATION SIGNATURE PAGE

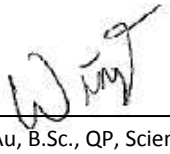
The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Justin Geisel, B.Sc., Organics Supervisor



Poonam Sharma, cCT, Organics Supervisor



Winnie Au, B.Sc., QP, 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.



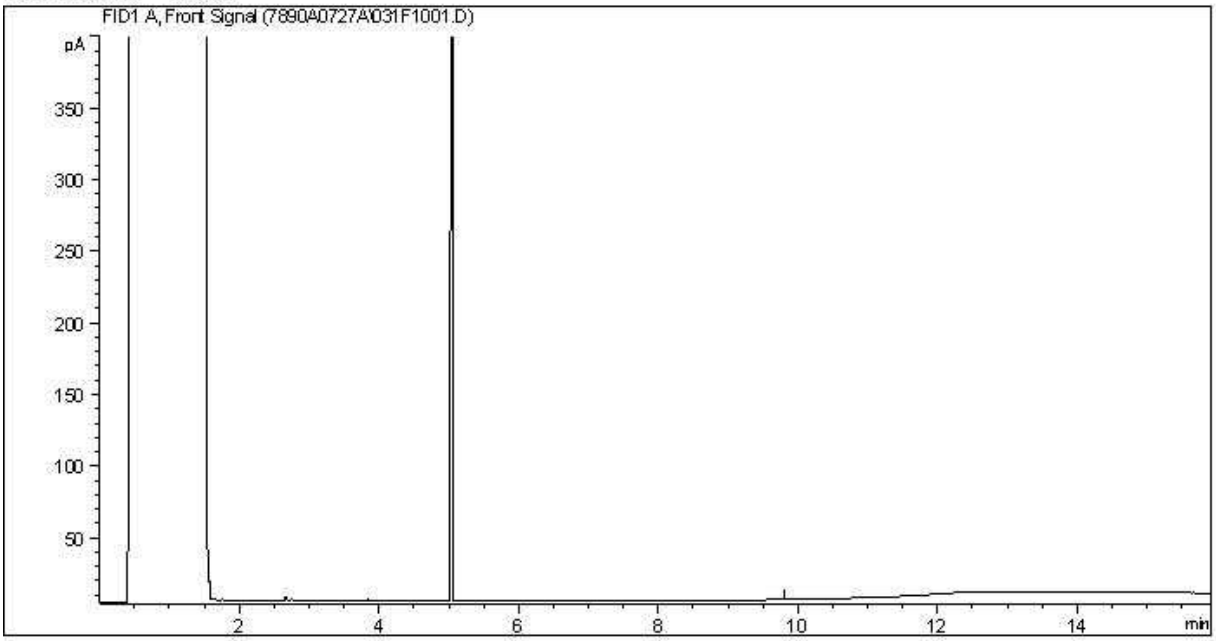
Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B860419
Report Date: 2018/07/30
Maxxam Sample: TX3741

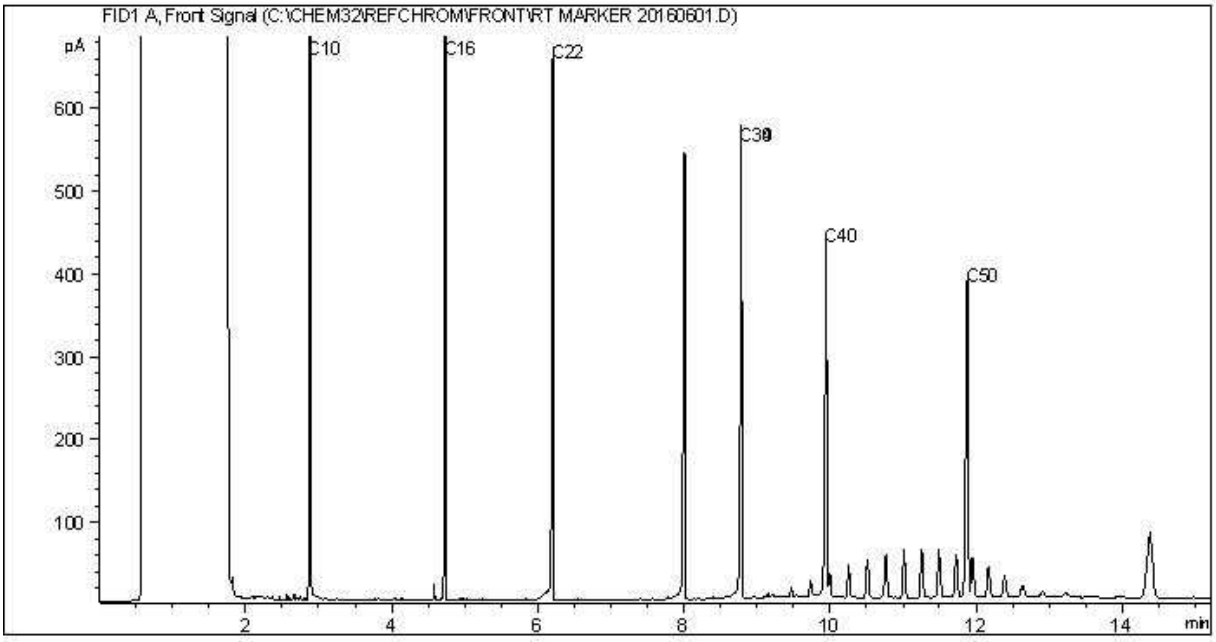
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: BIS 97-1-3

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890A




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

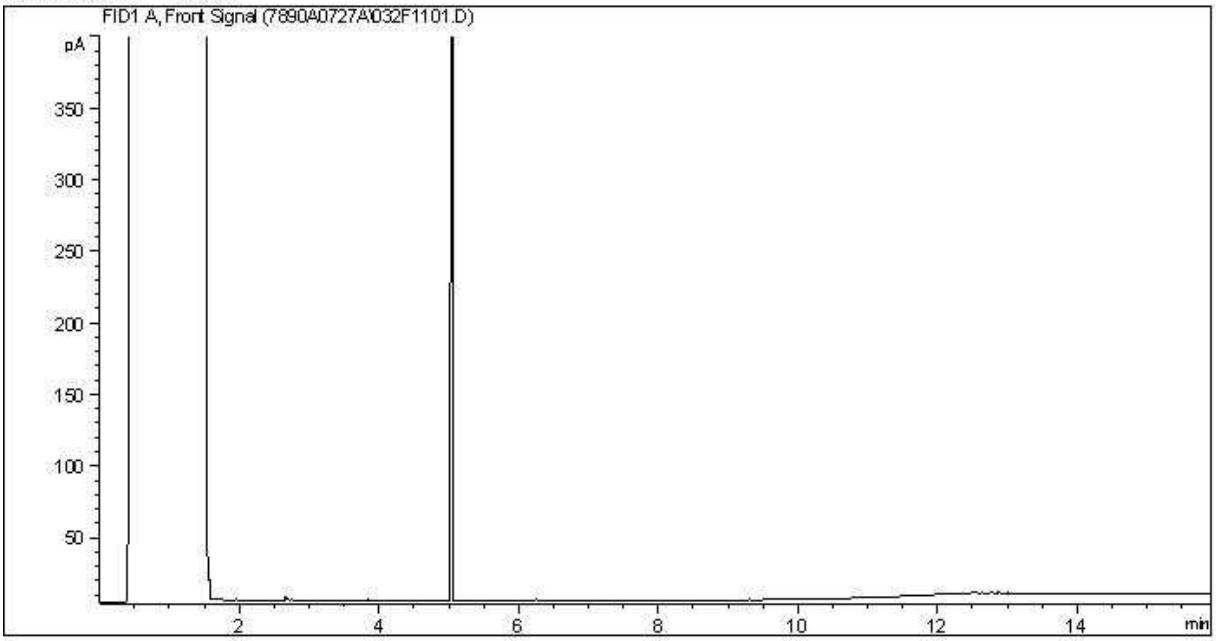
**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam Job #: B860419
Report Date: 2018/07/30
Maxxam Sample: TX3741 Lab-Dup

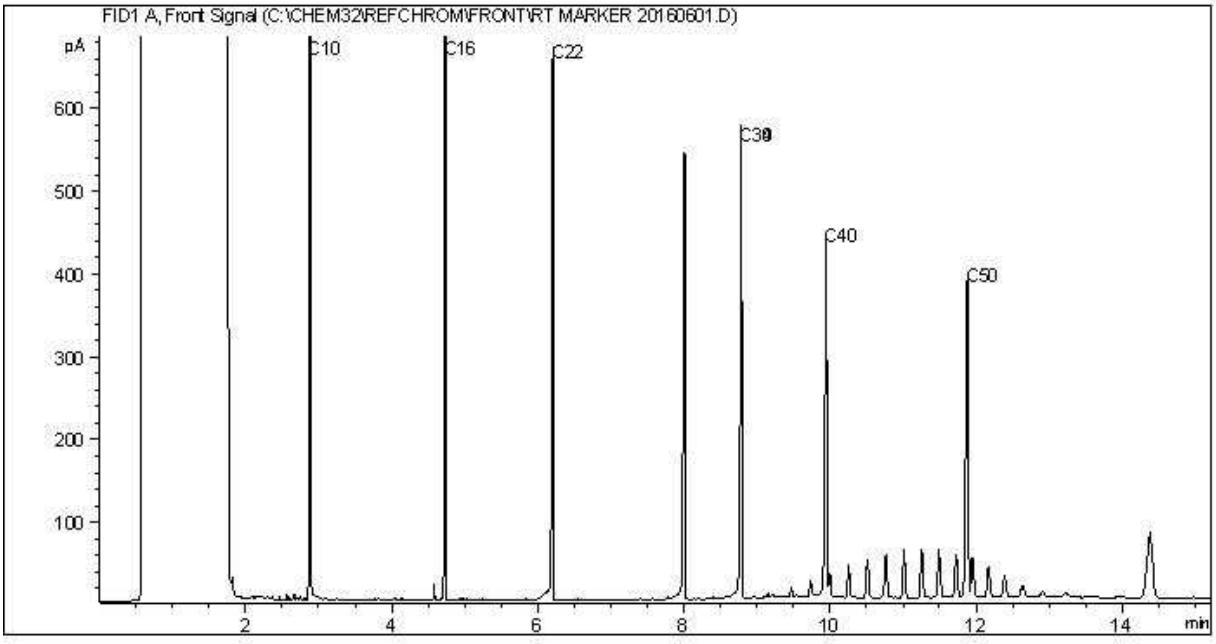
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: BIS 97-1-3

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890A




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

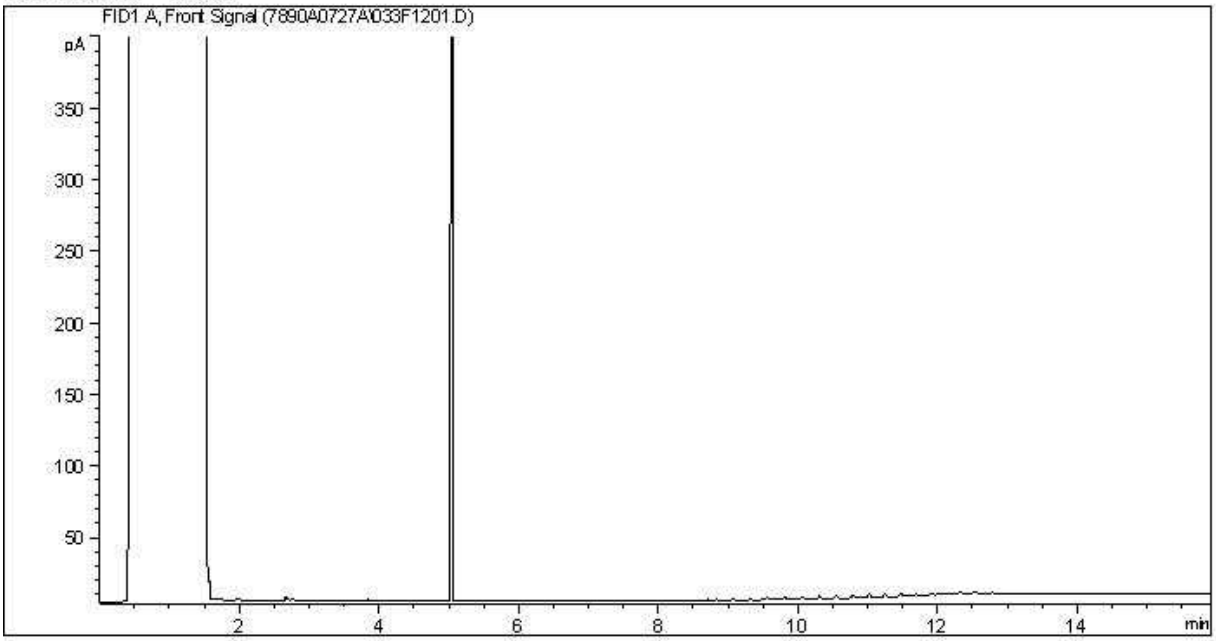
**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam Job #: B860419
Report Date: 2018/07/30
Maxxam Sample: TX3742

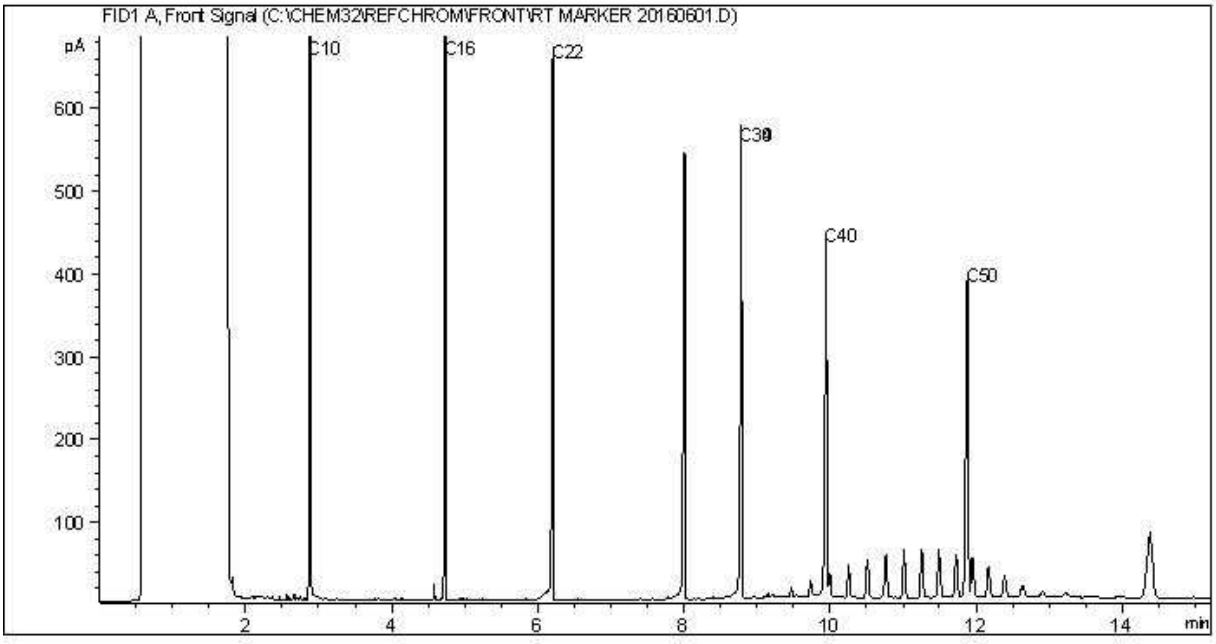
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: CPF 97-7-5

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890A




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

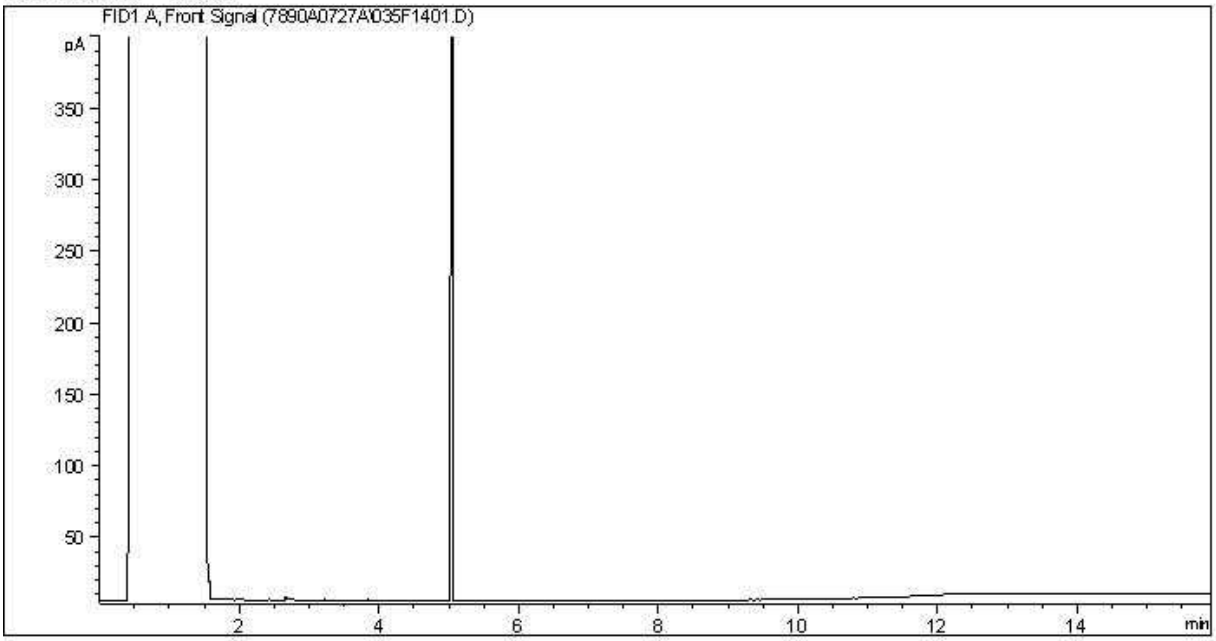
**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam Job #: B860419
Report Date: 2018/07/30
Maxxam Sample: TX3743

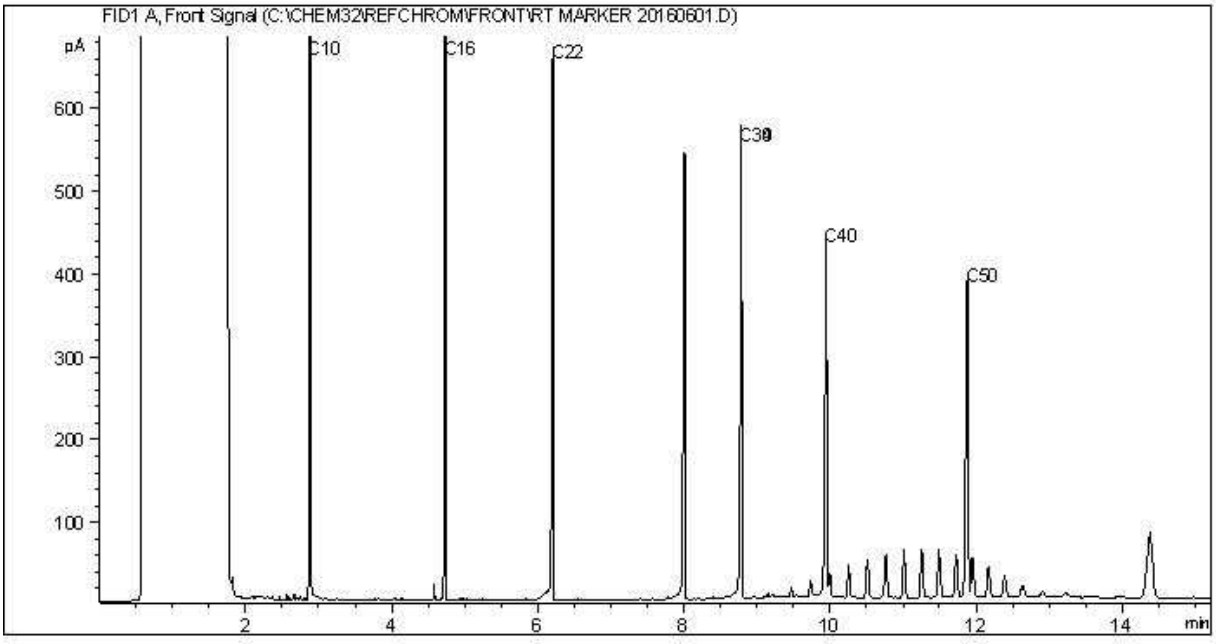
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: NWD 18-45

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890A




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

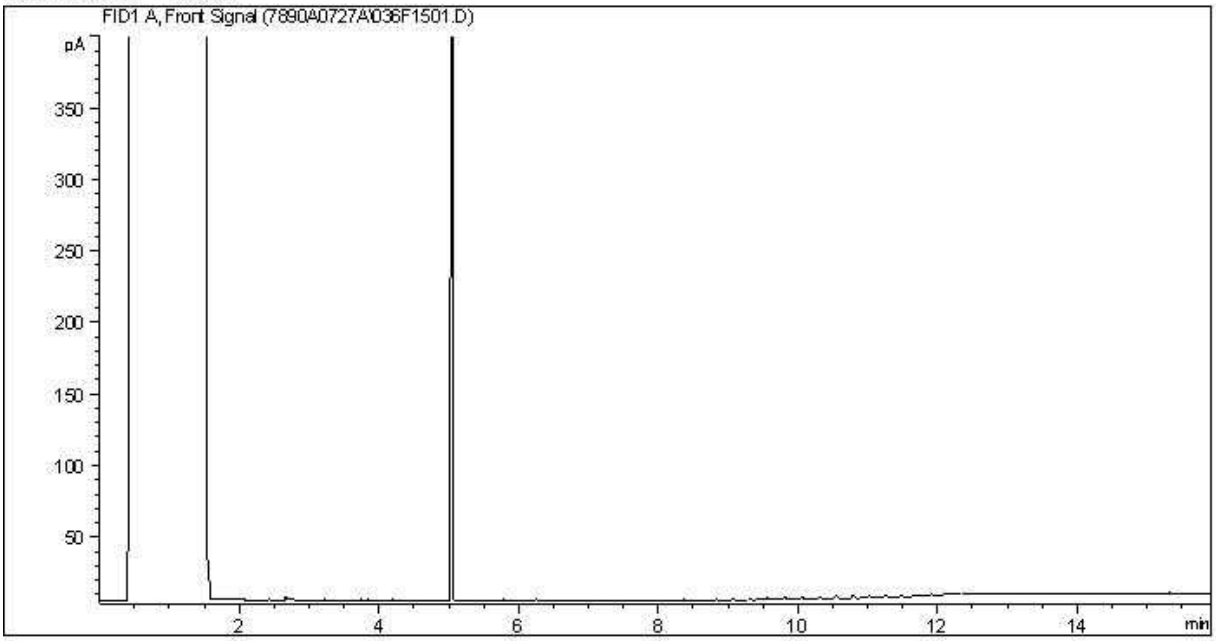
**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam Job #: B860419
Report Date: 2018/07/30
Maxxam Sample: TX3744

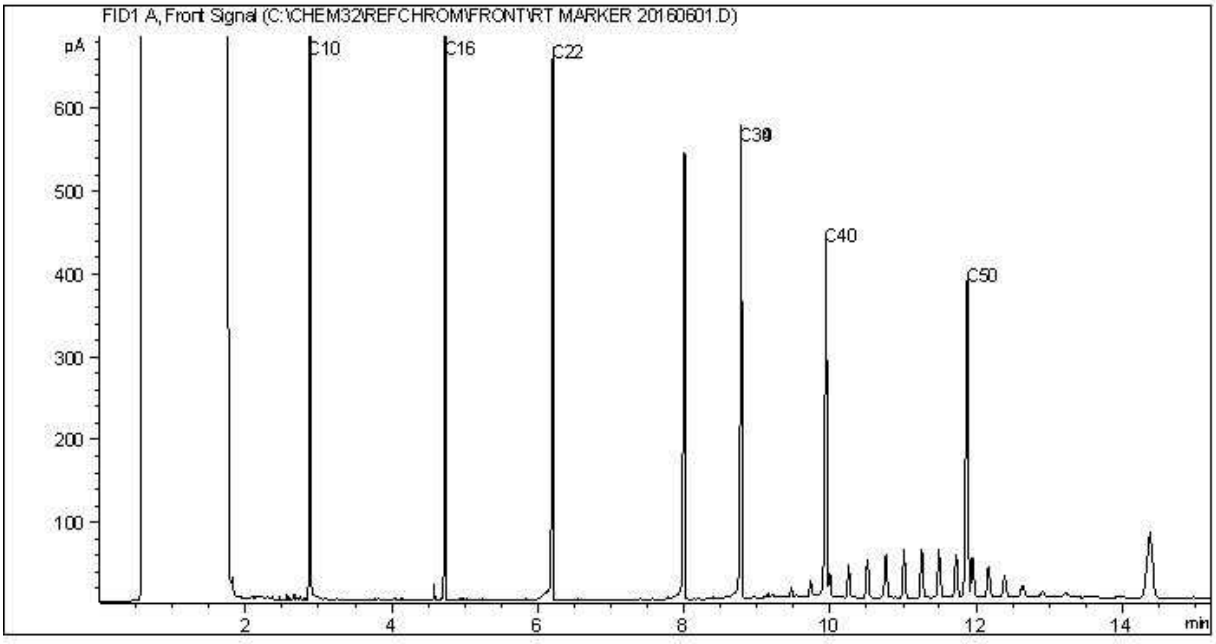
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: NWD 18-20

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890A




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

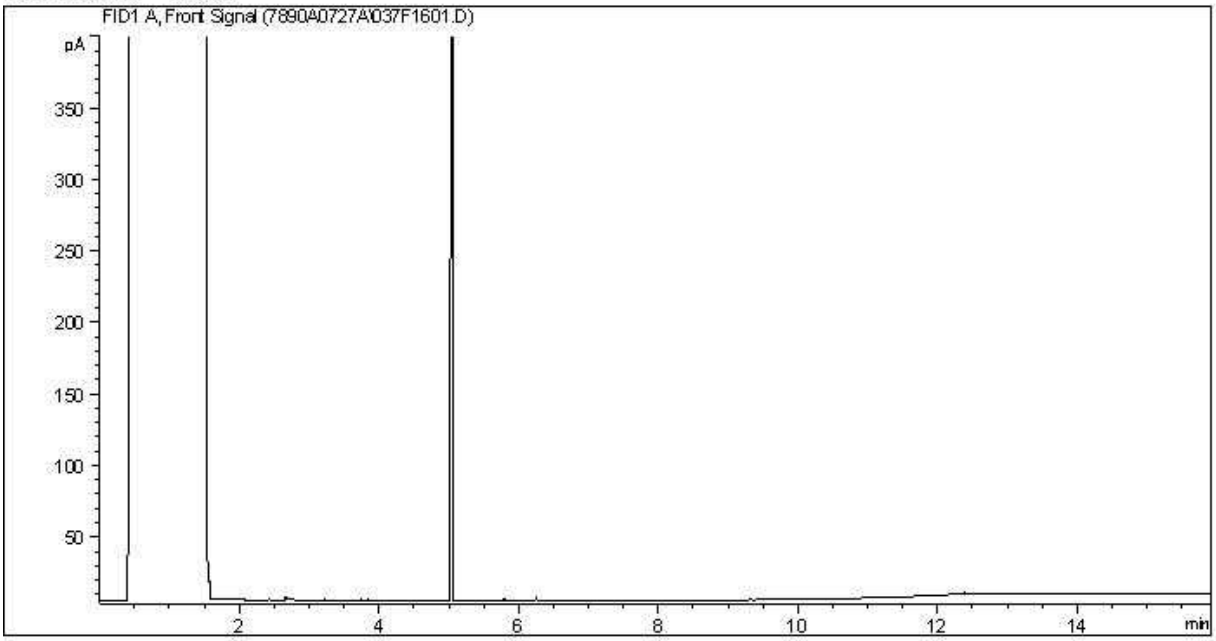
**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam Job #: B860419
Report Date: 2018/07/30
Maxxam Sample: TX3745

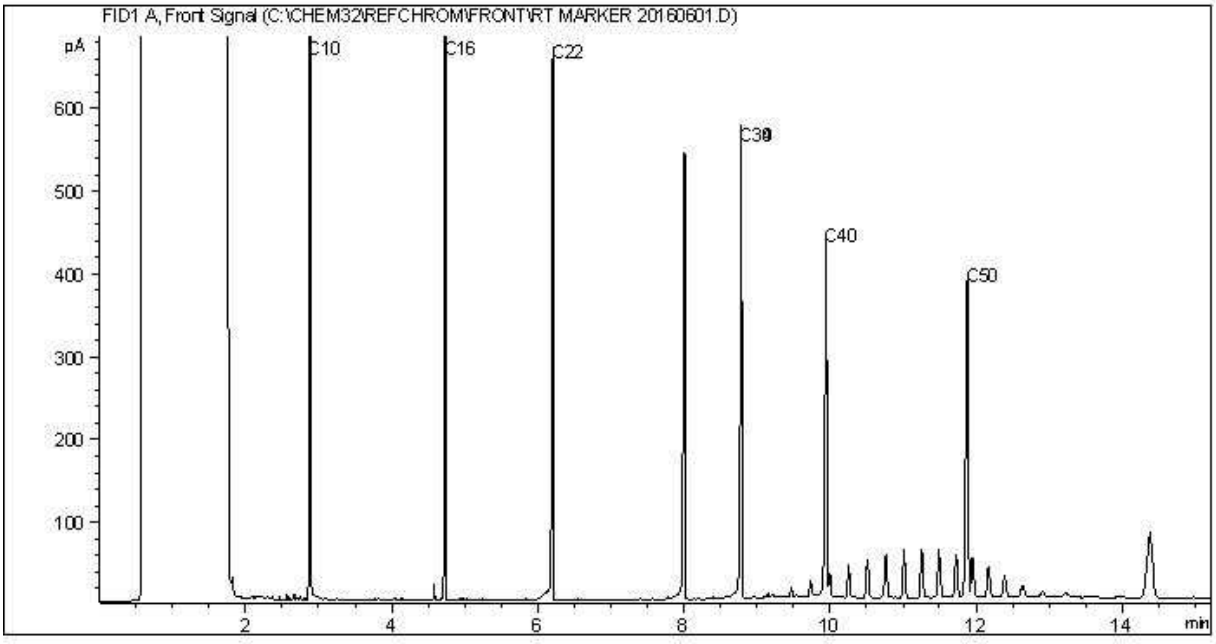
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: NWD 18-10

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890A




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam
A Bureau Veritas Group Company

☐ Calgary
4000 19th St. NE, T2E 6P8
Phone: (403) 291-3077
Fax: (403) 735-2240
Toll Free: (800) 386-7247

☑ Edmonton
9331 - 48 Street, T6B 2R4
Phone: (780) 577-7100
Fax: (780) 450-4187
Toll Free: (800) 386-7247

1205

# EXXON MOBIL/IMPERIAL OIL - MAXXAM CHAIN-OF-CUSTODY RECORD

Page 1 of 1

C of C # 298591

| INVOICE INFORMATION | REPORT INFORMATION |
|---|---|
| Company Name: ☒ Imperial Oil ☐ ExxonMobil | Company Name: WorleyParsons |
| Contact Name: WorleyParsons | Contact Name: Stacy Gibb |
| Address: 500, 151 Canada Olympic Rd SW Calgary, AB T3B 6B7 | Address: 500, 151 Canada Olympic Rd SW Calgary, AB T3B 6B7 |
| Email: Sanj.perera@advisian.com | Email: stacy.gibb@advisian.com |
| Ph: 587-952-1490 | Ph: 587-952-1461 |
| Sampler Name (Print): Michelle Vokaty, Melanie Jones | Consultant Project #: 00586-400 407011- |

ANALYSIS REQUESTED

| FIELD SAMPLE ID | MATRIX: GROUND WATER | SURFACE WATER | SOIL | OTHER | # CONTAINERS | SAMPLING: DATE (YYYY/MM/DD) | TIME (24 HR) | FIELD FILTERED & PRESERVED | LAB FILTRATION REQUIRED | VOC | PAH | PHCs (FRACTIONS 1-2 PLUS BTEX) | PHCs (FRACTIONS 1-4 PLUS BTEX) | PHCs (FRACTIONS 2-4) | PHCs (FRACTION 1 PLUS BTEX) | GRAIN SIZE (75 MICRON) | TEXTURE (% SAND, SILT, CLAY) | PARTICLE SIZE DISTRIBUTION WITH GRAPH | REGULATED METALS TOT ☐ DIS ☒ | MERCURY TOTAL ☐ DISSOLVED ☒ | SALINITY SOIL | FERTILIZER SOIL | FERTILIZER WATER | NUTRIENTS SOIL | ROUTINE POTABILITY | pH ☐ EC ☐ ALKALINITY ☐ | BASIC CLASS II LANDFILL PKG | Phenols by 4AAP | Bubbles in BTEX vials | Limited sample/missing bottle(s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 BIS 97-1-3 | X | | | | 10 | 2018/07/20 | 13:20 | X | | | | X | | | | | | | X | X | | | | | X | | | X | | | |
| 2 CPF 97-7-5 | X | | | | 10 | | 15:40 | X | | | | X | | | | | | | X | X | | | | | X | | | X | | | |
| 3 NWD 18-45 | X | | | | 10 | | 15:50 | X | | | | X | | | | | | | X | X | | | | | X | | | X | | | |
| 4 NWD 18-20 | | | | X | 5 | | 15:45 | | | | | X | | | | | | | | | | | | | | | | | | | |
| 5 NWD 18-10 | | | | X | 4 | ↓ | 17:00 | | | | | X | | | | | | | | | | | | | | | | | X | X | |
| 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

IOL SITE LOCATION: Norman Wells, NT

IOL PROJECT # (if applicable): N/A

MAXXAM TASK ORDER # OR SERVICE ORDER # + LINE ITEM: 00586-400 407011-

REGULATORY CRITERIA / DETECTION LIMITS:
☐ Alberta Tier 1 ☐ CDWG
☐ SEQG (SK) ☐ NoSC (SK)
☒ CCME (incl. level) FAL ☐ Other

SPECIAL INSTRUCTIONS:
also email
- Standard Norman Wells list
- melissa.lord@advisian.com

IES A2601436

# JARS USED & NOT SUBMITTED (Enter N/A for Water): N/A

TURNAROUND TIME
Standard (5 days) ☒
Rush (3 days) ☐
(2 days) ☐
(1 day) ☐
(same day) ☐
Date Required

| | YES | NO | COOLER ID # | TEMP °C | 1 | 2 | 3 |
|---|---|---|---|---|---|---|---|
| SEAL PRESENT | / | | | | | | |
| SEAL INTACT | / | | | | | | |
| COOLING MEDIA PRESENT | / | | | | | | |

| | YES | NO | COOLER ID # | TEMP °C | 1 | 2 | 3 |
|---|---|---|---|---|---|---|---|
| SEAL PRESENT | | | | | | | |
| SEAL INTACT | | | | | | | |
| COOLING MEDIA PRESENT | | | | | | | |

| | YES | NO | COOLER ID # | TEMP °C | 1 | 2 | 3 |
|---|---|---|---|---|---|---|---|
| SEAL PRESENT | | | | | | | |
| SEAL INTACT | | | | | | | |
| COOLING MEDIA PRESENT | | | | | | | |

| RELINQUISHED BY: | | DATE: | TIME (24 HR) | RECEIVED BY: | DATE: | TIME (24 HR) |
|---|---|---|---|---|---|---|
| 1. | Melissa Lord | 2018/07/21 | 08:00 | 1. | 2018/07/22 | 11:35 |
| 2. | | | | 2. | | |
| 3. | | | | 3. | | |

LAB USE ONLY
MAXXAM JOB # B860419
SAMPLES
LABELED BY: DW2
VERIFIED BY: RBE

COC-1010 (06/2016) IOL-AB

White: Maxxam Yellow: Client

# DATA QUALITY REVIEW CHECKLIST - IMPERIAL OIL PROJECTS

Consultant: Advisian | Sampling Date: 22-Jul-18

Location: Norman Wells | Laboratory : Maxxam Edmonton

Consultant Project Number: 407011-00586-400 | Sample Submission Number: B861140

Are All Laboratory QC Within Acceptance Criteria (Yes, No, Not Applicable)?

| | Yes | No | NA | Comments |
|---|---|---|---|---|
| Instrument Surrogate Recovery | x | | | All laboratory QC met acceptance criteria. |
| Extraction Surrogate Recovery | x | | | |
| Method Blank Concentration | x | | | |
| Matrix Duplicate RPD | x | | | |
| Matrix Spike Recovery | x | | | |
| Lab Control Sample Recovery | x | | | |

Are All Field QC Samples Within Alert Limits (Yes, No, Not Applicable)?

| | Yes | No | NA | Comments |
|---|---|---|---|---|
| Field Blank Concentration | | | x | No field QC samples submitted. |
| Trip Blank Concentration | | | x | |
| Equipment Blank Concentration | | | x | |
| Field Duplicate RPD | | | x | |

| | |
|---|---|
| Has CoA been signed off (Yes/No)?: | Yes |
| Has lab warranted all tests were analyzed following SOP's in CoA (Yes/No)?: | Yes |
| Were all samples analyzed within hold times (Yes/No)?: | Yes |
| All volatiles samples methanol extracted (if required) within 48 hours (Yes/No)?: | n/a |
| Is Chain of Custody completed and signed (Yes/No)?: | Yes |
| Were sample temperatures acceptable when they reached lab (Yes/No)?: | Yes |

| | |
|---|---|
| Was a Data Quality Overview (DQO) issued (Yes/No)?: | No |
| Date DQO was received: | n/a |

Is data considered to be reliable (Yes/No)?: Yes

If answer is "No", describe and provide rationale:

Data Reviewed by (Print): Vivian Baptista | Data Reviewed by (Signature): 

Date: 23-Aug-18

Maxxam
A Bureau Veritas Group Company

Success Through Science®

Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400
Your C.O.C. #: 299260

**Attention: Stacy Gibb**

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

**Report Date: 2018/07/31**
Report #: R2597178
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B861140**
**Received: 2018/07/24, 09:35**

Sample Matrix: Water
# Samples Received: 1

| Analyses | Quantity | Laboratory Method | Primary Reference |
|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | 1 | AB SOP-00005 | SM 22 2320 B m |
| BTEX/F1 in Water by HS GC/MS/FID | 1 | AB SOP-00039 | CCME CWS/EPA 8260d m |
| F1-BTEX | 1 | AB SOP-00039 | Auto Calc |
| Cadmium - low level CCME - Dissolved | 1 | AB WI-00065 | Auto Calc |
| Chloride by Automated Colourimetry | 1 | AB SOP-00020 | SM 22 4500-Cl-E m |
| Conductivity @25C | 1 | AB SOP-00005 | SM 22 2510 B m |
| CCME Hydrocarbons in Water (F2; C10-C16) (1) | 1 | AB SOP-00037 / AB SOP-00040 | CCME PHC-CWS m |
| Hardness | 1 | AB WI-00065 | Auto Calc |
| Mercury - Low Level (Dissolved) (2) | 1 | EENVSOP-00031 | EPA 245.7 R2 m |
| Elements by ICP - Dissolved (2) | 1 | AB SOP-00042 | EPA 6010d R4 m |
| Elements by ICPMS - Dissolved (2) | 1 | AB SOP-00043 | EPA 6020b R2 m |
| Ion Balance | 1 | AB WI-00065 | Auto Calc |
| Nitrate and Nitrite | 1 | AB WI-00065 | Auto Calc |
| Nitrate + Nitrite-N (calculated) | 1 | AB WI-00065 | Auto Calc |
| Nitrogen (Nitrite - Nitrate) by IC | 1 | AB SOP-00023 | SM 23 4110 B m |
| Phenols (4-AAP) | 1 | EENVSOP-00061 | MMCW 154 1996 m |
| Sulphate by Automated Colourimetry | 1 | AB SOP-00018 | SM 22 4500-SO4 E m |
| Total Dissolved Solids (Filt. Residue) | 1 | AB SOP-00065 | SM 22 2540 C m |

**Remarks:**

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. All samples were analyzed within hold time unless otherwise flagged.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.



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

Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400
Your C.O.C. #: 299260

**Attention: Stacy Gibb**

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

**Report Date: 2018/07/31**
Report #: R2597178
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B861140**
**Received: 2018/07/24, 09:35**

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
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) Silica gel clean up employed.
(2) Dissolved > Total Imbalance: Whenever applicable, Dissolved >Total for any parameter that falls within method uncertainty for duplicates is likely equivalent. If RPD is >20% samples were reanalyzed and confirmed.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Jenna Chernuka, Project Manager
Email: JChernuka@maxxam.ca
Phone# (780)577-7178
==========
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.


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Maxxam Job #: B861140
Report Date: 2018/07/31

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## AT1 BTEX AND F1-F2 IN WATER (WATER)

| | | | | |
|---|---|---|---|---|
| Maxxam ID | | TX7223 | | |
| Sampling Date | | 2018/07/22 09:30 | | |
| COC Number | | 299260 | | |
| | **UNITS** | **CPF 98-8-3** | **RDL** | **QC Batch** |
| **Ext. Pet. Hydrocarbon** | | | | |
| F2 (C10-C16 Hydrocarbons) | mg/L | <0.10 | 0.10 | 9077691 |
| **Volatiles** | | | | |
| Benzene | mg/L | <0.00040 | 0.00040 | 9078012 |
| Toluene | mg/L | <0.00040 | 0.00040 | 9078012 |
| Ethylbenzene | mg/L | <0.00040 | 0.00040 | 9078012 |
| m & p-Xylene | mg/L | <0.00080 | 0.00080 | 9078012 |
| o-Xylene | mg/L | <0.00040 | 0.00040 | 9078012 |
| Xylenes (Total) | mg/L | <0.00089 | 0.00089 | 9076190 |
| F1 (C6-C10) - BTEX | mg/L | <0.10 | 0.10 | 9076190 |
| F1 (C6-C10) | mg/L | <0.10 | 0.10 | 9078012 |
| **Extraction Surrogate Recovery (%)** | | | | |
| O-TERPHENYL (sur.) | % | 91 | | 9077691 |
| **Instrument Surrogate Recovery (%)** | | | | |
| 1,4-Difluorobenzene (sur.) | % | 101 | | 9078012 |
| 4-Bromofluorobenzene (sur.) | % | 99 | | 9078012 |
| D4-1,2-Dichloroethane (sur.) | % | 99 | | 9078012 |
| 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 #: B861140
Report Date: 2018/07/31

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## REGULATED METALS INCLUDING MERCURY-DISS (WATER)

| Maxxam ID | | TX7223 | | | TX7223 | | |
|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/07/22 09:30 | | | 2018/07/22 09:30 | | |
| COC Number | | 299260 | | | 299260 | | |
| | **UNITS** | **CPF 98-8-3** | **RDL** | **QC Batch** | **CPF 98-8-3 Lab-Dup** | **RDL** | **QC Batch** |
| **Low Level Elements** | | | | | | | |
| Dissolved Cadmium (Cd) | mg/L | 0.000022 | 0.000020 | 9076528 | | | |
| **Elements** | | | | | | | |
| Dissolved Aluminum (Al) | mg/L | 0.032 | 0.0030 | 9078097 | | | |
| Dissolved Antimony (Sb) | mg/L | <0.00060 | 0.00060 | 9078097 | | | |
| Dissolved Arsenic (As) | mg/L | 0.00040 | 0.00020 | 9078097 | | | |
| Dissolved Barium (Ba) | mg/L | 0.15 | 0.010 | 9080092 | 0.15 | 0.010 | 9080092 |
| Dissolved Beryllium (Be) | mg/L | <0.0010 | 0.0010 | 9078097 | | | |
| Dissolved Boron (B) | mg/L | 0.022 | 0.020 | 9080092 | 0.022 | 0.020 | 9080092 |
| Dissolved Calcium (Ca) | mg/L | 150 | 0.30 | 9080092 | 150 | 0.30 | 9080092 |
| Dissolved Chromium (Cr) | mg/L | <0.0010 | 0.0010 | 9078097 | | | |
| Dissolved Cobalt (Co) | mg/L | 0.0011 | 0.00030 | 9078097 | | | |
| Dissolved Copper (Cu) | mg/L | 0.00086 | 0.00020 | 9078097 | | | |
| Dissolved Iron (Fe) | mg/L | 0.21 | 0.060 | 9080092 | 0.21 | 0.060 | 9080092 |
| Dissolved Lead (Pb) | mg/L | 0.00024 | 0.00020 | 9078097 | | | |
| Dissolved Lithium (Li) | mg/L | <0.020 | 0.020 | 9080092 | <0.020 | 0.020 | 9080092 |
| Dissolved Magnesium (Mg) | mg/L | 28 | 0.20 | 9080092 | 28 | 0.20 | 9080092 |
| Dissolved Manganese (Mn) | mg/L | 0.87 | 0.0040 | 9080092 | 0.87 | 0.0040 | 9080092 |
| Dissolved Molybdenum (Mo) | mg/L | 0.0012 | 0.00020 | 9078097 | | | |
| Dissolved Nickel (Ni) | mg/L | 0.0026 | 0.00050 | 9078097 | | | |
| Dissolved Phosphorus (P) | mg/L | <0.10 | 0.10 | 9080092 | <0.10 | 0.10 | 9080092 |
| Dissolved Potassium (K) | mg/L | 2.2 | 0.30 | 9080092 | 2.2 | 0.30 | 9080092 |
| Dissolved Selenium (Se) | mg/L | 0.00046 | 0.00020 | 9078097 | | | |
| Dissolved Silicon (Si) | mg/L | 3.3 | 0.10 | 9080092 | 3.3 | 0.10 | 9080092 |
| Dissolved Silver (Ag) | mg/L | <0.00010 | 0.00010 | 9078097 | | | |
| Dissolved Sodium (Na) | mg/L | 9.6 | 0.50 | 9080092 | 9.6 | 0.50 | 9080092 |
| Dissolved Strontium (Sr) | mg/L | 0.53 | 0.020 | 9080092 | 0.53 | 0.020 | 9080092 |
| Dissolved Sulphur (S) | mg/L | 76 | 0.20 | 9080092 | 76 | 0.20 | 9080092 |
| Dissolved Thallium (Tl) | mg/L | <0.00020 | 0.00020 | 9078097 | | | |
| Dissolved Tin (Sn) | mg/L | <0.0010 | 0.0010 | 9078097 | | | |

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate



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Maxxam Job #: B861140
Report Date: 2018/07/31

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## REGULATED METALS INCLUDING MERCURY-DISS (WATER)

| Maxxam ID | | TX7223 | | | TX7223 | | |
|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/07/22 09:30 | | | 2018/07/22 09:30 | | |
| COC Number | | 299260 | | | 299260 | | |
| | **UNITS** | **CPF 98-8-3** | **RDL** | **QC Batch** | **CPF 98-8-3 Lab-Dup** | **RDL** | **QC Batch** |
| Dissolved Titanium (Ti) | mg/L | <0.0010 | 0.0010 | 9078097 | | | |
| Dissolved Uranium (U) | mg/L | 0.00033 | 0.00010 | 9078097 | | | |
| Dissolved Vanadium (V) | mg/L | <0.0010 | 0.0010 | 9078097 | | | |
| Dissolved Zinc (Zn) | mg/L | 0.013 | 0.0030 | 9078097 | | | |
| **Low Level Elements** | | | | | | | |
| Dissolved Mercury (Hg) | mg/L | <0.0000020 | 0.0000020 | 9077973 | | | |

RDL = Reportable Detection Limit
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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## RESULTS OF CHEMICAL ANALYSES OF WATER

| Maxxam ID | | TX7223 | | | TX7223 | | |
|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/07/22 09:30 | | | 2018/07/22 09:30 | | |
| COC Number | | 299260 | | | 299260 | | |
| | **UNITS** | **CPF 98-8-3** | **RDL** | **QC Batch** | **CPF 98-8-3 Lab-Dup** | **RDL** | **QC Batch** |
| **Calculated Parameters** | | | | | | | |
| Hardness (CaCO3) | mg/L | 490 | 0.50 | 9075886 | | | |
| Ion Balance (% Difference) | % | 1.9 | N/A | 9075887 | | | |
| Dissolved Nitrate (NO3) | mg/L | <0.044 | 0.044 | 9075889 | | | |
| Nitrate plus Nitrite (N) | mg/L | <0.014 | 0.014 | 9076933 | | | |
| Dissolved Nitrite (NO2) | mg/L | <0.033 | 0.033 | 9075889 | | | |
| **Misc. Inorganics** | | | | | | | |
| Conductivity | uS/cm | 920 | 2.0 | 9078342 | | | |
| Total Dissolved Solids | mg/L | 680 (1) | 25 | 9077757 | | | |
| **Anions** | | | | | | | |
| Alkalinity (PP as CaCO3) | mg/L | <1.0 | 1.0 | 9078339 | | | |
| Alkalinity (Total as CaCO3) | mg/L | 270 | 1.0 | 9078339 | | | |
| Bicarbonate (HCO3) | mg/L | 330 | 1.0 | 9078339 | | | |
| Carbonate (CO3) | mg/L | <1.0 | 1.0 | 9078339 | | | |
| Hydroxide (OH) | mg/L | <1.0 | 1.0 | 9078339 | | | |
| Dissolved Sulphate (SO4) | mg/L | 240 (2) | 5.0 | 9080926 | | | |
| Dissolved Chloride (Cl) | mg/L | 6.8 | 1.0 | 9080923 | | | |
| **Nutrients** | | | | | | | |
| Dissolved Nitrite (N) | mg/L | <0.010 | 0.010 | 9078506 | <0.010 | 0.010 | 9078506 |
| Dissolved Nitrate (N) | mg/L | <0.010 | 0.010 | 9078506 | <0.010 | 0.010 | 9078506 |
| **Misc. Organics** | | | | | | | |
| Phenols | mg/L | 0.0052 | 0.0020 | 9080190 | | | |

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Detection limit raised based on sample volume used for analysis.
(2) Detection limits raised due to dilution to bring analyte within the calibrated range.



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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## TEST SUMMARY

**Maxxam ID:** TX7223
**Sample ID:** CPF 98-8-3
**Matrix:** Water

**Collected:** 2018/07/22
**Relinquished:** 2018/07/23
**Received:** 2018/07/24

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | AT/ALK | 9078339 | N/A | 2018/07/25 | Malina Alamyar |
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9078012 | N/A | 2018/07/26 | Adriana Munoz |
| F1-BTEX | CALC/MS | 9076190 | N/A | 2018/07/26 | Automated Statchk |
| Cadmium - low level CCME - Dissolved | CALC/MS | 9076528 | N/A | 2018/07/25 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 9080923 | N/A | 2018/07/27 | Marissa Richard |
| Conductivity @25C | COND | 9078342 | N/A | 2018/07/25 | Malina Alamyar |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9077691 | 2018/07/26 | 2018/07/28 | Shamsuddin Khairuddin |
| Hardness | CALC | 9075886 | N/A | 2018/07/26 | Automated Statchk |
| Mercury - Low Level (Dissolved) | CV/AF | 9077973 | 2018/07/25 | 2018/07/25 | Andrew Payne |
| Elements by ICP - Dissolved | ICPA | 9080092 | N/A | 2018/07/26 | Jonathan Kuprowsky |
| Elements by ICPMS - Dissolved | ICPM | 9078097 | N/A | 2018/07/25 | Jonathan Kuprowsky |
| Ion Balance | CALC | 9075887 | N/A | 2018/07/25 | Automated Statchk |
| Nitrate and Nitrite | CALC | 9075889 | N/A | 2018/07/26 | Automated Statchk |
| Nitrate + Nitrite-N (calculated) | CALC | 9076933 | N/A | 2018/07/26 | Automated Statchk |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9078506 | N/A | 2018/07/25 | Mahesh Ranjan |
| Phenols (4-AAP) | TECH/4AAP | 9080190 | N/A | 2018/07/26 | Ying Yang |
| Sulphate by Automated Colourimetry | KONE | 9080926 | N/A | 2018/07/27 | Marissa Richard |
| Total Dissolved Solids (Filt. Residue) | BAL | 9077757 | 2018/07/25 | 2018/07/26 | Victoria Fedorak |

**Maxxam ID:** TX7223 Dup
**Sample ID:** CPF 98-8-3
**Matrix:** Water

**Collected:** 2018/07/22
**Relinquished:** 2018/07/23
**Received:** 2018/07/24

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Elements by ICP - Dissolved | ICPA | 9080092 | N/A | 2018/07/26 | Jonathan Kuprowsky |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9078506 | N/A | 2018/07/25 | Mahesh Ranjan |



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Advisian
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Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## GENERAL COMMENTS

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

| | |
|---|---|
| Package 1 | 4.0°C |

**Results relate only to the items tested.**



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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| 9077691 | SKH | Method Blank | O-TERPHENYL (sur.) | 2018/07/28 | | 91 | % | 60 - 140 |
| | | | F2 (C10-C16 Hydrocarbons) | 2018/07/28 | <0.10 | | mg/L | |
| 9077757 | VFE | Method Blank | Total Dissolved Solids | 2018/07/26 | <10 | | mg/L | |
| 9077973 | APY | Method Blank | Dissolved Mercury (Hg) | 2018/07/25 | <0.0000020 | | mg/L | |
| 9078012 | AMJ | Method Blank | 1,4-Difluorobenzene (sur.) | 2018/07/26 | | 102 | % | 50 - 140 |
| | | | 4-Bromofluorobenzene (sur.) | 2018/07/26 | | 101 | % | 50 - 140 |
| | | | D4-1,2-Dichloroethane (sur.) | 2018/07/26 | | 99 | % | 50 - 140 |
| | | | Benzene | 2018/07/26 | <0.00040 | | mg/L | |
| | | | Toluene | 2018/07/26 | <0.00040 | | mg/L | |
| | | | Ethylbenzene | 2018/07/26 | <0.00040 | | mg/L | |
| | | | m & p-Xylene | 2018/07/26 | <0.00080 | | mg/L | |
| | | | o-Xylene | 2018/07/26 | <0.00040 | | mg/L | |
| | | | F1 (C6-C10) | 2018/07/26 | <0.10 | | mg/L | |
| 9078097 | JK9 | Method Blank | Dissolved Aluminum (Al) | 2018/07/25 | <0.0030 | | mg/L | |
| | | | Dissolved Chromium (Cr) | 2018/07/25 | <0.0010 | | mg/L | |
| | | | Dissolved Cobalt (Co) | 2018/07/25 | <0.00030 | | mg/L | |
| | | | Dissolved Copper (Cu) | 2018/07/25 | <0.00020 | | mg/L | |
| | | | Dissolved Lead (Pb) | 2018/07/25 | <0.00020 | | mg/L | |
| | | | Dissolved Antimony (Sb) | 2018/07/25 | <0.00060 | | mg/L | |
| | | | Dissolved Molybdenum (Mo) | 2018/07/25 | <0.00020 | | mg/L | |
| | | | Dissolved Nickel (Ni) | 2018/07/25 | <0.00050 | | mg/L | |
| | | | Dissolved Selenium (Se) | 2018/07/25 | <0.00020 | | mg/L | |
| | | | Dissolved Silver (Ag) | 2018/07/25 | <0.00010 | | mg/L | |
| | | | Dissolved Arsenic (As) | 2018/07/25 | <0.00020 | | mg/L | |
| | | | Dissolved Thallium (Tl) | 2018/07/25 | <0.00020 | | mg/L | |
| | | | Dissolved Tin (Sn) | 2018/07/25 | <0.0010 | | mg/L | |
| | | | Dissolved Titanium (Ti) | 2018/07/25 | <0.0010 | | mg/L | |
| | | | Dissolved Uranium (U) | 2018/07/25 | <0.00010 | | mg/L | |
| | | | Dissolved Vanadium (V) | 2018/07/25 | <0.0010 | | mg/L | |
| | | | Dissolved Zinc (Zn) | 2018/07/25 | <0.0030 | | mg/L | |
| | | | Dissolved Beryllium (Be) | 2018/07/25 | <0.0010 | | mg/L | |
| 9078339 | MA4 | Method Blank | Alkalinity (Total as CaCO3) | 2018/07/25 | <1.0 | | mg/L | |
| | | | Alkalinity (PP as CaCO3) | 2018/07/25 | <1.0 | | mg/L | |
| | | | Bicarbonate (HCO3) | 2018/07/25 | <1.0 | | mg/L | |
| | | | Carbonate (CO3) | 2018/07/25 | <1.0 | | mg/L | |
| | | | Hydroxide (OH) | 2018/07/25 | <1.0 | | mg/L | |
| 9078342 | MA4 | Method Blank | Conductivity | 2018/07/25 | <2.0 | | uS/cm | |
| 9078506 | MSD | Method Blank | Dissolved Nitrite (N) | 2018/07/25 | <0.010 | | mg/L | |
| | | | Dissolved Nitrate (N) | 2018/07/25 | <0.010 | | mg/L | |
| 9080092 | JK9 | Method Blank | Dissolved Iron (Fe) | 2018/07/26 | <0.060 | | mg/L | |
| | | | Dissolved Lithium (Li) | 2018/07/26 | <0.020 | | mg/L | |
| | | | Dissolved Magnesium (Mg) | 2018/07/26 | <0.20 | | mg/L | |
| | | | Dissolved Manganese (Mn) | 2018/07/26 | <0.0040 | | mg/L | |
| | | | Dissolved Potassium (K) | 2018/07/26 | <0.30 | | mg/L | |
| | | | Dissolved Sodium (Na) | 2018/07/26 | <0.50 | | mg/L | |
| | | | Dissolved Strontium (Sr) | 2018/07/26 | <0.020 | | mg/L | |
| | | | Dissolved Sulphur (S) | 2018/07/26 | <0.20 | | mg/L | |
| | | | Dissolved Phosphorus (P) | 2018/07/26 | <0.10 | | mg/L | |
| | | | Dissolved Barium (Ba) | 2018/07/26 | <0.010 | | mg/L | |
| | | | Dissolved Silicon (Si) | 2018/07/26 | <0.10 | | mg/L | |
| | | | Dissolved Boron (B) | 2018/07/26 | <0.020 | | mg/L | |



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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT(CONT'D)

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| | | | Dissolved Calcium (Ca) | 2018/07/26 | <0.30 | | mg/L | |
| 9080190 | YY | Method Blank | Phenols | 2018/07/26 | <0.0020 | | mg/L | |
| 9080923 | MRD | Method Blank | Dissolved Chloride (Cl) | 2018/07/27 | <1.0 | | mg/L | |
| 9080926 | MRD | Method Blank | Dissolved Sulphate (SO4) | 2018/07/27 | <1.0 | | mg/L | |
| 9078506 | MSD | RPD [TX7223-01] | Dissolved Nitrite (N) | 2018/07/25 | NC | | % | 20 |
| | | | Dissolved Nitrate (N) | 2018/07/25 | NC | | % | 20 |
| 9080092 | JK9 | RPD [TX7223-03] | Dissolved Iron (Fe) | 2018/07/26 | 0.53 | | % | 20 |
| | | | Dissolved Lithium (Li) | 2018/07/26 | NC | | % | 20 |
| | | | Dissolved Magnesium (Mg) | 2018/07/26 | 0.31 | | % | 20 |
| | | | Dissolved Manganese (Mn) | 2018/07/26 | 0.17 | | % | 20 |
| | | | Dissolved Potassium (K) | 2018/07/26 | 0.70 | | % | 20 |
| | | | Dissolved Sodium (Na) | 2018/07/26 | 0.013 | | % | 20 |
| | | | Dissolved Strontium (Sr) | 2018/07/26 | 0.21 | | % | 20 |
| | | | Dissolved Sulphur (S) | 2018/07/26 | 0.084 | | % | 20 |
| | | | Dissolved Phosphorus (P) | 2018/07/26 | NC | | % | 20 |
| | | | Dissolved Barium (Ba) | 2018/07/26 | 0.34 | | % | 20 |
| | | | Dissolved Silicon (Si) | 2018/07/26 | 0.49 | | % | 20 |
| | | | Dissolved Boron (B) | 2018/07/26 | 0.16 | | % | 20 |
| | | | Dissolved Calcium (Ca) | 2018/07/26 | 0.27 | | % | 20 |
| 9078506 | MSD | Matrix Spike [TX7223-01] | Dissolved Nitrite (N) | 2018/07/25 | | 99 | % | 80 - 120 |
| | | | Dissolved Nitrate (N) | 2018/07/25 | | 100 | % | 80 - 120 |
| 9080092 | JK9 | Matrix Spike [TX7223-03] | Dissolved Iron (Fe) | 2018/07/26 | | 104 | % | 80 - 120 |
| | | | Dissolved Lithium (Li) | 2018/07/26 | | 99 | % | 80 - 120 |
| | | | Dissolved Magnesium (Mg) | 2018/07/26 | | 100 | % | 80 - 120 |
| | | | Dissolved Manganese (Mn) | 2018/07/26 | | 96 | % | 80 - 120 |
| | | | Dissolved Potassium (K) | 2018/07/26 | | 102 | % | 80 - 120 |
| | | | Dissolved Sodium (Na) | 2018/07/26 | | 101 | % | 80 - 120 |
| | | | Dissolved Strontium (Sr) | 2018/07/26 | | 97 | % | 80 - 120 |
| | | | Dissolved Phosphorus (P) | 2018/07/26 | | 109 | % | 80 - 120 |
| | | | Dissolved Barium (Ba) | 2018/07/26 | | 102 | % | 80 - 120 |
| | | | Dissolved Silicon (Si) | 2018/07/26 | | 98 | % | 80 - 120 |
| | | | Dissolved Boron (B) | 2018/07/26 | | 105 | % | 80 - 120 |
| | | | Dissolved Calcium (Ca) | 2018/07/26 | | NC | % | 80 - 120 |
| 9077691 | SKH | LCS | O-TERPHENYL (sur.) | 2018/07/28 | | 99 | % | 60 - 140 |
| | | | F2 (C10-C16 Hydrocarbons) | 2018/07/28 | | 111 | % | 60 - 140 |
| 9077757 | VFE | LCS | Total Dissolved Solids | 2018/07/26 | | 100 | % | 80 - 120 |
| 9077973 | APY | LCS | Dissolved Mercury (Hg) | 2018/07/25 | | 108 | % | 80 - 120 |
| 9078012 | AMJ | LCS | 1,4-Difluorobenzene (sur.) | 2018/07/26 | | 96 | % | 50 - 140 |
| | | | 4-Bromofluorobenzene (sur.) | 2018/07/26 | | 102 | % | 50 - 140 |
| | | | D4-1,2-Dichloroethane (sur.) | 2018/07/26 | | 105 | % | 50 - 140 |
| | | | Benzene | 2018/07/26 | | 94 | % | 60 - 130 |
| | | | Toluene | 2018/07/26 | | 86 | % | 60 - 130 |
| | | | Ethylbenzene | 2018/07/26 | | 96 | % | 60 - 130 |
| | | | m & p-Xylene | 2018/07/26 | | 92 | % | 60 - 130 |
| | | | o-Xylene | 2018/07/26 | | 93 | % | 60 - 130 |
| | | | F1 (C6-C10) | 2018/07/26 | | 106 | % | 60 - 140 |
| 9078097 | JK9 | LCS | Dissolved Aluminum (Al) | 2018/07/25 | | 98 | % | 80 - 120 |
| | | | Dissolved Chromium (Cr) | 2018/07/25 | | 107 | % | 80 - 120 |
| | | | Dissolved Cobalt (Co) | 2018/07/25 | | 107 | % | 80 - 120 |
| | | | Dissolved Copper (Cu) | 2018/07/25 | | 108 | % | 80 - 120 |
| | | | Dissolved Lead (Pb) | 2018/07/25 | | 104 | % | 80 - 120 |



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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT(CONT'D)

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| | | | Dissolved Antimony (Sb) | 2018/07/25 | | 100 | % | 80 - 120 |
| | | | Dissolved Molybdenum (Mo) | 2018/07/25 | | 91 | % | 80 - 120 |
| | | | Dissolved Nickel (Ni) | 2018/07/25 | | 107 | % | 80 - 120 |
| | | | Dissolved Selenium (Se) | 2018/07/25 | | 93 | % | 80 - 120 |
| | | | Dissolved Silver (Ag) | 2018/07/25 | | 103 | % | 80 - 120 |
| | | | Dissolved Arsenic (As) | 2018/07/25 | | 102 | % | 80 - 120 |
| | | | Dissolved Thallium (Tl) | 2018/07/25 | | 104 | % | 80 - 120 |
| | | | Dissolved Tin (Sn) | 2018/07/25 | | 98 | % | 80 - 120 |
| | | | Dissolved Titanium (Ti) | 2018/07/25 | | 102 | % | 80 - 120 |
| | | | Dissolved Uranium (U) | 2018/07/25 | | 102 | % | 80 - 120 |
| | | | Dissolved Vanadium (V) | 2018/07/25 | | 107 | % | 80 - 120 |
| | | | Dissolved Zinc (Zn) | 2018/07/25 | | 102 | % | 80 - 120 |
| | | | Dissolved Beryllium (Be) | 2018/07/25 | | 97 | % | 80 - 120 |
| 9078339 | MA4 | LCS | Alkalinity (Total as CaCO3) | 2018/07/25 | | 100 | % | 80 - 120 |
| 9078342 | MA4 | LCS | Conductivity | 2018/07/25 | | 100 | % | 90 - 110 |
| 9078506 | MSD | LCS | Dissolved Nitrite (N) | 2018/07/25 | | 100 | % | 80 - 120 |
| | | | Dissolved Nitrate (N) | 2018/07/25 | | 101 | % | 80 - 120 |
| 9080092 | JK9 | LCS | Dissolved Iron (Fe) | 2018/07/26 | | 100 | % | 80 - 120 |
| | | | Dissolved Lithium (Li) | 2018/07/26 | | 96 | % | 80 - 120 |
| | | | Dissolved Magnesium (Mg) | 2018/07/26 | | 98 | % | 80 - 120 |
| | | | Dissolved Manganese (Mn) | 2018/07/26 | | 96 | % | 80 - 120 |
| | | | Dissolved Potassium (K) | 2018/07/26 | | 99 | % | 80 - 120 |
| | | | Dissolved Sodium (Na) | 2018/07/26 | | 100 | % | 80 - 120 |
| | | | Dissolved Strontium (Sr) | 2018/07/26 | | 97 | % | 80 - 120 |
| | | | Dissolved Phosphorus (P) | 2018/07/26 | | 99 | % | 80 - 120 |
| | | | Dissolved Barium (Ba) | 2018/07/26 | | 98 | % | 80 - 120 |
| | | | Dissolved Silicon (Si) | 2018/07/26 | | 96 | % | 80 - 120 |
| | | | Dissolved Boron (B) | 2018/07/26 | | 99 | % | 80 - 120 |
| | | | Dissolved Calcium (Ca) | 2018/07/26 | | 97 | % | 80 - 120 |
| 9080190 | YY | LCS | Phenols | 2018/07/26 | | 99 | % | 80 - 120 |
| 9080923 | MRD | LCS | Dissolved Chloride (Cl) | 2018/07/27 | | 109 | % | 80 - 120 |
| 9080926 | MRD | LCS | Dissolved Sulphate (SO4) | 2018/07/27 | | 101 | % | 80 - 120 |
| 9077973 | APY | SRM | Dissolved Mercury (Hg) | 2018/07/25 | | 103 | % | 80 - 120 |

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.

LCS: 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.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

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



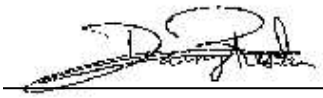
Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B861140
Report Date: 2018/07/31

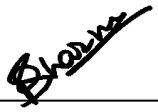
Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## VALIDATION SIGNATURE PAGE

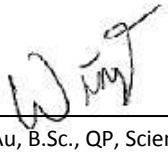
The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Daniel Reslan, cCT, QP, Organics Manager



Poonam Sharma, cCT, Organics Supervisor



Winnie Au, B.Sc., QP, 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.



