



# Groundwater Monitoring Program

Former Co-op Bulk Plant  
2<sup>nd</sup> Avenue & Railway Avenue  
Lang, Saskatchewan

Latitude/Longitude: 49° 55' 12.96" N / 104° 22' 29.01" W  
FCL Site No. 417

4 February 2020



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[www.woodplc.com](http://www.woodplc.com)**Groundwater Monitoring Program****Former Co-op Bulk Plant – 2<sup>nd</sup> Avenue & Railway Avenue****Latitude/Longitude: 49° 55' 12.96" N / 104° 22' 29.01" W****FCL Site No. 417****Wood Project No. ZE0803919**

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## Executive Summary

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited (Wood), conducted a groundwater monitoring program at the former Co-op bulk plant located on the southeast corner of 2<sup>nd</sup> Avenue and Railway Avenue in Lang, Saskatchewan (the "Site"). This work was approved by Mr. Sean Cruz of Federated Co-operatives Limited (FCL) on behalf of Prairie Sky Co-operative Association Ltd. (Prairie Sky Co-op). The purpose of the program was to gather updated groundwater information on-Site, which will be used in the determination of a future corrective action plan (CAP).

The 2019 groundwater monitoring program was conducted from 24 to 27 October 2019 and included monitoring 19 existing wells and collecting groundwater samples from 18 wells. It was determined that groundwater impacts are limited to the centre, and southeastern portions of the Site. LNAPL continues to be observed in 16-01; however, based on the well completion details and the analytical results at nearby monitoring wells, there is minimal LNAPL remaining at 16-01. The limited thicknesses noted in 2017 and 2019 indicates that there is minimal LNAPL remaining in this area.

The extent of soil and groundwater contamination is delineated at this Site with the possible exception of immediately northeast of 16-01. Furthermore, based on the age of the contamination identified, many of the locations that were contaminated over two decades ago would now have substantially lower soil and groundwater concentrations. This interpretation is also supported by the extent of groundwater contamination, which has been shown to be decreasing with time. As groundwater is a more sensitive indicator of contamination than soil, at locations where the groundwater is now below regulatory standards, the soil concentrations at those locations would also be below standards.

The National Classification System for Contaminated Sites (NCSCS) score was calculated to be 62.8, which classifies the Site as Class 2 – Medium Priority for Action. The classification is higher than the previous score of 57.1 in 2017. The increase in score is the result of including the freshwater aquatic pathway in 2019.



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## Glossary of Commonly Used Abbreviations

AST	aboveground storage tank
CCME	Canadian Council of Ministers of the Environment
cm/s	centimetres per second
Co-op	Co-operative
Code	Saskatchewan Environmental Code
DO	Dissolved oxygen
EC	electrical conductivity
ESA	Environmental Site Assessment
FCL	Federated Co-operatives Limited
MEnv	Saskatchewan Ministry of Environment
m bgl	metres below ground level
LNAPL	Light non-aqueous phase liquid
NCSCS	National Classification System for Contaminated Sites
ORP	oxidation-reduction potential
PHC	petroleum hydrocarbon
ppm <sub>v</sub>	parts per million organic vapour
QA/QC	quality assurance/quality control
RPD	relative percent difference
TDS	total dissolved solids
UST	underground storage tank
WSASK	Saskatchewan Water Security Agency

## 1.0 Introduction

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited (Wood), conducted a groundwater monitoring program at the former Co-op bulk plant located on the southeast corner of 2<sup>nd</sup> Avenue and Railway Avenue in Lang, Saskatchewan (the "Site"). This work was approved by Mr. Sean Cruz of Federated Co-operatives Limited (FCL) on behalf of Prairie Sky Co-operative Association Ltd. (Prairie Sky Co-op). The purpose of the program was to gather updated groundwater information on-Site, which will be used in the determination of a future remedial work plan or a risk management plan for the Site.

The Site location and surrounding area are shown on Figure 1.

## 2.0 Historical Information

The Site is currently undeveloped and is grass covered. The former bulk plant facility consisted of two underground storage tank (UST) nests located on the south central and southeast portions of the Site. A tank farm including above ground storage tanks (ASTs), surrounded by an earthen berm was located on the north central portion of the Site while an oil warehouse building was located on the northwest portion of the Site. Finally, extraction/compression equipment with a water tank was located east of the tank farm. All petroleum infrastructure has been removed from the Site.

Between 1998 and 2016, five Phase II Environmental Site Assessments (ESAs) were completed at this Site. Additionally, between 2001 and 2013, groundwater monitoring and sampling programs were conducted by Wood (formerly AMEC). Petroleum hydrocarbon (PHC) impacts in soil and groundwater were identified in the areas of the two separate UST tank nest locations and the former oil warehouse and loading rack. A review of previous environmental reports indicated that soil PHC impacts were delineated; however, groundwater PHC impacts possibly extended off-Site into Railway Avenue, Second Avenue, and the residential property to the east. Historically, light non-aqueous phase liquids (LNAPL) were encountered in BH1, located at the former UST tank nest directly south of the AST berm; BH2 located on the southwest corner of the AST berm; 08-05 adjacent to the southwest property boundary; and 16-01, located northwest of the former AST berm.

In 2015, the UST nest and associated piping located in the area of 08-09, southeast of the former AST tank farm, was removed and decommissioned. PHC soil impacts were identified on the west and north wall, and the northwest and southwest corners of the floor of the excavation. During this program, an excavation and test pit program was also completed in the area of the former tank nest, located near BH1, south of the AST berm. This test pitting was completed as there was no information pertaining to the removal of these USTs south of the AST. It was confirmed through the test pit program that the USTs were removed.

The most recent delineation program completed in 2017 consisted of drilling seven test holes, all completed as monitoring wells. A soil sample obtained from test hole 17-01, located in the centre of the Site, contained concentrations of benzene, ethylbenzene and PHC Fraction F2 in exceedance of applicable guidelines. In addition, groundwater samples containing PHC concentrations exceeding the applicable guidelines were found to be present along the western edge of the Site (16-02), in the southeast corner of the Site (16-06), in the centre of the Site (17-01), and off-site on the west side of Railway Avenue (17-04). LNAPL was identified off-Site in the ditch on the east side of Railway Avenue (08-05) and near the centre of the Site (16-01).

See Appendix A for a copy of the historical tables.

## 3.0 Scope of Work

Following a review of the project file and discussions with Sean Cruz of FCL, the scope of work (ZE0803919) was developed and approved on 6 September 2019.

The scope of work consisted of the following:

- Inspect and repair of existing monitoring wells.
- Complete groundwater monitoring of all existing monitoring wells for laboratory analysis of PHCs.
- Prepare a report summarizing results of the assessment.

The scope of work was completed as described above, with the following exceptions:

- LNAPL could not be confirmed in monitoring well 08-05 as the well was silted in.

## 4.0 Methodology

The 2019 groundwater monitoring program was conducted from 24 to 27 October 2019 and included monitoring 19 existing wells and collecting groundwater samples from 18 wells. Field protocols and quality assurance/quality control (QA/QC) procedures utilized by Wood were in accordance with standard industry protocols. A detailed summary of Wood's standard field methodology is provided in Appendix B.

## 5.0 Site Setting

### 5.1 Site and Surrounding Land Use

The Site is located on the north side of Railway Avenue in Lang, Saskatchewan. The Site consists of vacant property with a grass covered surface, which formerly operated as a Co-op bulk plant. Historically, the Site contained petroleum infrastructure including two separate UST nests, ASTs and associated loading rack, an oil warehouse building, and extraction/compression equipment with a water tank. All associated petroleum facilities have been decommissioned and removed off-Site.

The surrounding land use area consists of a drainage ditch followed by Second Avenue and agricultural land to the north; a residential property to the east; a drainage ditch followed by Railway Avenue to the south; and a commercial property to west. A Canadian Pacific Railway (CPR) railway line and undeveloped commercial property are located along the south and western properties.

Land use is summarized in Table 1 and shown on Figure 1. The layout of the Site is shown on Figure 2. Photographs of the Site and surrounding areas taken during the 2019 program are presented in Appendix C.

## 5.2 Regional Conditions

### 5.2.1 Regional Geology

The geology of the area in and around the Village of Lang is described by Saskatchewan Research Council (1953 and 1974). Surficial soils consist of undulating to gently rolling topography of glaciolacustrine silt or clay up to 7 m thick, which may be absent in some places. Bedrock underlying the Village of Lang is comprised of non-calcareous silt and clay known as the Bearpaw Shale.

### 5.2.2 Regional Hydrogeology and Hydrology

The Site is located in the Souris River Groundwater Basin (Potentiometric Surface Map, Weyburn [62 E-F], Saskatchewan, Saskatchewan Environment 1983). The regional groundwater gradient is interpreted to be toward the south or southeast towards the Souris River. Drift aquifers are the principal source of groundwater in the area and are comprised of glacial sand and gravel immediately below the surface, between tills and bedrock (SRC, 1974).

#### 5.2.2.1 Domestic Groundwater Use

During the previous investigations, the Village Administrator for Lang indicated that the residents of Lang are supplied with municipal water. This water is obtained from a well located approximately 45 m away from the Village water tower, which is 350 m southeast of the Site. The Village well is completed to a depth of 46 m bgl. The Village does not have any bylaw in place preventing the use or installation of private water wells. Wood confirmed with the current Village Administrator during this assessment that this information is still valid.

A water well survey was conducted on the Saskatchewan Water Security Agency (WSASK) water well database to identify any wells potentially within 500 m of the Site. Water well records for six water test holes, three municipal withdrawal, one domestic withdrawal, and six observation wells were found within the search area. However, based on the water well logs, previously drilled municipal wells were completed at depths ranging from 8.5 m bgl to 11.3 m bgl, with a water level of approximately 5 m bgl. The water well records indicate that these wells had pumping rates of approximately 114 L/min.

The withdrawal well identified from the WSASK search was completed to a depth of 7.9 m bgl and was reported to have a pumping rate of 9 L/min. Wood spoke with Mr. Mike Saip of the Prairie Sky Co-op regarding this well in 2017. He indicated that the property on which this well is located is on the same quarter section as the former bulk plant; however, is south of the railway tracks south of the Site and no longer contains a residence. However, there is still a workshop present. It is unknown if this well is still in use.

The WSASK well logs are presented in Appendix D.

## 5.3 Site Characterization

### 5.3.1 Site Hydrogeology

#### 5.3.1.1 Groundwater Levels

The depth to groundwater measured at the Site during the current assessment ranged from 2.59 m bgl (09-04) to 4.60 m bgl (16-05). Historically, groundwater depths have ranged anywhere from 0.11 m bgl to 6.64 m bgl, with the water levels observed in 2008 and 2009 being deeper than what is currently observed. The water levels measured in the wells installed in 2008 may not have fully equilibrated when monitoring in 2008; however, the 2009 water levels are similar, and lower than what is currently observed. A summary of current and historical information is provided in Appendix A. This includes historical groundwater information in Table A-1 and historical soil results in Table A-2.

Groundwater elevations identified in 2019 suggest that shallow groundwater flow beneath the Site was generally towards the east. The 2019 groundwater elevations and inferred groundwater flow directions are presented on Figure 3. The inferred groundwater flow direction is consistent with the 2016 assessment. No groundwater flow direction was inferred during the 2017 assessment.

#### 5.3.1.2 Hydraulic Conductivity and Groundwater Flow Velocity

Hydraulic conductivity testing was not completed as part of the 2019 groundwater monitoring program. Hydraulic conductivity tests completed as part of previous investigations on-Site have yielded values ranging from  $4.6 \times 10^{-3}$  cm/s to  $2.4 \times 10^{-7}$  cm/s. Hydraulic testing completed in the sand layer yielded the value of  $4.6 \times 10^{-3}$  cm/s while tests completed in the clay till yielded results of  $8.6 \times 10^{-5}$  cm/s and  $2.4 \times 10^{-7}$  cm/s.

Average linear groundwater flow velocity is calculated based on the measured gradients and hydraulic conductivities, and assuming a representative porosity of 30%. The average linear groundwater flow velocity ( $v$ ) is calculated as:

$$v = (K/n) * (\text{gradient})$$

In the saturated sands, with  $K = 4.6 \times 10^{-3}$  cm/s (or  $4.6 \times 10^{-5}$  m/s), a gradient of 0.02 m/m, and porosity of 30%, the calculated average linear groundwater flow velocity is 100 m/year. This groundwater flow velocity is typical of flow in a sand aquifer. This value is calculated using the steepest gradient and the highest hydraulic conductivity and represents an upper limit on the groundwater flow velocity.

As shown on Figure 3, the observed groundwater flow gradient is to the east at a maximum hydraulic gradient of approximately 0.02 m/m (i.e. 1.4 m in 70 m distance).

## 6.0 Assessment Criteria

Saskatchewan MEnv currently recognizes the results-based regulatory (RBR) framework as outlined in the [Saskatchewan Environmental Code](#) (MEnv 2014) for determining the appropriate environmental assessment criteria for a particular Site. The MEnv [Endpoint Selection Standard](#), 17 June 2016 (MEnv 2016) and the MEnv [Saskatchewan Environmental Quality Guidelines](#), 2019 (SEQG 2019) allow for tiered endpoint selection of the applicable assessment criteria based on land use, grain size, and human health and ecological exposure pathway considerations.

A Tier 2 approach was taken for assessing the results of the 2019 groundwater monitoring program. The endpoint selection and determination of assessment criteria for the Site is described in detail in Appendix E.

## 6.1 Soil and Groundwater

Given the current and future commercial land use of the Site, the residential and agricultural buffers, the coarse-grained nature of the soil, and the applicable exposure pathways (as outlined in Appendix E), assessment guidelines for each contaminant of concern in soil and groundwater were selected.

Based on the Site setting and above considerations, the limiting exposure pathways that are the most stringent for management of the Site impacts are:

### Soil:

- At or above 1.5 m bgl:
  - Dermal contact.
  - Soil ingestion.
  - Vapour inhalation.
  - Ecological soil contact.
  - Protection of Wildlife/Livestock.
  - Protection of Aquatic Life.
  - Protection of Potable Groundwater.
  - Management Limits.
- From 1.5 m to 3.0 m bgl:
  - Vapour inhalation.
  - Ecological soil contact.
  - Protection of Aquatic Life.
  - Protection of Potable Groundwater.
  - Management Limits.
- Below 3.0 m bgl:
  - Vapour Inhalation.
  - Protection of Aquatic Life.
  - Protection of Potable Groundwater.
  - Management Limits.

### Groundwater:

- Vapour inhalation.
- Ecological contact.
- Protection of aquatic life.
- Protection of potable groundwater.

The limiting exposure pathways are presented in Table E-1 (Appendix E).



## 7.0 Contaminant Assessment Results

### 7.1 Groundwater Conditions

#### 7.1.1 Monitoring Well Conditions

At the time of the 2019 groundwater monitoring program, all monitoring wells, with the exception of 08-05, were found to be in satisfactory condition. Monitoring well 08-05 was found to be silted in. The monitoring well inspection summary is presented in Appendix F.

##### 7.1.1.1 Well Headspace Vapour Concentrations

The maximum in-well headspace vapour concentration was 90 ppm<sub>v</sub> in monitoring well 16-01 (located on-Site north of the former tank farm and former oil warehouse). The remaining values ranged from non-detect to 35 ppm<sub>v</sub>.

##### 7.1.1.2 Well Headspace Methane Concentrations

The maximum in-well headspace methane concentration was 85 ppm<sub>v</sub> in monitoring well 17-02. The remaining in-well headspace vapour concentrations measured ranged from non-detect to 75 ppm<sub>v</sub>.

##### 7.1.1.3 Light Non-Aqueous Phase Liquids

LNAPL was detected in monitoring well 16-01 at a thickness of 25 mm. Historically, monitoring well 08-05 has contained LNAPL; however, this monitoring well was identified to be silted in during the 2019 assessment.

##### 7.1.1.4 Field Parameters

Groundwater parameters measured during the 2019 monitoring event included temperature, electrical conductivity (EC), dissolved oxygen (DO), pH, and oxidation reduction potential (ORP). The field parameter results are summarized in Table 2.

#### 7.1.2 Groundwater Laboratory Results

##### 7.1.2.1 Groundwater PHCs

Following the groundwater monitoring program, 19 groundwater samples, including two blind field duplicate samples, were submitted to ALS Canada Ltd. (ALS) in Saskatoon, SK for laboratory analysis of BTEX and PHC fractions F1 to F4.

Concentrations of benzene in exceedance of the applicable criteria were identified in the following monitoring wells:

- 08-04 and 16-02: benzene (west and south of the former oil warehouse).
- 16-03: PHC fraction F2 (south of former bulk plant ASTs and west of former UST nest).
- 17-01 and associated duplicate (B001): benzene and PHC fraction F2 (southwest of former bulk plant).
- 16-06: benzene (southeast of the former UST nest along the southeast property boundary).

The remaining analyzed samples were found to contain concentrations below the applicable SEQG and/or laboratory method detection limit.

Groundwater laboratory results for PHC parameters are presented on Figure 4-1 and summarized in Table 3. Copies of the detailed analytical reports are provided in Appendix G.

Historical groundwater exceedances included monitoring well 17-04 in 2017 and 16-05 in 2016. These concentrations were below criteria and/or laboratory method detection limit in subsequent monitoring events, including 2019. Historical groundwater analytical results are presented on Figure 4-2 and summarized in Table A-3 (Appendix A).

## 7.2 Quality Assurance/Quality Control

### 7.2.1 Laboratory Accreditation

The Canadian Association Laboratory Accreditation Inc. (CALA) has accredited ALS Environmental in Saskatoon, SK for testing in accordance with the International Standard ISO/IEC 17025:2017.

### 7.2.2 Data Validation

#### 7.2.2.1 Laboratory QA/QC

The laboratory QA/QC program is detailed following the laboratory analytical reports in Appendix G. The results of the QA/QC analyses are detailed on the laboratory reports.

#### 7.2.2.2 Field QA/QC

Two duplicate groundwater sample sets were submitted as part of the field program. Relative percent difference (RPD) was calculated for parameters containing detectable concentrations at least five times the laboratory method detection limit. All RPD values were found to be in the acceptable range. The calculated RPDs are summarized in Appendix G.

#### 7.2.2.3 Data Validation Summary

Wood validated the laboratory data for the major ions using electrical charge balance calculations. As shown on Table 4, the concentrations of the positively charged cations (i.e. calcium, magnesium, sodium, potassium, iron, and manganese) and the negatively charged anions (i.e. alkalinity, chloride, sulphate, and nitrate) was calculated using units of milliequivalents per litre (meq/L) which accounts for the weight and charge on the ion. The sum of the cations in meq/L should equal the sum of the anions in meq/L, and the balance is calculated as cations/anions with an acceptable range of +/- 15% (i.e. 115%-85%). As shown on Table 4, all sampling locations had acceptable charge balances of approximately 90%.

Based on the data validation applied, the methods applied for laboratory analysis, sample collection, sample storage and handling had no material negative effect on the quality of the data collected as part of this assessment. The laboratory results for groundwater samples obtained during Wood's investigation are considered to be valid and representative of the Site conditions.

### 7.3 Site Classification

The Canadian Council of Ministers of the Environment (CCME) National Classification System for Contaminated Sites (NCSCS) screening checklist was completed to quantitatively derive a ranking score to evaluate the potential human health and ecological risks due to residual PHC impacts in the subsurface soil, groundwater, and potential surface water. The NCSCS uses a scoring system which is evaluated using existing or available information on the Site's characteristics, contaminants and location. The completion of the NCSCS is in compliance with CCME [NCSCS Guidance Document \(2008\)](#) and MEnv 2014.

The 2017 NCSCS score sheet was reviewed and updated based on the 2019 Site conditions. An NCSCS score of 62.8 was generated for the Site. This score indicates that the Site Classification Category is Class 2 – Medium Priority for Action. This indicates there is a high potential for adverse impacts, although the threat to human health and the environment is generally not imminent; therefore, some action is likely required (CCME NCSCS 2010 vs 1.3). The classification is higher than the previous score of 57.1 in 2017. The increase in score is the result of the included freshwater aquatic pathway in 2019.

A copy of the NCSCS scoring is included in Appendix H.

### 7.4 Discharge and Discovery Reporting

As outlined in the [Discharge and Discovery Reporting Standard](#) of the Saskatchewan Environmental Code, any site assessment which identifies a substance of potential concern above the level set out in Table 2 of the Standard must be reported as a Discovery. In instances where the Discovery has previously been reported to the MEnv, there is no obligation to submit an additional report.

Previous reports for the Site have been submitted to MEnv. Therefore, Discharge and Discovery reporting was not completed as part of this scope of work.

## 8.0 Conceptual Site Model

As part of this assessment, historical soil analytical results for the Site were updated and included on Figure 6 of this report. This figure was updated from the version presented in the previous report, and it now shows that the lateral extent of soil contamination at the Site has been fully delineated with the exception of immediately northeast of 16-01. Soil impacts on-Site range in depth from 1.5 m to 9.1 m bgl.

Vertical soil delineation was not confirmed at two locations drilled in 1998 (BH2 and BH5) and one location in 2008 (08-09). More recently, soil contamination was not delineated vertically at 16-01, which historically has contained LNAPL, and at 17-01 which contained a trace benzene exceedance in a soil sample collected at 9.1 m depth. There is likely some residual soil contamination near the former UST basin based on soil analytical results in this area, and the field screening done during drilling in 1998 at BH5 and BH6; however, it appears that no soil samples were analyzed from these two locations. There is a potential for historic off-Site impacts to utility corridors at the southeast corner of the Site; however, the sampling locations indicate that the extent of contamination is delineated in this area.

Generally, PHC groundwater concentrations are stable or decreasing over time. Minor increases have been noted in groundwater concentrations at monitoring wells 16-06 and 17-01, along the southeast property boundary and centre portion of the property. The extent of soil and groundwater contamination is suitably delineated at this Site with the possible exception of immediately northeast of 16-01. Furthermore, based on the age of the contamination identified, many of the locations that were

contaminated over two decades ago would now have substantially lower concentrations. This is also supported by the extent of groundwater contamination which has been shown to be decreasing with time.

Physical LNAPL recovery have been completed on monitoring well 16-01 and natural source zone depletion due to natural attenuation has resulted in a decrease in the amount of LNAPL from 2016 as compared to 2017 and 2019. Both monitoring well 16-01 and monitoring well 08-05 are completed with the well screen below the water table within a sand layer. With these well completions, the LNAPL present in the monitoring wells must have been present within the sand layer, and any LNAPL that enters the well screen then rises through the water column and is trapped within the well bore. If there was more LNAPL in the sand layer, the thickness of LNAPL would continue to accumulate without reaching a limiting equilibrium as would happen with LNAPL in a water table well. This appears to have been the case in 2016 where 350 mm of LNAPL were measured in 16-01. As LNAPL floats on the water table, the presence of LNAPL in the deeper sands indicates that it must have been transported to this area during a low water table event. The historic water level data shows that measured depth to water values were significantly lower in 2008 and 2009 than what has been observed more recently. Therefore, the LNAPL result observed in 16-01 is not as indicative of a significant LNAPL problem as it would be if an equivalent thickness of LNAPL was measured in a water table well screened in coarser soils.

Nutrient data was evaluated as part of a QA/QC program during this assessment. Total cations and anions were calculated and compared to validate the data collected. It was determined that the results from the nutrient parameters are uniform throughout the sample locations and considered valid. Elevated dissolved iron and manganese concentrations have been observed in a number of monitoring wells, primarily located in the centre of the Site. This is considered indicative of iron and manganese reducing bacteria which are oxidizing hydrocarbons and mobilizing iron and manganese from the soil into the groundwater.

There does not appear to be significant reductions in long-term sulphate concentrations in groundwater to suggest that sulphate reduction is playing a major role at this time. Sulphate reducing bacteria are very common and typically provide most of the natural attenuation capacity for hydrocarbons, but the redox conditions do not seem to be that reduced at this Site. This may be related to the notable nitrate concentrations that were detected in several monitoring wells at the perimeter of the Site, with six wells having concentrations above 30 mg/L. These elevated nitrate concentrations are located outside the property boundary, to the northwest, northeast, and southeast of the Site. These nitrate concentrations may be natural, or there may be an off-Site source, but the nitrate would be consumed in the biodegradation of hydrocarbons because bacteria will use nitrate as an electron acceptor preferentially before iron, manganese, and sulphate. Regardless of whether the nitrate concentrations are natural or anthropogenic, they are elevated across a large area.

## 9.0 Conclusion

The purpose of the program was to gather updated groundwater information for the Site, which will be used in the determination of a CAP. Groundwater impacts are located in the centre, and southeastern portions of the Site. LNAPL continues to be observed in 16-01; however, based on the well completion details and the analytical results at nearby monitoring wells, there is minimal LNAPL remaining at 16-01. The limited thicknesses noted in 2017 and 2019 indicates that there is minimal LNAPL remaining in this area.

The extent of soil and groundwater contamination is delineated at this Site with the possible exception of

immediately northeast of 16-01. Furthermore, based on the age of the contamination identified, many of the locations that were contaminated over two decades ago would now have substantially lower soil and groundwater concentrations. This interpretation is also supported by the extent of groundwater contamination, which has been shown to be decreasing with time. As groundwater is a more sensitive indicator of contamination than soil, at locations where the groundwater is now below regulatory standards, the soil concentrations at those locations would also be below standards.

Based on the information obtained during this assessment, recommendations for future work on-Site will be provided under a separate cover.

## 10.0 Project Limitations

The American Society for Testing and Materials Standard of Practice notes that no environmental site assessment can wholly eliminate uncertainty regarding the potential for recognized environmental conditions in the connection with a property. Performance of a standardized environmental site assessment protocol is intended to reduce, but not eliminate, uncertainty regarding the potential for recognized environmental conditions in connection with the property, given reasonable limits of time and costs. The findings of this investigation are based on the interpretation of a limited number of analytical results pertaining to specific samples. The evaluation and interpretations do not preclude the existence of chemical substances other than those identified herein, or the possibility that contamination levels can vary between the areas of the investigation.

This report is based on, and limited by, the interpretation of data, circumstances, and conditions available at the time of completion of the work as referenced throughout the report. It has been prepared in accordance with generally accepted engineering practices.

## 11.0 Closure

We trust that the information presented in this report meets your current requirements. Should you have any questions, or concerns, please do not hesitate to contact Wood.

Further general limitations are provided in Appendix I.

As per the requirements of the Saskatchewan Environmental Code, the Qualified Person Certificate for this report is provided in Appendix J.

## 12.0 References

Amec Foster Wheeler. February 2016. 2015 Groundwater Monitoring Program, Former Co-op Service Station, Railway Avenue and Bernier Street, Dubuc, Saskatchewan. Amec Foster Wheeler Project #: ZE0901915.

Amec Foster Wheeler. 9 May 2018. Monitoring Well Installation and Groundwater Monitoring Program, Co-op Former Gas Bar, Railway Avenue & Bernier Street, Dubuc, Saskatchewan. Amec Foster Wheeler Project #: ZE0901917.