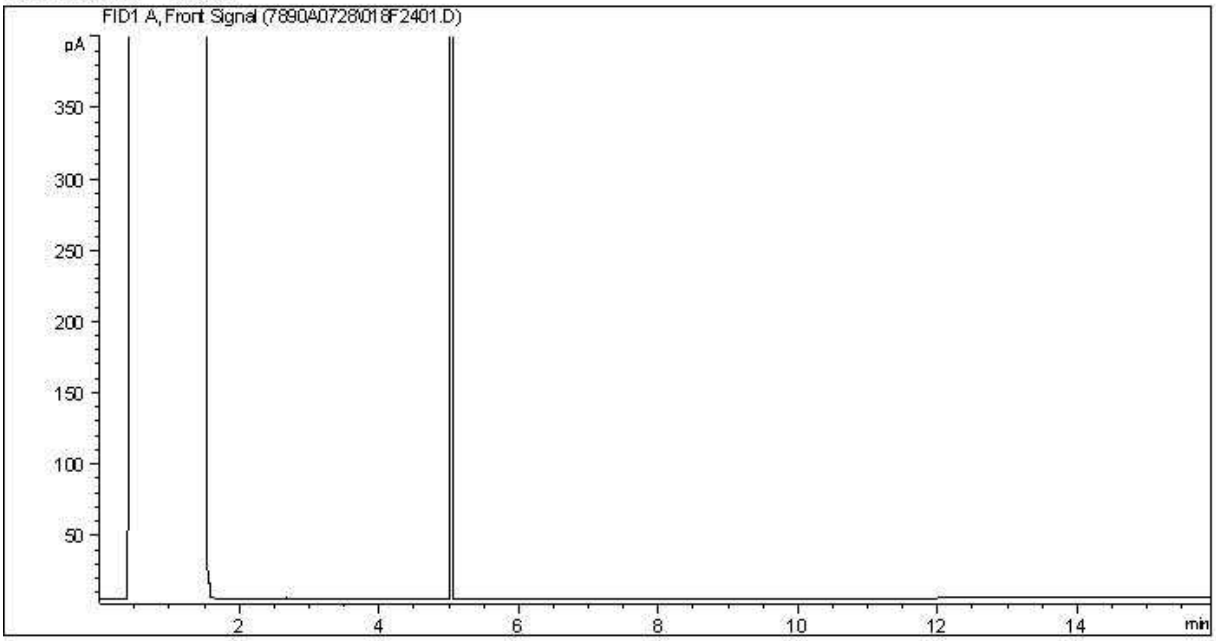
Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B861140
Report Date: 2018/07/31
Maxxam Sample: TX7223

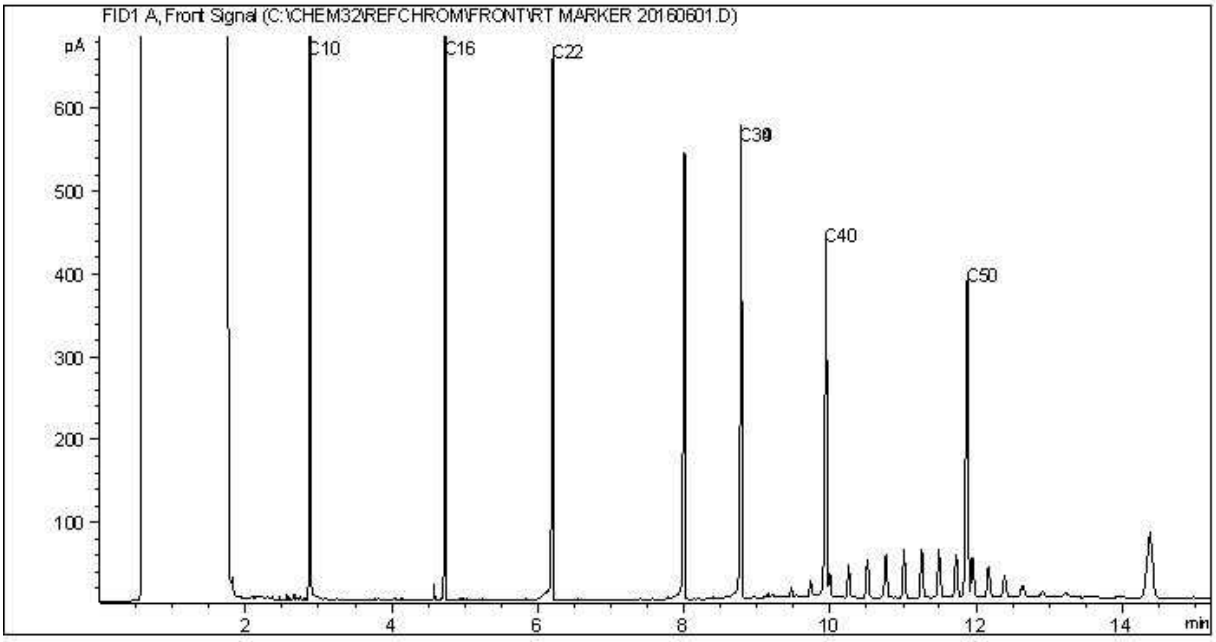
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: CPF 98-8-3

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890A




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam
A Bureau Veritas Group Company

☐ Calgary
4000 19th St. NE, T2E 6P8
Phone: (403) 291-3077
Fax: (403) 735-2240
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☒ Edmonton
9331 - 48 Street, T6B 2R4
Phone: (780) 577-7100
Fax: (780) 450-4187
Toll Free: (800) 386-7247

# EXXON MOBIL/IMPERIAL OIL - MAXXAM CHAIN-OF-CUSTODY RECORD

MIS



C of C # 299260

| INVOICE INFORMATION | REPORT INFORMATION |
|---|---|
| Company Name: ☒ Imperial Oil ☐ ExxonMobil | Company Name: WorleyParsons |
| Contact Name: WorleyParsons | Contact Name: Stacy Gibb |
| Address: 500, 151 Canada Olympic Rd SW Calgary, AB T3B 6B7 | Address: 500, 151 Canada Olympic Rd SW Calgary, AB T3B 6B7 |
| Email: sanj.perera@advisian.com | Email: stacy.gibb@advisian.com |
| Ph: 587-952-1490 | Ph: 403-247-0200 |
| Sampler Name (Print): Melissa Lord, Michelle Vukaty | Consultant Project #: 407011-00586-400 |

| FIELD SAMPLE ID | MATRIX: GROUND WATER | SURFACE WATER | SOIL | OTHER | # CONTAINERS | SAMPLING: DATE (YYYY/MM/DD) | TIME (24 HR) | FIELD FILTERED & PRESERVED | LAB FILTRATION REQUIRED |
|---|---|---|---|---|---|---|---|---|---|
| 1 CPF 98-8-3 | X | | | | 10 | 2018/07/22 | 09:30 | X | |
| 2 | | | | | | | | | |
| 3 | | | | | | | | | |
| 4 | | | | | | | | | |
| 5 | | | | | | | | | |
| 6 | | | | | | | | | |
| 7 | | | | | | | | | |
| 8 | | | | | | | | | |
| 9 | | | | | | | | | |
| 10 | | | | | | | | | |

ANALYSIS REQUESTED

| VOC | PAH | PHCs (FRACTIONS 1-2 PLUS BTEX) | PHCs (FRACTIONS 1-4 PLUS BTEX) | PHCs (FRACTIONS 2-4) | PHCs (FRACTION 1 PLUS BTEX) | GRAIN SIZE (75 MICRON) | TEXTURE (% SAND, SILT, CLAY) | PARTICLE SIZE DISTRIBUTION WITH GRAPH | REGULATED METALS ☐ TOT ☒ DIS | MERCURY ☐ TOTAL ☒ DISSOLVED | SALINITY SOIL | FERTILIZER SOIL | FERTILIZER WATER | NUTRIENTS SOIL | ROUTINE POTABILITY | pH ☐ EC ☐ ALKALINITY ☐ | BASIC CLASS II LANDFILL PKG | Metals by ICP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | X | | | | | | | X | X | | | | | X | | | X |

IOL SITE LOCATION: Norman Wells, NT

IOL PROJECT # (if applicable): N/A

MAXXAM TASK ORDER # OR SERVICE ORDER # + LINE ITEM: 407011-00586-400

REGULATORY CRITERIA / DETECTION LIMITS:
☐ Alberta Tier 1 ☐ CDWG
☐ SEQG (SK) ☐ NoSC (SK)
☒ CCME (incl. level) FAL ☐ Other

SPECIAL INSTRUCTIONS:
also email:
- standard Norman Wells list
- melissa.lord@advisian.com

IES A26014136

# JARS USED & NOT SUBMITTED (Enter N/A for Water): N/A

TURNAROUND TIME
Standard (5 days) ☒
Rush (3 days) ☐
(2 days) ☐
(1 day) ☐
(same day) ☐
Date Required

| | YES | NO | COOLER ID # | | | | YES | NO | COOLER ID # | | | | YES | NO | COOLER ID # | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SEAL PRESENT | ✓ | | TEMP °C | 2 | 4 | 6 | | | TEMP °C | 1 | 2 | 3 | | | TEMP °C | 1 | 2 | 3 |
| SEAL INTACT | ✓ | | | 1 | 2 | 3 | | | | | | | | | | | | |
| COOLING MEDIA PRESENT | ✓ | | | | | | | | | | | | | | | | | |

LAB USE ONLY
MAXXAM JOB # B861140

| RELINQUISHED BY: | | DATE: | TIME (24 HR) | RECEIVED BY: | | DATE: | TIME (24 HR) |
|---|---|---|---|---|---|---|---|
| 1. | Melissa Lord | 2018/07/23 | 08:00 | 1. | MIKAEL SMITH | 2018/07/24 | 0935 |
| 2. | | | | 2. | | | |
| 3. | | | | 3. | | | |

SAMPLES
LABELED BY: RBP
VERIFIED BY: MFB

COC-1010 (06/2016) IOL-AB

White: Maxxam Yellow: Client

# DATA QUALITY REVIEW CHECKLIST - IMPERIAL OIL PROJECTS

Consultant: Advisian

Sampling Date: 15-Sep-18

Location: Norman Wells

Laboratory : Maxxam Edmonton

Consultant Project Number: 407011-00586-0400

Sample Submission Number: B879711

Are All Laboratory QC Within Acceptance Criteria (Yes, No, Not Applicable)?

| | Yes | No | NA | Comments |
|---|---|---|---|---|
| Instrument Surrogate Recovery | x | | | All laboratory QC met acceptance criteria. |
| Extraction Surrogate Recovery | x | | | |
| Method Blank Concentration | x | | | |
| Matrix Duplicate RPD | x | | | |
| Matrix Spike Recovery | x | | | |
| Lab Control Sample Recovery | x | | | |

Are All Field QC Samples Within Alert Limits (Yes, No, Not Applicable)?

| | Yes | No | NA | Comments |
|---|---|---|---|---|
| Field Blank Concentration | | | x | All field QC samples met alert limits. |
| Trip Blank Concentration | x | | | |
| Equipment Blank Concentration | | | x | |
| Field Duplicate RPD | | | x | |

| | |
|---|---|
| Has CoA been signed off (Yes/No)?: | Yes |
| Has lab warranted all tests were analyzed following SOP's in CoA (Yes/No)?: | Yes |
| Were all samples analyzed within hold times (Yes/No)?: | Yes |
| All volatiles samples methanol extracted (if required) within 48 hours (Yes/No)?: | n/a |
| Is Chain of Custody completed and signed (Yes/No)?: | Yes |
| Were sample temperatures acceptable when they reached lab (Yes/No)?: | Yes |

| | |
|---|---|
| Was a Data Quality Overview (DQO) issued (Yes/No)?: | No |
| Date DQO was received: | n/a |

Is data considered to be reliable (Yes/No)?: Yes

If answer is "No", describe and provide rationale:

Data Reviewed by (Print): Vivian Baptista

Data Reviewed by (Signature): 

Date: 16-Oct-18

Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-0400
Your C.O.C. #: 299030

**Attention: Stacy Gibb**

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

**Report Date: 2018/09/24**
Report #: R2623675
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B879711**
**Received: 2018/09/17, 09:17**

Sample Matrix: Water
# Samples Received: 4

| Analyses | Quantity | Laboratory Method | Primary Reference |
|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | 3 | AB SOP-00005 | SM 23 2320 B m |
| BTEX/F1 in Water by HS GC/MS/FID | 4 | AB SOP-00039 | CCME CWS/EPA 8260d m |
| F1-BTEX | 4 | AB SOP-00039 | Auto Calc |
| Cadmium - low level CCME - Dissolved | 3 | AB WI-00065 | Auto Calc |
| Chloride by Automated Colourimetry | 3 | AB SOP-00020 | SM 22 4500-Cl-E m |
| Conductivity @25C | 3 | AB SOP-00005 | SM 23 2510 B m |
| CCME Hydrocarbons in Water (F2; C10-C16) (1) | 4 | AB SOP-00037 / AB SOP-00040 | CCME PHC-CWS m |
| Hardness | 3 | AB WI-00065 | Auto Calc |
| Mercury - Low Level (Dissolved) (2) | 3 | EENVSOP-00031 | EPA 245.7 R2 m |
| Elements by ICP - Dissolved (2) | 3 | AB SOP-00042 | EPA 6010d R4 m |
| Elements by ICPMS - Dissolved (2) | 3 | AB SOP-00043 | EPA 6020b R2 m |
| Ion Balance | 3 | AB WI-00065 | Auto Calc |
| Nitrate and Nitrite | 3 | AB WI-00065 | Auto Calc |
| Nitrate + Nitrite-N (calculated) | 3 | AB WI-00065 | Auto Calc |
| Nitrogen (Nitrite - Nitrate) by IC | 3 | AB SOP-00023 | SM 23 4110 B m |
| Benzo[a]pyrene Equivalency (3) | 1 | AB SOP-00003 | Auto Calc |
| PAH in Water by GC/MS | 1 | AB SOP-00037 / AB SOP-00003 | EPA 3510C/8270E m |
| Phenols (4-AAP) | 3 | EENVSOP-00061 | MMCW 154 1996 m |
| Sulphate by Automated Colourimetry | 3 | AB SOP-00018 | SM 22 4500-SO4 E m |
| Total Dissolved Solids (Filt. Residue) | 3 | AB SOP-00065 | SM 22 2540 C m |

**Remarks:**

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard. All samples were analyzed within hold time unless otherwise flagged.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed

Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-0400
Your C.O.C. #: 299030

**Attention: Stacy Gibb**

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

**Report Date: 2018/09/24**
Report #: R2623675
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B879711**
**Received: 2018/09/17, 09:17**

or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

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) Silica gel clean up employed.
(2) Dissolved > Total Imbalance: When applicable, Dissolved and Total results were reviewed and data quality meets acceptable levels unless otherwise noted.
(3) B[a]P TPE is calculated using 1/2 of the RDL for non detect results as per Alberta Environment instructions. This protocol may not apply in other jurisdictions.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Rhecie Phayouphone, Project Manager
Email: RPhayouphone@maxxam.ca
Phone# (403)735-2283

==========

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 #: B879711
Report Date: 2018/09/24

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-0400

## AT1 BTEX AND F1-F2 IN WATER (WATER)

| Maxxam ID | | UI2676 | UI2677 | | | UI2677 | | |
|---|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/09/15 16:15 | 2018/09/15 15:30 | | | 2018/09/15 15:30 | | |
| COC Number | | 299030 | 299030 | | | 299030 | | |
| | **UNITS** | **CPF-97-7-5** | **MEBG-10-1-3** | **RDL** | **QC Batch** | **MEBG-10-1-3 Lab-Dup** | **RDL** | **QC Batch** |
| **Ext. Pet. Hydrocarbon** | | | | | | | | |
| F2 (C10-C16 Hydrocarbons) | mg/L | <0.10 | <0.10 | 0.10 | 9132731 | | | |
| **Volatiles** | | | | | | | | |
| Benzene | mg/L | <0.00040 | <0.00040 | 0.00040 | 9146359 | <0.00040 | 0.00040 | 9146359 |
| Toluene | mg/L | <0.00040 | <0.00040 | 0.00040 | 9146359 | <0.00040 | 0.00040 | 9146359 |
| Ethylbenzene | mg/L | <0.00040 | <0.00040 | 0.00040 | 9146359 | <0.00040 | 0.00040 | 9146359 |
| m & p-Xylene | mg/L | <0.00080 | <0.00080 | 0.00080 | 9146359 | <0.00080 | 0.00080 | 9146359 |
| o-Xylene | mg/L | <0.00040 | <0.00040 | 0.00040 | 9146359 | <0.00040 | 0.00040 | 9146359 |
| Xylenes (Total) | mg/L | <0.00089 | <0.00089 | 0.00089 | 9145777 | | | |
| F1 (C6-C10) - BTEX | mg/L | <0.10 | <0.10 | 0.10 | 9145777 | | | |
| F1 (C6-C10) | mg/L | <0.10 | <0.10 | 0.10 | 9146359 | <0.10 | 0.10 | 9146359 |
| **Extraction Surrogate Recovery (%)** | | | | | | | | |
| O-TERPHENYL (sur.) | % | 94 | 88 | | 9132731 | | | |
| **Instrument Surrogate Recovery (%)** | | | | | | | | |
| 1,4-Difluorobenzene (sur.) | % | 99 | 97 | | 9146359 | 98 | | 9146359 |
| 4-Bromofluorobenzene (sur.) | % | 98 | 99 | | 9146359 | 99 | | 9146359 |
| D4-1,2-Dichloroethane (sur.) | % | 105 | 108 | | 9146359 | 107 | | 9146359 |

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate



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

Maxxam Job #: B879711
Report Date: 2018/09/24

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-0400

## AT1 BTEX AND F1-F2 IN WATER (WATER)

| Maxxam ID | | UI2678 | UI2679 | | |
|---|---|---|---|---|---|
| Sampling Date | | 2018/09/15 14:45 | 2018/09/15 18:00 | | |
| COC Number | | 299030 | 299030 | | |
| | **UNITS** | **ARB-12-3-3** | **NWD-18-48** | **RDL** | **QC Batch** |
| **Ext. Pet. Hydrocarbon** | | | | | |
| F2 (C10-C16 Hydrocarbons) | mg/L | <0.10 | <0.10 | 0.10 | 9132731 |
| **Volatiles** | | | | | |
| Benzene | mg/L | <0.00040 | <0.00040 | 0.00040 | 9146359 |
| Toluene | mg/L | <0.00040 | <0.00040 | 0.00040 | 9146359 |
| Ethylbenzene | mg/L | <0.00040 | <0.00040 | 0.00040 | 9146359 |
| m & p-Xylene | mg/L | <0.00080 | <0.00080 | 0.00080 | 9146359 |
| o-Xylene | mg/L | <0.00040 | <0.00040 | 0.00040 | 9146359 |
| Xylenes (Total) | mg/L | <0.00089 | <0.00089 | 0.00089 | 9145777 |
| F1 (C6-C10) - BTEX | mg/L | <0.10 | <0.10 | 0.10 | 9145777 |
| F1 (C6-C10) | mg/L | <0.10 | <0.10 | 0.10 | 9146359 |
| **Extraction Surrogate Recovery (%)** | | | | | |
| O-TERPHENYL (sur.) | % | 89 | 87 | | 9132731 |
| **Instrument Surrogate Recovery (%)** | | | | | |
| 1,4-Difluorobenzene (sur.) | % | 96 | 101 | | 9146359 |
| 4-Bromofluorobenzene (sur.) | % | 98 | 100 | | 9146359 |
| D4-1,2-Dichloroethane (sur.) | % | 108 | 107 | | 9146359 |
| 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 #: B879711
Report Date: 2018/09/24

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-0400

## REGULATED METALS INCLUDING MERCURY-DISS (WATER)

| Maxxam ID | | UI2676 | | | UI2676 | | |
|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/09/15 16:15 | | | 2018/09/15 16:15 | | |
| COC Number | | 299030 | | | 299030 | | |
| | **UNITS** | **CPF-97-7-5** | **RDL** | **QC Batch** | **CPF-97-7-5 Lab-Dup** | **RDL** | **QC Batch** |
| **Low Level Elements** | | | | | | | |
| Dissolved Cadmium (Cd) | mg/L | 0.00018 | 0.000020 | 9145947 | | | |
| **Elements** | | | | | | | |
| Dissolved Aluminum (Al) | mg/L | 0.063 | 0.0030 | 9146470 | 0.064 | 0.0030 | 9146470 |
| Dissolved Antimony (Sb) | mg/L | <0.00060 | 0.00060 | 9146470 | <0.00060 | 0.00060 | 9146470 |
| Dissolved Arsenic (As) | mg/L | 0.00053 | 0.00020 | 9146470 | 0.00065 | 0.00020 | 9146470 |
| Dissolved Barium (Ba) | mg/L | 0.064 | 0.010 | 9147748 | | | |
| Dissolved Beryllium (Be) | mg/L | <0.0010 | 0.0010 | 9146470 | <0.0010 | 0.0010 | 9146470 |
| Dissolved Boron (B) | mg/L | 0.036 | 0.020 | 9147748 | | | |
| Dissolved Calcium (Ca) | mg/L | 340 | 0.30 | 9147748 | | | |
| Dissolved Chromium (Cr) | mg/L | <0.0010 | 0.0010 | 9146470 | <0.0010 | 0.0010 | 9146470 |
| Dissolved Cobalt (Co) | mg/L | 0.0047 | 0.00030 | 9146470 | 0.0047 | 0.00030 | 9146470 |
| Dissolved Copper (Cu) | mg/L | 0.0021 | 0.00020 | 9146470 | 0.0020 | 0.00020 | 9146470 |
| Dissolved Iron (Fe) | mg/L | 3.6 | 0.060 | 9147748 | | | |
| Dissolved Lead (Pb) | mg/L | 0.00026 | 0.00020 | 9146470 | 0.00026 | 0.00020 | 9146470 |
| Dissolved Lithium (Li) | mg/L | <0.020 | 0.020 | 9147748 | | | |
| Dissolved Magnesium (Mg) | mg/L | 75 | 0.20 | 9147748 | | | |
| Dissolved Manganese (Mn) | mg/L | 2.0 | 0.0040 | 9147748 | | | |
| Dissolved Molybdenum (Mo) | mg/L | 0.0075 | 0.00020 | 9146470 | 0.0072 | 0.00020 | 9146470 |
| Dissolved Nickel (Ni) | mg/L | 0.011 | 0.00050 | 9146470 | 0.012 | 0.00050 | 9146470 |
| Dissolved Phosphorus (P) | mg/L | <0.10 | 0.10 | 9147748 | | | |
| Dissolved Potassium (K) | mg/L | 4.4 | 0.30 | 9147748 | | | |
| Dissolved Selenium (Se) | mg/L | 0.00028 | 0.00020 | 9146470 | 0.00026 | 0.00020 | 9146470 |
| Dissolved Silicon (Si) | mg/L | 5.2 | 0.10 | 9147748 | | | |
| Dissolved Silver (Ag) | mg/L | <0.00010 | 0.00010 | 9146470 | <0.00010 | 0.00010 | 9146470 |
| Dissolved Sodium (Na) | mg/L | 9.6 | 0.50 | 9147748 | | | |
| Dissolved Strontium (Sr) | mg/L | 1.0 | 0.020 | 9147748 | | | |
| Dissolved Sulphur (S) | mg/L | 270 | 0.20 | 9147748 | | | |
| Dissolved Thallium (Tl) | mg/L | <0.00020 | 0.00020 | 9146470 | <0.00020 | 0.00020 | 9146470 |
| Dissolved Tin (Sn) | mg/L | <0.0010 | 0.0010 | 9146470 | <0.0010 | 0.0010 | 9146470 |
| Dissolved Titanium (Ti) | mg/L | 0.0017 | 0.0010 | 9146470 | 0.0017 | 0.0010 | 9146470 |

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate



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Maxxam Job #: B879711
Report Date: 2018/09/24

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-0400

## REGULATED METALS INCLUDING MERCURY-DISS (WATER)

| Maxxam ID | | UI2676 | | | UI2676 | | |
|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/09/15 16:15 | | | 2018/09/15 16:15 | | |
| COC Number | | 299030 | | | 299030 | | |
| | **UNITS** | **CPF-97-7-5** | **RDL** | **QC Batch** | **CPF-97-7-5 Lab-Dup** | **RDL** | **QC Batch** |
| Dissolved Uranium (U) | mg/L | 0.0084 | 0.00010 | 9146470 | 0.0082 | 0.00010 | 9146470 |
| Dissolved Vanadium (V) | mg/L | <0.0010 | 0.0010 | 9146470 | <0.0010 | 0.0010 | 9146470 |
| Dissolved Zinc (Zn) | mg/L | 0.016 | 0.0030 | 9146470 | 0.017 | 0.0030 | 9146470 |
| **Low Level Elements** | | | | | | | |
| Dissolved Mercury (Hg) | mg/L | 0.0000023 | 0.0000020 | 9149048 | | | |

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate



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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-0400

## REGULATED METALS INCLUDING MERCURY-DISS (WATER)

| Maxxam ID | | UI2677 | UI2678 | | |
|---|---|---|---|---|---|
| Sampling Date | | 2018/09/15 15:30 | 2018/09/15 14:45 | | |
| COC Number | | 299030 | 299030 | | |
| | **UNITS** | **MEBG-10-1-3** | **ARB-12-3-3** | **RDL** | **QC Batch** |
| **Low Level Elements** | | | | | |
| Dissolved Cadmium (Cd) | mg/L | 0.000050 | 0.000065 | 0.000020 | 9145947 |
| **Elements** | | | | | |
| Dissolved Aluminum (Al) | mg/L | <0.0030 | 0.0078 | 0.0030 | 9146470 |
| Dissolved Antimony (Sb) | mg/L | <0.00060 | <0.00060 | 0.00060 | 9146470 |
| Dissolved Arsenic (As) | mg/L | 0.00085 | 0.00078 | 0.00020 | 9146470 |
| Dissolved Barium (Ba) | mg/L | 0.31 | 0.11 | 0.010 | 9147748 |
| Dissolved Beryllium (Be) | mg/L | <0.0010 | <0.0010 | 0.0010 | 9146470 |
| Dissolved Boron (B) | mg/L | 0.029 | 0.055 | 0.020 | 9147748 |
| Dissolved Calcium (Ca) | mg/L | 210 | 170 | 0.30 | 9147748 |
| Dissolved Chromium (Cr) | mg/L | <0.0010 | <0.0010 | 0.0010 | 9146470 |
| Dissolved Cobalt (Co) | mg/L | 0.0024 | 0.00064 | 0.00030 | 9146470 |
| Dissolved Copper (Cu) | mg/L | 0.00069 | 0.0042 | 0.00020 | 9146470 |
| Dissolved Iron (Fe) | mg/L | 3.2 | <0.060 | 0.060 | 9147748 |
| Dissolved Lead (Pb) | mg/L | <0.00020 | <0.00020 | 0.00020 | 9146470 |
| Dissolved Lithium (Li) | mg/L | <0.020 | <0.020 | 0.020 | 9147748 |
| Dissolved Magnesium (Mg) | mg/L | 45 | 52 | 0.20 | 9147748 |
| Dissolved Manganese (Mn) | mg/L | 1.4 | 0.15 | 0.0040 | 9147748 |
| Dissolved Molybdenum (Mo) | mg/L | 0.0013 | 0.0028 | 0.00020 | 9146470 |
| Dissolved Nickel (Ni) | mg/L | 0.0053 | 0.0041 | 0.00050 | 9146470 |
| Dissolved Phosphorus (P) | mg/L | <0.10 | 0.13 | 0.10 | 9147748 |
| Dissolved Potassium (K) | mg/L | 1.6 | 2.5 | 0.30 | 9147748 |
| Dissolved Selenium (Se) | mg/L | 0.00022 | 0.00085 | 0.00020 | 9146470 |
| Dissolved Silicon (Si) | mg/L | 5.0 | 5.4 | 0.10 | 9147748 |
| Dissolved Silver (Ag) | mg/L | <0.00010 | <0.00010 | 0.00010 | 9146470 |
| Dissolved Sodium (Na) | mg/L | 18 | 29 | 0.50 | 9147748 |
| Dissolved Strontium (Sr) | mg/L | 0.60 | 0.47 | 0.020 | 9147748 |
| Dissolved Sulphur (S) | mg/L | 83 | 53 | 0.20 | 9147748 |
| Dissolved Thallium (Tl) | mg/L | <0.00020 | <0.00020 | 0.00020 | 9146470 |
| Dissolved Tin (Sn) | mg/L | <0.0010 | <0.0010 | 0.0010 | 9146470 |
| Dissolved Titanium (Ti) | mg/L | <0.0010 | <0.0010 | 0.0010 | 9146470 |
| RDL = Reportable Detection Limit | | | | | |



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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-0400

## REGULATED METALS INCLUDING MERCURY-DISS (WATER)

| Maxxam ID | | UI2677 | UI2678 | | |
|---|---|---|---|---|---|
| Sampling Date | | 2018/09/15 15:30 | 2018/09/15 14:45 | | |
| COC Number | | 299030 | 299030 | | |
| | **UNITS** | **MEBG-10-1-3** | **ARB-12-3-3** | **RDL** | **QC Batch** |
| Dissolved Uranium (U) | mg/L | 0.0057 | 0.010 | 0.00010 | 9146470 |
| Dissolved Vanadium (V) | mg/L | <0.0010 | <0.0010 | 0.0010 | 9146470 |
| Dissolved Zinc (Zn) | mg/L | 0.0046 | 0.0065 | 0.0030 | 9146470 |
| **Low Level Elements** | | | | | |
| Dissolved Mercury (Hg) | mg/L | <0.0000020 | 0.0000025 | 0.0000020 | 9149048 |
| RDL = Reportable Detection Limit | | | | | |



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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-0400

## RESULTS OF CHEMICAL ANALYSES OF WATER

| Maxxam ID | | UI2676 | | | UI2676 | | | UI2677 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/09/15 16:15 | | | 2018/09/15 16:15 | | | 2018/09/15 15:30 | | |
| COC Number | | 299030 | | | 299030 | | | 299030 | | |
| | **UNITS** | **CPF-97-7-5** | **RDL** | **QC Batch** | **CPF-97-7-5 Lab-Dup** | **RDL** | **QC Batch** | **MEBG-10-1-3** | **RDL** | **QC Batch** |
| **Calculated Parameters** | | | | | | | | | | |
| Hardness (CaCO3) | mg/L | 1200 | 0.50 | 9145779 | | | | 710 | 0.50 | 9145779 |
| Ion Balance (% Difference) | % | 0.36 | N/A | 9145780 | | | | 0.58 | N/A | 9145780 |
| Dissolved Nitrate (NO3) | mg/L | <0.44 | 0.44 | 9145782 | | | | 0.26 | 0.044 | 9145782 |
| Nitrate plus Nitrite (N) | mg/L | <0.14 | 0.14 | 9145952 | | | | 0.058 | 0.014 | 9145952 |
| Dissolved Nitrite (NO2) | mg/L | <0.33 | 0.33 | 9145782 | | | | <0.033 | 0.033 | 9145782 |
| **Misc. Inorganics** | | | | | | | | | | |
| Conductivity | uS/cm | 1900 | 2.0 | 9147070 | | | | 1300 | 2.0 | 9147070 |
| Total Dissolved Solids | mg/L | 1600 | 10 | 9146201 | 1600 | 10 | 9146201 | 880 | 10 | 9146201 |
| **Anions** | | | | | | | | | | |
| Alkalinity (PP as CaCO3) | mg/L | <1.0 | 1.0 | 9147064 | | | | <1.0 | 1.0 | 9147064 |
| Alkalinity (Total as CaCO3) | mg/L | 360 | 1.0 | 9147064 | | | | 510 | 1.0 | 9147064 |
| Bicarbonate (HCO3) | mg/L | 440 | 1.0 | 9147064 | | | | 630 | 1.0 | 9147064 |
| Carbonate (CO3) | mg/L | <1.0 | 1.0 | 9147064 | | | | <1.0 | 1.0 | 9147064 |
| Hydroxide (OH) | mg/L | <1.0 | 1.0 | 9147064 | | | | <1.0 | 1.0 | 9147064 |
| Dissolved Sulphate (SO4) | mg/L | 770 (1) | 5.0 | 9147553 | | | | 240 (1) | 5.0 | 9147576 |
| Dissolved Chloride (Cl) | mg/L | 15 | 1.0 | 9147547 | | | | 2.3 | 1.0 | 9147575 |
| **Nutrients** | | | | | | | | | | |
| Dissolved Nitrite (N) | mg/L | <0.10 (2) | 0.10 | 9146206 | | | | <0.010 | 0.010 | 9146206 |
| Dissolved Nitrate (N) | mg/L | <0.10 (2) | 0.10 | 9146206 | | | | 0.058 | 0.010 | 9146206 |
| **Misc. Organics** | | | | | | | | | | |
| Phenols | mg/L | 0.0034 | 0.0020 | 9151279 | | | | 0.0038 | 0.0020 | 9151279 |

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.
(2) Detection limits raised due to matrix interference.



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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-0400

## RESULTS OF CHEMICAL ANALYSES OF WATER

| Maxxam ID | | UI2677 | | | UI2678 | | |
|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/09/15 15:30 | | | 2018/09/15 14:45 | | |
| COC Number | | 299030 | | | 299030 | | |
| | **UNITS** | **MEBG-10-1-3 Lab-Dup** | **RDL** | **QC Batch** | **ARB-12-3-3** | **RDL** | **QC Batch** |
| **Calculated Parameters** | | | | | | | |
| Hardness (CaCO3) | mg/L | | | | 640 | 0.50 | 9145779 |
| Ion Balance (% Difference) | % | | | | 7.1 | N/A | 9145780 |
| Dissolved Nitrate (NO3) | mg/L | | | | 1.1 | 0.044 | 9145782 |
| Nitrate plus Nitrite (N) | mg/L | | | | 0.25 | 0.014 | 9145952 |
| Dissolved Nitrite (NO2) | mg/L | | | | <0.033 | 0.033 | 9145782 |
| **Misc. Inorganics** | | | | | | | |
| Conductivity | uS/cm | | | | 1300 | 2.0 | 9147070 |
| Total Dissolved Solids | mg/L | | | | 800 | 10 | 9146201 |
| **Anions** | | | | | | | |
| Alkalinity (PP as CaCO3) | mg/L | | | | <1.0 | 1.0 | 9147064 |
| Alkalinity (Total as CaCO3) | mg/L | | | | 650 | 1.0 | 9147064 |
| Bicarbonate (HCO3) | mg/L | | | | 790 | 1.0 | 9147064 |
| Carbonate (CO3) | mg/L | | | | <1.0 | 1.0 | 9147064 |
| Hydroxide (OH) | mg/L | | | | <1.0 | 1.0 | 9147064 |
| Dissolved Sulphate (SO4) | mg/L | 230 | 5.0 | 9147576 | 140 | 1.0 | 9147553 |
| Dissolved Chloride (Cl) | mg/L | 2.4 | 1.0 | 9147575 | 16 | 1.0 | 9147547 |
| **Nutrients** | | | | | | | |
| Dissolved Nitrite (N) | mg/L | <0.010 | 0.010 | 9146206 | <0.010 | 0.010 | 9146206 |
| Dissolved Nitrate (N) | mg/L | 0.056 | 0.010 | 9146206 | 0.25 | 0.010 | 9146206 |
| **Misc. Organics** | | | | | | | |
| Phenols | mg/L | | | | 0.0048 | 0.0020 | 9151279 |

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable



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Report Date: 2018/09/24

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-0400

## SEMIVOLATILE ORGANICS BY GC-MS (WATER)

| Maxxam ID | | UI2677 | | |
|---|---|---|---|---|
| Sampling Date | | 2018/09/15 15:30 | | |
| COC Number | | 299030 | | |
| | **UNITS** | **MEBG-10-1-3** | **RDL** | **QC Batch** |
| **Polycyclic Aromatics** | | | | |
| Benzo[a]pyrene equivalency | mg/L | <0.000010 | 0.000010 | 9145953 |
| Acenaphthene | mg/L | <0.00010 | 0.00010 | 9146468 |
| Acenaphthylene | mg/L | <0.00010 | 0.00010 | 9146468 |
| Acridine | mg/L | <0.000050 | 0.000050 | 9146468 |
| Anthracene | mg/L | <0.000010 | 0.000010 | 9146468 |
| Benzo(a)anthracene | mg/L | <0.0000085 | 0.0000085 | 9146468 |
| Benzo(b&j)fluoranthene | mg/L | <0.0000085 | 0.0000085 | 9146468 |
| Benzo(k)fluoranthene | mg/L | <0.0000085 | 0.0000085 | 9146468 |
| Benzo(g,h,i)perylene | mg/L | <0.0000085 | 0.0000085 | 9146468 |
| Benzo(c)phenanthrene | mg/L | <0.000050 | 0.000050 | 9146468 |
| Benzo(a)pyrene | mg/L | <0.0000075 | 0.0000075 | 9146468 |
| Benzo[e]pyrene | mg/L | <0.000050 | 0.000050 | 9146468 |
| Chrysene | mg/L | <0.0000085 | 0.0000085 | 9146468 |
| Dibenz(a,h)anthracene | mg/L | <0.0000075 | 0.0000075 | 9146468 |
| Fluoranthene | mg/L | <0.000010 | 0.000010 | 9146468 |
| Fluorene | mg/L | <0.000050 | 0.000050 | 9146468 |
| Indeno(1,2,3-cd)pyrene | mg/L | <0.0000085 | 0.0000085 | 9146468 |
| 1-Methylnaphthalene | mg/L | <0.00010 | 0.00010 | 9146468 |
| 2-Methylnaphthalene | mg/L | <0.00010 | 0.00010 | 9146468 |
| Naphthalene | mg/L | <0.00010 | 0.00010 | 9146468 |
| Phenanthrene | mg/L | <0.000050 | 0.000050 | 9146468 |
| Perylene | mg/L | <0.000050 | 0.000050 | 9146468 |
| Pyrene | mg/L | <0.000020 | 0.000020 | 9146468 |
| Quinoline | mg/L | <0.00020 | 0.00020 | 9146468 |
| **Extraction Surrogate Recovery (%)** | | | | |
| D10-ANTHRACENE (sur.) | % | 109 | | 9146468 |
| D8-ACENAPHTHYLENE (sur.) | % | 99 | | 9146468 |
| D8-NAPHTHALENE (sur.) | % | 76 | | 9146468 |
| TERPHENYL-D14 (sur.) | % | 60 | | 9146468 |
| RDL = Reportable Detection Limit | | | | |



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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-0400

## TEST SUMMARY

**Maxxam ID:** UI2676
**Sample ID:** CPF-97-7-5
**Matrix:** Water

**Collected:** 2018/09/15
**Relinquished:** 2018/09/16
**Received:** 2018/09/17

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | AT/ALK | 9147064 | N/A | 2018/09/18 | Malina Alamyar |
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9146359 | N/A | 2018/09/17 | Sandra Wilson |
| F1-BTEX | CALC/MS | 9145777 | N/A | 2018/09/18 | Automated Statchk |
| Cadmium - low level CCME - Dissolved | CALC/MS | 9145947 | N/A | 2018/09/18 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 9147547 | N/A | 2018/09/18 | Chelsea Harmatys |
| Conductivity @25C | COND | 9147070 | N/A | 2018/09/18 | Malina Alamyar |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9132731 | 2018/09/18 | 2018/09/18 | Kelsey Holt |
| Hardness | CALC | 9145779 | N/A | 2018/09/19 | Automated Statchk |
| Mercury - Low Level (Dissolved) | CV/AF | 9149048 | 2018/09/19 | 2018/09/19 | Andrew Payne |
| Elements by ICP - Dissolved | ICPA | 9147748 | N/A | 2018/09/18 | Jonathan Kuprowsky |
| Elements by ICPMS - Dissolved | ICPM | 9146470 | N/A | 2018/09/17 | Andrew Payne |
| Ion Balance | CALC | 9145780 | N/A | 2018/09/18 | Automated Statchk |
| Nitrate and Nitrite | CALC | 9145782 | N/A | 2018/09/18 | Automated Statchk |
| Nitrate + Nitrite-N (calculated) | CALC | 9145952 | N/A | 2018/09/18 | Automated Statchk |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9146206 | N/A | 2018/09/17 | Maria Paola Solis Ares |
| Phenols (4-AAP) | TECH/4AAP | 9151279 | N/A | 2018/09/20 | Ashley Fedoriuk |
| Sulphate by Automated Colourimetry | KONE | 9147553 | N/A | 2018/09/18 | Chelsea Harmatys |
| Total Dissolved Solids (Filt. Residue) | BAL | 9146201 | 2018/09/17 | 2018/09/18 | Victoria Fedorak |

**Maxxam ID:** UI2676 Dup
**Sample ID:** CPF-97-7-5
**Matrix:** Water

**Collected:** 2018/09/15
**Relinquished:** 2018/09/16
**Received:** 2018/09/17

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Elements by ICPMS - Dissolved | ICPM | 9146470 | N/A | 2018/09/17 | Andrew Payne |
| Total Dissolved Solids (Filt. Residue) | BAL | 9146201 | 2018/09/17 | 2018/09/18 | Victoria Fedorak |

**Maxxam ID:** UI2677
**Sample ID:** MEBG-10-1-3
**Matrix:** Water

**Collected:** 2018/09/15
**Relinquished:** 2018/09/16
**Received:** 2018/09/17

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | AT/ALK | 9147064 | N/A | 2018/09/18 | Malina Alamyar |
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9146359 | N/A | 2018/09/17 | Sandra Wilson |
| F1-BTEX | CALC/MS | 9145777 | N/A | 2018/09/18 | Automated Statchk |
| Cadmium - low level CCME - Dissolved | CALC/MS | 9145947 | N/A | 2018/09/18 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 9147575 | N/A | 2018/09/18 | Chelsea Harmatys |
| Conductivity @25C | COND | 9147070 | N/A | 2018/09/18 | Malina Alamyar |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9132731 | 2018/09/18 | 2018/09/18 | Kelsey Holt |
| Hardness | CALC | 9145779 | N/A | 2018/09/19 | Automated Statchk |
| Mercury - Low Level (Dissolved) | CV/AF | 9149048 | 2018/09/19 | 2018/09/19 | Andrew Payne |
| Elements by ICP - Dissolved | ICPA | 9147748 | N/A | 2018/09/18 | Jonathan Kuprowsky |
| Elements by ICPMS - Dissolved | ICPM | 9146470 | N/A | 2018/09/17 | Andrew Payne |



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Advisian
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Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-0400

## TEST SUMMARY

**Maxxam ID:** UI2677
**Sample ID:** MEBG-10-1-3
**Matrix:** Water

**Collected:** 2018/09/15
**Relinquished:** 2018/09/16
**Received:** 2018/09/17

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Ion Balance | CALC | 9145780 | N/A | 2018/09/18 | Automated Statchk |
| Nitrate and Nitrite | CALC | 9145782 | N/A | 2018/09/18 | Automated Statchk |
| Nitrate + Nitrite-N (calculated) | CALC | 9145952 | N/A | 2018/09/18 | Automated Statchk |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9146206 | N/A | 2018/09/17 | Maria Paola Solis Ares |
| Benzo[a]pyrene Equivalency | GC/MSD | 9145953 | N/A | 2018/09/19 | Automated Statchk |
| PAH in Water by GC/MS | GC/MS | 9146468 | 2018/09/17 | 2018/09/19 | Bert Chi |
| Phenols (4-AAP) | TECH/4AAP | 9151279 | N/A | 2018/09/20 | Ashley Fedoriuk |
| Sulphate by Automated Colourimetry | KONE | 9147576 | N/A | 2018/09/18 | Chelsea Harmatys |
| Total Dissolved Solids (Filt. Residue) | BAL | 9146201 | 2018/09/17 | 2018/09/18 | Victoria Fedorak |

**Maxxam ID:** UI2677 Dup
**Sample ID:** MEBG-10-1-3
**Matrix:** Water

**Collected:** 2018/09/15
**Relinquished:** 2018/09/16
**Received:** 2018/09/17

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9146359 | N/A | 2018/09/17 | Sandra Wilson |
| Chloride by Automated Colourimetry | KONE | 9147575 | N/A | 2018/09/18 | Chelsea Harmatys |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9146206 | N/A | 2018/09/17 | Maria Paola Solis Ares |
| Sulphate by Automated Colourimetry | KONE | 9147576 | N/A | 2018/09/18 | Chelsea Harmatys |

**Maxxam ID:** UI2678
**Sample ID:** ARB-12-3-3
**Matrix:** Water

**Collected:** 2018/09/15
**Relinquished:** 2018/09/16
**Received:** 2018/09/17

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | AT/ALK | 9147064 | N/A | 2018/09/18 | Malina Alamyar |
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9146359 | N/A | 2018/09/17 | Sandra Wilson |
| F1-BTEX | CALC/MS | 9145777 | N/A | 2018/09/18 | Automated Statchk |
| Cadmium - low level CCME - Dissolved | CALC/MS | 9145947 | N/A | 2018/09/18 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 9147547 | N/A | 2018/09/18 | Chelsea Harmatys |
| Conductivity @25C | COND | 9147070 | N/A | 2018/09/18 | Malina Alamyar |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9132731 | 2018/09/18 | 2018/09/18 | Kelsey Holt |
| Hardness | CALC | 9145779 | N/A | 2018/09/19 | Automated Statchk |
| Mercury - Low Level (Dissolved) | CV/AF | 9149048 | 2018/09/19 | 2018/09/19 | Andrew Payne |
| Elements by ICP - Dissolved | ICPA | 9147748 | N/A | 2018/09/18 | Jonathan Kuprowsky |
| Elements by ICPMS - Dissolved | ICPM | 9146470 | N/A | 2018/09/17 | Andrew Payne |
| Ion Balance | CALC | 9145780 | N/A | 2018/09/18 | Automated Statchk |
| Nitrate and Nitrite | CALC | 9145782 | N/A | 2018/09/18 | Automated Statchk |
| Nitrate + Nitrite-N (calculated) | CALC | 9145952 | N/A | 2018/09/18 | Automated Statchk |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9146206 | N/A | 2018/09/17 | Maria Paola Solis Ares |
| Phenols (4-AAP) | TECH/4AAP | 9151279 | N/A | 2018/09/20 | Ashley Fedoriuk |
| Sulphate by Automated Colourimetry | KONE | 9147553 | N/A | 2018/09/18 | Chelsea Harmatys |
| Total Dissolved Solids (Filt. Residue) | BAL | 9146201 | 2018/09/17 | 2018/09/18 | Victoria Fedorak |



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Report Date: 2018/09/24

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-0400

## TEST SUMMARY

**Maxxam ID:** UI2679
**Sample ID:** NWD-18-48
**Matrix:** Water

**Collected:** 2018/09/15
**Relinquished:** 2018/09/16
**Received:** 2018/09/17

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9146359 | N/A | 2018/09/17 | Sandra Wilson |
| F1-BTEX | CALC/MS | 9145777 | N/A | 2018/09/18 | Automated Statchk |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9132731 | 2018/09/18 | 2018/09/18 | Kelsey Holt |



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## GENERAL COMMENTS

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

| | |
|---|---|
| Package 1 | 3.7°C |

Note: Labelling issue (label missing and /or incorrect). The sample ID on the Chain of Custody is NWD 18-49 while all the containers were labeled as NWD 18-48. Informed client and was directed to proceed with the sample ID as per containers.

**Results relate only to the items tested.**



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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-0400

## QUALITY ASSURANCE REPORT

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| 9132731 | KHO | Method Blank | O-TERPHENYL (sur.) | 2018/09/08 | | 99 | % | 60 - 140 |
| | | | F2 (C10-C16 Hydrocarbons) | 2018/09/08 | <0.10 | | mg/L | |
| 9146201 | VFE | Method Blank | Total Dissolved Solids | 2018/09/18 | <10 | | mg/L | |
| 9146206 | MPX | Method Blank | Dissolved Nitrite (N) | 2018/09/17 | <0.010 | | mg/L | |
| | | | Dissolved Nitrate (N) | 2018/09/17 | <0.010 | | mg/L | |
| 9146359 | SB8 | Method Blank | 1,4-Difluorobenzene (sur.) | 2018/09/17 | | 98 | % | 50 - 140 |
| | | | 4-Bromofluorobenzene (sur.) | 2018/09/17 | | 98 | % | 50 - 140 |
| | | | D4-1,2-Dichloroethane (sur.) | 2018/09/17 | | 104 | % | 50 - 140 |
| | | | Benzene | 2018/09/17 | <0.00040 | | mg/L | |
| | | | Toluene | 2018/09/17 | <0.00040 | | mg/L | |
| | | | Ethylbenzene | 2018/09/17 | <0.00040 | | mg/L | |
| | | | m & p-Xylene | 2018/09/17 | <0.00080 | | mg/L | |
| | | | o-Xylene | 2018/09/17 | <0.00040 | | mg/L | |
| | | | F1 (C6-C10) | 2018/09/17 | <0.10 | | mg/L | |
| 9146468 | BC5 | Method Blank | D10-ANTHRACENE (sur.) | 2018/09/19 | | 121 | % | 50 - 130 |
| | | | TERPHENYL-D14 (sur.) | 2018/09/19 | | 102 | % | 50 - 130 |
| | | | D8-ACENAPHTHYLENE (sur.) | 2018/09/19 | | 104 | % | 50 - 130 |
| | | | D8-NAPHTHALENE (sur.) | 2018/09/19 | | 77 | % | 50 - 130 |
| | | | Acenaphthene | 2018/09/19 | <0.00010 | | mg/L | |
| | | | Acenaphthylene | 2018/09/19 | <0.00010 | | mg/L | |
| | | | Acridine | 2018/09/19 | <0.000050 | | mg/L | |
| | | | Anthracene | 2018/09/19 | <0.000010 | | mg/L | |
| | | | Benzo(a)anthracene | 2018/09/19 | <0.0000085 | | mg/L | |
| | | | Benzo(b&j)fluoranthene | 2018/09/19 | <0.0000085 | | mg/L | |
| | | | Benzo(k)fluoranthene | 2018/09/19 | <0.0000085 | | mg/L | |
| | | | Benzo(g,h,i)perylene | 2018/09/19 | <0.0000085 | | mg/L | |
| | | | Benzo(c)phenanthrene | 2018/09/19 | <0.000050 | | mg/L | |
| | | | Benzo(a)pyrene | 2018/09/19 | <0.0000075 | | mg/L | |
| | | | Benzo[e]pyrene | 2018/09/19 | <0.000050 | | mg/L | |
| | | | Chrysene | 2018/09/19 | <0.0000085 | | mg/L | |
| | | | Dibenz(a,h)anthracene | 2018/09/19 | <0.0000075 | | mg/L | |
| | | | Fluoranthene | 2018/09/19 | <0.000010 | | mg/L | |
| | | | Fluorene | 2018/09/19 | <0.000050 | | mg/L | |
| | | | Indeno(1,2,3-cd)pyrene | 2018/09/19 | <0.0000085 | | mg/L | |
| | | | 1-Methylnaphthalene | 2018/09/19 | <0.00010 | | mg/L | |
| | | | 2-Methylnaphthalene | 2018/09/19 | <0.00010 | | mg/L | |
| | | | Naphthalene | 2018/09/19 | <0.00010 | | mg/L | |
| | | | Phenanthrene | 2018/09/19 | <0.000050 | | mg/L | |
| | | | Perylene | 2018/09/19 | <0.000050 | | mg/L | |
| | | | Pyrene | 2018/09/19 | <0.000020 | | mg/L | |
| | | | Quinoline | 2018/09/19 | <0.00020 | | mg/L | |
| 9146470 | APY | Method Blank | Dissolved Aluminum (Al) | 2018/09/17 | <0.0030 | | mg/L | |
| | | | Dissolved Chromium (Cr) | 2018/09/17 | <0.0010 | | mg/L | |
| | | | Dissolved Cobalt (Co) | 2018/09/17 | <0.00030 | | mg/L | |
| | | | Dissolved Copper (Cu) | 2018/09/17 | <0.00020 | | mg/L | |
| | | | Dissolved Lead (Pb) | 2018/09/17 | <0.00020 | | mg/L | |
| | | | Dissolved Antimony (Sb) | 2018/09/17 | <0.00060 | | mg/L | |
| | | | Dissolved Molybdenum (Mo) | 2018/09/17 | <0.00020 | | mg/L | |
| | | | Dissolved Nickel (Ni) | 2018/09/17 | <0.00050 | | mg/L | |
| | | | Dissolved Selenium (Se) | 2018/09/17 | <0.00020 | | mg/L | |
| | | | Dissolved Silver (Ag) | 2018/09/17 | <0.00010 | | mg/L | |



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Project #: 407011-00586-0400

## QUALITY ASSURANCE REPORT(CONT'D)

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| | | | Dissolved Arsenic (As) | 2018/09/17 | <0.00020 | | mg/L | |
| | | | Dissolved Thallium (Tl) | 2018/09/17 | <0.00020 | | mg/L | |
| | | | Dissolved Tin (Sn) | 2018/09/17 | <0.0010 | | mg/L | |
| | | | Dissolved Titanium (Ti) | 2018/09/17 | <0.0010 | | mg/L | |
| | | | Dissolved Uranium (U) | 2018/09/17 | <0.00010 | | mg/L | |
| | | | Dissolved Vanadium (V) | 2018/09/17 | <0.0010 | | mg/L | |
| | | | Dissolved Zinc (Zn) | 2018/09/17 | <0.0030 | | mg/L | |
| | | | Dissolved Beryllium (Be) | 2018/09/17 | <0.0010 | | mg/L | |
| 9147064 | MA4 | Method Blank | Alkalinity (Total as CaCO3) | 2018/09/18 | <1.0 | | mg/L | |
| | | | Alkalinity (PP as CaCO3) | 2018/09/18 | <1.0 | | mg/L | |
| | | | Bicarbonate (HCO3) | 2018/09/18 | <1.0 | | mg/L | |
| | | | Carbonate (CO3) | 2018/09/18 | <1.0 | | mg/L | |
| | | | Hydroxide (OH) | 2018/09/18 | <1.0 | | mg/L | |
| 9147070 | MA4 | Method Blank | Conductivity | 2018/09/18 | <2.0 | | uS/cm | |
| 9147547 | CH7 | Method Blank | Dissolved Chloride (Cl) | 2018/09/18 | <1.0 | | mg/L | |
| 9147553 | CH7 | Method Blank | Dissolved Sulphate (SO4) | 2018/09/18 | <1.0 | | mg/L | |
| 9147575 | CH7 | Method Blank | Dissolved Chloride (Cl) | 2018/09/18 | <1.0 | | mg/L | |
| 9147576 | CH7 | Method Blank | Dissolved Sulphate (SO4) | 2018/09/18 | <1.0 | | mg/L | |
| 9147748 | JK9 | Method Blank | Dissolved Iron (Fe) | 2018/09/18 | <0.060 | | mg/L | |
| | | | Dissolved Lithium (Li) | 2018/09/18 | <0.020 | | mg/L | |
| | | | Dissolved Magnesium (Mg) | 2018/09/18 | <0.20 | | mg/L | |
| | | | Dissolved Manganese (Mn) | 2018/09/18 | <0.0040 | | mg/L | |
| | | | Dissolved Potassium (K) | 2018/09/18 | <0.30 | | mg/L | |
| | | | Dissolved Sodium (Na) | 2018/09/18 | <0.50 | | mg/L | |
| | | | Dissolved Strontium (Sr) | 2018/09/18 | <0.020 | | mg/L | |
| | | | Dissolved Sulphur (S) | 2018/09/18 | <0.20 | | mg/L | |
| | | | Dissolved Phosphorus (P) | 2018/09/18 | <0.10 | | mg/L | |
| | | | Dissolved Barium (Ba) | 2018/09/18 | <0.010 | | mg/L | |
| | | | Dissolved Silicon (Si) | 2018/09/18 | <0.10 | | mg/L | |
| | | | Dissolved Boron (B) | 2018/09/18 | <0.020 | | mg/L | |
| | | | Dissolved Calcium (Ca) | 2018/09/18 | <0.30 | | mg/L | |
| 9149048 | APY | Method Blank | Dissolved Mercury (Hg) | 2018/09/19 | <0.0000020 | | mg/L | |
| 9151279 | AF6 | Method Blank | Phenols | 2018/09/20 | <0.0020 | | mg/L | |
| 9146201 | VFE | RPD [UI2676-02] | Total Dissolved Solids | 2018/09/18 | 0.25 | | % | 20 |
| 9146470 | APY | RPD [UI2676-03] | Dissolved Aluminum (Al) | 2018/09/17 | 2.8 | | % | 20 |
| | | | Dissolved Chromium (Cr) | 2018/09/17 | NC | | % | 20 |
| | | | Dissolved Cobalt (Co) | 2018/09/17 | 0.25 | | % | 20 |
| | | | Dissolved Copper (Cu) | 2018/09/17 | 3.4 | | % | 20 |
| | | | Dissolved Lead (Pb) | 2018/09/17 | 1.1 | | % | 20 |
| | | | Dissolved Antimony (Sb) | 2018/09/17 | NC | | % | 20 |
| | | | Dissolved Molybdenum (Mo) | 2018/09/17 | 3.6 | | % | 20 |
| | | | Dissolved Nickel (Ni) | 2018/09/17 | 5.7 | | % | 20 |
| | | | Dissolved Selenium (Se) | 2018/09/17 | 8.3 | | % | 20 |
| | | | Dissolved Silver (Ag) | 2018/09/17 | NC | | % | 20 |
| | | | Dissolved Arsenic (As) | 2018/09/17 | NC | | % | 20 |
| | | | Dissolved Thallium (Tl) | 2018/09/17 | NC | | % | 20 |
| | | | Dissolved Tin (Sn) | 2018/09/17 | NC | | % | 20 |
| | | | Dissolved Titanium (Ti) | 2018/09/17 | 0.58 | | % | 20 |
| | | | Dissolved Uranium (U) | 2018/09/17 | 2.7 | | % | 20 |
| | | | Dissolved Vanadium (V) | 2018/09/17 | NC | | % | 20 |
| | | | Dissolved Zinc (Zn) | 2018/09/17 | 3.8 | | % | 20 |



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## QUALITY ASSURANCE REPORT(CONT'D)

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| | | | Dissolved Beryllium (Be) | 2018/09/17 | NC | | % | 20 |
| 9146206 | MPX | RPD [UI2677-01] | Dissolved Nitrite (N) | 2018/09/17 | NC | | % | 20 |
| | | | Dissolved Nitrate (N) | 2018/09/17 | 3.9 | | % | 20 |
| 9146359 | SB8 | RPD [UI2677-06] | Benzene | 2018/09/17 | NC | | % | 30 |
| | | | Toluene | 2018/09/17 | NC | | % | 30 |
| | | | Ethylbenzene | 2018/09/17 | NC | | % | 30 |
| | | | m & p-Xylene | 2018/09/17 | NC | | % | 30 |
| | | | o-Xylene | 2018/09/17 | NC | | % | 30 |
| | | | F1 (C6-C10) | 2018/09/17 | NC | | % | 30 |
| 9147575 | CH7 | RPD [UI2677-01] | Dissolved Chloride (Cl) | 2018/09/18 | 5.5 | | % | 20 |
| 9147576 | CH7 | RPD [UI2677-01] | Dissolved Sulphate (SO4) | 2018/09/18 | 6.0 | | % | 20 |
| 9146201 | VFE | Matrix Spike [UI2676-02] | Total Dissolved Solids | 2018/09/18 | | NC | % | 80 - 120 |
| 9146206 | MPX | Matrix Spike [UI2677-01] | Dissolved Nitrite (N) | 2018/09/17 | | 92 | % | 80 - 120 |
| | | | Dissolved Nitrate (N) | 2018/09/17 | | 93 | % | 80 - 120 |
| 9146359 | SB8 | Matrix Spike [UI2678-06] | 1,4-Difluorobenzene (sur.) | 2018/09/17 | | 91 | % | 50 - 140 |
| | | | 4-Bromofluorobenzene (sur.) | 2018/09/17 | | 98 | % | 50 - 140 |
| | | | D4-1,2-Dichloroethane (sur.) | 2018/09/17 | | 105 | % | 50 - 140 |
| | | | Benzene | 2018/09/17 | | 83 | % | 50 - 140 |
| | | | Toluene | 2018/09/17 | | 97 | % | 50 - 140 |
| | | | Ethylbenzene | 2018/09/17 | | 86 | % | 50 - 140 |
| | | | m & p-Xylene | 2018/09/17 | | 83 | % | 50 - 140 |
| | | | o-Xylene | 2018/09/17 | | 86 | % | 50 - 140 |
| | | | F1 (C6-C10) | 2018/09/17 | | 79 | % | 60 - 140 |
| 9146470 | APY | Matrix Spike [UI2676-03] | Dissolved Aluminum (Al) | 2018/09/17 | | NC | % | 80 - 120 |
| | | | Dissolved Chromium (Cr) | 2018/09/17 | | 99 | % | 80 - 120 |
| | | | Dissolved Cobalt (Co) | 2018/09/17 | | 99 | % | 80 - 120 |
| | | | Dissolved Copper (Cu) | 2018/09/17 | | 98 | % | 80 - 120 |
| | | | Dissolved Lead (Pb) | 2018/09/17 | | 89 | % | 80 - 120 |
| | | | Dissolved Antimony (Sb) | 2018/09/17 | | 92 | % | 80 - 120 |
| | | | Dissolved Molybdenum (Mo) | 2018/09/17 | | 99 | % | 80 - 120 |
| | | | Dissolved Nickel (Ni) | 2018/09/17 | | 99 | % | 80 - 120 |
| | | | Dissolved Selenium (Se) | 2018/09/17 | | 103 | % | 80 - 120 |
| | | | Dissolved Silver (Ag) | 2018/09/17 | | 89 | % | 80 - 120 |
| | | | Dissolved Arsenic (As) | 2018/09/17 | | 98 | % | 80 - 120 |
| | | | Dissolved Thallium (Tl) | 2018/09/17 | | 91 | % | 80 - 120 |
| | | | Dissolved Tin (Sn) | 2018/09/17 | | 92 | % | 80 - 120 |
| | | | Dissolved Titanium (Ti) | 2018/09/17 | | 93 | % | 80 - 120 |
| | | | Dissolved Uranium (U) | 2018/09/17 | | 93 | % | 80 - 120 |
| | | | Dissolved Vanadium (V) | 2018/09/17 | | 101 | % | 80 - 120 |
| | | | Dissolved Zinc (Zn) | 2018/09/17 | | 96 | % | 80 - 120 |
| | | | Dissolved Beryllium (Be) | 2018/09/17 | | 95 | % | 80 - 120 |
| 9147575 | CH7 | Matrix Spike [UI2677-01] | Dissolved Chloride (Cl) | 2018/09/18 | | 106 | % | 80 - 120 |
| 9147576 | CH7 | Matrix Spike [UI2677-01] | Dissolved Sulphate (SO4) | 2018/09/18 | | NC | % | 80 - 120 |
| 9132731 | KHO | LCS | O-TERPHENYL (sur.) | 2018/09/08 | | 100 | % | 60 - 140 |
| | | | F2 (C10-C16 Hydrocarbons) | 2018/09/08 | | 100 | % | 60 - 140 |
| 9146201 | VFE | LCS | Total Dissolved Solids | 2018/09/18 | | 102 | % | 80 - 120 |
| 9146206 | MPX | LCS | Dissolved Nitrite (N) | 2018/09/17 | | 101 | % | 80 - 120 |
| | | | Dissolved Nitrate (N) | 2018/09/17 | | 102 | % | 80 - 120 |
| 9146359 | SB8 | LCS | 1,4-Difluorobenzene (sur.) | 2018/09/18 | | 92 | % | 50 - 140 |
| | | | 4-Bromofluorobenzene (sur.) | 2018/09/18 | | 96 | % | 50 - 140 |
| | | | D4-1,2-Dichloroethane (sur.) | 2018/09/18 | | 103 | % | 50 - 140 |



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## QUALITY ASSURANCE REPORT(CONT'D)

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| | | | Benzene | 2018/09/18 | | 82 | % | 60 - 130 |
| | | | Toluene | 2018/09/18 | | 95 | % | 60 - 130 |
| | | | Ethylbenzene | 2018/09/18 | | 85 | % | 60 - 130 |
| | | | m & p-Xylene | 2018/09/18 | | 83 | % | 60 - 130 |
| | | | o-Xylene | 2018/09/18 | | 86 | % | 60 - 130 |
| | | | F1 (C6-C10) | 2018/09/18 | | 112 | % | 60 - 140 |
| 9146468 | BC5 | LCS | D10-ANTHRACENE (sur.) | 2018/09/19 | | 101 | % | 50 - 130 |
| | | | TERPHENYL-D14 (sur.) | 2018/09/19 | | 100 | % | 50 - 130 |
| | | | D8-ACENAPHTHYLENE (sur.) | 2018/09/19 | | 98 | % | 50 - 130 |
| | | | D8-NAPHTHALENE (sur.) | 2018/09/19 | | 73 | % | 50 - 130 |
| | | | Acenaphthene | 2018/09/19 | | 96 | % | 50 - 130 |
| | | | Acenaphthylene | 2018/09/19 | | 101 | % | 50 - 130 |
| | | | Acridine | 2018/09/19 | | 103 | % | 50 - 130 |
| | | | Anthracene | 2018/09/19 | | 98 | % | 50 - 130 |
| | | | Benzo(a)anthracene | 2018/09/19 | | 106 | % | 50 - 130 |
| | | | Benzo(b&j)fluoranthene | 2018/09/19 | | 93 | % | 50 - 130 |
| | | | Benzo(k)fluoranthene | 2018/09/19 | | 106 | % | 50 - 130 |
| | | | Benzo(g,h,i)perylene | 2018/09/19 | | 93 | % | 50 - 130 |
| | | | Benzo(c)phenanthrene | 2018/09/19 | | 112 | % | 50 - 130 |
| | | | Benzo(a)pyrene | 2018/09/19 | | 98 | % | 50 - 130 |
| | | | Benzo[e]pyrene | 2018/09/19 | | 100 | % | 50 - 130 |
| | | | Chrysene | 2018/09/19 | | 106 | % | 50 - 130 |
| | | | Dibenz(a,h)anthracene | 2018/09/19 | | 97 | % | 50 - 130 |
| | | | Fluoranthene | 2018/09/19 | | 98 | % | 50 - 130 |
| | | | Fluorene | 2018/09/19 | | 99 | % | 50 - 130 |
| | | | Indeno(1,2,3-cd)pyrene | 2018/09/19 | | 78 | % | 50 - 130 |
| | | | 1-Methylnaphthalene | 2018/09/19 | | 86 | % | 50 - 130 |
| | | | 2-Methylnaphthalene | 2018/09/19 | | 85 | % | 50 - 130 |
| | | | Naphthalene | 2018/09/19 | | 84 | % | 50 - 130 |
| | | | Phenanthrene | 2018/09/19 | | 92 | % | 50 - 130 |
| | | | Perylene | 2018/09/19 | | 84 | % | 50 - 130 |
| | | | Pyrene | 2018/09/19 | | 98 | % | 50 - 130 |
| | | | Quinoline | 2018/09/19 | | 117 | % | 50 - 130 |
| 9146470 | APY | LCS | Dissolved Aluminum (Al) | 2018/09/18 | | 94 | % | 80 - 120 |
| | | | Dissolved Chromium (Cr) | 2018/09/18 | | 99 | % | 80 - 120 |
| | | | Dissolved Cobalt (Co) | 2018/09/18 | | 102 | % | 80 - 120 |
| | | | Dissolved Copper (Cu) | 2018/09/18 | | 101 | % | 80 - 120 |
| | | | Dissolved Lead (Pb) | 2018/09/18 | | 97 | % | 80 - 120 |
| | | | Dissolved Antimony (Sb) | 2018/09/18 | | 97 | % | 80 - 120 |
| | | | Dissolved Molybdenum (Mo) | 2018/09/18 | | 98 | % | 80 - 120 |
| | | | Dissolved Nickel (Ni) | 2018/09/18 | | 102 | % | 80 - 120 |
| | | | Dissolved Selenium (Se) | 2018/09/18 | | 99 | % | 80 - 120 |
| | | | Dissolved Silver (Ag) | 2018/09/18 | | 98 | % | 80 - 120 |
| | | | Dissolved Arsenic (As) | 2018/09/18 | | 100 | % | 80 - 120 |
| | | | Dissolved Thallium (Tl) | 2018/09/18 | | 95 | % | 80 - 120 |
| | | | Dissolved Tin (Sn) | 2018/09/18 | | 98 | % | 80 - 120 |
| | | | Dissolved Titanium (Ti) | 2018/09/18 | | 104 | % | 80 - 120 |
| | | | Dissolved Uranium (U) | 2018/09/18 | | 95 | % | 80 - 120 |
| | | | Dissolved Vanadium (V) | 2018/09/18 | | 100 | % | 80 - 120 |
| | | | Dissolved Zinc (Zn) | 2018/09/18 | | 93 | % | 80 - 120 |
| | | | Dissolved Beryllium (Be) | 2018/09/18 | | 94 | % | 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 #: B879711
Report Date: 2018/09/24

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-0400

## QUALITY ASSURANCE REPORT(CONT'D)

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| 9147064 | MA4 | LCS | Alkalinity (Total as CaCO3) | 2018/09/18 | | 101 | % | 80 - 120 |
| 9147070 | MA4 | LCS | Conductivity | 2018/09/18 | | 100 | % | 90 - 110 |
| 9147547 | CH7 | LCS | Dissolved Chloride (Cl) | 2018/09/18 | | 106 | % | 80 - 120 |
| 9147553 | CH7 | LCS | Dissolved Sulphate (SO4) | 2018/09/18 | | 105 | % | 80 - 120 |
| 9147575 | CH7 | LCS | Dissolved Chloride (Cl) | 2018/09/18 | | 106 | % | 80 - 120 |
| 9147576 | CH7 | LCS | Dissolved Sulphate (SO4) | 2018/09/18 | | 104 | % | 80 - 120 |
| 9147748 | JK9 | LCS | Dissolved Iron (Fe) | 2018/09/18 | | 95 | % | 80 - 120 |
| | | | Dissolved Lithium (Li) | 2018/09/18 | | 94 | % | 80 - 120 |
| | | | Dissolved Magnesium (Mg) | 2018/09/18 | | 97 | % | 80 - 120 |
| | | | Dissolved Manganese (Mn) | 2018/09/18 | | 98 | % | 80 - 120 |
| | | | Dissolved Potassium (K) | 2018/09/18 | | 98 | % | 80 - 120 |
| | | | Dissolved Sodium (Na) | 2018/09/18 | | 100 | % | 80 - 120 |
| | | | Dissolved Strontium (Sr) | 2018/09/18 | | 88 | % | 80 - 120 |
| | | | Dissolved Sulphur (S) | 2018/09/18 | | 97 | % | 80 - 120 |
| | | | Dissolved Phosphorus (P) | 2018/09/18 | | 100 | % | 80 - 120 |
| | | | Dissolved Barium (Ba) | 2018/09/18 | | 98 | % | 80 - 120 |
| | | | Dissolved Silicon (Si) | 2018/09/18 | | 94 | % | 80 - 120 |
| | | | Dissolved Boron (B) | 2018/09/18 | | 99 | % | 80 - 120 |
| | | | Dissolved Calcium (Ca) | 2018/09/18 | | 96 | % | 80 - 120 |
| 9149048 | APY | LCS | Dissolved Mercury (Hg) | 2018/09/19 | | 106 | % | 80 - 120 |
| 9151279 | AF6 | LCS | Phenols | 2018/09/20 | | 95 | % | 80 - 120 |
| 9149048 | APY | SRM | Dissolved Mercury (Hg) | 2018/09/19 | | 98 | % | 80 - 120 |

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.

LCS: 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.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

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



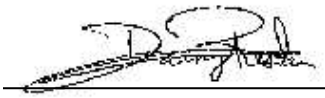
Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B879711
Report Date: 2018/09/24

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-0400

## VALIDATION SIGNATURE PAGE

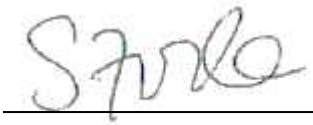
The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Daniel Reslan, cCT, QP, Organics Manager



Justin Geisel, B.Sc., Organics Supervisor



Suwan Fock, B.Sc., QP, Inorganics Senior Analyst

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.