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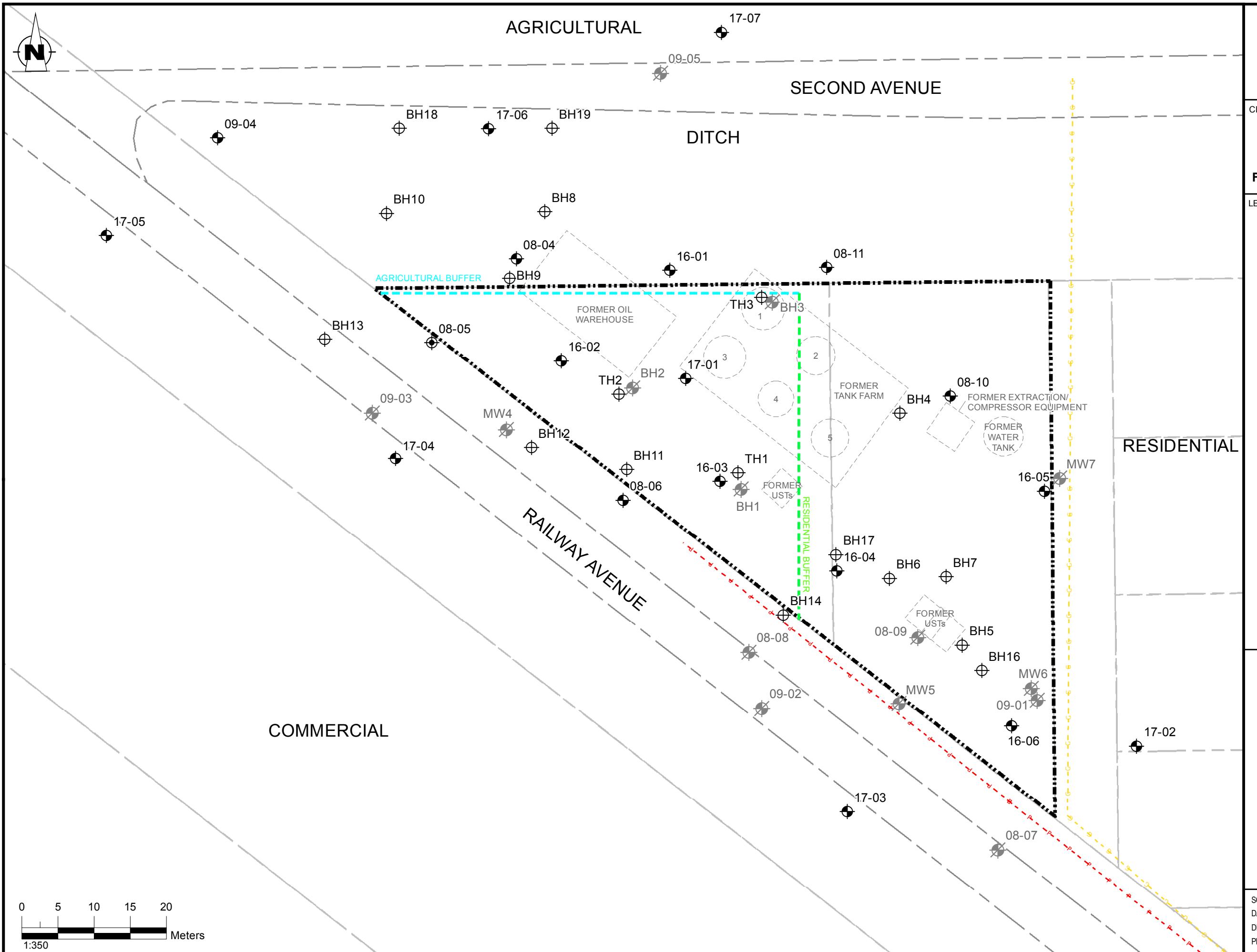
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# Figures

- Figure 1      Site and Surrounding Land Use Plan**
- Figure 2      Site Plan**
- Figure 3      Groundwater Elevation – 24 October 2019**
- Figure 4-1      Groundwater Analytical Results - PHCs**
- Figure 4-2      Historical Groundwater Analytical Results – PHCs**
- Figure 5-1      Groundwater Analytical Results - Nutrients**
- Figure 5-2      Historical Groundwater Analytical Results – Nutrients**
- Figure 6      Historical Soil Analytical Results – PHCs**



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<b>FEDERATED CO-OPERATIVES LIMITED</b>	
<b>LEGEND:</b> <ul style="list-style-type: none"> <li>30 m RESIDENTIAL BUFFER</li> <li>SITE BOUNDARY</li> <li>PROPERTY LINE</li> </ul>	
NOTE: SITE FEATURE LOCATIONS ARE APPROXIMATE.	GROUNDWATER MONITORING PROGRAM
<b>FORMER CO-OP BULK PLANT</b> 2ND AVENUE & RAILWAY AVENUE LANG, SASKATCHEWAN	
<b>SITE &amp; SURROUNDING LAND USE PLAN</b>	
SCALE: AS SHOWN	FIGURE 1
DATE: DECEMBER 2019	
DRAWN BY: MM	
PROJECT NO.: ZE0803919	



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**LEGEND:**

- The legend includes the following entries:

  - MONITORING WELL (represented by a black circle with a dot)
  - TEST HOLE (represented by a black circle with a crosshair)
  - DESTROYED WELL (represented by a black circle with a diagonal line)
  - SILTED IN WELL (represented by a black circle with a horizontal line)

Buffer zones are indicated by colored dashed lines:

  - 30m AGRICULTURAL BUFFER (cyan dashed line)
  - 30 m RESIDENTIAL BUFFER (green dashed line)

Other features are shown with specific line styles:

  - OVERHEAD POWERLINE (black dashed line)
  - NATURAL GASLINE (yellow dashed line)
  - PROPERTY LINE (thick black line)
  - FORMER FEATURES (dashed line)
  - LEGAL SUBDIVISION (thin black line)

NOTE: SITE FEATURE LOCATIONS ARE APPROXIMATE.

## GROUNDWATER MONITORING PROGRAM

# **FORMER CO-OP BULK PLANT**

2ND AVENUE & RAILWAY AVENUE  
LANG, SASKATCHEWAN

## SITE PLAN

SCALE: 1:350  
DATE: DECEMBER 2019  
DRAWN BY: MM  
PROJECT NUMBER: ZE0803919

## FIGURE 2

CLIENT:



FEDERATED CO-OPERATIVES LIMITED

LEGEND:

- MONITORING WELL
- TEST HOLE
- DESTROYED WELL
- SILTED IN WELL
- 30m AGRICULTURAL BUFFER
- 30 m RESIDENTIAL BUFFER
- OVERHEAD POWERLINE
- NATURAL GASLINE
- PROPERTY LINE
- FORMER FEATURES
- LEGAL SUBDIVISION
- INFERRED GROUNDWATER FLOW DIRECTION
- GROUNDWATER ELEVATION CONTOURS (0.2 METER INTERVALS)
- (576.73) GROUNDWATER ELEVATION (METERS)

NOTE: SITE FEATURE LOCATIONS ARE APPROXIMATE.

### GROUNDWATER MONITORING PROGRAM

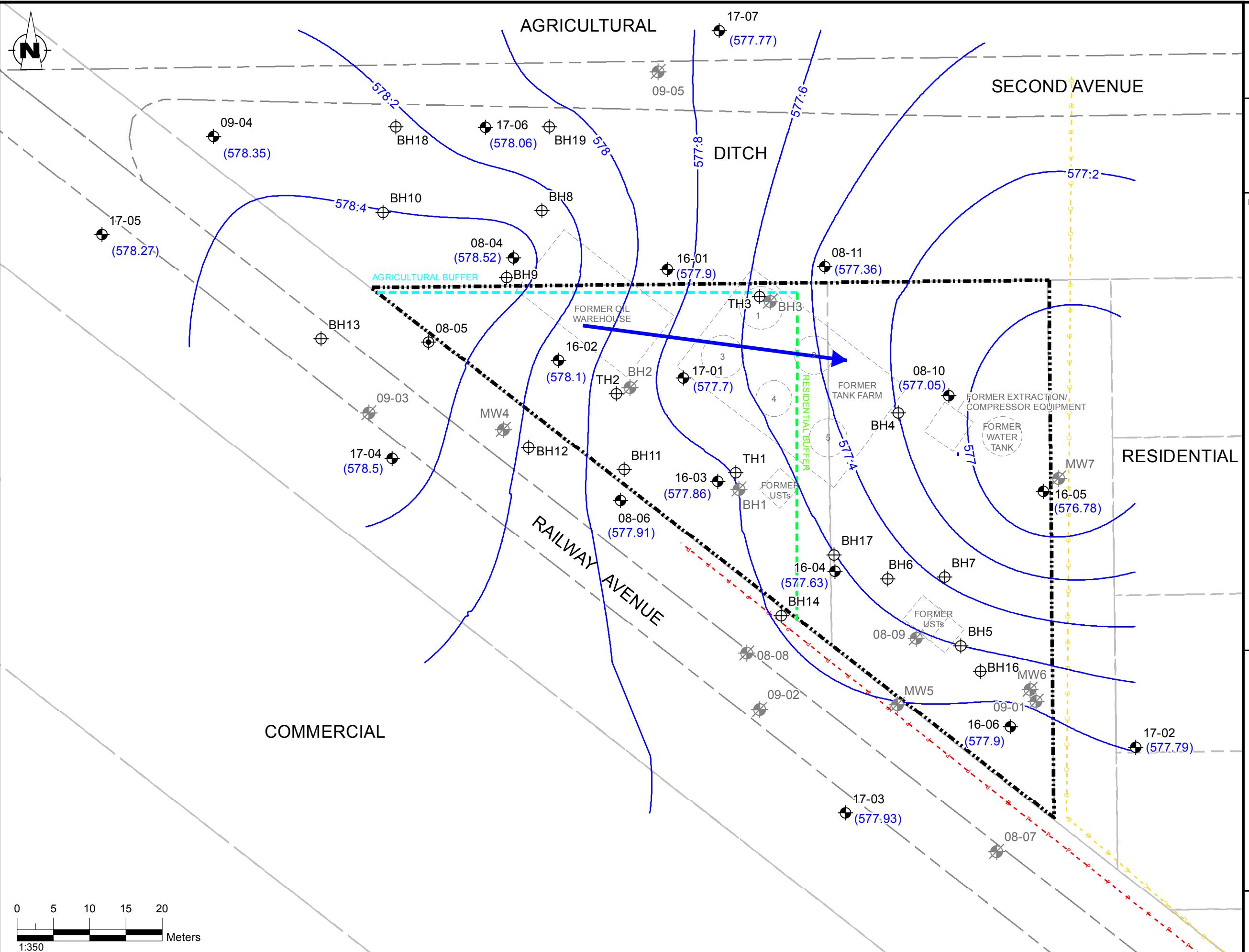
### FORMER CO-OP BULK PLANT

2ND AVENUE & RAILWAY AVENUE  
LANG, SASKATCHEWAN

GROUNDWATER ELEVATION  
- 24 OCTOBER 2019

SCALE: 1:350  
DATE: DECEMBER 2019  
DRAWN BY: MM  
PROJECT NUMBER: ZE0803919

FIGURE 3



CLIENT:



### FEDERATED CO-OPERATIVES LIMITED

LEGEND:

- BELOW CRITERIA
- ABOVE CRITERIA
- MONITORING WELL
- TEST HOLE
- DESTROYED WELL
- 30m AGRICULTURAL BUFFER
- 30 m RESIDENTIAL BUFFER
- OVERHEAD POWERLINE
- NATURAL GASLINE
- PROPERTY LINE
- FORMER FEATURES
- LEGAL SUBDIVISION

Groundwater Criteria - SEQG 2019			
mg/kg	Commercial	Residential	Agricultural
B	0.005 <sup>A</sup>	0.021 <sup>B</sup>	0.81 <sup>C</sup>
T	<0.00050	<0.00050	
E	0.14 <sup>A</sup>		
X	0.09 <sup>A</sup>		
F1 (PHC)	2.2 <sup>A</sup>	0.81 <sup>C</sup>	
F2 (PHC)		1.1 <sup>A</sup>	
F3 (PHC)	NV	NV	NV
F4 (PHC)	NV	NV	NV

<sup>A</sup> Protection of Groundwater - Potable    <sup>B</sup> Freshwater Aquatic  
<sup>C</sup> Vapour Inhalation

NOTE: SITE FEATURE LOCATIONS ARE APPROXIMATE.

GROUNDWATER  
MONITORING PROGRAM

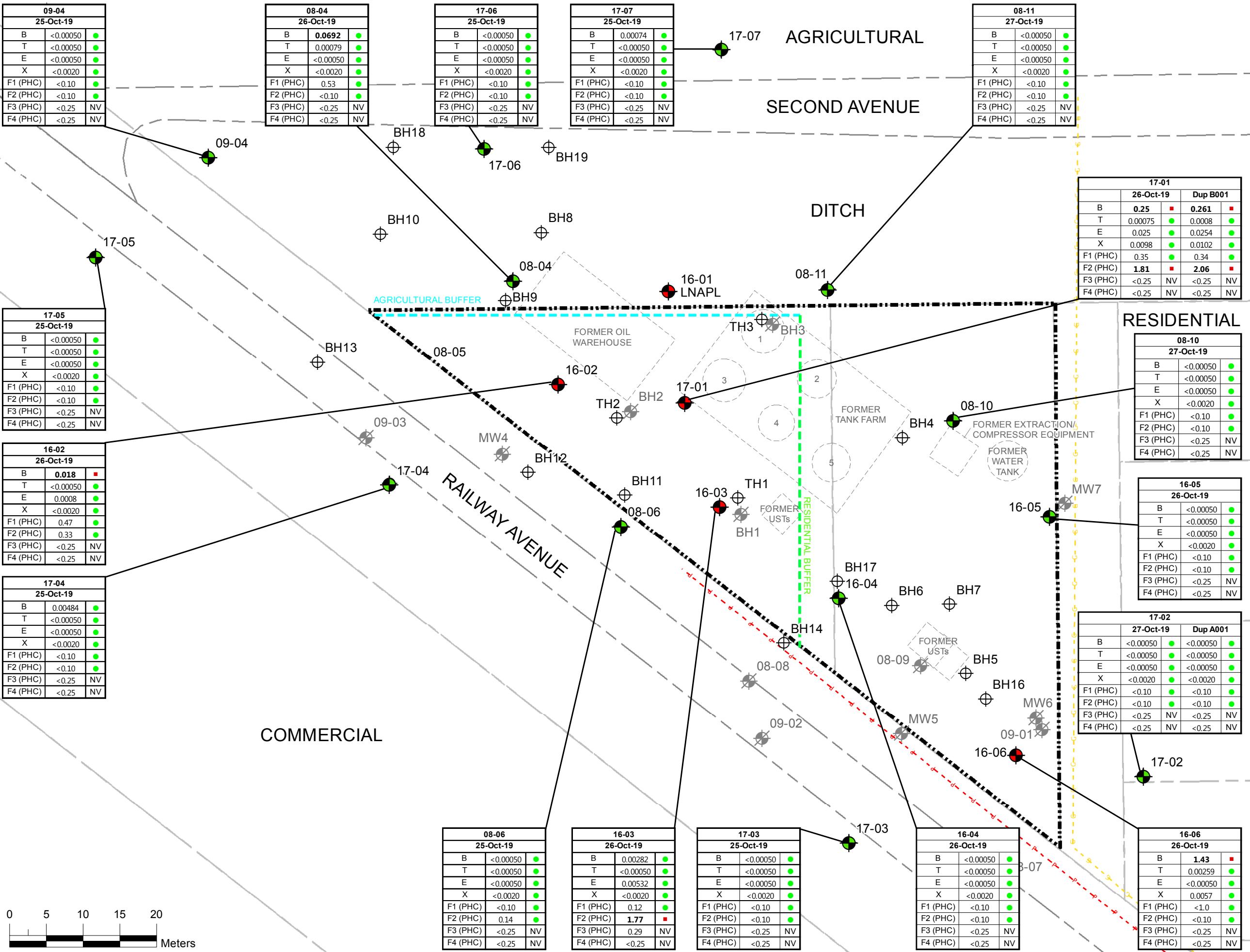
### FORMER CO-OP BULK PLANT

2ND AVENUE & RAILWAY AVENUE  
LANG, SASKATCHEWAN

### GROUNDWATER ANALYTICAL RESULTS - PHCs

SCALE: 1:350  
DATE: DECEMBER 2019  
DRAWN BY: MM  
PROJECT NUMBER: ZE0803919

FIGURE 4-1



CLIENT:



### FEDERATED CO-OPERATIVES LIMITED

LEGEND:

- BELOW CRITERIA
- ABOVE CRITERIA
- MONITORING WELL
- TEST HOLE
- DESTROYED WELL
- 30m AGRICULTURAL BUFFER
- 30 m RESIDENTIAL BUFFER
- OVERHEAD POWERLINE
- NATURAL GASLINE
- PROPERTY LINE
- FORMER FEATURES
- LEGAL SUBDIVISION

#### Groundwater Criteria - SEQG 2019

mg/kg	Commercial	Residential	Agricultural
B	0.005 <sup>A</sup>		
T	0.021 <sup>B</sup>		
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F1 (PHC)	2.2 <sup>A</sup>	0.81 <sup>C</sup>	
F2 (PHC)	1.1 <sup>A</sup>		
F3 (PHC)	NV	NV	NV
F4 (PHC)	NV	NV	NV

<sup>A</sup> Protection of Groundwater - Potable    <sup>B</sup> Freshwater Aquatic

<sup>C</sup> Vapour Inhalation

NOTE: SITE FEATURE LOCATIONS ARE APPROXIMATE.

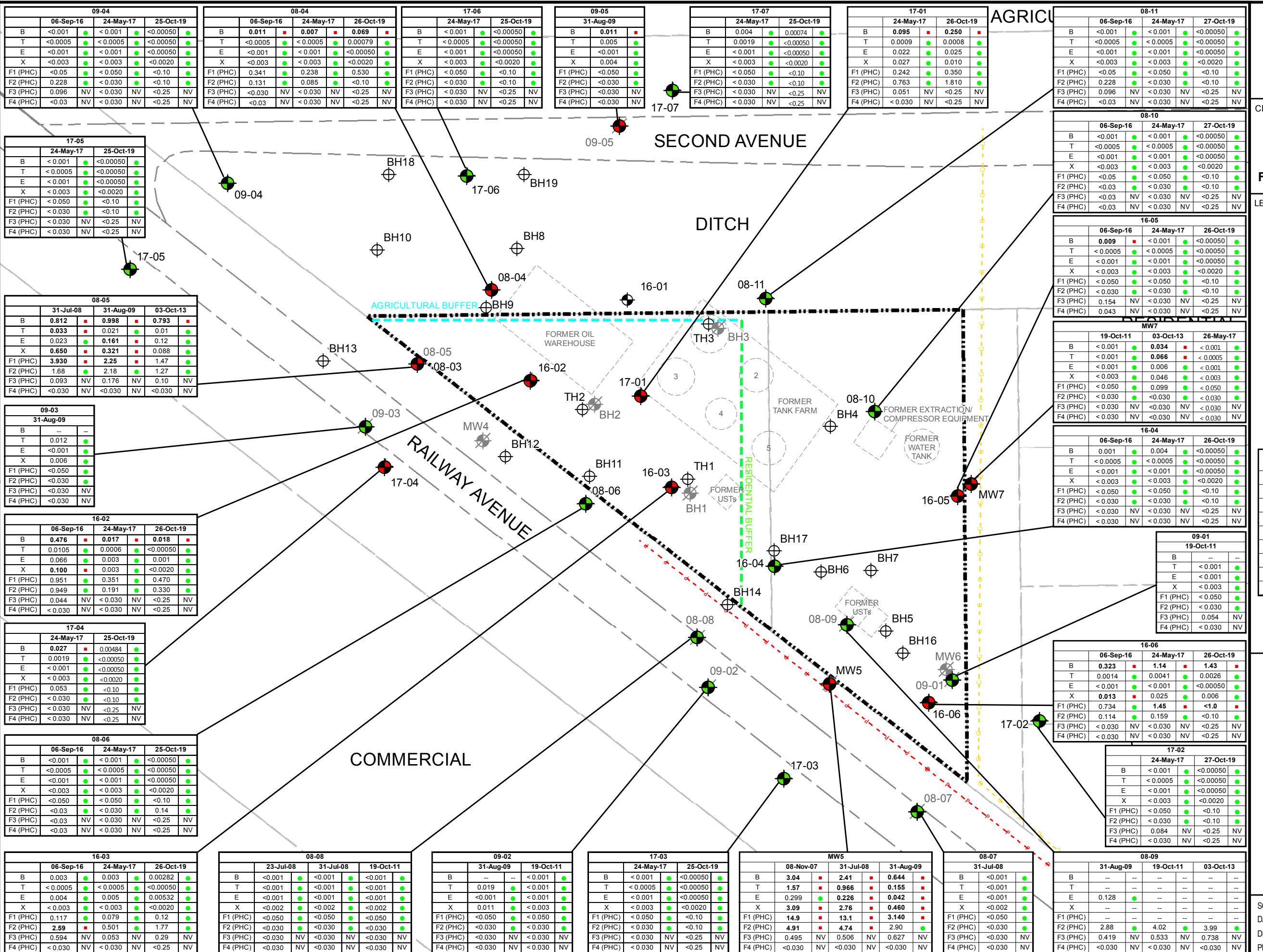
#### GROUNDWATER MONITORING PROGRAM

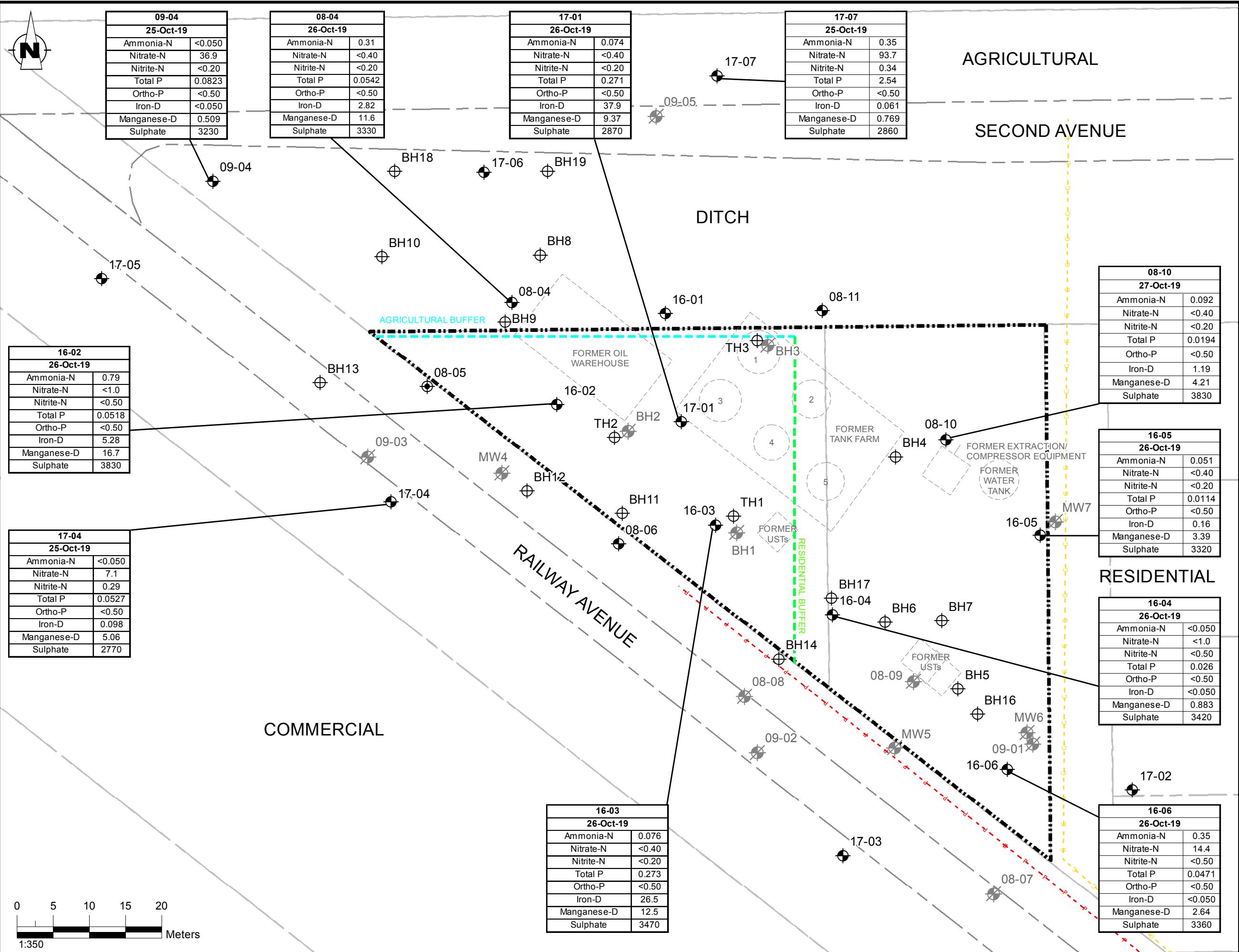
### FORMER CO-OP BULK PLANT

2ND AVENUE & RAILWAY AVENUE  
LANG, SASKATCHEWAN

### HISTORICAL GROUNDWATER ANALYTICAL RESULTS - PHCs

SCALE: 1:400  
DATE: DECEMBER 2019  
DRAWN BY: MM  
PROJECT NUMBER: ZE0803919





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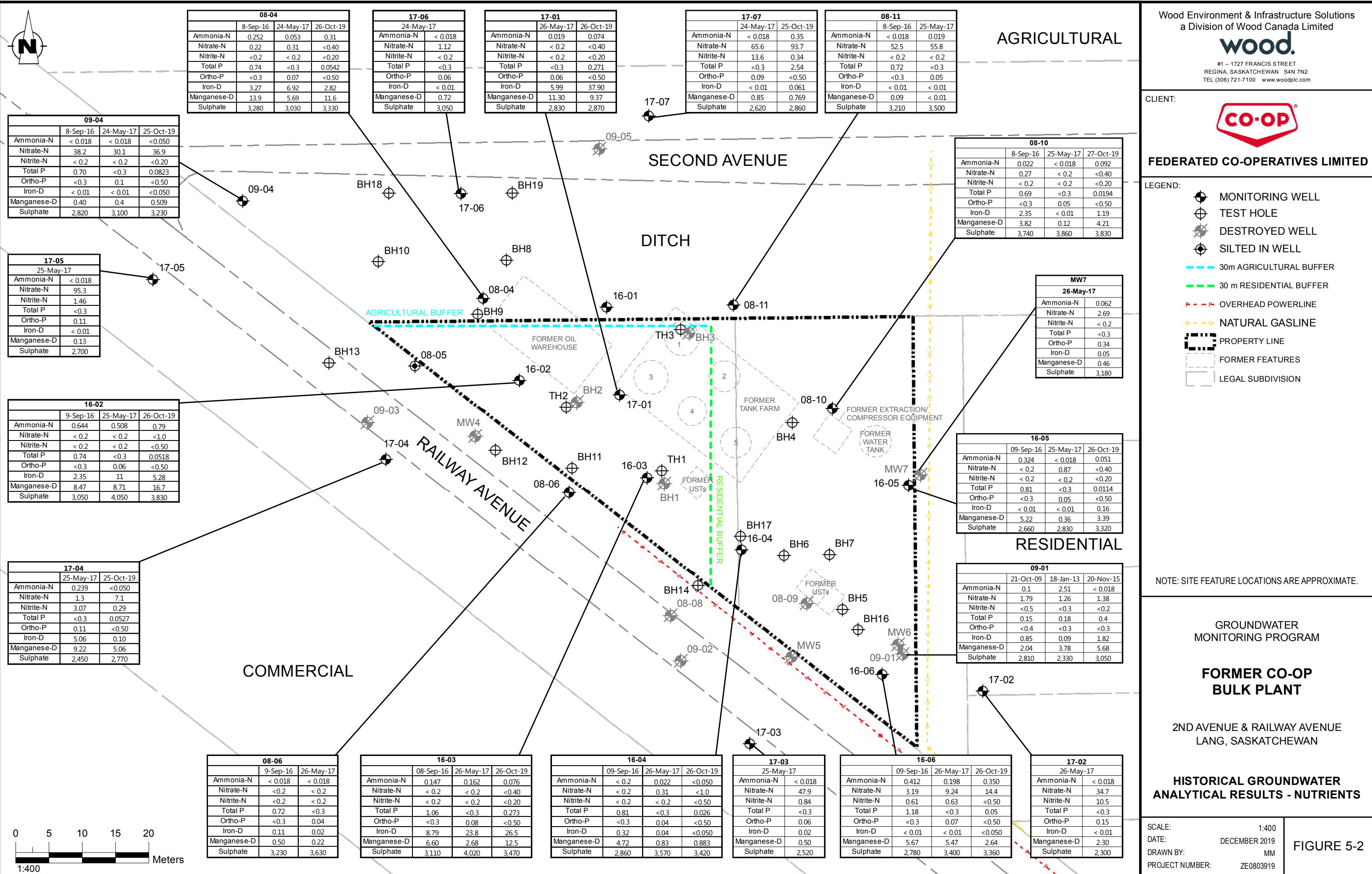
**CO-OP**

FEDERATED CO-OPERATIVES LIMITED

LEGEND:

- MONITORING WELL
- TEST HOLE
- DESTROYED WELL
- SILT IN WELL
- 30m AGRICULTURAL BUFFER
- 30 m RESIDENTIAL BUFFER
- OVERHEAD POWERLINE
- NATURAL GASLINE
- PROPERTY LINE
- FORMER FEATURES
- LEGAL SUBDIVISION

NOTE: SITE FEATURE LOCATIONS ARE APPROXIMATE.