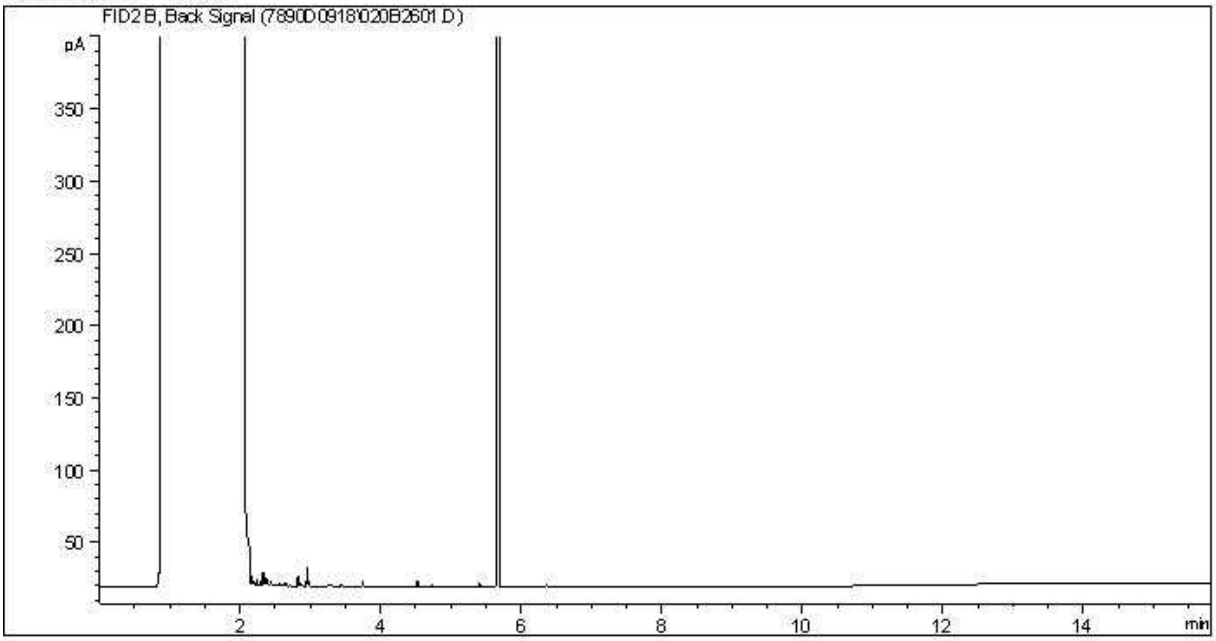
Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B879711
Report Date: 2018/09/24
Maxxam Sample: UI2676

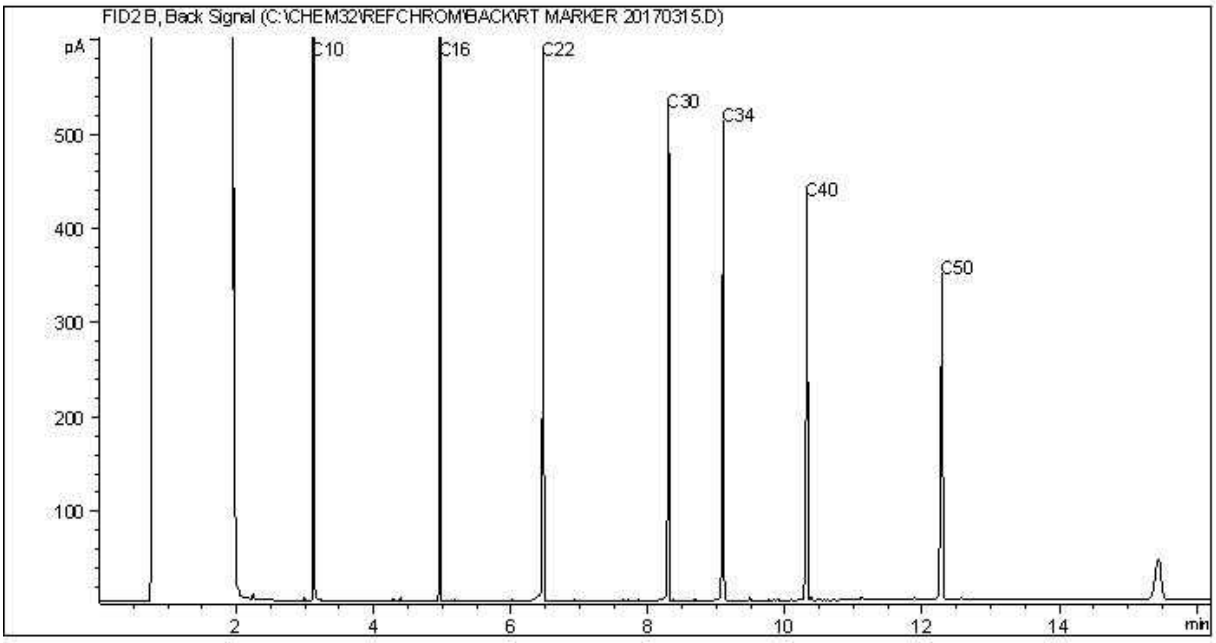
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: CPF-97-7-5

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890D




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

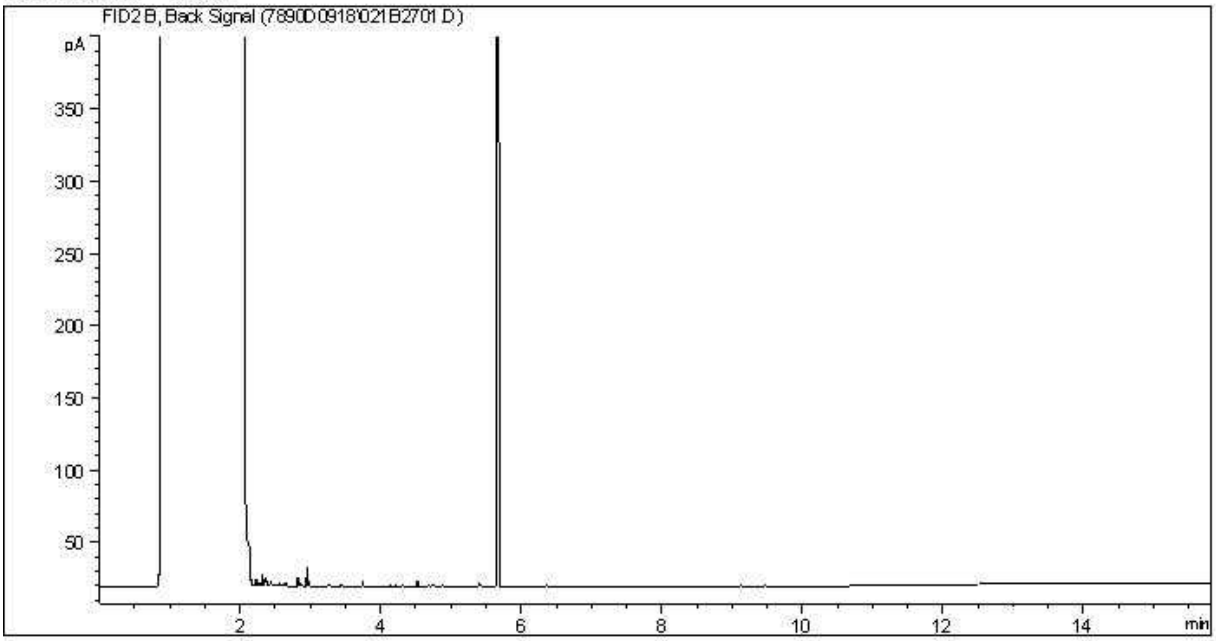
**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam Job #: B879711
Report Date: 2018/09/24
Maxxam Sample: UI2677

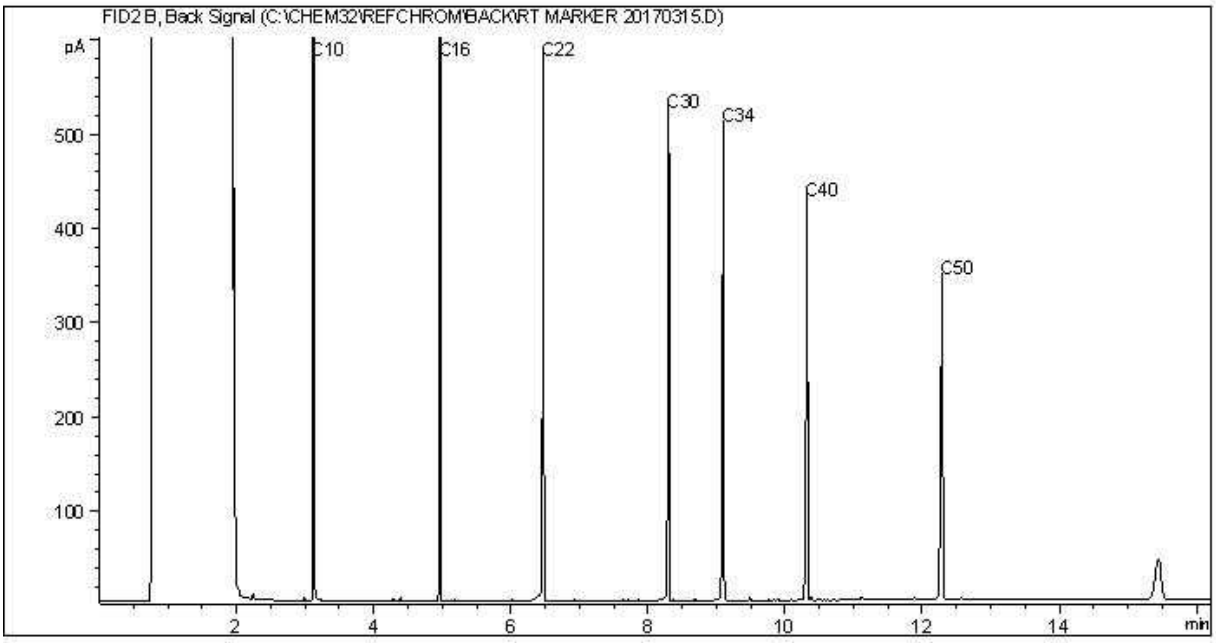
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: MEBG-10-1-3

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890D




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

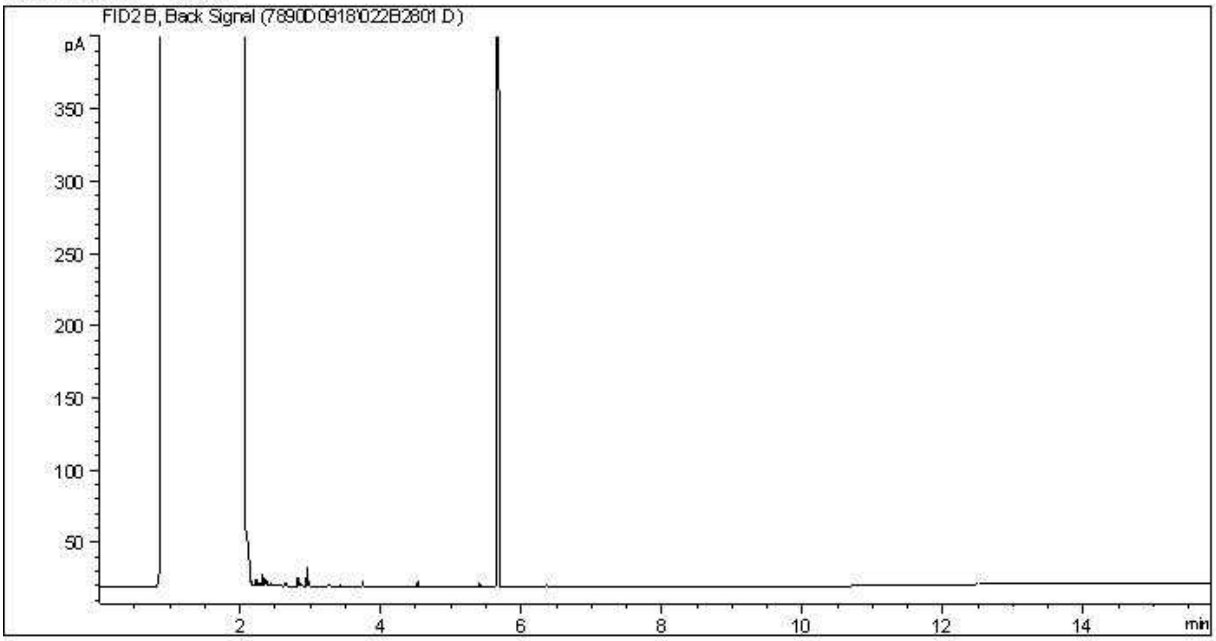
**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam Job #: B879711
Report Date: 2018/09/24
Maxxam Sample: UI2678

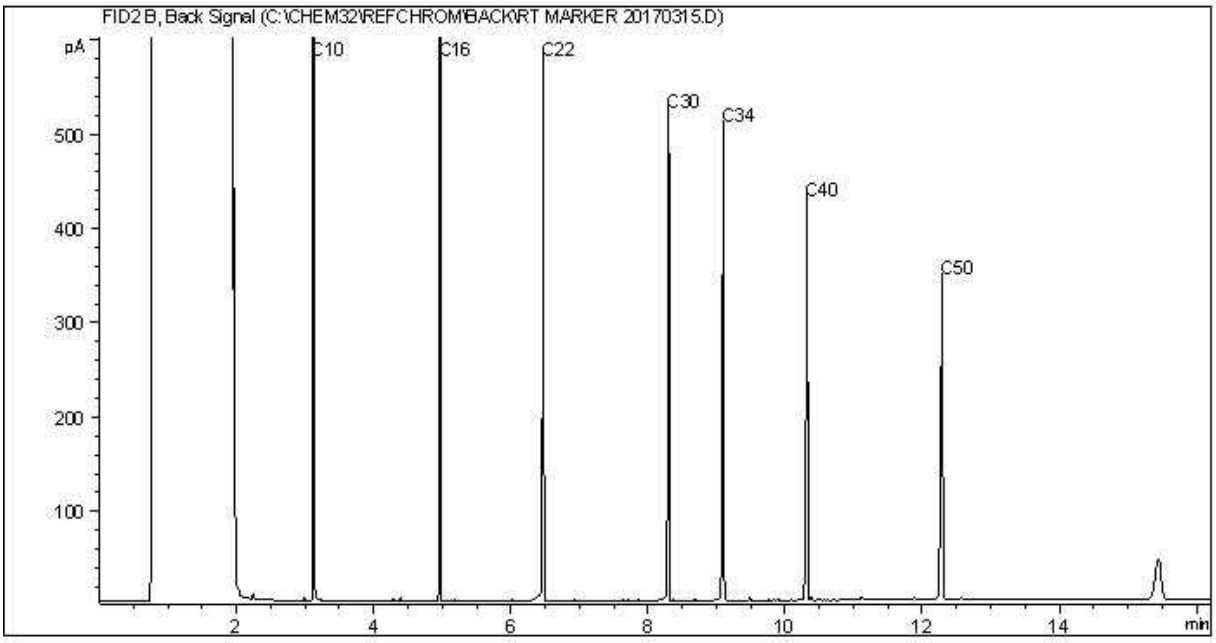
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: ARB-12-3-3

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890D




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

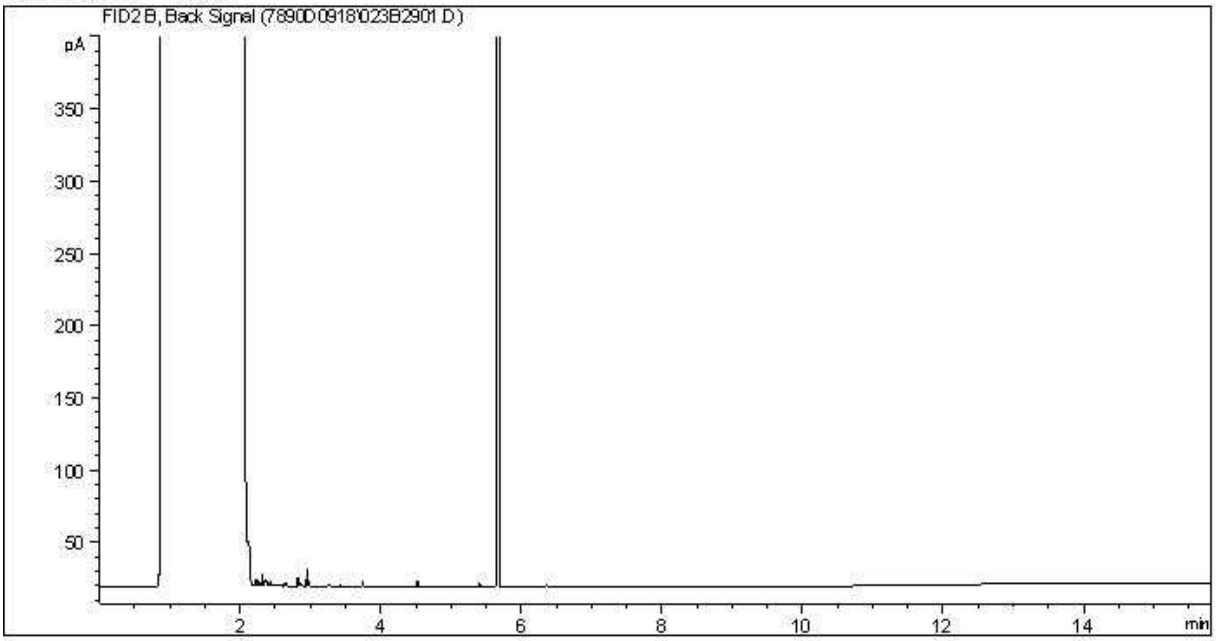
**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam Job #: B879711
Report Date: 2018/09/24
Maxxam Sample: UI2679

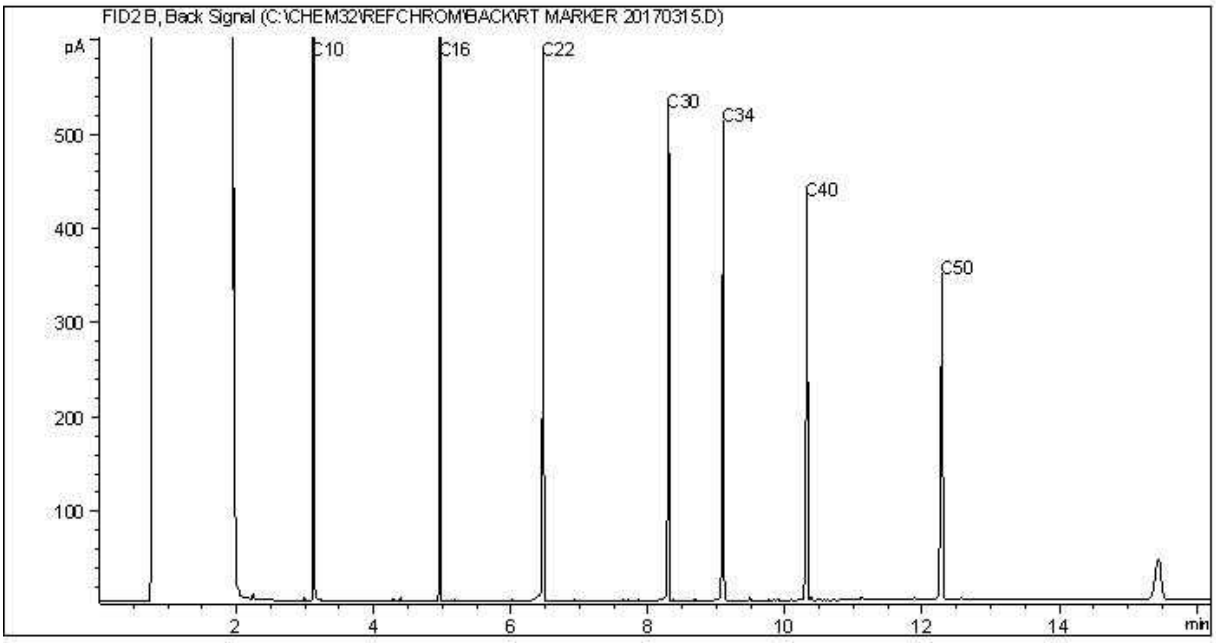
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: NWD-18-48

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890D




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam
A Bureau Veritas Group Company

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9331 - 48 Street, T6B 2R4
Phone: (780) 577-7100
Fax: (780) 450-4187
Toll Free: (800) 386-7247

734 D-T

# EXXON MOBIL/IMPERIAL OIL - MAXXAM CHAIN-OF-CUSTODY RECORD



C of C # 299030

| INVOICE INFORMATION | REPORT INFORMATION |
|---|---|
| Company Name: ☒ Imperial Oil ☐ ExxonMobil | Company Name: WORLEYPARSONS |
| Contact Name: WORLEYPARSONS | Contact Name: STACY GIBB |
| Address: 500 - 151 CANADA OLYMPIC RD SW CALGARY, AB T3B 6B7 | Address: 500 - 151 CANADA OLYMPIC RD SW CALGARY, AB T3B 6B7 |
| Email: SANJ.RERERAC@ADVISIAN.COM | Email: STACY.GIBB@ADVISIAN.COM |
| Ph: 587-952-1490 | Ph: 403-247-0200 |
| Sampler Name (Print): DEVON GREVES | Consultant Project #: 407011-00586-0400 |

| | FIELD SAMPLE ID | MATRIX: GROUND WATER | SURFACE WATER | SOIL | OTHER | # CONTAINERS | SAMPLING: DATE (YYYY/MM/DD) | TIME (24 HR) | FIELD FILTERED & PRESERVED | LAB FILTRATION REQUIRED | VOC | PAH | PHCs (FRACTIONS 1-2 PLUS BTEX) | PHCs (FRACTIONS 1-4 PLUS BTEX) | PHCs (FRACTIONS 2-4) | PHCs (FRACTION 1 PLUS BTEX) | GRAIN SIZE (75 MICRON) | TEXTURE (% SAND, SILT, CLAY) | PARTICLE SIZE DISTRIBUTION WITH GRAPH | REGULATED METALS TOT ☐ DIS ☒ | MERCURY TOTAL ☐ DISSOLVED ☒ | SALINITY SOIL | FERTILIZER SOIL | FERTILIZER WATER | NUTRIENTS SOIL | ROUTINE POTABILITY | pH ☐ EC ☐ ALKALINITY ☐ | BASIC CLASS II LANDFILL PKG | PHENOLS (4-AAP) | LIMITED SAMPLE VOLUME |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | CPF 97-7-5 | X | | | | 10 | 2018/09/15 | 16:15 | X | | | | X | | | | | | | X | X | | | | | X | | | X | |
| 2 | MEBG-10-1-3 | X | | | | 12 | ↓ | 15:30 | X | | | X | X | | | | | | | X | X | | | | | X | | | X | |
| 3 | ARB-12-3-3 | X | | | | 10 | | 14:45 | X | | | | X | | | | | | | X | X | | | | | X | | | X | |
| 4 | NWD 18-49 | | | | X | 4 | 2018/09/15 | 18:00 | | | | | X | | | | | | | | | | | | | | | | | X | |
| 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

IOL SITE LOCATION: NORMAN WELLS, NT

IOL PROJECT # (if applicable): N/A

MAXXAM TASK ORDER # OR SERVICE ORDER # + LINE ITEM: 407011-00586-0400

REGULATORY CRITERIA / DETECTION LIMITS:
☐ Alberta Tier 1 ☐ CDWG
☐ SEQG (SK) ☐ NoSC (SK)
☒ CCME (incl. level) FWAL ☐ Other

SPECIAL INSTRUCTIONS:
ALSO EMAIL!
- STANDARD NORMAN WELLS EMAIL LIST
- MELISSA.LORD@ADVISIAN.COM
- DEVON.GREVES@ADVISIAN.COM
* IES A2601436

# JARS USED & NOT SUBMITTED (Enter N/A for Water): N/A

TURNAROUND TIME
Standard (5 days) ☒
Rush (3 days) ☐
(2 days) ☐
(1 day) ☐
(same day) ☐
Date Required

| | YES | NO | COOLER ID # | | | |
|---|---|---|---|---|---|---|
| SEAL PRESENT | ✓ | | TEMP °C | 3 | 4 | 4 |
| SEAL INTACT | ✓ | | | 1 | 2 | 3 |
| COOLING MEDIA PRESENT | ✓ | | | | | |

| | YES | NO | COOLER ID # | | | |
|---|---|---|---|---|---|---|
| SEAL PRESENT | | | TEMP °C | 1 | 2 | 3 |
| SEAL INTACT | | | | | | |
| COOLING MEDIA PRESENT | | | | | | |

| | YES | NO | COOLER ID # | | | |
|---|---|---|---|---|---|---|
| SEAL PRESENT | | | TEMP °C | 1 | 2 | 3 |
| SEAL INTACT | | | | | | |
| COOLING MEDIA PRESENT | | | | | | |

LAB USE ONLY
MAXXAM JOB # B879711

SAMPLES
LABELED BY: RBF
VERIFIED BY: D-T

| RELINQUISHED BY: | | DATE: | TIME (24 HR) | RECEIVED BY: | | DATE: | TIME (24 HR) |
|---|---|---|---|---|---|---|---|
| 1. | Devon Greves | 2018/09/16 | 10:00 | 1. | RACHEL BERNARDF | 2018091 7 | 0917 |
| 2. | | | | 2. | | | |
| 3. | | | | 3. | | | |

COC-1010 (06/2016) IOL-AB White: Maxxam Yellow: Client

# DATA QUALITY REVIEW CHECKLIST - IMPERIAL OIL PROJECTS

Consultant: Advisian

Sampling Date: 16-Sep-18

Location: Norman Wells

Laboratory : Maxxam Edmonton

Consultant Project Number: 407011-00586-0400

Sample Submission Number: B880368

Are All Laboratory QC Within Acceptance Criteria (Yes, No, Not Applicable)?

| | Yes | No | NA | Comments |
|---|---|---|---|---|
| Instrument Surrogate Recovery | x | | | All laboratory QC met acceptance criteria. |
| Extraction Surrogate Recovery | x | | | |
| Method Blank Concentration | x | | | |
| Matrix Duplicate RPD | | | x | |
| Matrix Spike Recovery | | | x | |
| Lab Control Sample Recovery | x | | | |

Are All Field QC Samples Within Alert Limits (Yes, No, Not Applicable)?

| | Yes | No | NA | Comments |
|---|---|---|---|---|
| Field Blank Concentration | | | x | No field QC samples submitted. |
| Trip Blank Concentration | | | x | |
| Equipment Blank Concentration | | | x | |
| Field Duplicate RPD | | | x | |

| | |
|---|---|
| Has CoA been signed off (Yes/No)?: | Yes |
| Has lab warranted all tests were analyzed following SOP's in CoA (Yes/No)?: | Yes |
| Were all samples analyzed within hold times (Yes/No)?: | Yes |
| All volatiles samples methanol extracted (if required) within 48 hours (Yes/No)?: | n/a |
| Is Chain of Custody completed and signed (Yes/No)?: | Yes |
| Were sample temperatures acceptable when they reached lab (Yes/No)?: | Yes |

| | |
|---|---|
| Was a Data Quality Overview (DQO) issued (Yes/No)?: | No |
| Date DQO was received: | n/a |

Is data considered to be reliable (Yes/No)?: Yes

If answer is "No", describe and provide rationale:

Data Reviewed by (Print): Vivian Baptista

Data Reviewed by (Signature): 

Date: 16-Oct-18

Maxxam
A Bureau Veritas Group Company

Success Through Science®

Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400
Your C.O.C. #: 299031

**Attention: Stacy Gibb**

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

**Report Date: 2018/09/24**
Report #: R2624289
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B880368**
**Received: 2018/09/18, 11:30**

Sample Matrix: Water
# Samples Received: 4

| Analyses | Quantity | Laboratory Method | Primary Reference |
|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | 4 | AB SOP-00005 | SM 23 2320 B m |
| BTEX/F1 in Water by HS GC/MS/FID | 4 | AB SOP-00039 | CCME CWS/EPA 8260d m |
| F1-BTEX | 4 | AB SOP-00039 | Auto Calc |
| Cadmium - low level CCME - Dissolved | 4 | AB WI-00065 | Auto Calc |
| Chloride by Automated Colourimetry | 4 | AB SOP-00020 | SM 22 4500-Cl-E m |
| Chloride (Cl) and Sulphate (SO4) by IC | 1 | AB SOP-00026 | SM 23 4110 B m |
| Conductivity @25C | 4 | AB SOP-00005 | SM 23 2510 B m |
| CCME Hydrocarbons in Water (F2; C10-C16) (1) | 4 | AB SOP-00037 / AB SOP-00040 | CCME PHC-CWS m |
| Hardness | 4 | AB WI-00065 | Auto Calc |
| Mercury - Low Level (Dissolved) (2) | 4 | EENVSOP-00031 | EPA 245.7 R2 m |
| Elements by ICP - Dissolved (2) | 4 | AB SOP-00042 | EPA 6010d R4 m |
| Elements by ICPMS - Dissolved (2) | 4 | AB SOP-00043 | EPA 6020b R2 m |
| Ion Balance | 4 | AB WI-00065 | Auto Calc |
| Nitrate and Nitrite | 4 | AB WI-00065 | Auto Calc |
| Nitrate + Nitrite-N (calculated) | 4 | AB WI-00065 | Auto Calc |
| Nitrogen (Nitrite - Nitrate) by IC | 4 | AB SOP-00023 | SM 23 4110 B m |
| Phenols (4-AAP) | 4 | EENVSOP-00061 | MMCW 154 1996 m |
| Sulphate by Automated Colourimetry | 4 | AB SOP-00018 | SM 22 4500-SO4 E m |
| Total Dissolved Solids (Filt. Residue) | 4 | AB SOP-00065 | SM 22 2540 C m |

**Remarks:**

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard. All samples were analyzed within hold time unless otherwise flagged.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report.



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

Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400
Your C.O.C. #: 299031

**Attention: Stacy Gibb**

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

**Report Date: 2018/09/24**
Report #: R2624289
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B880368**
**Received: 2018/09/18, 11:30**

Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

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) Silica gel clean up employed.
(2) Dissolved > Total Imbalance: When applicable, Dissolved and Total results were reviewed and data quality meets acceptable levels unless otherwise noted.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Rhecie Phayouphone, Project Manager
Email: RPhayouphone@maxxam.ca
Phone# (403)735-2283

==========

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

Maxxam Job #: B880368
Report Date: 2018/09/24

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## AT1 BTEX AND F1-F2 IN WATER (WATER)

| Maxxam ID | | UI6181 | UI6182 | UI6183 | UI6184 | | |
|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/09/16 15:30 | 2018/09/16 10:15 | 2018/09/16 09:30 | 2018/09/16 14:30 | | |
| COC Number | | 299031 | 299031 | 299031 | 299031 | | |
| | **UNITS** | **CPF 98-8-3** | **C38 08-1-4** | **TF 03-12-3** | **MTF 97-1-5** | **RDL** | **QC Batch** |
| **Ext. Pet. Hydrocarbon** | | | | | | | |
| F2 (C10-C16 Hydrocarbons) | mg/L | <0.10 | <0.10 | <0.10 | 0.13 | 0.10 | 9146887 |
| **Volatiles** | | | | | | | |
| Benzene | mg/L | <0.00040 | <0.00040 | <0.00040 | <0.00040 | 0.00040 | 9148216 |
| Toluene | mg/L | <0.00040 | <0.00040 | <0.00040 | <0.00040 | 0.00040 | 9148216 |
| Ethylbenzene | mg/L | <0.00040 | <0.00040 | <0.00040 | <0.00040 | 0.00040 | 9148216 |
| m & p-Xylene | mg/L | <0.00080 | <0.00080 | <0.00080 | <0.00080 | 0.00080 | 9148216 |
| o-Xylene | mg/L | <0.00040 | <0.00040 | <0.00040 | <0.00040 | 0.00040 | 9148216 |
| Xylenes (Total) | mg/L | <0.00089 | <0.00089 | <0.00089 | <0.00089 | 0.00089 | 9148018 |
| F1 (C6-C10) - BTEX | mg/L | <0.10 | <0.10 | <0.10 | <0.10 | 0.10 | 9148018 |
| F1 (C6-C10) | mg/L | <0.10 | <0.10 | <0.10 | <0.10 | 0.10 | 9148216 |
| **Extraction Surrogate Recovery (%)** | | | | | | | |
| O-TERPHENYL (sur.) | % | 104 | 93 | 96 | 92 | | 9146887 |
| **Instrument Surrogate Recovery (%)** | | | | | | | |
| 1,4-Difluorobenzene (sur.) | % | 97 | 97 | 100 | 97 | | 9148216 |
| 4-Bromofluorobenzene (sur.) | % | 101 | 102 | 102 | 101 | | 9148216 |
| D4-1,2-Dichloroethane (sur.) | % | 103 | 100 | 104 | 97 | | 9148216 |
| RDL = Reportable Detection Limit | | | | | | | |



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Maxxam Job #: B880368
Report Date: 2018/09/24

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## REGULATED METALS INCLUDING MERCURY-DISS (WATER)

| Maxxam ID | | UI6181 | UI6182 | UI6183 | UI6184 | | |
|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/09/16 15:30 | 2018/09/16 10:15 | 2018/09/16 09:30 | 2018/09/16 14:30 | | |
| COC Number | | 299031 | 299031 | 299031 | 299031 | | |
| | **UNITS** | **CPF 98-8-3** | **C38 08-1-4** | **TF 03-12-3** | **MTF 97-1-5** | **RDL** | **QC Batch** |
| **Low Level Elements** | | | | | | | |
| Dissolved Cadmium (Cd) | mg/L | <0.000020 | 0.00013 | 0.000075 | 0.00016 | 0.000020 | 9147004 |
| **Elements** | | | | | | | |
| Dissolved Aluminum (Al) | mg/L | 0.029 | 0.93 | 0.013 | <0.0030 | 0.0030 | 9150241 |
| Dissolved Antimony (Sb) | mg/L | <0.00060 | <0.00060 | <0.00060 | <0.00060 | 0.00060 | 9150241 |
| Dissolved Arsenic (As) | mg/L | 0.00083 | 0.010 | 0.0082 | <0.00020 | 0.00020 | 9150241 |
| Dissolved Barium (Ba) | mg/L | 0.15 | 0.56 | 0.073 | 0.027 | 0.010 | 9149519 |
| Dissolved Beryllium (Be) | mg/L | <0.0010 | <0.0010 | <0.0010 | <0.0010 | 0.0010 | 9150241 |
| Dissolved Boron (B) | mg/L | 0.029 | 0.032 | 0.040 | 0.037 | 0.020 | 9149519 |
| Dissolved Calcium (Ca) | mg/L | 160 | 170 | 200 | 260 | 0.30 | 9149519 |
| Dissolved Chromium (Cr) | mg/L | <0.0010 | 0.0017 | <0.0010 | <0.0010 | 0.0010 | 9150241 |
| Dissolved Cobalt (Co) | mg/L | 0.0022 | 0.0042 | 0.0036 | <0.00030 | 0.00030 | 9150241 |
| Dissolved Copper (Cu) | mg/L | 0.00078 | 0.0023 | 0.0011 | 0.0018 | 0.00020 | 9150241 |
| Dissolved Iron (Fe) | mg/L | 2.4 | 23 | 3.3 | <0.060 | 0.060 | 9149519 |
| Dissolved Lead (Pb) | mg/L | <0.00020 | 0.0034 | <0.00020 | <0.00020 | 0.00020 | 9150241 |
| Dissolved Lithium (Li) | mg/L | <0.020 | 0.025 | <0.020 | <0.020 | 0.020 | 9149519 |
| Dissolved Magnesium (Mg) | mg/L | 34 | 53 | 76 | 68 | 0.20 | 9149519 |
| Dissolved Manganese (Mn) | mg/L | 1.2 | 1.8 | 0.39 | <0.0040 | 0.0040 | 9149519 |
| Dissolved Molybdenum (Mo) | mg/L | 0.00043 | 0.00037 | 0.19 | 0.014 | 0.00020 | 9150241 |
| Dissolved Nickel (Ni) | mg/L | 0.0039 | 0.010 | 0.026 | 0.0047 | 0.00050 | 9150241 |
| Dissolved Phosphorus (P) | mg/L | <0.10 | 0.70 | <0.10 | <0.10 | 0.10 | 9149519 |
| Dissolved Potassium (K) | mg/L | 2.4 | 3.7 | 4.7 | 1.7 | 0.30 | 9149519 |
| Dissolved Selenium (Se) | mg/L | 0.00078 | 0.00087 | 0.0019 | 0.16 | 0.00020 | 9150241 |
| Dissolved Silicon (Si) | mg/L | 4.5 | 13 | 13 | 4.6 | 0.10 | 9149519 |
| Dissolved Silver (Ag) | mg/L | <0.00010 | <0.00010 | <0.00010 | <0.00010 | 0.00010 | 9150241 |
| Dissolved Sodium (Na) | mg/L | 17 | 45 | 50 | 3.6 | 0.50 | 9149519 |
| Dissolved Strontium (Sr) | mg/L | 0.60 | 0.50 | 0.65 | 0.39 | 0.020 | 9149519 |
| Dissolved Sulphur (S) | mg/L | 67 | 4.5 | 77 | 210 | 0.20 | 9149519 |
| Dissolved Thallium (Tl) | mg/L | <0.00020 | <0.00020 | 0.0013 | <0.00020 | 0.00020 | 9150241 |
| Dissolved Tin (Sn) | mg/L | <0.0010 | <0.0010 | <0.0010 | <0.0010 | 0.0010 | 9150241 |
| Dissolved Titanium (Ti) | mg/L | <0.0010 | 0.0096 | <0.0010 | <0.0010 | 0.0010 | 9150241 |
| RDL = Reportable Detection Limit | | | | | | | |



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Maxxam Job #: B880368
Report Date: 2018/09/24

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## REGULATED METALS INCLUDING MERCURY-DISS (WATER)

| Maxxam ID | | UI6181 | UI6182 | UI6183 | UI6184 | | |
|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/09/16 15:30 | 2018/09/16 10:15 | 2018/09/16 09:30 | 2018/09/16 14:30 | | |
| COC Number | | 299031 | 299031 | 299031 | 299031 | | |
| | **UNITS** | **CPF 98-8-3** | **C38 08-1-4** | **TF 03-12-3** | **MTF 97-1-5** | **RDL** | **QC Batch** |
| Dissolved Uranium (U) | mg/L | 0.00057 | 0.00052 | 0.025 | 0.022 | 0.00010 | 9150241 |
| Dissolved Vanadium (V) | mg/L | <0.0010 | 0.0042 | 0.0037 | <0.0010 | 0.0010 | 9150241 |
| Dissolved Zinc (Zn) | mg/L | 0.0093 | 0.039 | 0.012 | 0.0082 | 0.0030 | 9150241 |
| **Low Level Elements** | | | | | | | |
| Dissolved Mercury (Hg) | mg/L | <0.0000020 | 0.0000042 (1) | <0.0000020 | <0.0000020 | 0.0000020 | 9151018 |

RDL = Reportable Detection Limit
(1) Client supplied DHg bottle contained particulate.



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Maxxam Job #: B880368
Report Date: 2018/09/24

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## RESULTS OF CHEMICAL ANALYSES OF WATER

| Maxxam ID | | UI6181 | | | UI6182 | | | UI6183 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/09/16 15:30 | | | 2018/09/16 10:15 | | | 2018/09/16 09:30 | | |
| COC Number | | 299031 | | | 299031 | | | 299031 | | |
| | **UNITS** | **CPF 98-8-3** | **RDL** | **QC Batch** | **C38 08-1-4** | **RDL** | **QC Batch** | **TF 03-12-3** | **RDL** | **QC Batch** |
| **Calculated Parameters** | | | | | | | | | | |
| Hardness (CaCO3) | mg/L | 540 | 0.50 | 9148021 | 640 | 0.50 | 9148021 | 810 | 0.50 | 9148021 |
| Ion Balance (% Difference) | % | 2.5 | N/A | 9148022 | 0.32 | N/A | 9148022 | 3.8 | N/A | 9148022 |
| Dissolved Nitrate (NO3) | mg/L | 0.10 | 0.044 | 9146877 | <0.44 | 0.44 | 9146877 | <0.044 | 0.044 | 9146877 |
| Nitrate plus Nitrite (N) | mg/L | 0.036 | 0.014 | 9146878 | <0.14 | 0.14 | 9146878 | <0.014 | 0.014 | 9146878 |
| Dissolved Nitrite (NO2) | mg/L | 0.045 | 0.033 | 9146877 | <0.33 | 0.33 | 9146877 | <0.033 | 0.033 | 9146877 |
| **Misc. Inorganics** | | | | | | | | | | |
| Conductivity | uS/cm | 1000 | 2.0 | 9151395 | 1400 | 2.0 | 9151395 | 1700 | 2.0 | 9151395 |
| Total Dissolved Solids | mg/L | 740 | 10 | 9148975 | 840 (1) | 50 | 9148975 | 1100 | 10 | 9149839 |
| **Anions** | | | | | | | | | | |
| Alkalinity (PP as CaCO3) | mg/L | <1.0 | 1.0 | 9151393 | <1.0 | 1.0 | 9151393 | <1.0 | 1.0 | 9151393 |
| Alkalinity (Total as CaCO3) | mg/L | 400 | 1.0 | 9151393 | 760 | 1.0 | 9151393 | 670 | 1.0 | 9151393 |
| Bicarbonate (HCO3) | mg/L | 490 | 1.0 | 9151393 | 930 | 1.0 | 9151393 | 810 | 1.0 | 9151393 |
| Carbonate (CO3) | mg/L | <1.0 | 1.0 | 9151393 | <1.0 | 1.0 | 9151393 | <1.0 | 1.0 | 9151393 |
| Hydroxide (OH) | mg/L | <1.0 | 1.0 | 9151393 | <1.0 | 1.0 | 9151393 | <1.0 | 1.0 | 9151393 |
| Dissolved Sulphate (SO4) | mg/L | 200 | 1.0 | 9149800 | 3.4 | 0.50 | 9151011 | 180 (2) | 2.0 | 9149800 |
| Dissolved Chloride (Cl) | mg/L | 8.5 | 1.0 | 9149797 | 18 | 1.0 | 9149797 | 110 | 1.0 | 9149797 |
| **Nutrients** | | | | | | | | | | |
| Dissolved Nitrite (N) | mg/L | 0.014 | 0.010 | 9149493 | <0.10 (2) | 0.10 | 9149493 | <0.010 | 0.010 | 9149493 |
| Dissolved Nitrate (N) | mg/L | 0.023 | 0.010 | 9149493 | <0.10 (2) | 0.10 | 9149493 | <0.010 | 0.010 | 9149493 |
| **Misc. Organics** | | | | | | | | | | |
| Phenols | mg/L | 0.0074 | 0.0020 | 9156351 | 0.020 | 0.0020 | 9156351 | 0.0083 | 0.0020 | 9156351 |

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limit raised based on sample volume used for analysis.
(2) Detection limits raised due to matrix interference.



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Maxxam Job #: B880368
Report Date: 2018/09/24

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## RESULTS OF CHEMICAL ANALYSES OF WATER

| Maxxam ID | | UI6184 | | |
|---|---|---|---|---|
| Sampling Date | | 2018/09/16 14:30 | | |
| COC Number | | 299031 | | |
| | **UNITS** | **MTF 97-1-5** | **RDL** | **QC Batch** |
| **Calculated Parameters** | | | | |
| Hardness (CaCO3) | mg/L | 920 | 0.50 | 9148021 |
| Ion Balance (% Difference) | % | 1.2 | N/A | 9148022 |
| Dissolved Nitrate (NO3) | mg/L | 15 | 0.044 | 9146877 |
| Nitrate plus Nitrite (N) | mg/L | 3.4 | 0.014 | 9146878 |
| Dissolved Nitrite (NO2) | mg/L | <0.033 | 0.033 | 9146877 |
| **Misc. Inorganics** | | | | |
| Conductivity | uS/cm | 1600 | 2.0 | 9151395 |
| Total Dissolved Solids | mg/L | 1400 | 10 | 9149839 |
| **Anions** | | | | |
| Alkalinity (PP as CaCO3) | mg/L | <1.0 | 1.0 | 9151393 |
| Alkalinity (Total as CaCO3) | mg/L | 310 | 1.0 | 9151393 |
| Bicarbonate (HCO3) | mg/L | 380 | 1.0 | 9151393 |
| Carbonate (CO3) | mg/L | <1.0 | 1.0 | 9151393 |
| Hydroxide (OH) | mg/L | <1.0 | 1.0 | 9151393 |
| Dissolved Sulphate (SO4) | mg/L | 610 (1) | 5.0 | 9149800 |
| Dissolved Chloride (Cl) | mg/L | <1.0 | 1.0 | 9149797 |
| **Nutrients** | | | | |
| Dissolved Nitrite (N) | mg/L | <0.010 | 0.010 | 9149493 |
| Dissolved Nitrate (N) | mg/L | 3.4 | 0.010 | 9149493 |
| **Misc. Organics** | | | | |
| Phenols | mg/L | <0.0020 | 0.0020 | 9156351 |

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



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Maxxam Job #: B880368
Report Date: 2018/09/24

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## TEST SUMMARY

**Maxxam ID:** UI6181
**Sample ID:** CPF 98-8-3
**Matrix:** Water

**Collected:** 2018/09/16
**Relinquished:** 2018/09/17
**Received:** 2018/09/18

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | AT/ALK | 9151393 | N/A | 2018/09/20 | Malina Alamyar |
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9148216 | N/A | 2018/09/19 | Hetul Patel |
| F1-BTEX | CALC/MS | 9148018 | N/A | 2018/09/20 | Automated Statchk |
| Cadmium - low level CCME - Dissolved | CALC/MS | 9147004 | N/A | 2018/09/20 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 9149797 | N/A | 2018/09/19 | Chelsea Harmatys |
| Conductivity @25C | COND | 9151395 | N/A | 2018/09/20 | Malina Alamyar |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9146887 | 2018/09/19 | 2018/09/20 | Jana Rychlikova |
| Hardness | CALC | 9148021 | N/A | 2018/09/20 | Automated Statchk |
| Mercury - Low Level (Dissolved) | CV/AF | 9151018 | 2018/09/20 | 2018/09/20 | Andrew Payne |
| Elements by ICP - Dissolved | ICPA | 9149519 | N/A | 2018/09/19 | Jonathan Kuprowsky |
| Elements by ICPMS - Dissolved | ICPM | 9150241 | N/A | 2018/09/20 | Jonathan Kuprowsky |
| Ion Balance | CALC | 9148022 | N/A | 2018/09/19 | Automated Statchk |
| Nitrate and Nitrite | CALC | 9146877 | N/A | 2018/09/20 | Automated Statchk |
| Nitrate + Nitrite-N (calculated) | CALC | 9146878 | N/A | 2018/09/20 | Automated Statchk |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9149493 | N/A | 2018/09/19 | Maria Paola Solis Ares |
| Phenols (4-AAP) | TECH/4AAP | 9156351 | N/A | 2018/09/24 | Ying Yang |
| Sulphate by Automated Colourimetry | KONE | 9149800 | N/A | 2018/09/19 | Chelsea Harmatys |
| Total Dissolved Solids (Filt. Residue) | BAL | 9148975 | 2018/09/19 | 2018/09/20 | Luminita Chiosa |

**Maxxam ID:** UI6182
**Sample ID:** C38 08-1-4
**Matrix:** Water

**Collected:** 2018/09/16
**Relinquished:** 2018/09/17
**Received:** 2018/09/18

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | AT/ALK | 9151393 | N/A | 2018/09/20 | Malina Alamyar |
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9148216 | N/A | 2018/09/19 | Hetul Patel |
| F1-BTEX | CALC/MS | 9148018 | N/A | 2018/09/20 | Automated Statchk |
| Cadmium - low level CCME - Dissolved | CALC/MS | 9147004 | N/A | 2018/09/20 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 9149797 | N/A | 2018/09/19 | Chelsea Harmatys |
| Chloride (Cl) and Sulphate (SO4) by IC | IC/EC | 9151011 | N/A | 2018/09/20 | Maria Paola Solis Ares |
| Conductivity @25C | COND | 9151395 | N/A | 2018/09/20 | Malina Alamyar |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9146887 | 2018/09/19 | 2018/09/20 | Jana Rychlikova |
| Hardness | CALC | 9148021 | N/A | 2018/09/20 | Automated Statchk |
| Mercury - Low Level (Dissolved) | CV/AF | 9151018 | 2018/09/20 | 2018/09/20 | Andrew Payne |
| Elements by ICP - Dissolved | ICPA | 9149519 | N/A | 2018/09/19 | Jonathan Kuprowsky |
| Elements by ICPMS - Dissolved | ICPM | 9150241 | N/A | 2018/09/20 | Jonathan Kuprowsky |
| Ion Balance | CALC | 9148022 | N/A | 2018/09/19 | Automated Statchk |
| Nitrate and Nitrite | CALC | 9146877 | N/A | 2018/09/20 | Automated Statchk |
| Nitrate + Nitrite-N (calculated) | CALC | 9146878 | N/A | 2018/09/20 | Automated Statchk |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9149493 | N/A | 2018/09/19 | Maria Paola Solis Ares |
| Phenols (4-AAP) | TECH/4AAP | 9156351 | N/A | 2018/09/24 | Ying Yang |
| Total Dissolved Solids (Filt. Residue) | BAL | 9148975 | 2018/09/19 | 2018/09/20 | Luminita Chiosa |



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Maxxam Job #: B880368
Report Date: 2018/09/24

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## TEST SUMMARY

**Maxxam ID:** UI6183
**Sample ID:** TF 03-12-3
**Matrix:** Water

**Collected:** 2018/09/16
**Relinquished:** 2018/09/17
**Received:** 2018/09/18

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | AT/ALK | 9151393 | N/A | 2018/09/20 | Malina Alamyar |
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9148216 | N/A | 2018/09/19 | Hetul Patel |
| F1-BTEX | CALC/MS | 9148018 | N/A | 2018/09/20 | Automated Statchk |
| Cadmium - low level CCME - Dissolved | CALC/MS | 9147004 | N/A | 2018/09/20 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 9149797 | N/A | 2018/09/19 | Chelsea Harmatys |
| Conductivity @25C | COND | 9151395 | N/A | 2018/09/20 | Malina Alamyar |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9146887 | 2018/09/18 | 2018/09/20 | Jana Rychlikova |
| Hardness | CALC | 9148021 | N/A | 2018/09/20 | Automated Statchk |
| Mercury - Low Level (Dissolved) | CV/AF | 9151018 | 2018/09/20 | 2018/09/20 | Andrew Payne |
| Elements by ICP - Dissolved | ICPA | 9149519 | N/A | 2018/09/19 | Jonathan Kuprowsky |
| Elements by ICPMS - Dissolved | ICPM | 9150241 | N/A | 2018/09/20 | Jonathan Kuprowsky |
| Ion Balance | CALC | 9148022 | N/A | 2018/09/19 | Automated Statchk |
| Nitrate and Nitrite | CALC | 9146877 | N/A | 2018/09/20 | Automated Statchk |
| Nitrate + Nitrite-N (calculated) | CALC | 9146878 | N/A | 2018/09/20 | Automated Statchk |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9149493 | N/A | 2018/09/19 | Maria Paola Solis Ares |
| Phenols (4-AAP) | TECH/4AAP | 9156351 | N/A | 2018/09/24 | Ying Yang |
| Sulphate by Automated Colourimetry | KONE | 9149800 | N/A | 2018/09/19 | Chelsea Harmatys |
| Total Dissolved Solids (Filt. Residue) | BAL | 9149839 | 2018/09/19 | 2018/09/20 | Luminita Chiosa |

**Maxxam ID:** UI6184
**Sample ID:** MTF 97-1-5
**Matrix:** Water

**Collected:** 2018/09/16
**Relinquished:** 2018/09/17
**Received:** 2018/09/18

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | AT/ALK | 9151393 | N/A | 2018/09/20 | Malina Alamyar |
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9148216 | N/A | 2018/09/19 | Hetul Patel |
| F1-BTEX | CALC/MS | 9148018 | N/A | 2018/09/20 | Automated Statchk |
| Cadmium - low level CCME - Dissolved | CALC/MS | 9147004 | N/A | 2018/09/20 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 9149797 | N/A | 2018/09/19 | Chelsea Harmatys |
| Conductivity @25C | COND | 9151395 | N/A | 2018/09/20 | Malina Alamyar |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9146887 | 2018/09/19 | 2018/09/20 | Jana Rychlikova |
| Hardness | CALC | 9148021 | N/A | 2018/09/20 | Automated Statchk |
| Mercury - Low Level (Dissolved) | CV/AF | 9151018 | 2018/09/20 | 2018/09/20 | Andrew Payne |
| Elements by ICP - Dissolved | ICPA | 9149519 | N/A | 2018/09/19 | Jonathan Kuprowsky |
| Elements by ICPMS - Dissolved | ICPM | 9150241 | N/A | 2018/09/20 | Jonathan Kuprowsky |
| Ion Balance | CALC | 9148022 | N/A | 2018/09/19 | Automated Statchk |
| Nitrate and Nitrite | CALC | 9146877 | N/A | 2018/09/20 | Automated Statchk |
| Nitrate + Nitrite-N (calculated) | CALC | 9146878 | N/A | 2018/09/20 | Automated Statchk |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9149493 | N/A | 2018/09/19 | Maria Paola Solis Ares |
| Phenols (4-AAP) | TECH/4AAP | 9156351 | N/A | 2018/09/24 | Ying Yang |
| Sulphate by Automated Colourimetry | KONE | 9149800 | N/A | 2018/09/19 | Chelsea Harmatys |
| Total Dissolved Solids (Filt. Residue) | BAL | 9149839 | 2018/09/19 | 2018/09/20 | Luminita Chiosa |



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Maxxam Job #: B880368
Report Date: 2018/09/24

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## GENERAL COMMENTS

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

| | |
|---|---|
| Package 1 | 3.0°C |

Sample UI6182 [C38 08-1-4] : Client supplied DM bottle contained particulate.

**Results relate only to the items tested.**



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Report Date: 2018/09/24

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| 9146887 | JR1 | Method Blank | O-TERPHENYL (sur.) | 2018/09/18 | | 116 | % | 60 - 140 |
| | | | F2 (C10-C16 Hydrocarbons) | 2018/09/18 | <0.10 | | mg/L | |
| 9148216 | HP5 | Method Blank | 1,4-Difluorobenzene (sur.) | 2018/09/19 | | 101 | % | 50 - 140 |
| | | | 4-Bromofluorobenzene (sur.) | 2018/09/19 | | 100 | % | 50 - 140 |
| | | | D4-1,2-Dichloroethane (sur.) | 2018/09/19 | | 90 | % | 50 - 140 |
| | | | Benzene | 2018/09/19 | <0.00040 | | mg/L | |
| | | | Toluene | 2018/09/19 | <0.00040 | | mg/L | |
| | | | Ethylbenzene | 2018/09/19 | <0.00040 | | mg/L | |
| | | | m & p-Xylene | 2018/09/19 | <0.00080 | | mg/L | |
| | | | o-Xylene | 2018/09/19 | <0.00040 | | mg/L | |
| | | | F1 (C6-C10) | 2018/09/19 | <0.10 | | mg/L | |
| 9148975 | LCA | Method Blank | Total Dissolved Solids | 2018/09/20 | <10 | | mg/L | |
| 9149493 | MPX | Method Blank | Dissolved Nitrite (N) | 2018/09/19 | <0.010 | | mg/L | |
| | | | Dissolved Nitrate (N) | 2018/09/19 | <0.010 | | mg/L | |
| 9149519 | JK9 | Method Blank | Dissolved Iron (Fe) | 2018/09/19 | <0.060 | | mg/L | |
| | | | Dissolved Lithium (Li) | 2018/09/19 | <0.020 | | mg/L | |
| | | | Dissolved Magnesium (Mg) | 2018/09/19 | <0.20 | | mg/L | |
| | | | Dissolved Manganese (Mn) | 2018/09/19 | <0.0040 | | mg/L | |
| | | | Dissolved Potassium (K) | 2018/09/19 | <0.30 | | mg/L | |
| | | | Dissolved Sodium (Na) | 2018/09/19 | <0.50 | | mg/L | |
| | | | Dissolved Strontium (Sr) | 2018/09/19 | <0.020 | | mg/L | |
| | | | Dissolved Sulphur (S) | 2018/09/19 | <0.20 | | mg/L | |
| | | | Dissolved Phosphorus (P) | 2018/09/19 | <0.10 | | mg/L | |
| | | | Dissolved Barium (Ba) | 2018/09/19 | <0.010 | | mg/L | |
| | | | Dissolved Silicon (Si) | 2018/09/19 | <0.10 | | mg/L | |
| | | | Dissolved Boron (B) | 2018/09/19 | <0.020 | | mg/L | |
| | | | Dissolved Calcium (Ca) | 2018/09/19 | <0.30 | | mg/L | |
| 9149797 | CH7 | Method Blank | Dissolved Chloride (Cl) | 2018/09/19 | <1.0 | | mg/L | |
| 9149800 | CH7 | Method Blank | Dissolved Sulphate (SO4) | 2018/09/19 | <1.0 | | mg/L | |
| 9149839 | LCA | Method Blank | Total Dissolved Solids | 2018/09/20 | <10 | | mg/L | |
| 9150241 | JK9 | Method Blank | Dissolved Aluminum (Al) | 2018/09/20 | <0.0030 | | mg/L | |
| | | | Dissolved Chromium (Cr) | 2018/09/20 | <0.0010 | | mg/L | |
| | | | Dissolved Cobalt (Co) | 2018/09/20 | <0.00030 | | mg/L | |
| | | | Dissolved Copper (Cu) | 2018/09/20 | <0.00020 | | mg/L | |
| | | | Dissolved Lead (Pb) | 2018/09/20 | <0.00020 | | mg/L | |
| | | | Dissolved Antimony (Sb) | 2018/09/20 | <0.00060 | | mg/L | |
| | | | Dissolved Molybdenum (Mo) | 2018/09/20 | <0.00020 | | mg/L | |
| | | | Dissolved Nickel (Ni) | 2018/09/20 | <0.00050 | | mg/L | |
| | | | Dissolved Selenium (Se) | 2018/09/20 | <0.00020 | | mg/L | |
| | | | Dissolved Silver (Ag) | 2018/09/20 | <0.00010 | | mg/L | |
| | | | Dissolved Arsenic (As) | 2018/09/20 | <0.00020 | | mg/L | |
| | | | Dissolved Thallium (Tl) | 2018/09/20 | <0.00020 | | mg/L | |
| | | | Dissolved Tin (Sn) | 2018/09/20 | <0.0010 | | mg/L | |
| | | | Dissolved Titanium (Ti) | 2018/09/20 | <0.0010 | | mg/L | |
| | | | Dissolved Uranium (U) | 2018/09/20 | <0.00010 | | mg/L | |
| | | | Dissolved Vanadium (V) | 2018/09/20 | <0.0010 | | mg/L | |
| | | | Dissolved Zinc (Zn) | 2018/09/20 | <0.0030 | | mg/L | |
| | | | Dissolved Beryllium (Be) | 2018/09/20 | <0.0010 | | mg/L | |
| 9151011 | MPX | Method Blank | Dissolved Sulphate (SO4) | 2018/09/20 | <0.50 | | mg/L | |
| 9151018 | APY | Method Blank | Dissolved Mercury (Hg) | 2018/09/20 | <0.0000020 | | mg/L | |
| 9151393 | MA4 | Method Blank | Alkalinity (Total as CaCO3) | 2018/09/20 | <1.0 | | mg/L | |



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Maxxam Job #: B880368
Report Date: 2018/09/24

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT(CONT'D)

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| | | | Alkalinity (PP as CaCO3) | 2018/09/20 | <1.0 | | mg/L | |
| | | | Bicarbonate (HCO3) | 2018/09/20 | <1.0 | | mg/L | |
| | | | Carbonate (CO3) | 2018/09/20 | <1.0 | | mg/L | |
| | | | Hydroxide (OH) | 2018/09/20 | <1.0 | | mg/L | |
| 9151395 | MA4 | Method Blank | Conductivity | 2018/09/20 | <2.0 | | uS/cm | |
| 9156351 | YY | Method Blank | Phenols | 2018/09/24 | <0.0020 | | mg/L | |
| 9146887 | JR1 | LCS | O-TERPHENYL (sur.) | 2018/09/18 | | 111 | % | 60 - 140 |
| | | | F2 (C10-C16 Hydrocarbons) | 2018/09/18 | | 114 | % | 60 - 140 |
| 9148216 | HP5 | LCS | 1,4-Difluorobenzene (sur.) | 2018/09/18 | | 108 | % | 50 - 140 |
| | | | 4-Bromofluorobenzene (sur.) | 2018/09/18 | | 105 | % | 50 - 140 |
| | | | D4-1,2-Dichloroethane (sur.) | 2018/09/18 | | 120 | % | 50 - 140 |
| | | | Benzene | 2018/09/18 | | 96 | % | 60 - 130 |
| | | | Toluene | 2018/09/18 | | 103 | % | 60 - 130 |
| | | | Ethylbenzene | 2018/09/18 | | 94 | % | 60 - 130 |
| | | | m & p-Xylene | 2018/09/18 | | 91 | % | 60 - 130 |
| | | | o-Xylene | 2018/09/18 | | 93 | % | 60 - 130 |
| | | | F1 (C6-C10) | 2018/09/18 | | 69 | % | 60 - 140 |
| 9148975 | LCA | LCS | Total Dissolved Solids | 2018/09/20 | | 94 | % | 80 - 120 |
| 9149493 | MPX | LCS | Dissolved Nitrite (N) | 2018/09/19 | | 101 | % | 80 - 120 |
| | | | Dissolved Nitrate (N) | 2018/09/19 | | 102 | % | 80 - 120 |
| 9149519 | JK9 | LCS | Dissolved Iron (Fe) | 2018/09/19 | | 96 | % | 80 - 120 |
| | | | Dissolved Lithium (Li) | 2018/09/19 | | 95 | % | 80 - 120 |
| | | | Dissolved Magnesium (Mg) | 2018/09/19 | | 98 | % | 80 - 120 |
| | | | Dissolved Manganese (Mn) | 2018/09/19 | | 97 | % | 80 - 120 |
| | | | Dissolved Potassium (K) | 2018/09/19 | | 98 | % | 80 - 120 |
| | | | Dissolved Sodium (Na) | 2018/09/19 | | 98 | % | 80 - 120 |
| | | | Dissolved Strontium (Sr) | 2018/09/19 | | 92 | % | 80 - 120 |
| | | | Dissolved Sulphur (S) | 2018/09/19 | | 99 | % | 80 - 120 |
| | | | Dissolved Phosphorus (P) | 2018/09/19 | | 98 | % | 80 - 120 |
| | | | Dissolved Barium (Ba) | 2018/09/19 | | 99 | % | 80 - 120 |
| | | | Dissolved Silicon (Si) | 2018/09/19 | | 95 | % | 80 - 120 |
| | | | Dissolved Boron (B) | 2018/09/19 | | 100 | % | 80 - 120 |
| | | | Dissolved Calcium (Ca) | 2018/09/19 | | 95 | % | 80 - 120 |
| 9149797 | CH7 | LCS | Dissolved Chloride (Cl) | 2018/09/19 | | 106 | % | 80 - 120 |
| 9149800 | CH7 | LCS | Dissolved Sulphate (SO4) | 2018/09/19 | | 104 | % | 80 - 120 |
| 9149839 | LCA | LCS | Total Dissolved Solids | 2018/09/20 | | 98 | % | 80 - 120 |
| 9150241 | JK9 | LCS | Dissolved Aluminum (Al) | 2018/09/20 | | 102 | % | 80 - 120 |
| | | | Dissolved Chromium (Cr) | 2018/09/20 | | 95 | % | 80 - 120 |
| | | | Dissolved Cobalt (Co) | 2018/09/20 | | 94 | % | 80 - 120 |
| | | | Dissolved Copper (Cu) | 2018/09/20 | | 97 | % | 80 - 120 |
| | | | Dissolved Lead (Pb) | 2018/09/20 | | 95 | % | 80 - 120 |
| | | | Dissolved Antimony (Sb) | 2018/09/20 | | 102 | % | 80 - 120 |
| | | | Dissolved Molybdenum (Mo) | 2018/09/20 | | 98 | % | 80 - 120 |
| | | | Dissolved Nickel (Ni) | 2018/09/20 | | 95 | % | 80 - 120 |
| | | | Dissolved Selenium (Se) | 2018/09/20 | | 103 | % | 80 - 120 |
| | | | Dissolved Silver (Ag) | 2018/09/20 | | 99 | % | 80 - 120 |
| | | | Dissolved Arsenic (As) | 2018/09/20 | | 97 | % | 80 - 120 |
| | | | Dissolved Thallium (Tl) | 2018/09/20 | | 96 | % | 80 - 120 |
| | | | Dissolved Tin (Sn) | 2018/09/20 | | 102 | % | 80 - 120 |
| | | | Dissolved Titanium (Ti) | 2018/09/20 | | 96 | % | 80 - 120 |
| | | | Dissolved Uranium (U) | 2018/09/20 | | 95 | % | 80 - 120 |



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Maxxam Job #: B880368
Report Date: 2018/09/24

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT(CONT'D)

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| | | | Dissolved Vanadium (V) | 2018/09/20 | | 99 | % | 80 - 120 |
| | | | Dissolved Zinc (Zn) | 2018/09/20 | | 98 | % | 80 - 120 |
| | | | Dissolved Beryllium (Be) | 2018/09/20 | | 97 | % | 80 - 120 |
| 9151011 | MPX | LCS | Dissolved Sulphate (SO4) | 2018/09/20 | | 101 | % | 75 - 125 |
| 9151018 | APY | LCS | Dissolved Mercury (Hg) | 2018/09/20 | | 106 | % | 80 - 120 |
| 9151393 | MA4 | LCS | Alkalinity (Total as CaCO3) | 2018/09/20 | | 101 | % | 80 - 120 |
| 9151395 | MA4 | LCS | Conductivity | 2018/09/20 | | 98 | % | 90 - 110 |
| 9156351 | YY | LCS | Phenols | 2018/09/24 | | 95 | % | 80 - 120 |
| 9151018 | APY | SRM | Dissolved Mercury (Hg) | 2018/09/20 | | 102 | % | 80 - 120 |

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

LCS: 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.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.



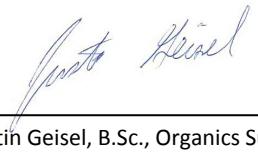
Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B880368
Report Date: 2018/09/24

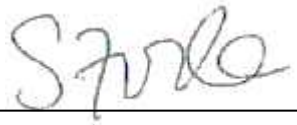
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Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## VALIDATION SIGNATURE PAGE

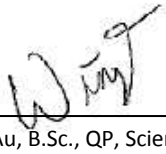
The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Justin Geisel, B.Sc., Organics Supervisor



Suwan Fock, B.Sc., QP, Inorganics Senior Analyst



Winnie Au, B.Sc., QP, 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.



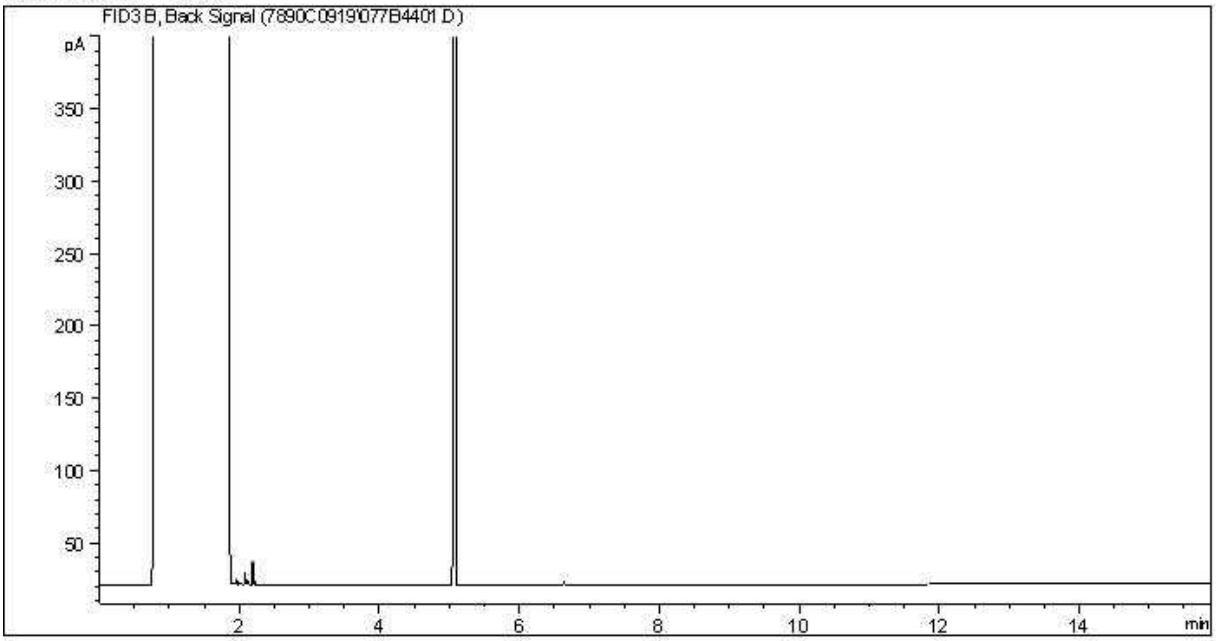
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Maxxam Job #: B880368
Report Date: 2018/09/24
Maxxam Sample: UI6181

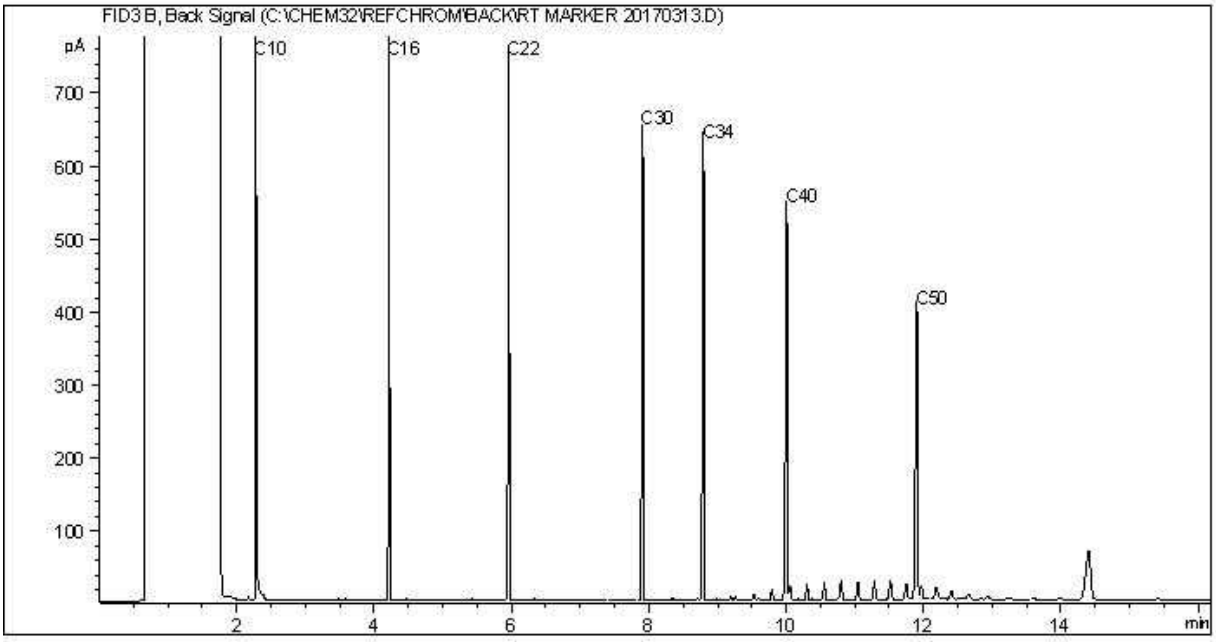
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: CPF 98-8-3

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890C




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

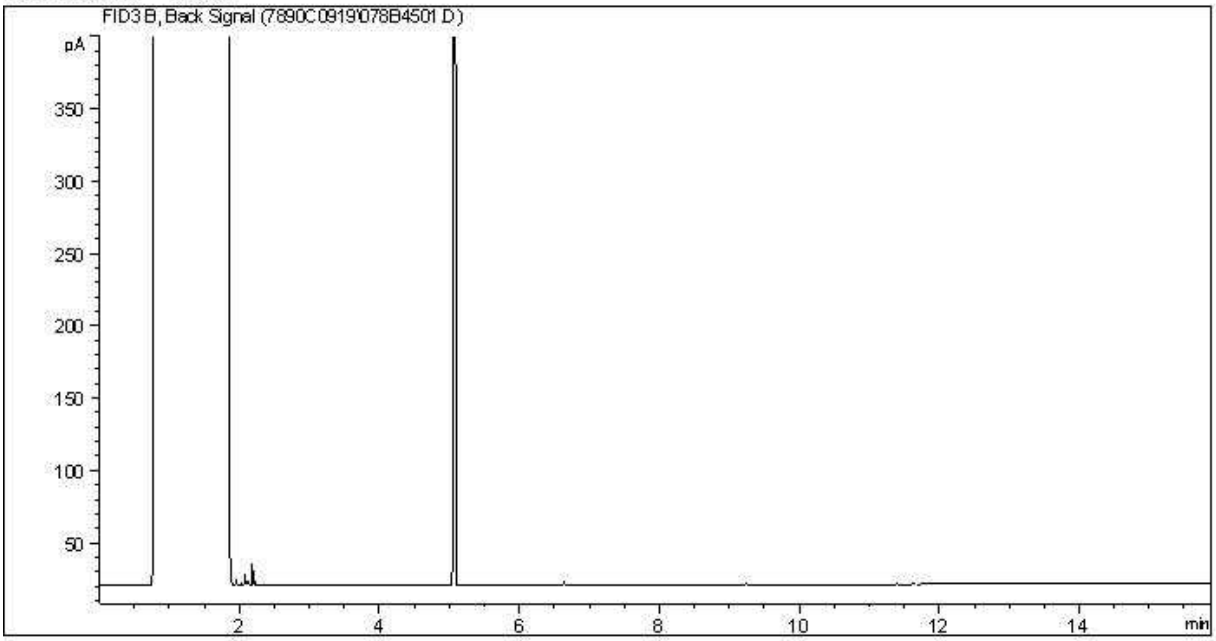
**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam Job #: B880368
Report Date: 2018/09/24
Maxxam Sample: UI6182

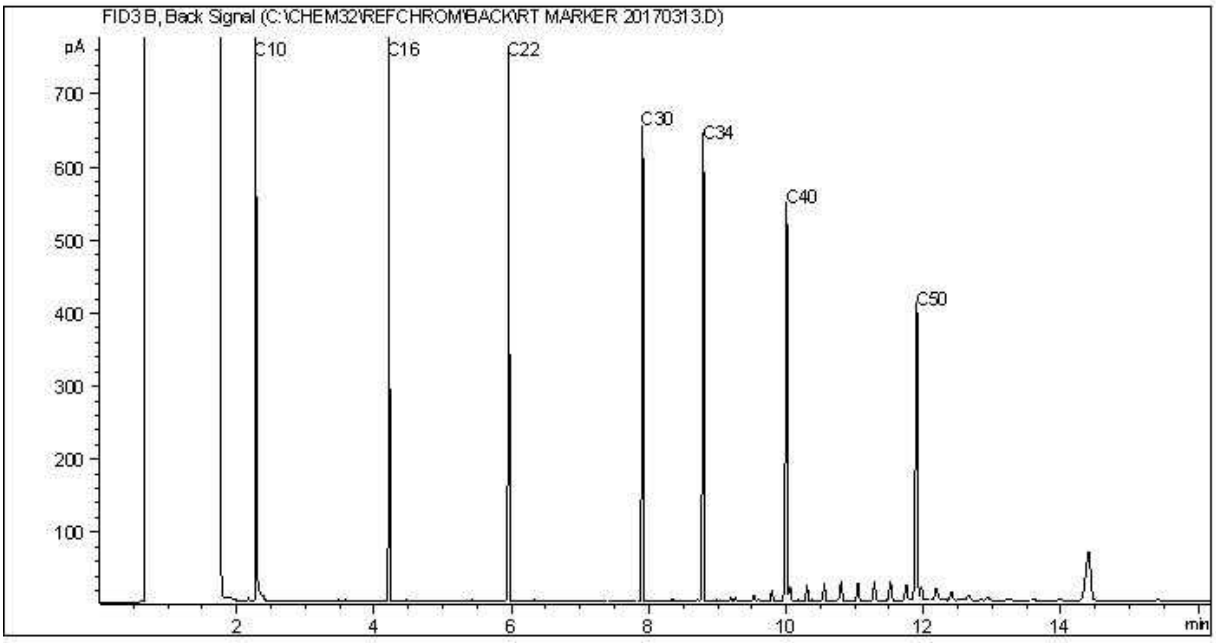
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: C38 08-1-4

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890C




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

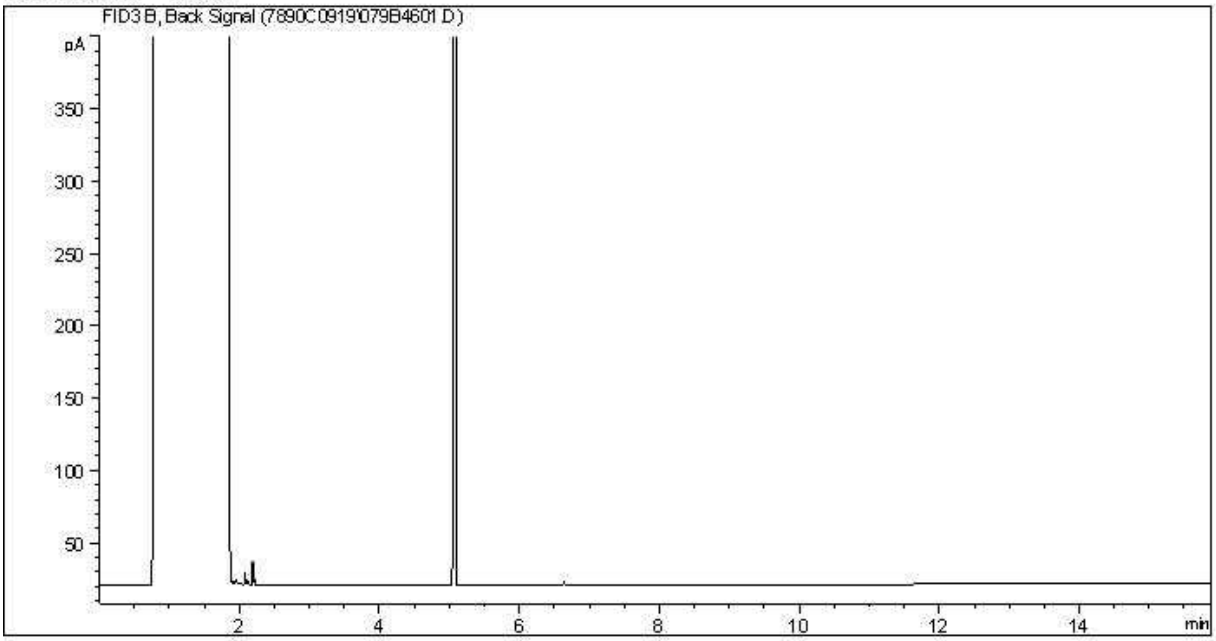
**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam Job #: B880368
Report Date: 2018/09/24
Maxxam Sample: UI6183

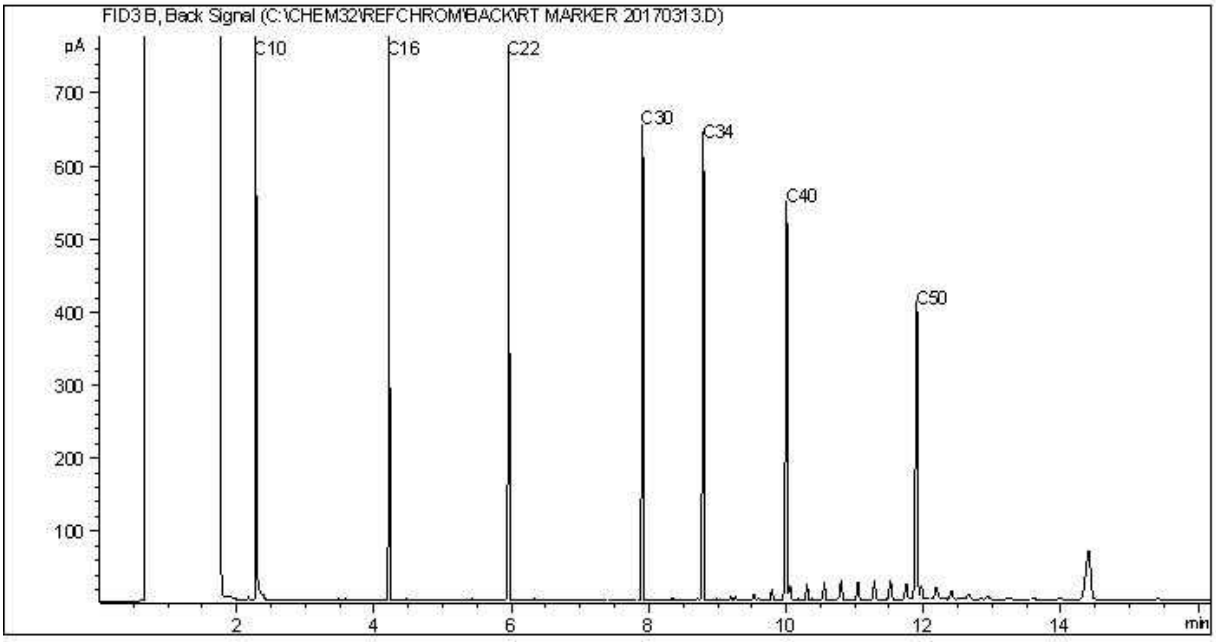
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: TF 03-12-3

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890C




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

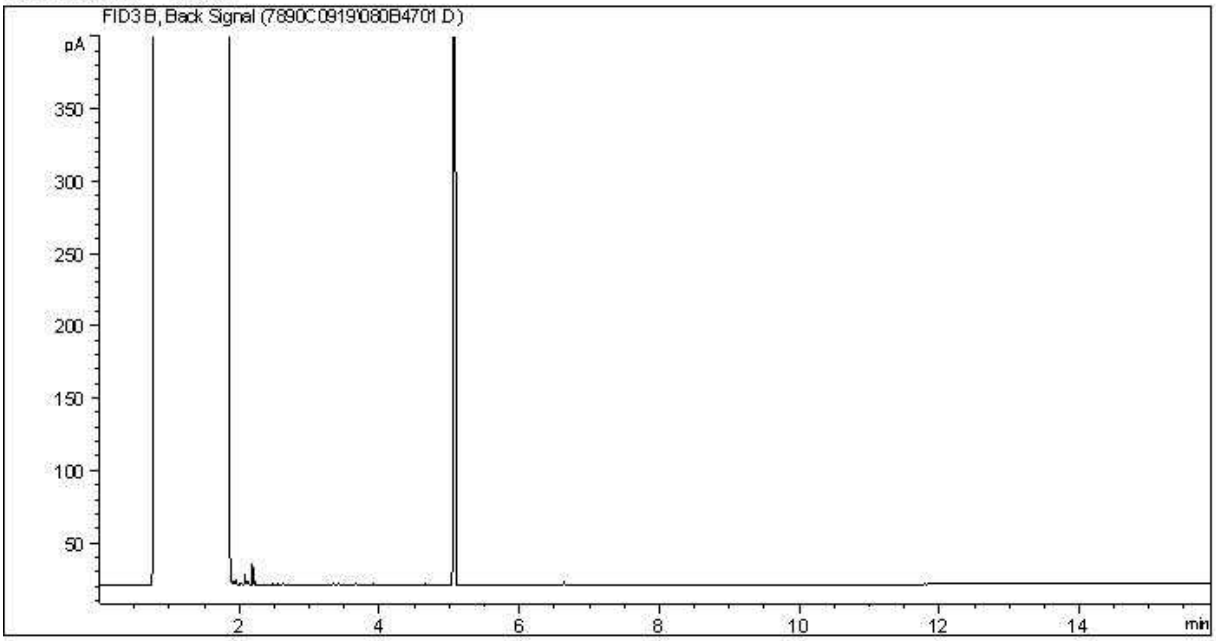
**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam Job #: B880368
Report Date: 2018/09/24
Maxxam Sample: UI6184

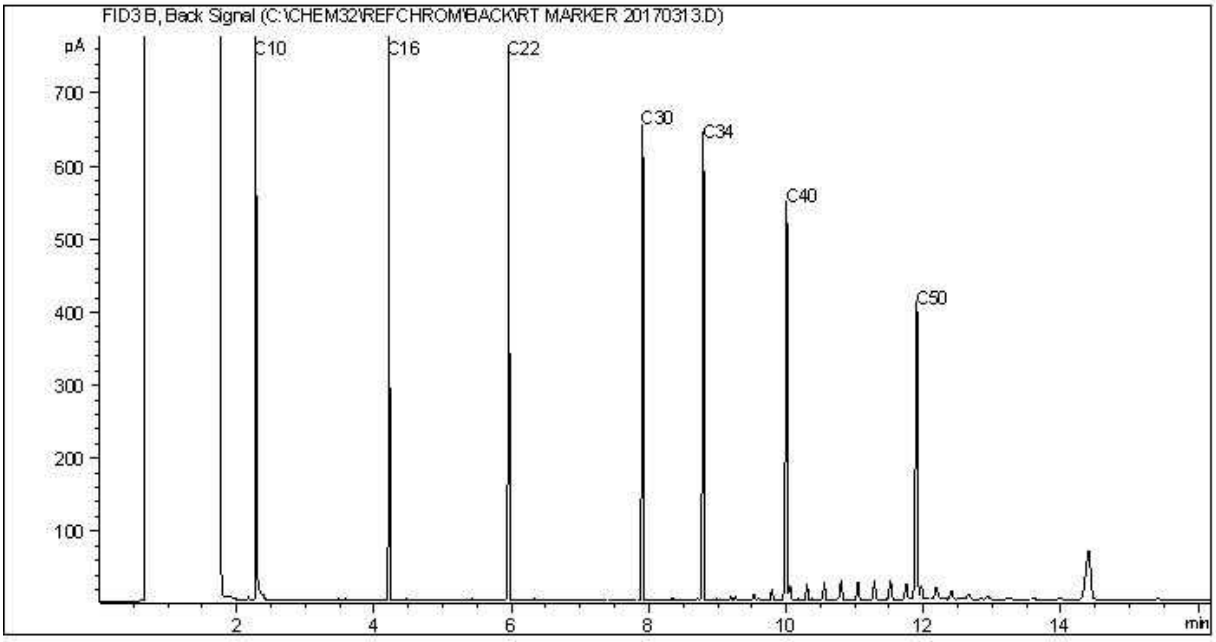
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: MTF 97-1-5

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890C




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam
A Bureau Veritas Group Company

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# EXXON MOBIL/IMPERIAL OIL - MAXXAM CHAIN-OF-CUSTODY RECORD

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C of C # 299031

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| INVOICE INFORMATION | REPORT INFORMATION |
|---|---|
| Company Name: ☒ Imperial Oil ☐ ExxonMobil | Company Name: WORLEYPARSONS |
| Contact Name: WORLEYPARSONS-SANJ PERERA | Contact Name: STACY GIBB |
| Address: 500-151 CANADA OLYMPIC RD SW CALGARY, AB T3B 6B7 | Address: 500-151 CANADA OLYMPIC RD SW CALGARY, AB T3B 6B7 |
| Email: SANJ.PERERA@AQUISIAN.COM | Email: STACY.GIBB@AQUISIAN.COM |
| Ph: 587-952-1490 | Ph: 403-247-0200 |
| Sampler Name (Print): DEVON GREVES | Consultant Project #: 407011-00586-0400 |

ANALYSIS REQUESTED

| | FIELD SAMPLE ID | MATRIX: GROUND WATER | SURFACE WATER | SOIL | OTHER | # CONTAINERS | SAMPLING: DATE (YYYY/MM/DD) | TIME (24 HR) | FIELD FILTERED & PRESERVED | LAB FILTRATION REQUIRED | VOC | PAH | PHCs (FRACTIONS 1-2 PLUS BTEX) | PHCs (FRACTIONS 1-4 PLUS BTEX) | PHCs (FRACTIONS 2-4) | PHCs (FRACTION 1 PLUS BTEX) | GRAIN SIZE (75 MICRON) | TEXTURE (% SAND, SILT, CLAY) | PARTICLE SIZE DISTRIBUTION WITH GRAPH | REGULATED METALS: TOT ☐ DIS ☒ | MERCURY: TOTAL ☐ DISSOLVED ☒ | SALINITY SOIL | FERTILIZER SOIL | FERTILIZER WATER | NUTRIENTS SOIL | ROUTINE POTABILITY | pH ☐ EC ☐ ALKALINITY ☐ | BASIC CLASS II LANDFILL PKG | PHENOLS (4-AAP) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | CPF 98-8-3 | X | | | | 10 | 2018/09/16 | 15:30 | X | | | | X | | | | | | | X | X | | | | | X | | | X |
| 2 | C38 08-1-4 | X | | | | 10 | 2018/09/16 | 10:15 | X | | | | X | | | | | | | X | X | | | | | X | | | X |
| 3 | TF 03-12-3 | X | | | | 10 | 2018/09/16 | 09:30 | X | | | | X | | | | | | | X | X | | | | | X | | | X |
| 4 | MTF 97-1-5 | X | | | | 10 | 2018/09/16 | 14:30 | X | | | | X | | | | | | | X | X | | | | | X | | | X |
| 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

IOL SITE LOCATION: NORMAN WELLS, NT

IOL PROJECT # (if applicable): N/A

MAXXAM TASK ORDER # OR SERVICE ORDER # + LINE ITEM: 407011-00586-0400

REGULATORY CRITERIA / DETECTION LIMITS:
☐ Alberta Tier 1 ☐ CDWG
☐ SEQG (SK) ☐ NoSC (SK)
☒ CCME (incl. level) FWAL ☐ Other

SPECIAL INSTRUCTIONS:
ALSO EMAIL:
-STANDARD NORMAN WELLS EMAIL LIST
-MELISSA.LORD@AQUISIAN.COM
-DEVON.GREVES@AQUISIAN.COM
* IE3 A2601436

# JARS USED & NOT SUBMITTED (Enter N/A for Water): N/A

TURNAROUND TIME
Standard (5 days) ☒
Rush (3 days) ☐
(2 days) ☐
(1 day) ☐
(same day) ☐
Date Required

| | YES | NO | COOLER ID # | TEMP °C 1 | 2 | 3 |
|---|---|---|---|---|---|---|
| SEAL PRESENT | ✓ | | | 3 | 4 | 2 |
| SEAL INTACT | ✓ | | | | | |
| COOLING MEDIA PRESENT | ✓ | | | | | |

| | YES | NO | COOLER ID # | TEMP °C 1 | 2 | 3 |
|---|---|---|---|---|---|---|
| SEAL PRESENT | | | | | | |
| SEAL INTACT | | | | | | |
| COOLING MEDIA PRESENT | | | | | | |

| | YES | NO | COOLER ID # | TEMP °C 1 | 2 | 3 |
|---|---|---|---|---|---|---|
| SEAL PRESENT | | | | | | |
| SEAL INTACT | | | | | | |
| COOLING MEDIA PRESENT | | | | | | |

LAB USE ONLY
MAXXAM JOB # B880368

SAMPLES
LABELED BY: YLB
VERIFIED BY: KVT

| RELINQUISHED BY: | | DATE: | TIME (24 HR) | RECEIVED BY: | | DATE: | TIME (24 HR) |
|---|---|---|---|---|---|---|---|
| 1. | DEVON GREVES | 2018/09/17 | 11:00 | 1. | Jenna Walter | 20180918 | 1130 |
| 2. | | | | 2. | | | |
| 3. | | | | 3. | | | |

COC-1010 (06/2016) IOL-AB

White: Maxxam Yellow: Client

# DATA QUALITY REVIEW CHECKLIST - IMPERIAL OIL PROJECTS

Consultant: Advisian

Sampling Date: 18-Sep-18

Location: Norman Wells

Laboratory : Maxxam Edmonton

Consultant Project Number: 407011-00586-0400

Sample Submission Number: B881917

Are All Laboratory QC Within Acceptance Criteria (Yes, No, Not Applicable)?

| | Yes | No | NA | Comments |
|---|---|---|---|---|
| Instrument Surrogate Recovery | x | | | All laboratory QC met acceptance criteria. |
| Extraction Surrogate Recovery | x | | | |
| Method Blank Concentration | x | | | |
| Matrix Duplicate RPD | | | x | |
| Matrix Spike Recovery | | | x | |
| Lab Control Sample Recovery | x | | | |

Are All Field QC Samples Within Alert Limits (Yes, No, Not Applicable)?

| | Yes | No | NA | Comments |
|---|---|---|---|---|
| Field Blank Concentration | | | x | No field QC samples submitted. |
| Trip Blank Concentration | | | x | |
| Equipment Blank Concentration | | | x | |
| Field Duplicate RPD | | | x | |

| | |
|---|---|
| Has CoA been signed off (Yes/No)?: | Yes |
| Has lab warranted all tests were analyzed following SOP's in CoA (Yes/No)?: | Yes |
| Were all samples analyzed within hold times (Yes/No)?: | Yes |
| All volatiles samples methanol extracted (if required) within 48 hours (Yes/No)?: | n/a |
| Is Chain of Custody completed and signed (Yes/No)?: | Yes |
| Were sample temperatures acceptable when they reached lab (Yes/No)?: | Yes |

| | |
|---|---|
| Was a Data Quality Overview (DQO) issued (Yes/No)?: | No |
| Date DQO was received: | n/a |

Is data considered to be reliable (Yes/No)?: Yes

If answer is "No", describe and provide rationale:

Data Reviewed by (Print): Vivian Baptista

Data Reviewed by (Signature): 

Date: 16-Oct-18

Maxxam
A Bureau Veritas Group Company

Success Through Science®

Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400
Your C.O.C. #: 299023

**Attention: Stacy Gibb**

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

**Report Date: 2018/09/27**
Report #: R2625970
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B881917**
**Received: 2018/09/20, 09:56**

Sample Matrix: Water
# Samples Received: 1

| Analyses | Quantity | Laboratory Method | Primary Reference |
|---|---|---|---|
| BTEX/F1 in Water by HS GC/MS/FID | 1 | AB SOP-00039 | CCME CWS/EPA 8260d m |
| F1-BTEX | 1 | AB SOP-00039 | Auto Calc |
| CCME Hydrocarbons in Water (F2; C10-C16) (1) | 1 | AB SOP-00037 / AB SOP-00040 | CCME PHC-CWS m |

**Remarks:**

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard. All samples were analyzed within hold time unless otherwise flagged.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
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) Silica gel clean up employed.



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

Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400
Your C.O.C. #: 299023

**Attention: Stacy Gibb**

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

**Report Date: 2018/09/27**
Report #: R2625970
Version: 1 - Final

# CERTIFICATE OF ANALYSIS

**MAXXAM JOB #: B881917**
**Received: 2018/09/20, 09:56**

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Rhecie Phayouphone, Project Manager
Email: RPhayouphone@maxxam.ca
Phone# (403)735-2283

==========

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.



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Maxxam Job #: B881917
Report Date: 2018/09/27

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## AT1 BTEX AND F1-F2 IN WATER (WATER)

| | | | | |
|---|---|---|---|---|
| Maxxam ID | | UJ4376 | | |
| Sampling Date | | 2018/09/18 13:30 | | |
| COC Number | | 299023 | | |
| | **UNITS** | **WSY 97-1-5** | **RDL** | **QC Batch** |
| **Ext. Pet. Hydrocarbon** | | | | |
| F2 (C10-C16 Hydrocarbons) | mg/L | <0.10 | 0.10 | 9154534 |
| **Volatiles** | | | | |
| Benzene | mg/L | <0.00040 | 0.00040 | 9155023 |
| Toluene | mg/L | <0.00040 | 0.00040 | 9155023 |
| Ethylbenzene | mg/L | <0.00040 | 0.00040 | 9155023 |
| m & p-Xylene | mg/L | <0.00080 | 0.00080 | 9155023 |
| o-Xylene | mg/L | <0.00040 | 0.00040 | 9155023 |
| Xylenes (Total) | mg/L | <0.00089 | 0.00089 | 9153609 |
| F1 (C6-C10) - BTEX | mg/L | <0.10 | 0.10 | 9153609 |
| F1 (C6-C10) | mg/L | <0.10 | 0.10 | 9155023 |
| **Extraction Surrogate Recovery (%)** | | | | |
| O-TERPHENYL (sur.) | % | 94 | | 9154534 |
| **Instrument Surrogate Recovery (%)** | | | | |
| 1,4-Difluorobenzene (sur.) | % | 98 | | 9155023 |
| 4-Bromofluorobenzene (sur.) | % | 98 | | 9155023 |
| D4-1,2-Dichloroethane (sur.) | % | 102 | | 9155023 |
| RDL = Reportable Detection Limit | | | | |



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Maxxam Job #: B881917
Report Date: 2018/09/27

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## TEST SUMMARY

**Maxxam ID:** UJ4376
**Sample ID:** WSY 97-1-5
**Matrix:** Water

**Collected:** 2018/09/18
**Relinquished:** 2018/09/19
**Received:** 2018/09/20

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9155023 | N/A | 2018/09/22 | Dan Uong |
| F1-BTEX | CALC/MS | 9153609 | N/A | 2018/09/24 | Automated Statchk |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9154534 | 2018/09/23 | 2018/09/23 | Jana Rychlikova |



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Maxxam Job #: B881917
Report Date: 2018/09/27

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## GENERAL COMMENTS

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

| | |
|---|---|
| Package 1 | 5.3°C |

**Results relate only to the items tested.**



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Maxxam Job #: B881917
Report Date: 2018/09/27

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| 9154534 | JR1 | Method Blank | O-TERPHENYL (sur.) | 2018/09/23 | | 95 | % | 60 - 140 |
| | | | F2 (C10-C16 Hydrocarbons) | 2018/09/23 | <0.10 | | mg/L | |
| 9155023 | DUO | Method Blank | 1,4-Difluorobenzene (sur.) | 2018/09/22 | | 100 | % | 50 - 140 |
| | | | 4-Bromofluorobenzene (sur.) | 2018/09/22 | | 100 | % | 50 - 140 |
| | | | D4-1,2-Dichloroethane (sur.) | 2018/09/22 | | 105 | % | 50 - 140 |
| | | | Benzene | 2018/09/22 | <0.00040 | | mg/L | |
| | | | Toluene | 2018/09/22 | <0.00040 | | mg/L | |
| | | | Ethylbenzene | 2018/09/22 | <0.00040 | | mg/L | |
| | | | m & p-Xylene | 2018/09/22 | <0.00080 | | mg/L | |
| | | | o-Xylene | 2018/09/22 | <0.00040 | | mg/L | |
| | | | F1 (C6-C10) | 2018/09/22 | <0.10 | | mg/L | |
| 9154534 | JR1 | LCS | O-TERPHENYL (sur.) | 2018/09/23 | | 96 | % | 60 - 140 |
| | | | F2 (C10-C16 Hydrocarbons) | 2018/09/23 | | 95 | % | 60 - 140 |
| 9155023 | DUO | LCS | 1,4-Difluorobenzene (sur.) | 2018/09/22 | | 93 | % | 50 - 140 |
| | | | 4-Bromofluorobenzene (sur.) | 2018/09/22 | | 101 | % | 50 - 140 |
| | | | D4-1,2-Dichloroethane (sur.) | 2018/09/22 | | 106 | % | 50 - 140 |
| | | | Benzene | 2018/09/22 | | 76 | % | 60 - 130 |
| | | | Toluene | 2018/09/22 | | 75 | % | 60 - 130 |
| | | | Ethylbenzene | 2018/09/22 | | 78 | % | 60 - 130 |
| | | | m & p-Xylene | 2018/09/22 | | 78 | % | 60 - 130 |
| | | | o-Xylene | 2018/09/22 | | 82 | % | 60 - 130 |
| | | | F1 (C6-C10) | 2018/09/22 | | 109 | % | 60 - 140 |

LCS: 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.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.



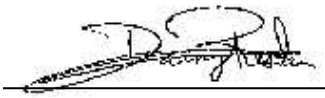
Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B881917
Report Date: 2018/09/27

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## VALIDATION SIGNATURE PAGE

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



Daniel Reslan, cCT, QP, Organics Manager



Justin Geisel, B.Sc., Organics Supervisor

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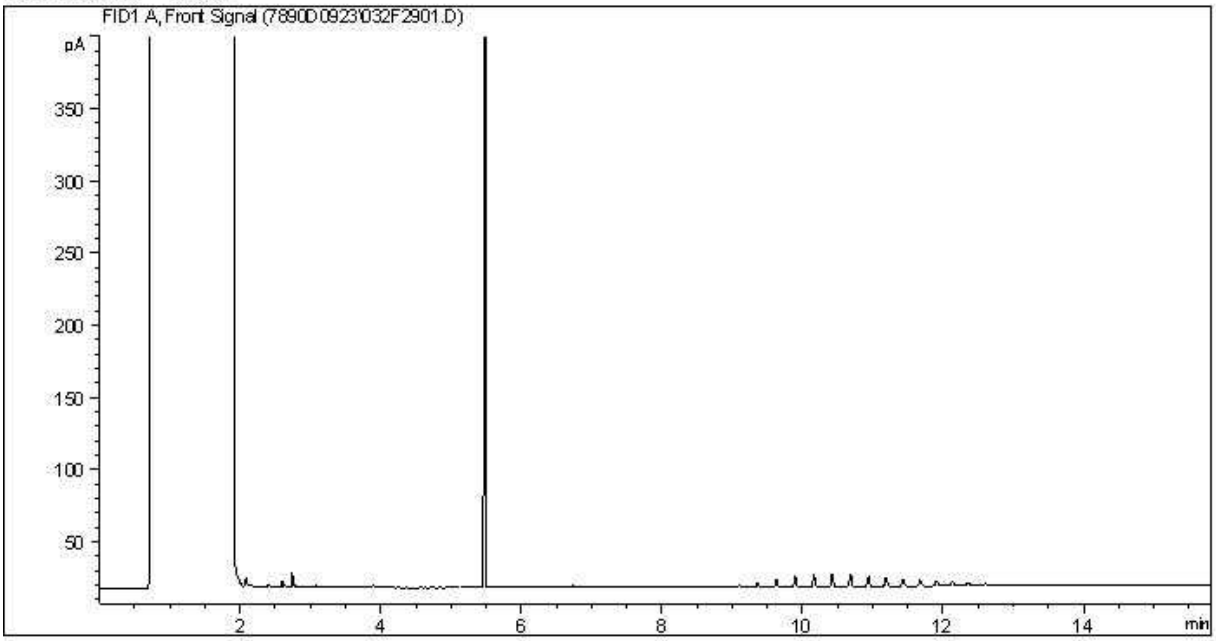
Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B881917
Report Date: 2018/09/27
Maxxam Sample: UJ4376

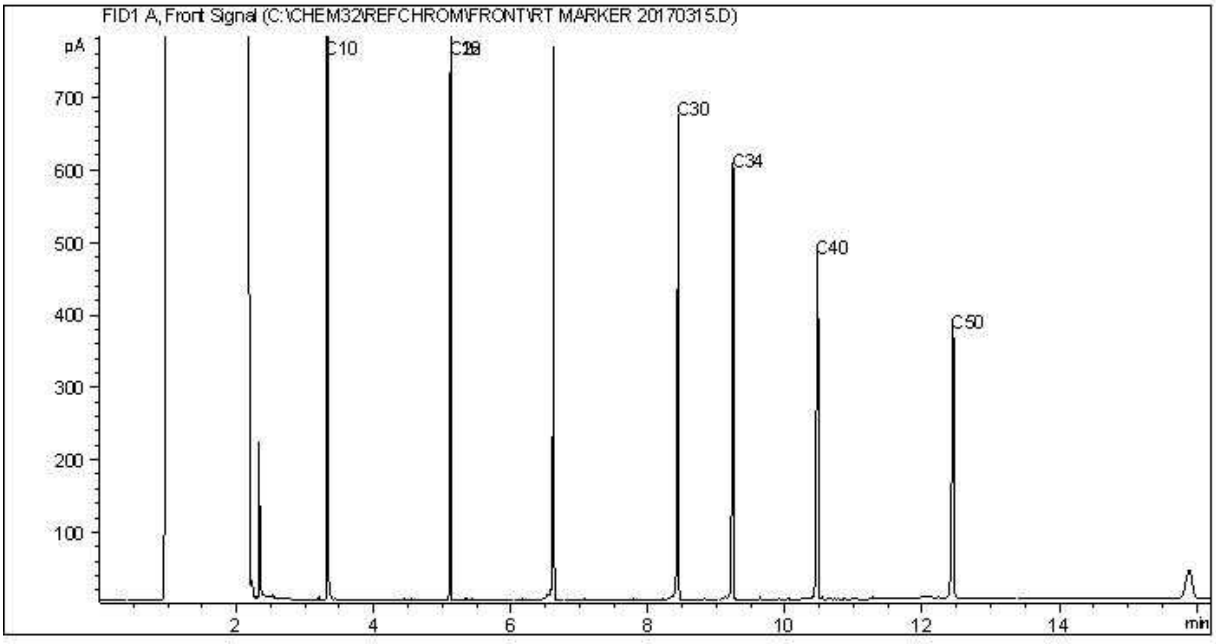
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: WSY 97-1-5

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890D




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam
A Bureau Veritas Group Company

☐ Calgary
4000 19th St. NE, T2E 6P8
Phone: (403) 291-3077
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☒ Edmonton
9331 - 48 Street, T6B 2R4
Phone: (780) 577-7100
Fax: (780) 450-4187
Toll Free: (800) 386-7247

# EXXON MOBIL/IMPERIAL OIL - MAXXAM CHAIN-OF-CUSTODY RECORD



C of C # 299023

| INVOICE INFORMATION | REPORT INFORMATION |
|---|---|
| Company Name: ☒ Imperial Oil ☐ ExxonMobil | Company Name: WORLEYPARSONS |
| Contact Name: WORLEYPARSONS | Contact Name: STACY GIBB |
| Address: 500-151 CANADA OLYMPIC RD SW CALGARY, AB T3B 6B7 | Address: 500-151 CANADA OLYMPIC RD SW CALGARY, AB T3B 6B7 |
| Email: SANJ.PERERA@ADVISIAN.COM | Email: STACY.GIBB@ADVISIAN.COM |
| Ph: 587-952-1490 | Ph: 403-247-0200 |
| Sampler Name (Print): DEVON GREVES | Consultant Project #: 407011-00586-0400 |

| FIELD SAMPLE ID | MATRIX: GROUND WATER | MATRIX: SURFACE WATER | MATRIX: SOIL | MATRIX: OTHER | # CONTAINERS | SAMPLING: DATE (YYYY/MM/DD) | SAMPLING: TIME (24 HR) | FIELD FILTERED & PRESERVED | LAB FILTRATION REQUIRED | VOC | PAH | PHCs (FRACTIONS 1-2 PLUS BTEX) | PHCs (FRACTIONS 1-4 PLUS BTEX) | PHCs (FRACTIONS 2-4) | PHCs (FRACTION 1 PLUS BTEX) | GRAIN SIZE (75 MICRON) | TEXTURE (% SAND, SILT, CLAY) | PARTICLE SIZE DISTRIBUTION WITH GRAPH | REGULATED METALS TOT ☐ DIS ☒ | MERCURY TOTAL ☐ DISSOLVED ☒ | SALINITY SOIL | FERTILIZER SOIL | FERTILIZER WATER | NUTRIENTS SOIL | ROUTINE POTABILITY | pH ☐ EC ☐ ALKALINITY ☐ | BASIC CLASS II LANDFILL PKG | PHENOLS (4-AAP) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 WSY 97-1-5 | X | | | | 5 | 2018/09/18 | 1330 | | | | | X | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

IOL SITE LOCATION: NORMAN WELLS, NT

IOL PROJECT # (if applicable): N/A

MAXXAM TASK ORDER # OR SERVICE ORDER # + LINE ITEM: 407011-00586-0400

REGULATORY CRITERIA / DETECTION LIMITS:
☐ Alberta Tier 1 ☐ CDWG
☐ SEQG (SK) ☐ NoSC (SK)
☒ CCME (incl. level) FWAL ☐ Other

SPECIAL INSTRUCTIONS:
ALSO EMAIL:
- STANDARD NORMAN WELLS EMAIL LIST
- MELISSA.LORD@ADVISIAN.COM
- DEVON.GREVES@ADVISIAN.COM
* IES A2601436

# JARS USED & NOT SUBMITTED Enter N/A for Water: N/A

TURNAROUND TIME
Standard (5 days) ☒
Rush (3 days) ☐
(2 days) ☐
(1 day) ☐
(same day) ☐
Date Required

| | YES | NO | COOLER ID # | | | |
|---|---|---|---|---|---|---|
| SEAL PRESENT | ✓ | | TEMP °C | 6 | 4 | 6 |
| SEAL INTACT | ✓ | | | 1 | 2 | 3 |
| COOLING MEDIA PRESENT | ✓ | | | | | |

| | YES | NO | COOLER ID # | | | |
|---|---|---|---|---|---|---|
| SEAL PRESENT | | | TEMP °C | | | |
| SEAL INTACT | | | | 1 | 2 | 3 |
| COOLING MEDIA PRESENT | | | | | | |

| | YES | NO | COOLER ID # | | | |
|---|---|---|---|---|---|---|
| SEAL PRESENT | | | TEMP °C | | | |
| SEAL INTACT | | | | 1 | 2 | 3 |
| COOLING MEDIA PRESENT | | | | | | |

LAB USE ONLY
MAXXAM JOB # B881917

| RELINQUISHED BY: | | DATE: | TIME (24 HR) | RECEIVED BY: | | DATE: | TIME (24 HR) |
|---|---|---|---|---|---|---|---|
| 1. | Devon Greves | 2018/09/19 | 1000 | 1. | Jenna Walter | 20180920 | 0956 |
| 2. | | | | 2. | | | |
| 3. | | | | 3. | | | |

SAMPLES
LABELED BY: DWL
VERIFIED BY: MFB

# DATA QUALITY REVIEW CHECKLIST - IMPERIAL OIL PROJECTS

Consultant: Advisian

Sampling Date: 20-Sep-18

Location: Norman Wells

Laboratory : Maxxam Edmonton

Consultant Project Number: 407011-00586-0400

Sample Submission Number: B882325

Are All Laboratory QC Within Acceptance Criteria (Yes, No, Not Applicable)?

| | Yes | No | NA | Comments |
|---|---|---|---|---|
| Instrument Surrogate Recovery | x | | | Extraction surrogate recovery of TERPHENYL-D14 (sur.) (18%) did not meet acceptance criteria (50-130%) for sample GIBG-10-2-3. All other laboratory QC met acceptance criteria. |
| Extraction Surrogate Recovery | | x | | |
| Method Blank Concentration | x | | | |
| Matrix Duplicate RPD | x | | | |
| Matrix Spike Recovery | x | | | |
| Lab Control Sample Recovery | x | | | |

Are All Field QC Samples Within Alert Limits (Yes, No, Not Applicable)?

| | Yes | No | NA | Comments |
|---|---|---|---|---|
| Field Blank Concentration | | | x | All QC samples met alert limits. |
| Trip Blank Concentration | | | x | |
| Equipment Blank Concentration | | | x | |
| Field Duplicate RPD | x | | | |

| | |
|---|---|
| Has CoA been signed off (Yes/No)?: | Yes |
| Has lab warranted all tests were analyzed following SOP's in CoA (Yes/No)?: | Yes |
| Were all samples analyzed within hold times (Yes/No)?: | Yes |
| All volatiles samples methanol extracted (if required) within 48 hours (Yes/No)?: | n/a |
| Is Chain of Custody completed and signed (Yes/No)?: | Yes |
| Were sample temperatures acceptable when they reached lab (Yes/No)?: | Yes |

Was a Data Quality Overview (DQO) issued (Yes/No)?: No

Date DQO was received: n/a

Is data considered to be reliable (Yes/No)?: Yes

If answer is "No", describe and provide rationale:

Data Reviewed by (Print): Vivian Baptista

Data Reviewed by (Signature): 

Date: 16-Oct-18

Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400
Your C.O.C. #: 299035

**Attention: Stacy Gibb**

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

**Report Date: 2018/10/01**
Report #: R2627879
Version: 2 - Revision

# CERTIFICATE OF ANALYSIS – REVISED REPORT

**MAXXAM JOB #: B882325**
**Received: 2018/09/22, 09:13**

Sample Matrix: Water
# Samples Received: 8

| Analyses | Quantity | Laboratory Method | Primary Reference |
|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | 8 | AB SOP-00005 | SM 23 2320 B m |
| BTEX/F1 in Water by HS GC/MS/FID | 8 | AB SOP-00039 | CCME CWS/EPA 8260d m |
| F1-BTEX | 8 | AB SOP-00039 | Auto Calc |
| Cadmium - low level CCME - Dissolved | 8 | AB WI-00065 | Auto Calc |
| Chloride by Automated Colourimetry | 8 | AB SOP-00020 | SM 22 4500-Cl-E m |
| Conductivity @25C | 8 | AB SOP-00005 | SM 23 2510 B m |
| CCME Hydrocarbons in Water (F2; C10-C16) (1) | 8 | AB SOP-00037 / AB SOP-00040 | CCME PHC-CWS m |
| Hardness | 8 | AB WI-00065 | Auto Calc |
| Mercury - Low Level (Dissolved) (2) | 8 | EENVSOP-00031 | EPA 245.7 R2 m |
| Elements by ICP - Dissolved (2) | 8 | AB SOP-00042 | EPA 6010d R4 m |
| Elements by ICPMS - Dissolved (2) | 8 | AB SOP-00043 | EPA 6020b R2 m |
| Ion Balance | 8 | AB WI-00065 | Auto Calc |
| Nitrate and Nitrite | 8 | AB WI-00065 | Auto Calc |
| Nitrate + Nitrite-N (calculated) | 8 | AB WI-00065 | Auto Calc |
| Nitrogen (Nitrite - Nitrate) by IC | 8 | AB SOP-00023 | SM 23 4110 B m |
| Benzo[a]pyrene Equivalency (3) | 3 | AB SOP-00003 | Auto Calc |
| PAH in Water by GC/MS | 3 | AB SOP-00037 / AB SOP-00003 | EPA 3510C/8270E m |
| Phenols (4-AAP) | 8 | EENVSOP-00061 | MMCW 154 1996 m |
| Sulphate by Automated Colourimetry | 8 | AB SOP-00018 | SM 22 4500-SO4 E m |
| Total Dissolved Solids (Filt. Residue) | 8 | AB SOP-00065 | SM 22 2540 C m |

**Remarks:**

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard. All samples were analyzed within hold time unless otherwise flagged.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed



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Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400
Your C.O.C. #: 299035

**Attention: Stacy Gibb**

Advisian
Suite 500, 151 Canada Olympic
Calgary, AB
Canada T3B 6B7

**Report Date: 2018/10/01**
Report #: R2627879
Version: 2 - Revision

# CERTIFICATE OF ANALYSIS – REVISED REPORT

**MAXXAM JOB #: B882325**
**Received: 2018/09/22, 09:13**

or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

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) Silica gel clean up employed.
(2) Dissolved > Total Imbalance: When applicable, Dissolved and Total results were reviewed and data quality meets acceptable levels unless otherwise noted.
(3) B[a]P TPE is calculated using 1/2 of the RDL for non detect results as per Alberta Environment instructions. This protocol may not apply in other jurisdictions.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Rhecie Phayouphone, Project Manager
Email: RPhayouphone@maxxam.ca
Phone# (403)735-2283

==========

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 #: B882325
Report Date: 2018/10/01

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## AT1 BTEX AND F1-F2 IN WATER (WATER)

| Maxxam ID | | UJ7441 | UJ7442 | UJ7443 | UJ7444 | UJ7445 | | |
|---|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/09/20 11:20 | 2018/09/20 12:40 | 2018/09/20 10:45 | 2018/09/20 13:26 | 2018/09/20 14:10 | | |
| COC Number | | 299035 | 299035 | 299035 | 299035 | 299035 | | |
| | **UNITS** | **BIS 97-1-3** | **BI-13-3-4.5** | **BIBG -10-1-4** | **BI-13-1-4** | **GIBG-10-2-3** | **RDL** | **QC Batch** |
| **Ext. Pet. Hydrocarbon** | | | | | | | | |
| F2 (C10-C16 Hydrocarbons) | mg/L | <0.10 | <0.10 | <0.10 | <0.10 | <0.10 | 0.10 | 9155935 |
| **Volatiles** | | | | | | | | |
| Benzene | mg/L | <0.00040 | <0.00040 | <0.00040 | <0.00040 | <0.00040 | 0.00040 | 9155762 |
| Toluene | mg/L | <0.00040 | <0.00040 | <0.00040 | <0.00040 | <0.00040 | 0.00040 | 9155762 |
| Ethylbenzene | mg/L | <0.00040 | <0.00040 | <0.00040 | <0.00040 | <0.00040 | 0.00040 | 9155762 |
| m & p-Xylene | mg/L | <0.00080 | <0.00080 | <0.00080 | <0.00080 | <0.00080 | 0.00080 | 9155762 |
| o-Xylene | mg/L | <0.00040 | <0.00040 | <0.00040 | <0.00040 | <0.00040 | 0.00040 | 9155762 |
| Xylenes (Total) | mg/L | <0.00089 | <0.00089 | <0.00089 | <0.00089 | <0.00089 | 0.00089 | 9155433 |
| F1 (C6-C10) - BTEX | mg/L | <0.10 | <0.10 | <0.10 | <0.10 | <0.10 | 0.10 | 9155433 |
| F1 (C6-C10) | mg/L | <0.10 | <0.10 | <0.10 | <0.10 | <0.10 | 0.10 | 9155762 |
| **Extraction Surrogate Recovery (%)** | | | | | | | | |
| O-TERPHENYL (sur.) | % | 90 | 101 | 93 | 94 | 91 | | 9155935 |
| **Instrument Surrogate Recovery (%)** | | | | | | | | |
| 1,4-Difluorobenzene (sur.) | % | 103 | 103 | 103 | 105 | 103 | | 9155762 |
| 4-Bromofluorobenzene (sur.) | % | 100 | 99 | 99 | 99 | 100 | | 9155762 |
| D4-1,2-Dichloroethane (sur.) | % | 117 | 114 | 114 | 116 | 112 | | 9155762 |

RDL = Reportable Detection Limit



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Maxxam Job #: B882325
Report Date: 2018/10/01

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## AT1 BTEX AND F1-F2 IN WATER (WATER)

| Maxxam ID | | UJ7445 | | | UJ7446 | UJ7447 | UJ7448 | | |
|---|---|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/09/20 14:10 | | | 2018/09/20 14:35 | 2018/09/20 15:30 | 2018/09/20 14:40 | | |
| COC Number | | 299035 | | | 299035 | 299035 | 299035 | | |
| | **UNITS** | **GIBG-10-2-3 Lab-Dup** | **RDL** | **QC Batch** | **GIQ8-10-2-4** | **GIP11 09-1-4R** | **NWD 18-49** | **RDL** | **QC Batch** |
| **Ext. Pet. Hydrocarbon** | | | | | | | | | |
| F2 (C10-C16 Hydrocarbons) | mg/L | <0.10 | 0.10 | 9155935 | <0.10 | <0.10 | <0.10 | 0.10 | 9155935 |
| **Volatiles** | | | | | | | | | |
| Benzene | mg/L | | | | <0.00040 | <0.00040 | <0.00040 | 0.00040 | 9155762 |
| Toluene | mg/L | | | | <0.00040 | <0.00040 | <0.00040 | 0.00040 | 9155762 |
| Ethylbenzene | mg/L | | | | <0.00040 | <0.00040 | <0.00040 | 0.00040 | 9155762 |
| m & p-Xylene | mg/L | | | | <0.00080 | <0.00080 | <0.00080 | 0.00080 | 9155762 |
| o-Xylene | mg/L | | | | <0.00040 | <0.00040 | <0.00040 | 0.00040 | 9155762 |
| Xylenes (Total) | mg/L | | | | <0.00089 | <0.00089 | <0.00089 | 0.00089 | 9155433 |
| F1 (C6-C10) - BTEX | mg/L | | | | <0.10 | <0.10 | <0.10 | 0.10 | 9155433 |
| F1 (C6-C10) | mg/L | | | | <0.10 | <0.10 | <0.10 | 0.10 | 9155762 |
| **Extraction Surrogate Recovery (%)** | | | | | | | | | |
| O-TERPHENYL (sur.) | % | 90 | | 9155935 | 90 | 89 | 88 | | 9155935 |
| **Instrument Surrogate Recovery (%)** | | | | | | | | | |
| 1,4-Difluorobenzene (sur.) | % | | | | 101 | 104 | 105 | | 9155762 |
| 4-Bromofluorobenzene (sur.) | % | | | | 100 | 99 | 98 | | 9155762 |
| D4-1,2-Dichloroethane (sur.) | % | | | | 116 | 114 | 111 | | 9155762 |

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate



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Maxxam Job #: B882325
Report Date: 2018/10/01

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## REGULATED METALS INCLUDING MERCURY-DISS (WATER)

| Maxxam ID | | UJ7441 | | | UJ7441 | | |
|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/09/20 11:20 | | | 2018/09/20 11:20 | | |
| COC Number | | 299035 | | | 299035 | | |
| | **UNITS** | **BIS 97-1-3** | **RDL** | **QC Batch** | **BIS 97-1-3 Lab-Dup** | **RDL** | **QC Batch** |
| **Low Level Elements** | | | | | | | |
| Dissolved Cadmium (Cd) | mg/L | 0.000046 | 0.000020 | 9155026 | | | |
| **Elements** | | | | | | | |
| Dissolved Aluminum (Al) | mg/L | 0.012 | 0.0030 | 9156601 | | | |
| Dissolved Antimony (Sb) | mg/L | <0.00060 | 0.00060 | 9156601 | | | |
| Dissolved Arsenic (As) | mg/L | 0.0016 | 0.00020 | 9156601 | | | |
| Dissolved Barium (Ba) | mg/L | 0.047 | 0.010 | 9155872 | | | |
| Dissolved Beryllium (Be) | mg/L | <0.0010 | 0.0010 | 9156601 | | | |
| Dissolved Boron (B) | mg/L | <0.020 | 0.020 | 9155872 | | | |
| Dissolved Calcium (Ca) | mg/L | 230 | 0.30 | 9155872 | | | |
| Dissolved Chromium (Cr) | mg/L | <0.0010 | 0.0010 | 9156601 | | | |
| Dissolved Cobalt (Co) | mg/L | 0.0025 | 0.00030 | 9156601 | | | |
| Dissolved Copper (Cu) | mg/L | 0.0019 | 0.00020 | 9156601 | | | |
| Dissolved Iron (Fe) | mg/L | 27 | 0.060 | 9155872 | | | |
| Dissolved Lead (Pb) | mg/L | <0.00020 | 0.00020 | 9156601 | | | |
| Dissolved Lithium (Li) | mg/L | <0.020 | 0.020 | 9155872 | | | |
| Dissolved Magnesium (Mg) | mg/L | 87 | 0.20 | 9155872 | | | |
| Dissolved Manganese (Mn) | mg/L | 0.92 | 0.0040 | 9155872 | | | |
| Dissolved Molybdenum (Mo) | mg/L | 0.0041 | 0.00020 | 9156601 | | | |
| Dissolved Nickel (Ni) | mg/L | 0.0072 | 0.00050 | 9156601 | | | |
| Dissolved Phosphorus (P) | mg/L | <0.10 | 0.10 | 9155872 | | | |
| Dissolved Potassium (K) | mg/L | 3.5 | 0.30 | 9155872 | | | |
| Dissolved Selenium (Se) | mg/L | 0.00056 | 0.00020 | 9156601 | | | |
| Dissolved Silicon (Si) | mg/L | 6.9 | 0.10 | 9155872 | | | |
| Dissolved Silver (Ag) | mg/L | <0.00010 | 0.00010 | 9156601 | | | |
| Dissolved Sodium (Na) | mg/L | 18 | 0.50 | 9155872 | | | |
| Dissolved Strontium (Sr) | mg/L | 0.81 | 0.020 | 9155872 | | | |
| Dissolved Sulphur (S) | mg/L | 60 | 0.20 | 9155872 | | | |
| Dissolved Thallium (Tl) | mg/L | <0.00020 | 0.00020 | 9156601 | | | |
| Dissolved Tin (Sn) | mg/L | <0.0010 | 0.0010 | 9156601 | | | |

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Report Date: 2018/10/01

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## REGULATED METALS INCLUDING MERCURY-DISS (WATER)

| Maxxam ID | | UJ7441 | | | UJ7441 | | |
|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/09/20 11:20 | | | 2018/09/20 11:20 | | |
| COC Number | | 299035 | | | 299035 | | |
| | **UNITS** | **BIS 97-1-3** | **RDL** | **QC Batch** | **BIS 97-1-3 Lab-Dup** | **RDL** | **QC Batch** |
| Dissolved Titanium (Ti) | mg/L | <0.0010 | 0.0010 | 9156601 | | | |
| Dissolved Uranium (U) | mg/L | 0.0010 | 0.00010 | 9156601 | | | |
| Dissolved Vanadium (V) | mg/L | 0.0017 | 0.0010 | 9156601 | | | |
| Dissolved Zinc (Zn) | mg/L | 0.0058 | 0.0030 | 9156601 | | | |
| **Low Level Elements** | | | | | | | |
| Dissolved Mercury (Hg) | mg/L | 0.0000028 | 0.0000020 | 9159519 | 0.0000027 | 0.0000020 | 9159519 |

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Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## REGULATED METALS INCLUDING MERCURY-DISS (WATER)

| Maxxam ID | | UJ7442 | UJ7443 | UJ7444 | UJ7445 | UJ7446 | | |
|---|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/09/20 12:40 | 2018/09/20 10:45 | 2018/09/20 13:26 | 2018/09/20 14:10 | 2018/09/20 14:35 | | |
| COC Number | | 299035 | 299035 | 299035 | 299035 | 299035 | | |
| | **UNITS** | **BI-13-3-4.5** | **BIBG -10-1-4** | **BI-13-1-4** | **GIBG-10-2-3** | **GIQ8-10-2-4** | **RDL** | **QC Batch** |
| **Low Level Elements** | | | | | | | | |
| Dissolved Cadmium (Cd) | mg/L | 0.00015 | 0.000028 | 0.000033 | 0.000053 | 0.00037 | 0.000020 | 9155026 |
| **Elements** | | | | | | | | |
| Dissolved Aluminum (Al) | mg/L | 0.0071 | 0.0087 | 0.0093 | 0.0049 | 0.010 | 0.0030 | 9156601 |
| Dissolved Antimony (Sb) | mg/L | <0.00060 | <0.00060 | <0.00060 | <0.00060 | <0.00060 | 0.00060 | 9156601 |
| Dissolved Arsenic (As) | mg/L | 0.00059 | 0.00038 | 0.0035 | <0.00020 | 0.00086 | 0.00020 | 9156601 |
| Dissolved Barium (Ba) | mg/L | 0.058 | 0.044 | 0.048 | 0.16 | 0.16 | 0.010 | 9155872 |
| Dissolved Beryllium (Be) | mg/L | <0.0010 | <0.0010 | <0.0010 | <0.0010 | <0.0010 | 0.0010 | 9156601 |
| Dissolved Boron (B) | mg/L | <0.020 | <0.020 | <0.020 | 0.031 | 0.026 | 0.020 | 9155872 |
| Dissolved Calcium (Ca) | mg/L | 250 | 220 | 230 | 140 | 370 | 0.30 | 9155872 |
| Dissolved Chromium (Cr) | mg/L | <0.0010 | <0.0010 | <0.0010 | <0.0010 | <0.0010 | 0.0010 | 9156601 |
| Dissolved Cobalt (Co) | mg/L | 0.0019 | 0.0018 | 0.010 | <0.00030 | 0.012 | 0.00030 | 9156601 |
| Dissolved Copper (Cu) | mg/L | 0.0045 | 0.00093 | 0.0014 | 0.0025 | 0.0023 | 0.00020 | 9156601 |
| Dissolved Iron (Fe) | mg/L | 0.28 | 0.30 | 27 | <0.060 | 3.6 | 0.060 | 9155872 |
| Dissolved Lead (Pb) | mg/L | <0.00020 | <0.00020 | <0.00020 | <0.00020 | <0.00020 | 0.00020 | 9156601 |
| Dissolved Lithium (Li) | mg/L | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | 0.020 | 9155872 |
| Dissolved Magnesium (Mg) | mg/L | 130 | 55 | 72 | 26 | 95 | 0.20 | 9155872 |
| Dissolved Manganese (Mn) | mg/L | 0.55 | 2.0 | 2.8 | 0.052 | 5.8 | 0.0040 | 9155872 |
| Dissolved Molybdenum (Mo) | mg/L | 0.012 | 0.032 | 0.0022 | 0.00065 | 0.00062 | 0.00020 | 9156601 |
| Dissolved Nickel (Ni) | mg/L | 0.022 | 0.0077 | 0.016 | 0.0024 | 0.022 | 0.00050 | 9156601 |
| Dissolved Phosphorus (P) | mg/L | <0.10 | <0.10 | <0.10 | <0.10 | <0.10 | 0.10 | 9155872 |
| Dissolved Potassium (K) | mg/L | 3.1 | 1.8 | 1.6 | 2.8 | 3.6 | 0.30 | 9155872 |
| Dissolved Selenium (Se) | mg/L | 0.0010 | 0.00060 | 0.00040 | <0.00020 | 0.00022 | 0.00020 | 9156601 |
| Dissolved Silicon (Si) | mg/L | 5.4 | 5.0 | 4.9 | 4.8 | 5.7 | 0.10 | 9155872 |
| Dissolved Silver (Ag) | mg/L | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | 0.00010 | 9156601 |
| Dissolved Sodium (Na) | mg/L | 14 | 7.5 | 13 | 30 | 25 | 0.50 | 9155872 |
| Dissolved Strontium (Sr) | mg/L | 0.84 | 0.63 | 1.3 | 0.71 | 1.6 | 0.020 | 9155872 |
| Dissolved Sulphur (S) | mg/L | 240 | 110 | 50 | 42 | 240 | 0.20 | 9155872 |
| Dissolved Thallium (Tl) | mg/L | <0.00020 | <0.00020 | <0.00020 | <0.00020 | <0.00020 | 0.00020 | 9156601 |
| Dissolved Tin (Sn) | mg/L | <0.0010 | <0.0010 | <0.0010 | <0.0010 | <0.0010 | 0.0010 | 9156601 |
| Dissolved Titanium (Ti) | mg/L | <0.0010 | <0.0010 | <0.0010 | <0.0010 | <0.0010 | 0.0010 | 9156601 |

RDL = Reportable Detection Limit



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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## REGULATED METALS INCLUDING MERCURY-DISS (WATER)

| Maxxam ID | | UJ7442 | UJ7443 | UJ7444 | UJ7445 | UJ7446 | | |
|---|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/09/20 12:40 | 2018/09/20 10:45 | 2018/09/20 13:26 | 2018/09/20 14:10 | 2018/09/20 14:35 | | |
| COC Number | | 299035 | 299035 | 299035 | 299035 | 299035 | | |
| | **UNITS** | **BI-13-3-4.5** | **BIBG -10-1-4** | **BI-13-1-4** | **GIBG-10-2-3** | **GIQ8-10-2-4** | **RDL** | **QC Batch** |
| Dissolved Uranium (U) | mg/L | 0.0097 | 0.0099 | 0.0062 | 0.0028 | 0.0082 | 0.00010 | 9156601 |
| Dissolved Vanadium (V) | mg/L | <0.0010 | <0.0010 | 0.0010 | <0.0010 | <0.0010 | 0.0010 | 9156601 |
| Dissolved Zinc (Zn) | mg/L | 0.021 | 0.012 | 0.011 | 0.0081 | 0.018 | 0.0030 | 9156601 |
| **Low Level Elements** | | | | | | | | |
| Dissolved Mercury (Hg) | mg/L | 0.0000021 | <0.0000020 | <0.0000020 | <0.0000020 | 0.0000020 | 0.0000020 | 9159519 |
| RDL = Reportable Detection Limit | | | | | | | | |



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Maxxam Job #: B882325
Report Date: 2018/10/01

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## REGULATED METALS INCLUDING MERCURY-DISS (WATER)

| Maxxam ID | | UJ7447 | UJ7448 | | |
|---|---|---|---|---|---|
| Sampling Date | | 2018/09/20 15:30 | 2018/09/20 14:40 | | |
| COC Number | | 299035 | 299035 | | |
| | **UNITS** | **GIP11 09-1-4R** | **NWD 18-49** | **RDL** | **QC Batch** |
| **Low Level Elements** | | | | | |
| Dissolved Cadmium (Cd) | mg/L | 0.00027 | 0.00034 | 0.000020 | 9155026 |
| **Elements** | | | | | |
| Dissolved Aluminum (Al) | mg/L | 0.0052 | 0.017 | 0.0030 | 9156601 |
| Dissolved Antimony (Sb) | mg/L | <0.00060 | <0.00060 | 0.00060 | 9156601 |
| Dissolved Arsenic (As) | mg/L | 0.00035 | 0.00089 | 0.00020 | 9156601 |
| Dissolved Barium (Ba) | mg/L | 0.082 | 0.16 | 0.010 | 9155872 |
| Dissolved Beryllium (Be) | mg/L | <0.0010 | <0.0010 | 0.0010 | 9156601 |
| Dissolved Boron (B) | mg/L | 0.047 | 0.029 | 0.020 | 9155872 |
| Dissolved Calcium (Ca) | mg/L | 250 | 380 | 0.30 | 9155872 |
| Dissolved Chromium (Cr) | mg/L | <0.0010 | <0.0010 | 0.0010 | 9156601 |
| Dissolved Cobalt (Co) | mg/L | 0.0024 | 0.012 | 0.00030 | 9156601 |
| Dissolved Copper (Cu) | mg/L | 0.0037 | 0.0018 | 0.00020 | 9156601 |
| Dissolved Iron (Fe) | mg/L | <0.060 | 4.0 | 0.060 | 9155872 |
| Dissolved Lead (Pb) | mg/L | <0.00020 | <0.00020 | 0.00020 | 9156601 |
| Dissolved Lithium (Li) | mg/L | 0.027 | <0.020 | 0.020 | 9155872 |
| Dissolved Magnesium (Mg) | mg/L | 47 | 98 | 0.20 | 9155872 |
| Dissolved Manganese (Mn) | mg/L | 0.37 | 6.0 | 0.0040 | 9155872 |
| Dissolved Molybdenum (Mo) | mg/L | 0.00069 | 0.00061 | 0.00020 | 9156601 |
| Dissolved Nickel (Ni) | mg/L | 0.014 | 0.021 | 0.00050 | 9156601 |
| Dissolved Phosphorus (P) | mg/L | <0.10 | <0.10 | 0.10 | 9155872 |
| Dissolved Potassium (K) | mg/L | 3.7 | 3.7 | 0.30 | 9155872 |
| Dissolved Selenium (Se) | mg/L | 0.0048 | <0.00020 | 0.00020 | 9156601 |
| Dissolved Silicon (Si) | mg/L | 5.3 | 5.9 | 0.10 | 9155872 |
| Dissolved Silver (Ag) | mg/L | <0.00010 | <0.00010 | 0.00010 | 9156601 |
| Dissolved Sodium (Na) | mg/L | 6.2 | 25 | 0.50 | 9155872 |
| Dissolved Strontium (Sr) | mg/L | 0.95 | 1.7 | 0.020 | 9155872 |
| Dissolved Sulphur (S) | mg/L | 62 | 240 | 0.20 | 9155872 |
| Dissolved Thallium (Tl) | mg/L | <0.00020 | <0.00020 | 0.00020 | 9156601 |
| Dissolved Tin (Sn) | mg/L | <0.0010 | <0.0010 | 0.0010 | 9156601 |
| Dissolved Titanium (Ti) | mg/L | <0.0010 | <0.0010 | 0.0010 | 9156601 |
| RDL = Reportable Detection Limit | | | | | |



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Maxxam Job #: B882325
Report Date: 2018/10/01

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## REGULATED METALS INCLUDING MERCURY-DISS (WATER)

| Maxxam ID | | UJ7447 | UJ7448 | | |
|---|---|---|---|---|---|
| Sampling Date | | 2018/09/20 15:30 | 2018/09/20 14:40 | | |
| COC Number | | 299035 | 299035 | | |
| | **UNITS** | **GIP11 09-1-4R** | **NWD 18-49** | **RDL** | **QC Batch** |
| Dissolved Uranium (U) | mg/L | 0.0065 | 0.0085 | 0.00010 | 9156601 |
| Dissolved Vanadium (V) | mg/L | <0.0010 | <0.0010 | 0.0010 | 9156601 |
| Dissolved Zinc (Zn) | mg/L | 0.021 | 0.015 | 0.0030 | 9156601 |
| **Low Level Elements** | | | | | |
| Dissolved Mercury (Hg) | mg/L | <0.0000020 | <0.0000020 | 0.0000020 | 9159519 |
| RDL = Reportable Detection Limit | | | | | |



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Maxxam Job #: B882325
Report Date: 2018/10/01

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## RESULTS OF CHEMICAL ANALYSES OF WATER

| Maxxam ID | | UJ7441 | | | UJ7442 | | | UJ7442 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/09/20 11:20 | | | 2018/09/20 12:40 | | | 2018/09/20 12:40 | | |
| COC Number | | 299035 | | | 299035 | | | 299035 | | |
| | **UNITS** | **BIS 97-1-3** | **RDL** | **QC Batch** | **BI-13-3-4.5** | **RDL** | **QC Batch** | **BI-13-3-4.5 Lab-Dup** | **RDL** | **QC Batch** |
| **Calculated Parameters** | | | | | | | | | | |
| Hardness (CaCO3) | mg/L | 940 | 0.50 | 9155633 | 1200 | 0.50 | 9155633 | | | |
| Ion Balance (% Difference) | % | 3.0 | N/A | 9155030 | 0.33 | N/A | 9155634 | | | |
| Dissolved Nitrate (NO3) | mg/L | 0.051 | 0.044 | 9155032 | 0.60 | 0.044 | 9155635 | | | |
| Nitrate plus Nitrite (N) | mg/L | <0.014 | 0.014 | 9155033 | 0.14 | 0.014 | 9155636 | | | |
| Dissolved Nitrite (NO2) | mg/L | <0.033 | 0.033 | 9155032 | <0.033 | 0.033 | 9155635 | | | |
| **Misc. Inorganics** | | | | | | | | | | |
| Conductivity | uS/cm | 1500 | 2.0 | 9157664 | 1900 | 2.0 | 9157664 | | | |
| Total Dissolved Solids | mg/L | 1100 | 10 | 9155697 | 1600 | 10 | 9157647 | 1600 | 10 | 9157647 |
| **Anions** | | | | | | | | | | |
| Alkalinity (PP as CaCO3) | mg/L | <1.0 | 1.0 | 9157661 | <1.0 | 1.0 | 9157661 | | | |
| Alkalinity (Total as CaCO3) | mg/L | 780 | 1.0 | 9157661 | 450 | 1.0 | 9157661 | | | |
| Bicarbonate (HCO3) | mg/L | 950 | 1.0 | 9157661 | 550 | 1.0 | 9157661 | | | |
| Carbonate (CO3) | mg/L | <1.0 | 1.0 | 9157661 | <1.0 | 1.0 | 9157661 | | | |
| Hydroxide (OH) | mg/L | <1.0 | 1.0 | 9157661 | <1.0 | 1.0 | 9157661 | | | |
| Dissolved Sulphate (SO4) | mg/L | 160 | 1.0 | 9155702 | 710 (1) | 5.0 | 9155702 | | | |
| Dissolved Chloride (Cl) | mg/L | 22 | 1.0 | 9155701 | 10 | 1.0 | 9155701 | | | |
| **Nutrients** | | | | | | | | | | |
| Dissolved Nitrite (N) | mg/L | <0.010 | 0.010 | 9155694 | <0.010 | 0.010 | 9155694 | | | |
| Dissolved Nitrate (N) | mg/L | 0.011 | 0.010 | 9155694 | 0.14 | 0.010 | 9155694 | | | |
| **Misc. Organics** | | | | | | | | | | |
| Phenols | mg/L | 0.0076 (2) | 0.0040 | 9161623 | 0.0042 | 0.0020 | 9161623 | 0.0036 | 0.0020 | 9161623 |

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.
(2) Detection limits raised due to sample matrix.



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Maxxam Job #: B882325
Report Date: 2018/10/01

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## RESULTS OF CHEMICAL ANALYSES OF WATER

| Maxxam ID | | UJ7443 | | UJ7444 | | UJ7445 | | UJ7446 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/09/20 10:45 | | 2018/09/20 13:26 | | 2018/09/20 14:10 | | 2018/09/20 14:35 | | |
| COC Number | | 299035 | | 299035 | | 299035 | | 299035 | | |
| | **UNITS** | **BIBG -10-1-4** | **RDL** | **BI-13-1-4** | **RDL** | **GIBG-10-2-3** | **RDL** | **GIQ8-10-2-4** | **RDL** | **QC Batch** |
| **Calculated Parameters** | | | | | | | | | | |
| Hardness (CaCO3) | mg/L | 780 | 0.50 | 870 | 0.50 | 450 | 0.50 | 1300 | 0.50 | 9155633 |
| Ion Balance (% Difference) | % | 0.18 | N/A | 3.0 | N/A | 0.039 | N/A | 0.12 | N/A | 9155634 |
| Dissolved Nitrate (NO3) | mg/L | <0.044 | 0.044 | 1.2 | 0.044 | 0.45 | 0.044 | <0.044 | 0.044 | 9155635 |
| Nitrate plus Nitrite (N) | mg/L | <0.014 | 0.014 | 0.28 | 0.014 | 0.10 | 0.014 | <0.014 | 0.014 | 9155636 |
| Dissolved Nitrite (NO2) | mg/L | <0.033 | 0.033 | <0.033 | 0.033 | <0.033 | 0.033 | <0.033 | 0.033 | 9155635 |
| **Misc. Inorganics** | | | | | | | | | | |
| Conductivity | uS/cm | 1300 | 2.0 | 1400 | 2.0 | 870 | 2.0 | 2100 | 2.0 | 9157664 |
| Total Dissolved Solids | mg/L | 1000 | 10 | 1300 | 10 | 580 (1) | 25 | 1800 (1) | 25 | 9157647 |
| **Anions** | | | | | | | | | | |
| Alkalinity (PP as CaCO3) | mg/L | <1.0 | 1.0 | <1.0 | 1.0 | <1.0 | 1.0 | <1.0 | 1.0 | 9157661 |
| Alkalinity (Total as CaCO3) | mg/L | 450 | 1.0 | 720 | 1.0 | 370 | 1.0 | 640 | 1.0 | 9157661 |
| Bicarbonate (HCO3) | mg/L | 550 | 1.0 | 880 | 1.0 | 460 | 1.0 | 780 | 1.0 | 9157661 |
| Carbonate (CO3) | mg/L | <1.0 | 1.0 | <1.0 | 1.0 | <1.0 | 1.0 | <1.0 | 1.0 | 9157661 |
| Hydroxide (OH) | mg/L | <1.0 | 1.0 | <1.0 | 1.0 | <1.0 | 1.0 | <1.0 | 1.0 | 9157661 |
| Dissolved Sulphate (SO4) | mg/L | 300 (2) | 5.0 | 160 | 1.0 | 130 | 1.0 | 700 (2) | 5.0 | 9155702 |
| Dissolved Chloride (Cl) | mg/L | 23 | 1.0 | 8.3 | 1.0 | 6.9 | 1.0 | 21 | 1.0 | 9155701 |
| **Nutrients** | | | | | | | | | | |
| Dissolved Nitrite (N) | mg/L | <0.010 | 0.010 | <0.010 | 0.010 | <0.010 | 0.010 | <0.010 | 0.010 | 9155694 |
| Dissolved Nitrate (N) | mg/L | <0.010 | 0.010 | 0.28 | 0.010 | 0.10 | 0.010 | <0.010 | 0.010 | 9155694 |
| **Misc. Organics** | | | | | | | | | | |
| Phenols | mg/L | <0.0020 | 0.0020 | 0.0077 | 0.0020 | 0.0067 | 0.0020 | 0.0043 | 0.0020 | 9161623 |

RDL = Reportable Detection Limit
N/A = Not Applicable
(1) Detection limit raised based on sample volume used for analysis.
(2) Detection limits raised due to dilution to bring analyte within the calibrated range.



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Maxxam Job #: B882325
Report Date: 2018/10/01

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## RESULTS OF CHEMICAL ANALYSES OF WATER

| Maxxam ID | | UJ7446 | | | UJ7447 | | | UJ7448 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/09/20 14:35 | | | 2018/09/20 15:30 | | | 2018/09/20 14:40 | | |
| COC Number | | 299035 | | | 299035 | | | 299035 | | |
| | **UNITS** | **GIQ8-10-2-4 Lab-Dup** | **RDL** | **QC Batch** | **GIP11 09-1-4R** | **RDL** | **QC Batch** | **NWD 18-49** | **RDL** | **QC Batch** |
| **Calculated Parameters** | | | | | | | | | | |
| Hardness (CaCO3) | mg/L | | | | 810 | 0.50 | 9155633 | 1300 | 0.50 | 9155633 |
| Ion Balance (% Difference) | % | | | | 3.2 | N/A | 9155030 | 0.94 | N/A | 9155634 |
| Dissolved Nitrate (NO3) | mg/L | | | | 1.2 | 0.044 | 9155032 | <0.044 | 0.044 | 9155635 |
| Nitrate plus Nitrite (N) | mg/L | | | | 0.27 | 0.014 | 9155033 | <0.014 | 0.014 | 9155636 |
| Dissolved Nitrite (NO2) | mg/L | | | | <0.033 | 0.033 | 9155032 | <0.033 | 0.033 | 9155635 |
| **Misc. Inorganics** | | | | | | | | | | |
| Conductivity | uS/cm | 2100 | 2.0 | 9157664 | 1400 | 2.0 | 9157664 | 2100 | 2.0 | 9157664 |
| Total Dissolved Solids | mg/L | | | | 970 | 10 | 9157647 | 1800 (1) | 25 | 9157647 |
| **Anions** | | | | | | | | | | |
| Alkalinity (PP as CaCO3) | mg/L | <1.0 | 1.0 | 9157661 | <1.0 | 1.0 | 9157661 | <1.0 | 1.0 | 9157661 |
| Alkalinity (Total as CaCO3) | mg/L | 630 | 1.0 | 9157661 | 650 | 1.0 | 9157661 | 710 | 1.0 | 9157661 |
| Bicarbonate (HCO3) | mg/L | 770 | 1.0 | 9157661 | 800 | 1.0 | 9157661 | 860 | 1.0 | 9157661 |
| Carbonate (CO3) | mg/L | <1.0 | 1.0 | 9157661 | <1.0 | 1.0 | 9157661 | <1.0 | 1.0 | 9157661 |
| Hydroxide (OH) | mg/L | <1.0 | 1.0 | 9157661 | <1.0 | 1.0 | 9157661 | <1.0 | 1.0 | 9157661 |
| Dissolved Sulphate (SO4) | mg/L | | | | 200 | 1.0 | 9155702 | 690 (2) | 5.0 | 9155702 |
| Dissolved Chloride (Cl) | mg/L | | | | 14 | 1.0 | 9155701 | 21 | 1.0 | 9155701 |
| **Nutrients** | | | | | | | | | | |
| Dissolved Nitrite (N) | mg/L | | | | <0.010 | 0.010 | 9155694 | <0.010 | 0.010 | 9155694 |
| Dissolved Nitrate (N) | mg/L | | | | 0.27 | 0.010 | 9155694 | <0.010 | 0.010 | 9155694 |
| **Misc. Organics** | | | | | | | | | | |
| Phenols | mg/L | | | | 0.0023 | 0.0020 | 9161623 | 0.0039 | 0.0020 | 9161623 |

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Detection limit raised based on sample volume used for analysis.
(2) Detection limits raised due to dilution to bring analyte within the calibrated range.


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Maxxam Job #: B882325
Report Date: 2018/10/01

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## SEMIVOLATILE ORGANICS BY GC-MS (WATER)

| Maxxam ID | | UJ7441 | | UJ7443 | | UJ7445 | | |
|---|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/09/20 11:20 | | 2018/09/20 10:45 | | 2018/09/20 14:10 | | |
| COC Number | | 299035 | | 299035 | | 299035 | | |
| | **UNITS** | **BIS 97-1-3** | **QC Batch** | **BIBG -10-1-4** | **QC Batch** | **GIBG-10-2-3** | **RDL** | **QC Batch** |
| **Polycyclic Aromatics** | | | | | | | | |
| Benzo[a]pyrene equivalency | mg/L | <0.000010 | 9155034 | <0.000010 | 9155034 | <0.000010 | 0.000010 | 9155637 |
| Acenaphthene | mg/L | <0.00010 | 9155176 | <0.00010 | 9154722 | <0.00010 | 0.00010 | 9155176 |
| Acenaphthylene | mg/L | <0.00010 | 9155176 | <0.00010 | 9154722 | <0.00010 | 0.00010 | 9155176 |
| Acridine | mg/L | <0.000050 | 9155176 | <0.000050 | 9154722 | <0.000050 | 0.000050 | 9155176 |
| Anthracene | mg/L | <0.000010 | 9155176 | <0.000010 | 9154722 | <0.000010 | 0.000010 | 9155176 |
| Benzo(a)anthracene | mg/L | <0.0000085 | 9155176 | <0.0000085 | 9154722 | <0.0000085 | 0.0000085 | 9155176 |
| Benzo(b&j)fluoranthene | mg/L | <0.0000085 | 9155176 | <0.0000085 | 9154722 | <0.0000085 | 0.0000085 | 9155176 |
| Benzo(k)fluoranthene | mg/L | <0.0000085 | 9155176 | <0.0000085 | 9154722 | <0.0000085 | 0.0000085 | 9155176 |
| Benzo(g,h,i)perylene | mg/L | <0.0000085 | 9155176 | <0.0000085 | 9154722 | <0.0000085 | 0.0000085 | 9155176 |
| Benzo(c)phenanthrene | mg/L | <0.000050 | 9155176 | <0.000050 | 9154722 | <0.000050 | 0.000050 | 9155176 |
| Benzo(a)pyrene | mg/L | <0.0000075 | 9155176 | <0.0000075 | 9154722 | <0.0000075 | 0.0000075 | 9155176 |
| Benzo[e]pyrene | mg/L | <0.000050 | 9155176 | <0.000050 | 9154722 | <0.000050 | 0.000050 | 9155176 |
| Chrysene | mg/L | <0.0000085 | 9155176 | <0.0000085 | 9154722 | <0.0000085 | 0.0000085 | 9155176 |
| Dibenz(a,h)anthracene | mg/L | <0.0000075 | 9155176 | <0.0000075 | 9154722 | <0.0000075 | 0.0000075 | 9155176 |
| Fluoranthene | mg/L | <0.000010 | 9155176 | <0.000010 | 9154722 | <0.000010 | 0.000010 | 9155176 |
| Fluorene | mg/L | <0.000050 | 9155176 | <0.000050 | 9154722 | <0.000050 | 0.000050 | 9155176 |
| Indeno(1,2,3-cd)pyrene | mg/L | <0.0000085 | 9155176 | <0.0000085 | 9154722 | <0.0000085 | 0.0000085 | 9155176 |
| 1-Methylnaphthalene | mg/L | <0.00010 | 9155176 | <0.00010 | 9154722 | <0.00010 | 0.00010 | 9155176 |
| 2-Methylnaphthalene | mg/L | <0.00010 | 9155176 | <0.00010 | 9154722 | <0.00010 | 0.00010 | 9155176 |
| Naphthalene | mg/L | <0.00010 | 9155176 | <0.00010 | 9154722 | <0.00010 | 0.00010 | 9155176 |
| Phenanthrene | mg/L | <0.000050 | 9155176 | <0.000050 | 9154722 | <0.000050 | 0.000050 | 9155176 |
| Perylene | mg/L | <0.000050 | 9155176 | <0.000050 | 9154722 | <0.000050 | 0.000050 | 9155176 |
| Pyrene | mg/L | <0.000020 | 9155176 | <0.000020 | 9154722 | <0.000020 | 0.000020 | 9155176 |
| Quinoline | mg/L | <0.00020 | 9155176 | <0.00020 | 9154722 | <0.00020 | 0.00020 | 9155176 |
| **Extraction Surrogate Recovery (%)** | | | | | | | | |
| D10-ANTHRACENE (sur.) | % | 91 | 9155176 | 88 | 9154722 | 57 | | 9155176 |
| D8-ACENAPHTHYLENE (sur.) | % | 103 | 9155176 | 103 | 9154722 | 94 | | 9155176 |
| D8-NAPHTHALENE (sur.) | % | 80 | 9155176 | 84 | 9154722 | 77 | | 9155176 |

RDL = Reportable Detection Limit



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Maxxam Job #: B882325
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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## SEMIVOLATILE ORGANICS BY GC-MS (WATER)

| Maxxam ID | | UJ7441 | | UJ7443 | | UJ7445 | | |
|---|---|---|---|---|---|---|---|---|
| Sampling Date | | 2018/09/20 11:20 | | 2018/09/20 10:45 | | 2018/09/20 14:10 | | |
| COC Number | | 299035 | | 299035 | | 299035 | | |
| | **UNITS** | **BIS 97-1-3** | **QC Batch** | **BIBG -10-1-4** | **QC Batch** | **GIBG-10-2-3** | **RDL** | **QC Batch** |
| TERPHENYL-D14 (sur.) | % | 61 | 9155176 | 54 | 9154722 | 18 (1) | | 9155176 |

RDL = Reportable Detection Limit
(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.