CLIENT:



### FEDERATED CO-OPERATIVES LIMITED

LEGEND:
● BELOW CRITERIA
● ABOVE CRITERIA
● MONITORING WELL
● TEST HOLE
● DESTROYED WELL
● SILTED IN WELL
— 30m AGRICULTURAL BUFFER
— 30 m RESIDENTIAL BUFFER
— OVERHEAD POWERLINE
— NATURAL GASLINE
— PROPERTY LINE
— FORMER FEATURES
— LEGAL SUBDIVISION

Commercial Soil Criteria - SEQG		Residential & Agricultural Soil Criteria - SEQG 2019	
2019		0 - 1.5m	1.5m - > 3.0m
B	0.09	37	21
T	3.8	240	110
E	5.7	46	29
X	77	290	160
F1 (PHC)	900	2,500	2,500
F2 (PHC)	-	-	-
F3 (PHC)	-	-	-
F4 (PHC)	-	-	-
0 - 1.5m	1.5m - > 3.0m	0 - 1.5m	1.5m - > 3.0m
B	0.073 <sup>A</sup>	0.078 <sup>A</sup>	
T	0.95 <sup>A</sup>	0.95 <sup>A</sup>	
E	0.14 <sup>A</sup>		
X	1.9 <sup>A</sup>		
F1 (PHC)	240 <sup>A</sup>		
F2 (PHC)	30 <sup>D</sup>		
F3 (PHC)	260 <sup>B</sup>	320 <sup>A</sup>	150 <sup>B</sup>
F4 (PHC)	1,700 <sup>B</sup>	3,400 <sup>B</sup> / 3,500 <sup>C</sup>	300 <sup>B</sup> / 600 <sup>B</sup> / 2,500 <sup>C</sup>

<sup>A</sup> Protection of Groundwater - Potable    <sup>B</sup> Ecological Contact  
<sup>C</sup> Management Limit    <sup>D</sup> Vapour Inhalation

NOTE: SITE FEATURE LOCATIONS ARE APPROXIMATE.

### GROUNDWATER MONITORING PROGRAM

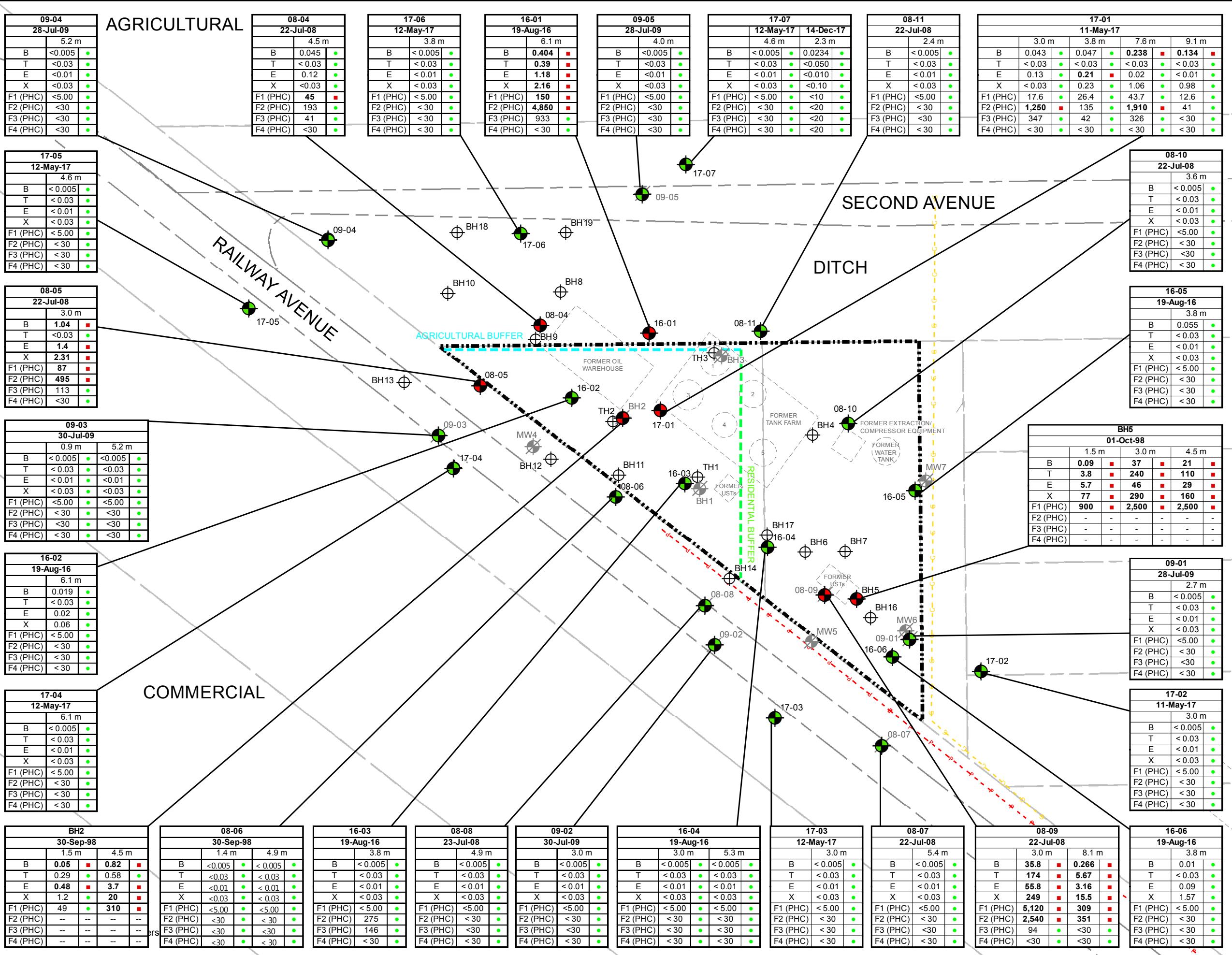
#### FORMER CO-OP BULK PLANT

2ND AVENUE & RAILWAY AVENUE  
LANG, SASKATCHEWAN

#### HISTORICAL SOIL ANALYTICAL RESULTS - PHCs

SCALE: 1:500  
DATE: DECEMBER 2019  
DRAWN BY: MM  
PROJECT NUMBER: ZE0803919

**FIGURE 6**



# Tables

- Table 1      Site and Surrounding Land Use**
- Table 2      Monitoring Well Data**
- Table 3      Groundwater Analytical Results – PHCs**
- Table 4      Groundwater Analytical Results – Nutrients**

**TABLE 1: SITE AND SURROUNDING LAND USE**

Direction	Land Use	Approx. Distance (m)
Site	Co-op Former Bulk Plant	-
	Commercial Land Use	
North	Second Avenue followed by agricultural land use	Adjacent/ 30 m
	Agricultural	
East	Residential property	Adjacent
	Residential	
South	Railway Avenue followed by commercial property	Adjacent/ 30 m
	Commerical	
West	Railway Avenue followed by commercial property	Adjacent/ 30 m
	Commercial	

**Notes:**

- m - metres

TABLE 2: GROUNDWATER MONITORING WELL DATA

Monitoring Well	Date	Total Depth	Ground Elevation	TOC Elevation	Depth to Water	Depth to Water	Ground Water Elevation	LNAPL Thickness	Well Headspace Vapours	Methane - Well Headspace Vapours	Groundwater Headspace Vapours	Temp	EC	TDS	DO	pH	ORP
		dd-mmm-yy	m btoc	m	m	m btoc	m bgl	m	mm	ppm <sub>v</sub>	ppm <sub>v</sub>	ppm <sub>v</sub>	(°C)	(µS/cm)	(mg/L)	(mg/L)	-
08-04	24-Oct-19	7.48	581.26	582.24	3.72	2.74	578.52	0	ND	30	25	4.8	4,521	4,789	6.23	6.53	-154.7
08-05	24-Oct-19								Silted In								
08-06	24-Oct-19	5.08	580.87	NS	3.80	2.97	577.91	0	20	40	ND	10.7	4,851	4,338	1.47	6.74	-177.2
08-10	24-Oct-19	5.83	581.56	582.32	5.27	4.51	577.05	0	ND	30	ND	2.3	4,147	4,262	0.74	6.8	-126.9
08-11	24-Oct-19	5.53	581.49	582.38	5.02	4.13	577.36	0	ND	20	ND	2.7	4,375	4,976	6.80	6.97	-59.7
09-04	24-Oct-19	7.05	580.94	NS	3.58	2.59	578.35	0	ND	30	ND	7.6	4,084	3,982	5.6	6.8	-129.6
16-01	24-Oct-19	9.49	581.36	582.23	4.34	3.47	577.90	25	90	ND	---	--	--	--	--	--	--
16-02	24-Oct-19	6.82	581.38	582.30	4.20	3.28	578.10	0	10	ND	ND	5.3	5,046	5,255	1.35	6.71	-22.6
16-03	24-Oct-19	6.35	581.55	582.46	4.60	3.69	577.86	0	ND	10	ND	4.9	4,985	5,260	0.33	6.41	-198.9
16-04	24-Oct-19	6.73	581.45	582.46	4.83	3.83	577.63	0	5	35	ND	4.6	4,597	4,895	5.59	6.58	-54.7
16-05	24-Oct-19	6.84	581.38	582.34	5.56	4.60	576.78	0	ND	30	5	4.1	3,861	4,176	0.51	6.78	-13.5
16-06	24-Oct-19	6.70	581.28	582.12	4.22	3.39	577.90	0	5	35	35	4.1	4,585	4,945	1.03	6.63	15.2
17-01	24-Oct-19	9.36	581.41	582.43	4.73	3.71	577.70	0	ND	25	35	5.2	4,325	4,526	0.79	6.61	-153.9
17-02	24-Oct-19	5.84	581.34	NS	3.43	3.56	577.79	0	25	85	ND	-0.2	3,328	4,170	2.04	6.72	-33.2
17-03	24-Oct-19	5.82	581.63	581.40	3.48	3.70	577.93	0	25	75	ND	11.4	5,061	4,442	0.74	6.84	-91.8
17-04	24-Oct-19	8.18	581.68	581.42	2.92	3.18	578.50	0	ND	30	ND	10.8	4,574	4,074	0.33	6.79	-124.0
17-05	24-Oct-19	5.77	581.73	581.56	3.30	3.47	578.27	0	35	30	ND	10.2	4,681	4,246	1.57	6.83	-69.3
17-06	24-Oct-19	5.80	580.94	580.89	2.83	2.88	578.06	0	5	35	ND	8.4	4,006	3,811	6.48	6.87	-137.1
17-07	24-Oct-19	5.74	581.53	581.43	3.66	3.76	577.77	0	ND	30	ND	8.4	4,464	4,244	0.93	6.64	-132.2

**Notes:**

- TOC - top of casing
- LNAPL - light non-aqueous phase liquids
- EC - electrical conductivity
- TDS - total dissolved solids
- DO - dissolved oxygen
- ORP - oxidation/reduction potential
- m - meters
- m btoc - meters below top of casing
- m bgl - meters below ground level
- mm - millimeters
- ppm<sub>v</sub> - parts per million organic vapour
- µS/cm - microSiemens per centimetre
- mg/L - milligrams per litre
- mV - millivolts
- NS - not surveyed
- --- - not measured

TABLE 3: GROUNDWATER ANALYTICAL RESULTS - PHCs

Monitoring Well	Date	Groundwater Vapour Concentration (ppm <sub>v</sub> )	Concentration (mg/L)							
			Benzene	Toluene	Ethylbenzene	Xylenes	PHC Fraction F1	PHC Fraction F2	PHC Fraction F3	PHC Fraction F4
08-04	26-Oct-19	25	<b>0.0692</b>	0.00079	<0.00050	<0.0020	0.53	<0.10	<0.25	<0.25
08-11	27-Oct-19	ND	<0.00050	<0.00050	<0.00050	<0.0020	<0.10	<0.10	<0.25	<0.25
09-04	25-Oct-19	ND	<0.00050	<0.00050	<0.00050	<0.0020	<0.10	<0.10	<0.25	<0.25
17-05	25-Oct-19	ND	<0.00050	<0.00050	<0.00050	<0.0020	<0.10	<0.10	<0.25	<0.25
17-06	25-Oct-19	ND	<0.00050	<0.00050	<0.00050	<0.0020	<0.10	<0.10	<0.25	<0.25
17-07	25-Oct-19	ND	0.00074	<0.00050	<0.00050	<0.0020	<0.10	<0.10	<0.25	<0.25
<b>Applicable Agricultural Groundwater Criteria - SEQG 2019</b>			<b>0.005</b>	<b>0.02</b>	<b>0.14</b>	<b>0.09</b>	<b>0.81</b>	<b>1.1</b>	<b>NV</b>	<b>NV</b>
08-06	25-Oct-19	ND	<0.00050	<0.00050	<0.00050	<0.0020	<0.10	0.14	<0.25	<0.25
16-02	26-Oct-19	ND	<b>0.018</b>	<0.00050	0.0008	<0.0020	0.47	0.33	<0.25	<0.25
16-03	26-Oct-19	ND	0.00282	<0.00050	0.00532	<0.0020	0.12	<b>1.77</b>	0.29	<0.25
17-01	26-Oct-19	35	<b>0.25</b>	0.00075	0.025	0.0098	0.35	<b>1.81</b>	<0.25	<0.25
B001 (Duplicate of 17-01)			<b>0.261</b>	0.0008	0.0254	0.0102	0.34	<b>2.06</b>	<0.25	<0.25
17-04	25-Oct-19	ND	0.00484	<0.00050	<0.00050	<0.0020	<0.10	<0.10	<0.25	<0.25
<b>Applicable Commercial Groundwater Criteria - SEQG 2019</b>			<b>0.005</b>	<b>0.02</b>	<b>0.14</b>	<b>0.09</b>	<b>2.2</b>	<b>1.1</b>	<b>NV</b>	<b>NV</b>
08-10	27-Oct-19	ND	<0.00050	<0.00050	<0.00050	<0.0020	<0.10	<0.10	<0.25	<0.25
16-04	26-Oct-19	ND	<0.00050	<0.00050	<0.00050	<0.0020	<0.10	<0.10	<0.25	<0.25
16-05	26-Oct-19	5	<0.00050	<0.00050	<0.00050	<0.0020	<0.10	<0.10	<0.25	<0.25
16-06	26-Oct-19	35	<b>1.43</b>	0.00259	<0.00050	0.0057	<1.0	<0.10	<0.25	<0.25
17-02	27-Oct-19	ND	<0.00050	<0.00050	<0.00050	<0.0020	<0.10	<0.10	<0.25	<0.25
A001 (Duplicate of 17-02)			<0.00050	<0.00050	<0.00050	<0.0020	<0.10	<0.10	<0.25	<0.25
17-03	25-Oct-19	ND	<0.00050	<0.00050	<0.00050	<0.0020	<0.10	<0.10	<0.25	<0.25
<b>Applicable Residential Groundwater Criteria - SEQG 2019</b>			<b>0.005</b>	<b>0.021</b>	<b>0.14</b>	<b>0.09</b>	<b>0.81</b>	<b>1.1</b>	<b>NG</b>	<b>NG</b>

**Notes:**

- mg/L - concentration in milligrams per liter
- ppm<sub>v</sub> - parts per million organic vapour
- PHC Fraction F1 - volatile petroleum hydrocarbons (C<sub>6</sub> – C<sub>10</sub>), less BTEX
- PHC Fraction F2 - extractable petroleum hydrocarbons (C<sub>10</sub> – C<sub>16</sub>)
- PHC Fraction F3 - extractable petroleum hydrocarbons (C<sub>16</sub> – C<sub>34</sub>)
- PHC Fraction F4 - extractable petroleum hydrocarbons (C<sub>34</sub> – C<sub>50</sub>)
- < - less than the analytical detection limit
- NG - no guideline
- SEQG 2019 - see Table E-1
- See laboratory report for detection limits, testing protocols and QA/QC procedures. Laboratory analysis was performed by ALS Canada Ltd.

**BOLD** exceeds applicable SEQG 2019 groundwater criteria

**TABLE 4: GROUNDWATER ANALYTICAL RESULTS - NUTRIENTS**

Parameter	Units	08-04	08-10	09-04	16-02	16-03	16-04	16-05	16-06	17-01	17-04	17-07
		26-Oct-19	27-Oct-19	25-Oct-19	26-Oct-19	26-Oct-19	26-Oct-19	26-Oct-19	26-Oct-19	26-Oct-19	25-Oct-19	25-Oct-19
Ammonia, Total (as N)	mg/L	0.31	0.092	<0.050	0.79	0.076	<0.050	0.051	0.35	0.074	<0.050	0.35
Nitrate-N	mg/L	<0.40	<0.40	36.9	<1.0	<0.40	<1.0	<0.40	14.4	<0.40	7.1	93.7
Nitrite-N	mg/L	<0.20	<0.20	<0.20	<0.50	<0.20	<0.50	<0.20	<0.50	<0.20	0.29	0.34
Phosphorus (P)-Total	mg/L	0.0542	0.0194	0.0823	0.0518	0.273	0.026	0.0114	0.0471	0.271	0.0527	2.54
Orthophosphate-Dissolved (as P)	mg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Iron (Fe)-Total	mg/L	3.51	1.3	4.21	5.55	45.7	1.15	0.815	1.32	38.3	3.68	126
Iron (Fe)-Dissolved	mg/L	2.82	1.19	<0.050	5.28	26.5	<0.050	0.16	<0.050	37.9	0.098	0.061
Manganese (Mn)-Dissolved	mg/L	11.6	4.21	0.509	16.7	12.5	0.883	3.39	2.64	9.37	5.06	0.769
Sulfate (SO <sub>4</sub> )	mg/L	3,330	3,830	3,230	3,830	3,470	3,420	3,320	3,360	2,870	2,770	2,860
Total Dissolved Solids	mg/L	5,720	5,740	5,330	6,490	6,400	5,780	5,250	5,560	5,380	5,210	5,780
Calcium (Ca)-Dissolved	mg/L	461	426	446	465	445	480	438	498	504	498	502
Magnesium (Mg)-Dissolved	mg/L	384	357	357	424	444	410	358	426	354	337	414
Potassium (K)-Dissolved	mg/L	22	24.4	25.4	23.3	22.9	28.2	25	27.2	22.8	21.7	23.8
Sodium (Na)-Dissolved	mg/L	658	733	538	797	703	635	506	593	519	546	492
Bicarbonate (HCO <sub>3</sub> )	mg/L	1130	708	474	1070	1070	1100	789	1120	1250	825	585
Carbonate (CO <sub>3</sub> )	mg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Chloride (Cl)	mg/L	213	28.6	298	236	392	276	52	305	256	500	453
Hydroxide (OH)	mg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Conductivity	µS/cm	6,220	6,260	5,890	6,910	6,880	6,470	5,530	6,520	5,910	6,010	6,260
pH	pH	7.47	7.66	7.68	7.3	7.17	7.56	7.68	7.54	7.38	7.6	7.67
SAR	SAR	5.61	6.77	4.79	6.7	5.63	5.3	4.44	4.85	4.35	4.82	3.55
Total Organic Carbon	mg/L	42.1	46.4	47.3	58	89.7	58	26.3	121	88.8	66	130
Chemical Oxygen Demand	mg/L	196	129	135	230	262	165	83	355	283	204	280
Acidity (as CaCO <sub>3</sub> )	mg/L	192	73.2	47.4	232	331	133	69.8	140	240	95.9	60.9
Alkalinity, Total (as CaCO <sub>3</sub> )	mg/L	923	581	389	875	873	904	647	919	1020	676	480
Total Cations	meq/L	84.3	83.3	78.3	94.2	91.3	86.1	74.1	86.5	79.1	77.1	81.2
Total Anions	meq/L	93.8	92.2	83.4	103.9	100.8	97.1	83.5	98.0	87.4	85.8	88.6
Balance (Cations/Anions)	%	89.9%	90.4%	93.9%	90.6%	90.6%	88.7%	88.7%	88.3%	90.6%	89.8%	91.6%
Missing Cations	meq/L	9.5	8.8	5.1	9.7	9.4	11.0	9.4	11.5	8.2	8.7	7.4
Missing Cations as N	mg/L	133	124	72	136	132	154	132	160	115	122	104

**Notes:**

- < - less than the analytical method detection limit
- See laboratory report for detection limits, testing protocols and QA/QC procedures.
- mg/L - milligrams per litre
- meq/L - milliequivalents per litre
- µS/cm - microSiemens per centimetre
- SAR - Sodium Absorption Ratio

# Appendix A

## Historical Tables

TABLE A1: HISTORICAL MONITORING WELL DATA

Monitoring Well	Monitoring Date	Construction Details				Monitoring Data							Field Parameters					
		Monitoring Well Depth	Elevation GL	Elevation TOC	Screen Interval	Well Vapour Level	Groundwater Vapour Level	Groundwater Depth	Groundwater Depth	Groundwater Elevation	LNAPL	Temp	EC	TDS	DO	pH	ORP	
		(m)	(m)	(m)	(m)	(ppm <sub>v</sub> )	(ppm <sub>v</sub> )	(m btoc)	(m bgl)	(m)	(mm)	°C	(uS/cm)	(ppm)	(mg/L)	-	(mV)	
BH1	6-Oct-98	5.3	100.16	NS	--	40	--	--	2.12	98.04	--	--	--	--	--	--	--	
	3-Feb-99	--	--	NS		125	--	--	2.31	97.85	--	--	--	--	--	--	--	
BH2	6-Oct-98	6.0	100.11	NS	1.5-6.0	465	--	--	5.53	94.58	43	--	--	--	--	--	--	
	3-Feb-99	--	--	NS		3,630	--	--	2.37	97.74	5	--	--	--	--	--	--	
BH3	6-Oct-98	5.4	100.22	NS	0.9-5.4	25	--	--	1.53	98.69	--	--	--	--	--	--	--	
	3-Feb-99	--	--	NS		30	--	--	2.60	97.62	--	--	--	--	--	--	--	
MW5	8-Nov-07	5.9	100.08	NS	--	3,000	--	--	3.20	96.88	--	--	--	--	--	--	--	
	23-Jul-08	--	--	NS		--	--	--	2.26	97.82	--	--	--	--	--	--	--	
	31-Jul-08	--	--	NS		1,050	--	--	3.11	96.97	--	--	--	--	--	--	--	
	31-Aug-09	5.85	--	NS		110	70	--	3.18	96.83	0	9.26	1,697	--	0.84	7.42	33.5	
MW7	8-Nov-07	6.6	100.95	NS	--	0	--	--	4.88	96.07	--	--	--	--	--	--	--	
	23-Jul-08	--	--	NS		--	--	--	5.14	95.81	--	--	--	--	--	--	--	
	31-Jul-08	--	--	NS		0	--	--	5.15	95.80	--	--	--	--	--	--	--	
	31-Aug-09	6.56	--	NS		0	15	--	5.19	95.12	0	8.30	3,969	--	1.44	7.92	75.4	
	19-Oct-11	6.61	--	NS		0	0	--	3.29	96.88	0	8.0	8,245	--	2.31	7.11	113.6	
	3-Oct-13	6.6	--	NS		20	--	--	3.69	96.49	0	8.8	4,039	--	1	6.92	68.8	
	24-May-17				Destroyed													
08-04	23-Jul-08	7.5	100.88	NS	4.0-5.95	--	--	--	4.57	96.31	--	--	--	--	--	--	--	
	31-Jul-08	--	--	NS		5	--	--	4.75	96.13	--	--	--	--	--	--	--	
	31-Aug-09	6.46	--	NS		0	10	--	3.88	96.11	0	8.8	5,978	--	0.77	7.41	-93.9	
	19-Oct-11	7.49	--	NS		20	0	--	2.54	97.40	0	7.0	7,120	--	2.37	6.79	-218.7	
	3-Oct-13	7.48	--	NS		30	--	--	2.72	97.22	0	8.8	3,452	--	0.62	6.77	-46.2	
	6-Sep-16	7.475	562.26	NS		0	10	3.57	2.80	559.47	0	NM	6,538	--	0.49	9.23	-21.2	
	24-May-17	7.48	581.25	NS		ND	ND	2.13	1.37	579.88	0	9.08	3,858	--	0.31	6.8	-108.7	
	24-Oct-19	7.48	581.26	NS		ND	25	3.72	2.74	578.52	0	4.77	4,521	4,789	6.23	6.53	-154.7	
08-05	23-Jul-08	7.0	100.37	NS	5.0-6.6	--	--	--	4.00	96.37	--	--	--	--	--	--	--	
	31-Jul-08	--	--	NS		210	--	--	3.97	96.40	--	--	--	--	--	--	--	
	31-Aug-09	5.84	--	NS		220	55	--	3.39	95.97	0	8.7	5,216	--	0.71	7.39	-22.1	
	19-Oct-11	5.83	--	NS		3,200	--	--	2.06	97.29	25	--	--	--	--	--	--	
	3-Oct-13	5.86	--	NS		1,200	--	--	2.22	97.13	--	9.10	3,140	--	0.72	6.71	-54.30	
	6-Sep-16	5.85	561.69	NS		200	0	2.76	1.88	558.93	3	--	--	--	--	--	--	
	24-May-17	5.85	580.65	NS		680	--	1.57	0.69	579.96	1	--	--	--	--	--	--	
08-06	23-Jul-08	6.0	100.58	NS	3.0-5.05	--	--	--	4.52	96.06	--	--	--	--	--	--	--	
	31-Jul-08	--	--	NS		40	--	--	4.36	96.22	--	--	--	--	--	--	--	
	31-Aug-09	6.01	--	NS		0	15	--	3.38	96.21	0	9.36	7,806	--	0.68	7.47	-39.7	
	19-Oct-11	5.09	--	NS		10	25	--	2.22	97.34	0	7.90	10,123	--	1.59	7.13	-152.4	
	3-Oct-13	5.08	--	NS		<5	--	--	2.40	97.17	0	6.90	4,396	--	1.08	6.85	15.8	
	6-Sep-16	5.09	561.93	NS		0	5	2.92	2.08	559.93	0	11.6	6,183	--	0.61	nm	-73.2	
	24-May-17	1.68	580.87	NS		ND	ND	1.68	0.84	580.03	0	10.7	4,575	--	0.15	6.87	-34.3	
	24-Oct-19	5.08	580.87	NS		20	ND	3.80	2.97	577.90	0	10.7	4,851	4,338	1.47	6.74	-177.2	
08-07	23-Jul-08	6.0	100.23	NS	3.0-6.1	--	--	--	4.75	95.48	--	--	--	--	--	--	--	
	31-Jul-08	--	--	NS		0	--	--	3.32	96.91	--	--	--	--	--	--	--	
	31-Aug-09	6.03	--	NS		45	15	--	3.23	96.88	0	9.6	2,955	--	0.80	7.39	-134.3	
	19-Oct-11	6.06	--	NS		0	--	--	2.10	98.01	0	--	--	--	--	--	--	