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Maxxam Job #: B882325
Report Date: 2018/10/01

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## TEST SUMMARY

**Maxxam ID:** UJ7441
**Sample ID:** BIS 97-1-3
**Matrix:** Water

**Collected:** 2018/09/20
**Relinquished:** 2018/09/21
**Received:** 2018/09/22

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | AT/ALK | 9157661 | N/A | 2018/09/25 | Malina Alamyar |
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9155762 | N/A | 2018/09/25 | Hetul Patel |
| F1-BTEX | CALC/MS | 9155433 | N/A | 2018/09/26 | Automated Statchk |
| Cadmium - low level CCME - Dissolved | CALC/MS | 9155026 | N/A | 2018/09/25 | Justin Geisel |
| Chloride by Automated Colourimetry | KONE | 9155701 | N/A | 2018/09/23 | Marissa Richard |
| Conductivity @25C | COND | 9157664 | N/A | 2018/09/25 | Malina Alamyar |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9155935 | 2018/09/24 | 2018/09/24 | Jana Rychlikova |
| Hardness | CALC | 9155633 | N/A | 2018/09/24 | Automated Statchk |
| Mercury - Low Level (Dissolved) | CV/AF | 9159519 | 2018/09/26 | 2018/09/26 | Andrew Payne |
| Elements by ICP - Dissolved | ICPA | 9155872 | N/A | 2018/09/23 | Mahboubeh Bahadori |
| Elements by ICPMS - Dissolved | ICPM | 9156601 | N/A | 2018/09/24 | Jonathan Kuprowsky |
| Ion Balance | CALC | 9155030 | N/A | 2018/09/23 | Justin Geisel |
| Nitrate and Nitrite | CALC | 9155032 | N/A | 2018/09/24 | Automated Statchk |
| Nitrate + Nitrite-N (calculated) | CALC | 9155033 | N/A | 2018/09/24 | Automated Statchk |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9155694 | N/A | 2018/09/23 | Krista Dawe |
| Benzo[a]pyrene Equivalency | GC/MSD | 9155034 | N/A | 2018/09/25 | Justin Geisel |
| PAH in Water by GC/MS | GC/MS | 9155176 | 2018/09/23 | 2018/09/24 | Dharmesh Rana |
| Phenols (4-AAP) | TECH/4AAP | 9161623 | N/A | 2018/09/27 | Ashley Fedoriuk |
| Sulphate by Automated Colourimetry | KONE | 9155702 | N/A | 2018/09/23 | Marissa Richard |
| Total Dissolved Solids (Filt. Residue) | BAL | 9155697 | 2018/09/23 | 2018/09/24 | Luminita Chiosa |

**Maxxam ID:** UJ7441 Dup
**Sample ID:** BIS 97-1-3
**Matrix:** Water

**Collected:** 2018/09/20
**Relinquished:** 2018/09/21
**Received:** 2018/09/22

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Mercury - Low Level (Dissolved) | CV/AF | 9159519 | 2018/09/26 | 2018/09/26 | Andrew Payne |

**Maxxam ID:** UJ7442
**Sample ID:** BI-13-3-4.5
**Matrix:** Water

**Collected:** 2018/09/20
**Relinquished:** 2018/09/21
**Received:** 2018/09/22

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | AT/ALK | 9157661 | N/A | 2018/09/25 | Malina Alamyar |
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9155762 | N/A | 2018/09/25 | Hetul Patel |
| F1-BTEX | CALC/MS | 9155433 | N/A | 2018/09/26 | Automated Statchk |
| Cadmium - low level CCME - Dissolved | CALC/MS | 9155026 | N/A | 2018/09/25 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 9155701 | N/A | 2018/09/23 | Marissa Richard |
| Conductivity @25C | COND | 9157664 | N/A | 2018/09/25 | Malina Alamyar |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9155935 | 2018/09/24 | 2018/09/24 | Jana Rychlikova |
| Hardness | CALC | 9155633 | N/A | 2018/09/24 | Automated Statchk |
| Mercury - Low Level (Dissolved) | CV/AF | 9159519 | 2018/09/26 | 2018/09/26 | Andrew Payne |
| Elements by ICP - Dissolved | ICPA | 9155872 | N/A | 2018/09/23 | Mahboubeh Bahadori |



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Maxxam Job #: B882325
Report Date: 2018/10/01

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## TEST SUMMARY

**Maxxam ID:** UJ7442
**Sample ID:** BI-13-3-4.5
**Matrix:** Water

**Collected:** 2018/09/20
**Relinquished:** 2018/09/21
**Received:** 2018/09/22

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Elements by ICPMS - Dissolved | ICPM | 9156601 | N/A | 2018/09/24 | Jonathan Kuprowsky |
| Ion Balance | CALC | 9155634 | N/A | 2018/09/23 | Automated Statchk |
| Nitrate and Nitrite | CALC | 9155635 | N/A | 2018/09/24 | Automated Statchk |
| Nitrate + Nitrite-N (calculated) | CALC | 9155636 | N/A | 2018/09/24 | Automated Statchk |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9155694 | N/A | 2018/09/23 | Krista Dawe |
| Phenols (4-AAP) | TECH/4AAP | 9161623 | N/A | 2018/09/27 | Ashley Fedoriuk |
| Sulphate by Automated Colourimetry | KONE | 9155702 | N/A | 2018/09/23 | Marissa Richard |
| Total Dissolved Solids (Filt. Residue) | BAL | 9157647 | 2018/09/25 | 2018/09/26 | Victoria Fedorak |

**Maxxam ID:** UJ7442 Dup
**Sample ID:** BI-13-3-4.5
**Matrix:** Water

**Collected:** 2018/09/20
**Relinquished:** 2018/09/21
**Received:** 2018/09/22

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Phenols (4-AAP) | TECH/4AAP | 9161623 | N/A | 2018/09/27 | Ashley Fedoriuk |
| Total Dissolved Solids (Filt. Residue) | BAL | 9157647 | 2018/09/25 | 2018/09/26 | Victoria Fedorak |

**Maxxam ID:** UJ7443
**Sample ID:** BIBG -10-1-4
**Matrix:** Water

**Collected:** 2018/09/20
**Relinquished:** 2018/09/21
**Received:** 2018/09/22

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | AT/ALK | 9157661 | N/A | 2018/09/25 | Malina Alamyar |
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9155762 | N/A | 2018/09/25 | Hetul Patel |
| F1-BTEX | CALC/MS | 9155433 | N/A | 2018/09/26 | Automated Statchk |
| Cadmium - low level CCME - Dissolved | CALC/MS | 9155026 | N/A | 2018/09/25 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 9155701 | N/A | 2018/09/23 | Marissa Richard |
| Conductivity @25C | COND | 9157664 | N/A | 2018/09/25 | Malina Alamyar |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9155935 | 2018/09/24 | 2018/09/24 | Jana Rychlikova |
| Hardness | CALC | 9155633 | N/A | 2018/09/24 | Automated Statchk |
| Mercury - Low Level (Dissolved) | CV/AF | 9159519 | 2018/09/26 | 2018/09/26 | Andrew Payne |
| Elements by ICP - Dissolved | ICPA | 9155872 | N/A | 2018/09/23 | Mahboubeh Bahadori |
| Elements by ICPMS - Dissolved | ICPM | 9156601 | N/A | 2018/09/24 | Jonathan Kuprowsky |
| Ion Balance | CALC | 9155634 | N/A | 2018/09/23 | Automated Statchk |
| Nitrate and Nitrite | CALC | 9155635 | N/A | 2018/09/24 | Automated Statchk |
| Nitrate + Nitrite-N (calculated) | CALC | 9155636 | N/A | 2018/09/24 | Automated Statchk |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9155694 | N/A | 2018/09/23 | Krista Dawe |
| Benzo[a]pyrene Equivalency | GC/MSD | 9155034 | N/A | 2018/09/25 | Automated Statchk |
| PAH in Water by GC/MS | GC/MS | 9154722 | 2018/09/23 | 2018/09/24 | Dharmesh Rana |
| Phenols (4-AAP) | TECH/4AAP | 9161623 | N/A | 2018/09/27 | Ashley Fedoriuk |
| Sulphate by Automated Colourimetry | KONE | 9155702 | N/A | 2018/09/23 | Marissa Richard |
| Total Dissolved Solids (Filt. Residue) | BAL | 9157647 | 2018/09/25 | 2018/09/26 | Victoria Fedorak |



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Maxxam Job #: B882325
Report Date: 2018/10/01

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## TEST SUMMARY

**Maxxam ID:** UJ7444
**Sample ID:** BI-13-1-4
**Matrix:** Water

**Collected:** 2018/09/20
**Relinquished:** 2018/09/21
**Received:** 2018/09/22

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | AT/ALK | 9157661 | N/A | 2018/09/25 | Malina Alamyar |
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9155762 | N/A | 2018/09/25 | Hetul Patel |
| F1-BTEX | CALC/MS | 9155433 | N/A | 2018/09/26 | Automated Statchk |
| Cadmium - low level CCME - Dissolved | CALC/MS | 9155026 | N/A | 2018/09/25 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 9155701 | N/A | 2018/09/23 | Marissa Richard |
| Conductivity @25C | COND | 9157664 | N/A | 2018/09/25 | Malina Alamyar |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9155935 | 2018/09/24 | 2018/09/24 | Jana Rychlikova |
| Hardness | CALC | 9155633 | N/A | 2018/09/24 | Automated Statchk |
| Mercury - Low Level (Dissolved) | CV/AF | 9159519 | 2018/09/26 | 2018/09/26 | Andrew Payne |
| Elements by ICP - Dissolved | ICPA | 9155872 | N/A | 2018/09/23 | Mahboubeh Bahadori |
| Elements by ICPMS - Dissolved | ICPM | 9156601 | N/A | 2018/09/24 | Jonathan Kuprowsky |
| Ion Balance | CALC | 9155634 | N/A | 2018/09/23 | Automated Statchk |
| Nitrate and Nitrite | CALC | 9155635 | N/A | 2018/09/24 | Automated Statchk |
| Nitrate + Nitrite-N (calculated) | CALC | 9155636 | N/A | 2018/09/24 | Automated Statchk |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9155694 | N/A | 2018/09/23 | Krista Dawe |
| Phenols (4-AAP) | TECH/4AAP | 9161623 | N/A | 2018/09/27 | Ashley Fedoriuk |
| Sulphate by Automated Colourimetry | KONE | 9155702 | N/A | 2018/09/23 | Marissa Richard |
| Total Dissolved Solids (Filt. Residue) | BAL | 9157647 | 2018/09/25 | 2018/09/26 | Victoria Fedorak |

**Maxxam ID:** UJ7445
**Sample ID:** GIBG-10-2-3
**Matrix:** Water

**Collected:** 2018/09/20
**Relinquished:** 2018/09/21
**Received:** 2018/09/22

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | AT/ALK | 9157661 | N/A | 2018/09/25 | Malina Alamyar |
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9155762 | N/A | 2018/09/25 | Hetul Patel |
| F1-BTEX | CALC/MS | 9155433 | N/A | 2018/09/26 | Automated Statchk |
| Cadmium - low level CCME - Dissolved | CALC/MS | 9155026 | N/A | 2018/09/25 | Justin Geisel |
| Chloride by Automated Colourimetry | KONE | 9155701 | N/A | 2018/09/23 | Marissa Richard |
| Conductivity @25C | COND | 9157664 | N/A | 2018/09/25 | Malina Alamyar |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9155935 | 2018/09/24 | 2018/09/24 | Jana Rychlikova |
| Hardness | CALC | 9155633 | N/A | 2018/09/24 | Automated Statchk |
| Mercury - Low Level (Dissolved) | CV/AF | 9159519 | 2018/09/26 | 2018/09/26 | Andrew Payne |
| Elements by ICP - Dissolved | ICPA | 9155872 | N/A | 2018/09/23 | Mahboubeh Bahadori |
| Elements by ICPMS - Dissolved | ICPM | 9156601 | N/A | 2018/09/24 | Jonathan Kuprowsky |
| Ion Balance | CALC | 9155634 | N/A | 2018/09/23 | Justin Geisel |
| Nitrate and Nitrite | CALC | 9155635 | N/A | 2018/09/24 | Automated Statchk |
| Nitrate + Nitrite-N (calculated) | CALC | 9155636 | N/A | 2018/09/24 | Automated Statchk |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9155694 | N/A | 2018/09/23 | Krista Dawe |
| Benzo[a]pyrene Equivalency | GC/MSD | 9155637 | N/A | 2018/09/25 | Justin Geisel |
| PAH in Water by GC/MS | GC/MS | 9155176 | 2018/09/23 | 2018/09/24 | Dharmesh Rana |
| Phenols (4-AAP) | TECH/4AAP | 9161623 | N/A | 2018/09/27 | Ashley Fedoriuk |
| Sulphate by Automated Colourimetry | KONE | 9155702 | N/A | 2018/09/23 | Marissa Richard |



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Maxxam Job #: B882325
Report Date: 2018/10/01

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## TEST SUMMARY

**Maxxam ID:** UJ7445
**Sample ID:** GIBG-10-2-3
**Matrix:** Water

**Collected:** 2018/09/20
**Relinquished:** 2018/09/21
**Received:** 2018/09/22

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Total Dissolved Solids (Filt. Residue) | BAL | 9157647 | 2018/09/25 | 2018/09/26 | Victoria Fedorak |

**Maxxam ID:** UJ7445 Dup
**Sample ID:** GIBG-10-2-3
**Matrix:** Water

**Collected:** 2018/09/20
**Relinquished:** 2018/09/21
**Received:** 2018/09/22

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9155935 | 2018/09/24 | 2018/09/24 | Jana Rychlikova |

**Maxxam ID:** UJ7446
**Sample ID:** GIQ8-10-2-4
**Matrix:** Water

**Collected:** 2018/09/20
**Relinquished:** 2018/09/21
**Received:** 2018/09/22

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | AT/ALK | 9157661 | N/A | 2018/09/25 | Malina Alamyar |
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9155762 | N/A | 2018/09/25 | Hetul Patel |
| F1-BTEX | CALC/MS | 9155433 | N/A | 2018/09/26 | Automated Statchk |
| Cadmium - low level CCME - Dissolved | CALC/MS | 9155026 | N/A | 2018/09/25 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 9155701 | N/A | 2018/09/23 | Marissa Richard |
| Conductivity @25C | COND | 9157664 | N/A | 2018/09/25 | Malina Alamyar |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9155935 | 2018/09/24 | 2018/09/24 | Jana Rychlikova |
| Hardness | CALC | 9155633 | N/A | 2018/09/24 | Automated Statchk |
| Mercury - Low Level (Dissolved) | CV/AF | 9159519 | 2018/09/26 | 2018/09/26 | Andrew Payne |
| Elements by ICP - Dissolved | ICPA | 9155872 | N/A | 2018/09/23 | Mahboubeh Bahadori |
| Elements by ICPMS - Dissolved | ICPM | 9156601 | N/A | 2018/09/24 | Jonathan Kuprowsky |
| Ion Balance | CALC | 9155634 | N/A | 2018/09/23 | Automated Statchk |
| Nitrate and Nitrite | CALC | 9155635 | N/A | 2018/09/24 | Automated Statchk |
| Nitrate + Nitrite-N (calculated) | CALC | 9155636 | N/A | 2018/09/24 | Automated Statchk |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9155694 | N/A | 2018/09/23 | Krista Dawe |
| Phenols (4-AAP) | TECH/4AAP | 9161623 | N/A | 2018/09/27 | Ashley Fedoriuk |
| Sulphate by Automated Colourimetry | KONE | 9155702 | N/A | 2018/09/23 | Marissa Richard |
| Total Dissolved Solids (Filt. Residue) | BAL | 9157647 | 2018/09/25 | 2018/09/26 | Victoria Fedorak |

**Maxxam ID:** UJ7446 Dup
**Sample ID:** GIQ8-10-2-4
**Matrix:** Water

**Collected:** 2018/09/20
**Relinquished:** 2018/09/21
**Received:** 2018/09/22

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | AT/ALK | 9157661 | N/A | 2018/09/25 | Malina Alamyar |
| Conductivity @25C | COND | 9157664 | N/A | 2018/09/25 | Malina Alamyar |



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Maxxam Job #: B882325
Report Date: 2018/10/01

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## TEST SUMMARY

**Maxxam ID:** UJ7447
**Sample ID:** GIP11 09-1-4R
**Matrix:** Water

**Collected:** 2018/09/20
**Relinquished:** 2018/09/21
**Received:** 2018/09/22

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | AT/ALK | 9157661 | N/A | 2018/09/25 | Malina Alamyar |
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9155762 | N/A | 2018/09/25 | Hetul Patel |
| F1-BTEX | CALC/MS | 9155433 | N/A | 2018/09/26 | Automated Statchk |
| Cadmium - low level CCME - Dissolved | CALC/MS | 9155026 | N/A | 2018/09/25 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 9155701 | N/A | 2018/09/23 | Marissa Richard |
| Conductivity @25C | COND | 9157664 | N/A | 2018/09/25 | Malina Alamyar |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9155935 | 2018/09/24 | 2018/09/24 | Jana Rychlikova |
| Hardness | CALC | 9155633 | N/A | 2018/09/24 | Automated Statchk |
| Mercury - Low Level (Dissolved) | CV/AF | 9159519 | 2018/09/26 | 2018/09/26 | Andrew Payne |
| Elements by ICP - Dissolved | ICPA | 9155872 | N/A | 2018/09/23 | Mahboubeh Bahadori |
| Elements by ICPMS - Dissolved | ICPM | 9156601 | N/A | 2018/09/24 | Jonathan Kuprowsky |
| Ion Balance | CALC | 9155030 | N/A | 2018/09/23 | Automated Statchk |
| Nitrate and Nitrite | CALC | 9155032 | N/A | 2018/09/24 | Automated Statchk |
| Nitrate + Nitrite-N (calculated) | CALC | 9155033 | N/A | 2018/09/24 | Automated Statchk |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9155694 | N/A | 2018/09/23 | Krista Dawe |
| Phenols (4-AAP) | TECH/4AAP | 9161623 | N/A | 2018/09/27 | Ashley Fedoriuk |
| Sulphate by Automated Colourimetry | KONE | 9155702 | N/A | 2018/09/23 | Marissa Richard |
| Total Dissolved Solids (Filt. Residue) | BAL | 9157647 | 2018/09/25 | 2018/09/26 | Victoria Fedorak |

**Maxxam ID:** UJ7448
**Sample ID:** NWD 18-49
**Matrix:** Water

**Collected:** 2018/09/20
**Relinquished:** 2018/09/21
**Received:** 2018/09/22

| Test Description | Instrumentation | Batch | Extracted | Date Analyzed | Analyst |
|---|---|---|---|---|---|
| Alkalinity @25C (pp, total), CO3,HCO3,OH | AT/ALK | 9157661 | N/A | 2018/09/25 | Malina Alamyar |
| BTEX/F1 in Water by HS GC/MS/FID | HSGC/MS | 9155762 | N/A | 2018/09/25 | Hetul Patel |
| F1-BTEX | CALC/MS | 9155433 | N/A | 2018/09/26 | Automated Statchk |
| Cadmium - low level CCME - Dissolved | CALC/MS | 9155026 | N/A | 2018/09/25 | Automated Statchk |
| Chloride by Automated Colourimetry | KONE | 9155701 | N/A | 2018/09/23 | Marissa Richard |
| Conductivity @25C | COND | 9157664 | N/A | 2018/09/25 | Malina Alamyar |
| CCME Hydrocarbons in Water (F2; C10-C16) | GC/FID | 9155935 | 2018/09/24 | 2018/09/24 | Jana Rychlikova |
| Hardness | CALC | 9155633 | N/A | 2018/09/24 | Automated Statchk |
| Mercury - Low Level (Dissolved) | CV/AF | 9159519 | 2018/09/26 | 2018/09/26 | Andrew Payne |
| Elements by ICP - Dissolved | ICPA | 9155872 | N/A | 2018/09/23 | Mahboubeh Bahadori |
| Elements by ICPMS - Dissolved | ICPM | 9156601 | N/A | 2018/09/24 | Jonathan Kuprowsky |
| Ion Balance | CALC | 9155634 | N/A | 2018/09/23 | Automated Statchk |
| Nitrate and Nitrite | CALC | 9155635 | N/A | 2018/09/24 | Automated Statchk |
| Nitrate + Nitrite-N (calculated) | CALC | 9155636 | N/A | 2018/09/24 | Automated Statchk |
| Nitrogen (Nitrite - Nitrate) by IC | IC/UV | 9155694 | N/A | 2018/09/23 | Krista Dawe |
| Phenols (4-AAP) | TECH/4AAP | 9161623 | N/A | 2018/09/27 | Ashley Fedoriuk |
| Sulphate by Automated Colourimetry | KONE | 9155702 | N/A | 2018/09/23 | Marissa Richard |
| Total Dissolved Solids (Filt. Residue) | BAL | 9157647 | 2018/09/25 | 2018/09/26 | Victoria Fedorak |



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Maxxam Job #: B882325
Report Date: 2018/10/01

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## GENERAL COMMENTS

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

| | |
|---|---|
| Package 1 | 4.0°C |

2018/10/01 - As per client's request, report re-issued to change the sample ID for UJ7444 from BI 13-1-4 to BI-13-1-4.

**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 #: B882325
Report Date: 2018/10/01

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| 9154722 | DR5 | Method Blank | D10-ANTHRACENE (sur.) | 2018/09/23 | | 94 | % | 50 - 130 |
| | | | TERPHENYL-D14 (sur.) | 2018/09/23 | | 95 | % | 50 - 130 |
| | | | D8-ACENAPHTHYLENE (sur.) | 2018/09/23 | | 98 | % | 50 - 130 |
| | | | D8-NAPHTHALENE (sur.) | 2018/09/23 | | 68 | % | 50 - 130 |
| | | | Acenaphthene | 2018/09/23 | <0.00010 | | mg/L | |
| | | | Acenaphthylene | 2018/09/23 | <0.00010 | | mg/L | |
| | | | Acridine | 2018/09/23 | <0.000050 | | mg/L | |
| | | | Anthracene | 2018/09/23 | <0.000010 | | mg/L | |
| | | | Benzo(a)anthracene | 2018/09/23 | <0.0000085 | | mg/L | |
| | | | Benzo(b&j)fluoranthene | 2018/09/23 | <0.0000085 | | mg/L | |
| | | | Benzo(k)fluoranthene | 2018/09/23 | <0.0000085 | | mg/L | |
| | | | Benzo(g,h,i)perylene | 2018/09/23 | <0.0000085 | | mg/L | |
| | | | Benzo(c)phenanthrene | 2018/09/23 | <0.000050 | | mg/L | |
| | | | Benzo(a)pyrene | 2018/09/23 | <0.0000075 | | mg/L | |
| | | | Benzo[e]pyrene | 2018/09/23 | <0.000050 | | mg/L | |
| | | | Chrysene | 2018/09/23 | <0.0000085 | | mg/L | |
| | | | Dibenz(a,h)anthracene | 2018/09/23 | <0.0000075 | | mg/L | |
| | | | Fluoranthene | 2018/09/23 | <0.000010 | | mg/L | |
| | | | Fluorene | 2018/09/23 | <0.000050 | | mg/L | |
| | | | Indeno(1,2,3-cd)pyrene | 2018/09/23 | <0.0000085 | | mg/L | |
| | | | 1-Methylnaphthalene | 2018/09/23 | <0.00010 | | mg/L | |
| | | | 2-Methylnaphthalene | 2018/09/23 | <0.00010 | | mg/L | |
| | | | Naphthalene | 2018/09/23 | <0.00010 | | mg/L | |
| | | | Phenanthrene | 2018/09/23 | <0.000050 | | mg/L | |
| | | | Perylene | 2018/09/23 | <0.000050 | | mg/L | |
| | | | Pyrene | 2018/09/23 | <0.000020 | | mg/L | |
| | | | Quinoline | 2018/09/23 | <0.00020 | | mg/L | |
| 9155176 | DR5 | Method Blank | D10-ANTHRACENE (sur.) | 2018/09/24 | | 101 | % | 50 - 130 |
| | | | TERPHENYL-D14 (sur.) | 2018/09/24 | | 123 | % | 50 - 130 |
| | | | D8-ACENAPHTHYLENE (sur.) | 2018/09/24 | | 108 | % | 50 - 130 |
| | | | D8-NAPHTHALENE (sur.) | 2018/09/24 | | 83 | % | 50 - 130 |
| | | | Acenaphthene | 2018/09/24 | <0.00010 | | mg/L | |
| | | | Acenaphthylene | 2018/09/24 | <0.00010 | | mg/L | |
| | | | Acridine | 2018/09/24 | <0.000050 | | mg/L | |
| | | | Anthracene | 2018/09/24 | <0.000010 | | mg/L | |
| | | | Benzo(a)anthracene | 2018/09/24 | <0.0000085 | | mg/L | |
| | | | Benzo(b&j)fluoranthene | 2018/09/24 | <0.0000085 | | mg/L | |
| | | | Benzo(k)fluoranthene | 2018/09/24 | <0.0000085 | | mg/L | |
| | | | Benzo(g,h,i)perylene | 2018/09/24 | <0.0000085 | | mg/L | |
| | | | Benzo(c)phenanthrene | 2018/09/24 | <0.000050 | | mg/L | |
| | | | Benzo(a)pyrene | 2018/09/24 | <0.0000075 | | mg/L | |
| | | | Benzo[e]pyrene | 2018/09/24 | <0.000050 | | mg/L | |
| | | | Chrysene | 2018/09/24 | <0.0000085 | | mg/L | |
| | | | Dibenz(a,h)anthracene | 2018/09/24 | <0.0000075 | | mg/L | |
| | | | Fluoranthene | 2018/09/24 | <0.000010 | | mg/L | |
| | | | Fluorene | 2018/09/24 | <0.000050 | | mg/L | |
| | | | Indeno(1,2,3-cd)pyrene | 2018/09/24 | <0.0000085 | | mg/L | |
| | | | 1-Methylnaphthalene | 2018/09/24 | <0.00010 | | mg/L | |
| | | | 2-Methylnaphthalene | 2018/09/24 | <0.00010 | | mg/L | |
| | | | Naphthalene | 2018/09/24 | <0.00010 | | mg/L | |
| | | | Phenanthrene | 2018/09/24 | <0.000050 | | mg/L | |



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Maxxam Job #: B882325
Report Date: 2018/10/01

Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT(CONT'D)

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| | | | Perylene | 2018/09/24 | <0.000050 | | mg/L | |
| | | | Pyrene | 2018/09/24 | <0.000020 | | mg/L | |
| | | | Quinoline | 2018/09/24 | <0.00020 | | mg/L | |
| 9155694 | KD5 | Method Blank | Dissolved Nitrite (N) | 2018/09/23 | <0.010 | | mg/L | |
| | | | Dissolved Nitrate (N) | 2018/09/23 | <0.010 | | mg/L | |
| 9155697 | LCA | Method Blank | Total Dissolved Solids | 2018/09/24 | <10 | | mg/L | |
| 9155701 | MRD | Method Blank | Dissolved Chloride (Cl) | 2018/09/23 | <1.0 | | mg/L | |
| 9155702 | MRD | Method Blank | Dissolved Sulphate (SO4) | 2018/09/23 | <1.0 | | mg/L | |
| 9155762 | HP5 | Method Blank | 1,4-Difluorobenzene (sur.) | 2018/09/25 | | 103 | % | 50 - 140 |
| | | | 4-Bromofluorobenzene (sur.) | 2018/09/25 | | 99 | % | 50 - 140 |
| | | | D4-1,2-Dichloroethane (sur.) | 2018/09/25 | | 113 | % | 50 - 140 |
| | | | Benzene | 2018/09/25 | <0.00040 | | mg/L | |
| | | | Toluene | 2018/09/25 | <0.00040 | | mg/L | |
| | | | Ethylbenzene | 2018/09/25 | <0.00040 | | mg/L | |
| | | | m & p-Xylene | 2018/09/25 | <0.00080 | | mg/L | |
| | | | o-Xylene | 2018/09/25 | <0.00040 | | mg/L | |
| | | | F1 (C6-C10) | 2018/09/25 | <0.10 | | mg/L | |
| 9155872 | BAH | Method Blank | Dissolved Iron (Fe) | 2018/09/23 | <0.060 | | mg/L | |
| | | | Dissolved Lithium (Li) | 2018/09/23 | <0.020 | | mg/L | |
| | | | Dissolved Magnesium (Mg) | 2018/09/23 | <0.20 | | mg/L | |
| | | | Dissolved Manganese (Mn) | 2018/09/23 | <0.0040 | | mg/L | |
| | | | Dissolved Potassium (K) | 2018/09/23 | <0.30 | | mg/L | |
| | | | Dissolved Sodium (Na) | 2018/09/23 | <0.50 | | mg/L | |
| | | | Dissolved Strontium (Sr) | 2018/09/23 | <0.020 | | mg/L | |
| | | | Dissolved Sulphur (S) | 2018/09/23 | <0.20 | | mg/L | |
| | | | Dissolved Phosphorus (P) | 2018/09/23 | <0.10 | | mg/L | |
| | | | Dissolved Barium (Ba) | 2018/09/23 | <0.010 | | mg/L | |
| | | | Dissolved Silicon (Si) | 2018/09/23 | <0.10 | | mg/L | |
| | | | Dissolved Boron (B) | 2018/09/23 | <0.020 | | mg/L | |
| | | | Dissolved Calcium (Ca) | 2018/09/23 | <0.30 | | mg/L | |
| 9155935 | JR1 | Method Blank | O-TERPHENYL (sur.) | 2018/09/24 | | 93 | % | 60 - 140 |
| | | | F2 (C10-C16 Hydrocarbons) | 2018/09/24 | <0.10 | | mg/L | |
| 9156601 | JK9 | Method Blank | Dissolved Aluminum (Al) | 2018/09/25 | <0.0030 | | mg/L | |
| | | | Dissolved Chromium (Cr) | 2018/09/25 | <0.0010 | | mg/L | |
| | | | Dissolved Cobalt (Co) | 2018/09/25 | <0.00030 | | mg/L | |
| | | | Dissolved Copper (Cu) | 2018/09/25 | <0.00020 | | mg/L | |
| | | | Dissolved Lead (Pb) | 2018/09/25 | <0.00020 | | mg/L | |
| | | | Dissolved Antimony (Sb) | 2018/09/25 | <0.00060 | | mg/L | |
| | | | Dissolved Molybdenum (Mo) | 2018/09/25 | <0.00020 | | mg/L | |
| | | | Dissolved Nickel (Ni) | 2018/09/25 | <0.00050 | | mg/L | |
| | | | Dissolved Selenium (Se) | 2018/09/25 | <0.00020 | | mg/L | |
| | | | Dissolved Silver (Ag) | 2018/09/25 | <0.00010 | | mg/L | |
| | | | Dissolved Arsenic (As) | 2018/09/25 | <0.00020 | | mg/L | |
| | | | Dissolved Thallium (Tl) | 2018/09/25 | <0.00020 | | mg/L | |
| | | | Dissolved Tin (Sn) | 2018/09/25 | <0.0010 | | mg/L | |
| | | | Dissolved Titanium (Ti) | 2018/09/25 | <0.0010 | | mg/L | |
| | | | Dissolved Uranium (U) | 2018/09/25 | <0.00010 | | mg/L | |
| | | | Dissolved Vanadium (V) | 2018/09/25 | <0.0010 | | mg/L | |
| | | | Dissolved Zinc (Zn) | 2018/09/25 | <0.0030 | | mg/L | |
| | | | Dissolved Beryllium (Be) | 2018/09/25 | <0.0010 | | mg/L | |
| 9157647 | VFE | Method Blank | Total Dissolved Solids | 2018/09/26 | <10 | | mg/L | |



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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT(CONT'D)

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| 9157661 | MA4 | Method Blank | Alkalinity (Total as CaCO3) | 2018/09/25 | <1.0 | | mg/L | |
| | | | Alkalinity (PP as CaCO3) | 2018/09/25 | <1.0 | | mg/L | |
| | | | Bicarbonate (HCO3) | 2018/09/25 | <1.0 | | mg/L | |
| | | | Carbonate (CO3) | 2018/09/25 | <1.0 | | mg/L | |
| | | | Hydroxide (OH) | 2018/09/25 | <1.0 | | mg/L | |
| 9157664 | MA4 | Method Blank | Conductivity | 2018/09/25 | <2.0 | | uS/cm | |
| 9159519 | APY | Method Blank | Dissolved Mercury (Hg) | 2018/09/26 | <0.0000020 | | mg/L | |
| 9161623 | AF6 | Method Blank | Phenols | 2018/09/27 | <0.0020 | | mg/L | |
| 9159519 | APY | RPD [UJ7441-04] | Dissolved Mercury (Hg) | 2018/09/26 | 4.0 | | % | 20 |
| 9157647 | VFE | RPD [UJ7442-02] | Total Dissolved Solids | 2018/09/26 | 0.25 | | % | 20 |
| 9161623 | AF6 | RPD [UJ7442-06] | Phenols | 2018/09/27 | 15 | | % | 20 |
| 9155935 | JR1 | RPD [UJ7445-05] | F2 (C10-C16 Hydrocarbons) | 2018/09/24 | NC | | % | 30 |
| 9157661 | MA4 | RPD [UJ7446-01] | Alkalinity (Total as CaCO3) | 2018/09/25 | 0.90 | | % | 20 |
| | | | Alkalinity (PP as CaCO3) | 2018/09/25 | NC | | % | 20 |
| | | | Bicarbonate (HCO3) | 2018/09/25 | 0.90 | | % | 20 |
| | | | Carbonate (CO3) | 2018/09/25 | NC | | % | 20 |
| | | | Hydroxide (OH) | 2018/09/25 | NC | | % | 20 |
| 9157664 | MA4 | RPD [UJ7446-01] | Conductivity | 2018/09/25 | 0 | | % | 10 |
| 9155935 | JR1 | Matrix Spike [UJ7446-05] | O-TERPHENYL (sur.) | 2018/09/24 | | 98 | % | 60 - 140 |
| | | | F2 (C10-C16 Hydrocarbons) | 2018/09/24 | | 114 | % | 60 - 130 |
| 9157647 | VFE | Matrix Spike [UJ7442-02] | Total Dissolved Solids | 2018/09/26 | | NC | % | 80 - 120 |
| 9159519 | APY | Matrix Spike [UJ7442-04] | Dissolved Mercury (Hg) | 2018/09/26 | | 100 | % | 80 - 120 |
| 9161623 | AF6 | Matrix Spike [UJ7442-06] | Phenols | 2018/09/27 | | 91 | % | 80 - 120 |
| 9154722 | DR5 | LCS | D10-ANTHRACENE (sur.) | 2018/09/23 | | 90 | % | 50 - 130 |
| | | | TERPHENYL-D14 (sur.) | 2018/09/23 | | 95 | % | 50 - 130 |
| | | | D8-ACENAPHTHYLENE (sur.) | 2018/09/23 | | 94 | % | 50 - 130 |
| | | | D8-NAPHTHALENE (sur.) | 2018/09/23 | | 69 | % | 50 - 130 |
| | | | Acenaphthene | 2018/09/23 | | 94 | % | 50 - 130 |
| | | | Acenaphthylene | 2018/09/23 | | 101 | % | 50 - 130 |
| | | | Acridine | 2018/09/23 | | 101 | % | 50 - 130 |
| | | | Anthracene | 2018/09/23 | | 95 | % | 50 - 130 |
| | | | Benzo(a)anthracene | 2018/09/23 | | 111 | % | 50 - 130 |
| | | | Benzo(b&j)fluoranthene | 2018/09/23 | | 99 | % | 50 - 130 |
| | | | Benzo(k)fluoranthene | 2018/09/23 | | 91 | % | 50 - 130 |
| | | | Benzo(g,h,i)perylene | 2018/09/23 | | 101 | % | 50 - 130 |
| | | | Benzo(c)phenanthrene | 2018/09/23 | | 108 | % | 50 - 130 |
| | | | Benzo(a)pyrene | 2018/09/23 | | 106 | % | 50 - 130 |
| | | | Benzo[e]pyrene | 2018/09/23 | | 102 | % | 50 - 130 |
| | | | Chrysene | 2018/09/23 | | 98 | % | 50 - 130 |
| | | | Dibenz(a,h)anthracene | 2018/09/23 | | 112 | % | 50 - 130 |
| | | | Fluoranthene | 2018/09/23 | | 93 | % | 50 - 130 |
| | | | Fluorene | 2018/09/23 | | 100 | % | 50 - 130 |
| | | | Indeno(1,2,3-cd)pyrene | 2018/09/23 | | 115 | % | 50 - 130 |
| | | | 1-Methylnaphthalene | 2018/09/23 | | 83 | % | 50 - 130 |
| | | | 2-Methylnaphthalene | 2018/09/23 | | 85 | % | 50 - 130 |
| | | | Naphthalene | 2018/09/23 | | 81 | % | 50 - 130 |
| | | | Phenanthrene | 2018/09/23 | | 93 | % | 50 - 130 |
| | | | Perylene | 2018/09/23 | | 92 | % | 50 - 130 |
| | | | Pyrene | 2018/09/23 | | 93 | % | 50 - 130 |
| | | | Quinoline | 2018/09/23 | | 120 | % | 50 - 130 |
| 9155176 | DR5 | LCS | D10-ANTHRACENE (sur.) | 2018/09/24 | | 85 | % | 50 - 130 |



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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT(CONT'D)

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| | | | TERPHENYL-D14 (sur.) | 2018/09/24 | | 109 | % | 50 - 130 |
| | | | D8-ACENAPHTHYLENE (sur.) | 2018/09/24 | | 96 | % | 50 - 130 |
| | | | D8-NAPHTHALENE (sur.) | 2018/09/24 | | 77 | % | 50 - 130 |
| | | | Acenaphthene | 2018/09/24 | | 92 | % | 50 - 130 |
| | | | Acenaphthylene | 2018/09/24 | | 97 | % | 50 - 130 |
| | | | Acridine | 2018/09/24 | | 96 | % | 50 - 130 |
| | | | Anthracene | 2018/09/24 | | 101 | % | 50 - 130 |
| | | | Benzo(a)anthracene | 2018/09/24 | | 118 | % | 50 - 130 |
| | | | Benzo(b&j)fluoranthene | 2018/09/24 | | 115 | % | 50 - 130 |
| | | | Benzo(k)fluoranthene | 2018/09/24 | | 83 | % | 50 - 130 |
| | | | Benzo(g,h,i)perylene | 2018/09/24 | | 105 | % | 50 - 130 |
| | | | Benzo(c)phenanthrene | 2018/09/24 | | 113 | % | 50 - 130 |
| | | | Benzo(a)pyrene | 2018/09/24 | | 113 | % | 50 - 130 |
| | | | Benzo[e]pyrene | 2018/09/24 | | 112 | % | 50 - 130 |
| | | | Chrysene | 2018/09/24 | | 96 | % | 50 - 130 |
| | | | Dibenz(a,h)anthracene | 2018/09/24 | | 100 | % | 50 - 130 |
| | | | Fluoranthene | 2018/09/24 | | 114 | % | 50 - 130 |
| | | | Fluorene | 2018/09/24 | | 104 | % | 50 - 130 |
| | | | Indeno(1,2,3-cd)pyrene | 2018/09/24 | | 106 | % | 50 - 130 |
| | | | 1-Methylnaphthalene | 2018/09/24 | | 85 | % | 50 - 130 |
| | | | 2-Methylnaphthalene | 2018/09/24 | | 88 | % | 50 - 130 |
| | | | Naphthalene | 2018/09/24 | | 85 | % | 50 - 130 |
| | | | Phenanthrene | 2018/09/24 | | 97 | % | 50 - 130 |
| | | | Perylene | 2018/09/24 | | 89 | % | 50 - 130 |
| | | | Pyrene | 2018/09/24 | | 108 | % | 50 - 130 |
| | | | Quinoline | 2018/09/24 | | 107 | % | 50 - 130 |
| 9155694 | KD5 | LCS | Dissolved Nitrite (N) | 2018/09/23 | | 101 | % | 80 - 120 |
| | | | Dissolved Nitrate (N) | 2018/09/23 | | 102 | % | 80 - 120 |
| 9155697 | LCA | LCS | Total Dissolved Solids | 2018/09/24 | | 100 | % | 80 - 120 |
| 9155701 | MRD | LCS | Dissolved Chloride (Cl) | 2018/09/23 | | 110 | % | 80 - 120 |
| 9155702 | MRD | LCS | Dissolved Sulphate (SO4) | 2018/09/23 | | 111 | % | 80 - 120 |
| 9155762 | HP5 | LCS | 1,4-Difluorobenzene (sur.) | 2018/09/25 | | 99 | % | 50 - 140 |
| | | | 4-Bromofluorobenzene (sur.) | 2018/09/25 | | 98 | % | 50 - 140 |
| | | | D4-1,2-Dichloroethane (sur.) | 2018/09/25 | | 110 | % | 50 - 140 |
| | | | Benzene | 2018/09/25 | | 93 | % | 60 - 130 |
| | | | Toluene | 2018/09/25 | | 91 | % | 60 - 130 |
| | | | Ethylbenzene | 2018/09/25 | | 98 | % | 60 - 130 |
| | | | m & p-Xylene | 2018/09/25 | | 93 | % | 60 - 130 |
| | | | o-Xylene | 2018/09/25 | | 97 | % | 60 - 130 |
| | | | F1 (C6-C10) | 2018/09/25 | | 92 | % | 60 - 140 |
| 9155872 | BAH | LCS | Dissolved Iron (Fe) | 2018/09/23 | | 102 | % | 80 - 120 |
| | | | Dissolved Lithium (Li) | 2018/09/23 | | 102 | % | 80 - 120 |
| | | | Dissolved Magnesium (Mg) | 2018/09/23 | | 105 | % | 80 - 120 |
| | | | Dissolved Manganese (Mn) | 2018/09/23 | | 100 | % | 80 - 120 |
| | | | Dissolved Potassium (K) | 2018/09/23 | | 105 | % | 80 - 120 |
| | | | Dissolved Sodium (Na) | 2018/09/23 | | 103 | % | 80 - 120 |
| | | | Dissolved Strontium (Sr) | 2018/09/23 | | 102 | % | 80 - 120 |
| | | | Dissolved Sulphur (S) | 2018/09/23 | | 102 | % | 80 - 120 |
| | | | Dissolved Phosphorus (P) | 2018/09/23 | | 104 | % | 80 - 120 |
| | | | Dissolved Barium (Ba) | 2018/09/23 | | 102 | % | 80 - 120 |
| | | | Dissolved Silicon (Si) | 2018/09/23 | | 100 | % | 80 - 120 |



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Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## QUALITY ASSURANCE REPORT(CONT'D)

| QA/QC Batch | Init | QC Type | Parameter | Date Analyzed | Value | Recovery | UNITS | QC Limits |
|---|---|---|---|---|---|---|---|---|
| | | | Dissolved Boron (B) | 2018/09/23 | | 105 | % | 80 - 120 |
| | | | Dissolved Calcium (Ca) | 2018/09/23 | | 101 | % | 80 - 120 |
| 9155935 | JR1 | LCS | O-TERPHENYL (sur.) | 2018/09/24 | | 103 | % | 60 - 140 |
| | | | F2 (C10-C16 Hydrocarbons) | 2018/09/24 | | 114 | % | 70 - 130 |
| 9156601 | JK9 | LCS | Dissolved Aluminum (Al) | 2018/09/24 | | 107 | % | 80 - 120 |
| | | | Dissolved Chromium (Cr) | 2018/09/24 | | 97 | % | 80 - 120 |
| | | | Dissolved Cobalt (Co) | 2018/09/24 | | 97 | % | 80 - 120 |
| | | | Dissolved Copper (Cu) | 2018/09/24 | | 99 | % | 80 - 120 |
| | | | Dissolved Lead (Pb) | 2018/09/24 | | 94 | % | 80 - 120 |
| | | | Dissolved Antimony (Sb) | 2018/09/24 | | 98 | % | 80 - 120 |
| | | | Dissolved Molybdenum (Mo) | 2018/09/24 | | 98 | % | 80 - 120 |
| | | | Dissolved Nickel (Ni) | 2018/09/24 | | 97 | % | 80 - 120 |
| | | | Dissolved Selenium (Se) | 2018/09/24 | | 102 | % | 80 - 120 |
| | | | Dissolved Silver (Ag) | 2018/09/24 | | 99 | % | 80 - 120 |
| | | | Dissolved Arsenic (As) | 2018/09/24 | | 98 | % | 80 - 120 |
| | | | Dissolved Thallium (Tl) | 2018/09/24 | | 92 | % | 80 - 120 |
| | | | Dissolved Tin (Sn) | 2018/09/24 | | 100 | % | 80 - 120 |
| | | | Dissolved Titanium (Ti) | 2018/09/24 | | 97 | % | 80 - 120 |
| | | | Dissolved Uranium (U) | 2018/09/24 | | 94 | % | 80 - 120 |
| | | | Dissolved Vanadium (V) | 2018/09/24 | | 97 | % | 80 - 120 |
| | | | Dissolved Zinc (Zn) | 2018/09/24 | | 100 | % | 80 - 120 |
| | | | Dissolved Beryllium (Be) | 2018/09/24 | | 101 | % | 80 - 120 |
| 9157647 | VFE | LCS | Total Dissolved Solids | 2018/09/26 | | 102 | % | 80 - 120 |
| 9157661 | MA4 | LCS | Alkalinity (Total as CaCO3) | 2018/09/25 | | 99 | % | 80 - 120 |
| 9157664 | MA4 | LCS | Conductivity | 2018/09/25 | | 100 | % | 90 - 110 |
| 9159519 | APY | LCS | Dissolved Mercury (Hg) | 2018/09/26 | | 106 | % | 80 - 120 |
| 9161623 | AF6 | LCS | Phenols | 2018/09/27 | | 88 | % | 80 - 120 |
| 9159519 | APY | SRM | Dissolved Mercury (Hg) | 2018/09/26 | | 106 | % | 80 - 120 |

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.

LCS: 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.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

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



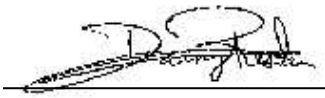
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Maxxam Job #: B882325
Report Date: 2018/10/01

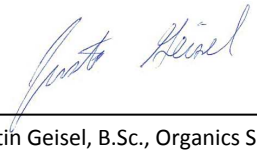
Advisian
Task Order#: 407011-00586-400
Site#: N/A
Site Location: Norman Wells, NT
Project #: 407011-00586-400

## VALIDATION SIGNATURE PAGE

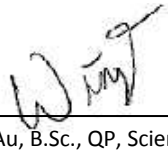
The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Daniel Reslan, cCT, QP, Organics Manager



Justin Geisel, B.Sc., Organics Supervisor



Winnie Au, B.Sc., QP, 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.



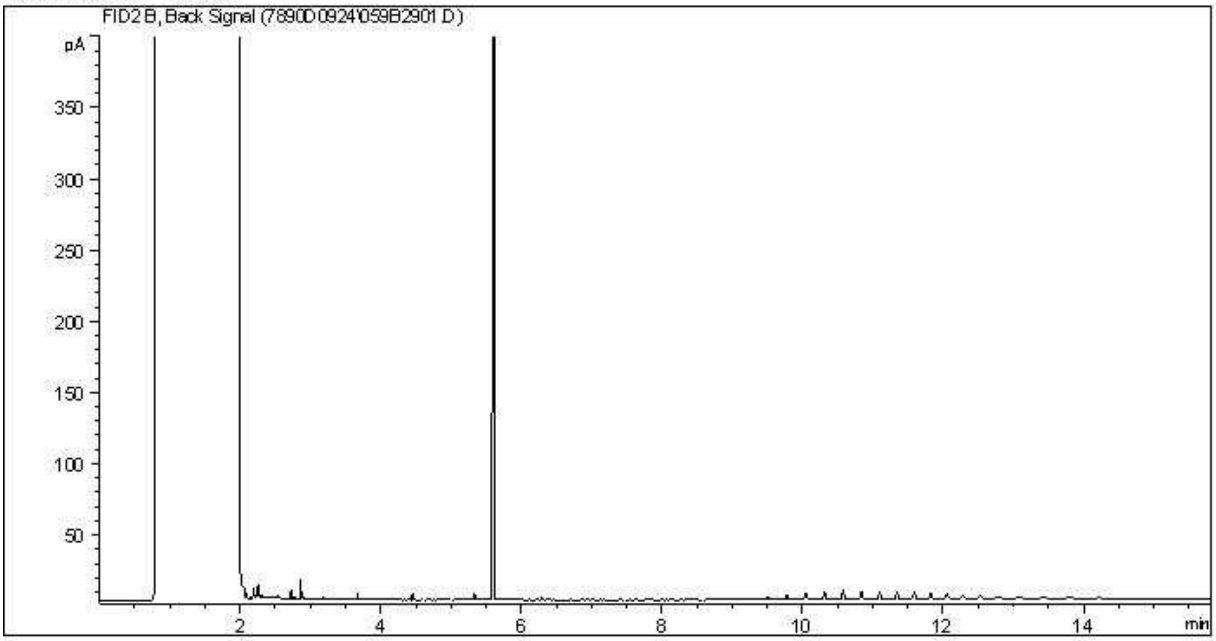
Maxxam Analytics International Corporation o/a Maxxam Analytics Edmonton: 9331 - 48th Street T6B 2R4 Telephone (780)577-7100 Fax (780)450-4187

Maxxam Job #: B882325
Report Date: 2018/10/01
Maxxam Sample: UJ7441

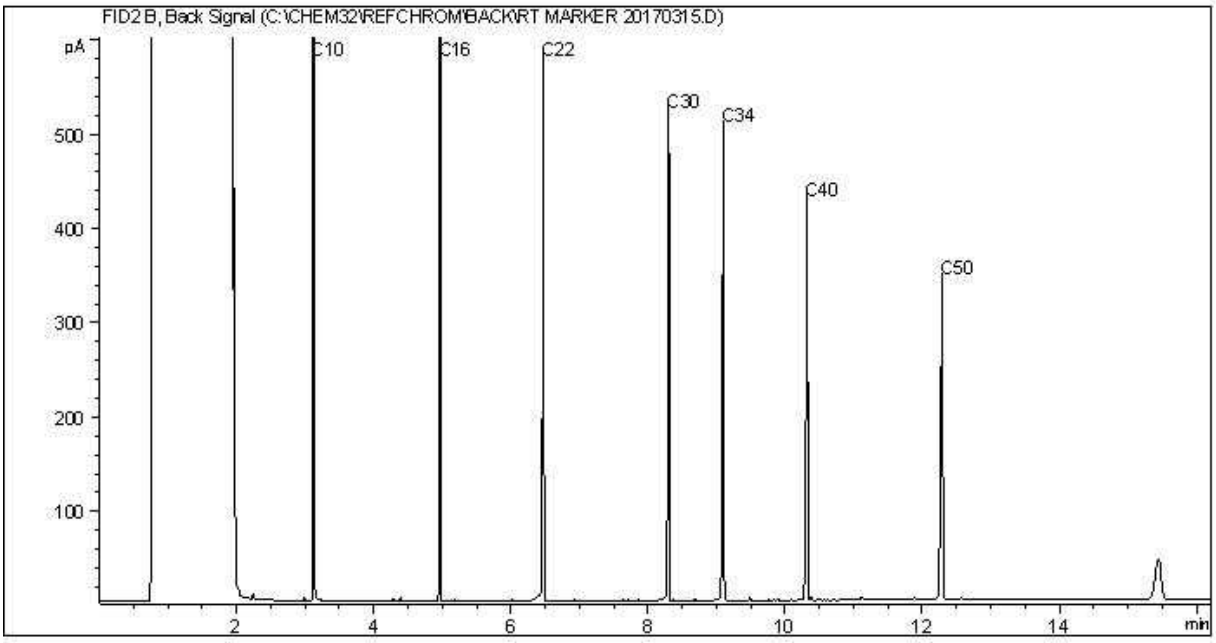
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: BIS 97-1-3

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890D




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

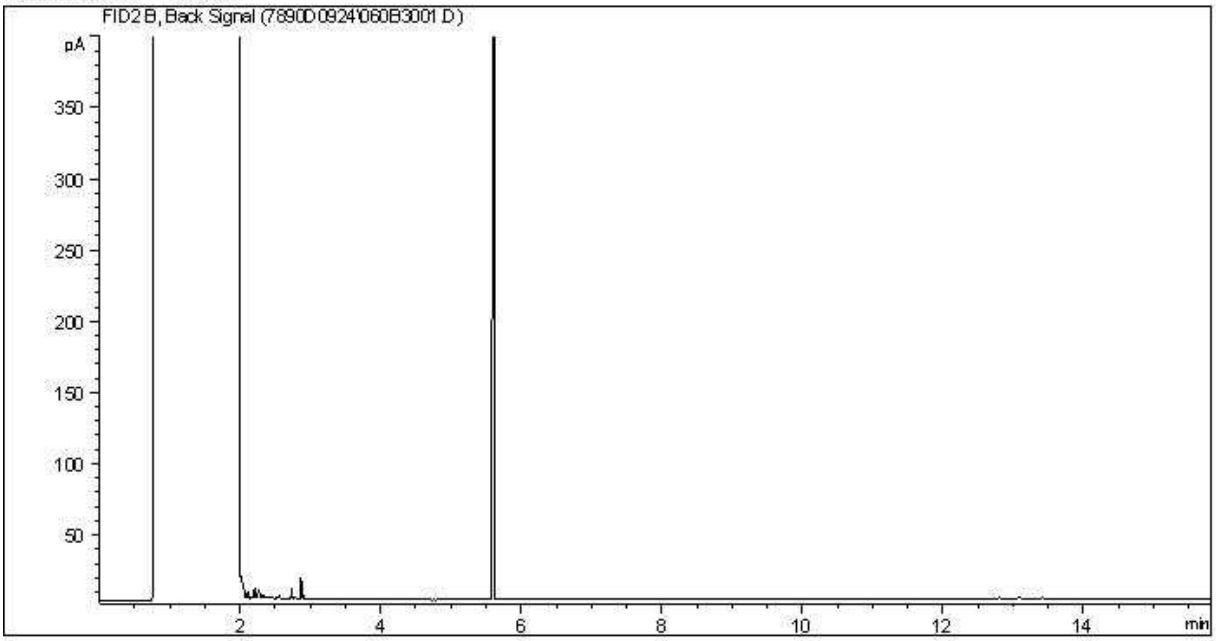
**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam Job #: B882325
Report Date: 2018/10/01
Maxxam Sample: UJ7442

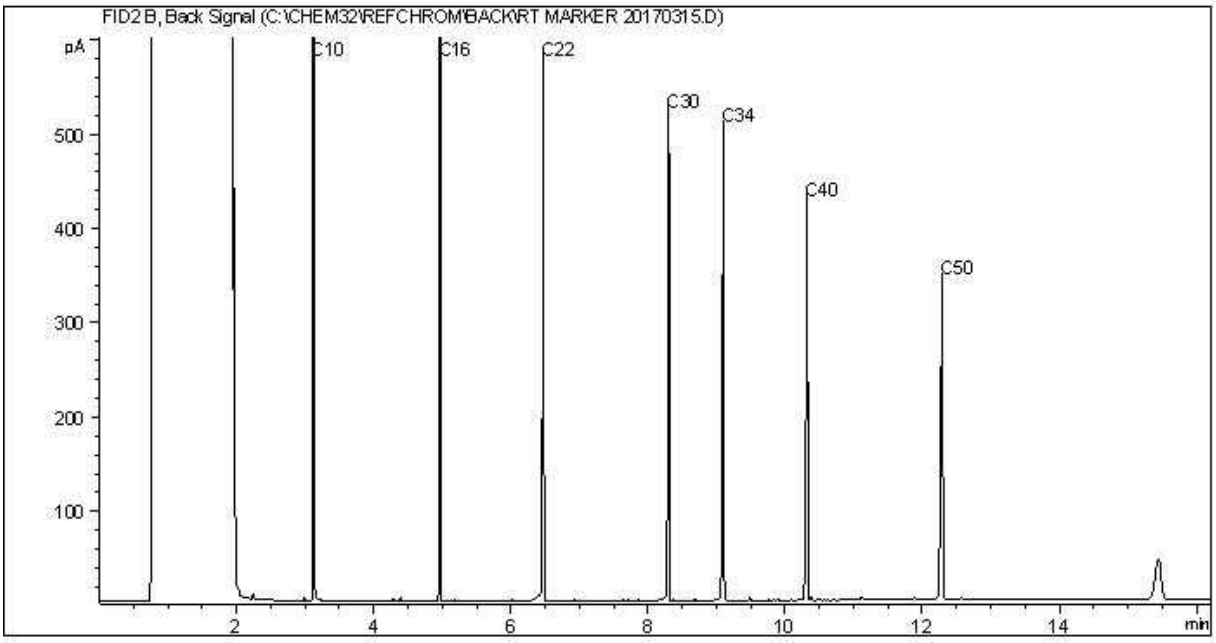
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Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: BI-13-3-4.5

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890D




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

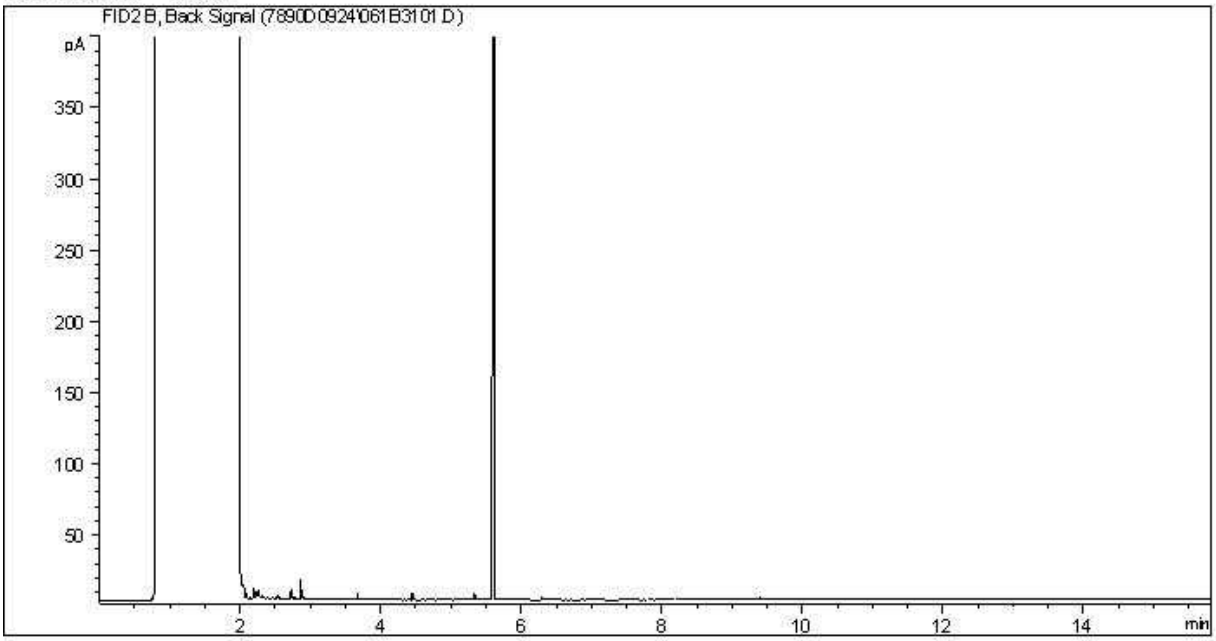
**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam Job #: B882325
Report Date: 2018/10/01
Maxxam Sample: UJ7443

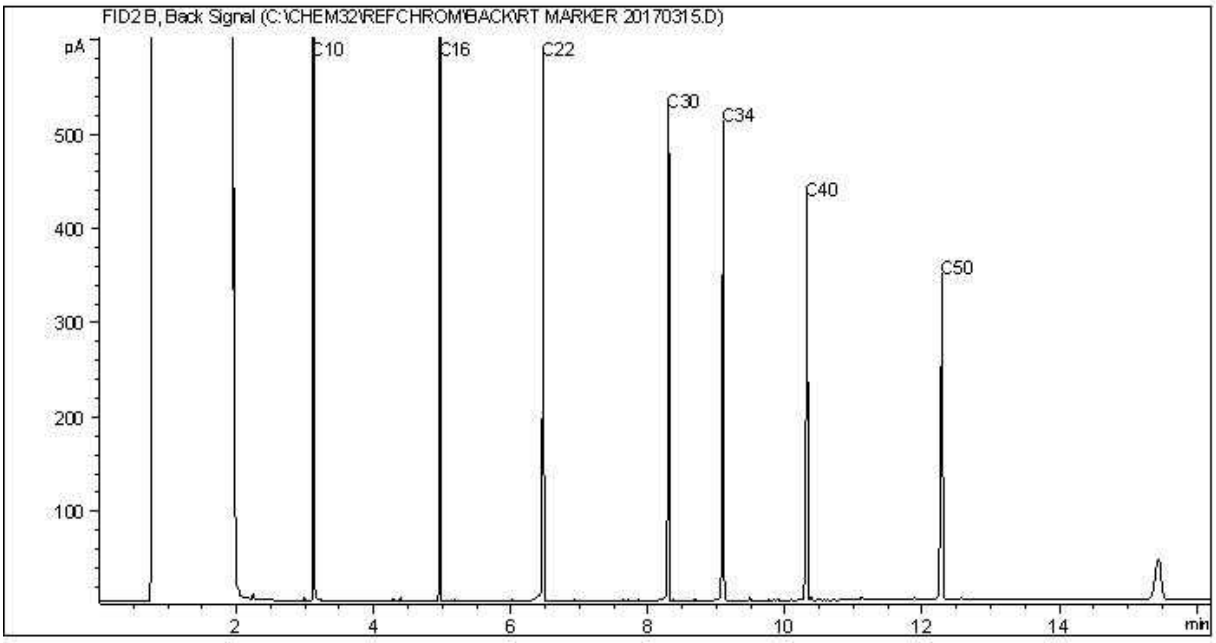
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: BIBG -10-1-4

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890D




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

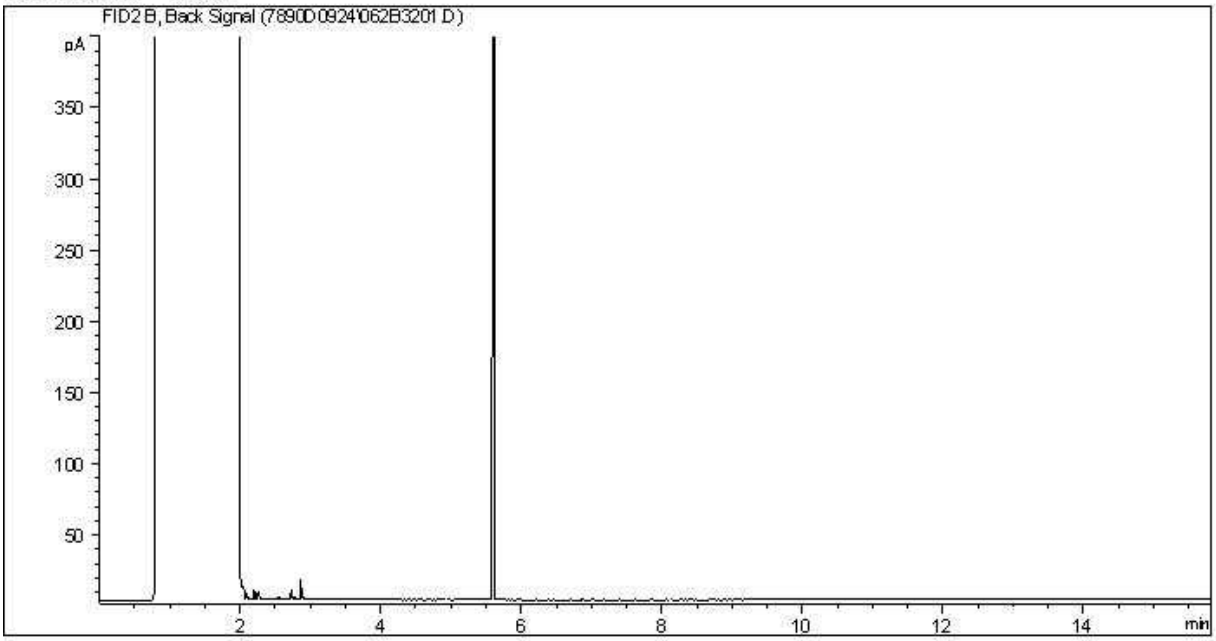
**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam Job #: B882325
Report Date: 2018/10/01
Maxxam Sample: UJ7444

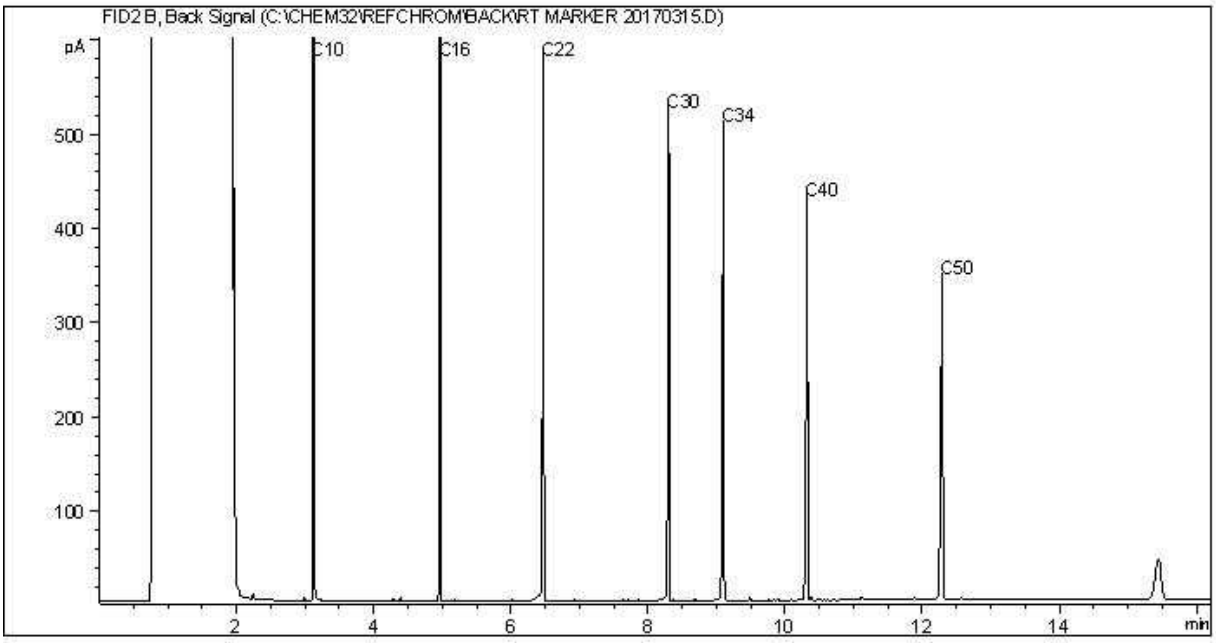
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: BI-13-1-4

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890D




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

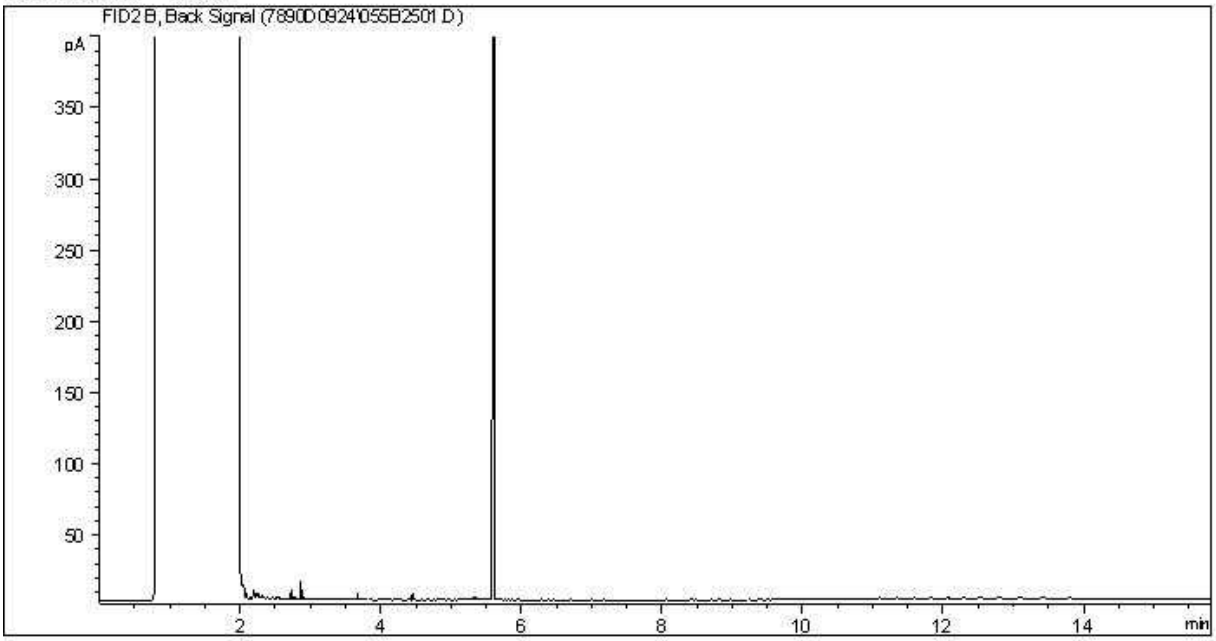
**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam Job #: B882325
Report Date: 2018/10/01
Maxxam Sample: UJ7445

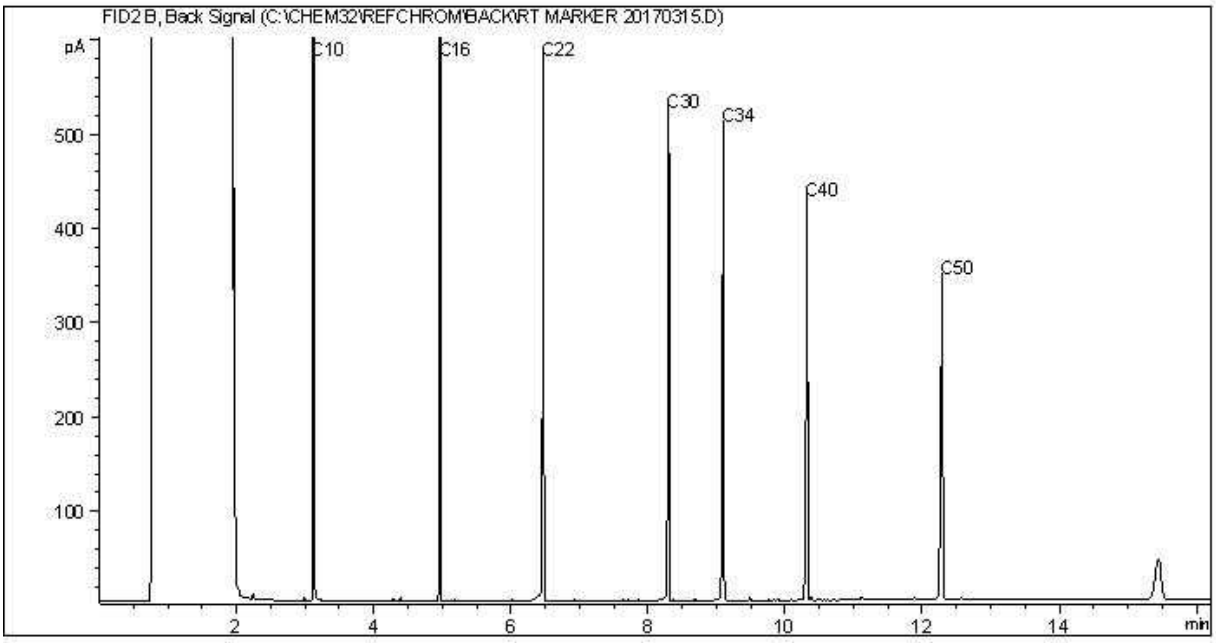
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: GIBG-10-2-3

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890D




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

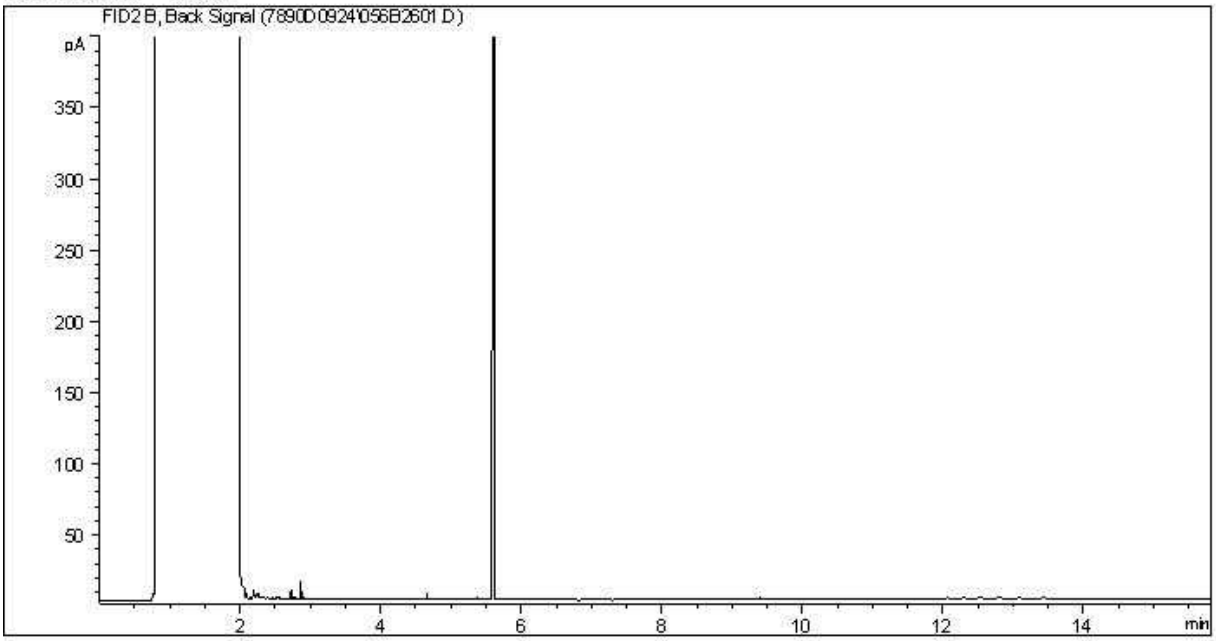
**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam Job #: B882325
Report Date: 2018/10/01
Maxxam Sample: UJ7445 Lab-Dup

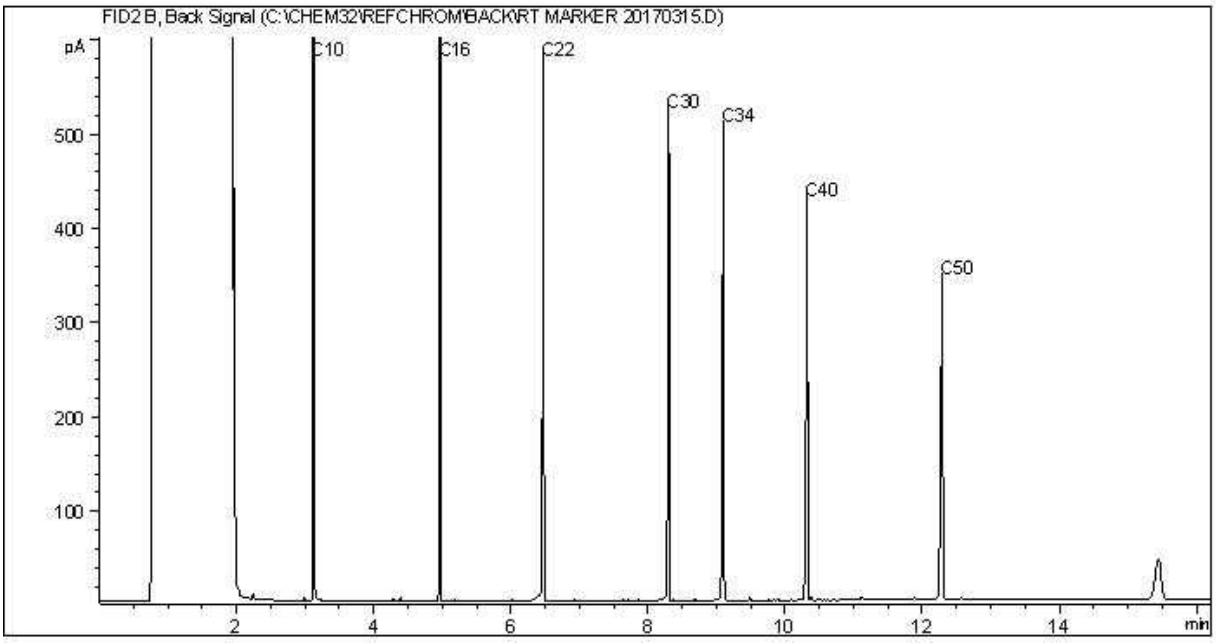
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: GIBG-10-2-3

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890D




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

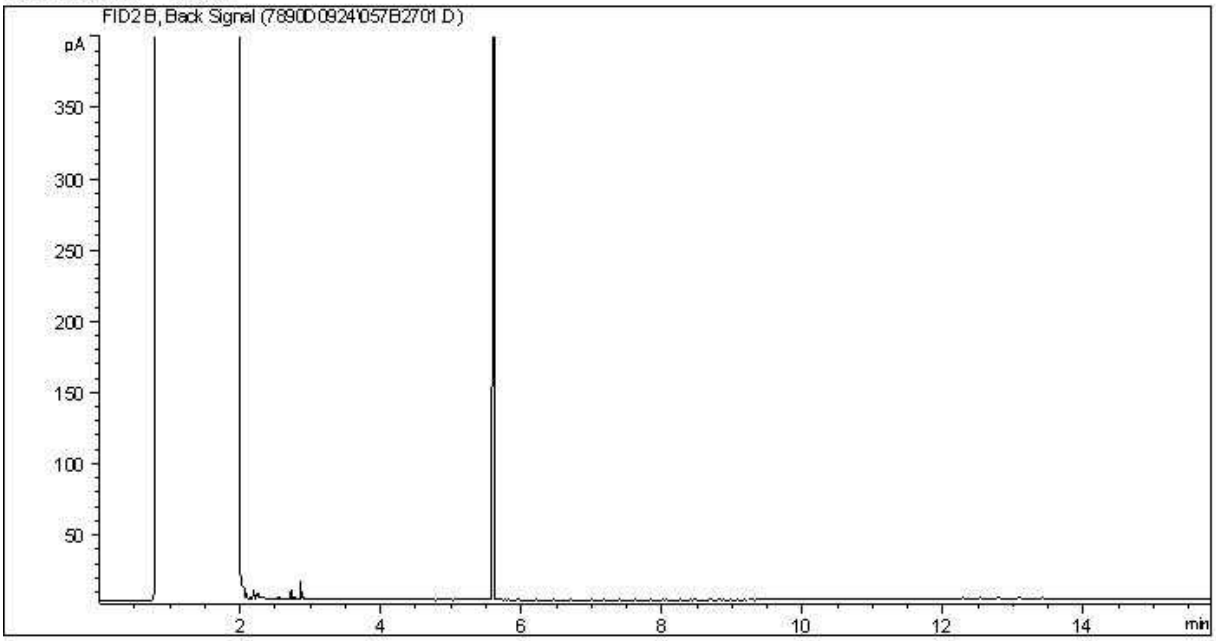
**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam Job #: B882325
Report Date: 2018/10/01
Maxxam Sample: UJ7446

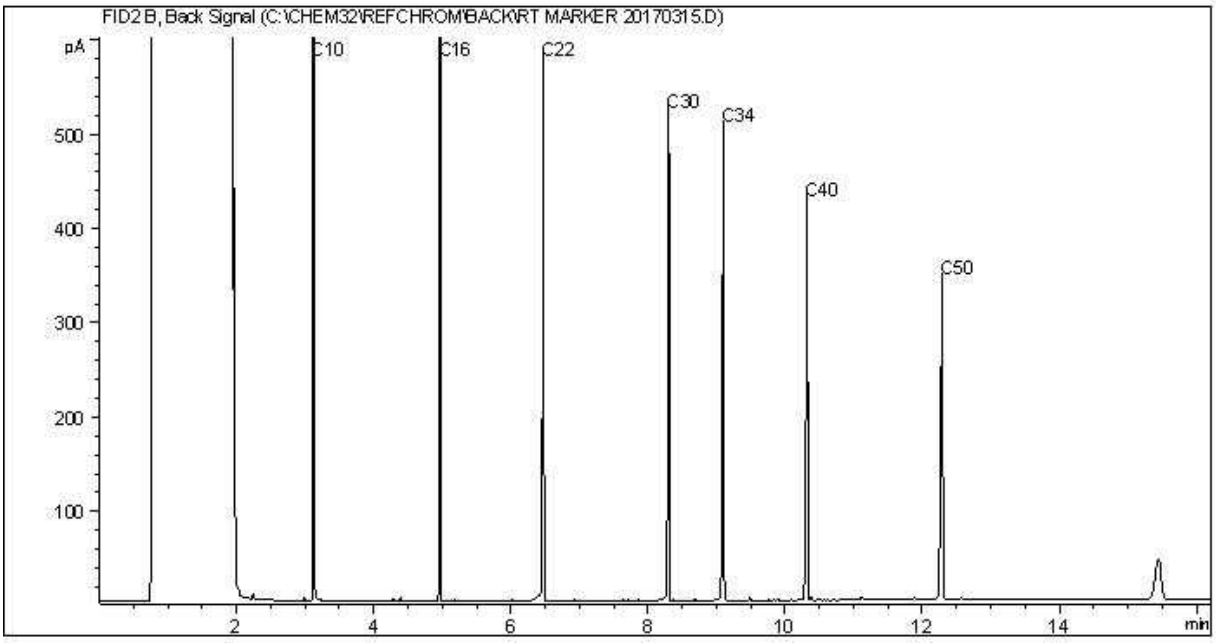
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: GIQ8-10-2-4

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890D




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

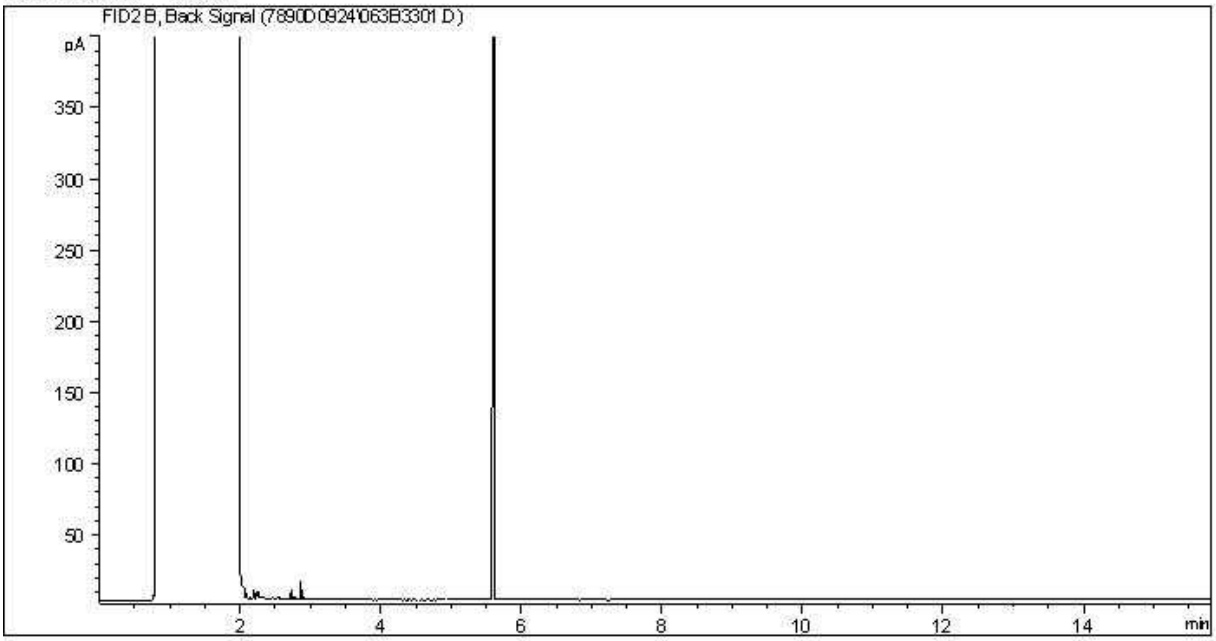
**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam Job #: B882325
Report Date: 2018/10/01
Maxxam Sample: UJ7447

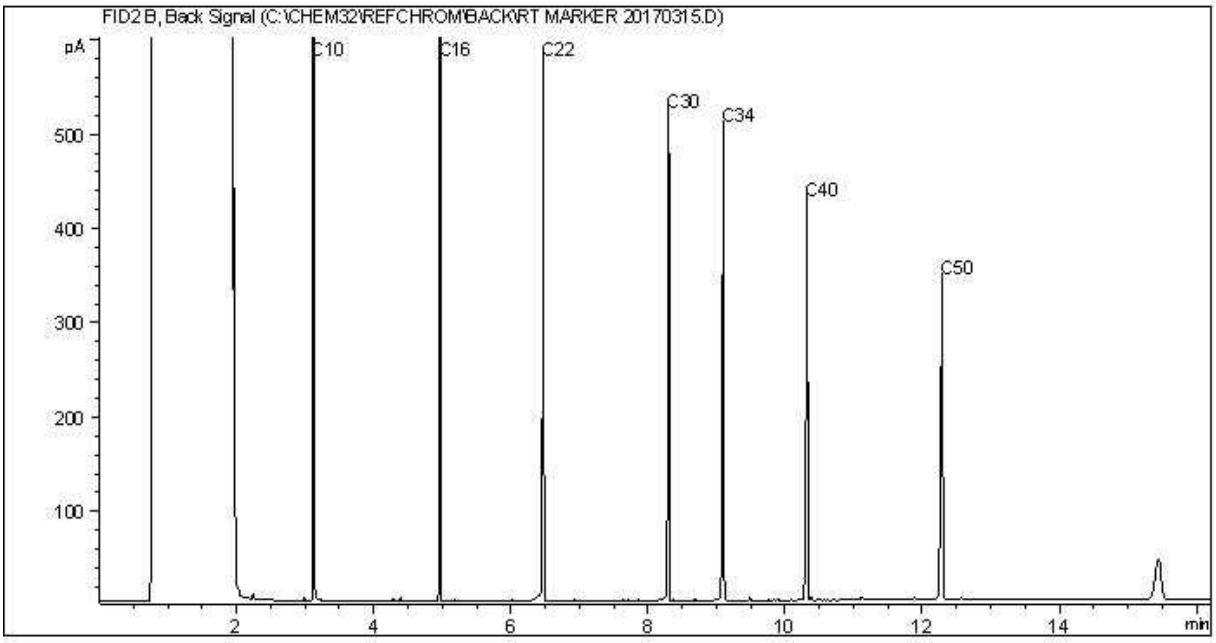
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: GIP11 09-1-4R

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890D




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

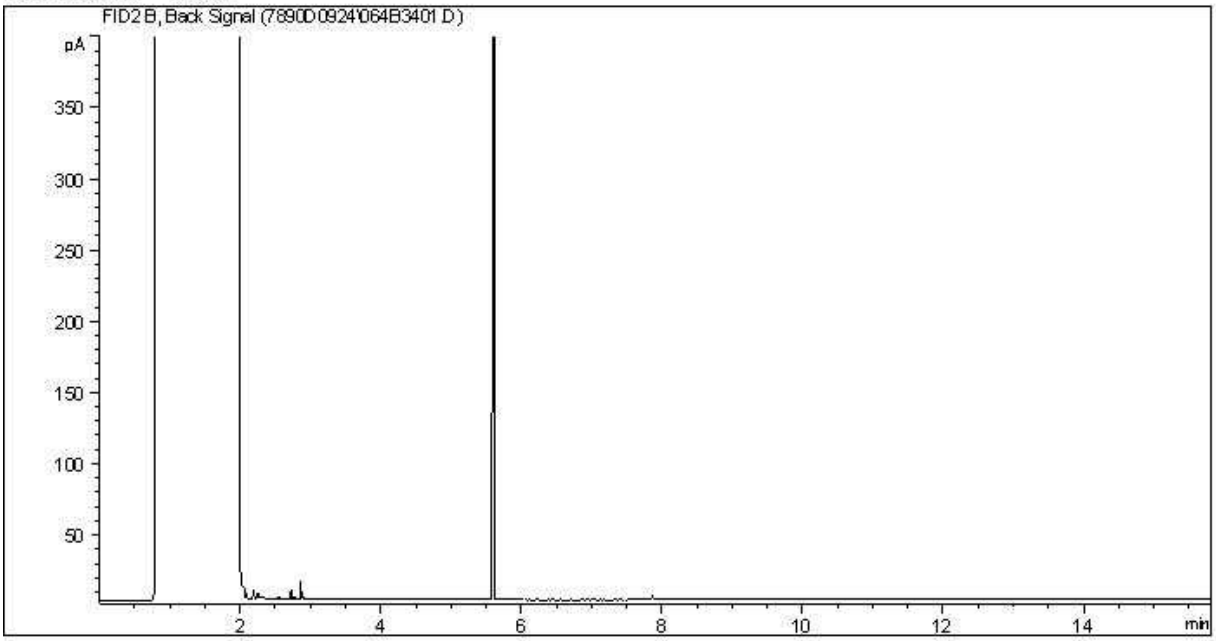
**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam Job #: B882325
Report Date: 2018/10/01
Maxxam Sample: UJ7448

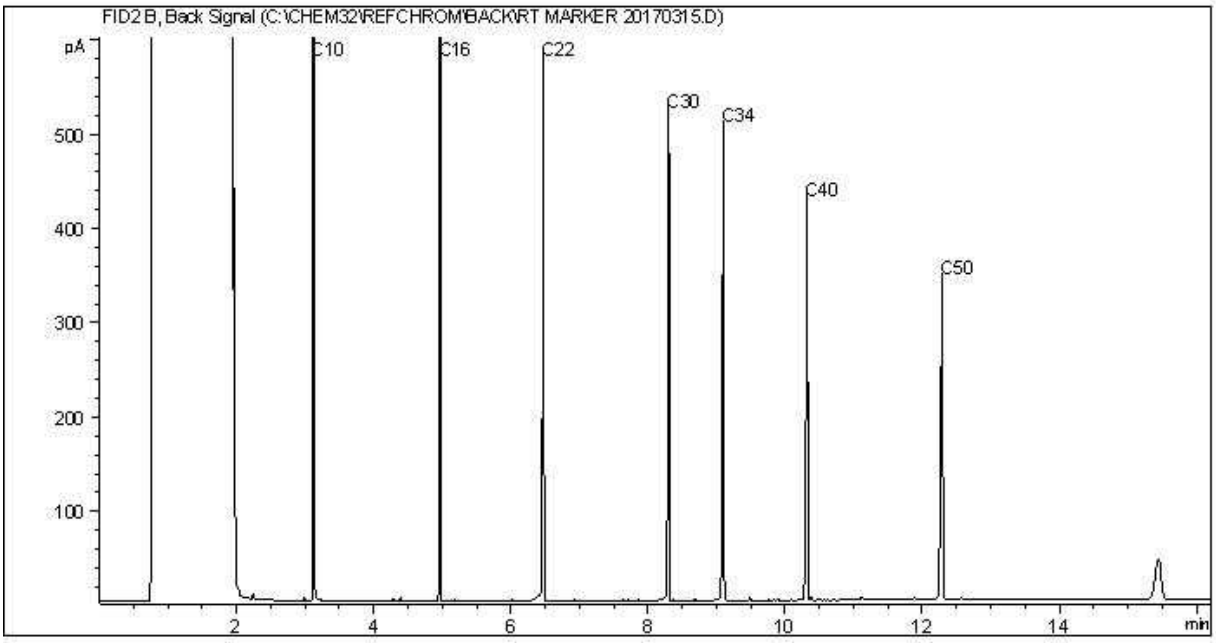
Advisian
Task Order#:407011-00586-400Line Item:
Site#: N/A
Site Location: Norman Wells, NT
Client ID: NWD 18-49

**CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram**

Instrument: 7890D




Carbon Range Distribution - Reference Chromatogram




TYPICAL PRODUCT CARBON NUMBER RANGES

| | | | |
|---|---|---|---|
| Gasoline: | C4 - C12 | Diesel: | C8 - C22 |
| Varsol: | C8 - C12 | Lubricating Oils: | C20 - C40 |
| Kerosene: | C7 - C16 | Crude Oils: | C3 - C60+ |

**Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.**

Maxxam
A Bureau Veritas Group Company

☐ Calgary
4000 19th St. NE, T2E 6P8
Phone: (403) 291-3077
Fax: (403) 735-2240
Toll Free: (800) 386-7247

☒ Edmonton
9331 - 48 Street, T6B 2R4
Phone: (780) 577-7100
Fax: (780) 450-4187
Toll Free: (800) 386-7247

1178(2)
LMV

# EXXON MOBIL/IMPERIAL OIL - MAXXAM CHAIN-OF-CUSTODY RECORD

Page 1 of 1

C of C # 299035

| INVOICE INFORMATION | REPORT INFORMATION |
|---|---|
| Company Name: ☒ Imperial Oil ☐ ExxonMobil | Company Name: WORLEY PARSONS |
| Contact Name: Worley Parsons - Sanj Perera | Contact Name: Stacy Gibb |
| Address: 500 - 151 Canada Olympic Rd SW Calgary, AB T3B 6B7 | Address: 500 - 151 Canada Olympic Rd SW Calgary, AB T3B 6B7 |
| Email: Sanj.Perera@advisian.com | Email: Stacy.Gibb@advisian.com |
| Ph: 587-952-1490 | Ph: 403-247-0200 |
| Sampler Name (Print): Devon Greves | Consultant Project #: 407011-00586-0400 |

| FIELD SAMPLE ID | MATRIX: GROUND WATER | SURFACE WATER | SOIL | OTHER | # CONTAINERS | SAMPLING: DATE (YYYY/MM/DD) | TIME (24 HR) | FIELD FILTERED & PRESERVED | LAB FILTRATION REQUIRED | VOC | PAH | PHCs (FRACTIONS 1-2 PLUS BTEX) | PHCs (FRACTIONS 1-4 PLUS BTEX) | PHCs (FRACTIONS 2-4) | PHCs (FRACTION 1 PLUS BTEX) | GRAIN SIZE (75 MICRON) | TEXTURE (% SAND, SILT, CLAY) | PARTICLE SIZE DISTRIBUTION WITH GRAPH | REGULATED METALS TOT ☐ DIS ☒ | MERCURY TOTAL ☐ DISSOLVED ☒ | SALINITY SOIL | FERTILIZER SOIL | FERTILIZER WATER | NUTRIENTS SOIL | ROUTINE POTABILITY | pH ☐ EC ☐ ALKALINITY ☐ | BASIC CLASS II LANDFILL PKG | Phenols (4-AAP) | BUBBLE IN BTEX VIAL | Limited Sample Volume Submitted in May, ~5 > 1cm headspace |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 BIS 97-1-3 | X | | | | 12 | 2018/09/20 | 11:20 | X | | | X | X | | | | | | | X | X | | | | | X | | | X | | |
| 2 BI-13-3-4.5 | X | | | | 10 | | 12:40 | X | | | | X | | | | | | | X | X | | | | | X | | | X | | |
| 3 BIBG-10-1-4 | X | | | | 12 | | 10:45 | X | | | X | X | | | | | | | X | X | | | | | X | | | X | | |
| 4 BI 13-1-4 | X | | | | 10 | | 13:26 | X | | | | X | | | | | | | X | X | | | | | X | | | X | X | |
| 5 GIBG-10-2-3 | X | | | | 12 | | 14:10 | X | | | X | X | | | | | | | X | X | | | | | X | | | X | | |
| 6 GIQ8-10-2-4 | X | | | | 10 | | 14:35 | X | | | | X | | | | | | | X | X | | | | | X | | | X | X | |
| 7 GIP11 09-1-4R | X | | | | 9 | | 15:30 | X | | | | X | | | | | | | X | X | | | | | X | | | X | | |
| 8 NWD 18-49 | X | | | | 10 | | 14:40 | X | | | | X | | | | | | | X | X | | | | | X | | | X | X | |
| 9 | | | | | | | | | | | | | | | | | | | X | | | | | | X | | | X | | |
| 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

IOL SITE LOCATION: Norman Wells, NT

IOL PROJECT # (if applicable): N/A

MAXXAM TASK ORDER # OR SERVICE ORDER # + LINE ITEM: 407011-00586-0400

REGULATORY CRITERIA / DETECTION LIMITS:
☐ Alberta Tier 1 ☐ CDWG
☐ SEQG (SK) ☐ NoSC (SK)
☒ CCME (incl. level) EWAL ☐ Other

SPECIAL INSTRUCTIONS:
ALSO EMAIL:
- Standard Norman Wells email list
- melissa.lord@advisian.com
- Devon.GREVES@advisian.com
* IES A2601436

# JARS USED & NOT SUBMITTED (Enter N/A for Water): N/A

TURNAROUND TIME
Standard (5 days) ☒
Rush (3 days) ☐
(2 days) ☐
(1 day) ☐
(same day) ☐
Date Required

| | YES | NO | COOLER ID # | | | |
|---|---|---|---|---|---|---|
| SEAL PRESENT | ✓ | | TEMP °C | 4 (1) | 4 (2) | 4 (3) |
| SEAL INTACT | ✓ | | | | | |
| COOLING MEDIA PRESENT | ✓ | | | | | |

| | YES | NO | COOLER ID # | | | |
|---|---|---|---|---|---|---|
| SEAL PRESENT | ✓ | | TEMP °C | 3 (1) | 3 (2) | 3 (3) |
| SEAL INTACT | ✓ | | | | | |
| COOLING MEDIA PRESENT | ✓ | | | | | |

| | YES | NO | COOLER ID # | | | |
|---|---|---|---|---|---|---|
| SEAL PRESENT | | | TEMP °C | (1) | (2) | (3) |
| SEAL INTACT | | | | | | |
| COOLING MEDIA PRESENT | | | | | | |

| RELINQUISHED BY: | | DATE: | TIME (24 HR) | RECEIVED BY: | DATE: | TIME (24 HR) |
|---|---|---|---|---|---|---|
| 1. | Devon Greves | 2018/09/21 | 10:00 | 1. Jessa Watts | 20180922 | 0913 |
| 2. | | | | 2. | | |
| 3. | | | | 3. | | |

LAB USE ONLY
MAXXAM JOB # B382325

SAMPLES
LABELED BY: DMX
VERIFIED BY: JWF

COC-1010 (06/2016) IOL-AB

White: Maxxam Yellow: Client

# Appendix D Quality Assurance and Quality Control



# Quality Assurance/Quality Control (QA/QC)

## *Field QA/QC Program*

The field QA/QC for the Surveillance Network Program consisted of four field duplicate samples for the analysis of dissolved chloride and BTEX parameters. Four trip blank samples and three field blank samples were also submitted for analysis of petroleum hydrocarbon parameters as part of the 2018 field program.

For the field duplicate samples, the QA/QC results were evaluated by calculating the relative percent difference (RPD) between the parent and duplicate sample results and comparison of the RPD to designated alert limits.

The RPD is calculated using the following formula:

$$\text{RPD \%} = \left( \frac{|x1 - x2|}{(x1 + x2)/_2} \right) * 100$$

Where $x_1$ = original field sample
$x_2$ = blind field duplicate sample

Consistent with laboratory practices and to permit reliable calculations, an RPD is only considered to be statistically relevant when the original and duplicate sample concentrations are at least five times the reportable detection limit. These limits vary parameter to parameter and sample to sample, and are indicated by the laboratory alongside the analytical results in the Certificates of Analysis (Appendix C).

The designated field duplicate RPD alert limits are presented in the analytical tables. All field duplicate RPDs were within the designated alert limits (<50% for dissolved chloride and <80% for BTEX).

The designated trip and field blank alert limits are >5X reportable detection limit (RDL) for BTEX and >2X RDL for PHC fractions F1 and F2. The trip and field blank results were below the reportable detection limits and are presented in Table D-1. All of the results were below the reportable detection limits.

## *Laboratory QA/QC Program*

The laboratory QA/QC program consisted of one or more of the following analyses:

- instrument and extraction surrogate recoveries for samples that were analyzed; and
- the analysis of method blank, laboratory duplicate, matrix spike and/or laboratory control samples for the sample analytical batches that were analyzed.

The laboratory QA/QC results are presented in the certificates of analysis (Appendix C). There were no QA/QC laboratory issues identified that impact the SNP selected parameters (dissolved chloride and BTEX).

No field or laboratory QA/QC issues were identified that would affect the overall conclusions presented in this report. Overall, the results reported are considered to be reliable.

Advisian
WorleyParsons Group

# Table D-1

## Field and Trip Blanks: Petroleum Hydrocarbons Parameters (PHCs)

**PROJECT No.: 407011-00586-400**

| Sample Name | Date (dd-mmm-yyyy) | Benzene (mg/L) | Toluene (mg/L) | Ethylbenzene (mg/L) | Xylenes (Total) (mg/L) | PHC F1 ($C_6$-$C_{10}$) - BTEX (mg/L) | PHC F2 ($C_{10}$-$C_{16}$) (mg/L) |
|---|---|---|---|---|---|---|---|
| **CCME CEQG Freshwater Aquatic Life** | | **0.37** | **0.002** | **0.09** | **---** | **---** | **---** |
| **W-CAT-1** | | **0.0005** | **0.0005** | **0.0005** | **0.0010** | **0.1** | **0.1** |
| **W-CAT-2** | | **0.0004** | **0.0004** | **0.0004** | **0.0008** | **0.1** | **0.1** |
| **Groundwater Field Blank** | | | | | | | |
| NWD 18-13 | 13-Jul-2018 | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 | < 0.10 | < 0.10 |
| NWD 18-14 | 14-Jul-2018 | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 | < 0.10 | < 0.10 |
| NWD 18-20 | 20-Jul-2018 | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 | < 0.10 | < 0.10 |
| **Groundwater Trip Blank** | | | | | | | |
| NWD 18-03 | 13-Jul-2018 | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 | < 0.10 | < 0.10 |
| NWD 18-04 | 14-Jul-2018 | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 | < 0.10 | < 0.10 |
| NWD 18-10 | 20-Jul-2018 | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 | < 0.10 | < 0.10 |
| NWD-18-48 | 15-Sep-2018 | < 0.00040 | < 0.00040 | < 0.00040 | < 0.00089 | < 0.10 | < 0.10 |

**NOTES:**

1. --- in guideline row(s) denotes no criteria for that parameter.
2. --- in detail data row(s) denotes parameter not analyzed.

**Bold** 3. Denotes values exceeding applied background concentrations and CCME guidelines
(CCME 2018. Canadian Environmental Quality Guidelines Summary Table. Water Quality Guidelines for the Protection of Freshwater Aquatic Life. http://st-ts.ccme.ca/?chems=all&chapters=1 accessed Sept, 2018).

**Bold** 4. Denotes non-detect values where reportable detection limit exceeds applied background concentrations and CCME guidelines
(CCME 2018. Canadian Environmental Quality Guidelines Summary Table. Water Quality Guidelines for the Protection of Freshwater Aquatic Life. http://st-ts.ccme.ca/?chems=all&chapters=1 accessed Sept, 2018).

5. Background 95th Percentile Statistical Category:
W-CAT-1: Mainland Locations - Surficial Sediments - 95th Percentile Background
W-CAT-2: Bear, Goose, and Frenchy's Islands - Surficial Sediments - 95th Percentile Background

# Appendix E Mann-Kendall Statistical Analyses and Hydrochemical Trend Charts



# Table E-1
# Mann-Kendall Statistical Analysis (1997-2018) - Chloride

***Filtered Trend Results, two-sided p-value < 0.05 And Normalized Slope > ± 10%/Year***

| Location | Count | Mann-Kendall S | Two-sided p-value (for MK test) | Slope (mg/L/year) | Normalized Slope (%/year) | Min (mg/L) | Median (mg/L) | Max (mg/L) |
|---|---|---|---|---|---|---|---|---|
| MEBG-10-1-3 | 13 | -47 | 0.00 | -0.2687 | -11 | 1.9 | 2.4 | 5 |

***Full Mann-Kendall Analysis, Sorted by two-sided p-value***

| Location | Count | Mann-Kendall S | Two-sided p-value (for MK test) | Slope (mg/L/year) | Normalized Slope (%/year) | Min (mg/L) | Median (mg/L) | Max (mg/L) |
|---|---|---|---|---|---|---|---|---|
| TF 03-12-3 | 20 | -90 | 0.00 | -5.5411 | -3 | 110 | 170.0 | 280 |
| MEBG-10-1-3 | 13 | -47 | 0.00 | -0.2687 | -11 | 1.9 | 2.4 | 5 |
| CPF 98-8-3 | 24 | -102 | 0.01 | -0.3290 | -3 | 6.8 | 13.0 | 22 |
| C38 08-1-4 | 15 | -50 | 0.01 | -0.5233 | -2 | 14 | 21.0 | 25 |
| BIS 97-1-3 | 19 | -67 | 0.01 | -0.3683 | -2 | 16 | 22.0 | 35 |
| MTF 97-1-5 | 19 | -62 | 0.03 | -0.0549 | -4 | < 1.0 | 1.3 | 3.4 |
| CPF 97-7-5 | 25 | 73 | 0.09 | 0.2261 | 2 | 7.7 | 14.0 | 190 |
| BIBG-10-1-4 | 10 | 19 | 0.10 | 2.1761 | 21 | 3.0 | 10.5 | 25 |
| BI-13-1-4 | 7 | -11 | 0.13 | -0.7259 | -9 | 4.6 | 7.9 | 9.5 |
| BI-13-3-4.5 | 8 | -13 | 0.13 | -0.8268 | -9 | 6.5 | 9.35 | 13 |
| GIQ8-10-2-4 | 10 | 16 | 0.18 | 1.5282 | 10 | 5.8 | 16.0 | 21 |
| GIP11 09-1-4 | 7 | -9 | 0.23 | -4.5933 | -66 | 3.6 | 7.0 | 110 |
| BIBG-12-1-7 | 4 | -4 | 0.30 | -0.5959 | -7 | 7.5 | 8.65 | 11 |
| WSY 97-1-5 | 24 | -40 | 0.33 | -0.2906 | -2 | 6.5 | 18.45 | 64 |
| GIBG-10-2-3 | 13 | -5 | 0.80 | -0.1107 | -4 | < 1.0 | 3.1 | 9 |
| ARB-12-3-3 | 11 | -3 | 0.87 | -0.3289 | -2 | 8.7 | 18.0 | 32 |

# Table E-2
# Mann-Kendall Statistical Analysis (1998-2018) - Benzene

***Filtered Trend Results, two-sided p-value < 0.05 And Normalized Slope > ± 10%/Year***

| Location | Count | Mann-Kendall S | Two-sided p-value (for MK test) | Slope (mg/L/year) | Normalized Slope (%/year) | Min (mg/L) | Median (mg/L) | Max (mg/L) |
|---|---|---|---|---|---|---|---|---|

***Full Mann-Kendall Analysis, Sorted by two-sided p-value***

| Location | Count | Mann-Kendall S | Two-sided p-value (for MK test) | Slope (mg/L/year) | Normalized Slope (%/year) | Min (mg/L) | Median (mg/L) | Max (mg/L) |
|---|---|---|---|---|---|---|---|---|
| CPF 98-8-3 | 24 | -141 | 0.00 | 0.0000 | -1 | < 0.0004 | 0.0002 | < 0.0050 |
| CPF 97-7-5 | 23 | -128 | 0.00 | 0.0000 | -1 | < 0.0004 | 0.0002 | < 0.0050 |
| WSY 97-1-5 | 21 | -90 | 0.00 | 0.0000 | 0 | < 0.0004 | 0.0002 | < 0.0005 |
| TF 03-12-3 | 20 | -71 | 0.00 | 0.0000 | 0 | < 0.0004 | 0.0002 | 0.0017 |
| BIS 97-1-3 | 15 | -54 | 0.00 | 0.0000 | -1 | < 0.0004 | 0.0002 | < 0.0005 |
| MTF 97-1-5 | 15 | -36 | 0.01 | 0.0000 | 0 | < 0.0004 | 0.0002 | < 0.0005 |
| C38 08-1-4 | 15 | 0 | 1.00 | 0.0000 | 0 | < 0.0004 | 0.0002 | < 0.0004 |
| GIBG-10-2-3 | 13 | 0 | 1.00 | 0.0000 | 0 | < 0.0004 | 0.0002 | < 0.0004 |
| MEBG-10-1-3 | 13 | 0 | 1.00 | 0.0000 | 0 | < 0.0004 | 0.0002 | < 0.0004 |
| ARB-12-3-3 | 11 | 0 | 1.00 | 0.0000 | 0 | < 0.00040 | 0.0002 | < 0.00040 |
| GIQ8-10-2-4 | 10 | 0 | 1.00 | 0.0000 | 0 | < 0.00040 | 0.0002 | < 0.00040 |
| BIBG-10-1-4 | 10 | 0 | 1.00 | 0.0000 | 0 | < 0.0004 | 0.0002 | < 0.0004 |
| BI-13-3-4.5 | 8 | -1 | 1.00 | 0.0000 | 0 | < 0.00040 | 0.0002 | 0.00042 |
| GIP11 09-1-4 | 7 | 0 | 1.00 | 0.0000 | 0 | < 0.0004 | 0.0002 | < 0.0004 |
| BI-13-1-4 | 6 | 0 | 1.00 | 0.0000 | 0 | < 0.00040 | 0.0002 | < 0.00040 |
| BIBG-12-1-7 | 4 | 0 | 1.00 | 0.0000 | 0 | < 0.00040 | 0.0002 | < 0.00040 |

# Table E-3
# Mann-Kendall Statistical Analysis (1998-2018) - Toluene

***Filtered Trend Results, two-sided p-value < 0.05 And Normalized Slope > ± 10%/Year***

| Location | Count | Mann-Kendall S | Two-sided p-value (for MK test) | Slope (mg/L/year) | Normalized Slope (%/year) | Min (mg/L) | Median (mg/L) | Max (mg/L) |
|---|---|---|---|---|---|---|---|---|

***Full Mann-Kendall Analysis, Sorted by two-sided p-value***

| Location | Count | Mann-Kendall S | Two-sided p-value (for MK test) | Slope (mg/L/year) | Normalized Slope (%/year) | Min (mg/L) | Median (mg/L) | Max (mg/L) |
|---|---|---|---|---|---|---|---|---|
| CPF 98-8-3 | 24 | -147 | 0.00 | 0.0000 | -2 | < 0.0004 | 0.0002 | < 0.0050 |
| CPF 97-7-5 | 23 | -133 | 0.00 | 0.0000 | -2 | < 0.0004 | 0.0002 | < 0.0050 |
| WSY 97-1-5 | 21 | -90 | 0.00 | 0.0000 | 0 | < 0.0004 | 0.0002 | < 0.0005 |
| BIS 97-1-3 | 15 | -54 | 0.00 | 0.0000 | -1 | < 0.0004 | 0.0002 | < 0.0005 |
| TF 03-12-3 | 20 | -64 | 0.00 | 0.0000 | 0 | < 0.0004 | 0.0002 | < 0.0005 |
| MTF 97-1-5 | 15 | -36 | 0.01 | 0.0000 | 0 | < 0.0004 | 0.0002 | < 0.0005 |
| C38 08-1-4 | 15 | 0 | 1.00 | 0.0000 | 0 | < 0.0004 | 0.0002 | < 0.0004 |
| GIBG-10-2-3 | 13 | 0 | 1.00 | 0.0000 | 0 | < 0.0004 | 0.0002 | < 0.0004 |
| MEBG-10-1-3 | 13 | 0 | 1.00 | 0.0000 | 0 | < 0.0004 | 0.0002 | < 0.0004 |
| ARB-12-3-3 | 11 | 0 | 1.00 | 0.0000 | 0 | < 0.00040 | 0.0002 | < 0.00040 |
| GIQ8-10-2-4 | 10 | 0 | 1.00 | 0.0000 | 0 | < 0.00040 | 0.0002 | < 0.00040 |
| BIBG-10-1-4 | 10 | 0 | 1.00 | 0.0000 | 0 | < 0.0004 | 0.0002 | < 0.0004 |
| BI-13-3-4.5 | 8 | 0 | 1.00 | 0.0000 | 0 | < 0.00040 | 0.0002 | < 0.00040 |
| GIP11 09-1-4 | 7 | 0 | 1.00 | 0.0000 | 0 | < 0.0004 | 0.0002 | < 0.0004 |
| BI-13-1-4 | 6 | 0 | 1.00 | 0.0000 | 0 | < 0.00040 | 0.0002 | < 0.00040 |
| BIBG-12-1-7 | 4 | 0 | 1.00 | 0.0000 | 0 | < 0.00040 | 0.0002 | < 0.00040 |

# Table E-4
## Mann-Kendall Statistical Analysis (1998-2018) - Ethylbenzene

***Filtered Trend Results, two-sided p-value < 0.05 And Normalized Slope > ± 10%/Year***

| Location | Count | Mann-Kendall S | Two-sided p-value (for MK test) | Slope (mg/L/year) | Normalized Slope (%/year) | Min (mg/L) | Median (mg/L) | Max (mg/L) |
|---|---|---|---|---|---|---|---|---|

***Full Mann-Kendall Analysis, Sorted by two-sided p-value***

| Location | Count | Mann-Kendall S | Two-sided p-value (for MK test) | Slope (mg/L/year) | Normalized Slope (%/year) | Min (mg/L) | Median (mg/L) | Max (mg/L) |
|---|---|---|---|---|---|---|---|---|
| CPF 98-8-3 | 24 | -141 | 0.00 | 0.0000 | -1 | < 0.0004 | 0.0002 | < 0.0050 |
| CPF 97-7-5 | 23 | -128 | 0.00 | 0.0000 | -1 | < 0.0004 | 0.0002 | < 0.0050 |
| WSY 97-1-5 | 21 | -90 | 0.00 | 0.0000 | 0 | < 0.0004 | 0.0002 | < 0.0005 |
| BIS 97-1-3 | 15 | -54 | 0.00 | 0.0000 | -1 | < 0.0004 | 0.0002 | < 0.0005 |
| TF 03-12-3 | 20 | -64 | 0.00 | 0.0000 | 0 | < 0.0004 | 0.0002 | < 0.0005 |
| MTF 97-1-5 | 15 | -36 | 0.01 | 0.0000 | 0 | < 0.0004 | 0.0002 | < 0.0005 |
| C38 08-1-4 | 15 | 0 | 1.00 | 0.0000 | 0 | < 0.0004 | 0.0002 | < 0.0004 |
| GIBG-10-2-3 | 13 | 0 | 1.00 | 0.0000 | 0 | < 0.0004 | 0.0002 | < 0.0004 |
| MEBG-10-1-3 | 13 | 0 | 1.00 | 0.0000 | 0 | < 0.0004 | 0.0002 | < 0.0004 |
| ARB-12-3-3 | 11 | 0 | 1.00 | 0.0000 | 0 | < 0.00040 | 0.0002 | < 0.00040 |
| GIQ8-10-2-4 | 10 | 0 | 1.00 | 0.0000 | 0 | < 0.00040 | 0.0002 | < 0.00040 |
| BIBG-10-1-4 | 10 | 0 | 1.00 | 0.0000 | 0 | < 0.0004 | 0.0002 | < 0.0004 |
| BI-13-3-4.5 | 8 | 0 | 1.00 | 0.0000 | 0 | < 0.00040 | 0.0002 | < 0.00040 |
| GIP11 09-1-4 | 7 | 0 | 1.00 | 0.0000 | 0 | < 0.0004 | 0.0002 | < 0.0004 |
| BI-13-1-4 | 6 | 0 | 1.00 | 0.0000 | 0 | < 0.00040 | 0.0002 | < 0.00040 |
| BIBG-12-1-7 | 4 | 0 | 1.00 | 0.0000 | 0 | < 0.00040 | 0.0002 | < 0.00040 |

# Table E-5
# Mann-Kendall Statistical Analysis (1998-2018) - Xylenes-Total

***Filtered Trend Results, two-sided p-value < 0.05 And Normalized Slope > ± 10%/Year***

| Location | Count | Mann-Kendall S | Two-sided p-value (for MK test) | Slope (mg/L/year) | Normalized Slope (%/year) | Min (mg/L) | Median (mg/L) | Max (mg/L) |
|---|---|---|---|---|---|---|---|---|

***Full Mann-Kendall Analysis, Sorted by two-sided p-value***

| Location | Count | Mann-Kendall S | Two-sided p-value (for MK test) | Slope (mg/L/year) | Normalized Slope (%/year) | Min (mg/L) | Median (mg/L) | Max (mg/L) |
|---|---|---|---|---|---|---|---|---|
| C38 08-1-4 | 15 | 26 | 0.03 | 0.0000 | 0 | < 0.0008 | 0.0004 | < 0.00089 |
| GIBG-10-2-3 | 13 | 22 | 0.03 | 0.0000 | 0 | < 0.0008 | 0.0004 | < 0.00089 |
| MEBG-10-1-3 | 13 | 22 | 0.03 | 0.0000 | 0 | < 0.0008 | 0.0004 | < 0.00089 |
| ARB-12-3-3 | 11 | 18 | 0.04 | 0.0000 | 0 | < 0.00080 | 0.0004 | < 0.00089 |
| GIQ8-10-2-4 | 10 | 16 | 0.05 | 0.0000 | 0 | < 0.00080 | 0.0004 | < 0.00089 |
| BIBG-10-1-4 | 10 | 16 | 0.05 | 0.0000 | 0 | < 0.0008 | 0.0004 | < 0.00089 |
| BI-13-3-4.5 | 8 | 12 | 0.07 | 0.0000 | 0 | < 0.00080 | 0.0004 | < 0.00089 |
| TF 03-12-3 | 20 | -35 | 0.16 | 0.0000 | 0 | < 0.0008 | 0.0004 | < 0.0015 |
| CPF 98-8-3 | 24 | -47 | 0.21 | 0.0000 | 0 | < 0.0005 | 0.0004 | < 0.0050 |
| BI-13-1-4 | 6 | 5 | 0.24 | 0.0000 | 0 | < 0.00080 | 0.0004 | < 0.00089 |
| CPF 97-7-5 | 23 | -33 | 0.34 | 0.0000 | 0 | < 0.0005 | 0.0004 | < 0.0050 |
| MTF 97-1-5 | 15 | 10 | 0.59 | 0.0000 | 0 | < 0.0005 | 0.0004 | < 0.001 |
| BIS 97-1-3 | 15 | 5 | 0.83 | 0.0000 | 0 | < 0.0005 | 0.0004 | < 0.0015 |
| WSY 97-1-5 | 21 | 5 | 0.88 | 0.0000 | 0 | < 0.0005 | 0.0004 | < 0.0015 |
| GIP11 09-1-4 | 7 | 0 | 1.00 | 0.0000 | 0 | < 0.0008 | 0.0004 | < 0.0008 |
| BIBG-12-1-7 | 4 | 0 | 1.00 | 0.0000 | 0 | < 0.00080 | 0.0004 | < 0.00080 |

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# Table E-6
## Statistical Summary

| Project No.: 407011-00586-400 | | | | Trend Analysis | | | | | | | Upper Control Limit Analysis | | | Lower Control Limit Analysis | | | Basic Analysis | | | | | | | | | | Guideline Analysis | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | Historical | | | | | | | | Reporting Period | | | |
| Location | Monitoring Station | Hydrostatigraphic Unit | Parameter | P Value of Two Tailed Test (-) | Inferred Confidence Level (of Trend Present in Data % | Slope (mg/L/yr) | Normalized Slope (%/yr) | Meets Trend Assumptions? [7] | Statistically Significant Mann-Kendall Trend [5] | Visual Trend Assessment [10] | UCL [6] (mg/L) | 2018 Values Greater than UCL | Meets UCL Assumptions [7] | LCL [6] (mg/L) | 2018 Values Less than LCL | Meets LCL Assumptions [7] | Count | Min (mg/L) | Median (mg/L) | Max (mg/L) | Range | Variability [4] | Avg. (mg/L) | Std. Dev. (mg/L) | Count | Max | Guideline Value [9] | 2018 Guideline Exceedances |
| ARB-12-3-3 | **ARB-12-3-3** | Surficial Sediments | Chloride | 0.876 | 0.124 | -0.3 | -1.8 | Y | --- | --- | 51.238 | 0 | Y | NC | NA | N (LCL <0) | 11 | 8.7 | 18.0 | 32 | 23.30 | 1.29 | 18.97 | 7.17 | 2 | 27 | 120 | 0 |
| ARB-12-3-3 | | | Benzene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 11 | < 0.00040 | NC | < 0.00040 | NC | NC | NC | NC | 2 | < 0.00040 | 0.37 | 0 |
| ARB-12-3-3 | | | Toluene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 11 | < 0.00040 | NC | < 0.00040 | NC | NC | NC | NC | 2 | < 0.00040 | 0.00 | 0 |
| ARB-12-3-3 | | | Ethylbenzene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 11 | < 0.00040 | NC | < 0.00040 | NC | NC | NC | NC | 2 | < 0.00040 | 0.09 | 0 |
| ARB-12-3-3 | | | Xylenes-Total | 0.047 | 0.953 | NC | NC | N (ins. trend data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 11 | < 0.00080 | NC | < 0.00089 | NC | NC | NC | NC | 2 | < 0.00089 | --- | --- |
| C38 08-1-4 | **C38 08-1-4** | Surficial Sediments | Chloride | 0.014 | 0.986 | -0.5 | -2.5 | Y | --- | --- | 33.916 | 0 | Y | 7.817 | 0 | Y | 15 | 14 | 21.0 | 25 | 11.00 | 0.52 | 20.87 | 2.9 | 2 | 21 | 120 | 0 |
| C38 08-1-4 | | | Benzene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 15 | < 0.0004 | NC | < 0.0004 | NC | NC | NC | NC | 2 | < 0.00040 | 0.37 | 0 |
| C38 08-1-4 | | | Toluene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 15 | < 0.0004 | NC | < 0.0004 | NC | NC | NC | NC | 2 | < 0.00040 | 0.00 | 0 |
| C38 08-1-4 | | | Ethylbenzene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 15 | < 0.0004 | NC | < 0.0004 | NC | NC | NC | NC | 2 | < 0.00040 | 0.09 | 0 |
| C38 08-1-4 | | | Xylenes-Total | 0.034 | 0.966 | NC | NC | N (ins. trend data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 15 | < 0.0008 | NC | < 0.00089 | NC | NC | NC | NC | 2 | < 0.00089 | --- | --- |
| CPF 97-7-5 | **CPF 97-7-5** | Surficial Sediments | Chloride | 0.092 | 0.908 | 0.2 | 1.6 | Y | --- | --- | 180.48 | 0 | Y | NC | NA | N (LCL <0) | 25 | 7.7 | 14.0 | 190 | 182.30 | 13.02 | 21.42 | 35.35 | 2 | 16 | 120 | 0 |
| CPF 97-7-5 | | | Benzene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | 0.003 | 0 | Y | NC | NA | N (LCL <0) | 23 | < 0.0004 | NC | < 0.0050 | NC | NC | NC | NC | 2 | < 0.00040 | 0.37 | 0 |
| CPF 97-7-5 | | | Toluene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | 0.003 | 0 | Y | NC | NA | N (LCL <0) | 23 | < 0.0004 | NC | < 0.0050 | NC | NC | NC | NC | 2 | < 0.00040 | 0.00 | 0 |
| CPF 97-7-5 | | | Ethylbenzene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | 0.003 | 0 | Y | NC | NA | N (LCL <0) | 23 | < 0.0004 | NC | < 0.0050 | NC | NC | NC | NC | 2 | < 0.00040 | 0.09 | 0 |
| CPF 97-7-5 | | | Xylenes-Total | 0.347 | 0.653 | NC | NC | N (ins. trend data) | --- | --- | 0.003 | 0 | Y | NC | NA | N (LCL <0) | 23 | < 0.0005 | NC | < 0.0050 | NC | NC | NC | NC | 2 | < 0.00089 | --- | --- |
| CPF 98-8-3 | **CPF 98-8-3** | Surficial Sediments | Chloride | 0.012 | 0.988 | -0.3 | -2.5 | Y | --- | --- | 31.026 | 0 | Y | NC | NA | N (LCL <0) | 24 | 6.8 | 13.0 | 22 | 15.20 | 1.17 | 12.84 | 4.04 | 2 | 8.5 | 120 | 0 |
| CPF 98-8-3 | | | Benzene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | 0.003 | 0 | Y | NC | NA | N (LCL <0) | 24 | < 0.0004 | NC | < 0.0050 | NC | NC | NC | NC | 2 | < 0.00040 | 0.37 | 0 |
| CPF 98-8-3 | | | Toluene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | 0.003 | 0 | Y | NC | NA | N (LCL <0) | 24 | < 0.0004 | NC | < 0.0050 | NC | NC | NC | NC | 2 | < 0.00040 | 0.00 | 0 |
| CPF 98-8-3 | | | Ethylbenzene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | 0.003 | 0 | Y | NC | NA | N (LCL <0) | 24 | < 0.0004 | NC | < 0.0050 | NC | NC | NC | NC | 2 | < 0.00040 | 0.09 | 0 |
| CPF 98-8-3 | | | Xylenes-Total | 0.21 | 0.79 | NC | NC | N (ins. trend data) | --- | --- | 0.003 | 0 | Y | NC | NA | N (LCL <0) | 24 | < 0.0005 | NC | < 0.0050 | NC | NC | NC | NC | 2 | < 0.00089 | --- | --- |
| MEBG-10-1-3 | **MEBG-10-1-3** | Surficial Sediments | Chloride | 0.005 | 0.995 | -0.3 | -11.2 | Y | D | --- | 6.952 | 0 | Y | NC | NA | N (LCL <0) | 13 | 1.9 | 2.4 | 5 | 3.10 | 1.29 | 2.85 | 0.91 | 2 | 2.3 | 120 | 0 |
| MEBG-10-1-3 | | | Benzene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (D Trend) | NC | NA | N (ins. >DL data) | 13 | < 0.0004 | NC | < 0.0004 | NC | NC | NC | NC | 2 | < 0.00040 | 0.37 | 0 |
| MEBG-10-1-3 | | | Toluene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 13 | < 0.0004 | NC | < 0.0004 | NC | NC | NC | NC | 2 | < 0.00040 | 0.00 | 0 |
| MEBG-10-1-3 | | | Ethylbenzene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 13 | < 0.0004 | NC | < 0.0004 | NC | NC | NC | NC | 2 | < 0.00040 | 0.09 | 0 |
| MEBG-10-1-3 | | | Xylenes-Total | 0.039 | 0.961 | NC | NC | N (ins. trend data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 13 | < 0.0008 | NC | < 0.00089 | NC | NC | NC | NC | 2 | < 0.00089 | --- | --- |
| MTF 97-1-5 | **MTF 97-1-5** | Surficial Sediments | Chloride | 0.031 | 0.969 | -0.05 | -4.2 | Y | --- | --- | 4.912 | 0 | Y | NC | NA | N (LCL <0) | 19 | < 1.0 | 1.3 | 3.4 | 2.90 | 2.23 | 1.41 | 0.78 | 2 | 1.9 | 120 | 0 |
| MTF 97-1-5 | | | Benzene | 0.012 | 0.988 | NC | NC | N (ins. trend data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 15 | < 0.0004 | NC | < 0.0005 | NC | NC | NC | NC | 2 | < 0.00040 | 0.37 | 0 |
| MTF 97-1-5 | | | Toluene | 0.012 | 0.988 | NC | NC | N (ins. trend data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 15 | < 0.0004 | NC | < 0.0005 | NC | NC | NC | NC | 2 | < 0.00040 | 0.00 | 0 |
| MTF 97-1-5 | | | Ethylbenzene | 0.012 | 0.988 | NC | NC | N (ins. trend data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 15 | < 0.0004 | NC | < 0.0005 | NC | NC | NC | NC | 2 | < 0.00040 | 0.09 | 0 |
| MTF 97-1-5 | | | Xylenes-Total | 0.592 | 0.408 | NC | NC | N (ins. trend data) | --- | --- | 0.001 | 0 | Y | NC | NA | N (ins. >DL data) | 15 | < 0.0005 | NC | < 0.001 | NC | NC | NC | NC | 2 | < 0.00089 | --- | --- |
| TF 03-12-3 | **TF 03-12-3** | Surficial Sediments | Chloride | 0.004 | 0.996 | -5.5 | -3.3 | Y | --- | --- | 381.732 | 0 | Y | NC | NA | N (LCL <0) | 20 | 110 | 170.0 | 280 | 170.00 | 1.00 | 177.25 | 45.44 | 2 | 170 | 120 | 1.00 |
| TF 03-12-3 | | | Benzene | 0.002 | 0.998 | NC | NC | N (ins. trend data) | --- | --- | 0.002 | 0 | Y | NC | NA | N (LCL <0) | 20 | < 0.0004 | NC | 0.0017 | NC | NC | NC | NC | 2 | < 0.00040 | 0.37 | 0 |
| TF 03-12-3 | | | Toluene | 0.003 | 0.997 | NC | NC | N (ins. trend data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 20 | < 0.0004 | NC | < 0.0005 | NC | NC | NC | NC | 2 | < 0.00040 | 0.00 | 0 |
| TF 03-12-3 | | | Ethylbenzene | 0.003 | 0.997 | NC | NC | N (ins. trend data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 20 | < 0.0004 | NC | < 0.0005 | NC | NC | NC | NC | 2 | < 0.00040 | 0.09 | 0 |
| TF 03-12-3 | | | Xylenes-Total | 0.169 | 0.831 | NC | NC | N (ins. trend data) | --- | --- | 0.001 | 0 | Y | NC | NA | N (ins. >DL data) | 20 | < 0.0008 | NC | < 0.0015 | NC | NC | NC | NC | 2 | < 0.00089 | --- | --- |

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WorleyParsons Group

# Table E-6
## Statistical Summary

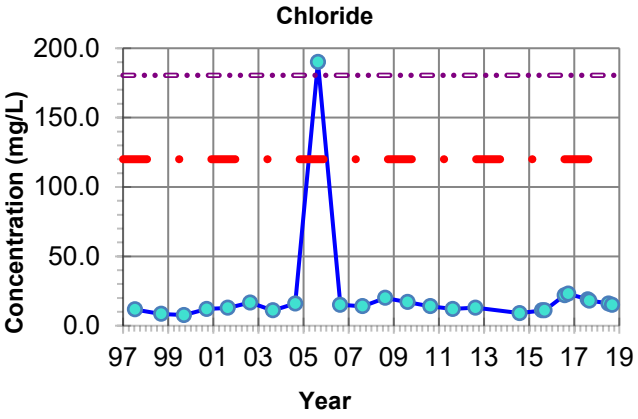
| Project No.: 407011-00586-400 | | | | Trend Analysis | | | | | | | Upper Control Limit Analysis | | | Lower Control Limit Analysis | | | Basic Analysis | | | | | | | | | Guideline Analysis | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | Historical | | | | | | | | Reporting Period | | | |
| Location | Monitoring Station | Hydrostatigraphic Unit | Parameter | P Value of Two Tailed Test (-) | Inferred Confidence Level (of Trend Present in Data % | Slope (mg/L/yr) | Normalized Slope (%/yr) | Meets Trend Assumptions? [7] | Statistically Significant Mann-Kendall Trend [5] | Visual Trend Assessment [10] | UCL [6] (mg/L) | 2018 Values Greater than UCL | Meets UCL Assumptions [7] | LCL [6] (mg/L) | 2018 Values Less than LCL | Meets LCL Assumptions [7] | Count | Min (mg/L) | Median (mg/L) | Max (mg/L) | Range | Variability [4] | Avg. (mg/L) | Std. Dev. (mg/L) | Count | Max | Guideline Value [9] | 2018 Guideline Exceedances |
| WSY 97-1-5 | **WSY 97-1-5** | Surficial Sediments | Chloride | 0.333 | 0.667 | -0.3 | -1.6 | Y | --- | --- | 69.696 | 0 | Y | NC | NA | N (LCL <0) | 24 | 6.5 | 18.45 | 64 | 57.50 | 3.12 | 19.35 | 11.19 | 2 | 26 | 120 | 0 |
| WSY 97-1-5 | | | Benzene | 0.001 | 0.999 | NC | NC | N (ins. trend data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 21 | < 0.0004 | NC | < 0.0005 | NC | NC | NC | NC | 2 | < 0.00040 | 0.37 | 0 |
| WSY 97-1-5 | | | Toluene | 0.001 | 0.999 | NC | NC | N (ins. trend data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 21 | < 0.0004 | NC | < 0.0005 | NC | NC | NC | NC | 2 | < 0.00040 | 0.00 | 0 |
| WSY 97-1-5 | | | Ethylbenzene | 0.001 | 0.999 | NC | NC | N (ins. trend data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 21 | < 0.0004 | NC | < 0.0005 | NC | NC | NC | NC | 2 | < 0.00040 | 0.09 | 0 |
| WSY 97-1-5 | | | Xylenes-Total | 0.889 | 0.111 | NC | NC | N (ins. trend data) | --- | --- | 0.001 | 0 | Y | NC | NA | N (LCL <0) | 21 | < 0.0005 | NC | < 0.0015 | NC | NC | NC | NC | 2 | < 0.00089 | --- | --- |
| BI-13-1-4 | **BI-13-1-4** | Surficial Sediments | Chloride | 0.133 | 0.867 | -0.7 | -9.2 | Y | --- | --- | 14.805 | 0 | Y | 0.224 | 0 | Y | 7 | 4.6 | 7.9 | 9.5 | 4.90 | 0.62 | 7.51 | 1.62 | 2 | 8.3 | 120 | 0 |
| BI-13-1-4 | | | Benzene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 6 | < 0.00040 | NC | < 0.00040 | NC | NC | NC | NC | 1 | < 0.00040 | 0.37 | 0 |
| BI-13-1-4 | | | Toluene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 6 | < 0.00040 | NC | < 0.00040 | NC | NC | NC | NC | 1 | < 0.00040 | 0.00 | 0 |
| BI-13-1-4 | | | Ethylbenzene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 6 | < 0.00040 | NC | < 0.00040 | NC | NC | NC | NC | 1 | < 0.00040 | 0.09 | 0 |
| BI-13-1-4 | | | Xylenes-Total | 0.242 | 0.758 | NC | NC | N (ins. trend data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 6 | < 0.00080 | NC | < 0.00089 | NC | NC | NC | NC | 1 | < 0.00089 | --- | --- |
| BI-13-3-4.5 | **BI-13-3-4.5** | Surficial Sediments | Chloride | 0.135 | 0.865 | -0.8 | -8.8 | Y | --- | --- | 19.248 | 0 | Y | NC | NA | N (LCL <0) | 8 | 6.5 | 9.35 | 13 | 6.50 | 0.70 | 9.49 | 2.17 | 2 | 10 | 120 | 0 |
| BI-13-3-4.5 | | | Benzene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | 0.001 | 0 | Y | NC | NA | N (LCL <0) | 8 | < 0.00040 | NC | 0.00042 | NC | NC | NC | NC | 2 | < 0.00040 | 0.37 | 0 |
| BI-13-3-4.5 | | | Toluene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 8 | < 0.00040 | NC | < 0.00040 | NC | NC | NC | NC | 2 | < 0.00040 | 0.00 | 0 |
| BI-13-3-4.5 | | | Ethylbenzene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 8 | < 0.00040 | NC | < 0.00040 | NC | NC | NC | NC | 2 | < 0.00040 | 0.09 | 0 |
| BI-13-3-4.5 | | | Xylenes-Total | 0.071 | 0.929 | NC | NC | N (ins. trend data) | --- | --- | 0.001 | 0 | Y | NC | NA | N (ins. >DL data) | 8 | < 0.00080 | NC | < 0.00089 | NC | NC | NC | NC | 2 | < 0.00089 | --- | --- |
| BIBG-10-1-4 | **BIBG-10-1-4** | Surficial Sediments | Chloride | 0.107 | 0.893 | 2.2 | 20.7 | Y | --- | --- | 48.894 | 0 | Y | NC | NA | N (LCL <0) | 10 | 3.0 | 10.5 | 25 | 22.00 | 2.10 | 11.91 | 8.22 | 2 | 23 | 120 | 0 |
| BIBG-10-1-4 | | | Benzene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 10 | < 0.0004 | NC | < 0.0004 | NC | NC | NC | NC | 2 | < 0.00040 | 0.37 | 0 |
| BIBG-10-1-4 | | | Toluene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 10 | < 0.0004 | NC | < 0.0004 | NC | NC | NC | NC | 2 | < 0.00040 | 0.00 | 0 |
| BIBG-10-1-4 | | | Ethylbenzene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 10 | < 0.0004 | NC | < 0.0004 | NC | NC | NC | NC | 2 | < 0.00040 | 0.09 | 0 |
| BIBG-10-1-4 | | | Xylenes-Total | 0.052 | 0.948 | NC | NC | N (ins. trend data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 10 | < 0.0008 | NC | < 0.00089 | NC | NC | NC | NC | 2 | < 0.00089 | --- | --- |
| BIBG-12-1-7 | **BIBG-12-1-7** | Surficial Sediments | Chloride | 0.308 | 0.692 | -0.6 | -6.9 | Y | --- | --- | 15.868 | NA | N (no new data) | NC | NA | N (no new data) | 4 | 7.5 | 8.65 | 11 | 3.50 | 0.40 | 8.95 | 1.54 | 0 | --- | 120 | --- |
| BIBG-12-1-7 | | | Benzene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (no new data) | NC | NA | N (no new data) | 4 | < 0.00040 | NC | < 0.00040 | NC | NC | NC | NC | 0 | --- | 0.37 | --- |
| BIBG-12-1-7 | | | Toluene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (no new data) | NC | NA | N (no new data) | 4 | < 0.00040 | NC | < 0.00040 | NC | NC | NC | NC | 0 | --- | 0.00 | --- |
| BIBG-12-1-7 | | | Ethylbenzene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (no new data) | NC | NA | N (no new data) | 4 | < 0.00040 | NC | < 0.00040 | NC | NC | NC | NC | 0 | --- | 0.09 | --- |
| BIBG-12-1-7 | | | Xylenes-Total | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (no new data) | NC | NA | N (no new data) | 4 | < 0.00080 | NC | < 0.00080 | NC | NC | NC | NC | 0 | --- | --- | --- |
| BIS 97-1-3 | **BIS 97-1-3** | Surficial Sediments | Chloride | 0.019 | 0.981 | -0.4 | -1.0 | Y | --- | --- | 43.659 | 0 | Y | 3.236 | 0 | Y | 19 | 16 | 22.0 | 35 | 19.00 | 0.86 | 23.45 | 4.49 | 2 | 22 | 120 | 0 |
| BIS 97-1-3 | | | Benzene | 0.003 | 0.997 | NC | NC | N (ins. trend data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 15 | < 0.0004 | NC | < 0.0005 | NC | NC | NC | NC | 2 | < 0.00040 | 0.37 | 0 |
| BIS 97-1-3 | | | Toluene | 0.003 | 0.997 | NC | NC | N (ins. trend data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 15 | < 0.0004 | NC | < 0.0005 | NC | NC | NC | NC | 2 | < 0.00040 | 0.00 | 0 |
| BIS 97-1-3 | | | Ethylbenzene | 0.003 | 0.997 | NC | NC | N (ins. trend data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 15 | < 0.0004 | NC | < 0.0005 | NC | NC | NC | NC | 2 | < 0.00040 | 0.09 | 0 |
| BIS 97-1-3 | | | Xylenes-Total | 0.833 | 0.167 | NC | NC | N (ins. trend data) | --- | --- | 0.001 | 0 | Y | NC | NA | N (LCL <0) | 15 | < 0.0005 | NC | < 0.0015 | NC | NC | NC | NC | 2 | < 0.00089 | --- | --- |
| GIP11 09-1-4 | **GIP11 09-1-4** | Surficial Sediments | Chloride | 0.23 | 0.77 | -4.6 | -65.6 | Y | --- | --- | 197.673 | NA | N (no new data) | NC | NA | N (no new data) | 7 | 3.6 | 7.0 | 110 | 106.40 | 15.20 | 24.2 | 38.55 | 0 | --- | 120 | --- |
| GIP11 09-1-4 | | | Benzene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (no new data) | NC | NA | N (no new data) | 7 | < 0.0004 | NC | < 0.0004 | NC | NC | NC | NC | 0 | --- | 0.37 | --- |
| GIP11 09-1-4 | | | Toluene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (no new data) | NC | NA | N (no new data) | 7 | < 0.0004 | NC | < 0.0004 | NC | NC | NC | NC | 0 | --- | 0.00 | --- |
| GIP11 09-1-4 | | | Ethylbenzene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (no new data) | NC | NA | N (no new data) | 7 | < 0.0004 | NC | < 0.0004 | NC | NC | NC | NC | 0 | --- | 0.09 | --- |
| GIP11 09-1-4 | | | Xylenes-Total | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (no new data) | NC | NA | N (no new data) | 7 | < 0.0008 | NC | < 0.0008 | NC | NC | NC | NC | 0 | --- | --- | --- |
| GIP11 09-1-4-R | **GIP11 09-1-4-R** | Surficial Sediments | Chloride | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (ins. data) | NC | NA | N (ins. data) | 2 | 14 | 32.0 | 50 | 36.00 | 1.13 | 32.0 | 25.46 | 2 | 50 | 120 | 0 |
| GIP11 09-1-4-R | | | Benzene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (ins. data) | NC | NA | N (ins. data) | 2 | < 0.00040 | NC | < 0.00040 | NC | NC | NC | NC | 2 | < 0.00040 | 0.37 | 0 |
| GIP11 09-1-4-R | | | Toluene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (ins. data) | NC | NA | N (ins. data) | 2 | < 0.00040 | NC | < 0.00040 | NC | NC | NC | NC | 2 | < 0.00040 | 0.00 | 0 |
| GIP11 09-1-4-R | | | Ethylbenzene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (ins. data) | NC | NA | N (ins. data) | 2 | < 0.00040 | NC | < 0.00040 | NC | NC | NC | NC | 2 | < 0.00040 | 0.09 | 0 |
| GIP11 09-1-4-R | | | Xylenes-Total | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (ins. data) | NC | NA | N (ins. data) | 2 | < 0.00089 | NC | < 0.00089 | NC | NC | NC | NC | 2 | < 0.00089 | --- | --- |
| GIQ8-10-2-4 | **GIQ8-10-2-4** | Surficial Sediments | Chloride | 0.18 | 0.82 | 1.5 | 9.6 | Y | --- | --- | 42.589 | 0 | Y | NC | NA | N (LCL <0) | 10 | 5.8 | 16.0 | 21 | 15.20 | 0.95 | 14.27 | 6.29 | 2 | 21 | 120 | 0 |
| GIQ8-10-2-4 | | | Benzene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 10 | < 0.00040 | NC | < 0.00040 | NC | NC | NC | NC | 2 | < 0.00040 | 0.37 | 0 |
| GIQ8-10-2-4 | | | Toluene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 10 | < 0.00040 | NC | < 0.00040 | NC | NC | NC | NC | 2 | < 0.00040 | 0.00 | 0 |
| GIQ8-10-2-4 | | | Ethylbenzene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 10 | < 0.00040 | NC | < 0.00040 | NC | NC | NC | NC | 2 | < 0.00040 | 0.09 | 0 |
| GIQ8-10-2-4 | | | Xylenes-Total | 0.052 | 0.948 | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 10 | < 0.00080 | NC | < 0.00089 | NC | NC | NC | NC | 2 | < 0.00089 | --- | --- |

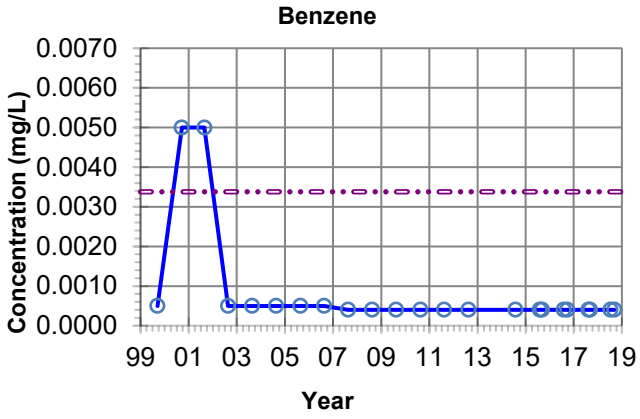
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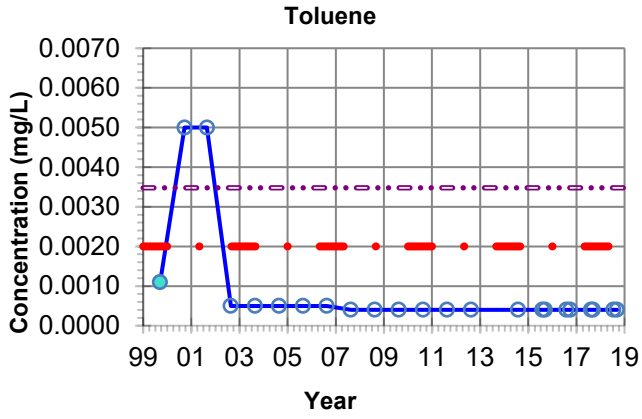
# Table E-6
# Statistical Summary

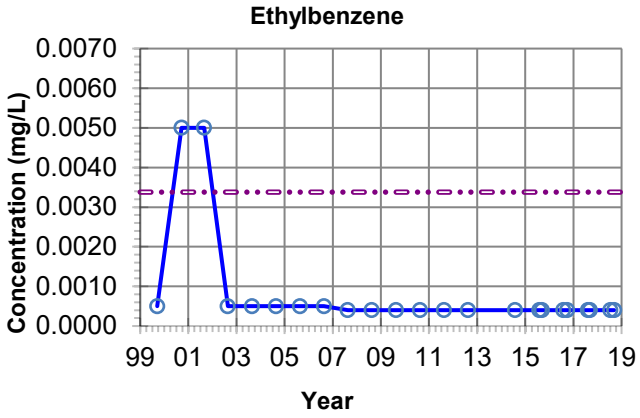
| Project No.: 407011-00586-400 | | | | Trend Analysis | | | | | | | Upper Control Limit Analysis | | | Lower Control Limit Analysis | | | Basic Analysis | | | | | | | | | | Guideline Analysis | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | Historical | | | | | | | | Reporting Period | | | |
| Location | Monitoring Station | Hydrostatigraphic Unit | Parameter | P Value of Two Tailed Test (-) | Inferred Confidence Level (of Trend Present in Data % | Slope (mg/L/yr) | Normalized Slope (%/yr) | Meets Trend Assumptions? [7] | Statistically Significant Mann-Kendall Trend [5] | Visual Trend Assessment [10] | UCL [6] (mg/L) | 2018 Values Greater than UCL | Meets UCL Assumptions [7] | LCL [6] (mg/L) | 2018 Values Less than LCL | Meets LCL Assumptions [7] | Count | Min (mg/L) | Median (mg/L) | Max (mg/L) | Range | Variability [4] | Avg. (mg/L) | Std. Dev. (mg/L) | Count | Max | Guideline Value [9] | 2018 Guideline Exceedances |
| GIBG-10-2-3 | **GIBG-10-2-3** | Surficial Sediments | Chloride | 0.807 | 0.193 | -0.1 | -3.6 | Y | --- | --- | 15.126 | 0 | Y | NC | NA | N (LCL <0) | 13 | < 1.0 | 3.1 | 9 | 8.50 | 2.74 | 4.12 | 2.45 | 2 | 6.9 | 120 | 0 |
| GIBG-10-2-3 | | | Benzene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 13 | < 0.0004 | NC | < 0.0004 | NC | NC | NC | NC | 2 | < 0.00040 | 0.37 | 0 |
| GIBG-10-2-3 | | | Toluene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 13 | < 0.0004 | NC | < 0.0004 | NC | NC | NC | NC | 2 | < 0.00040 | 0.00 | 0 |
| GIBG-10-2-3 | | | Ethylbenzene | NC | NC | NC | NC | N (ins. >DL data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 13 | < 0.0004 | NC | < 0.0004 | NC | NC | NC | NC | 2 | < 0.00040 | 0.09 | 0 |
| GIBG-10-2-3 | | | Xylenes-Total | 0.039 | 0.961 | NC | NC | N (ins. trend data) | --- | --- | NC | NA | N (ins. >DL data) | NC | NA | N (ins. >DL data) | 13 | < 0.0008 | NC | < 0.00089 | NC | NC | NC | NC | 2 | < 0.00089 | --- | --- |