08-08	23-Jul-08	6.0	100.42	NS	3.0-6.1		--	--	DRY	--	--	--	--	--	--	--	--
	31-Jul-08	--	--	NS		0	--	--	4.03	96.39	--	--	--	--	--	--	--
	31-Aug-09	6.03	--	NS		0	10	--	3.65	96.67	0	8.3	3.945	--	0.76	7.43	18.1
	19-Oct-11	4.08	--	NS		0	--	--	2.01	98.33	0	--	--	--	--	--	--
08-09	23-Jul-08	6.7	101.06	NS	3.0-5.9		--	--	6.64	94.42	--	--	--	--	--	--	--
	31-Jul-08	--	--	NS		6,200	--	--	6.63	94.43	--	--	--	--	--	--	--
	31-Aug-09	6.68	--	NS		4,175	310	--	4.85	95.39	0	9.2	6.980	--	0.72	7.41	48.4
	19-Oct-11	6.70	--	NS		0	1,200	--	2.80	97.25	0	9.4	8,915	--	1.87	6.66	38.2
	3-Oct-13	6.7	--	NS		120		--	3.01	97.04	0	9.20	5,195	--	0.99	6.66	58.8
08-10	23-Jul-08	5.9	101.23	NS	3.0-4.95		--	--	DRY	--	--	--	--	--	--	--	--
	31-Jul-08	--	101.23	NS		10	--	--	5.54	95.69	--	--	--	--	--	--	--
	31-Aug-09	5.83	--	NS		0	30	--	5.01	95.30	0	9.50	6.161	--	1.17	7.51	-126.7
	19-Oct-11	5.86	--	NS		0	0	--	3.16	97.04	0	7.4	8,953	--	1.68	7.01	-223.6
	3-Oct-13	5.84	--	NS		20	--	--	3.50	96.71	--	9.4	4,454	--	0.47	6.99	-142
	6-Sep-16	5.86	562.56	NS		15	0	4.3	3.51	559.06	0	11.49	6,240	--	0.42	NM	12.3
	24-May-17	5.09	581.52	NS		ND	ND	3.96	3.19	578.33	0	8.7	4,398	--	2.29	6.99	103.4
	24-Oct-19	5.83	581.555	NS		0	ND	5.27	4.51	577.05	0	2.3	4,147	4,262	0.74	6.8	-126.9
08-11	23-Jul-08	5.5	101.28	NS	2.0-4.6		--	--	DRY	--	--	--	--	--	--	--	--
	31-Jul-08	--	--	NS		5	--	--	DRY	--	--	--	--	--	--	--	--
	31-Aug-09	5.51	--	NS		10	20	--	4.70	95.65	0	9.7	6.529	--	1.66	7.46	-2.5
	19-Oct-11	5.54	--	NS		5	20	--	3.10	97.12	0	8.0	6,301	--	1.94	7.34	87.10
	3-Oct-13	5.52	--	NS		30	--	--	3.44	96.79	0	9.20	4,026	--	0.66	7.11	26.8
	6-Sep-16	5.54	562.57	NS		5	10	4.26	3.39	559.18	0	12.8	6,510	--	0.78	NM	6.8
	24-May-17	4.68	581.47	NS		ND	ND	4.02	3.16	578.31	0	9.65	4,787	--	2.34	7.09	75.9
	24-Oct-19	5.53	581.489	NS		ND	ND	5.02	4.13	577.36	0	2.71	4,375	4,976	6.8	6.97	-59.7
09-01	19-Oct-11	6.11		NS	--	0	5	--	2.99	97.06	0	8.9	11,004	--	1.62	7.07	110.6
09-02	31-Aug-09	6.12	--	NS	--	25	25	--	3.62	94.86	0	7.77	6,409	--	22.57	7.47	76.1
	19-Oct-11	6.14	--	NS		10	0	--	1.98	98.25	0	6.5	9,798	--	2.57	7.04	50.4
09-03	31-Aug-09	11.90		NS	--	30	35	--	2.17	95.59	0	8.39	5.587	--	0.83	7.44	59.9
09-04	31-Aug-09	7.07	--	NS	--	45	15	--	3.78	95.26	0	9.41	6,058	--	7.63	7.43	12.2
	19-Oct-11	7.08	--	NS		45	5	--	2.42	97.16	0	6.7	8,248	--	1.27	7.11	1.24
	3-Oct-13	4.55	--	NS		<5	--	--	2.62	96.97	0	8.5	4,110	--	1.02	7.03	83.4
	6-Sep-16	7.06	561.9	NS		5	5	1.41	0.41	561.50	0	12.16	5,844	--	2.10	NM	5.8
	24-May-17	6.05	580.94	NS		ND	15	2.08	1.08	579.86	0	10.61	4,208	--	0.22	7.00	151.7
	24-Oct-19	7.05	580.905	580.969		ND	ND	3.58	2.59	578.32	0	7.55	4,084	3,982	5.58	6.80	-129.6

09-05	31-Aug-09	6.01	--	NS	--	25	0	---	3.48	95.19	0	9.03	5.980	--	18.42	7.42	95.8
16-01	6-Sep-16	9.4	562.4	NS	5.5-8.5	880	--	3.45	2.63	559.77	350	--	--	--	--	--	--
	24-May-17	9.4	581.34	NS		90	ND	3.34	2.505	578.83	25	--	--	--	--	--	--
	24-Oct-19	9.485	581.36	NS		ND	--	4.34	3.47	577.89	25	--	--	--	--	--	--
16-02	6-Sep-16	6.84	562.45	NS	3.1-6.1	15	30	3.57	2.69	559.76	0	11.23	6,292	--	2.85	--	-66.2
	24-May-17	5.92	581.27	NS		ND	ND	2.08	1.185	580.09	0	8.41	4,885	--	0.32	6.59	-28.0
	24-Oct-19	6.82	581.38	NS		10	ND	4.20	3.28	578.10	0	5.33	5,046	5,255	1.35	6.71	-22.6
16-03	6-Sep-16	6.36	562.68	NS	2.5-5.5	55	ND	3.70	2.85	559.83	0	10.86	6,703	--	0.77	--	12.3
	24-May-17	5.48	581.49	NS		ND	ND	2.72	1.84	579.65	0	4.72	5,828	--	0.49	6.74	-72.5
	24-Oct-19	6.35	581.55	NS		ND	ND	4.60	3.69	577.86	0	4.91	4,985	5,260	0.33	6.41	-998.9
16-04	6-Sep-16	6.78	562.49	NS	3.1-6.1	15	45	3.82	2.81	559.68	0	13.2	6,034	--	3.62	--	-43.6
	24-May-17	5.80	581.32	NS		ND	ND	1.11	0.105	581.21	0	9.1	4,920	--	0.47	6.9	100.4
	24-Oct-19	6.73	581.45	NS		5	ND	4.83	3.83	577.62	0	4.61	4,597	4,895	5.59	6.58	-54.7
16-05	6-Sep-16	6.84	562.45	NS	3.1-6.1	5	--	4.42	3.45	559.00	0	12.41	5,313	--	6.73	--	-27.1
	24-May-17	5.87	581.32	NS		5	5	4.07	3.10	578.22	0	7.83	3,254	--	0.84	7.01	6.6
	24-Oct-19	6.84	581.38	NS		ND	5	5.56	4.60	576.78	0	4.12	3,861	4,176	0.51	6.78	-13.5
16-06	6-Sep-16	6.69	562.35	NS	3.1-6.1	ND	50	3.42	2.58	559.77	0	12.31	6,251	--	5.97	--	-34.5
	24-May-17	5.84	581.20	NS		ND	ND	3.28	2.42	578.78	0	7.71	4,582	--	0.7	6.68	147
	24-Oct-19	6.70	581.28	NS		5	35	4.22	3.39	577.89	0	4.14	4,585	4,945	1.03	6.63	15.2
17-01	24-May-17	8.44	581.34	NS	5.5 - 8.5	30	70	2.80	1.78	579.56	0	11.74	3,915	--	0.26	6.60	-236.8
	24-Oct-19	9.36	581.41	NS		ND	35	4.73	3.71	577.70	0	5.16	4,325	4,526	0.79	6.61	-153.9
17-02	24-May-17	6.00	581.34	NS	3.0 - 6.0	ND	ND	2.34	2.455	578.89	0	10.16	3,217	--	0.80	6.93	44.4
	24-Oct-19	5.84	581.34	NS		25	ND	3.43	3.56	577.78	0	-0.20	3,328	4,170	2.04	6.72	-33.2
17-03	24-May-17	5.96	581.58	NS	3.0 - 6.0	ND	ND	2.39	2.50	579.08	0	7.17	3,483	--	3.61	7.03	178.6
	24-Oct-19	5.82	581.63	581.51		25	ND	3.48	3.70	577.93	0	11.42	5,061	4,442	0.74	6.84	-91.8
17-04	24-May-17	8.42	581.68	NS	5.5 - 8.5	290	170	1.51	1.72	579.96	0	7.94	3,805	--	0.45	6.85	-341.9
	24-Oct-19	8.18	581.68	581.47		ND	ND	2.92	3.18	578.50	0	10.84	4,574	4,074	0.33	6.79	-124.0
17-05	24-May-17	5.88	581.71	NS	3.0 - 6.0	ND	ND	2.11	2.15	579.56	0	9.94	4,420	--	4.09	7.07	98.2
	24-Oct-19	5.77	581.73	581.63		35	ND	3.30	3.47	578.26	0	10.15	4,681	4,246	1.57	6.83	-69.3
17-06	24-May-17	5.84	580.94	NS	3.0 - 6.0	ND	ND	1.45	1.48	579.46	0	8.27	3,398	--	0.84	7.01	159.7
	24-Oct-19	5.80	580.94	581.53		5	35	2.83	2.88	578.06	0	8.42	4,006	3,811	6.48	6.87	-137.1
17-07	24-May-17	5.91	581.55	NS	3.0 - 6.0	ND	ND	2.86	2.92	578.63	0	10.64	4,001	--	0.37	6.94	200.8
	24-Oct-19	5.74	581.53	581.46		ND	ND	3.66	3.76	577.77	0	8.44	4,464	4,244	0.93	6.64	-132.2

**Notes:**

- TOC - top of casing
- LNAPL - light non-aqueous phase liquids
- EC - electrical conductivity
- TDS - total dissolved solids
- DO - dissolved oxygen
- ORP - oxidation/reduction potential
- m - meters
- m btoc - meters below top of casing

TABLE A2: HISTORICAL SOIL ANALYTICAL RESULTS - PHCs

Test Hole	Date	Depth (m)	Soil Vapour Concentration (ppm <sub>v</sub> )	Concentration (mg/kg)								Grain Size (%<75 µm)
				Benzene	Toluene	Ethylbenzene	Xylenes	PHC F1	PHC F2	PHC F3	PHC F4	
08-04	22-Jul-08	4.5	210	0.045	< 0.03	0.12	<0.03	45	193	41	<30	--
08-05	22-Jul-08	3.0	430	<b>1.04</b>	<0.03	<b>1.4</b>	<b>2.31</b>	<b>87</b>	<b>495</b>	113	<30	--
08-11	22-Jul-08	3.4	60	--	--	--	--	--	--	--	--	16.8
09-04	28-Jul-09	2.4	ND	< 0.005	< 0.03	< 0.01	< 0.03	< 5.00	< 30	< 30	< 30	--
		5.2	20	<0.005	<0.03	<0.01	<0.03	<5.00	<30	<30	<30	--
		4.6	ND	--	--	--	--	--	--	--	--	13.2
16-01	19-Aug-16	6.1	110	<b>0.404</b>	<b>0.39</b>	<b>1.18</b>	<b>2.16</b>	<b>150</b>	<b>4,850</b>	933	< 30	14.4
17-05	12-May-17	4.6	ND	< 0.005	< 0.03	< 0.01	< 0.03	< 5.00	< 30	< 30	< 30	--
17-06	12-May-17	3.8	ND	< 0.005	< 0.03	< 0.01	< 0.03	< 5.00	< 30	< 30	< 30	--
17-07	12-May-17	4.6	ND	< 0.005	< 0.03	< 0.01	< 0.03	< 5.00	< 30	< 30	< 30	--
	14-Dec-17	2.3	ND	0.0234	<0.050	<0.010	<0.10	<10	<20	<20	<20	--
Applicable Agricultural Soil Criteria 2019				<b>Surface Soil (&lt;1.5 m)</b>					<b>150</b>	<b>300</b>	<b>2,800</b>	NG
				<b>Subsoil (&gt;1.5 - 3.0 m)</b>	<b>0.078</b>	<b>0.12</b>	<b>0.14</b>	<b>1.9</b>	<b>30</b>	<b>300</b>	<b>600</b>	<b>5,600</b>
				<b>Subsoil (&gt;3.0 m)</b>						<b>320</b>	<b>2,500</b>	<b>10,000</b>
BH2	30-Sep-98	1.5	770	<b>0.05</b>	0.29	<b>0.48</b>	1.2	49	--	--	--	--
	30-Sep-98	4.5	1,650	<b>0.82</b>	0.58	<b>3.7</b>	<b>20</b>	<b>310</b>	--	--	--	--
08-06	22-Jul-08	1.4	70	<0.005	<0.03	<0.01	<0.03	<5.00	<30	<30	<30	--
		1.8	ND	--	--	--	--	--	--	--	--	66.6
08-08	23-Jul-08	4.9	5	< 0.005	< 0.03	< 0.01	< 0.03	< 5.00	< 30	< 30	< 30	--
16-02	19-Aug-16	6.1	ND	0.019	< 0.03	0.02	0.06	< 5.00	< 30	< 30	< 30	--
16-03	19-Aug-16	3.8	25	< 0.005	< 0.03	< 0.01	< 0.03	< 5.00	275	146	< 30	67.8
17-01	11-May-17	3.0	150	0.043	< 0.03	0.13	< 0.03	17.6	<b>1,250</b>	347	< 30	--
		3.8	5	0.047	< 0.03	<b>0.21</b>	0.23	26.4	135	42	< 30	--
		7.6	500	<b>0.238</b>	< 0.03	0.02	1.06	43.7	<b>1,910</b>	326	< 30	--
17-04	12-May-17	9.1	5	<b>0.134</b>	< 0.03	< 0.01	0.98	12.6	41	< 30	< 30	--
Applicable Commercial Soil Criteria 2019				<b>Surface Soil (&lt;1.5 m)</b>					<b>260</b>	<b>1,700</b>	<b>3,300</b>	NG
				<b>Subsoil (&gt;1.5 - 3.0 m)</b>	<b>0.078</b>	<b>0.95</b>	<b>0.14</b>	<b>1.9</b>	<b>240</b>	<b>320</b>	<b>3,400</b>	<b>6,600</b>
				<b>Subsoil (&gt;3.0 m)</b>							<b>3,500</b>	<b>10,000</b>
BH5	1-Oct-98	1.5	6,380	<b>0.09</b>	<b>3.8</b>	<b>5.7</b>	<b>77</b>	<b>900</b>	-	-	-	--
		3.0	>10,000	<b>37</b>	<b>240</b>	<b>46</b>	<b>290</b>	<b>2,500</b>	-	-	-	--
		4.5	>10,000	<b>21</b>	<b>110</b>	<b>29</b>	<b>160</b>	<b>2,500</b>	-	-	-	--
08-07	22-Jul-08	5.4	5	< 0.005	< 0.03	< 0.01	< 0.03	< 5.00	< 30	< 30	< 30	--
08-09	22-Jul-08	3.0	>10,000	<b>35.8</b>	<b>174</b>	<b>55.8</b>	<b>249</b>	<b>5,120</b>	<b>2,540</b>	94	< 30	< 30
		8.1	>10,000	<b>0.266</b>	<b>5.67</b>	<b>3.16</b>	<b>15.5</b>	<b>309</b>	<b>351</b>	<30	<30	<30
08-10	22-Jul-08	3.6	45	< 0.005	< 0.03	< 0.01	< 0.03	< 5.00	< 30	< 30	< 30	--
09-01	28-Jul-09	2.7	20	< 0.005	< 0.03	< 0.01	< 0.03	< 5.00	< 30	< 30	< 30	--
09-02	30-Jul-09	3	15	< 0.005	< 0.03	< 0.01	< 0.03	< 5.00	< 30	< 30	< 30	--
09-03	30-Jul-09	0.9	5	< 0.005	< 0.03	< 0.01	< 0.03	< 5.00	< 30	< 30	< 30	--
		5.2	ND	< 0.005	< 0.03	< 0.01	< 0.03	< 5.00	< 30	< 30	< 30	--
		6.1	ND	--	--	--	--	--	--	--	--	2.9
09-05	28-Jul-09	4.0	5	< 0.005	< 0.03	< 0.01	< 0.03	< 5.00	< 30	< 30	< 30	--
16-04	19-Aug-16	3.0	ND	< 0.005	< 0.03	< 0.01	< 0.03	< 5.00	< 30	< 30	< 30	--
		5.3	5	< 0.005	< 0.03	< 0.01	< 0.03	< 5.00	< 30	< 30	< 30	--
16-05	19-Aug-16	3.8	ND	0.055	< 0.03	< 0.01	< 0.03	< 5.00	< 30	< 30	< 30	97.1
16-06	19-Aug-16	3.8	5	0.01	< 0.03	0.09	1.57	< 5.00	< 30	< 30	< 30	--
17-02	11-May-17	3.0	ND	< 0.005	< 0.03	< 0.01	< 0.03	< 5.00	< 30	< 30	< 30	--
17-03	12-May-17	3.0	ND	< 0.005	< 0.03	< 0.01	< 0.03	< 5.00	< 30	< 30	< 30	--
N 3-2	27-Oct-15	2.0	4,000	<b>0.139</b>	0.69	<b>0.33</b>	<b>2.25</b>	<b>87.2</b>	4	< 30	< 30	--
E 2-2	27-Oct-15	2.0	100	0.011	< 0.03	< 0.01	<b>11.5</b>	0.07	11.5	41	< 30	--
W 2-2	27-Oct-15	2.0	>11,000	<b>2.56</b>	<b>17.1</b>	<b>0.53</b>	<b>226</b>	<b>9,500</b>	<b>4,960</b>	101	> 30	--
TP1	27-Oct-15	3.0	380	0.016	0.040	< 0.01	0.07	< 5.00	< 30	< 30	< 30	--
Applicable Residential Soil Criteria 2019				<b>Surface Soil (&lt;1.5 m)</b>	<b>0.073</b>				<b>300</b>	<b>2,800</b>	NG	
				<b>Subsoil (&gt;1.5 - 3.0 m)</b>	<b>0.078</b>	<b>0.95&lt;/b</b>						

TABLE A3: HISTORICAL GROUNDWATER ANALYTICAL RESULTS - PHCs

Monitoring Well	Date	Groundwater Vapour Concentrations (ppmv)	Concentrations (mg/L)							
			Benzene	Toluene	Ethylbenzene	Xylenes	PHC F1	PHC F2	PHC F3	PHC F4
			(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
08-04	31-Jul-08	--	<b>0.397</b>	0.004	0.015	0.019	<b>1.74</b>	1.08	0.060	<0.030
	31-Aug-09	--	<b>0.212</b>	0.011	0.009	0.013	0.718	0.318	0.032	<0.030
	19-Oct-11	--	<b>0.029</b>	< 0.001	0.005	< 0.003	0.305	0.248	< 0.030	< 0.030
	3-Oct-13	--	<b>0.026</b>	0.001	0.004	< 0.003	0.185	0.134	0.045	< 0.03
	6-Sep-16	20	<b>0.011</b>	<0.0005	<0.001	<0.003	0.341	0.131	<0.030	<0.03
	24-May-17	ND	<b>0.007</b>	< 0.0005	< 0.001	< 0.003	0.238	0.085	< 0.030	< 0.030
	26-Oct-19	25	<b>0.069</b>	0.00079	<0.00050	<0.0020	0.530	<0.10	<0.25	<0.25
08-05	31-Jul-08	--	<b>0.812</b>	<b>0.033</b>	0.023	<b>0.650</b>	<b>3.930</b>	<b>1.680</b>	0.093	<0.030
	31-Aug-09	--	<b>0.998</b>	<b>0.021</b>	<b>0.161</b>	<b>0.321</b>	<b>2.25</b>	<b>2.180</b>	0.176	<0.030
	3-Oct-13	ND	<b>0.793</b>	0.01	0.12	0.088	<b>1.47</b>	<b>1.270</b>	0.10	<0.030
08-11	19-Oct-11	--	< 0.001	< 0.001	< 0.001	< 0.003	< 0.050	< 0.030	0.035	< 0.030
	3-Oct-13	--	0.001	< 0.001	< 0.001	< 0.003	< 0.05	< 0.03	< 0.03	< 0.03
	6-Sep-16	--	< 0.001	< 0.0005	< 0.001	< 0.003	< 0.05	< 0.03	< 0.03	< 0.03
	24-May-17	--	< 0.001	< 0.0005	< 0.001	< 0.003	< 0.050	< 0.030	< 0.030	< 0.030
	27-Oct-19	ND	< 0.00050	< 0.00050	< 0.00050	< 0.0020	< 0.10	< 0.10	< 0.25	< 0.25
09-04	31-Aug-09	--	<b>0.016</b>	0.007	< 0.001	0.005	< 0.050	< 0.030	< 0.030	< 0.030
	19-Oct-11	--	< 0.001	< 0.001	< 0.001	< 0.003	< 0.050	< 0.030	< 0.030	< 0.030
	3-Oct-13	--	< 0.001	< 0.001	< 0.001	< 0.003	< 0.05	0.228	0.096	< 0.03
	6-Sep-16	--	< 0.001	< 0.0005	< 0.001	< 0.003	< 0.05	0.228	0.096	< 0.03
	24-May-17	--	< 0.001	< 0.0005	< 0.001	< 0.003	< 0.050	< 0.030	< 0.030	< 0.030
	25-Oct-19	ND	< 0.00050	< 0.00050	< 0.00050	< 0.0020	< 0.10	< 0.10	< 0.25	< 0.25
17-05	24-May-17	--	< 0.001	< 0.0005	< 0.001	< 0.003	< 0.050	< 0.030	< 0.030	< 0.030
	25-Oct-19	ND	< 0.00050	< 0.00050	< 0.00050	< 0.0020	< 0.10	< 0.10	< 0.25	< 0.25
17-06	24-May-17	--	< 0.001	< 0.0005	< 0.001	< 0.003	< 0.050	< 0.030	< 0.030	< 0.030
	25-Oct-19	ND	< 0.00050	< 0.00050	< 0.00050	< 0.0020	< 0.10	< 0.10	< 0.25	< 0.25
17-07	24-May-17	--	0.004	0.0019	< 0.001	< 0.003	< 0.050	< 0.030	< 0.030	< 0.030
	25-Oct-19	ND	0.00074	< 0.00050	< 0.00050	< 0.0020	< 0.10	< 0.10	< 0.25	< 0.25
<b>Applicable Agricultural Groundwater Criteria - SEQG 2019</b>			<b>0.005</b>	<b>0.02</b>	<b>0.14</b>	<b>0.09</b>	<b>0.81</b>	<b>1.1</b>	<b>NG</b>	<b>NG</b>
08-06	31-Jul-08	ND	< 0.001	< 0.001	< 0.001	< 0.002	< 0.050	< 0.030	< 0.030	< 0.030
	19-Oct-11	ND	0.001	< 0.001	< 0.001	< 0.003	< 0.050	< 0.030	< 0.030	< 0.030
	3-Oct-13	190	< 0.001	< 0.001	< 0.001	< 0.003	< 0.050	< 0.03	< 0.03	< 0.03
	6-Sep-16	730	< 0.001	< 0.0005	< 0.001	< 0.003	< 0.050	< 0.03	< 0.03	< 0.03
	24-May-17	730	< 0.001	< 0.0005	< 0.001	< 0.003	< 0.050	< 0.030	< 0.030	< 0.030
	25-Oct-19	ND	< 0.00050	< 0.00050	< 0.00050	< 0.0020	< 0.10	0.14	< 0.25	< 0.25
08-08	23-Jul-08	ND	< 0.001	< 0.001	< 0.001	< 0.002	< 0.050	< 0.030	< 0.030	< 0.030
	31-Jul-08	--	< 0.001	< 0.001	< 0.001	< 0.002	< 0.050	< 0.030	< 0.030	< 0.030
	19-Oct-11	ND	< 0.001	< 0.001	< 0.001	< 0.002	< 0.050	< 0.030	< 0.030	< 0.030
16-02	6-Sep-16	--	<b>0.476</b>	0.0105	0.066	<b>0.100</b>	0.951	0.949	0.044	< 0.030
	24-May-17	--	<b>0.017</b>	0.0006	0.003	0.003	0.351	0.191	< 0.030	< 0.030
	26-Oct-19	ND	<b>0.018</b>	< 0.00050	0.001	< 0.0020	0.470	0.330	< 0.25	< 0.25
16-03	6-Sep-16	--	0.003	< 0.0005	0.004	< 0.003	0.117	<b>2.59</b>	0.594	< 0.030
	24-May-17	--	0.003	< 0.0005	0.005	< 0.003	0.079	0.501	0.053	< 0.030
	26-Oct-19	ND	0.00282	< 0.00050	0.00532	< 0.0020	0.12	<b>1.77</b>	0.29	< 0.25
17-01	24-May-17	--	<b>0.095</b>	0.0009	0.022	0.027	0.242	0.763	0.051	< 0.030
	26-Oct-19	35	<b>0.250</b>	0.0008	0.025	0.010	0.350	<b>1.81</b>	< 0.25	< 0.25
17-04	24-May-17	--	<b>0.027</b>	0.0019	< 0.001	< 0.003	0.053	< 0.030	< 0.030	< 0.030
	25-Oct-19	ND	0.00484	< 0.00050	< 0.00050	< 0.0020	< 0.10	< 0.10	< 0.25	< 0.25
<b>Applicable Commercial Groundwater Criteria - SEQG 2019</b>			<b>0.005</b>	<b>0.02</b>	<b>0.14</b>	<b>0.09</b>	<b>2.2</b>	<b>1.1</b>	<b>NG</b>	<b>NG</b>
MW5	8-Nov-07	ND	<b>3.04</b>	<b>1.57</b>	<b>0.299</b>	<b>3.09</b>	<b>14.9</b>	<b>4.91</b>	0.495	< 0.030
	31-Jul-08	ND	<b>2.41</b>	<b>0.966</b>	<b>0.226</b>	<b>2.76</b>	<b>13.1</b>	<b>4.74</b>	0.506	< 0.030
	31-Aug-09	ND	<b>0.644</b>	<b>0.155</b>	<b>0.042</b>	<b>0.460</b>	<b>3.14</b>	<b>2.9</b>	0.627	< 0.030
MW7	8-Nov-07	--	< 0.001	< 0.001	< 0.001	< 0.002	< 0.050	< 0.030	< 0.030	< 0.030
	31-Jul-08	--</td								