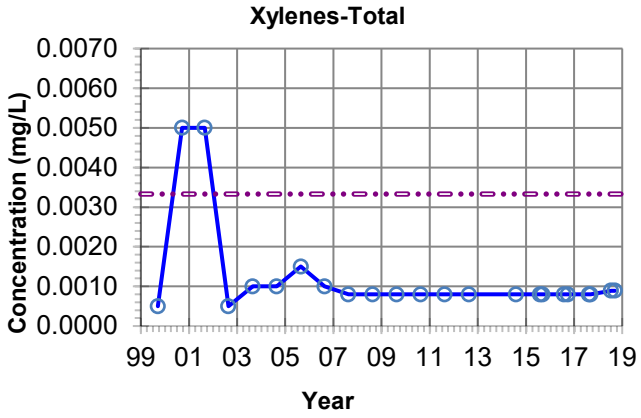
1. *Bold formatting indicates a value is above the applied guideline*
   - *The following results have been checked against the guideline: minimum, median, maximum, average, LCL, UCL*
2. *Shading in the parameter column indicates one or more analyses returned notable results (analysis-specific shading is further specified below)*
3. *Basic analysis performed with the following conditions:*
   - *Historical: all data before 01-Jan-2017*
   - *Reporting period is defined as 01-Jan-2017 to 22-Nov-2017 (inclusive)*
   - *Non-detect multiplier of 0.5 applied to <DL sample data*
4. *Variability calculated as range / median*
5. *Trend Analysis:*
   - *Analyses performed on all sample data before 22-Nov-2017 (inclusive)*
   - *Non-detect multiplier of 0.5 applied to <DL sample data*
   - *Statistically signficant trend defined as:*
     - *Inferred confidence level greater than 95%*
       - *(in other words, P-value of two-tailed test is less than or equal to 0.05)*
     - *Absolute value of Sen's normalized slope is greater than 10%*
     - *Absolute slope criteria met for individual parameters (see criteria below)*
   - *U: Denotes statistically significant upward trend*
   - *D: Denotes statistically significant downward trend*
   - *"---": Denotes no trend*
   - *Shading of trend analysis cells indicates a Mann-Kendall trend has been detected*
6. *Upper Control Limit (UCL) and Lower Control Limit (LCL) calculated as follows:*
   - *Calculated on all data before 31-Dec-2017 (inclusive)*
   - *Minimum 8 data points; no maximum number of data points*
   - *Non-detect multiplier of 0.5 applied to <DL sample data*
   - *Control limit exceedances reported on sample data between 01-Jan-2017 and 31-Dec-2017 (inclusive)*
   - *Shading of control limit cells indicates one or more control limit exceedances were detected*
7. *Legend for control limit/trend assumptions:*
   - *Y: All conditions are met*
   - *N: Not all conditions are met, specified as follows:*
     - *No new data: No sample data present for years reported*
     - *LCL < 0: calculated LCL was less than 0*
     - *Ins. CL data: insufficient data to calculate a control limit*
     - *Ins. >DL data: Less than 50% of control limit data was above detection limit*
     - *Ins. >DL data: Less than 50% of trend data was above detection limit*
     - *UCL <2x/<5x RDL: The UCL is less than twice/less than 5 times the reporting detection limit*
     - *U Trend: An upward Mann-Kendall trend is present*
     - *D Trend: A downward Mann-Kendall trend is present*
8. *Parameter dependent criteria as follows:*
   - *Chloride - control limit criteria: 5.0 mg/L (5x the reporting detection limit); absolute slope criteria: 2.0 mg/L*
9. *Guideline: Canadian Environmental Quality Guidelines Summary Table. Water Quality Guidelines for the Protection of Freshwater Aquatic Life. Sept, 2014.*
   - *Chloride guideline based on chronic exposure*
10. *Visual Trend Assessment includes: trend reversals, trend stabilizations, possible developing trends, and probable (monotonic) trends*
11. *NC: not calculated due to assumptions not being met*
12. ** indicates outlier removed from calculation. Outliers were detemined using a Dixon's outlier test (5% significance level).*




Upper Control Limit

Lower Control Limit

**NOTES:** - Filled symbols denote Sample Values
- Unfilled symbols denote Values < Detection Limit(s)

GUIDELINE:
CCME CEQG Freshwater Aquatic Life

Benzene - 0.37 mg/L
Toluene - 0.002 mg/L
Ethylbenzene - 0.09 mg/L
Chloride - 120 mg/L

Infrastructure & Environment

**Imperial**
**2018 Groundwater Surveillance Network Program**
**Norman Wells, NT**

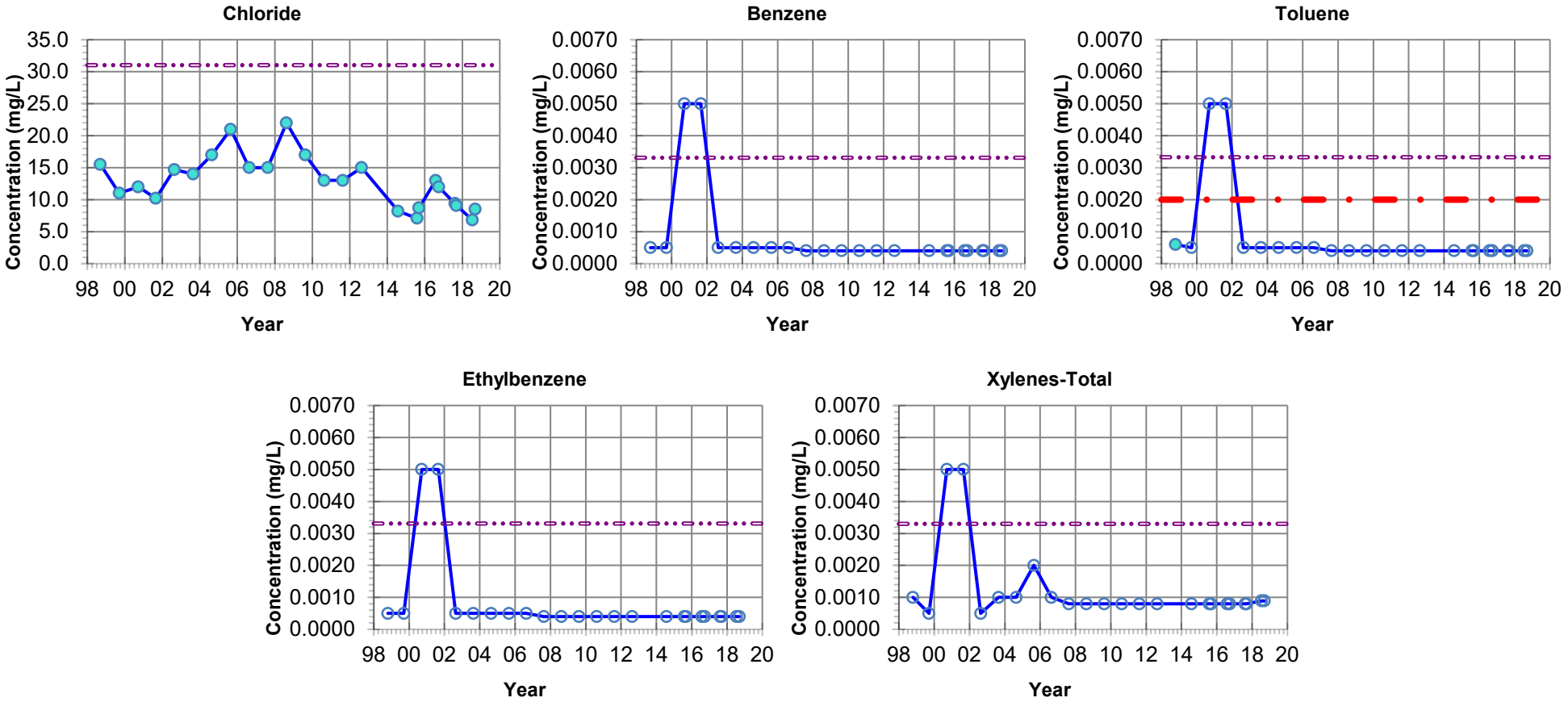
**Trend Graphs**
**Monitoring Well: CPF 97-7-5**

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WorleyParsons Group

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|---|---|---|---|---|---|

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**NOTES:** - Filled symbols denote Sample Values
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**GUIDELINE:**
**CCME CEQG Freshwater Aquatic Life**

**Benzene - 0.37 mg/L**
**Toluene - 0.002 mg/L**
**Ethylbenzene - 0.09 mg/L**
**Chloride - 120 mg/L**

Infrastructure & Environment

**Imperial**
**2018 Surveillance Network Program**
**Norman Wells, NT**

**Trend Graphs**
**Monitoring Well: CPF 98-8-3**

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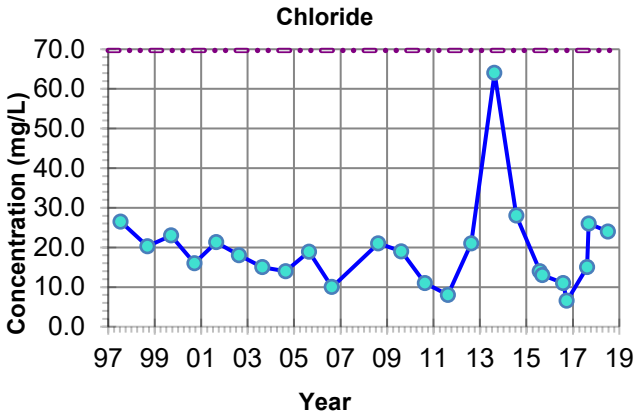
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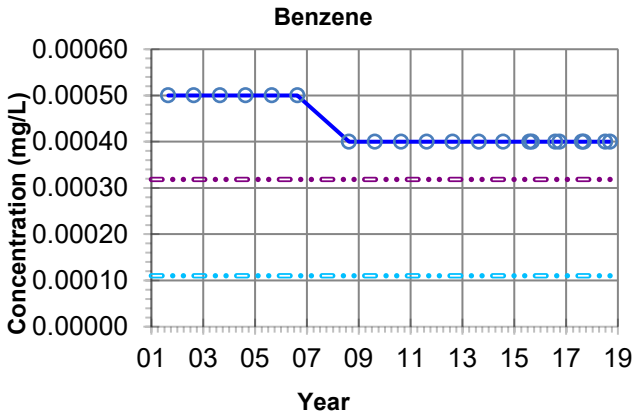
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WorleyParsons Group

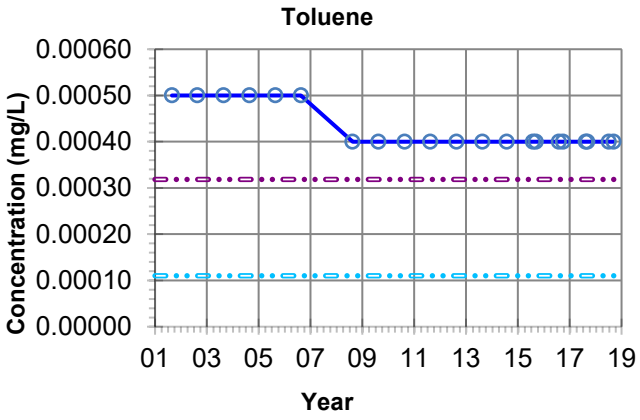
**PROJECT NUMBER:** 407011-00586

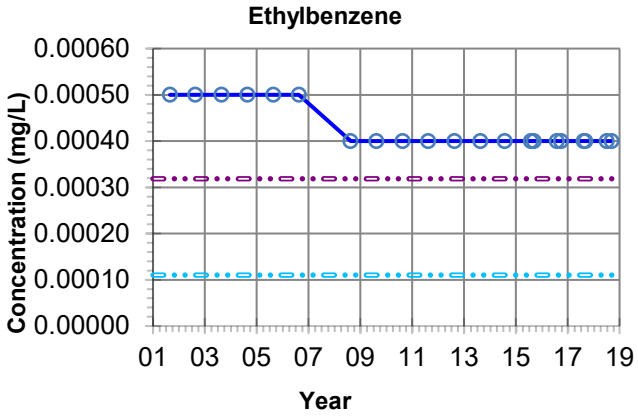
**Figure** E-2

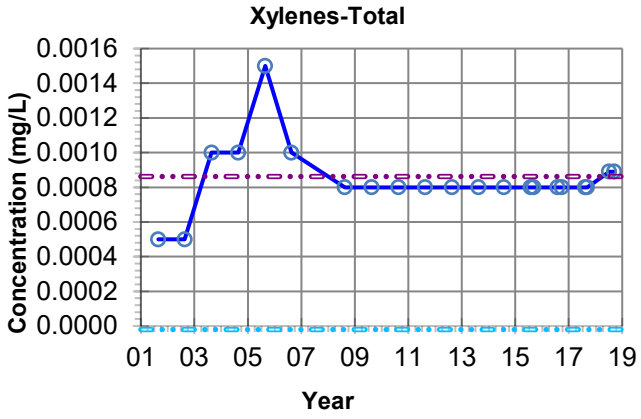
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**NOTES:** - Filled symbols denote Sample Values
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Upper Control Limit
Lower Control Limit

GUIDELINE:
CCME CEQG Freshwater Aquatic Life

Benzene - 0.37 mg/L
Toluene - 0.002 mg/L
Ethylbenzene - 0.09 mg/L
Chloride - 120 mg/L

Infrastructure & Environment

**Imperial**
**2018 Surveillance Network Program**
**Norman Wells, NT**

**Trend Graphs**
**Monitoring Well: WSY 97-1-5**

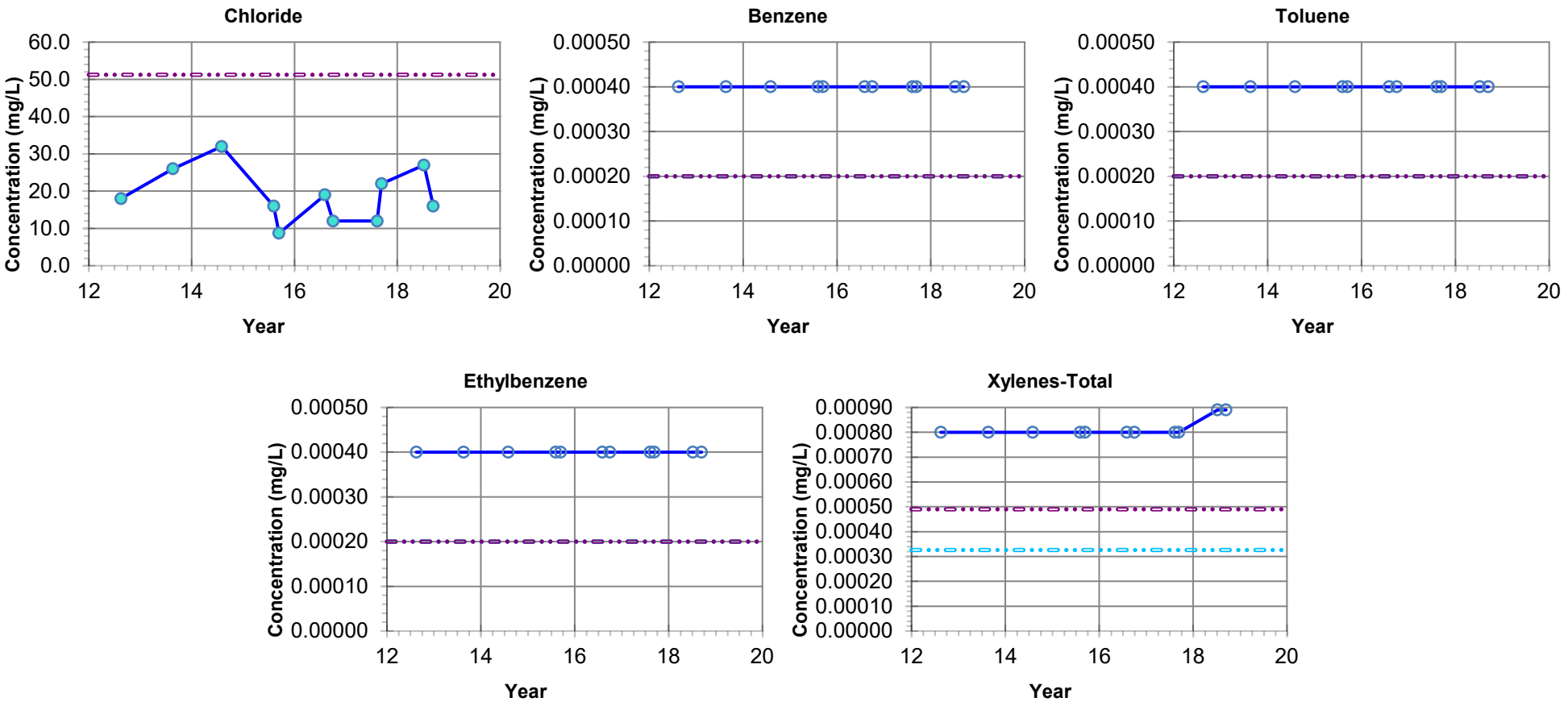
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| PROJECT NUMBER: | Figure |
|---|---|
| 407011-00586 | E-3 |

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Upper Control Limit
Lower Control Limit

– · – GUIDELINE:
CCME CEQG Freshwater Aquatic Life

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Toluene - 0.002 mg/L
Ethylbenzene - 0.09 mg/L
Chloride - 120 mg/L

Infrastructure & Environment

**Imperial**
**2018 Surveillance Network Program**
**Norman Wells, NT**

**Trend Graphs**
**Monitoring Well: ARB-12-3-3**

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WorleyParsons Group

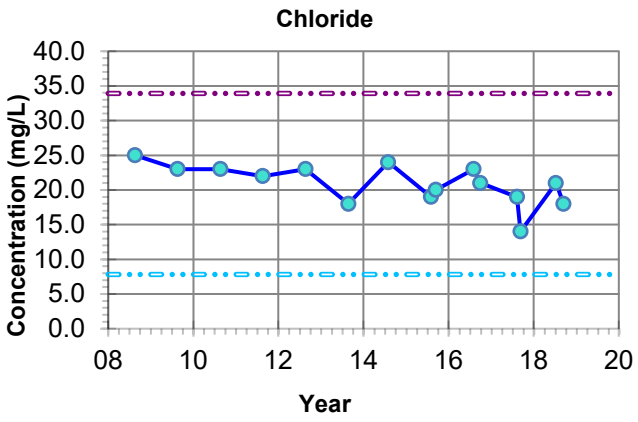
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|---|---|---|---|

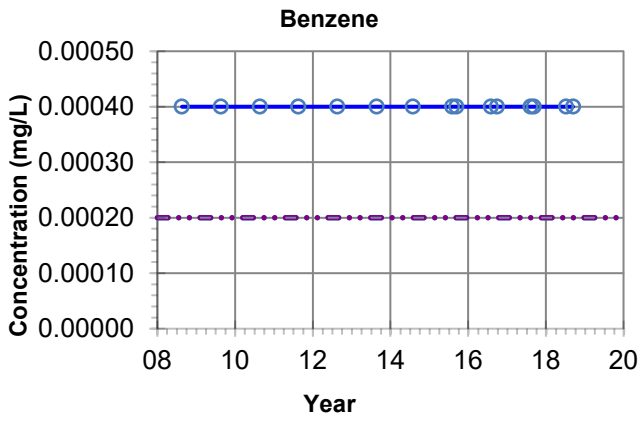
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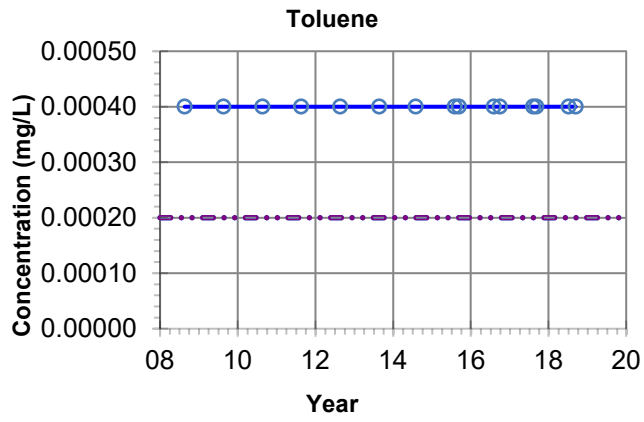
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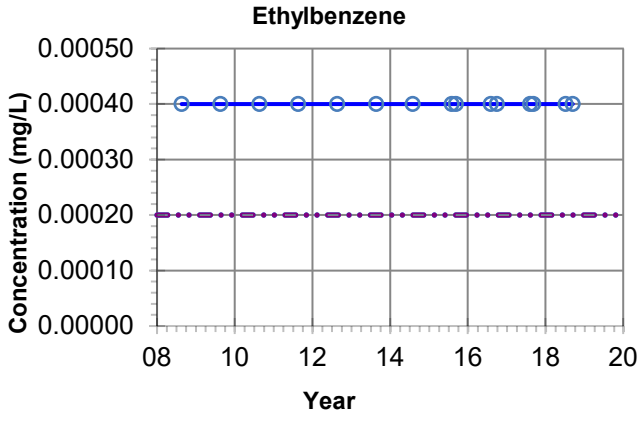
Figure E-4

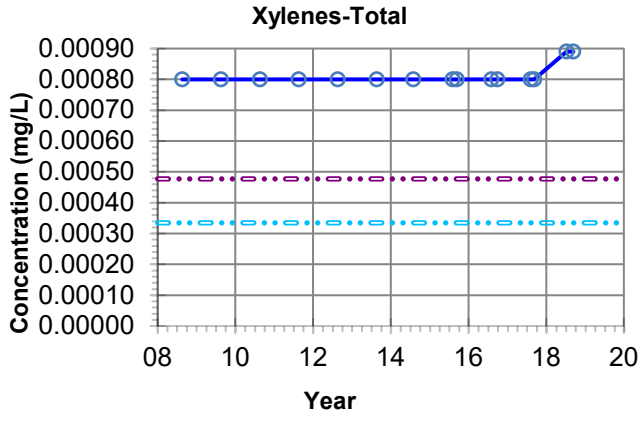
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Upper Control Limit
Lower Control Limit

GUIDELINE:
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Ethylbenzene - 0.09 mg/L
Chloride - 120 mg/L

Infrastructure & Environment

**Imperial**
**2018 Surveillance Network Program**
**Norman Wells, NT**

**Trend Graphs**
**Monitoring Well: C38 08-1-4**

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|---|---|---|---|

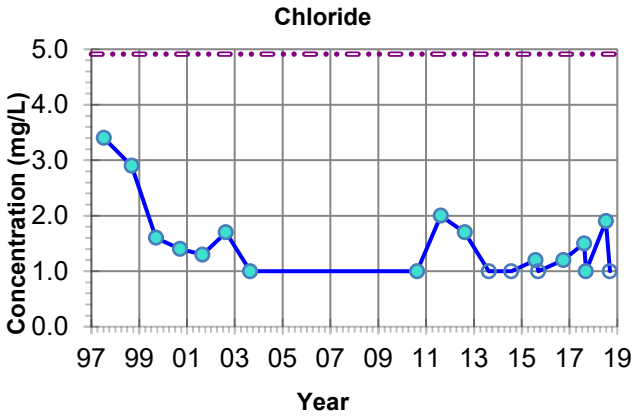
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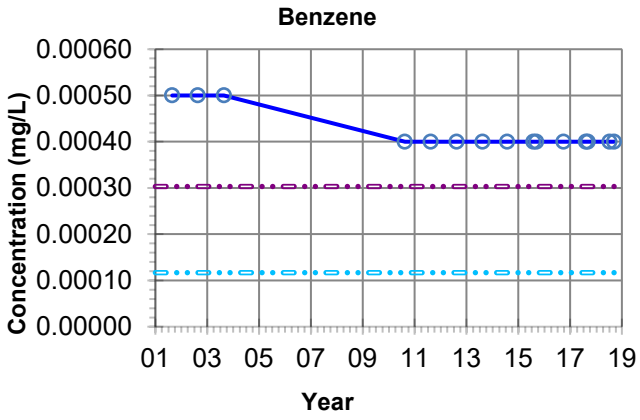
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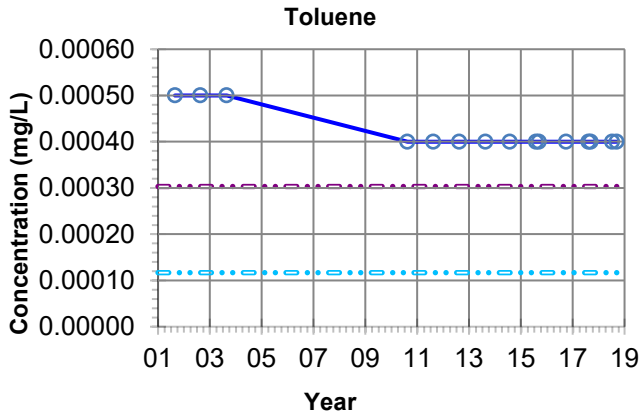
PROJECT NUMBER: 407011-00586

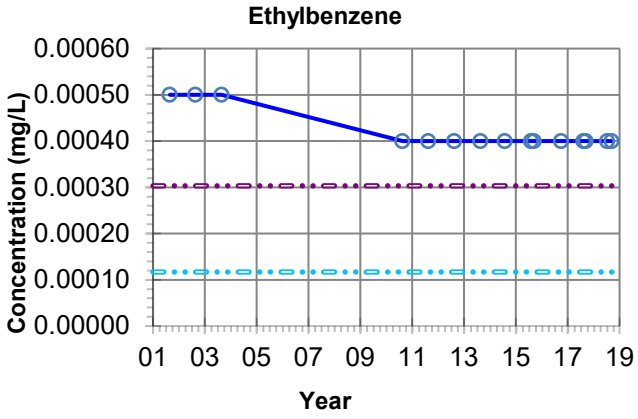
Figure E-5

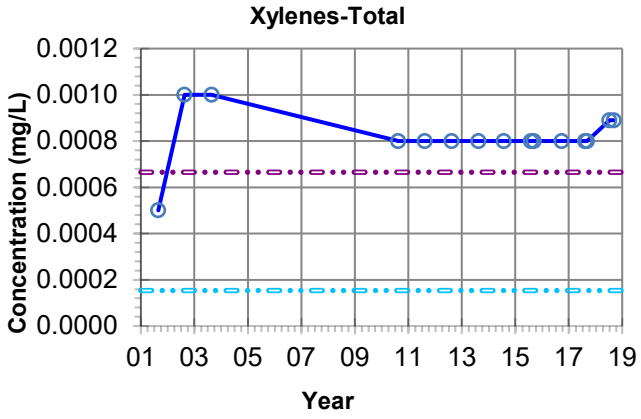
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Upper Control Limit
Lower Control Limit

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Ethylbenzene - 0.09 mg/L
Chloride - 120 mg/L

Infrastructure & Environment

**Imperial**
**2018 Surveillance Network Program**
**Norman Wells, NT**

**Trend Graphs**
**Monitoring Well: MTF 97-1-5**

| 05-Dec-2018 date | NA edited by | JC drawn by | NA app by |
|---|---|---|---|

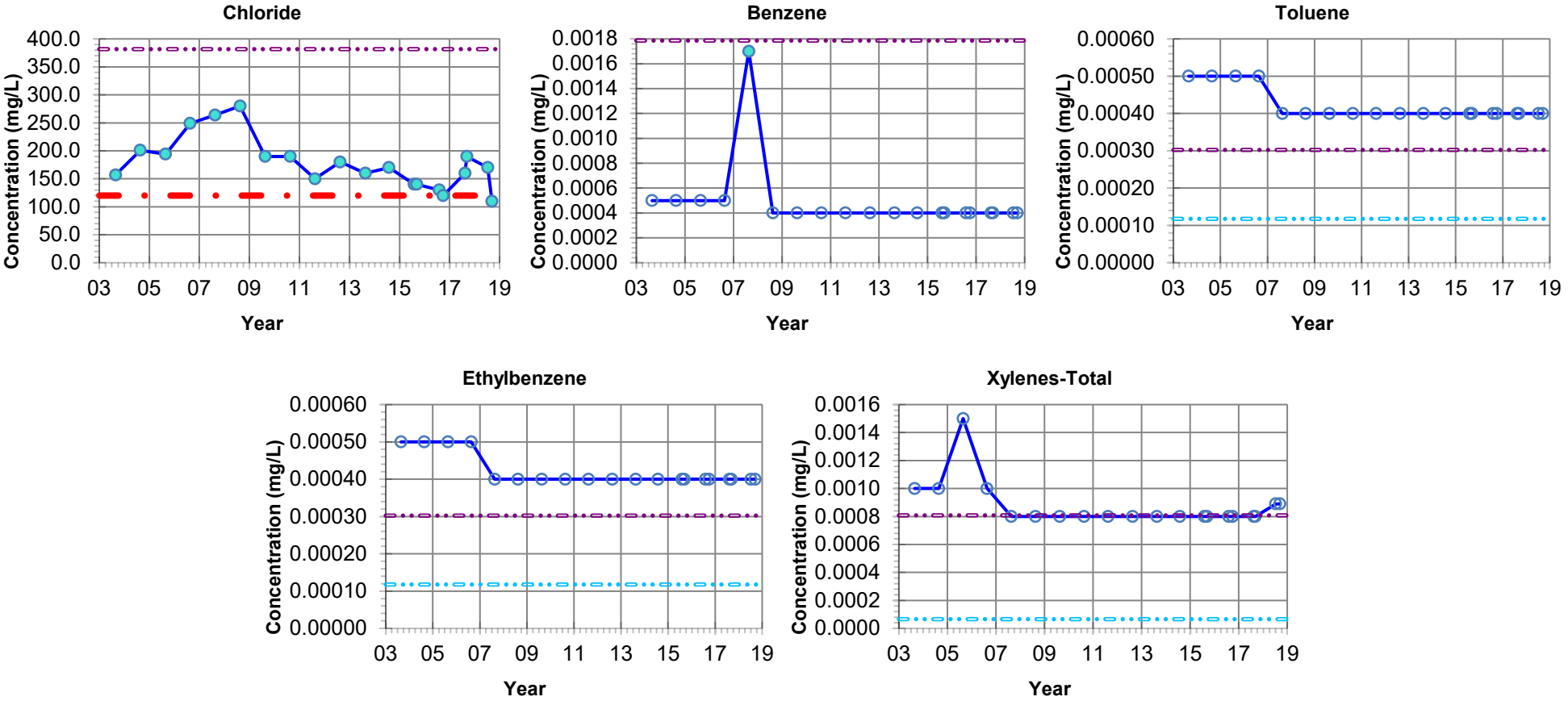
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Figure E-6

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**NOTES:** - Filled symbols denote Sample Values
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GUIDELINE:
CCME CEQG Freshwater Aquatic Life

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Ethylbenzene - 0.09 mg/L
Chloride - 120 mg/L

**Imperial**
**2018 Surveillance Network Program**
**Norman Wells, NT**

**Trend Graphs**
**Monitoring Well: TF 03-12-3**

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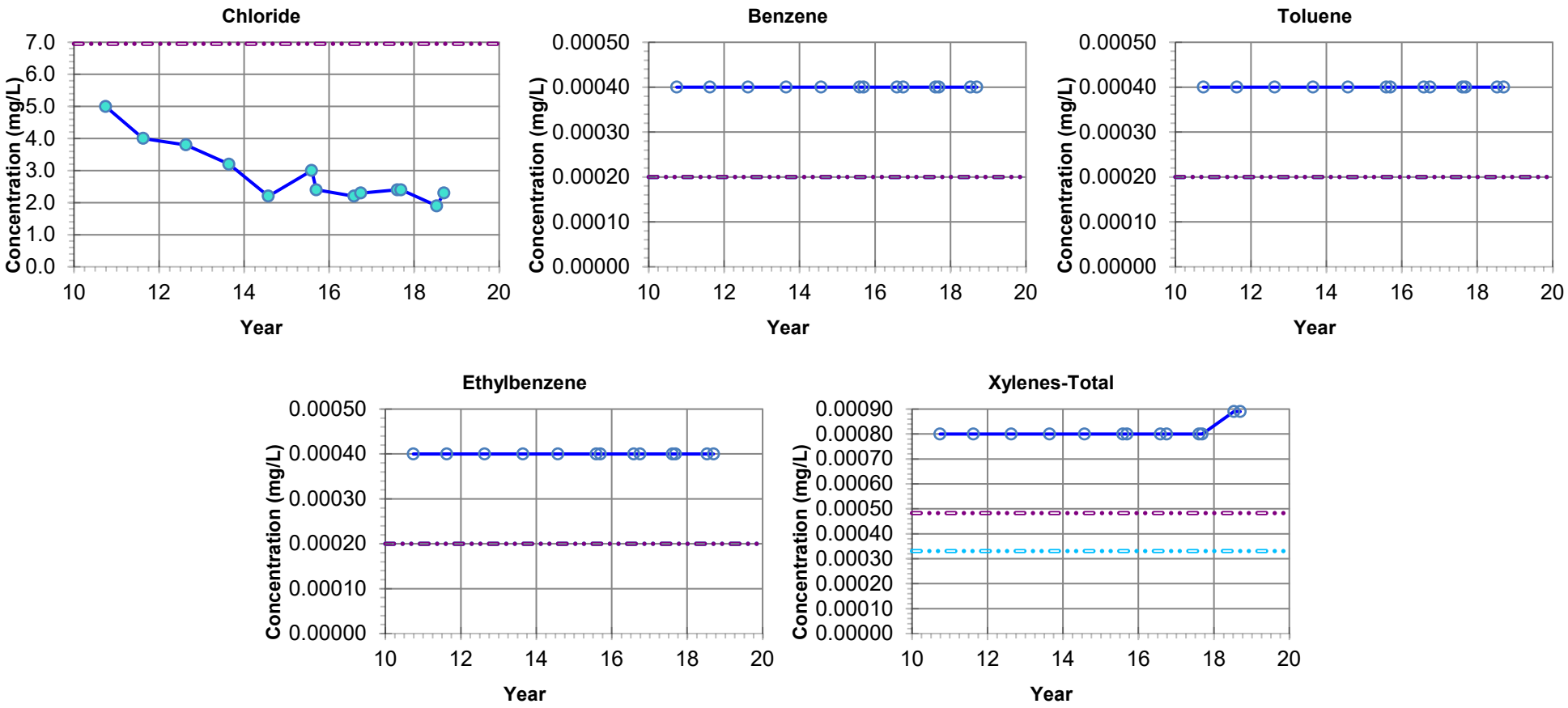
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**PROJECT NUMBER:** 407011-00586

**Figure** E-7

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**NOTES:** - Filled symbols denote Sample Values
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Infrastructure & Environment

**Imperial**
**2018 Surveillance Network Program**
**Norman Wells, NT**

**Trend Graphs**
**Monitoring Well: MEBG-10-1-3**

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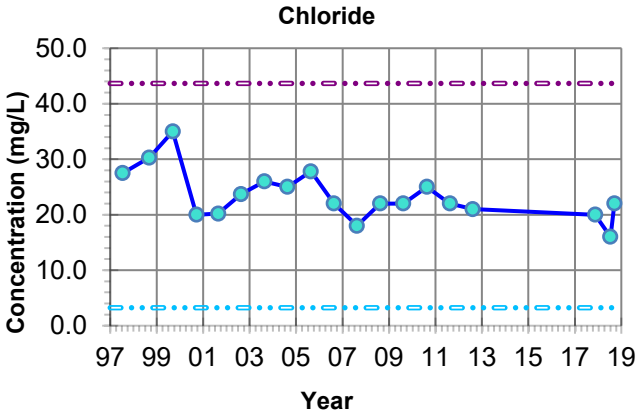
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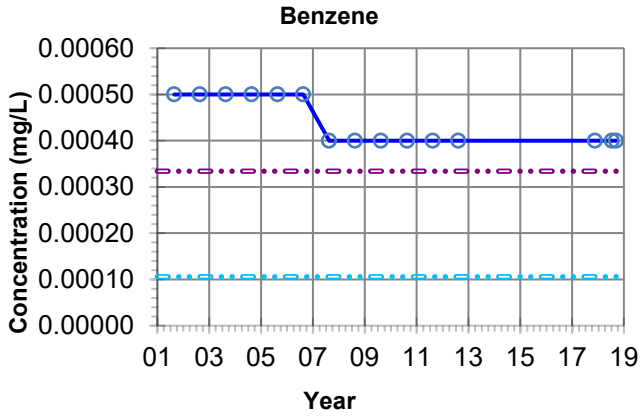
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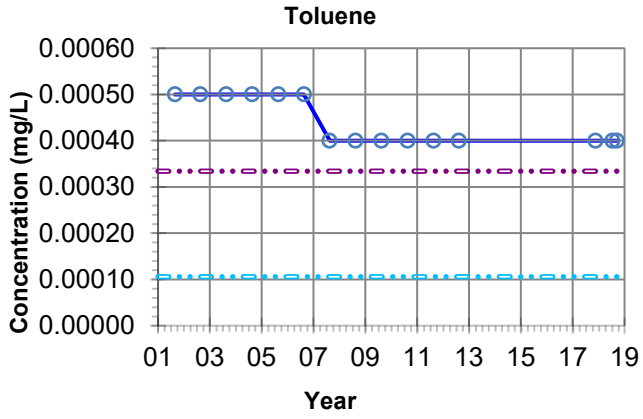
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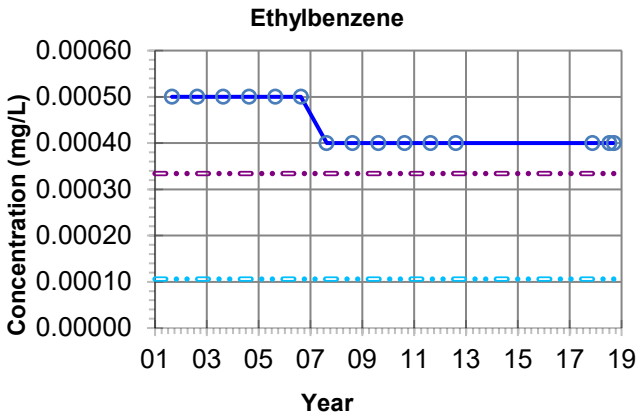
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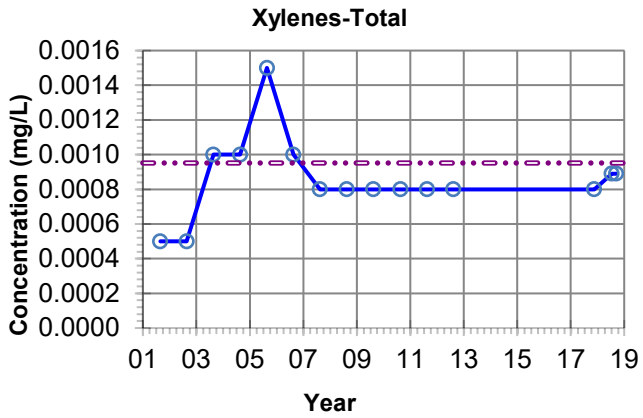
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**NOTES:** - Filled symbols denote Sample Values
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Upper Control Limit
Lower Control Limit

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Infrastructure & Environment

**Imperial**
**2018 Surveillance Network Program**
**Norman Wells, NT**

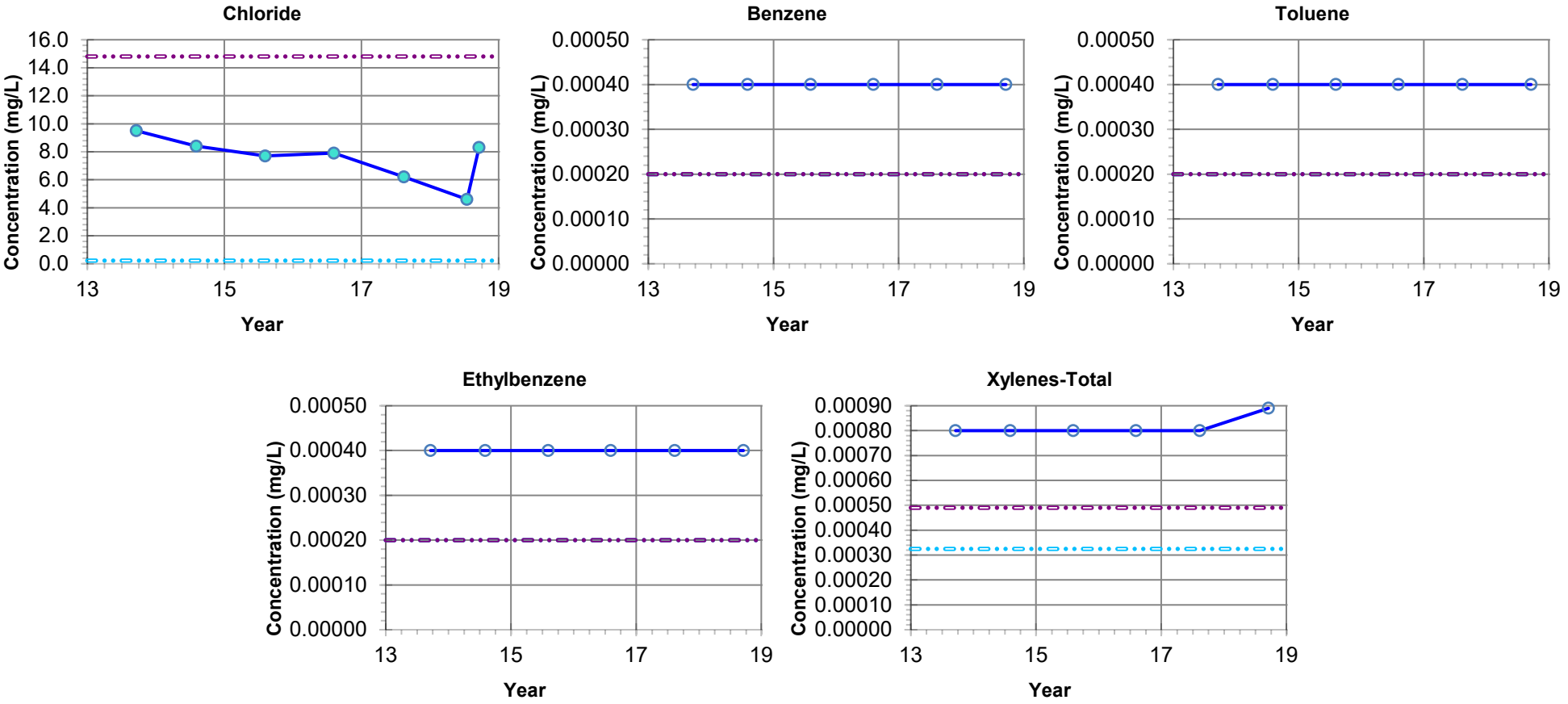
**Trend Graphs**
**Monitoring Well: BIS 97-1-3**

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| 05-Dec-2018 date | NA edited by | JC drawn by | NA app by | PROJECT NUMBER: 407011-00586 | Figure E-9 |
|---|---|---|---|---|---|

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Upper Control Limit
Lower Control Limit

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Infrastructure & Environment

**Imperial**
**2018 Surveillance Network Program**
**Norman Wells, NT**

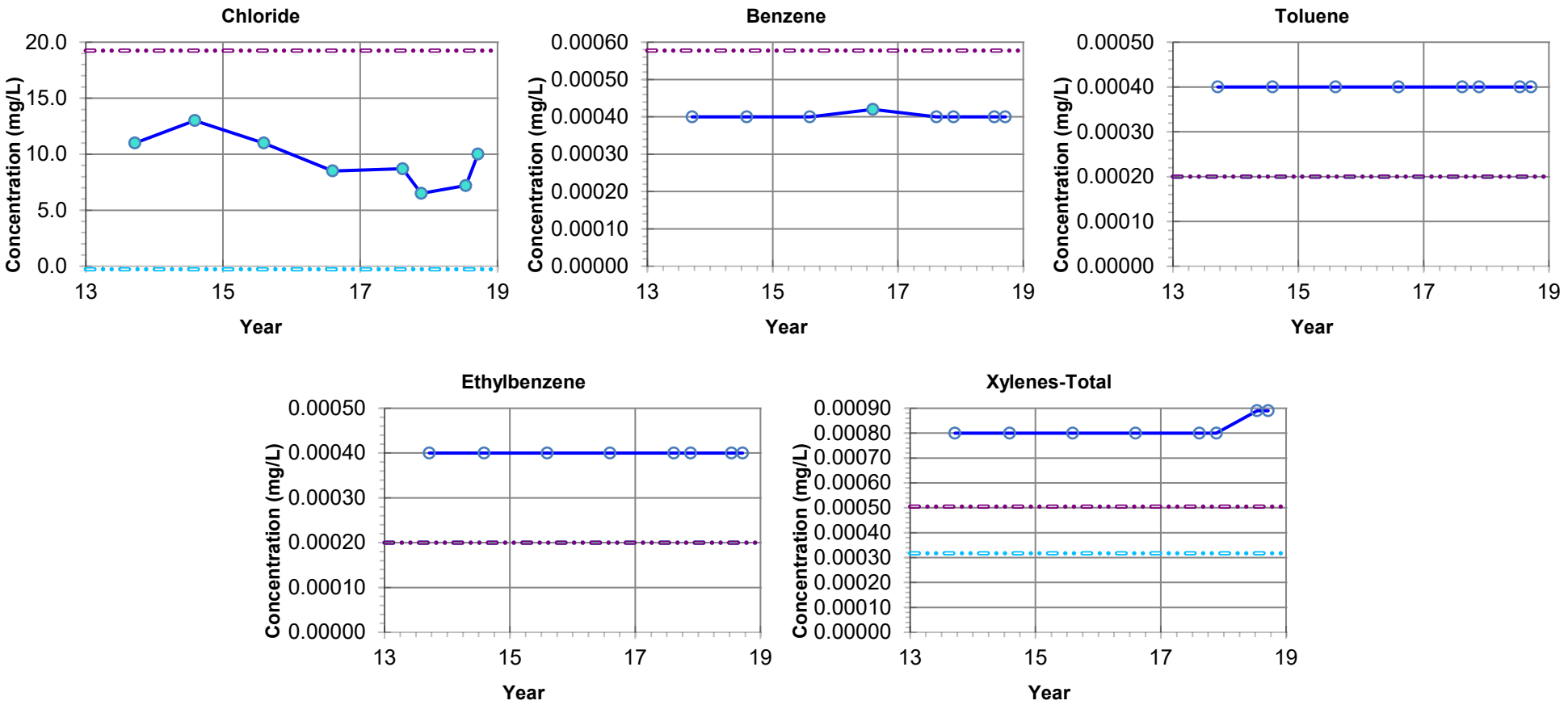
**Trend Graphs**
**Monitoring Well: BI-13-1-4**

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WorleyParsons Group

| 05-Dec-2018 date | NA edited by | JC drawn by | NA app by | PROJECT NUMBER: 407011-00586 | Figure E-10 |
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Upper Control Limit
Lower Control Limit

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Infrastructure & Environment

**Imperial**
**2018 Surveillance Network Program**
**Norman Wells, NT**

**Trend Graphs**
**Monitoring Well: BI-13-3-4.5**

| 05-Dec-2018 date | NA edited by | JC drawn by | NA app by |
|---|---|---|---|

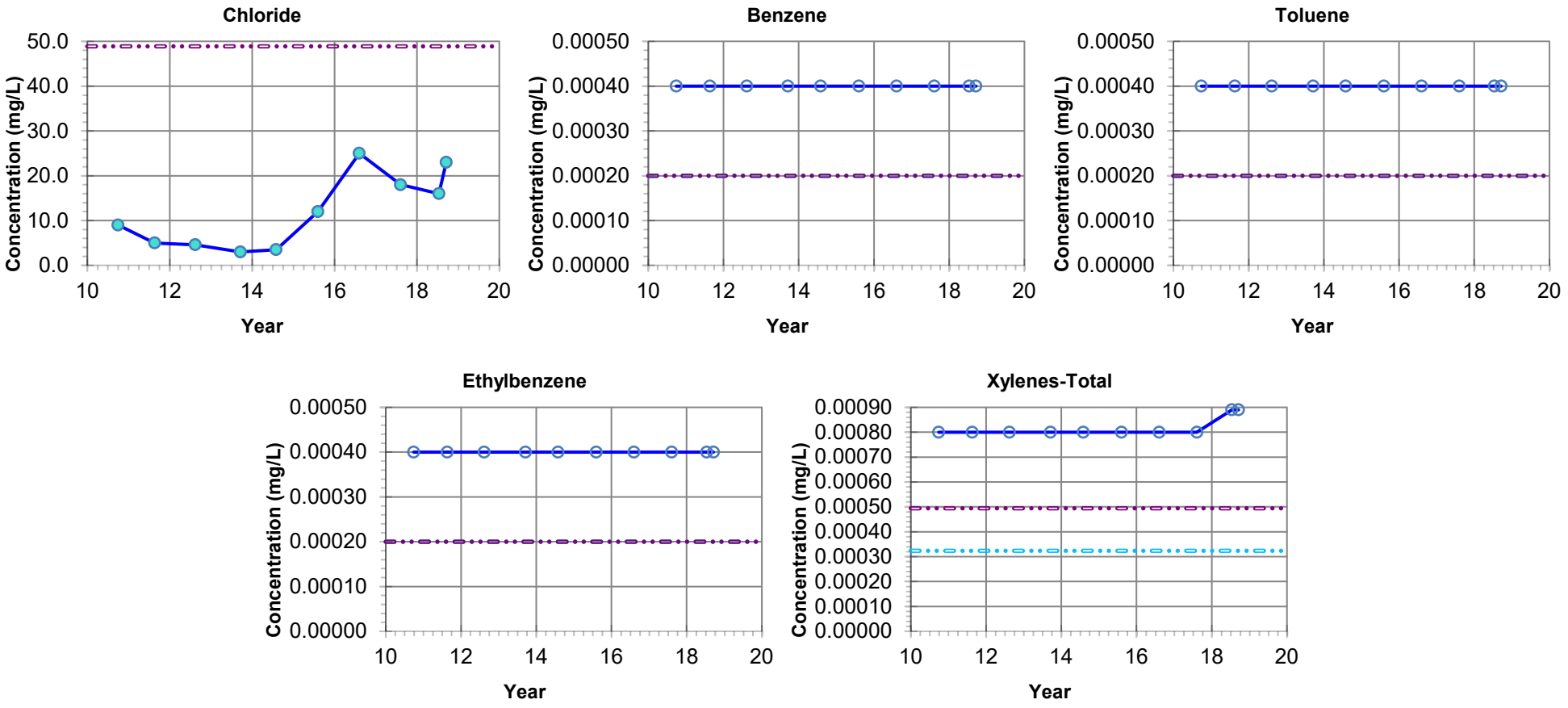
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PROJECT NUMBER: 407011-00586

Figure E-11

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**NOTES:** - Filled symbols denote Sample Values
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**GUIDELINE:**
**CCME CEQG Freshwater Aquatic Life**

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**Ethylbenzene - 0.09 mg/L**
**Chloride - 120 mg/L**

Infrastructure & Environment

**Imperial**
**2018 Surveillance Network Program**
**Norman Wells, NT**

**Trend Graphs**
**Monitoring Well: BIBG-10-1-4**

| 05-Dec-2018 date | NA edited by | JC drawn by | NA app by |
|---|---|---|---|

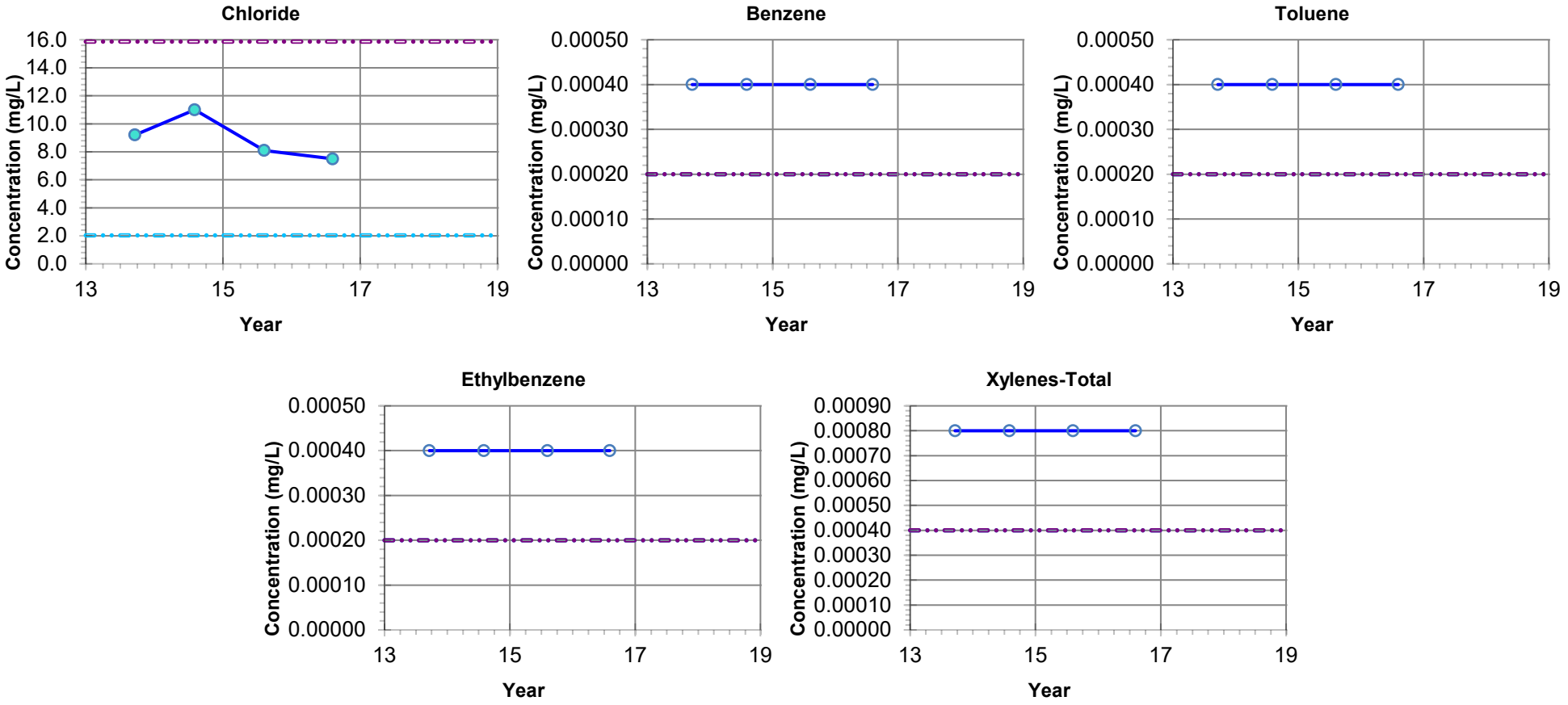
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**PROJECT NUMBER:** 407011-00586

**Figure** E-12

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**NOTES:** - Filled symbols denote Sample Values
- Unfilled symbols denote Values < Detection Limit(s)

– · – GUIDELINE:
CCME CEQG Freshwater Aquatic Life

Benzene - 0.37 mg/L
Toluene - 0.002 mg/L
Ethylbenzene - 0.09 mg/L
Chloride - 120 mg/L

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**Norman Wells, NT**

**Trend Graphs**
**Monitoring Well: BIBG-12-1-7**

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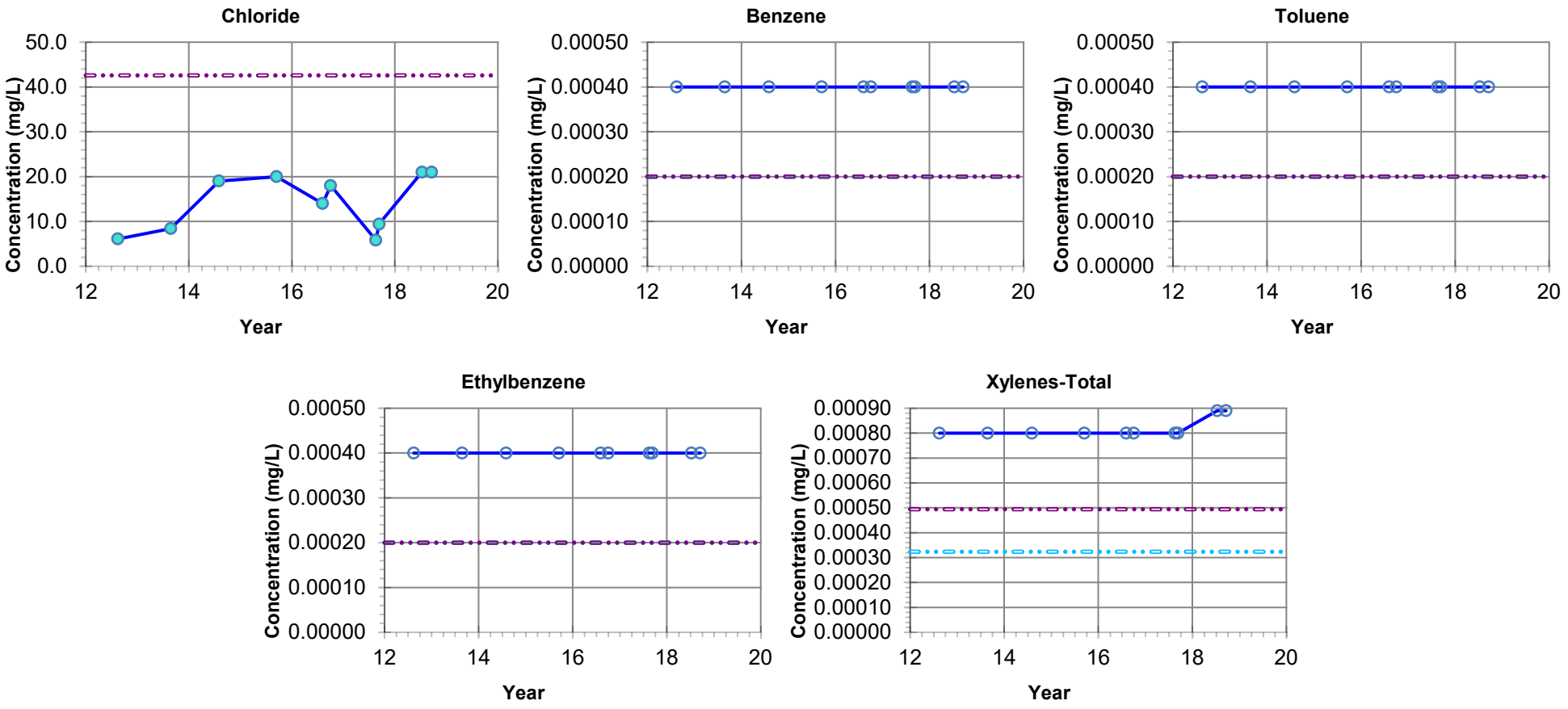
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PROJECT NUMBER: 407011-00586

Figure E-13

File Path: C:\Users\Jinrong.Cui\Desktop\Graphs\norman wells




**NOTES:** - Filled symbols denote Sample Values
- Unfilled symbols denote Values < Detection Limit(s)

– · – GUIDELINE:
CCME CEQG Freshwater Aquatic Life

Benzene - 0.37 mg/L
Toluene - 0.002 mg/L
Ethylbenzene - 0.09 mg/L
Chloride - 120 mg/L

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**Norman Wells, NT**

**Trend Graphs**
**Monitoring Well: GIQ8-10-2-4**

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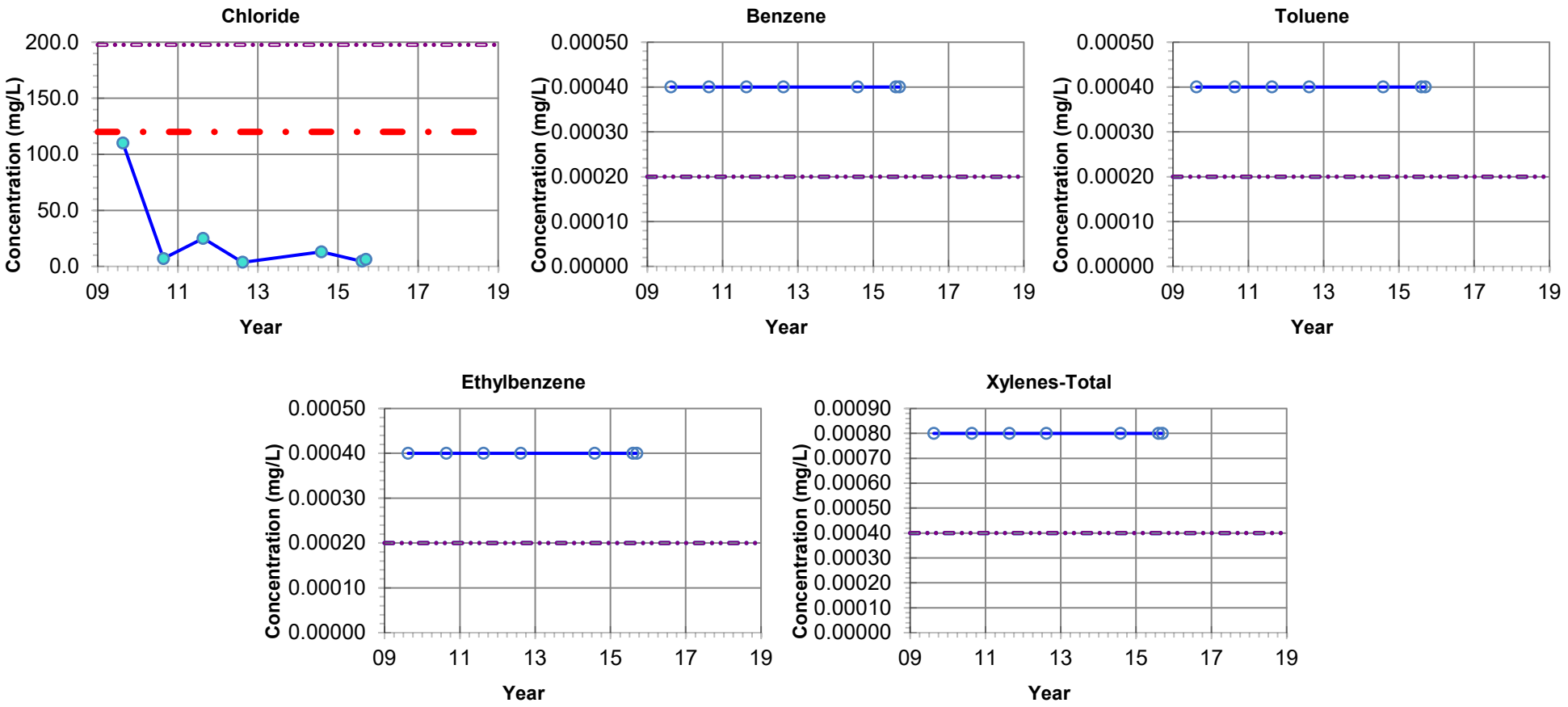
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**Figure** E-14

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**NOTES:** - Filled symbols denote Sample Values
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Upper Control Limit
Lower Control Limit

**GUIDELINE:**
**CCME CEQG Freshwater Aquatic Life**

**Benzene - 0.37 mg/L**
**Toluene - 0.002 mg/L**
**Ethylbenzene - 0.09 mg/L**
**Chloride - 120 mg/L**

Infrastructure & Environment

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**2018 Surveillance Network Program**
**Norman Wells, NT**

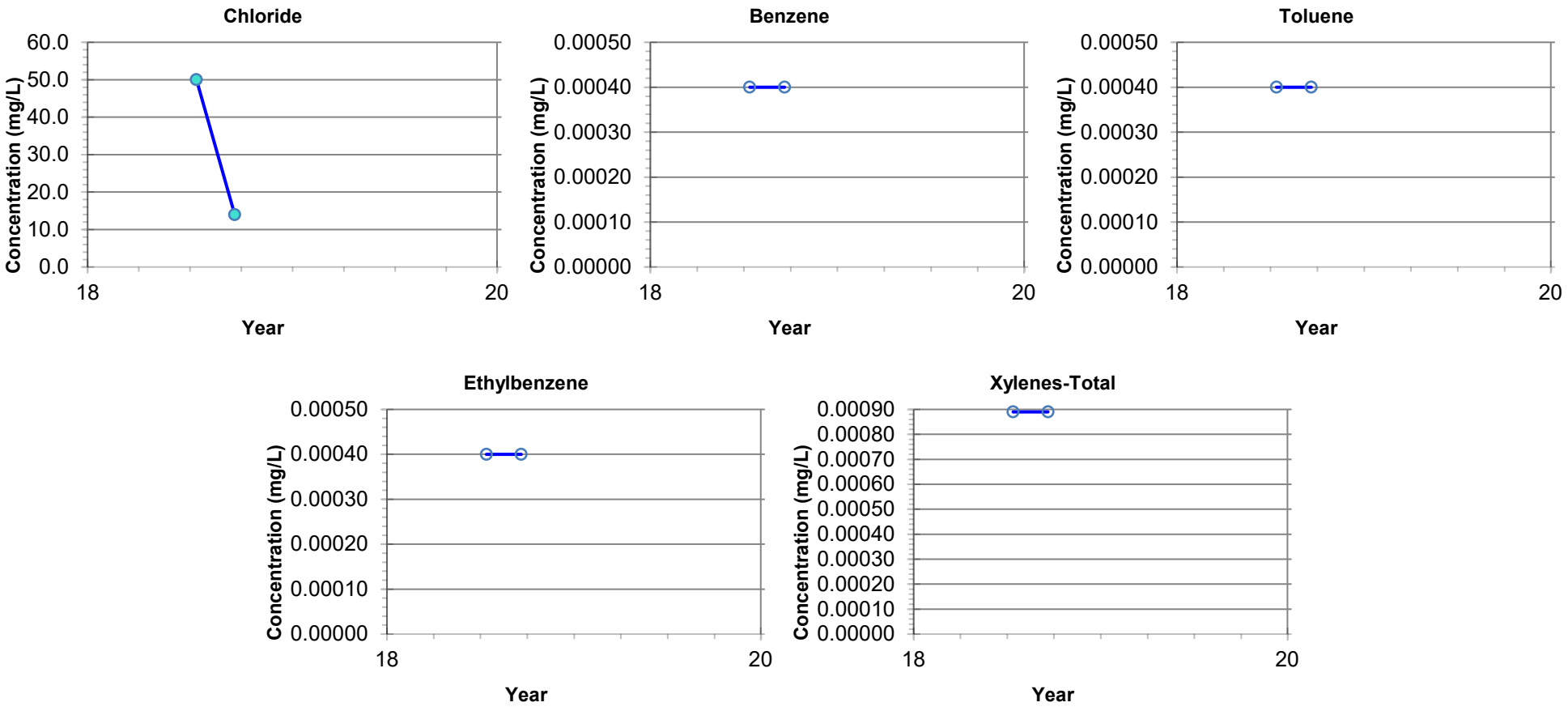
**Trend Graphs**
**Monitoring Well: GIP11 09-1-4**

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- Unfilled symbols denote Values < Detection Limit(s)

Upper Control Limit
Lower Control Limit

– · – GUIDELINE:
CCME CEQG Freshwater Aquatic Life

Benzene - 0.37 mg/L
Toluene - 0.002 mg/L
Ethylbenzene - 0.09 mg/L
Chloride - 120 mg/L

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**Trend Graphs**
**Monitoring Well: GIP11 09-1-4-R**

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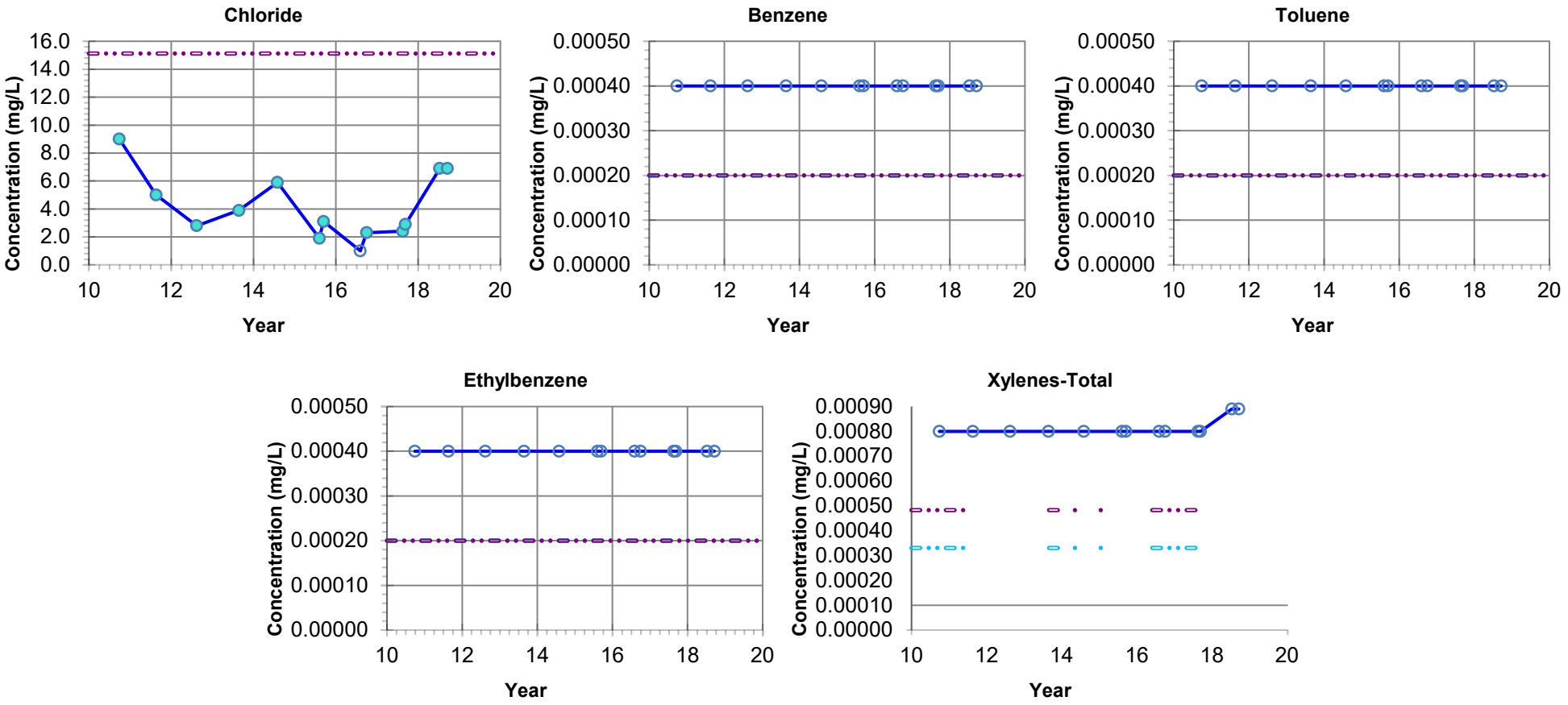
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Figure E-16

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- Unfilled symbols denote Values < Detection Limit(s)

**GUIDELINE:**
**CCME CEQG Freshwater Aquatic Life**

**Benzene - 0.37 mg/L**
**Toluene - 0.002 mg/L**
**Ethylbenzene - 0.09 mg/L**
**Chloride - 120 mg/L**

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**2018 Surveillance Network Program**
**Norman Wells, NT**

**Trend Graphs**
**Monitoring Well: GIBG-10-2-3**

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**Figure** E-17

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# Appendix F Background Geochemical Statistical Summary



Imperial

# Background Geochemical Statistical Summary (Appendix F)

## Norman Wells, NT

31 May 2018

407011-00622 – CA-REP-0006

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## Project No. 407011-00622-CA-REP-0006 - Background Geochemical Statistical Summary (Appendix 3): Norman Wells, NT

| Rev | Description | Originator Approval | Reviewer Approval | Project Manager Approval | Date |
|---|---|---|---|---|---|
| 0 | Issued as fnal | M. Brown | A. Glatiotis | S. Gibb | 31-May-18 |
| | | | | | |
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# 1. Introduction and Methodology

## 1.1 Introduction

Soil, bedrock, and groundwater analytical results from numerous Phase II Environmental Site Assessments (ESAs) conducted to date within the Norman Wells Field (the Site) have indicated that there are concentrations of select hydrocarbon, salt and metals parameters in certain lithologic / stratigraphic units that are naturally elevated above generic federal and territorial environmental quality guidelines. Understanding background (pre-industrial disturbance) environmental quality is required to properly evaluate site characterization data, and determine appropriate site remediation objectives and endpoints for the Norman Wells Field. The evaluation of background geochemical conditions is complicated by the presence of natural crude oil, gas, and saline water seepage in several Mainland areas of the Site.