	31-Jul-08	--	<0.001	<0.001	<0.001	<0.002	<0.050	<0.030	<0.030	<0.030
08-10	19-Oct-11	ND	< 0.001	< 0.001	< 0.001	< 0.003	< 0.050	< 0.030	< 0.030	< 0.030
	3-Oct-13	ND	<0.001	<0.001	<0.001	<0.003	<0.05	<0.03	<0.03	<0.03
	6-Sep-16	--	<0.001	<0.0005	<0.001	<0.003	<0.05	<0.03	<0.03	<0.03
	24-May-17	--	< 0.001	< 0.0005	< 0.001	< 0.003	< 0.050	< 0.030	< 0.030	< 0.030
	27-Oct-19	ND	<0.00050	<0.00050	<0.00050	<0.0020	<0.10	<0.10	<0.25	<0.25
09-01	19-Oct-11	--	--	< 0.001	< 0.001	< 0.003	< 0.050	< 0.030	0.054	< 0.030
09-02	31-Aug-09	--	--	0.019	< 0.001	0.011	< 0.050	< 0.030	< 0.030	< 0.030
	19-Oct-11	--	< 0.001	< 0.001	< 0.001	< 0.003	< 0.050	< 0.030	< 0.030	< 0.030
09-03	31-Aug-09	--	--	0.012	< 0.001	0.006	< 0.050	< 0.030	< 0.030	< 0.030
09-05	31-Aug-09	--	<b>0.011</b>	0.005	< 0.001	0.004	< 0.050	< 0.030	< 0.030	< 0.030
16-04	6-Sep-16	--	0.001	< 0.0005	< 0.001	< 0.003	< 0.050	< 0.030	< 0.030	< 0.030
	24-May-17	--	0.004	< 0.0005	< 0.001	< 0.003	< 0.050	< 0.030	< 0.030	< 0.030
	26-Oct-19	ND	<0.00050	<0.00050	<0.00050	<0.0020	<0.10	<0.10	<0.25	<0.25
16-05	6-Sep-16	--	<b>0.009</b>	< 0.0005	< 0.001	< 0.003	< 0.050	< 0.030	0.154	0.043
	24-May-17	--	< 0.001	< 0.0005	< 0.001	< 0.003	< 0.050	< 0.030	< 0.030	< 0.030
	26-Oct-19	5	<0.00050	<0.00050	<0.00050	<0.0020	<0.10	<0.10	<0.25	<0.25
16-06	6-Sep-16	--	<b>0.323</b>	0.0014	< 0.001	0.013	<b>0.734</b>	0.114	< 0.030	< 0.030
	24-May-17	--	<b>1.14</b>	0.0041	< 0.001	0.025	<b>1.45</b>	0.159	< 0.030	< 0.030
	26-Oct-19	35	<b>1.43</b>	0.0026	<0.00050	0.006	<b>&lt;1.0</b>	<0.10	<0.25	<0.25
17-02	24-May-17	--	< 0.001	< 0.0005	< 0.001	< 0.003	< 0.050	< 0.030	0.084	< 0.030
	27-Oct-19	ND	<0.00050	<0.00050	<0.00050	<0.0020	<0.10	<0.10	<0.25	<0.25
17-03	24-May-17	--	< 0.001	< 0.0005	< 0.001	< 0.003	< 0.050	< 0.030	< 0.030	< 0.030
	25-Oct-19	ND	<0.00050	<0.00050	<0.00050	<0.0020	<0.10	<0.10	<0.25	<0.25
<b>Applicable Residential Groundwater Criteria - SEQG 2019</b>		<b>0.005</b>	<b>0.021</b>	<b>0.14</b>	<b>0.09</b>	<b>0.81</b>	<b>1.1</b>	<b>NG</b>	<b>NG</b>	

**Notes:**

- mg/L - concentration in milligrams per liter
- ppm<sub>v</sub> - parts per million organic vapour
- PHC Fraction F1 - volatile petroleum hydrocarbons (C<sub>6</sub> – C<sub>10</sub>), less BTEX
- PHC Fraction F2 - extractable petroleum hydrocarbons (C<sub>10</sub> – C<sub>16</sub>)
- PHC Fraction F3 - extractable petroleum hydrocarbons (C<sub>16</sub> – C<sub>34</sub>)
- PHC Fraction F4 - extractable petroleum hydrocarbons (C<sub>34</sub> – C<sub>50</sub>)
- < - less than the analytical detection limit
- NG - no guideline
- SEQG 2019 - see Table E-1
- -- - not measured
- ND - non detected

**BOLD**

exceeds applicable SEQG 2019 groundwater criteria

TABLE A4: HISTORICAL GROUNDWATER ANALYTICAL RESULTS - NUTRIENTS

Parameters	Units	MW7	08-04			08-06			08-10			08-11			09-04		
		26-May-17	8-Sep-16	24-May-17	26-Oct-19	9-Sep-16	26-May-17	8-Sep-16	25-May-17	27-Oct-19	8-Sep-16	25-May-17	8-Sep-16	24-May-17	25-Oct-19		
Ammonia, Total (as N)	mg/L	0.062	0.252	0.053	0.31	< 0.018	< 0.018	0.022	< 0.018	0.092	< 0.018	0.019	< 0.018	< 0.018	< 0.050		
Nitrate-N	mg/L	2.69	0.22	0.31	<0.40	*<0.2	< 0.2	< 0.2	0.27	< 0.2	<0.40	52.5	55.8	38.2	30.1	36.9	
Nitrite-N	mg/L	< 0.2	*<0.2	< 0.2	<0.20	*<0.2	< 0.2	*<0.2	< 0.2	<0.20	*<0.2	< 0.2	*<0.2	< 0.2	<0.20		
Phosphorus (P)-Total	mg/L	<0.3	0.74	<0.3	0.0542	0.72	<0.3	0.69	<0.3	0.0194	0.72	<0.3	0.70	<0.3	0.0823		
Orthophosphate-Dissolved (as P)	mg/L	0.34	*<0.3	0.07	<0.50	*<0.3	0.04	*<0.3	0.05	<0.50	*<0.3	0.05	*<0.3	0.1	<0.50		
Iron (Fe)-Total	mg/L	6.65	4.41	7.54	3.51	0.22	0.03	1.53	0.07	1.3	0.04	0.06	1.68	6.34	4.21		
Iron (Fe)-Dissolved	mg/L	0.05	3.27	6.92	2.82	0.11	0.02	2.35	< 0.01	1.19	< 0.01	< 0.01	< 0.01	< 0.01	< 0.050		
Manganese (Mn)-Dissolved	mg/L	0.46	13.9	5.69	11.6	0.50	0.22	3.82	0.12	4.21	0.09	< 0.01	0.40	0.4	0.509		
Sulfate (SO4)	mg/L	3180	3280	3030	3330	3230	3630	3740	3860	3830	3210	3500	2820	3100	3230		
Total Dissolved Solids	mg/L	5144	6384	5472	5720	6188	6184	6380	6048	5740	6480	6536	5600	5440	5330		
Calcium (Ca)-Dissolved	mg/L	512	516	553	461	435	458	439	457	426	507	522	520	522	446		
Magnesium (Mg)-Dissolved	mg/L	397	455	387	384	427	431	426	424	357	440	452	423	414	357		
Potassium (K)-Dissolved	mg/L	27.2	38.3	18.2	22	37.6	20.6	45.5	29.3	24.4	49.1	33.3	46.3	32.7	25.4		
Sodium (Na)-Dissolved	mg/L	555	723	651	658	726	872	785	893	733	727	844	550	618	538		
Bicarbonate (HCO3)	mg/L	738	1080	969	1130	806	899	635	712	708	756	815	438	492	474		
Carbonate (CO3)	mg/L	---	---	---	<5.0	---	---	---	---	<5.0	---	---	---	---	<5.0		
Chloride (Cl)	mg/L	29.9	181	92.8	213	83.5	35.2	23.0	20.4	28.6	189	197	336	251	298		
Hydroxide (OH)	mg/L	---	---	---	<5.0	---	---	---	---	<5.0	---	---	---	---	<5.0		
Conductivity	uS/cm	4.58	4.99	4.78	6220	4.90	5.38	4.92	5.35	6260	5.05	5.59	4.66	5.01	5890		
pH	pH	7.62	7.56	7.41	7.47	7.70	7.55	7.78	7.68	7.66	7.78	7.58	7.70	7.59	7.68		
SAR	SAR	4.48	5.60	5.19	5.61	5.92	7.03	6.40	7.23	6.77	5.70	6.53	4.34	4.91	4.79		
Total Organic Carbon	mg/L	22.4	---	39.4	42.1	---	20.4	---	39.7	46.4	---	60.8	---	43.3	47.3		
Chemical Oxygen Demand	mg/L	72	201	119	196	59	46	117	110	129	149	177	144	130	135		
Acidity (as CaCO3)	mg/L	-541	-719	-667	192	-636	-663	-453	-494	73.2	-536	-569	-342	-348	47.4		
Alkalinity, Total (as CaCO3)	mg/L	---	---	---	923	---	---	---	---	581	---	---	---	---	389		

Notes:

- mg/L - milligrams per litre
- < - less than the analytical method detection limit
- --- - not analysed

16-02			16-03			16-04			16-05			16-06			17-01			17-02			17-03			17-04			17-05			17-06			17-07		
9-Sep-16	25-May-17	26-Oct-19	8-Sep-16	26-May-17	26-Oct-19	9-Sep-16	26-May-17	26-Oct-19	9-Sep-16	25-May-17	26-Oct-19	9-Sep-16	26-May-17	26-Oct-19	26-May-17	25-May-17	26-Oct-19	26-May-17	25-May-17	25-Oct-19	25-May-17	24-May-17	24-May-17	25-Oct-19	25-May-17	24-May-17	24-May-17	25-Oct-19							
0.644	0.508	0.79	0.147	0.162	0.076	0.080	0.022	<0.050	0.324	<0.018	0.051	0.412	0.198	0.350	0.019	0.074	<0.018	<0.018	0.239	<0.050	<0.018	<0.018	<0.018	<0.018	<0.018	0.35									
*<0.2	<0.2	<1.0	*<0.2	<0.2	<0.40	*<0.2	0.31	<1.0	*<0.2	0.87	<0.40	3.19	9.24	14.4	<0.2	<0.40	34.7	47.9	1.3	7.1	95.3	1.12	65.6	93.7											
*<0.2	<0.2	<0.50	*<0.2	<0.2	<0.20	*<0.2	<0.2	<0.50	*<0.2	<0.2	<0.20	0.61	0.63	<0.50	<0.2	<0.20	10.5	0.84	3.07	0.29	1.46	<0.2	13.6	0.34											
0.74	<0.3	0.0518	1.06	<0.3	0.273	0.81	<0.3	0.026	0.81	<0.3	0.0114	1.18	<0.3	0.05	<0.3	0.271	<0.3	<0.3	0.0527	<0.3	<0.3	<0.3	<0.3	2.54											
*<0.3	0.06	<0.50	*<0.3	0.08	<0.50	*<0.3	0.04	<0.50	*<0.3	0.05	<0.50	0.07	<0.50	0.06	<0.50	0.15	0.06	0.11	<0.50	0.11	0.06	0.09	<0.50												
3.63	11.7	5.55	32.0	32	45.7	4.55	0.4	1.15	7.52	1.17	0.815	29.1	2.15	1.32	7.01	38.30	5.09	1.14	8.43	3.68	3.17	1.95	2.28	126											
2.35	11	5.28	8.79	23.8	26.5	0.32	0.04	<0.050	<0.01	<0.01	0.16	<0.01	<0.01	<0.050	5.99	37.90	<0.01	0.02	5.06	0.10	<0.01	<0.01	<0.01	0.061											
8.47	8.71	16.7	6.60	2.68	12.5	4.72	0.83	0.883	5.22	0.36	3.39	5.67	5.47	2.64	11.30	9.37	2.30	0.50	9.22	5.06	0.13	0.72	0.85	0.769											
3050	4050	3830	3110	4020	3470	2860	3570	3420	2660	2830	3320	2780	3400	3360.0	2830.0	2870.0	2300.0	2520.0	2450.0	2770	2700	3050	2620	2860											
5904	6948	6490	6164	8024	6400	5608	6828	5780	5152	4632	5250	5664	6676	5560	5236	5380	4104	4880	4980	5210	5580	5024	5128	5780											
511	463	465	511	507	445	533	495	480	555	546	438	533	521	498.0	560.0	504.0	634.0	493.0	643.0	498.0	553.0	491.0	559.0	502											
388	484	424	435	578	444	385	498	410	329	375	358	374	507	426	325	354	316	337	359	337	319	324	380	414											
39.4	24.4	23.3	40.1	19.9	22.9	48.7	33.3	28.2	47.1	24.4	25	47.5	34.4	27.20	23.30	22.80	24.20	27.20	34.00	21.70	19.80	25.90	24.70	23.8											
716	1050	797	759	1270	703	640	922	635	531	421	506	697	838	593.0	606.0	519.0	375.0	687.0	641.0	546.0	807.0	561.0	504.0	492											
1060	819	1,070	992	1,300	1,070	973	1,100	1,100	692	694	789	887	1,070	1,120	886	1,250	646	699	771	825	517	493	478	585											
---	---	<5.0	---	---	<5.0	---	---	<5.0	---	---	<5.0	---	---	<5.0	---	<5.0	---	<5.0	---	---	<5.0	---	---	<5.0											
282	174	236	378	468	392	314	266	276	192	26.9	52	330	273	305	118	256	78.7	109	420	500.0	325.0	21.2	352.0	453											
---	---	<5.0	---	---	<5.0	---	---	<5.0	---	---	<5.0	---	---	<5.0	---	<5.0	---	<5.0	---	---	<5.0	---	---	<5.0											
4.93	5.97	6910	5.15	6.82	6880	4.76	5.85	6470	4.33	4.22	5530	4.86	5.99	6,520	5	5,910	4	5	5	6010	5	4	5	6260											
7.55	7.22	7.3	7.63	7.36	7.17	7.72	7.56	7.85	7.6	7.68	7.78	7.32	7.54	7.27	7.38	7.47	7.59	7.52	7.60	7.64	7.59	7.55	7.67												
5.81	8.12	6.7	5.96	9.17	5.63	5.15	6.99	5.3	4.42	3.4	4.44	5.66	6.26	4.85	5.04	4.35	3.04	5.84	5.02	4.82	6.76	4.82	4.03	3.55											
---	51.3	58	---	109	89.7	---	62.1	58	---	16.4	26.3	---	131	121.0	72.8	88.8	26.4	41.2	184.0	66.0	60.7	28.2	70.0	130											
187	154	230	205	322	262	117	175	165	49	39	83	251	410	355	223	283	91	158	184	204	177	78	214	280											
-750	-529	232	-654	-810	331	-720	-731	133	-517	-531	69.8	-665	-723	140.0	-561.0	240	-478	-521	-570	95.9	-369.0	-317.0	-374.0	60.9											
---	---	875	---	---	873	---	---	904	---	---	647	---	---	919	---	1020	---	---	676	---	---	---	480												

# Appendix B

## Field Methodology

## Methodology

The environmental assessment reported in this document followed standard Wood procedures unless expressed otherwise. Wood's standard environmental assessment methodology is summarized below.

### Monitoring Well Sampling Methodology

#### Groundwater Monitoring and Sampling

The groundwater monitoring program included measurement of the following parameters:

- Monitoring well headspace vapour concentrations (hexane and methane);
- Depth to groundwater (from top of pipe and ground level);
- Depth to light non-aqueous phase liquid (LNAPL) and volume of LNAPL (if present);
- Depth to bottom of well;
- Groundwater headspace vapour concentrations;
- Temperature, electrical conductivity (EC), total dissolved solids (TDS), dissolved oxygen (DO), pH, and ORP;

Hydrocarbon vapour and methane concentrations were measured with individual RKI Eagles™ calibrated to hexane and methane, respectively. Groundwater levels (and LNAPL if present) were measured with a Solinst Model 122 Interface Meter. Groundwater parameters (temperature, EC, DO, pH, and ORP) were measured with a Hanna HI98194 multi-parameter meter.

Groundwater samples were collected using low-flow techniques. The low-flow sampling method involved the continuous collection of groundwater from the central depth of the well screen via a peristaltic pump. The groundwater was pumped through a flow-through cell, where the multi-parameter meter was used to continuously measure the above referenced parameters. Low-flow water extraction from each well continued until the multi-parameter readings stabilized, indicating that formation groundwater was being accessed.

The groundwater samples were placed in clean-certified bottles provided by the laboratory and stored in an insulated cooler that contained ice packs while on-Site and during transport to the laboratory.

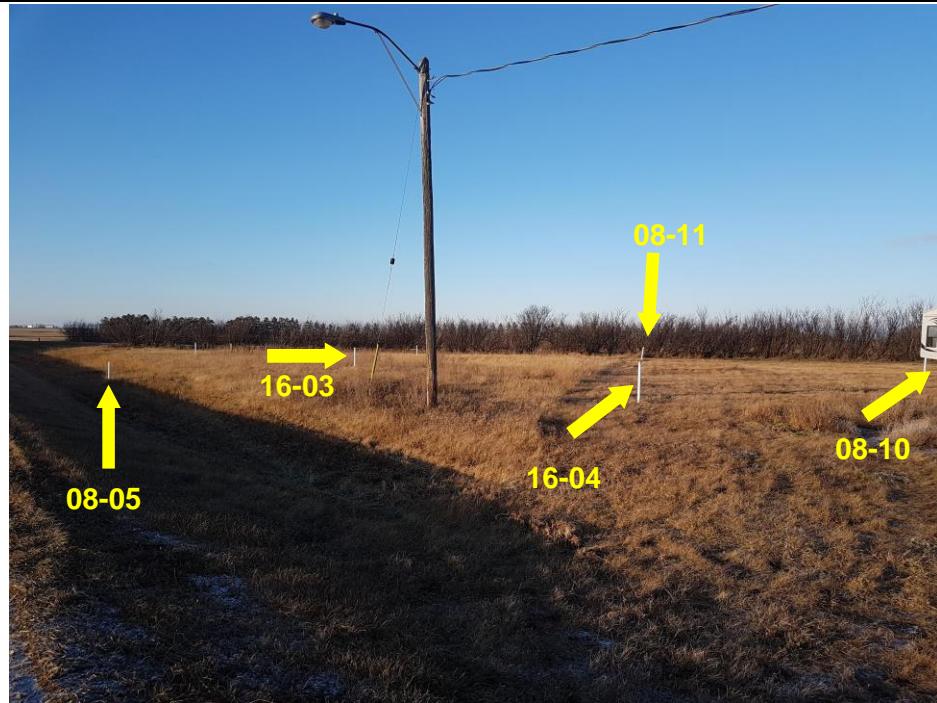
### Surveying

The location and elevation of all test holes and newly installed monitoring wells were surveyed using a Spectra Precision rover system, set in the NAD-83 datum. Northings and eastings, as well as top of casing and ground level elevations, were measured and recorded for all points. In addition to the monitoring well/test hole locations, the corners of buildings and other permanent structures and any identified utility locations were surveyed in, where possible.

# Appendix C

## Photographs





Photograph 1: Monitoring wells 13-07, 15-03 and 15-04 facing south (23 October 2019).



Photograph 2: Monitoring wells 15-01, 15-06, 15-07 and 15-08 facing south. (23 October 2019).

**wood.**

Environment & Infrastructure  
Solutions  
#1-1727 Francis Street  
Regina SK, S4N 7N2  
[www.woodplc.com](http://www.woodplc.com)

**Groundwater Monitoring Program**  
**Former Co-op Bulk Plant**  
**2<sup>nd</sup> Avenue & Railway Avenue**  
**Lang, Saskatchewan**

Made by: KM

Date: NOV 2019

Project No.: ZE0803919

Plate 1

# Appendix D

## WSASK Results

Well Name: **LINN**WWDR #: **066503**

### Well Location

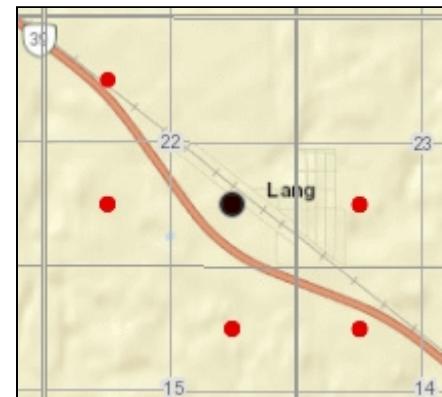
Land Location	<b>SE-22-011 -18 -W2</b>	Location of Well (in Quarter)
LSD	<b>00</b>	<b>0</b> ft from N/S Boundary
Reserve		<b>0</b> ft from E/W Boundary
RM:	<b>999</b>	
NTS Map:	<b>72H00</b>	Major Basin: <b>05</b>
Elevation (ft)	<b>1900</b>	SubBasin: <b>23</b>
Aquifer		

### Well Information

		Well Casings			
Driller	<b>M &amp; D DRILLING</b>	Length (ft)	Btm (ft)	Dia (in)	Material
Completion Date	<b>1981.05.18</b>	<b>13</b>	<b>26</b>	<b>30</b>	<b>Galvanized Iron</b>
Hole #		<b>0</b>	<b>0</b>	<b>0</b>	
Install Method	<b>Bored</b>	Well Screens			
Borehole Depth (ft)	<b>26</b>	Length (ft)	Bottom (ft)	Dia (in)	Slot (in) Material
Bit Dia (in)	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Water Level	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Flowing Head	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Water Use	<b>Domestic</b>	Pump Test			
Well Use	<b>Withdrawal</b>	Draw Down		<b>22</b> ft	
Completion Method	<b>Curbed</b>	Duration		<b>1</b> hrs	
E-Log	<b>No</b>	Pumping Rate		<b>2</b> igpm	
		Temperature		<b>0</b> deg. F	
		Rec. Pumping Rate		<b>2</b> igpm	

### Lithology List

Depth (ft):	Material	Colour	Description
16	Old Well	Unknown	Unknown
17	Silt	Unknown	Sandy
20	Clay	Brown	Unknown
26	Clay	Blue	Unknown



Well Name: **LANG**WWDR #: **072916**

### Well Location

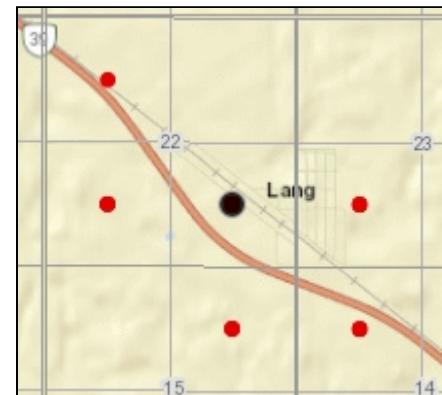
Land Location	<b>SE-22-011 -18 -W2</b>	Location of Well (in Quarter)
LSD	<b>00</b>	<b>0</b> ft from N/S Boundary
Reserve		<b>0</b> ft from E/W Boundary
RM:		
NTS Map:	<b>72H00</b>	Major Basin: <b>05</b>
Elevation (ft)	<b>1900</b>	SubBasin: <b>23</b>
Aquifer		

### Well Information

		Well Casings			
Driller	<b>AL'S DRILLING</b>	Length (ft)	Btm (ft)	Dia (in)	Material
Completion Date	<b>1982.09.08</b>	<b>20</b>	<b>140</b>	<b>6</b>	<b>Plastic</b>
Hole #	<b>003</b>	<b>120</b>	<b>120</b>	<b>8</b>	<b>Plastic</b>
Install Method	<b>Drilled</b>				
Borehole Depth (ft)		Well Screens			
Borehole Depth (ft)	<b>150</b>	Length (ft)	Bottom (ft)	Dia (in)	Slot (in)
Bit Dia (in)	<b>12.2</b>	<b>10</b>	<b>150</b>	<b>6</b>	<b>20</b>
Water Level	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Flowing Head	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Water Use	<b>Municipal</b>	Pump Test			
Well Use	<b>Withdrawal</b>	Draw Down			
Completion Method	<b>Well Screen And Gravel</b>	Duration			
E-Log	<b>Pack</b>	Pumping Rate			
	<b>No</b>	Temperature			
		Rec. Pumping Rate			

### Lithology List

Depth (ft):	Material	Colour	Description
1	Topsoil	Unknown	Unknown
15	Clay	Yellow	Unknown
35	Sand	Unknown	Medium
38	Till	Blue	Unknown
46	Sand	Unknown	Fine
122	Till	Blue	Unknown
145	Sand & Gravel	Unknown	Unknown
150	Sand	Unknown	Medium



Well Name: **LANG**WWDR #: **072917**

### Well Location

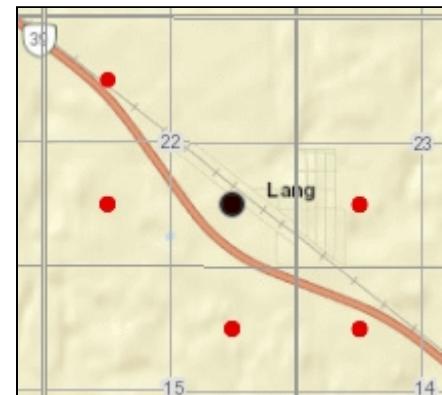
Land Location	<b>SE-22-011 -18 -W2</b>	Location of Well (in Quarter)
LSD	<b>00</b>	<b>0</b> ft from N/S Boundary
Reserve		<b>0</b> ft from E/W Boundary
RM:		
NTS Map:	<b>72H00</b>	Major Basin: <b>05</b>
Elevation (ft)	<b>1900</b>	SubBasin: <b>23</b>
Aquifer		

### Well Information

Driller	<b>AL'S DRILLING</b>	Well Casings			
		Length (ft)	Btm (ft)	Dia (in)	Material
Completion Date	<b>1982.08.23</b>	<b>137</b>	<b>136</b>	<b>4</b>	<b>Plastic</b>
Hole #	<b>002</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Install Method	<b>Drilled</b>				
Borehole Depth (ft)		Well Screens			
Bit Dia (in)	<b>4.5</b>	Length (ft)	Bottom (ft)	Dia (in)	Slot (in) Material
Water Level	<b>63</b>	<b>5</b>	<b>141</b>	<b>4</b>	<b>20 Stainless Steel</b>
Flowing Head	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Water Use	<b>Municipal</b>				Pump Test
Well Use	<b>Observation</b>				Draw Down <b>5.3 ft</b>
Completion Method	<b>Well Screen And Gravel</b>				Duration <b>12 hrs</b>
E-Log	<b>Pack No</b>				Pumping Rate <b>30 igpm</b>
					Temperature <b>0 deg. F</b>
					Rec. Pumping Rate <b>0 igpm</b>

### Lithology List

Depth (ft):	Material	Colour	Description
1	Topsoil	Unknown	Unknown
15	Clay	Yellow	Unknown
35	Sand	Unknown	Medium
38	Till	Blue	Unknown
46	Sand	Unknown	Fine
122	Till	Blue	Unknown
145	Sand & Gravel	Unknown	Unknown
150	Sand	Unknown	Medium



Well Name: **LANG**WWDR #: **010860**

### Well Location

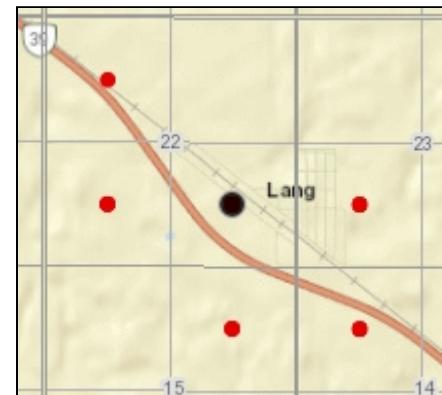
Land Location	<b>SE-22-011 -18 -W2</b>	Location of Well (in Quarter)
LSD	<b>00</b>	<b>0</b> ft from N/S Boundary
Reserve		<b>0</b> ft from E/W Boundary
RM:		
NTS Map:	<b>72H00</b>	Major Basin: <b>01</b>
Elevation (ft)	<b>1909</b>	SubBasin: <b>24</b>
Aquifer		

### Well Information

Well Casings					
Driller	<b>JOHNSON BROTHERS DRILLING</b>	Length (ft)	Btm (ft)	Dia (in)	Material
		<b>0</b>	<b>23</b>	<b>6.6</b>	<b>Steel</b>
Completion Date	<b>1963.04.15</b>	<b>0</b>	<b>32</b>	<b>6</b>	<b>Steel</b>
Hole #	<b>003</b>	<b>0</b>	<b>0</b>	<b>0</b>	
Install Method	<b>Drilled</b>				
Well Screens					
Borehole Depth (ft)	<b>37</b>	Length (ft)	Bottom (ft)	Dia (in)	Slot (in)
Bit Dia (in)	<b>6.6</b>	<b>5</b>	<b>28</b>	<b>6</b>	<b>25</b>
Water Level	<b>18</b>	<b>5</b>	<b>37</b>	<b>6</b>	<b>30</b>
Flowing Head	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Water Use	<b>Municipal</b>				Pump Test
Well Use	<b>Withdrawal</b>		Draw Down		<b>3</b> ft
Completion Method	<b>Well Screen</b>		Duration		<b>50</b> hrs
E-Log	<b>No</b>		Pumping Rate		<b>25</b> igpm
			Temperature		<b>0</b> deg. F
			Rec. Pumping Rate		<b>0</b> igpm

### Lithology List

Depth (ft):	Material	Colour	Description
7	Till	Unknown	Unknown
28	Gravel	Unknown	Unknown
29	Till	Unknown	Unknown
38	Gravel	Unknown	Unknown



Well Name: **LANG**WWDR #: **010861**

### Well Location

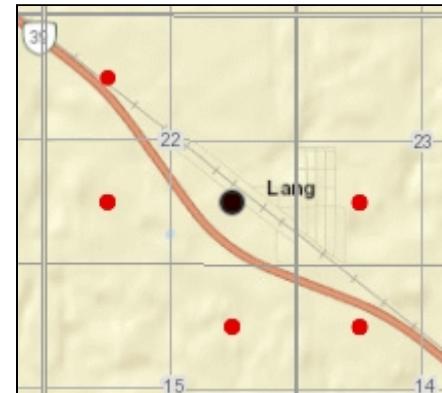
Land Location	<b>SE-22-011 -18 -W2</b>	Location of Well (in Quarter)
LSD	<b>00</b>	<b>0</b> ft from N/S Boundary
Reserve		<b>0</b> ft from E/W Boundary
RM:		
NTS Map:	<b>72H00</b>	Major Basin: <b>01</b>
Elevation (ft)	<b>1909</b>	SubBasin: <b>24</b>
Aquifer		

### Well Information

		Well Casings			
Driller	<b>JOHNSON BROTHERS DRILLING</b>	Length (ft)	Btm (ft)	Dia (in)	Material
Completion Date	<b>1963.04.04</b>	<b>0</b>	<b>0</b>	<b>0</b>	
Hole #	<b>004</b>	<b>0</b>	<b>0</b>	<b>0</b>	
Install Method	<b>Drilled</b>				
Borehole Depth (ft)		Well Screens			
Borehole Depth (ft)	<b>50</b>	Length (ft)	Bottom (ft)	Dia (in)	Slot (in)
Bit Dia (in)	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Water Level	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Flowing Head	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Water Use	<b>Municipal</b>	Pump Test			
Well Use	<b>Water Test Hole</b>	Draw Down			
Completion Method		Duration			
E-Log	<b>No</b>	Pumping Rate			
		Temperature			
		Rec. Pumping Rate			
		<b>0</b> ft			
		<b>0</b> hrs			
		<b>0</b> igpm			
		<b>0</b> deg. F			
		<b>0</b> igpm			

### Lithology List

Depth (ft):	Material	Colour	Description
13	Till	Yellow	Unknown
22	Sand	Unknown	Unknown
30	Clay	Unknown	Unknown
33	Sand	Unknown	Unknown
50	Till	Grey	Unknown



Well Name: **LANG**WWDR #: **010862**

### Well Location

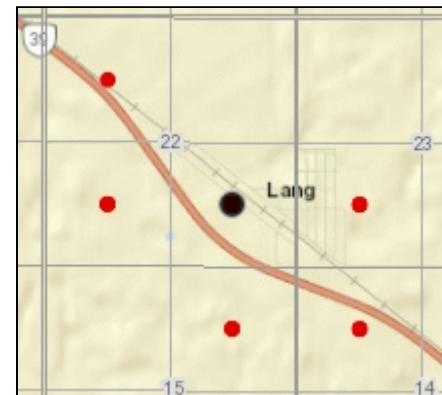
Land Location	<b>SE-22-011 -18 -W2</b>	Location of Well (in Quarter)	
LSD	<b>00</b>	<b>1500</b> ft from N/S Boundary	<b>S</b>
Reserve		<b>2500</b> ft from E/W Boundary	<b>W</b>
RM:			
NTS Map:	<b>72H00</b>	Major Basin:	<b>01</b>
Elevation (ft)	<b>1909</b>	SubBasin:	<b>24</b>
Aquifer			

### Well Information

		Well Casings			
Driller	<b>RAINBOW DRILLING</b>	Length (ft)	Btm (ft)	Dia (in)	Material
Completion Date	<b>1964.05.20</b>	<b>0</b>	<b>142</b>	<b>2</b>	<b>Steel</b>
Hole #	<b>001</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Install Method	<b>Drilled</b>				
Borehole Depth (ft)	<b>147</b>	Well Screens			
Bit Dia (in)	<b>2</b>	Length (ft)	Bottom (ft)	Dia (in)	Slot (in)
Water Level	<b>35</b>	<b>5</b>	<b>147</b>	<b>2</b>	<b>25</b>
Flowing Head	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Water Use	<b>Municipal</b>	Pump Test			
Well Use	<b>Observation</b>	Draw Down			
Completion Method	<b>Well Screen</b>	Duration			
E-Log	<b>No</b>	Pumping Rate			
		Temperature			
		Rec. Pumping Rate			
		<b>0</b> deg. F			
		<b>20</b> igpm			

### Lithology List

Depth (ft):	Material	Colour	Description
5	Till	Brown	Sandy
14	Till	Blue	Unknown
17	Clay	Unknown	Unknown
125	Till	Blue	Unknown
147	Sand & Gravel	Unknown	Unknown
155	Till	Blue	Unknown



Well Name: **LANG**WWDR #: **010863**

### Well Location

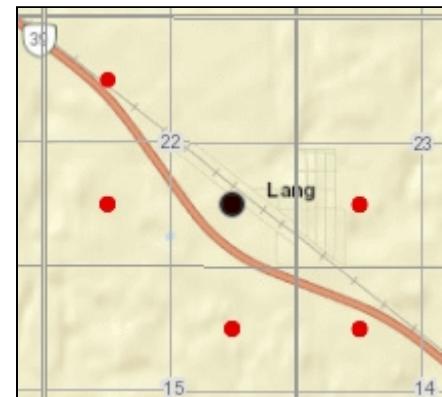
Land Location	<b>SE-22-011 -18 -W2</b>	Location of Well (in Quarter)	
LSD	<b>00</b>	<b>2000</b> ft from N/S Boundary	<b>S</b>
Reserve		<b>2000</b> ft from E/W Boundary	<b>E</b>
RM:			
NTS Map:	<b>72H00</b>	Major Basin:	<b>01</b>
Elevation (ft)	<b>1910</b>	SubBasin:	<b>24</b>
Aquifer	<b>Glac</b>		

### Well Information

		Well Casings			
Driller	<b>RAINBOW DRILLING</b>	Length (ft)	Btm (ft)	Dia (in)	Material
		<b>0</b>	<b>155</b>	<b>6</b>	<b>Steel</b>
Completion Date	<b>1964.05.22</b>	<b>0</b>	<b>0</b>	<b>0</b>	
Hole #	<b>002</b>	<b>0</b>	<b>0</b>	<b>0</b>	
Install Method	<b>Drilled</b>		Well Screens		
Borehole Depth (ft)	<b>165</b>	Length (ft)	Bottom (ft)	Dia (in)	Slot (in) Material
Bit Dia (in)	<b>6</b>	<b>10</b>	<b>165</b>	<b>6</b>	<b>30</b> Unknown
Water Level	<b>56</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Flowing Head	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Water Use	<b>Municipal</b>		Pump Test		
Well Use	<b>Observation</b>		Draw Down	<b>0</b> ft	
Completion Method	<b>Well Screen</b>		Duration	<b>0</b> hrs	
E-Log	<b>No</b>		Pumping Rate	<b>0</b> igpm	
			Temperature	<b>0</b> deg. F	
			Rec. Pumping Rate	<b>90</b> igpm	

### Lithology List

Depth (ft):	Material	Colour	Description
1	Topsoil	Unknown	Unknown
10	Till	Brown	Unknown
35	Gravel	Unknown	Unknown
45	Gravel	Unknown	Clay Streaks
69	Till	Blue	Unknown
80	Gravel	Unknown	Unknown
101	Gravel	Unknown	Unknown
145	Till	Unknown	Unknown
165	Gravel	Unknown	Unknown
180	Till	Unknown	Unknown



Well Name: **LANG**WWDR #: **010864**

### Well Location

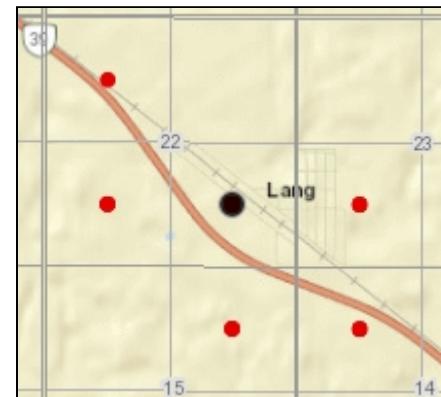
Land Location	<b>SE-22-011 -18 -W2</b>	Location of Well (in Quarter)
LSD	<b>00</b>	<b>0</b> ft from N/S Boundary
Reserve		<b>0</b> ft from E/W Boundary
RM:		
NTS Map:	<b>72H00</b>	Major Basin: <b>01</b>
Elevation (ft)	<b>1909</b>	SubBasin: <b>24</b>
Aquifer		

### Well Information

		Well Casings			
Driller	<b>RAINBOW DRILLING</b>	Length (ft)	Btm (ft)	Dia (in)	Material
Completion Date	<b>1964.05.23</b>	<b>0</b>	<b>155</b>	<b>2</b>	<b>Steel</b>
Hole #	<b>003</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Install Method	<b>Drilled</b>	Well Screens			
Borehole Depth (ft)	<b>160</b>	Length (ft)	Bottom (ft)	Dia (in)	Slot (in)
Bit Dia (in)	<b>2</b>	<b>5</b>	<b>160</b>	<b>2</b>	<b>25</b>
Water Level	<b>57</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Flowing Head	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Water Use	<b>Municipal</b>	Pump Test			
Well Use	<b>Observation</b>	Draw Down			
Completion Method	<b>Well Screen</b>	Duration			
E-Log	<b>No</b>	Pumping Rate			
		Temperature			
		Rec. Pumping Rate			
		<b>0</b> deg. F			
		<b>20</b> igpm			

### Lithology List

Depth (ft):	Material	Colour	Description
1	Topsoil	Unknown	Unknown
6	Till	Brown	Unknown
27	Sand & Gravel	Unknown	Unknown
130	Till	Blue	Unknown
135	Sand & Gravel	Unknown	Unknown
145	Till	Blue	Unknown
160	Gravel	Unknown	Unknown
170	Till	Unknown	Unknown



Well Name: **LANG**WWDR #: **010855**

### Well Location

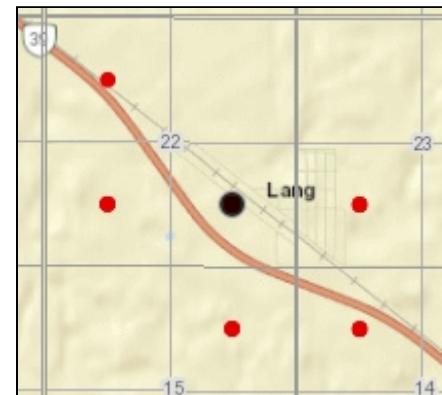
Land Location **SE-22-011 -18 -W2** Location of Well (in Quarter)  
 LSD **00** **0** ft from N/S Boundary  
 Reserve **0** ft from E/W Boundary  
 RM:  
 NTS Map: **72H00** Major Basin: **01**  
 Elevation (ft) **1909** SubBasin: **24**  
 Aquifer

### Well Information

		Well Casings			
Driller	<b>JOHNSON BROTHERS DRILLING</b>	Length (ft)	Btm (ft)	Dia (in)	Material
Completion Date	<b>1963.03.01</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Hole #		<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Install Method	<b>Drilled</b>				
Borehole Depth (ft) <b>100</b>		Well Screens			
Bit Dia (in)	<b>4</b>	Length (ft)	Bottom (ft)	Dia (in)	Slot (in)
Water Level	<b>19</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Flowing Head	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Water Use	<b>Municipal</b>				Pump Test
Well Use	<b>Water Test Hole</b>		Draw Down	<b>0</b> ft	
Completion Method			Duration	<b>0</b> hrs	
E-Log	<b>No</b>		Pumping Rate	<b>0</b> igpm	
			Temperature	<b>0</b> deg. F	
			Rec. Pumping Rate	<b>0</b> igpm	

### Lithology List

Depth (ft):	Material	Colour	Description
26	Till	Unknown	Sandy
44	Clay	Unknown	Unknown
47	Sand	Unknown	Fine
100	Till	Grey	Unknown



Well Name: **LANG**WWDR #: **010856**

### Well Location

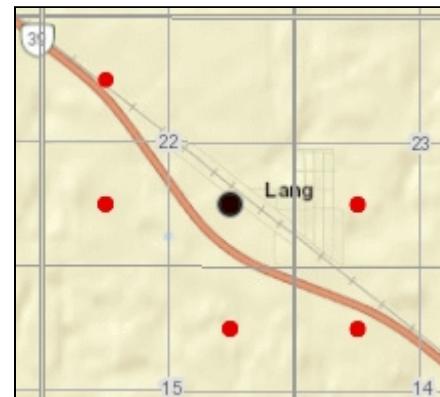
Land Location	<b>SE-22-011 -18 -W2</b>	Location of Well (in Quarter)
LSD	<b>00</b>	<b>0</b> ft from N/S Boundary
Reserve		<b>0</b> ft from E/W Boundary
RM:		
NTS Map:	<b>72H00</b>	Major Basin: <b>01</b>
Elevation (ft)	<b>1909</b>	SubBasin: <b>24</b>
Aquifer		

### Well Information

		Well Casings			
Driller	<b>JOHNSON BROTHERS DRILLING</b>	Length (ft)	Btm (ft)	Dia (in)	Material
Completion Date	<b>1963.03.01</b>	<b>0</b>	<b>18</b>	<b>6</b>	<b>Steel</b>
Hole #		<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Install Method	<b>Drilled</b>	Well Screens			
Borehole Depth (ft)	<b>28</b>	Length (ft)	Bottom (ft)	Dia (in)	Slot (in)
Bit Dia (in)	<b>6</b>	<b>5</b>	<b>23</b>	<b>6</b>	<b>25</b>
Water Level	<b>19</b>	<b>5</b>	<b>28</b>	<b>6</b>	<b>30</b>
Flowing Head	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Water Use	<b>Municipal</b>	Pump Test			
Well Use	<b>Withdrawal</b>	Draw Down			
Completion Method	<b>Well Screen</b>	Duration			
E-Log	<b>No</b>	Pumping Rate			
		Temperature			
		Rec. Pumping Rate			
		<b>4</b> ft			
		<b>50</b> hrs			
		<b>25</b> igpm			
		<b>0</b> deg. F			
		<b>0</b> igpm			

### Lithology List

Depth (ft):	Material	Colour	Description
19	Sandy Clay	Unknown	Unknown
28	Gravel	Unknown	Unknown



Well Name: **LANG**WWDR #: **010857**

### Well Location

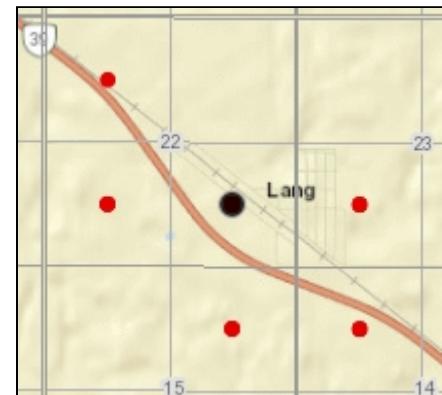
Land Location	<b>SE-22-011 -18 -W2</b>	Location of Well (in Quarter)
LSD	<b>00</b>	<b>0</b> ft from N/S Boundary
Reserve		<b>0</b> ft from E/W Boundary
RM:		
NTS Map:	<b>72H00</b>	Major Basin: <b>01</b>
Elevation (ft)	<b>1909</b>	SubBasin: <b>24</b>
Aquifer		

### Well Information

		Well Casings			
Driller	<b>JOHNSON BROTHERS DRILLING</b>	Length (ft)	Btm (ft)	Dia (in)	Material
Completion Date	<b>1963.03.24</b>	<b>0</b>	<b>25</b>	<b>2</b>	<b>Steel</b>
Hole #	<b>001</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Install Method	<b>Drilled</b>				
Borehole Depth (ft)		Well Screens			
Borehole Depth (ft)	<b>50</b>	Length (ft)	Bottom (ft)	Dia (in)	Slot (in)
Bit Dia (in)	<b>4</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Water Level	<b>18</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Flowing Head	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Water Use	<b>Municipal</b>	Pump Test			
Well Use	<b>Observation</b>	Draw Down			
Completion Method	<b>Perforated Casing</b>	Duration			
E-Log	<b>No</b>	Pumping Rate			
		Temperature			
		Rec. Pumping Rate			

### Lithology List

Depth (ft):	Material	Colour	Description
9	Till	Yellow	Unknown
17	Gravelly Clay	Unknown	Unknown
25	Gravel	Unknown	Unknown
40	Clay	Unknown	Unknown
48	Sand	Unknown	Unknown
50	Clay	Unknown	Unknown



Well Name: **LANG**WWDR #: **010858**

### Well Location

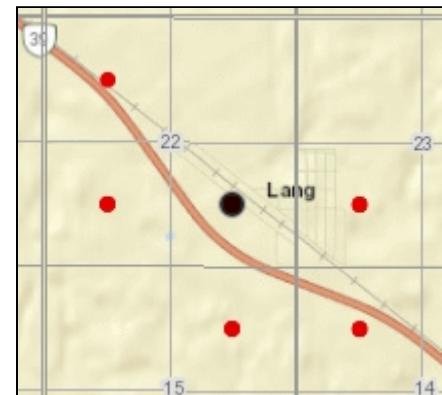
Land Location	<b>SE-22-011 -18 -W2</b>	Location of Well (in Quarter)
LSD	<b>00</b>	<b>0</b> ft from N/S Boundary
Reserve		<b>0</b> ft from E/W Boundary
RM:		
NTS Map:	<b>72H00</b>	Major Basin: <b>01</b>
Elevation (ft)	<b>1909</b>	SubBasin: <b>24</b>
Aquifer		

### Well Information

		Well Casings			
Driller	<b>JOHNSON BROTHERS DRILLING</b>	Length (ft)	Btm (ft)	Dia (in)	Material
Completion Date	<b>1963.03.01</b>	<b>0</b>	<b>30</b>	<b>2</b>	<b>Steel</b>
Hole #	<b>002</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Install Method	<b>Drilled</b>				
Borehole Depth (ft)	<b>35</b>	Well Screens			
Bit Dia (in)	<b>4</b>	Length (ft)	Bottom (ft)	Dia (in)	Slot (in)
Water Level	<b>24</b>	<b>5</b>	<b>35</b>	<b>2</b>	<b>25</b>
Flowing Head	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Water Use	<b>Municipal</b>	Pump Test			
Well Use	<b>Observation</b>	Draw Down			
Completion Method	<b>Well Screen</b>	Duration			
E-Log	<b>No</b>	Pumping Rate			
		Temperature			
		Rec. Pumping Rate			
		<b>0</b> ft			
		<b>0</b> hrs			
		<b>0</b> igpm			
		<b>0</b> deg. F			
		<b>0</b> igpm			

### Lithology List

Depth (ft):	Material	Colour	Description
25	Sand	Unknown	Unknown
31	Till	Grey	Unknown
36	Sand	Unknown	Silty
40	Sand	Unknown	Unknown
50	Sand	Unknown	Silty



Well Name: **LANG**WWDR #: **010859**

### Well Location

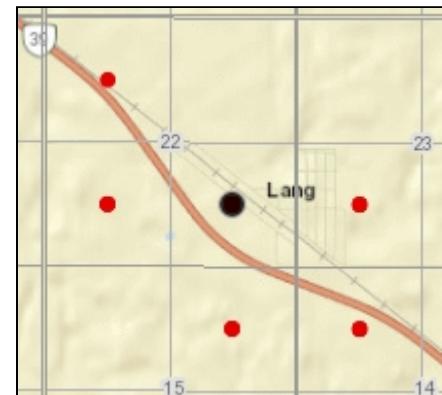
Land Location	<b>SE-22-011 -18 -W2</b>	Location of Well (in Quarter)
LSD	<b>00</b>	<b>0</b> ft from N/S Boundary
Reserve		<b>0</b> ft from E/W Boundary
RM:		
NTS Map:	<b>72H00</b>	Major Basin: <b>01</b>
Elevation (ft)	<b>1909</b>	SubBasin: <b>24</b>
Aquifer		

### Well Information

Driller	<b>JOHNSON BROTHERS DRILLING</b>	Well Casings			
		Length (ft)	Btm (ft)	Dia (in)	Material
Completion Date	<b>1963.04.13</b>	<b>0</b>	<b>0</b>	<b>0</b>	
Hole #		<b>0</b>	<b>0</b>	<b>0</b>	
Install Method	<b>Unknown</b>				
Borehole Depth (ft) <b>50</b>		Well Screens			
Bit Dia (in)	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	
Water Level	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	
Flowing Head	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	
Water Use	<b>Municipal</b>				Pump Test
Well Use	<b>Water Test Hole</b>		Draw Down		<b>0</b> ft
Completion Method			Duration		<b>0</b> hrs
E-Log	<b>No</b>		Pumping Rate		<b>0</b> igpm
			Temperature		<b>0</b> deg. F
			Rec. Pumping Rate		<b>0</b> igpm

### Lithology List

Depth (ft):	Material	Colour	Description
8	Till	Unknown	Unknown
22	Sand & Gravel	Unknown	Unknown
38	Till	Grey	Unknown
42	Sand & Gravel	Unknown	Coarse
47	Till	Unknown	Unknown
49	Sand	Unknown	Coarse
50	Till	Unknown	Unknown



Well Name: **LANG**WWDR #: **072918**

### Well Location

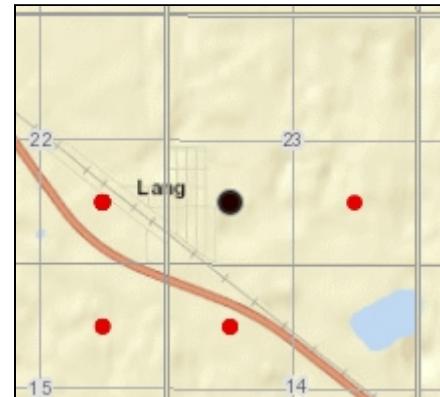
Land Location	<b>SW-23-011 -18 -W2</b>	Location of Well (in Quarter)
LSD	<b>00</b>	<b>0</b> ft from N/S Boundary
Reserve		<b>0</b> ft from E/W Boundary
RM:		
NTS Map:	<b>72H00</b>	Major Basin: <b>05</b>
Elevation (ft)	<b>1900</b>	SubBasin: <b>23</b>
Aquifer		

### Well Information

Driller	<b>AL'S DRILLING</b>	Well Casings			
		Length (ft)	Btm (ft)	Dia (in)	Material
Completion Date	<b>1982.08.18</b>	<b>0</b>	<b>0</b>	<b>0</b>	
Hole #	<b>001</b>	<b>0</b>	<b>0</b>	<b>0</b>	
Install Method	<b>Drilled</b>				
Borehole Depth (ft)		Well Screens			
Borehole Depth (ft)	<b>200</b>	Length (ft)	Bottom (ft)	Dia (in)	Slot (in)
Bit Dia (in)	<b>4.5</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Water Level	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Flowing Head	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Water Use	<b>Municipal</b>	Pump Test			
Well Use	<b>Water Test Hole</b>	Draw Down			
Completion Method		Duration			
E-Log	<b>No</b>	Pumping Rate			
		Temperature			
		Rec. Pumping Rate			
		<b>0</b> ft			
		<b>0</b> hrs			
		<b>0</b> igpm			
		<b>0</b> deg. F			
		<b>0</b> igpm			

### Lithology List

Depth (ft):	Material	Colour	Description
1	Topsoil	Unknown	Unknown
9	Clay	Brown	Unknown
31	Till	Yellow	Unknown
152	Till	Blue	Unknown
159	Sand	Unknown	Fine
162	Till	Blue	Unknown
171	Sand	Unknown	Fine
195	Till	Unknown	Silty
200	Shale	Unknown	Unknown



Well Name: **LANG**WWDR #: **010866**

### Well Location

Land Location	<b>SW-23-011 -18 -W2</b>	Location of Well (in Quarter)
LSD	<b>00</b>	<b>0</b> ft from N/S Boundary
Reserve		<b>0</b> ft from E/W Boundary
RM:		
NTS Map:	<b>72H00</b>	Major Basin: <b>01</b>
Elevation (ft)	<b>1909</b>	SubBasin: <b>24</b>
Aquifer		

### Well Information

		Well Casings			
Driller	<b>FOSTER'S DRILLING</b>	Length (ft)	Btm (ft)	Dia (in)	Material
Completion Date	<b>1961.07.18</b>	<b>0</b>	<b>0</b>	<b>0</b>	
Hole #		<b>0</b>	<b>0</b>	<b>0</b>	
Install Method	<b>Drilled</b>	Well Screens			
Borehole Depth (ft)	<b>40</b>	Length (ft)	Bottom (ft)	Dia (in)	Slot (in)
Bit Dia (in)	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Water Level	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Flowing Head	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Water Use	<b>Municipal</b>	Pump Test			
Well Use	<b>Water Test Hole</b>	Draw Down		<b>0</b> ft	
Completion Method		Duration		<b>0</b> hrs	
E-Log	<b>No</b>	Pumping Rate		<b>0</b> igpm	
		Temperature		<b>0</b> deg. F	
		Rec. Pumping Rate		<b>0</b> igpm	

### Lithology List

Depth (ft):	Material	Colour	Description
10	Clay	Unknown	Unknown
30	Sand	Unknown	Unknown
40	Clay	Unknown	Unknown



Well Name: **LANG**WWDR #: **010867**

### Well Location

Land Location	<b>SW-23-011 -18 -W2</b>	Location of Well (in Quarter)
LSD	<b>00</b>	<b>0</b> ft from N/S Boundary
Reserve		<b>0</b> ft from E/W Boundary
RM:		
NTS Map:	<b>72H00</b>	Major Basin: <b>01</b>
Elevation (ft)	<b>1909</b>	SubBasin: <b>24</b>
Aquifer		

### Well Information

		Well Casings			
Driller	<b>FOSTER'S DRILLING</b>	Length (ft)	Btm (ft)	Dia (in)	Material
Completion Date	<b>1961.07.18</b>	<b>0</b>	<b>0</b>	<b>0</b>	
Hole #		<b>0</b>	<b>0</b>	<b>0</b>	
Install Method	<b>Drilled</b>	Well Screens			
Borehole Depth (ft)	<b>50</b>	Length (ft)	Bottom (ft)	Dia (in)	Slot (in)
Bit Dia (in)	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Water Level	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Flowing Head	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Water Use	<b>Municipal</b>	Pump Test			
Well Use	<b>Water Test Hole</b>	Draw Down		<b>0</b> ft	
Completion Method		Duration		<b>0</b> hrs	
E-Log	<b>No</b>	Pumping Rate		<b>0</b> igpm	
		Temperature		<b>0</b> deg. F	
		Rec. Pumping Rate		<b>0</b> igpm	

### Lithology List

Depth (ft):	Material	Colour	Description
50	Sand	Unknown	Unknown



# Appendix E

## Assessment Criteria and Regulatory Information

## Assessment Criteria & Regulatory Information

### General

Saskatchewan Ministry of Environment (MEnv) currently recognizes the results-based regulatory framework as outlined in the Saskatchewan Environmental Code (MEnv 2014) for determining the appropriate environmental assessment criteria for soils and groundwater. As part of the Saskatchewan Environmental Code, further clarification for determining the appropriate assessment criteria is provided in MEnv's Guidance Document: Impacted Sites (MEnv 2015). The Guidance document references the following two supporting documents, for selection of endpoints and the appropriate criteria based on those endpoints:

- Saskatchewan MEnv, Endpoint Selection Standard, 17 June 2016. (MENV 2016); and
- Saskatchewan MEnv, Saskatchewan Environmental Quality Guidelines, 2019 (SEQG 2019).