This document includes a summary review and assessment of available data with the objective of determining background soil, bedrock and groundwater geochemical conditions, both within the natural seepage areas and outside of them, for the primary near surface (i.e. upper 20 metres (m)) lithologic / stratigraphic units present within the Norman Wells Field. To provide context the statistically evaluated results are compared to appropriate CCME federal regulatory guidelines for soil and groundwater quality, as summarized in the main text of this report.

## 1.2 Background Sampling Location Selection

### 1.2.1 Soil and Bedrock

The majority of the background soils/bedrock data was collected between 1998 and 2016. Data were collected for a range of environmental projects and it is possible that a location considered suitable for background purposes for a groundwater or subsurface soils investigation may not necessarily provide suitable background surface soils data due to disturbance of surface soils, or due to the presence of shale fill material. Only data from those background locations considered to have minimal or no potential industrial impact were included in the background assessment.

Background soil and bedrock sampling locations are shown on Figures 3-4, and summarized on Table 1. For the purposes of the Norman Wells environmental background assessment, soil and bedrock background locations were summarized into the following general categories / stratigraphic units:

- Surface organic soil generally above 0.5 mbgs:
  - Mainland (17 locations, 17 samples);
  - Mainland Seeps (4 locations, 4 samples); and
  - Islands (4 locations, 5 samples).
- Surface mineral soil (generally upper 0.5 m of soil profile):
  - Mainland (15 locations, 18 samples);
  - Mainland Seeps (5 locations, 8 samples); and

  - Islands (14 locations, 14 samples).
- Subsurface mineral soil (> 0.5 m below ground surface [bgs] to bedrock contact):
  - Mainland (28 locations, 53 samples);
  - Mainland Seeps (4 locations, 8 samples); and
  - Islands (19 locations, 45 samples).
- Bedrock:
  - Siltstone on Mainland (10 locations, 11 samples);
  - Mainland Seeps (2 locations, 4 samples); and
  - Shale Fill Material from Quarry (4 locations, 4 samples).

There were no natural seepage areas identified on the Islands and no bedrock was encountered or sampled during intrusive investigations on the Islands.

### 1.2.2 Groundwater

Background monitoring wells would ideally be installed in an undisturbed, up-gradient area, isolated from any potential sources of anthropogenic impact. However, these locations tend to be heavily influenced by permafrost in the vicinity of Norman Wells. Previous attempts to install background wells in up-gradient areas of the lease, removed from the Imperial facilities and in areas of natural vegetation, have resulted in rapidly frozen groundwater monitoring wells that consistently remain frozen. As such, the use of the term "background" in this report does not necessarily mean the groundwater monitoring well is installed in an undisturbed, up-gradient area. Rather, the term is used for locations inferred to be removed from site facilities and free of facility-related impacts.

Background groundwater sampling locations are shown on Figures 1-2, and summarized on Table 2. These background wells are separated into five groups, as follows. These groups are based on the hydrogeological zone where the monitoring well screen is completed, as well as evidence for the presence or absence of natural seepage in the vicinity:

- Surficial sediments on Mainland (14 wells, total of 64 samples);
- Surficial sediments on Natural Islands (10 wells, total of 65 samples);
- Shallow bedrock on Mainland inferred to represent natural saline water and hydrocarbon seepage (7 wells, total of 69 samples);
- Surficial sediments on Mainland inferred to represent natural saline water and hydrocarbon seepage (5 wells, total of 27 samples); and
- Surficial sediments on Mainland inferred to represent natural gas seepage without saline water (4 wells, total of 30 samples).

# 1.3 Analytical Data Compilation & Screening

## 1.3.1 Statistical Trend Analyses

Statistics were evaluated generally following protocols in U.S. EPA Unified Guidance (2009). Statistical trend analyses were used to evaluate temporal changes in key parameters at background locations for groundwater samples. A similar analysis could not be done on soil/bedrock data since these results do not have a temporal history, as they are derived from one-time drilling and sampling events. The presence of statistically significant temporal trends would suggest facility-related water quality impacts, meaning that the monitoring well in question may not be suitable as a background location. Key parameters considered for trend analyses were benzene, toluene, ethylbenzene, arsenic, copper, cadmium, iron and chloride.

The analysis was performed using the non-parametric Mann-Kendall trend test (Mann 1945; Kendall 1975; Gilbert 1987). The purpose of the Mann-Kendall (MK) test is to statistically assess if there is an upward or downward trend of the variable of interest over time. In each case, the trend analysis was conducted using the available data series from 2007 to 2013. The Mann-Kendall test was performed on data sets where at least four data points were available. To identify potentially significant trends, the trend analysis data was filtered using the probability of the trend: a probability of 95% or greater was used as the first level of screening, based on the statistical convention of $p < 0.05$ for rejection of the null hypothesis of "no trend".

## 1.3.2 Outliers Assessment

High outliers were reviewed for each sample group. High outliers were defined as data points which exist at three times the interquartile range (IQR) of the data set above the 75$^{th}$ percentile (> P75+3*IQR) for one of the analyzed parameters (AMSRP 2008). The IQR is the 75$^{th}$ percentile minus the 25$^{th}$ percentile (P75 - P25).

Samples detected as high outliers were reassessed by checking against the borehole log, location, other samples from the location, typographical error, and laboratory error. Samples deemed to be not impacted (false outliers) were still considered for the calculation of background statistical values while real outliers (potentially impacted or not reliable) were removed.

## 1.3.3 Statistical Analysis of Data

One of the key aspects of the statistical calculations is the method of dealing with results reported below the laboratory method detection limit (MDL), which is a frequent occurrence with some of the dissolved trace metals and hydrocarbons in particular. In order to calculate statistical values, a real number is required rather than a "less than" result. In the background statistical calculations analytical results reported below the MDL were conservatively considered as real numbers at the MDL value.

A geometric mean, minimum, maximum, and 95$^{th}$ percentile value for each parameter of interest was determined for each of the soil, bedrock and groundwater groups of interest.

# 2. Summary of Key Findings

## 2.1 Soil Statistical Background

Based on the review of the available statistical background data, the following general trends were inferred from data summarized on Table 3:

- Concentrations of one or more metals/trace elements (As, Mo, Ni, Se and Tl) exceeding CCME Industrial use guidelines have been confirmed in background organic surface soil and mineral subsurface soil on the Mainland.
- Above guideline SAR values have been measured / calculated for a limited number of mineral subsurface soil samples on the Mainland.
- In the Island soils, background metals concentrations in surface mineral soil are typically below CCME Parkland use guidelines. However, Mo may be present at concentrations above guidelines in the subsurface soil.
- EC levels above CCME Parkland use guidelines (2 dS/m) may be present in both organic and mineral soil on the Islands. The EC is typically associated with concentrations of sulphate, calcium and magnesium ions (considered to be naturally occurring) rather than chloride (considered to be an indicator of industrial activities).
- One or more BTEX and PHC F1 through F4 parameter concentrations above detection limits but generally below CCME guidelines have been reported in all strata and may be associated with organic matter and / or hydrocarbon seeps at the bedrock / soil interface, particularly in close proximity to the Mackenzie River.
- Background data sets for the organic and mineral surface soil on the Islands and natural seeps areas on the Mainland are limited and should be interpreted / referenced with caution.

## 2.2 Bedrock Statistical Background

General trends in bedrock geochemistry are based on a limited data set, and the following conclusions are derived from the data in Table 3:

- Concentrations of one or more metals/trace elements (As and Ni) exceeding CCME Industrial use guidelines have been confirmed in siltstone bedrock on the Mainland.
- Concentrations of As, Mo, Se and Tl exceeding CCME Industrial use guidelines have also been confirmed in shale bedrock samples collected from the Town of Norman Wells quarry. This shale material is used as fill throughout the Site and the adjacent Town.
- Above CCME Industrial use guideline SAR values have been measured / calculated for a limited number of siltstone bedrock samples from the Mainland.
- Background data sets for the bedrock are limited and should be interpreted / referenced with caution.

## 2.3 Groundwater Statistical Background

In terms of groundwater geochemistry, key characteristics noted for groundwater background locations in surficial sediments on both the Mainland and Islands areas are summarized below. Characteristics related to natural seepage areas are considered separately in Section 2.4 below:

- nitrate, nitrite and phenols levels were close to or exceeded the applied CCME Freshwater Aquatic Life (FWAL) guidelines in the near surface groundwater (Table 5);
- concentrations of several metals/trace elements (As, Cd, Cu, Fe, Pb, Hg, Se, Ag, Tl, U) exceeding CCME FWAL guidelines have been confirmed in shallow groundwater at Mainland locations (Table 6);
- at Islands background locations, a shorter list of metals/trace elements with groundwater concentrations exceeding CCME FWAL guidelines (Cd, Cu, Fe, U) is identified (Table 6);
- concentrations of PHC and/or PAH parameters are generally non-detectable in shallow groundwater background locations on the Islands, and at Mainland locations which are not identified as natural seepage zones (Tables 7, 8).

## 2.4 Natural Seepage Zones Statistical Background

General trends in soil and bedrock geochemistry for natural seeps areas are based on a limited data set, and include the following preliminary conclusions as summarized in Table 4:

- Soil/bedrock concentrations of one or more metals/trace elements (As and Ni) exceeding CCME Industrial use guidelines have been confirmed in natural seeps organic surface soil and mineral subsurface soil and/or bedrock on the Mainland.
- One or more natural seeps soil samples contained concentrations of benzene, PHC F1, PHC F2, PHC F3, and/or select PAHs (fluorene, naphthalene, phenanthrene) exceeding CCME guidelines for industrial and/or parkland use. Hydrocarbon concentrations appear to increase with depth in the natural seep areas.
- SAR levels in one or more natural seep mineral subsurface soil samples exceeded CCME parkland use guidelines.

In terms of groundwater geochemistry, key characteristics noted for the natural seepage zones are summarized below:

- chloride and phenols levels exceeded the applied CCME FWAL guidelines in the natural oil seeps in both upper bedrock and surficial sediments (Table 5);
- seeps identified as related to natural gas without saline water also exceeded the phenols guideline, but had chloride levels more typical of background non-seep surficial sediments (Table 5);
- concentrations of several metals/trace elements (Al, As, Cd, Cu, Fe, Pb, Hg, Se, Tl, U, Zn) exceeding CCME FWAL guidelines have been confirmed in groundwater near natural oil and gas seeps from both upper bedrock and surficial sediments (Table 6); and
- concentrations of several PHC and PAH parameters are detected in groundwater near natural oil and gas seeps, with toluene, anthracene, benzo(a)anthracene, benzo(a)pyrene, fluoranthene, naphthalene,

phenanthrene and pyrene exceeding CCME FWAL guidelines based on the statistical analyses. Benzene may also exceed the applied guideline in the inferred natural gas seeps, but is generally lower in the oil-related seeps (Tables 7, 8).

# 3. References

AMSRP (Abandoned Military Site Remediation Protocol), 2008. Abandoned Military Site Remediation Protocol. Vol II – Technical Supporting Documentation. Indian and Northern Affairs Canada (INAC) Contaminated Site Program. December 2008.

Gilbert, R.O. 1987. Statistical Methods for Environmental Pollution Monitoring, Wiley, NY.

Mann, H.B. 1945. Non-parametric tests against trend, Econometrica 13:163-171.

Kendall, M.G. 1975. Rank Correlation Methods, 4th edition, Charles Griffin, London.

U.S. EPA Unified Guidance 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance, March 2009. EPA 530/R-09-007. United States Environmental Protection Agency, Office of Resource Conservation and Recovery.

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# Figures



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## LEGEND

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NAD27 UTM ZONE 9N

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1:20000

IMPERIAL

APPENDIX 3 - BACKGROUND GEOCHEMICAL STATISTICAL SUMMARY

NORMAN WELLS, NT

## BACKGROUND MONITORING WELL LOCATIONS (MAINLAND)

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FIG No 1

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## LEGEND

- BACKGROUND MONITORING WELL LOCATION

NAD27 UTM ZONE 9N

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IMPERIAL

APPENDIX 3 - BACKGROUND GEOCHEMICAL STATISTICAL SUMMARY

NORMAN WELLS, NT

**BACKGROUND MONITORING WELL LOCATIONS (ISLANDS)**

| Date: | Drawn by: | Edited by: | App'd by: |
|---|---|---|---|
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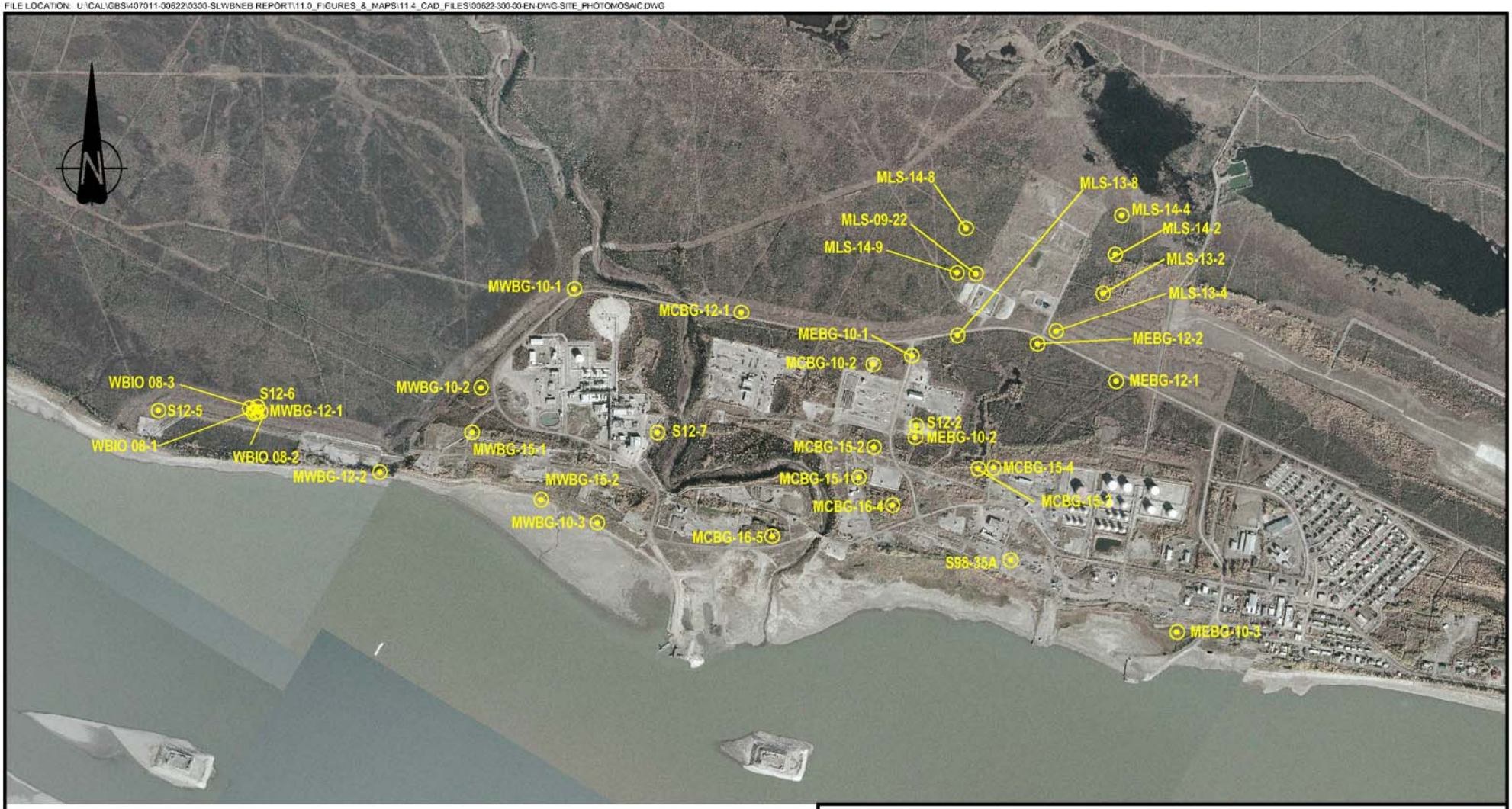
FIG No: 2

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## LEGEND

- BACKGROUND SOIL/BEDROCK SAMPLE LOCATION

NAD27 UTM ZONE 9N

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IMPERIAL

APPENDIX 3 - BACKGROUND GEOCHEMICAL STATISTICAL SUMMARY

NORMAN WELLS, NT

## BACKGROUND SOIL/BEDROCK SAMPLING LOCATIONS (MAINLAND)

| Date: | 23-MAY-18 | Drawn by: | MYT | Edited by: | B.M.F. | App'd by: | |
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FIG No 3 | REV B

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## LEGEND

- BACKGROUND SOIL/BEDROCK SAMPLE LOCATION

NAD27 UTM ZONE 9N

m 0 500 1000 2500 m

1:50000

IMPERIAL

APPENDIX 3 - BACKGROUND GEOCHEMICAL STATISTICAL SUMMARY

NORMAN WELLS, NT

## BACKGROUND SOIL/BEDROCK SAMPLING LOCATIONS (ALL AREAS)

| Date: | 23-MAY-18 | Drawn by: | MYT | Edited by: | B.M.F. | App'd by: | |
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# Table 1
## Background Soil / Bedrock Locations (1998-2016)

| AREA | LOCATIONS | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *Organic Surface Soil* | | *Mineral Surface Soil* | | *Mineral Subsurface Soil* | | *Bedrock* | |
| | Borehole ID | Sample Depths | Borehole ID | Sample Depths | Borehole ID | Sample Depths | Borehole ID | Sample Depth |
| **Mainland** | P98-35A | 0.0-0.15 m | MCBG-12-1 | 0.1-0.5 m | CLAY PIT#1 | Surface | **SILTSTONE** | |
| | MCBG-10-02 | 0.3-0.6 m | MLS-09-22 | 0.0-0.4 m | CLAY PIT#2 | Surface | MEBG-12-2 | 3.5-4.0 m |
| | MEBG-10-01 | 0.0-0.3 m | MWBG-12-2 | 0.3-0.6 m | A45X OVERBURDEN 1 | Surface | MWBG-10-01 | 2.4-2.7 m |
| | MEBG-12-1 | 0.0-0.3 m | S12-2D | 0.3-0.35 m | A45X OVERBURDEN 2 | Surface | MWBG-12-2 | 2.0-2.2 m |
| | MEBG-12-2 | 0.2-0.5 m | S12-2E | 0.3-0.35 m | WBIO 08-1 | 0.76-1.5, 2.3-3.0 m | MLS-13-4 | 2.0-2.2 m; 2.8-3.0 m |
| | MWBG-10-01 | 0.0-0.3 m | S12-2F | 0.3-0.35 m | WBIO 08-2 | 0.76-1.5, 2.3-3.0 m | MLS-14-4 | 3.0 m |
| | MWBG-10-02 | 0.0-0.3 m | S12-5D | 0.5-0.6 m | WBIO 08-3 | 0.76-1.5, 3.0-3.8 m | MLS-14-8 | 3.0 m |
| | MWBG-12-1 | 0.0-0.4 m | S12-6D | 0.1-0.2; 0.3-0.4 m | MCBG-10-02 | 0.6-1.0 m; 1.5-2.0 m | MLS-14-9 | 3.0 m |
| | S12-2D | 0.15-0.3 m | S12-6E | 0.1-0.2; 0.3-0.4 m | MCBG-12-1 | 0.6-0.9 m; 1.0-1.5 m; 1.7-2.1 m | MWBG-15-2 | 2.4-3.0 m |
| | S12-2E | 0.15-0.3 m | S12-6F | 0.1-0.2; 0.3-0.4 m | MEBG-10-01 | 0.3-0.6 m; 0.6-1.0 m; 2.5-3.0 m | MLS-14-2 | 2-2.5 m |
| | S12-2F | 0.15-0.3 m | MCBG-15-2 | 0.1-0.3 m | MEBG-10-2 | 0.3-0.6 m; 0.6-1.0 m; 1.8-2.3 m; 2.5-3.0 m | P98-35A | 2.0-3.0 m |
| | S12-5D | 0.1-0.2 m | MWBG-15-1 | 0.1-0.3 m | MEBG-12-1 | 1.5-2.0 m; 3.0-3.4 m | | |
| | MLS-13-8 | 0.5-0.7 m | MWBG-10-01 | 0.3-0.6 m | MEBG-12-2 | 1.0-1.5 m; 2.0-2.5 m | | |
| | MLS-14-4 | 1.0 m | MWBG-10-02 | 0.3-0.6 m | MWBG-10-01 | 0.6-1.0 m | | |
| | MWBG-15-1 | 0.0-0.1 m | MLS-14-2 | 1 m | MWBG-10-02 | 0.6-1.0 m; 2.4-2.7 m | | |
| | MCBG-15-2 | 0.0-0.1 m | | | MLS-09-22 | 1.0-1.3 m | | |
| | MEBG-10-2 | 0.0-0.3 m | | | MWBG-12-1 | 0.4-0.8 m; 1.5-2.0 m | | |
| | | | | | MLS-13-2 | 1.5-1.7 m; 2.0-2.2 m | | |
| | | | | | MLS-13-4 | 1.2-1.5 m | **SHALE** | |
| | | | | | MLS-13-8 | 1.3-1.5 m; 2.8-3.0 m | S12-Quarry 1 | Surface |
| | | | | | MLS-14-4 | 2.0 m | S12-Quarry 2 | Surface |
| | | | | | MLS-14-8 | 1.0 m; 2.0 m | S12-Quarry 3 | Surface |
| | | | | | MLS-14-9 | 1.0 m; 2.0 m | SHALE-1 | Surface |
| | | | | | MCBG-15-2 | 0.3-0.5 m; 2.4-3.0 m | | |
| | | | | | MWBG-15-1 | 0.3-0.8 m; 1.8-2.4 m | | |
| | | | | | MLS-14-2 | 2 m | | |
| | | | | | MCBG-16-4 | 0.7-1.1 m; 2.4-3.0 m; 4.0-4.5 m | | |
| | | | | | MEBG-16-5 | 0.6-1.2 m; 2.5-3.0 m; 4.2-4.8 m | | |
| **Mainland Natural Seepage Zones** | MEBG-10-3 | 0.0-0.3 m | MCBG-15-1 | 0.1-0.3 m; 0.3-0.5 m | MWBG-10-03 | 0.6-1.0; 2.2-2.7 m; 4.0-4.5 m | MCBG-15-1 | 4.2-4.8 m |
| | MCBG-15-1 | 0.0-0.1 m | MWBG-10-03 | 0.0-0.3 m; 0.3-0.6 m | MEBG-15-3 | 0.5-1.2 m; 2.4-3.0 m | MEBG-10-3 | 0.3-0.6 m; 0.6-1.0 m; 2.5-3.0 m |
| | MEBG-15-3 | 0.0-0.1 m | MEBG-15-3 | 0.1-0.5 m | MEBG-15-4 | 0.5-0.8 m; 1.8-2.4 m | | |
| | MEBG-15-4 | 0.0-0.2 m | MEBG-15-4 | 0.2-0.5 m | MWBG-15-2 | 2.4-3.0 m | | |
| | | | MWBG-15-2 | 0.0-0.15 m; 0.15-0.6 m | | | | |
| **Bear / Frenchy's/Goose Islands** | BI 08-01 | 0.0-0.3 m | BIBG-10-3 | 0.0-0.3 m | BI 08-01 | 0.8-1.2 m; 2.0-2.4 m | NA | NA |
| | BIBG-15-1 | 0.0-0.05 m; 0.05-0.4 m | BIBG-10-2 | 0.0-0.3 m | BIBG-10-3 | 0.3-0.6 m; 0.6-1.0 m; 1.8-2.1 m; 4.2-4.5 m | | |
| | BIBG-15-2 | 0.0-0.4 m | FIBG-10-1 | 0.0-0.3 m | BIBG-10-2 | 0.3-0.6 m; 0.6-1.0 m; 2.5-3.0 m; 4.0-4.5 m | | |
| | BIBG-15-3 | 0.0-0.2 m | GIBG-10-1 | 0.0-0.3 m | BIBG-10-1 | 0.9-1.2 m; 1.2-1.5 m; 1.5-1.8 m; 4.0-4.3 m | | |
| | | | GIBG-10-2 | 0.0-0.3 m | BIBG-12-1 | 0.5-0.8 m; 2.7-3.0 m; 4.2-4.5 m; 6.0-6.5 m; 7.0-7.5 m | | |
| | | | S12-8D | 0.1-0.2 m | BIBG-12-2 | 1.0-1.5 m; 3.5-4.0 m; 4.5-5.0 m | | |
| | | | S12-9D | 0.2-0.3 m | FIBG-10-1 | 0.3-0.6 m; 0.6-1.0 m; 2.3-2.8 m | | |
| | | | BIBG-15-1 | 0.4-0.8 m | GIBG-10-1 | 0.3-0.6 m; 0.6-1.0 m; 2.5-3.0 m | | |
| | | | BIBG-15-2 | 0.4-0.8 m | GIBG-10-2 | 0.3-0.6 m; 0.6-1.0 m; 1.8-2.3 m; 3.0-3.3 m | | |
| | | | BIBG-15-3 | 0.2-0.5 m | S12-8D | 0.5-0.6 m | | |
| | | | GIBG-15-13 | 0.6 m | BIBG-15-1 | 1.8-2.4 m | | |
| | | | GIBG-15-14 | 0.3 m | BIBG-15-2 | 1.8-2.4 m | | |
| | | | GIBG-15-15 | 1.0 m | BIBG-15-3 | 0.5-1.0 m | | |
| | | | GIBG-15-16 | 0.3 m | BIBG-15-3 | 1.8-2.4 m | | |
| | | | | | GIBG-15-13 | 0.8 m; 4.8 m | | |
| | | | | | GIBG-15-14 | 1.8 m; 3.6 m | | |
| | | | | | GIBG-15-15 | 3.5 m | | |
| | | | | | GIBG-15-16 | 1.8 m; 3.2 m | | |
| | | | | | BIBG-16-12 | 1.0-1.3 m | | |

Notes:
NA = not applicable. No bedrock or seeps observed/sampled on Natural Islands.

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# Table 2
## Background Groundwater Sampling Locations (1997-2017)

| Monitoring Well | Original Location Code (soil borehole / piezometer) | Depth Interval of Sandpack (m bgs) | Hydrogeologic Unit | Lithology Within Screened Interval |
|---|---|---|---|---|
| **Background Surficial Sediments Not Associated with Natural Seepage Zones** | | | | |
| | | | | |
| ***Mainland Locations - Surficial Sediments*** | | | | |
| **B38 93-2-4** | B38 93-2-4 | less than 4 m | Surficial sediment | no borehole log |
| **BT3 97-2-5** | BT3 97-2-5 | 1.10 - 4.60 | Surficial sediment | Silt |
| **MCBG-10-1-3** | MCBG-10-02 / 10-1-3 | 0.80 - 2.50 | Surficial sediment | Clayey Silt / Peat / Silty Clay |
| **MCBG-12-1-2** | MCBG-12-1 / BH-12-1-2 | 0.50 - 3.00 | Surficial sediment | Topsoil, Sand, Silty Clay |
| **MEBG-10-1-3** | MEBG-10-2 / 10-1-3 | 1.00 - 3.00 | Surficial sediment | Silty Sand / Clayey Silt |
| **MEBG-12-2-3** | MEBG-12-2 / 12-2-3 | 0.80 - 3.00 | Surficial sediment | Silty Clay and Bedrock |
| **MLS 09-6-2** | MLS 09-06-2 | 0.80 - 2.20 | Surficial sediment | Silty clay and bedrock |
| **MLS-13-9-3** | MLS-13-9 / MLS-13-9-3 | 0.90 - 2.40 | Surficial sediment | |
| **MLS-14-3-3** | MLS14-3 / MLS-14-3-3 | 1.50 - 3.00 | Surficial sediment | Silt |
| **MLS-14-4-3** | MLS14-4 / MLS-14-4-3 | 1.50 - 3.00 | Surficial sediment | Clayey silt, silt and gravel |
| **MLS-14-8-3** | MLS14-8 / MLS-14-8-3 | 1.50 - 3.00 | Surficial sediment | Clayey silt |
| **MWBG-10-1-3** | MWBG-10-02 / 10-1-3 | 0.80 - 2.70 | Surficial sediment | Silt / Clay |
| **MWBG-12-1-3** | MWBG-12-2 / 12-1-3 | 1.20 - 3.00 | Surficial sediment | Silt and Siltstone |
| **WBIO 08-1-2** | WBIO 08-1-2 | 0.60 - 2.40 | Surficial sediment | Sandy clay / Silty sand |
| ***Bear and Frenchy's Island Locations - Surficial Sediments*** | | | | |
| **BI 08-1-4** | BI 08-1-4 | 0.60 - 2.40 | Surficial sediment | Silty clay |
| **BI-13-6-2** | BI-13-6 / 13-6-2.4 | 0.60 - 2.70 | Surficial sediment | Silt and Clayey silt |
| **BI-14-8-3** | BI-14-8 / 14-8-3 | 1.66 - 3.16 | Surficial sediment | Silty clay |
| **BIBG-10-1-4** | BIBG-10-3 / 10-1-4 | 0.78 - 4.10 | Surficial sediment | Silty Clay / Sand |
| **BIBG-10-2-4** | BIBG-10-2 / 10-2-4 | 0.50 - 3.77 | Surficial sediment | Sand |
| **BIBG-12-1-7** | BIBG-12-1 / 12-1-7 | 3.80 - 7.50 | Surficial sediment | Silty Sand / Sandy Silt |
| **BIBG-12-2-4** | BIBG-12-02 / 12-2-4 | 0.70 - 4.20 | Surficial sediment | Silty Clay / Sandy Silt |
| **FIBG-10-1-4** | FIBG-10-1 / 10-1-4 | 0.69 - 3.97 | Surficial sediment | Silty Clay / Sand |
| ***Goose Island Locations - Surficial Sediments*** | | | | |
| **GIBG-10-1-5** | GIBG-10-1 / 10-1-5 | 1.20 - 4.50 | Surficial sediment | Sandy Silt |
| **GIBG-10-2-3** | GIBG-10-2 / 10-2-3 | 1.30 - 3.00 | Surficial sediment | Sand |

| Monitoring Well | Original Location Code (soil borehole / piezometer) | Depth Interval of Sandpack (m bgs) | Hydrogeologic Unit | Lithology Within Screened Interval |
|---|---|---|---|---|
| **Background Surficial Sediments and Bedrock Associated with Natural Seepage Zones** | | | | |
| | | | | |
| ***Background – Shallow Bedrock - Inferred to Represent Natural Hydrocarbon and Saline Water Seepage*** | | | | |
| NWR 98-18-15 | NWR 98-18-15 | 11.00 - 14.70 | Shallow bedrock | Siltstone |
| NWR 99-16-17 | NWR 99-16-17 | 12.60 - 17.00 | Shallow bedrock | Siltstone |
| RB 02-3-2 | RB 02-3-2 | 0.60 - 3.30 | Shallow bedrock | Siltstone / Shale |
| NWR-09-1-20 | NWR-09-1-20 | 16.50 - 20.00 | Shallow bedrock | Shale / Siltstone / Sandstone |
| NWR-09-3-20 | NWR-09-3-20 | 16.10 - 20.20 | Shallow bedrock | Sandstone |
| NWR-09-4-17 | NWR-09-4-17 | 15.24 - 17.30 | Shallow bedrock | Siltstone |
| BT3-99-21-12 | BT3-99-21-12 | 8.50 - 12.20 | Shallow bedrock | Siltstone |
| ***Background – Surficial Sediments - Inferred to Represent Natural Hydrocarbon and Saline Water Seepage*** | | | | |
| NWR 03-38-3 | NWR 03-38-3 | 0.50 - 3.00 | Surficial sediment | Sand and clay |
| RB-13-2-2.4 | RB-13-2 / RB-13-2-2.4 | 0.60 - 2.55 | Surficial sediment | Gravelly Sand and Clay |
| RB-13-4-3 | RB-13-4 / RB-13-4-3 | 1.20 - 3.30 | Surficial sediment | Sandy Gravel |
| RB-13-5-2.4 | RB-13-5 / RB-13-5-2.4 | 0.60 - 2.55 | Surficial sediment | Sandy Clay and Siltstone |
| RB-13-8-1.5 | RB-13-8 / RB-13-8-1.5 | 0.16 - 1.50 | Surficial sediment | Sandy Clay |
| ***Background – Surficial Sediments - Inferred to Represent Natural Gas Seepage Without Saline Water*** | | | | |
| MEBG-15-4-3 | MEBG-15-4 | 1.50 - 3.60 | Surficial sediment | Silty Clay |
| MLS-14-2-3 | MLS14-2 / MLS-14-2-3 | 1.00 - 2.50 | Surficial sediment | Silty Clay and Siltstone |
| B38 02-33-3 | B38X-02-2 / B38X 02-33-3 | 1.10 - 3.10 | Surficial sediment | Sandy Silt |
| B38 02-34-3 | B38X-02-3 / B38X 02-34-3 | 1.50 - 3.50 | Surficial sediment | Clayey Silt |

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# Table 3
## Soil and Bedrock Background Geochemical Statistical Summary (1998-2016)

**Background Geochemical Statistics for Soil and Bedrock: Salinity Parameters**

**Imperial Oil - Norman Wells**

| | pH (pH units) | EC (dS/m) | SAR (ratio) |
|---|---|---|---|
| CCME Residential/Parkland Fine Surface (Islands) | 6 - 8 | 2 | 5 |
| CCME Industrial Fine Surface (Mainland) | 6 - 8 | 4 | 12 |
| 95th Percentile Background - Organic Surface Soil (Mainland) | 7.52 | 1.13 | 1.38 |
| Maximum Background - Organic Surface Soil (Mainland) | 7.57 | 1.5 | 1.5 |
| 95th Percentile Background - Organic Surface Soil (Islands) | 7.83 | 2.9 | 0.7 |
| Maximum Background - Organic Surface Soil (Islands) | 7.9 | 3.3 | 0.75 |
| 95th Percentile Background - Mineral Surface Soil (Mainland) | 7.49 | 0.71 | 1.65 |
| Maximum Background - Mineral Surface Soil (Mainland) | 7.61 | 0.73 | 2 |
| 95th Percentile Background - Mineral Surface Soil (Islands) | 7.76 | 2.9 | 1.04 |
| Maximum Background - Mineral Surface Soil (Islands) | 7.77 | 2.9 | 1.4 |
| 95th Percentile Background - Mineral Subsurface Soil (Mainland) | 8.04 | 1.91 | 5.68 |
| Maximum Background - Mineral Subsurface Soil (Mainland) | 8.1 | 2.4 | 22 |
| 95th Percentile Background - Mineral Subsurface Soil (Islands) | 7.76 | 2.5 | 0.64 |
| Maximum Background - Mineral Subsurface Soil (Islands) | 7.81 | 2.9 | 1.1 |
| 95th Percentile Background - Bedrock (Mainland Siltstone) | 7.67 | 1.52 | 22.85 |
| Maximum Background - Bedrock (Mainland Siltstone) | 7.72 | 1.26 | 26 |
| 95th Percentile Background - Bedrock (Mainland Shale) | NC | NC | NC |
| Maximum Background - Bedrock (Mainland Shale) | NC | NC | NC |

| | |
|---|---|
| NA | Denotes guideline not available |
| NC | Denotes parameters not measured / not calculated |
| | Shading indicates parameters above most restrictive guidelines selected |

**Background Geochemical Statistics for Soil and Bedrock: Metals and Trace Elements**

**Imperial Oil - Norman Wells**

| | Antimony (mg/kg) | Arsenic (mg/kg) | Barium (mg/kg) | Beryllium (mg/kg) | Boron (Hot Water Soluble) (mg/kg) | Cadmium (mg/kg) | Chromium (6+) (mg/kg) | Chromium (mg/kg) | Cobalt (mg/kg) | Copper (mg/kg) | Lead (mg/kg) | Mercury (mg/kg) | Molybdenum (mg/kg) | Nickel (mg/kg) | Selenium (mg/kg) | Thallium (mg/kg) | Uranium (mg/kg) | Vanadium (mg/kg) | Zinc (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CCME Residential/Parkland Fine Surface (Islands) | 20 | 12 | 500 | 4 | --- | 10 | 0.4 | 64 | 50 | 63 | 140 | 6.6 | 10 | 50 | 1 | 1 | 23 | 130 | 200 |
| CCME Industrial Fine Surface (Mainland) | 40 | 12 | 2000 | 8 | --- | 22 | 1.4 | 87 | 300 | 91 | 600 | 50 | 40 | 50 | 2.9 | 1 | 300 | 130 | 360 |
| 95th Percentile Background - Organic Surface Soil (Mainland) | 2 | 9.05 | 471 | 0.83 | 2.64 | 1.01 | 0.15 | 51 | 10.7 | 22.7 | 12 | 0.13 | 17.2 | 33.8 | 1.62 | 1.26 | 4.2 | 45.7 | 90.2 |
| Maximum Background - Organic Surface Soil (Mainland) | 2 | 11 | 515 | 0.9 | 3 | 1.03 | 0.15 | 86.4 | 12 | 26 | 14 | 0.14 | 44 | 39 | 2.7 | 2.5 | 4.5 | 47 | 100 |
| 95th Percentile Background - Organic Surface Soil (Islands) | 1 | 9.7 | 356 | 0.8 | 0.45 | 0.94 | 0.14 | 16.4 | 8.9 | 20.6 | 10.6 | 0.1 | 2.1 | 28.2 | 1 | 0.36 | 0.8 | 26.2 | 116 |
| Maximum Background - Organic Surface Soil (Islands) | 1 | 10 | 380 | 0.8 | 0.45 | 1 | 0.15 | 17 | 9 | 21 | 11 | 0.1 | 2.2 | 29 | 1 | 0.4 | 0.9 | 27 | 120 |
| 95th Percentile Background - Mineral Surface Soil (Mainland) | 1 | 12.6 | 397 | 0.84 | 1.13 | 0.89 | 0.15 | 29.8 | 14 | 26 | 13.2 | 0.08 | 2.6 | 41.6 | 0.89 | 0.3 | 1.5 | 46.1 | 142 |
| Maximum Background - Mineral Surface Soil (Mainland) | 1 | 19 | 402 | 0.87 | 1.2 | 1.09 | 0.15 | 37 | 18 | 35 | 14 | 0.09 | 2.8 | 56 | 0.9 | 0.3 | 1.9 | 50 | 150 |
| 95th Percentile Background - Mineral Surface Soil (Islands) | 1 | 8.8 | 353 | 0.62 | 0.31 | 0.9 | 0.15 | 21.5 | 9.54 | 21.8 | 12.6 | 0.07 | 3.2 | 29.6 | 0.88 | 0.3 | 1 | 29.4 | 108.5 |
| Maximum Background - Mineral Surface Soil (Islands) | 1 | 9.4 | 360 | 0.63 | 0.31 | 1.32 | 0.15 | 30 | 9.8 | 23 | 13.9 | 0.08 | 4.1 | 32 | 1.01 | 0.3 | 1.2 | 29.5 | 140 |
| 95th Percentile Background - Mineral Subsurface Soil (Mainland) | 1 | 25.2 | 398 | 1.06 | 1.86 | 0.89 | 0.18 | 35 | 18.9 | 37.8 | 18.4 | 0.11 | 5.58 | 60.4 | 1.28 | 0.7 | 2 | 48.6 | 148 |
| Maximum Background - Mineral Subsurface Soil (Mainland) | 2 | 49 | 660 | 1.4 | 3.7 | 2 | 0.3 | 39 | 24.7 | 45 | 25.6 | 0.33 | 11 | 127 | 2.7 | 1 | 2.3 | 66 | 350 |
| 95th Percentile Background - Mineral Subsurface Soil (Islands) | 1 | 9.25 | 368 | 0.6 | 0.52 | 0.7 | 0.15 | 18 | 9.4 | 22.9 | 11 | 0.06 | 2.4 | 29.9 | 0.8 | 0.3 | 1 | 30 | 99.9 |
| Maximum Background - Mineral Subsurface Soil (Islands) | 2 | 9.9 | 408 | 0.8 | 0.58 | 0.9 | 0.15 | 20 | 10 | 25 | 12 | 0.1 | 14 | 31 | 1 | 1 | 2 | 36 | 120 |
| 95th Percentile Background - Bedrock (Mainland Siltstone) | 1 | 23.8 | 454 | 0.93 | 3 | 0.12 | 0.15 | 41.8 | 21.8 | 50 | 14.8 | 0.11 | 0.74 | 63.2 | 0.5 | 0.3 | 1 | 62.2 | 148 |
| Maximum Background - Bedrock (Mainland Siltstone) | 1 | 24 | 500 | 0.95 | 3.1 | 0.12 | 0.15 | 42 | 22 | 53 | 15 | 0.12 | 0.81 | 64 | 0.5 | 0.3 | 1 | 64 | 150 |
| 95th Percentile Background - Bedrock (Mainland Shale) | NC | 39.6 | NC | 0.65 | NC | 0.74 | NC | 51.2 | 6.97 | 42.5 | 10.8 | 0.284 | 64.7 | 49.2 | 7.56 | 2.29 | NC | 125.7 | 106.2 |
| Maximum Background - Bedrock (Mainland Shale) | NC | 42.9 | NC | 0.66 | NC | 0.82 | NC | 53.6 | 7.16 | 43.6 | 11 | 0.312 | 66.4 | 49.6 | 7.9 | 2.33 | NC | 129 | 108 |

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# Table 3
## Soil and Bedrock Background Geochemical Statistical Summary (1998-2016)

**Background Geochemical Statistics for Soil and Bedrock: Petroleum Hydrocarbon Parameters**

**Imperial Oil - Norman Wells**

| | Benzene (mg/kg) | Toluene (mg/kg) | Ethylbenzene (mg/kg) | Xylenes (Total) (mg/kg) | PHC-F1 (-BTEX) (mg/kg) | PHC-F2 (mg/kg) | PHC-F3 (mg/kg) | PHC-F4 (mg/kg) | Acenaphthene (mg/kg) | Acenaphthylene (mg/kg) | Anthracene (mg/kg) | Benzo(a)anthracene (mg/kg) | Benzo(a)pyrene (mg/kg) | Benzo[b&j]fluoranthene (mg/kg) | Chrysene (mg/kg) | Dibenzo[a,h]anthracene (mg/kg) | Fluoranthene (mg/kg) | Fluorene (mg/kg) | Indeno[1,2,3-cd]pyrene (mg/kg) | Naphthalene (mg/kg) | Phenanthrene (mg/kg) | Pyrene (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CCME Residential/Parkland Fine Surface (Islands) | 2.1 | 110 | 120 | 65 | 210 | 150 | 1300 | 5600 | 0.28 | 320 | 2.5 | 1 | 0.6 | 1 | 6.2 | 1 | 15.4 | 0.25 | 1 | 0.013 | 0.046 | 7.7 |
| CCME Industrial Fine Surface (Mainland) | 2.8 | 330 | 430 | 230 | 320 | 260 | 2500 | 6600 | 0.28 | 320 | 32 | 10 | 72 | 10 | NA | 10 | 180 | 0.25 | 10 | 0.013 | 0.046 | 100 |
| 95th Percentile Background - Organic Surface Soil (Mainland) | 0.018 | 0.073 | 0.036 | 0.144 | 43.3 | 111.5 | 831.5 | 195.5 | 0.016 | 0.016 | 0.012 | 0.02 | 0.02 | 0.02 | 0.15 | 0.0158 | 0.0196 | 0.026 | 0.0196 | 0.0226 | 0.3224 | 0.0476 |
| Maximum Background - Organic Surface Soil (Mainland) | 0.019 | 0.076 | 0.038 | 0.15 | 45 | 150 | 1200 | 200 | 0.019 | 0.019 | 0.015 | 0.02 | 0.02 | 0.02 | 0.23 | 0.019 | 0.02 | 0.03 | 0.02 | 0.025 | 0.52 | 0.066 |
| 95th Percentile Background - Organic Surface Soil (Islands) | 0.0234 | 0.0704 | 0.0436 | 0.288 | 25.2 | 41.2 | 422 | 157 | 0.005 | 0.005 | 0.004 | 0.005 | 0.005 | 0.0145 | 0.008 | 0.005 | 0.0078 | 0.0069 | 0.005 | 0.0301 | 0.035 | 0.0135 |
| Maximum Background - Organic Surface Soil (Islands) | 0.028 | 0.083 | 0.052 | 0.35 | 27 | 44 | 440 | 160 | 0.005 | 0.005 | 0.004 | 0.005 | 0.005 | 0.015 | 0.008 | 0.005 | 0.0083 | 0.0072 | 0.005 | 0.033 | 0.037 | 0.014 |
| 95th Percentile Background - Mineral Surface Soil (Mainland) | 0.011 | 0.044 | 0.022 | 0.088 | 14.1 | 33.8 | 277 | 118 | 0.005 | 0.005 | 0.004 | 0.01 | 0.01 | 0.014 | 0.01 | 0.005 | 0.01 | 0.018 | 0.01 | 0.0117 | 0.0289 | 0.0134 |
| Maximum Background - Mineral Surface Soil (Mainland) | 0.012 | 0.046 | 0.023 | 0.092 | 15 | 38 | 310 | 120 | 0.005 | 0.005 | 0.004 | 0.01 | 0.01 | 0.015 | 0.01 | 0.005 | 0.01 | 0.019 | 0.01 | 0.012 | 0.031 | 0.014 |
| 95th Percentile Background - Mineral Surface Soil (Islands) | 0.0182 | 0.0656 | 0.047 | 0.34 | 29.2 | 43.8 | 274 | 90 | 0.005 | 0.005 | 0.004 | 0.008 | 0.008 | 0.0255 | 0.0176 | 0.007 | 0.012 | 0.01 | 0.011 | 0.0395 | 0.0379 | 0.0192 |
| Maximum Background - Mineral Surface Soil (Islands) | 0.038 | 0.095 | 0.089 | 0.72 | 52 | 72 | 370 | 96 | 0.005 | 0.005 | 0.004 | 0.009 | 0.009 | 0.029 | 0.019 | 0.008 | 0.014 | 0.011 | 0.012 | 0.05 | 0.04 | 0.021 |
| 95th Percentile Background - Mineral Subsurface Soil (Mainland) | 0.015 | 0.02 | 0.016 | 0.081 | 18.3 | 83.7 | 536.5 | 209.5 | 0.006 | 0.006 | 0.004 | 0.006 | 0.009 | 0.022 | 0.025 | 0.006 | 0.011 | 0.013 | 0.01 | 0.018 | 0.045 | 0.02 |
| Maximum Background - Mineral Subsurface Soil (Mainland) | 0.02 | 0.18 | 0.059 | 0.34 | 42 | 180 | 1800 | 830 | 0.01 | 0.01 | 0.004 | 0.01 | 0.01 | 0.027 | 0.026 | 0.01 | 0.012 | 0.03 | 0.01 | 0.022 | 0.063 | 0.022 |
| 95th Percentile Background - Mineral Subsurface Soil (Islands) | 0.005 | 0.02 | 0.01 | 0.04 | 15.5 | 27 | 207 | 86 | 0.005 | 0.005 | 0.004 | 0.005 | 0.005 | 0.019 | 0.034 | 0.005 | 0.008 | 0.005 | 0.0064 | 0.025 | 0.059 | 0.0164 |
| Maximum Background - Mineral Subsurface Soil (Islands) | 0.02 | 0.048 | 0.021 | 0.04 | 30 | 79 | 380 | 96 | 0.005 | 0.005 | 0.004 | 0.005 | 0.005 | 0.02 | 0.059 | 0.005 | 0.008 | 0.005 | 0.009 | 0.028 | 0.11 | 0.019 |
| 95th Percentile Background - Bedrock (Mainland) | 0.0775 | 0.4 | 0.96 | 6.08 | 96.8 | 825.5 | 1265 | 288 | 0.034 | 0.023 | 0.004 | 0.023 | 0.0065 | 0.027 | 0.122 | 0.007 | 0.014 | 0.236 | 0.005 | 0.048 | 0.771 | 0.08 |
| Maximum Background - Bedrock (Mainland) | 0.15 | 0.78 | 1.9 | 12.1 | 140 | 920 | 1400 | 410 | 0.037 | 0.025 | 0.004 | 0.025 | 0.0067 | 0.027 | 0.13 | 0.007 | 0.014 | 0.26 | 0.005 | 0.05 | 0.83 | 0.086 |

# Table 4
## Natural Seeps Soil and Bedrock Background Geochemical Statistical Summary (1998-2016)

**Background Geochemical Statistics for Natural Seeps Soil and Bedrock: Salinity Parameters**

Imperial Oil - Norman Wells

| | pH (pH units) | EC (dS/m) | SAR (ratio) |
|---|---|---|---|
| CCME Industrial Fine Surface | 6 - 8 | 4 | 12 |
| 95th Percentile Background - Organic Surface Soil (Mainland) | 7.45 | 1.32 | 1.27 |
| Maximum Background - Organic Surface Soil (Mainland) | 7.49 | 1.4 | 1.4 |
| 95th Percentile Background - Mineral Surface Soil (Mainland) | 7.72 | 0.79 | 0.64 |
| Maximum Background - Mineral Surface Soil (Mainland) | 7.72 | 0.8 | 0.7 |
| 95th Percentile Background - Mineral Subsurface Soil (Mainland) | 7.78 | 0.98 | 7.28 |
| Maximum Background - Mineral Subsurface Soil (Mainland) | 7.8 | 1.1 | 11 |
| 95th Percentile Background - Bedrock (Mainland Siltstone) | 7.75 | 0.9 | 2.84 |
| Maximum Background - Bedrock (Mainland Siltstone) | 7.78 | 0.97 | 2.9 |

NA Denotes guideline not available
NC Denotes parameters not measured / not calculated
Shading indicates parameters above most restrictive guidelines selected

**Background Geochemical Statistics for Natural Seeps Soil and Bedrock: Metals and Trace Elements**

Imperial Oil - Norman Wells

| | Antimony (mg/kg) | Arsenic (mg/kg) | Barium (mg/kg) | Beryllium (mg/kg) | Boron (Hot Water Soluble) (mg/kg) | Cadmium (mg/kg) | Chromium (6+) (mg/kg) | Chromium (mg/kg) | Cobalt (mg/kg) | Copper (mg/kg) | Lead (mg/kg) | Mercury (mg/kg) | Molybdenum (mg/kg) | Nickel (mg/kg) | Selenium (mg/kg) | Thallium (mg/kg) | Uranium (mg/kg) | Vanadium (mg/kg) | Zinc (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CCME Industrial Fine Surface | 40 | 12 | 2000 | 8 | --- | 22 | 1.4 | 87 | 300 | 91 | 600 | 50 | 40 | 50 | 2.9 | 1 | 300 | 130 | 360 |
| 95th Percentile Background - Organic Surface Soil (Mainland) | 1 | 10.4 | 476.5 | 0.8 | 3.1 | 1.35 | 0.14 | 29.5 | 14.4 | 23.7 | 20.7 | 0.11 | 12.5 | 45.1 | 1.08 | 0.55 | 2.83 | 43 | 127 |
| Maximum Background - Organic Surface Soil (Mainland) | 1 | 11 | 520 | 0.8 | 3.5 | 1.5 | 0.15 | 33 | 16 | 24 | 21 | 0.11 | 14 | 49 | 1.1 | 0.6 | 3 | 46 | 130 |
| 95th Percentile Background - Mineral Surface Soil (Mainland) | 1 | 11.6 | 419.5 | 0.83 | 0.68 | 0.9 | 0.15 | 23.55 | 10.3 | 18.6 | 13.6 | 0.08 | 2.23 | 29.6 | 0.91 | 0.3 | 1.6 | 41.8 | 113 |
| Maximum Background - Mineral Surface Soil (Mainland) | 1 | 13 | 430 | 0.85 | 0.7 | 1.1 | 0.15 | 26 | 11 | 19 | 14 | 0.1 | 2.3 | 31 | 1 | 0.3 | 1.6 | 46 | 120 |
| 95th Percentile Background - Mineral Subsurface Soil (Mainland) | 1 | 20.2 | 360 | 0.87 | 1.65 | 0.96 | 0.15 | 33.6 | 17.4 | 41.8 | 15.4 | 0.05 | 2.84 | 52.2 | 0.98 | 0.3 | 1.28 | 46.8 | 154 |
| Maximum Background - Mineral Subsurface Soil (Mainland) | 1 | 25 | 380 | 0.99 | 2.3 | 1.2 | 0.15 | 42 | 21 | 49 | 17 | 0.05 | 3 | 63 | 1.1 | 0.3 | 1.4 | 54 | 170 |
| 95th Percentile Background - Bedrock (Mainland Siltstone) | 1 | 21 | 194 | 0.61 | 1.2 | 0.1 | 0.15 | 36.4 | 18.7 | 30.1 | 11 | 0.076 | 0.4 | 55.1 | 0.5 | 0.3 | 1 | 86.8 | 135.5 |
| Maximum Background - Bedrock (Mainland Siltstone) | 1 | 21 | 200 | 0.65 | 1.2 | 0.1 | 0.15 | 37 | 19 | 31 | 11 | 0.08 | 0.4 | 56 | 0.5 | 0.3 | 1 | 94 | 140 |

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# Table 4
## Natural Seeps Soil and Bedrock Background Geochemical Statistical Summary (1998-2016)

**Background Geochemical Statistics for Natural Seeps Soil and Bedrock: Petroleum Hydrocarbon Parameters**

Imperial Oil - Norman Wells

| | Benzene (mg/kg) | Toluene (mg/kg) | Ethylbenzene (mg/kg) | Xylenes (Total) (mg/kg) | PHC-F1 (-BTEX) (mg/kg) | PHC-F2 (mg/kg) | PHC-F3 (mg/kg) | PHC-F4 (mg/kg) | Acenaphthene (mg/kg) | Acenaphthylene (mg/kg) | Anthracene (mg/kg) | Benzo(a)anthracene (mg/kg) | Benzo(a)pyrene (mg/kg) | Benzo[b&j]fluoranthene (mg/kg) | Chrysene (mg/kg) | Dibenzo[a,h]anthracene (mg/kg) | Fluoranthene (mg/kg) | Fluorene (mg/kg) | Indeno[1,2,3-cd]pyrene (mg/kg) | Naphthalene (mg/kg) | Phenanthrene (mg/kg) | Pyrene (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CCME Industrial Fine Surface | 2.8 | 330 | 430 | 230 | 320 | 260 | 2500 | 6600 | 0.28 | 320 | 32 | 10 | 72 | 10 | NA | 10 | 180 | 0.25 | 10 | 0.013 | 0.046 | 100 |
| 95th Percentile Background - Organic Surface Soil (Mainland) | 0.011 | 0.044 | 0.022 | 0.09 | 18 | 150.7 | 4645 | 3019 | 0.01 | 0.01 | 0.008 | 0.01 | 0.0117 | 0.029 | 0.121 | 0.0117 | 0.011 | 0.0117 | 0.011 | 0.015 | 0.254 | 0.019 |
| Maximum Background - Organic Surface Soil (Mainland) | 0.011 | 0.044 | 0.022 | 0.09 | 19 | 160 | 5200 | 3400 | 0.01 | 0.01 | 0.008 | 0.01 | 0.012 | 0.032 | 0.14 | 0.012 | 0.011 | 0.012 | 0.011 | 0.016 | 0.29 | 0.019 |
| 95th Percentile Background - Mineral Surface Soil (Mainland) | 0.009 | 0.037 | 0.184 | 0.074 | 12.6 | 215.5 | 4750 | 3135 | 0.0165 | 0.011 | 0.009 | 0.013 | 0.026 | 0.016 | 0.107 | 0.009 | 0.019 | 0.017 | 0.012 | 0.034 | 0.045 | 0.043 |
| Maximum Background - Mineral Surface Soil (Mainland) | 0.012 | 0.046 | 0.023 | 0.092 | 13 | 240 | 5100 | 3800 | 0.02 | 0.012 | 0.01 | 0.014 | 0.032 | 0.017 | 0.15 | 0.01 | 0.024 | 0.021 | 0.013 | 0.047 | 0.052 | 0.059 |
| 95th Percentile Background - Mineral Subsurface Soil (Mainland) | 2.655 | 0.078 | 2.96 | 18.55 | 973 | 2706.5 | 4438.5 | 1691.5 | 0.149 | 0.02 | 0.004 | 0.076 | 0.005 | 0.065 | 0.633 | 0.006 | 0.034 | 0.646 | 0.005 | 1.386 | 2.366 | 0.286 |
| Maximum Background - Mineral Subsurface Soil (Mainland) | 2.9 | 0.097 | 4.3 | 21 | 1400 | 3900 | 6500 | 2500 | 0.21 | 0.026 | 0.004 | 0.11 | 0.005 | 0.091 | 0.95 | 0.006 | 0.048 | 0.93 | 0.005 | 2.1 | 3.5 | 0.43 |
| 95th Percentile Background - Bedrock (Mainland) | 0.034 | 0.02 | 0.018 | 0.06 | 139.5 | 1185 | 2780 | 1035.5 | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |
| Maximum Background - Bedrock (Mainland) | 0.039 | 0.02 | 0.02 | 0.063 | 150 | 1200 | 2900 | 1100 | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC | NC |

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# Table 5
## Groundwater Indicator Parameters - Background Geochemical Statistical Summary (1997-2017)

**PROJECT No.: 407011-00622**

| Monitoring Station | Bicarbonate (mg/L) | Calcium (mg/L) | Carbonate (CO3) (mg/L) | Chloride (mg/L) | Electrical Conductivity (uS/cm) | Hardness (as CaCO3) (mg/L) | Hydroxide (mg/L) | Nitrate (as N) (mg/L) | Nitrite (as N) (mg/L) | pH (pH units) | Phenols (mg/L) | Potassium (mg/L) | PP Alkalinity (as CaCO3) (mg/L) | Sodium (mg/L) | Sulphate (mg/L) | Total Dissolved Solids (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CCME 2015. CEQG Freshwater Aquatic Life** | --- | --- | --- | 120 | --- | --- | --- | 3 | 0.06 | (6.5 - 9) | 0.004 | --- | --- | --- | --- | --- |
| **Background Surficial Sediments** | | | | | | | | | | | | | | | | |
| Mainland Locations - Surficial Sediments - 95th Percentile Background | 1000 | 322 | 0.5 | 18 | 2355 | 1253 | 0.5 | 5.4 | 0.03 | 8.1 | 0.013 | 5.4 | 1.0 | 160 | 727.5 | 1640 |
| Mainland Locations - Surficial Sediments - Maximum Background | 1100 | 400 | 0.5 | 26 | 2800 | 1600 | 0.5 | 36 | 0.11 | 8.1 | 0.021 | 12.0 | 1.0 | 180 | 980 | 2200 |
| Bear, Goose, and Frenchy's Islands - Surficial Sediments - 95th Percentile Background | 987 | 480 | 0.5 | 18 | 2600 | 1600 | 0.5 | 2.5 | 0.04 | 8.0 | 0.014 | 4.5 | 0.5 | 125 | 970 | 2295 |
| Bear, Goose, and Frenchy's Islands - Surficial Sediments - Maximum Background | 1200 | 540 | 0.5 | 25 | 3000 | 1800 | 0.5 | 23 | 0.17 | 8.1 | 0.048 | 5.3 | 0.5 | 520 | 1200 | 2700 |
| **Background Shallow Bedrock Inferred to Represent Natural Saline Water & Hydrocarbon Seepage** | | | | | | | | | | | | | | | | |
| Shallow Bedrock - Natural Saline Water & Oil Seepage - 95th Percentile Background | 1570 | 147 | 26 | 314 | 2954 | 350 | 0.5 | 1.8 | 0.06 | 8.5 | 0.019 | 6.4 | 21.5 | 747 | 98 | 1956 |
| Shallow Bedrock - Natural Saline water & Oil Seepage - Maximum Background | 1680 | 170 | 40 | 346 | 3100 | 390 | 1.0 | 4.0 | 0.26 | 8.6 | 0.025 | 6.8 | 33.0 | 771 | 185 | 2600 |
| **Background Surficial Sediments Inferred to Represent Natural Saline Water & Hydrocarbon Seepage** | | | | | | | | | | | | | | | | |
| Surficial Sediments - Natural Saline Water & Oil Seepage - 95th Percentile Background | 1220 | 350 | 62 | 280 | 2780 | 1200 | 1.0 | 0.2 | 0.06 | 8.7 | 0.020 | 7.5 | 51.0 | 440 | 990 | 2015 |
| Surficial Sediments - Natural Saline Water & Oil Seepage - Maximum Background | 1300 | 390 | 200 | 291 | 2800 | 1300 | 1.0 | 0.4 | 0.06 | 10.1 | 0.023 | 8.6 | 160.0 | 680 | 1000 | 2300 |
| **Background Surficial Sediments Inferred to Represent Natural Gas Seepage without Saline Water** | | | | | | | | | | | | | | | | |
| Surficial Sediments - Natural Gas & Non-Saline Water Seepage - 95th Percentile Background | 879 | 270 | 1.0 | 11 | 1392 | 741 | 1.0 | 0.2 | 0.06 | 7.7 | 0.063 | 7.0 | 1.0 | 49 | 204 | 948 |
| Surficial Sediments - Natural Gas & Non-Saline Water Seepage - Maximum Background | 950 | 330 | 1.0 | 13 | 1600 | 750 | 1.0 | 0.2 | 0.06 | 7.9 | 0.072 | 10.0 | 1.0 | 72 | 330 | 1200 |

NA Denotes guideline not available
NC Denotes parameters not measured / not calculated
Shading indicates parameters above most restrictive guidelines selected

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# Table 6
## Groundwater Dissolved Metals - Background Geochemical Statistical Summary (1997-2017)

**PROJECT No.: 407011-00622**

| Monitoring Station | Aluminum (mg/L) | Arsenic (mg/L) | Barium (mg/L) | Boron (mg/L) | Cadmium (mg/L) | Chromium (mg/L) | Copper (mg/L) | Iron (mg/L) | Lead (mg/L) | Manganese (mg/L) | Mercury (mg/L) | Molybdenum (mg/L) | Nickel (mg/L) | Selenium (mg/L) | Silver (mg/L) | Thallium (mg/L) | Uranium (mg/L) | Zinc (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CCME 2015. CEQG Freshwater Aquatic Life** | **0.1** | **0.005** | **---** | **1.5** | **0.00009** | **0.0089** | **0.004** | **0.3** | **0.007** | **---** | **0.000026** | **0.073** | **0.15** | **0.001** | **0.00025** | **0.0008** | **0.015** | **0.03** |
| **Background Surficial Sediments** | | | | | | | | | | | | | | | | | | |
| Mainland Locations - Surficial Sediments - 95th Percentile Background | 0.05 | 0.006 | 0.55 | 0.29 | 0.0020 | 0.007 | 0.012 | 5 | 0.020 | 3 | 0.00037 | 0.005 | 0.03 | 0.003 | 0.0100 | 0.020 | 0.040 | 0.030 |
| Mainland Locations - Surficial Sediments - Maximum Background | 0.08 | 0.070 | 0.88 | 0.34 | 0.0020 | 0.010 | 0.020 | 10 | 0.100 | 4 | 0.00094 | 0.005 | 0.04 | 0.030 | 0.0100 | 0.030 | 1.0 | 0.042 |
| Bear, Goose, and Frenchy's Islands - Surficial Sediments - 95th Percentile Background | 0.03 | 0.002 | 0.22 | 0.04 | 0.00047 | 0.001 | 0.010 | 12 | 0.001 | 6 | 0.00000 | 0.025 | 0.02 | 0.001 | 0.0001 | 0.0002 | 0.029 | 0.030 |
| Bear, Goose, and Frenchy's Islands - Surficial Sediments - Maximum Background | 0.04 | 0.004 | 0.23 | 0.09 | 0.00073 | 0.010 | 0.014 | 64 | 0.002 | 10 | 0.00000 | 0.041 | 0.04 | 0.002 | 0.0010 | 0.002 | 0.082 | 0.034 |
| **Background Shallow Bedrock Inferred to Represent Natural Saline Water & Hydrocarbon Seepage** | | | | | | | | | | | | | | | | | | |
| Shallow Bedrock - Natural Saline Water & Oil Seepage - 95th Percentile Background | 0.12 | 0.050 | 7.51 | 1.34 | 0.0020 | 0.007 | 0.012 | 2 | 0.030 | 0.3 | 0.00025 | 0.009 | 0.02 | 0.004 | 0.0002 | 0.030 | 0.076 | 0.018 |
| Shallow Bedrock - Natural Saline water & Oil Seepage - Maximum Background | 5.35 | 0.066 | 9.30 | 1.37 | 0.0020 | 0.007 | 0.019 | 12 | 0.100 | 0.8 | 0.00058 | 0.031 | 0.04 | 0.030 | 0.0100 | 0.030 | 1.0 | 0.212 |
| **Background Surficial Sediments Inferred to Represent Natural Saline Water & Hydrocarbon Seepage** | | | | | | | | | | | | | | | | | | |
| Surficial Sediments - Natural Saline Water & Oil Seepage - 95th Percentile Background | 0.07 | 0.031 | 1.39 | 1.13 | 0.0014 | 0.007 | 0.012 | 25 | 0.042 | 3 | 0.00005 | 0.020 | 0.02 | 0.001 | 0.0001 | 0.0012 | 0.411 | 1.40 |
| Surficial Sediments - Natural Saline Water & Oil Seepage - Maximum Background | 0.12 | 0.035 | 2.01 | 1.40 | 0.0020 | 0.007 | 0.014 | 28 | 0.100 | 3 | 0.00005 | 0.020 | 0.02 | 0.002 | 0.0002 | 0.0016 | 1.0 | 1.70 |
| **Background Surficial Sediments Inferred to Represent Natural Gas Seepage without Saline Water** | | | | | | | | | | | | | | | | | | |
| Surficial Sediments - Natural Gas & Non-Saline Water Seepage - 95th Percentile Background | 0.03 | 0.016 | 1.32 | 0.09 | 0.0013 | 0.007 | 0.008 | 14 | 0.051 | 5 | 0.00005 | 0.006 | 0.02 | 0.002 | 0.0001 | 0.0008 | 0.506 | 0.022 |
| Surficial Sediments - Natural Gas & Non-Saline Water Seepage - Maximum Background | 0.14 | 0.021 | 1.41 | 0.12 | 0.0020 | 0.007 | 0.009 | 19 | 0.100 | 6 | 0.00005 | 0.006 | 0.03 | 0.003 | 0.0002 | 0.0008 | 1.0 | 0.037 |

NA Denotes guideline not available
NC Denotes parameters not measured / not calculated
Shading indicates parameters above most restrictive guidelines selected

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# Table 7
## Groundwater PHCs - Background Geochemical Statistical Summary (1997-2017)

**PROJECT No.: 407011-00622**

| Monitoring Station | Benzene (mg/L) | Ethylbenzene (mg/L) | PHC F1 (C6-C10) - BTEX (mg/L) | PHC F2 (C10-C16) (mg/L) | Toluene (mg/L) | Xylenes-Total (mg/L) |
|---|---|---|---|---|---|---|
| **CCME 2015. CEQG Freshwater Aquatic Life** | **0.37** | **0.09** | **---** | **---** | **0.002** | **---** |
| **Background - Surficial Sediments** | | | | | | |
| Mainland Locations - Surficial Sediments - 95th Percentile Background | 0.0005 | 0.0005 | 0.1 | 0.1 | 0.0005 | 0.0010 |
| Mainland Locations - Surficial Sediments - Maximum Background | 0.01 | 0.01 | 0.19 | 0.20 | 0.01 | 0.01 |
| Bear, Goose, and Frenchy's Islands - Surficial Sediments - 95th Percentile Background | 0.0004 | 0.0004 | 0.1 | 0.1 | 0.0004 | 0.0008 |
| Bear, Goose, and Frenchy's Islands - Surficial Sediments - Maximum Background | 0.0004 | 0.0004 | 0.1 | 0.1 | 0.0004 | 0.0008 |
| **Background - Shallow Bedrock - Inferred to Represent Natural Saline Water & Hydrocarbon Seepage** | | | | | | |
| Shallow Bedrock - Natural Saline Water & Oil Seepage - 95th Percentile Background | 0.06 | 0.002 | 0.89 | 35 | 0.003 | 0.010 |
| Shallow Bedrock - Natural Saline water & Oil Seepage - Maximum Background | 0.17 | 0.05 | 3.90 | 130 | 0.050 | 0.10 |
| **Background - Surficial Sediments - Inferred to Represent Natural Saline Water & Hydrocarbon Seepage** | | | | | | |
| Surficial Sediments - Natural Saline Water & Oil Seepage - 95th Percentile Background | 0.09 | 0.002 | 0.24 | 1.6 | 0.0009 | 0.014 |
| Surficial Sediments - Natural Saline Water & Oil Seepage - Maximum Background | 0.10 | 0.003 | 0.60 | 3.0 | 0.0014 | 0.08 |
| **Background - Surficial Sediments - Inferred to Represent Natural Gas Seepage without Saline Water** | | | | | | |
| Surficial Sediments - Natural Gas & Non-Saline Water Seepage - 95th Percentile Background | 0.97 | 0.007 | 0.28 | 2.1 | 0.016 | 0.22 |
| Surficial Sediments - Natural Gas & Non-Saline Water Seepage - Maximum Background | 1.25 | 0.025 | 0.82 | 2.8 | 0.025 | 0.37 |

NA Denotes guideline not available
NC Denotes parameters not measured / not calculated
Shading indicates parameters above most restrictive guidelines selected

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# Table 8

## Groundwater PAHs - Background Geochemical Statistical Summary (1997-2017)

**PROJECT No.: 407011-00622**

| Monitoring Station | Acenaphthene (mg/L) | Acridine (mg/L) | Anthracene (mg/L) | Benzo[a]anthracene (mg/L) | Benzo[a]pyrene (mg/L) | Fluoranthene (mg/L) | Fluorene (mg/L) | Naphthalene (mg/L) | Phenanthrene (mg/L) | Pyrene (mg/L) | Quinoline (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CCME 2015. CEQG Freshwater Aquatic Life** | **0.0058** | **0.0044** | **0.000012** | **0.000018** | **0.000015** | **0.00004** | **0.003** | **0.0011** | **0.0004** | **0.000025** | **0.0034** |
| **Background - Surficial Sediments** | | | | | | | | | | | |
| Mainland Locations - Surficial Sediments - 95th Percentile Background | 0.00010 | 0.00005 | 0.000010 | 0.000009 | 0.0000075 | 0.00004 | 0.00005 | 0.0001 | 0.00008 | 0.000036 | 0.0002 |
| Mainland Locations - Surficial Sediments - Maximum Background | 0.00010 | 0.00005 | 0.000032 | 0.000068 | 0.0000075 | 0.00039 | 0.00005 | 0.0001 | 0.00036 | 0.00028 | 0.0002 |
| Bear, Goose, and Frenchy's Islands - Surficial Sediments - 95th Percentile Background | 0.00010 | 0.00005 | 0.000010 | 0.000009 | 0.0000075 | 0.00001 | 0.00005 | 0.0001 | 0.00006 | 0.000020 | 0.0002 |
| Bear, Goose, and Frenchy's Islands - Surficial Sediments - Maximum Background | 0.00010 | 0.00005 | 0.000010 | 0.000009 | 0.0000075 | 0.00001 | 0.00005 | 0.0001 | 0.00007 | 0.000020 | 0.0002 |
| **Background - Shallow Bedrock - Inferred to Represent Natural Saline Water & Hydrocarbon Seepage** | | | | | | | | | | | |
| Shallow Bedrock - Natural Saline Water & Oil Seepage - 95th Percentile Background | 0.00053 | 0.00005 | 0.000012 | 0.000088 | 0.0000346 | 0.00007 | 0.0016 | 0.0054 | 0.00369 | 0.00026 | 0.0002 |
| Shallow Bedrock - Natural Saline water & Oil Seepage - Maximum Background | 0.00096 | 0.00005 | 0.000034 | 0.000110 | 0.0000770 | 0.00009 | 0.0022 | 0.0066 | 0.00470 | 0.00049 | 0.0002 |
| **Background - Surficial Sediments - Inferred to Represent Natural Saline Water & Hydrocarbon Seepage** | | | | | | | | | | | |
| Surficial Sediments - Natural Saline Water & Oil Seepage - 95th Percentile Background | 0.00042 | NC | 0.000024 | 0.000009 | 0.0000075 | 0.00006 | 0.0018 | 0.0031 | 0.00172 | 0.00020 | NC |
| Surficial Sediments - Natural Saline Water & Oil Seepage - Maximum Background | 0.00062 | NC | 0.000076 | 0.000016 | 0.0000075 | 0.00006 | 0.0020 | 0.0038 | 0.00370 | 0.00021 | NC |
| **Background - Surficial Sediments - Inferred to Represent Natural Gas Seepage without Saline Water** | | | | | | | | | | | |
| Surficial Sediments - Natural Gas & Non-Saline Water Seepage - 95th Percentile Background | 0.00016 | 0.00005 | 0.000049 | 0.000038 | 0.0000127 | 0.00030 | 0.0002 | 0.0035 | 0.00042 | 0.00022 | 0.0002 |
| Surficial Sediments - Natural Gas & Non-Saline Water Seepage - Maximum Background | 0.00016 | 0.00005 | 0.000051 | 0.000040 | 0.0000130 | 0.00032 | 0.0002 | 0.0037 | 0.00044 | 0.00023 | 0.0002 |

NA Denotes guideline not available
NC Denotes parameters not measured / not calculated
Shading indicates parameters above most restrictive guidelines selected