MEnv 2016 allows for the tiered endpoint selection of the applicable assessment criteria based on factors including, but not limited to, land use, grain size, and human health and ecological exposure pathways. The tiers referenced in MEnv 2016 include the following:

- Tier 1: Application of Tier 1 SEQG tables based on land use and grain size;
- Tier 2: Application of pathway elimination and/or receptor controls to achieve the application of Tier 2 SEQG tables; and
- Tier 3: Site specific environmental quality standards, risk assessment and/or risk management.

### Land Use

MEnv 2016 includes four generic land uses, agricultural, residential/parkland, commercial, and industrial. A generic exposure scenario is envisioned for each land use category based on the normal activities on these lands. The four land uses default exposure scenarios are:

Agricultural: Land used primarily for growing crops or tending livestock and includes agricultural lands that provide habitat for resident and transitory wildlife and native flora but does not include that portion of agricultural land used for a residence.

Residential/Parkland: Land used primarily for residential or recreational activity but does not include wild land.

Commercial: Land used primarily for business activity and there is free access to all members of the public, including children. It does not include operations where food is grown.

Industrial: Land where the primary activity involves the production, manufacture, or construction of goods. Public access is restricted and children are not permitted continuous access or occupancy.

Where the Site is located adjacent to a property where more restrictive SEQG 2019 values apply, the SEQG 2019 values for the adjacent property must be applied within the Site to a distance of 30 m from the adjacent property line.

The Site is currently zoned for commercial land use and will likely be used as commercial property for the foreseeable future. The Site is bordered by residential, commercial, and agriculture land use. The Site is considered commercial with applicable agricultural and residential buffers. The Site and surrounding land use are shown on Figures 1 and 2 and summarized in Table 1.

The Site and surrounding land use are shown on Figures 1 and 2 and summarized in Table 1.

## Grain Size Designation

SEQG 2019 guidelines are prescribed for coarse-grained and fine-grained soils. Fine-grained soils are defined in MEnv 2016 as having a median grain size of less than or equal to 75 µm; coarse-grained soils have a median grain size of greater than 75 µm. The absence of sufficient particle size information will result in the default application of the more conservative Tier 1 guideline. Where both fine- and coarse-grained strata are present, the dominant soil particle size is determined by the stratum governing horizontal and vertical migration to a receptor.

A total of seven grain size analyses were conducted as part of the Phase II ESAs completed in 2008, 2009, and 2016. The assessment in 2008 collected samples from 08-05 at 3.4 m bgl, within a sand layer and 08-06 at 1.8 m bgl, within a silty clay layer. Sample 08-05 had 16.8% passing through the 75 µm screen while sample 08-06 had 66.6% passing through the 75 µm screen. In 2009 samples were submitted from test holes 09-03 at 6.1 m bgl and 09-04 at 4.6 m bgl, both from within sand layers and determined to have had 2.9% and 13.2% passing through the 75 µm screen, respectively. Soil samples submitted in 2016, included 16-01 at a depth of 6.1 m, collected from a sand layer and 16-03 and 16-05 at 3.8 m bgl, collected from the clay till layer. The sample from the sand layer had 14.7% passing through the 75 µm screen while the samples from the clay till layer, had 67.8% and 97.1% passing through the 75 µm screen.

Based on the historical grain size analyses, the Site contains both fine- and coarse-grained soils; however, coarse-grained has been chosen as this material would govern migration on-Site.

## Applicable Exposure Pathways

### Human Exposure Pathways

Commercial, agricultural, and residential land use criteria apply to the Site. Potential human exposure pathways include the following: soil ingestion, dermal contact, vapour inhalation and potable groundwater. The applicability of each of these potential exposure pathways to the Site are discussed in the following sections. Note that in the absence of potable groundwater receptors, the Endpoint Selection Standard outlines guidelines for non-potable groundwater scenarios.

### Soil Ingestion and Dermal Contact

The soil ingestion and dermal contact pathways may be eliminated if:

- the substances of potential concern (SOPCs) are PHCs or BTEX compounds and no other SOPCs are present at the site; and
- the SOPCs are more than 1.5 m below ground level (bgl); and
- one or more of the following are met:
  - physical controls are present at the site;
  - engineering controls are present at the site; or

- appropriate administrative controls are established to reduce the risk that soil ingestion and dermal contact does not occur.

The Site surface consists primarily vegetated areas. Given this and the fact that impacts have been identified at depths shallower than 1.5 m bgl, the soil ingestion and dermal contact pathways are considered applicable to the Site.

### Vapour Inhalation

The vapour inhalation pathway may be eliminated if:

- the SOPCs are PHCs or BTEX compounds and no other SOPCs are present at the Site; and
- there are no occupied buildings within 30 m of the Site; and
- one or more of the following are met:
  - physical controls are present at the Site;
  - engineering controls are present at the Site; or
  - appropriate administrative controls are in place to ensure vapour inhalation does not occur.

The Site is currently undeveloped and there are no buildings present on-Site. However, there are residential properties within 30 m of the Site; therefore, the vapour inhalation pathway is applicable to the Site.

### Protection of Potable Groundwater

According to MEnv 2016, the protection of potable groundwater exposure pathway may be eliminated if the only contaminants of concern at a Site are PHCs and one or more of the following conditions exist:

- Sufficient physical controls exist to prevent the contaminants of concern from reaching the potable aquifer;
- The groundwater present at the Site does not provide sufficient yield or quality to be used as a potable supply; or
- The SOPCs will be attenuated such that the concentrations will be below the applicable environmental criteria before the contaminants reach the aquifer.

Further, a potable groundwater aquifer as defined by MEnv is "a hydrostratigraphic unit that has a bulk hydraulic conductivity of  $10^{-4}$  centimetre per second (cm/s) or greater, has a sufficient thickness to support a sustained yield of 0.76 L per minute or greater for a minimum of 20 years, and does not contain chemical constituents that make the water unsafe for human consumption or contain constituents that render the water undesirable aesthetically if those constituents cannot be removed."

Applicable exposure pathways were further evaluated through a search of the Saskatchewan Water Security Agency (WSASK) water well records and review of historical data. A summary of the water well record search and review are provided in the following sections.

#### Saskatchewan Water Security Agency Well Search

A water well survey was conducted on the WSASK water well database to identify any wells potentially within 500 m of the Site. Water well records for six water test holes, three municipal withdrawal, one domestic withdrawal, and six observation wells were found within the search area. According to the Village of Lang, the current Village well is completed to a depth of 46 m bgl. However, based on the water

well logs, previously drilled municipal wells were completed at depths ranging from 8.5 m bgl to 11.3 m bgl, with a water level of approximately 5 m bgl. The water well records indicate that these wells had pumping rates of approximately 114 L/min.

The withdrawal well identified from the WSASK search was completed to a depth of 7.9 m bgl and was reported to have a pumping rate of 9 L/min. Wood spoke with Mr. Mike Saip of the Cross-Country Co-op regarding this well in 2017. He indicated that the property on which this well is located is on the same quarter section as the former bulk plant but is south of the railway tracks south of the Site and no longer contains a residence. However, there is still a workshop present. It is unknown if this well is still in use.

### Municipal Drinking Water Supply

The Village of Lang was contacted regarding their municipal water supply. The Village indicated that their water supply comes from a well located approximately 45 m away from the village water tower, which is 350 m southeast of the Site. The Village does not have any bylaws in place to prevent the use of private water wells.

### Hydraulic Conductivity and DUA Determination

Hydraulic conductivity testing was not completed as part of the 2019 groundwater monitoring program. Hydraulic conductivity tests completed as part of previous investigations on-Site have yielded values ranging from  $4.58 \times 10^{-3}$  cm/s to  $2.39 \times 10^{-7}$  cm/s. Hydraulic testing completed in the sand layer observed the value of  $4.58 \times 10^{-3}$  cm/s while tests completed in the clay till yielded results of  $8.6 \times 10^{-5}$  cm/s and  $2.39 \times 10^{-7}$  cm/s.

### Summary

At this time, Wood considers the potable groundwater pathway to be applicable at the Site for the following reasons:

- The Village water well is located within 500 m of the Site.
- The WSASK water well search indicated that there may be a domestic withdrawal well within 500 m of the Site, completed to a depth of 7.9 m bgl with a pumping rate of 9 L/min.
- Municipal wells have historically been installed at shallow depths ranging from 8.5 m bgl to 11.3 m bgl. These wells had water levels at approximately 5 m bgl and a pumping rate of 114 L/min.
- The hydraulic conductivity test performed in the sand layer identified on-Site yielded a value of  $4.58 \times 10^{-3}$  cm/s. The sand layer in which this test was performed, was identified in several test holes across the Site; therefore is not isolated.
- The Village does not have a bylaw in place preventing residents from installing or using private water wells.

## **Ecological Exposure Pathways**

Commercial, agricultural, and residential land use criteria apply to the Site. Potential ecological exposure pathways include the following: ecological soil contact, soil ingestion by livestock/wildlife and protection of groundwater for aquatic life, irrigation, livestock and wildlife.

### **Ecological Soil Contact**

The ecological soil contact pathway may be eliminated if:

- the SOPCs are PHCs or BTEX compounds and no other SOPCs are present at the site; and
  - the SOPCs are more than 3 m bgl; or
  - the SOPCs are between 1.5 and 3 m bgl and all of the following are met:
    - ◆ sufficient engineering controls exist to prevent receptor exposure and there is no productive use for the soil at the impacted site; and
    - ◆ appropriate administrative controls are in place to address exposure to the contaminated soils.

The Site surface consists mainly of grass, and impacts have been identified above a depth of 3.0 m bgl. As such, the ecological soil contact pathway is considered applicable to the Site.

### **Soil Ingestion by Livestock/Wildlife**

The soil ingestion pathway may be eliminated if:

- the SOPCs are PHCs or BTEX compounds and no other SOPCs are present at the site;
- the SOPCs are more than 1.5 m bgl;
- appropriate administrative controls are established to reduce the risk of soil ingestion; and
- one or more of the following are met:
  - physical controls exist at the site; or
  - engineering controls exist at the site.

There are no physical or engineering controls in place at the Site. For these reasons, the soil ingestion by livestock and wildlife pathway is considered applicable.

### **Groundwater for Aquatic Life, Irrigation, Livestock and Wildlife**

The protection of groundwater for aquatic life, irrigation, livestock and wildlife watering pathway may be eliminated if:

- the SOPCs are PHCs or BTEX compounds and no other SOPCs are present at the site; and
  - there are no permanent water bodies that sustain aquatic life within 500 m of the site; or
  - one or more of the following are met:
    - ◆ there are sufficient physical controls to prevent SOPCs reaching the permanent water body;
    - ◆ natural attenuation of the SOPCs will reduce the concentrations to below the applicable environmental standards before the SOPCs reach the water body;
    - ◆ it can be established there is no hydrologic connectivity between contaminated media and the water body;
    - ◆ engineering controls with sufficient administrative controls are present to prevent receptor exposure.

Previous assessments have excluded the freshwater aquatic pathway; however, there is a dugout with a pumping station, that is located within to the north of the Site. Wood contacted the Rural Municipality (R.M.) of Scott No. 98 as part of this assessment to determine the purpose of the dugout. The R.M. administrator indicated that residents use this source of grey water and potentially for aquiculture and

livestock purposes. Given the dugout is located within 500 m of the Site and the hydraulic conductivity values observed in the sand layer, the freshwater aquatic life pathway is considered applicable to this Site.

### Miscellaneous Criteria

Commercial, agricultural, and residential land use criteria apply to the Site. The generic criteria applicable to this Site would include management limits, as set out in the Canadian Council for Ministers of the Environment (CCME) Canada-wide Standards for Petroleum Hydrocarbons (PHC) in Soil (CWS) (2008).

CCME established federal management limits for PHCs to address free-phase formation, exposure or workers in a trench, explosive hazards in excavations and overlying buildings, and effects on buried infrastructure. The management limits are considered upper limits applicable to all depths and cannot be excluded. Where concentrations exceed these limits, the expectation is that some form of risk management action is undertaken to address the potential risk.

### Summary – Soil and Groundwater Guidelines

Given the current of the Site, the agricultural and residential land use buffers, the coarse-grained nature of the soil, and the applicable exposure pathways as outlined in the previous sections, the following appropriate criteria have been selected for the assessment of soil and groundwater at the Site.

#### Soil:

- At or above 1.5 m bgl:
  - Dermal contact.
  - Soil ingestion.
  - Vapour inhalation.
  - Ecological soil contact.
  - Protection of Wildlife/Livestock.
  - Protection of Aquatic Life.
  - Protection of Potable Groundwater.
  - Management Limits.
  -
- From 1.5 m to 3.0 m bgl:
  - Vapour inhalation.
  - Ecological soil contact.
  - Protection of Aquatic Life.
  - Protection of Potable Groundwater.
  - Management Limits.
- Below 3.0 m bgl:
  - Vapour Inhalation.
  - Protection of Aquatic Life.
  - Protection of Potable Groundwater.
  - Management Limits.

Groundwater:

- Vapour inhalation.
- Ecological contact.
- Protection of aquatic life.
- Protection of potable groundwater.

The applicable soil and groundwater criteria selected from SEQG 2019 are summarized in Table E-1.

TABLE E-1: ASSESSMENT CRITERIA - PHCs

Coarse-Grained Soil Criteria (mg/kg)									
Criteria - Land Use	Exposure Pathway	Benzene	Toluene	Ethylbenzene	Xylenes	PHC Fraction F1	PHC Fraction F2	PHC Fraction F3	PHC Fraction F4
SEQG 2019 - Residential Surface Soil	Soil Ingestion	110	22,000	10,000	150,000	12,000	6,800	15,000	21,000
	Dermal Contact	78	640	1,700	480	12,000	6,800	15,000	21,000
	Vapour Inhalation (slab-on-grade)	0.073	95	44	12	30	150	NA	NA
	Vapour Inhalation (basement)	0.1	130	60	16	40	190	NA	NA
	Ecological Contact	31	75	55	95	210	150	300	2,800
	Protection of Groundwater - Potable	0.078	0.95	0.14	1.9	240	320	NA	NA
	Protection of Groundwater - Aquatic Life	0.17	0.12	540	41	970	380	NA	NA
	Protection of Groundwater - Livestock	NV	NV	NV	NV	NV	NV	NV	NV
	Management Limit	NV	NV	NV	NV	700	1,000	2,500	10,000
SEQG 2019 - Residential Subsoil	Vapour Inhalation (slab-on-grade)	0.14	180	86	23	30	150	NA	NA
	Vapour Inhalation (basement)	0.1	130	60	16	40	190	NA	NA
	Ecological Contact	62	150	110	190	420	300	600	5,600
	Protection of Groundwater - Potable	0.078	0.95	0.14	1.9	240	240	NA	NA
	Protection of Groundwater - Aquatic Life	0.17	0.12	540	41	970	380	NA	NA
	Management Limit	NV	NV	NV	NV	700	1,000	2,500	10,000
Applicable Residential Soil Criteria - SEQG 2019	Surface Soil ( $\leq 1.5$ m)	0.073						300	2,800
	Subsoil ( $>1.5 - 3.0$ m)		0.95					600	5,600
	Subsoil ( $>3.0$ m)							2,500	10,000
SEQG 2019 - Commercial Surface Soil	Soil Ingestion	110	82,000	36,000	560,000	19,000	10,000	23,000	RES
	Dermal Contact	120	980	2,500	720	19,000	10,000	23,000	30,000
	Vapour Inhalation (slab-on-grade)	0.9	1,200	530	140	320	1,700	NA	NA
	Vapour Inhalation (basement)	NV	NV	NV	NV	NV	NV	NV	NV
	Ecological Contact	180	250	300	350	320	260	1700	3300
	Protection of Groundwater - Potable	0.078	0.95	0.14	1.9	240	320	NA	NA
	Protection of Groundwater - Aquatic Life	0.17	0.12	540	41	970	380	NA	NA
	Protection of Groundwater - Livestock	NV	NV	NV	NV	NV	NV	NV	NV
	Management Limit	NV	NV	NV	NV	700	1,000	3,500	10,000
SEQG 2019 - Commercial Subsoil	Vapour Inhalation (slab-on-grade)	1.2	1,600	760	210	320	1,700	NV	NV
	Vapour Inhalation (basement)	NV	NV	NV	NV	NV	NV	NV	NV
	Ecological Contact	360	500	600	700	640	520	3,400	6,600
	Protection of Groundwater - Potable	0.078	0.95	0.14	1.9	240	320	NA	NA
	Protection of Groundwater - Aquatic Life	0.17	0.12	540	41	970	380	NA	NA
Applicable Commercial Soil Criteria - SEQG 2019	Management Limit	NV	NV	NV	NV	700	1,000	3,500	10,000
	Surface Soil ( $\leq 1.5$ m)		0.95					260	1,700
	Subsoil ( $>1.5 - 3.0$ m)							320	6,600
SEQG 2019 - Agricultural Surface Soil	Subsoil ( $>3.0$ m)							3,500	10,000
	Soil Ingestion	110	22,000	10,000	150,000	12,000	6,800	15,000	21,000
	Dermal Contact	78	640	1,700	480	12,000	6,800	15,000	21,000
	Vapour Inhalation (slab-on-grade)	0.073	95	44	12	30	150	NV	NV
	Vapour Inhalation (basement)	0.1	130	60	16	40	190	NV	NV
	Ecological Contact	31	75	55	95	210	150	300	2,800
	Protection of Groundwater - Potable	0.078	0.95	0.14	1.9	240	320	NV	NV
	Protection of Groundwater - Aquatic Life	0.17	0.12	540	41	970	380	NA	NA
	Protection of Groundwater - Livestock	0.21	29	42	180	5,300	14,000	NA	NA
SEQG 2019 - Agricultural Subsoil	Management Limit	NV	NV	NV	NV	700	1,000	2,500	10,000
	Vapour Inhalation (slab-on-grade)	0.14	180	86	23	30	150	NV	NV
	Vapour Inhalation (basement)	0.1	130	60	16	40	190	NV	NV
	Ecological Contact	62	150	110	190	420	300	600	5,600
	Protection of Groundwater - Potable	0.078	0.95	0.14	1.9	240	320	NV	NV
Applicable Agricultural Soil Criteria - SEQG 2019	Protection of Groundwater - Aquatic Life	0.17	0.12	540	41	970	380	NA	NA
	Management Limit	NV	NV	NV	NV	700	1,000	2,500	10,000
	Surface Soil ( $\leq 1.5$ m)		0.95					150	2,800
Applicable Agricultural Soil Criteria - SEQG 2019	Subsoil ( $>1.5 - 3.0$ m)		0.12					300	5,600
	Subsoil ( $>3.0$ m)							320	10,000
	Coarse-Grained Groundwater Criteria (mg/L)								
Criteria	Exposure Pathway	Benzene	Toluene	Ethylbenzene	Xylenes	PHC Fraction F1	PHC Fraction F2	PHC Fraction F3	PHC Fraction F4
SEQG 2019 - Residential Groundwater	Vapour Inhalation	0.14	74	16	3.9	0.81	1.5	NV	NV
	Protection of Groundwater - Potable	0.005	0.06	0.14	0.09	2.2	1.1	NV	NV
	Ecological Contact	61	59	20	31	7.1	1.8	NV	NV
	Protection of Groundwater - Aquatic Life	0.074	0.021	41	2.9	9.8	1.3	NV	NV
Applicable Residential Groundwater Criteria - SEQG 2019		0.005	0.021	0.14	0.09	0.81	1.1	NV	NV
SEQG 2019 - Commercial Groundwater	Vapour Inhalation	1.8	NGR	NGR	48	9.1	17	NV	NV
	Protection of Groundwater - Potable	0.005	0.06	0.14	0.09	2.2	1.1	NV	NV
	Ecological Contact	350	200	110	120	11	3.1	NV	NV
	Protection of Groundwater - Aquatic Life	0.074	0.021	41	2.9	9.8	1.3	NV	NV
Applicable Commercial Groundwater Criteria - SEQG 2019		0.005	0.02	0.14	0.09	2.2	1.1	NV	NV
SEQG 2019 - Agricultural Groundwater	Vapour Inhalation	0.14	74	16	3.9	0.81	1.5	NV	NV
	Protection of Groundwater - Potable	0.005	0.06	0.14	0.09	2.2	1.1	NV	NV
	Ecological Contact	61	59	20	31	7.1	1.8	NV	NV
	Protection of Groundwater - Aquatic Life	0.074	0.021	41	2.9	9.8	1.3	NV	NV
Applicable Agricultural Groundwater Criteria - SEQG 2019		0.005	0.02	0.14	0.09	0.81	1.1	NV	NV

**Notes:**

- mg/kg - milligrams per kilogram
- mg/L - milligrams per liter
- PHC Fraction F1 - volatile petroleum hydrocarbons ( $C_6 - C_{10}$ ), less BTEX
- PHC Fraction F2 - extractable petroleum hydrocarbons ( $C_{10} - C_{16}$ )
- PHC Fraction F3 - extractable petroleum hydrocarbons ( $C_{16} - C_{34}$ )
- PHC Fraction F4 - extractable petroleum hydrocarbons ( $C_{34} - C_{50}$ )
- NA - not applicable. Calculated value exceeds 1,000,000 mg/kg or pathway excluded.
- NV - no value.
- NGR - no guideline required; calculated guideline exceeds solubility limit.
- RES - residual PHC formation; calculated value exceeds 30,000 mg/kg and solubility limit for PHC fraction.
- SEQG 2019 - Saskatchewan Ministry of Environment, [Saskatchewan Environmental Quality Guidelines](https://envonline.gov.sk.ca/seqc-search/) (<https://envonline.gov.sk.ca/seqc-search/>), downloaded 27 October 2019

<b>BOLD</b>	applicable SEQG 2019 soil criteria at or above 1.5 m
<b>BOLD</b>	applicable SEQG 2019 soil criteria below 1.5 m
<b>BOLD ITALIC</b>	applicable SEQG 2019 soil criteria below 3.0 m
<b>BOLD</b>	applicable SEQG 2019 groundwater criteria

# Appendix F

## Monitoring Well Inspection



## MONITORING WELL INSPECTION CHECKLIST

Site: Former Co-op Bulk Plant  
 Address: Lang, Saskatchewan

FCL Site ID: 417  
 Wood Project #: ZE0803919

Monitoring Well ID	Onsite	Offsite	Well Condition		Screen Interval (m)	Measured DTB (m btoc)	Description of Well Condition (If Unsatisfactory) Examples include; no lid/bolt/pin, bent device, protruding cover, damaged concrete
			Satisfactory	Unsatisfactory			
08-04	X		X		4.0-5.95	7.483	
08-05		X		X	5.0-6.6	---	Silted In
08-06		X	X		3.0-5.05	5.080	
08-10	X		X		3.0-4.95	5.830	
08-11	X			X	2.0-4.6	5.530	Pipe bent
09-04		X	X		--	7.050	
16-01	X		X		5.5-8.5	9.485	
16-02	X		X		3.1-6.1	6.820	
16-03	X		X		2.5-5.5	6.353	
16-04	X		X		3.1-6.1	6.777	
16-05		X	X		3.1-6.1	6.835	
16-06	X		X		3.1-6.1	6.695	
17-01	X		X		5.5-8.5	9.360	
17-02		X	X		3.0-6.0	5.840	
17-03		X	X		3.0-6.0	5.815	
17-04	X		X		5.5-8.5	8.178	
17-05		X	X		3.0-6.0	5.765	
17-06		X	X		3.0-6.0	5.796	
17-07	X		X		3.0-6.0	5.735	

Inspection Completed By: Kinnon Stevenson-French

Inspection Date: 26-Oct-19

# Appendix G

## Laboratory Certificates and QA/QC



Wood Environment & Infrastructure Solutions  
(Regina)  
ATTN: Kent Muderewich  
#1 - 1727 Francis Street  
REGINA SK S4N 7N2

Date Received: 28-OCT-19  
Report Date: 04-NOV-19 12:37 (MT)  
Version: FINAL

Client Phone: 306-721-7100

## Certificate of Analysis

**Lab Work Order #:** L2372762

Project P.O. #: 3612  
Job Reference: ZE0803919  
C of C Numbers: 19-2019150927  
Legal Site Desc:

A handwritten signature in black ink that reads "B. Morgan".

Brian Morgan, B.Sc. Hons.  
Client Services Manager

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## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2372762-1 16-03 Sampled By: KSF on 26-OCT-19 @ 10:25 Matrix: WATER <b>BTEX, F1-F4 and SK Reg. PHC's</b>							
<b>BTEX and F1 (C6-C10)</b>							
Benzene	0.00282	0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906	
Toluene	<0.00050	0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906	
EthylBenzene	0.00532	0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906	
Xylenes	<0.0020	0.0020	mg/L	31-OCT-19	01-NOV-19	R4895906	
o-Xylene	<0.00050	0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906	
m+p-Xylene	<0.0010	0.0010	mg/L	31-OCT-19	01-NOV-19	R4895906	
F1(C6-C10)	0.12	0.10	mg/L	31-OCT-19	01-NOV-19	R4895906	
F1-BTEX	0.12	0.10	mg/L	31-OCT-19	01-NOV-19	R4895906	
Surrogate: 1,4-Difluorobenzene	100.9	70-130	%	31-OCT-19	01-NOV-19	R4895906	
Surrogate: 4-Bromofluorobenzene	115.0	70-130	%	31-OCT-19	01-NOV-19	R4895906	
Surrogate: 3,4-Dichlorotoluene	104.9	70-130	%	31-OCT-19	01-NOV-19	R4895906	
<b>CCME Total Hydrocarbons</b>							
Total Hydrocarbons (C6-C50)	2.2	1.0	mg/L			02-NOV-19	
<b>Extractable Hydrocarbons by GC-FID</b>							
F2 (C10-C16)	1.77	0.10	mg/L	01-NOV-19	02-NOV-19	R4896446	
F3 (C16-C34)	0.29	0.25	mg/L	01-NOV-19	02-NOV-19	R4896446	
F4 (C34-C50)	<0.25	0.25	mg/L	01-NOV-19	02-NOV-19	R4896446	
TEH (C11-C22)	2.11	0.30	mg/L	01-NOV-19	02-NOV-19	R4896446	
TEH (C23-C60)	<0.50	0.50	mg/L	01-NOV-19	02-NOV-19	R4896446	
Surrogate: 2-Bromobenzotrifluoride	71.6	60-140	%	01-NOV-19	02-NOV-19	R4896446	
<b>Single Metal in Water by ICPMS (Total)</b>							
<b>Total Metals in Water by CRC ICPMS</b>							
Iron (Fe)-Total	45.7	DLDS	0.050	mg/L		31-OCT-19	R4895046
<b>Miscellaneous Parameters</b>							
Acidity (as CaCO <sub>3</sub> )	331		5.0	mg/L		31-OCT-19	R4895888
Ammonia, Total (as N)	0.076		0.050	mg/L		01-NOV-19	R4893727
Chemical Oxygen Demand	262		10	mg/L	31-OCT-19	31-OCT-19	R4891148
Chloride (Cl)	392	DLDS	2.0	mg/L		29-OCT-19	R4895975
Conductivity	6880		5.0	uS/cm		29-OCT-19	R4889818
Orthophosphate-Dissolved (as P)	<0.50	DLM	0.50	mg/L	29-OCT-19	29-OCT-19	R4890369
Nitrate (as N)	<0.40	DLDS	0.40	mg/L		29-OCT-19	R4895975
Nitrite (as N)	<0.20	DLDS	0.20	mg/L		29-OCT-19	R4895975
SAR	5.63		0.10	SAR		01-NOV-19	
Sulfate (SO <sub>4</sub> )	3470	DLDS	6.0	mg/L		29-OCT-19	R4895975
TDS (Calculated from EC)	4470		1.0	mg/L		30-OCT-19	
Total Dissolved Solids	6400		80	mg/L		29-OCT-19	R4890264
Total Inorganic Carbon	168	DLHC	5.0	mg/L		31-OCT-19	R4895301
Total Organic Carbon	89.7	DLM	5.0	mg/L		31-OCT-19	R4895367
Phosphorus (P)-Total	0.273	DLHC	0.025	mg/L		30-OCT-19	R4890071
pH	7.17		0.10	pH		29-OCT-19	R4889818
<b>Alkalinity by Auto. Titration</b>							
Bicarbonate (HCO <sub>3</sub> )	1070		6.1	mg/L		29-OCT-19	R4889818
Hydroxide (OH)	<5.0		5.0	mg/L		29-OCT-19	R4889818
Carbonate (CO <sub>3</sub> )	<5.0		5.0	mg/L		29-OCT-19	R4889818
Alkalinity, Total (as CaCO <sub>3</sub> )	873		5.0	mg/L		29-OCT-19	R4889818
<b>Dissolved Metals in Water by CRC ICPMS</b>							
Dissolved Metals Filtration Location	FIELD					30-OCT-19	R4889919
Calcium (Ca)-Dissolved	445	DLDS	0.25	mg/L		31-OCT-19	R4895289
Iron (Fe)-Dissolved	26.5	DLDS	0.050	mg/L		31-OCT-19	R4895289

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2372762-1	16-03							
Sampled By:	KSF on 26-OCT-19 @ 10:25							
Matrix:	WATER							
<b>Dissolved Metals in Water by CRC ICPMS</b>								
Magnesium (Mg)-Dissolved	444	DLDS	0.025	mg/L			31-OCT-19	R4895289
Manganese (Mn)-Dissolved	12.5	DLHC	0.0010	mg/L			31-OCT-19	R4895289
Potassium (K)-Dissolved	22.9	DLDS	0.25	mg/L			31-OCT-19	R4895289
Sodium (Na)-Dissolved	703	DLDS	0.25	mg/L			31-OCT-19	R4895289
L2372762-2	17-06							
Sampled By:	KSF on 25-OCT-19 @ 11:00							
Matrix:	WATER							
<b>BTEX, F1-F4 and SK Reg. PHC's</b>								
<b>BTEX and F1 (C6-C10)</b>								
Benzene	<0.00050		0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906	
Toluene	<0.00050		0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906	
EthylBenzene	<0.00050		0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906	
Xylenes	<0.0020		0.0020	mg/L	31-OCT-19	01-NOV-19	R4895906	
o-Xylene	<0.00050		0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906	
m+p-Xylene	<0.0010		0.0010	mg/L	31-OCT-19	01-NOV-19	R4895906	
F1(C6-C10)	<0.10		0.10	mg/L	31-OCT-19	01-NOV-19	R4895906	
F1-BTEX	<0.10		0.10	mg/L	31-OCT-19	01-NOV-19	R4895906	
Surrogate: 1,4-Difluorobenzene	102.2		70-130	%	31-OCT-19	01-NOV-19	R4895906	
Surrogate: 4-Bromofluorobenzene	116.7		70-130	%	31-OCT-19	01-NOV-19	R4895906	
Surrogate: 3,4-Dichlorotoluene	95.9		70-130	%	31-OCT-19	01-NOV-19	R4895906	
<b>CCME Total Hydrocarbons</b>								
Total Hydrocarbons (C6-C50)	<1.0		1.0	mg/L			02-NOV-19	
<b>Extractable Hydrocarbons by GC-FID</b>								
F2 (C10-C16)	<0.10		0.10	mg/L	01-NOV-19	02-NOV-19	R4896446	
F3 (C16-C34)	<0.25		0.25	mg/L	01-NOV-19	02-NOV-19	R4896446	
F4 (C34-C50)	<0.25		0.25	mg/L	01-NOV-19	02-NOV-19	R4896446	
TEH (C11-C22)	<0.30		0.30	mg/L	01-NOV-19	02-NOV-19	R4896446	
TEH (C23-C60)	<0.50		0.50	mg/L	01-NOV-19	02-NOV-19	R4896446	
Surrogate: 2-Bromobenzotrifluoride	69.5		60-140	%	01-NOV-19	02-NOV-19	R4896446	
L2372762-3	17-07							
Sampled By:	KSF on 25-OCT-19 @ 14:45							
Matrix:	WATER							
<b>BTEX, F1-F4 and SK Reg. PHC's</b>								
<b>BTEX and F1 (C6-C10)</b>								
Benzene	0.00074		0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906	
Toluene	<0.00050		0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906	
EthylBenzene	<0.00050		0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906	
Xylenes	<0.0020		0.0020	mg/L	31-OCT-19	01-NOV-19	R4895906	
o-Xylene	<0.00050		0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906	
m+p-Xylene	<0.0010		0.0010	mg/L	31-OCT-19	01-NOV-19	R4895906	
F1(C6-C10)	<0.10		0.10	mg/L	31-OCT-19	01-NOV-19	R4895906	
F1-BTEX	<0.10		0.10	mg/L	31-OCT-19	01-NOV-19	R4895906	
Surrogate: 1,4-Difluorobenzene	101.8		70-130	%	31-OCT-19	01-NOV-19	R4895906	
Surrogate: 4-Bromofluorobenzene	119.7		70-130	%	31-OCT-19	01-NOV-19	R4895906	
Surrogate: 3,4-Dichlorotoluene	85.9		70-130	%	31-OCT-19	01-NOV-19	R4895906	
<b>CCME Total Hydrocarbons</b>								
Total Hydrocarbons (C6-C50)	<1.0		1.0	mg/L			02-NOV-19	
<b>Extractable Hydrocarbons by GC-FID</b>								
F2 (C10-C16)	<0.10		0.10	mg/L	01-NOV-19	02-NOV-19	R4896446	
F3 (C16-C34)	<0.25		0.25	mg/L	01-NOV-19	02-NOV-19	R4896446	

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2372762-3 17-07 Sampled By: KSF on 25-OCT-19 @ 14:45 Matrix: WATER <b>Extractable Hydrocarbons by GC-FID</b> F4 (C34-C50) <0.25 0.25 mg/L 01-NOV-19 02-NOV-19 R4896446 TEH (C11-C22) <0.30 0.30 mg/L 01-NOV-19 02-NOV-19 R4896446 TEH (C23-C60) <0.50 0.50 mg/L 01-NOV-19 02-NOV-19 R4896446 Surrogate: 2-Bromobenzotrifluoride 77.7 60-140 % 01-NOV-19 02-NOV-19 R4896446							
<b>Single Metal in Water by ICPMS (Total)</b> <b>Total Metals in Water by CRC ICPMS</b> Iron (Fe)-Total 126 DLDS 0.050 mg/L 31-OCT-19 R4895046							
<b>Miscellaneous Parameters</b> Acidity (as CaCO <sub>3</sub> ) 60.9 DLHC 5.0 mg/L 31-OCT-19 R4895888 Ammonia, Total (as N) 0.35 DLHC 0.25 mg/L 31-OCT-19 R4893727 Chemical Oxygen Demand 280 DLDS 10 mg/L 31-OCT-19 R4891148 Chloride (Cl) 453 DLDS 2.0 mg/L 29-OCT-19 R4895975 Conductivity 6260 DLDS 5.0 uS/cm 29-OCT-19 R4889818 Orthophosphate-Dissolved (as P) <0.50 DLM 0.50 mg/L 29-OCT-19 29-OCT-19 R4890369 Nitrate (as N) 93.7 DLDS 0.40 mg/L 29-OCT-19 R4895975 Nitrite (as N) 0.34 DLDS 0.20 mg/L 29-OCT-19 R4895975 SAR 3.55 DLDS 0.10 SAR 01-NOV-19 Sulfate (SO <sub>4</sub> ) 2860 DLDS 6.0 mg/L 29-OCT-19 R4895975 TDS (Calculated from EC) 4070 DLDS 1.0 mg/L 30-OCT-19 Total Dissolved Solids 5780 DLDS 80 mg/L 29-OCT-19 R4890264 Total Inorganic Carbon 92.7 DLHC 5.0 mg/L 31-OCT-19 R4895301 Total Organic Carbon 130 DLHC 100 mg/L 31-OCT-19 R4895367 Phosphorus (P)-Total 2.54 DLHC 0.15 mg/L 30-OCT-19 R4890071 pH 7.67 DLDS 0.10 pH 29-OCT-19 R4889818 <b>Alkalinity by Auto. Titration</b> Bicarbonate (HCO <sub>3</sub> ) 585. DLDS 6.1 mg/L 29-OCT-19 R4889818 Hydroxide (OH) <5.0 DLDS 5.0 mg/L 29-OCT-19 R4889818 Carbonate (CO <sub>3</sub> ) <5.0 DLDS 5.0 mg/L 29-OCT-19 R4889818 Alkalinity, Total (as CaCO <sub>3</sub> ) 480 DLDS 5.0 mg/L 29-OCT-19 R4889818 <b>Dissolved Metals in Water by CRC ICPMS</b> Dissolved Metals Filtration Location FIELD Calcium (Ca)-Dissolved 502 DLDS 0.25 mg/L 30-OCT-19 R4889919 Iron (Fe)-Dissolved 0.061 DLDS 0.050 mg/L 31-OCT-19 R4895289 Magnesium (Mg)-Dissolved 414 DLDS 0.025 mg/L 31-OCT-19 R4895289 Manganese (Mn)-Dissolved 0.769 DLDS 0.00050 mg/L 31-OCT-19 R4895289 Potassium (K)-Dissolved 23.8 DLDS 0.25 mg/L 31-OCT-19 R4895289 Sodium (Na)-Dissolved 492 DLDS 0.25 mg/L 31-OCT-19 R4895289							
L2372762-4 17-05 Sampled By: KSF on 25-OCT-19 @ 13:20 Matrix: WATER <b>BTEX, F1-F4 and SK Reg. PHC's</b> <b>BTEX and F1 (C6-C10)</b> Benzene <0.00050 0.00050 mg/L 31-OCT-19 01-NOV-19 R4895906 Toluene <0.00050 0.00050 mg/L 31-OCT-19 01-NOV-19 R4895906 EthylBenzene <0.00050 0.00050 mg/L 31-OCT-19 01-NOV-19 R4895906 Xylenes <0.0020 0.0020 mg/L 31-OCT-19 01-NOV-19 R4895906 o-Xylene <0.00050 0.00050 mg/L 31-OCT-19 01-NOV-19 R4895906 m+p-Xylene <0.0010 0.0010 mg/L 31-OCT-19 01-NOV-19 R4895906 F1(C6-C10) <0.10 0.10 mg/L 31-OCT-19 01-NOV-19 R4895906 F1-BTEX <0.10 0.10 mg/L 31-OCT-19 01-NOV-19 R4895906							

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

# ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2372762-4	17-05							
Sampled By:	KSF on 25-OCT-19 @ 13:20							
Matrix:	WATER							
<b>BTEX and F1 (C6-C10)</b>								
Surrogate: 1,4-Difluorobenzene		102.3		70-130	%	31-OCT-19	01-NOV-19	R4895906
Surrogate: 4-Bromofluorobenzene		117.1		70-130	%	31-OCT-19	01-NOV-19	R4895906
Surrogate: 3,4-Dichlorotoluene		98.9		70-130	%	31-OCT-19	01-NOV-19	R4895906
<b>CCME Total Hydrocarbons</b>								
Total Hydrocarbons (C6-C50)		<1.0		1.0	mg/L		02-NOV-19	
<b>Extractable Hydrocarbons by GC-FID</b>								
F2 (C10-C16)		<0.10		0.10	mg/L	01-NOV-19	02-NOV-19	R4896446
F3 (C16-C34)		<0.25		0.25	mg/L	01-NOV-19	02-NOV-19	R4896446
F4 (C34-C50)		<0.25		0.25	mg/L	01-NOV-19	02-NOV-19	R4896446
TEH (C11-C22)		<0.30		0.30	mg/L	01-NOV-19	02-NOV-19	R4896446
TEH (C23-C60)		<0.50		0.50	mg/L	01-NOV-19	02-NOV-19	R4896446
Surrogate: 2-Bromobenzotrifluoride		81.8		60-140	%	01-NOV-19	02-NOV-19	R4896446
L2372762-5	17-04							
Sampled By:	KSF on 25-OCT-19 @ 14:40							
Matrix:	WATER							
<b>BTEX, F1-F4 and SK Reg. PHC's</b>								
<b>BTEX and F1 (C6-C10)</b>								
Benzene		0.00484		0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906
Toluene		<0.00050		0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906
EthylBenzene		<0.00050		0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906
Xylenes		<0.0020		0.0020	mg/L	31-OCT-19	01-NOV-19	R4895906
o-Xylene		<0.00050		0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906
m+p-Xylene		<0.0010		0.0010	mg/L	31-OCT-19	01-NOV-19	R4895906
F1(C6-C10)		<0.10		0.10	mg/L	31-OCT-19	01-NOV-19	R4895906
F1-BTEX		<0.10		0.10	mg/L	31-OCT-19	01-NOV-19	R4895906
Surrogate: 1,4-Difluorobenzene		101.8		70-130	%	31-OCT-19	01-NOV-19	R4895906
Surrogate: 4-Bromofluorobenzene		113.1		70-130	%	31-OCT-19	01-NOV-19	R4895906
Surrogate: 3,4-Dichlorotoluene		85.6		70-130	%	31-OCT-19	01-NOV-19	R4895906
<b>CCME Total Hydrocarbons</b>								
Total Hydrocarbons (C6-C50)		<1.0		1.0	mg/L		02-NOV-19	
<b>Extractable Hydrocarbons by GC-FID</b>								
F2 (C10-C16)		<0.10		0.10	mg/L	01-NOV-19	02-NOV-19	R4896446
F3 (C16-C34)		<0.25		0.25	mg/L	01-NOV-19	02-NOV-19	R4896446
F4 (C34-C50)		<0.25		0.25	mg/L	01-NOV-19	02-NOV-19	R4896446
TEH (C11-C22)		<0.30		0.30	mg/L	01-NOV-19	02-NOV-19	R4896446
TEH (C23-C60)		<0.50		0.50	mg/L	01-NOV-19	02-NOV-19	R4896446
Surrogate: 2-Bromobenzotrifluoride		84.8		60-140	%	01-NOV-19	02-NOV-19	R4896446
<b>Single Metal in Water by ICPMS (Total)</b>								
<b>Total Metals in Water by CRC ICPMS</b>								
Iron (Fe)-Total		3.68	DLDS	0.050	mg/L		31-OCT-19	R4895046
<b>Miscellaneous Parameters</b>								
Acidity (as CaCO <sub>3</sub> )		95.9		5.0	mg/L		31-OCT-19	R4895888
Ammonia, Total (as N)		<0.050		0.050	mg/L		01-NOV-19	R4893727
Chemical Oxygen Demand		204		10	mg/L	31-OCT-19	31-OCT-19	R4891155
Chloride (Cl)		500	DLDS	2.0	mg/L		29-OCT-19	R4895975
Conductivity		6010		5.0	uS/cm		29-OCT-19	R4889818
Orthophosphate-Dissolved (as P)		<0.50	DLM	0.50	mg/L	29-OCT-19	29-OCT-19	R4890369
Nitrate (as N)		7.10	DLDS	0.40	mg/L		29-OCT-19	R4895975
Nitrite (as N)		0.29	DLDS	0.20	mg/L		29-OCT-19	R4895975
SAR		4.82		0.10	SAR		01-NOV-19	

\* Refer to Referenced Information for Qualifiers (if any) and Methodology

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2372762-5	17-04							
Sampled By:	KSF on 25-OCT-19 @ 14:40							
Matrix:	WATER							
Sulfate (SO4)		2770	DLDS	6.0	mg/L		29-OCT-19	R4895975
TDS (Calculated from EC)		3910		1.0	mg/L		30-OCT-19	
Total Dissolved Solids		5210		80	mg/L		29-OCT-19	R4890264
Total Inorganic Carbon		125	DLHC	5.0	mg/L		31-OCT-19	R4895301
Total Organic Carbon		66.0		1.0	mg/L		31-OCT-19	R4895367
Phosphorus (P)-Total		0.0527		0.0050	mg/L		30-OCT-19	R4890071
pH		7.60		0.10	pH		29-OCT-19	R4889818
<b>Alkalinity by Auto. Titration</b>								
Bicarbonate (HCO3)		825.		6.1	mg/L		29-OCT-19	R4889818
Hydroxide (OH)		<5.0		5.0	mg/L		29-OCT-19	R4889818
Carbonate (CO3)		<5.0		5.0	mg/L		29-OCT-19	R4889818
Alkalinity, Total (as CaCO3)		676		5.0	mg/L		29-OCT-19	R4889818
<b>Dissolved Metals in Water by CRC ICPMS</b>								
Dissolved Metals Filtration Location		FIELD					30-OCT-19	R4889919
Calcium (Ca)-Dissolved		498	DLDS	0.25	mg/L		31-OCT-19	R4895289
Iron (Fe)-Dissolved		0.098	DLDS	0.050	mg/L		31-OCT-19	R4895289
Magnesium (Mg)-Dissolved		337	DLDS	0.025	mg/L		31-OCT-19	R4895289
Manganese (Mn)-Dissolved		5.06	DLDS	0.00050	mg/L		31-OCT-19	R4895289
Potassium (K)-Dissolved		21.7	DLDS	0.25	mg/L		31-OCT-19	R4895289
Sodium (Na)-Dissolved		546	DLDS	0.25	mg/L		31-OCT-19	R4895289
L2372762-6	17-03							
Sampled By:	KSF on 25-OCT-19 @ 15:40							
Matrix:	WATER							
<b>BTEX, F1-F4 and SK Reg. PHC's</b>								
<b>BTEX and F1 (C6-C10)</b>								
Benzene		<0.00050		0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906
Toluene		<0.00050		0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906
EthylBenzene		<0.00050		0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906
Xylenes		<0.0020		0.0020	mg/L	31-OCT-19	01-NOV-19	R4895906
o-Xylene		<0.00050		0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906
m+p-Xylene		<0.0010		0.0010	mg/L	31-OCT-19	01-NOV-19	R4895906
F1(C6-C10)		<0.10		0.10	mg/L	31-OCT-19	01-NOV-19	R4895906
F1-BTEX		<0.10		0.10	mg/L	31-OCT-19	01-NOV-19	R4895906
Surrogate: 1,4-Difluorobenzene		101.4		70-130	%	31-OCT-19	01-NOV-19	R4895906
Surrogate: 4-Bromofluorobenzene		126.1		70-130	%	31-OCT-19	01-NOV-19	R4895906
Surrogate: 3,4-Dichlorotoluene		91.5		70-130	%	31-OCT-19	01-NOV-19	R4895906
<b>CCME Total Hydrocarbons</b>								
Total Hydrocarbons (C6-C50)		<1.0		1.0	mg/L		02-NOV-19	
<b>Extractable Hydrocarbons by GC-FID</b>								
F2 (C10-C16)		<0.10		0.10	mg/L	01-NOV-19	02-NOV-19	R4896446
F3 (C16-C34)		<0.25		0.25	mg/L	01-NOV-19	02-NOV-19	R4896446
F4 (C34-C50)		<0.25		0.25	mg/L	01-NOV-19	02-NOV-19	R4896446
TEH (C11-C22)		<0.30		0.30	mg/L	01-NOV-19	02-NOV-19	R4896446
TEH (C23-C60)		<0.50		0.50	mg/L	01-NOV-19	02-NOV-19	R4896446
Surrogate: 2-Bromobenzotrifluoride		71.6		60-140	%	01-NOV-19	02-NOV-19	R4896446
L2372762-7	17-02							
Sampled By:	KSF on 27-OCT-19 @ 12:55							
Matrix:	WATER							
<b>BTEX, F1-F4 and SK Reg. PHC's</b>								
<b>BTEX and F1 (C6-C10)</b>								

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2372762-7 17-02 Sampled By: KSF on 27-OCT-19 @ 12:55 Matrix: WATER <b>BTEX and F1 (C6-C10)</b> Benzene <0.00050 0.00050 mg/L 31-OCT-19 01-NOV-19 R4895906 Toluene <0.00050 0.00050 mg/L 31-OCT-19 01-NOV-19 R4895906 EthylBenzene <0.00050 0.00050 mg/L 31-OCT-19 01-NOV-19 R4895906 Xylenes <0.0020 0.0020 mg/L 31-OCT-19 01-NOV-19 R4895906 o-Xylene <0.00050 0.00050 mg/L 31-OCT-19 01-NOV-19 R4895906 m+p-Xylene <0.0010 0.0010 mg/L 31-OCT-19 01-NOV-19 R4895906 F1(C6-C10) <0.10 0.10 mg/L 31-OCT-19 01-NOV-19 R4895906 F1-BTEX <0.10 0.10 mg/L 31-OCT-19 01-NOV-19 R4895906 Surrogate: 1,4-Difluorobenzene 101.4 70-130 % 31-OCT-19 01-NOV-19 R4895906 Surrogate: 4-Bromofluorobenzene 123.0 70-130 % 31-OCT-19 01-NOV-19 R4895906 Surrogate: 3,4-Dichlorotoluene 89.5 70-130 % 31-OCT-19 01-NOV-19 R4895906 <b>CCME Total Hydrocarbons</b> Total Hydrocarbons (C6-C50) <1.0 1.0 mg/L 02-NOV-19 <b>Extractable Hydrocarbons by GC-FID</b> F2 (C10-C16) <0.10 0.10 mg/L 01-NOV-19 02-NOV-19 R4896446 F3 (C16-C34) <0.25 0.25 mg/L 01-NOV-19 02-NOV-19 R4896446 F4 (C34-C50) <0.25 0.25 mg/L 01-NOV-19 02-NOV-19 R4896446 TEH (C11-C22) <0.30 0.30 mg/L 01-NOV-19 02-NOV-19 R4896446 TEH (C23-C60) <0.50 0.50 mg/L 01-NOV-19 02-NOV-19 R4896446 Surrogate: 2-Bromobenzotrifluoride 81.8 60-140 % 01-NOV-19 02-NOV-19 R4896446							
L2372762-8 09-04 Sampled By: KSF on 25-OCT-19 @ 10:05 Matrix: WATER <b>BTEX, F1-F4 and SK Reg. PHC's</b> <b>BTEX and F1 (C6-C10)</b> Benzene <0.00050 0.00050 mg/L 31-OCT-19 01-NOV-19 R4895906 Toluene <0.00050 0.00050 mg/L 31-OCT-19 01-NOV-19 R4895906 EthylBenzene <0.00050 0.00050 mg/L 31-OCT-19 01-NOV-19 R4895906 Xylenes <0.0020 0.0020 mg/L 31-OCT-19 01-NOV-19 R4895906 o-Xylene <0.00050 0.00050 mg/L 31-OCT-19 01-NOV-19 R4895906 m+p-Xylene <0.0010 0.0010 mg/L 31-OCT-19 01-NOV-19 R4895906 F1(C6-C10) <0.10 0.10 mg/L 31-OCT-19 01-NOV-19 R4895906 F1-BTEX <0.10 0.10 mg/L 31-OCT-19 01-NOV-19 R4895906 Surrogate: 1,4-Difluorobenzene 102.7 70-130 % 31-OCT-19 01-NOV-19 R4895906 Surrogate: 4-Bromofluorobenzene 118.5 70-130 % 31-OCT-19 01-NOV-19 R4895906 Surrogate: 3,4-Dichlorotoluene 93.9 70-130 % 31-OCT-19 01-NOV-19 R4895906 <b>CCME Total Hydrocarbons</b> Total Hydrocarbons (C6-C50) <1.0 1.0 mg/L 02-NOV-19 <b>Extractable Hydrocarbons by GC-FID</b> F2 (C10-C16) <0.10 0.10 mg/L 01-NOV-19 02-NOV-19 R4896446 F3 (C16-C34) <0.25 0.25 mg/L 01-NOV-19 02-NOV-19 R4896446 F4 (C34-C50) <0.25 0.25 mg/L 01-NOV-19 02-NOV-19 R4896446 TEH (C11-C22) <0.30 0.30 mg/L 01-NOV-19 02-NOV-19 R4896446 TEH (C23-C60) <0.50 0.50 mg/L 01-NOV-19 02-NOV-19 R4896446 Surrogate: 2-Bromobenzotrifluoride 72.8 60-140 % 01-NOV-19 02-NOV-19 R4896446 <b>Single Metal in Water by ICPMS (Total)</b> <b>Total Metals in Water by CRC ICPMS</b> Iron (Fe)-Total 4.21 DLDS 0.050 mg/L 31-OCT-19 R4895046 <b>Miscellaneous Parameters</b> Acidity (as CaCO <sub>3</sub> ) 47.4 5.0 mg/L 31-OCT-19 R4895888							

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2372762-8	09-04							
Sampled By:	KSF on 25-OCT-19 @ 10:05							
Matrix:	WATER							
Ammonia, Total (as N)	<0.050			0.050	mg/L		01-NOV-19	R4893727
Chemical Oxygen Demand	135			10	mg/L	31-OCT-19	31-OCT-19	R4891155
Chloride (Cl)	298		DLDS	2.0	mg/L		29-OCT-19	R4895975
Conductivity	5890			5.0	µS/cm		29-OCT-19	R4889818
Orthophosphate-Dissolved (as P)	<0.50		DLM	0.50	mg/L	29-OCT-19	29-OCT-19	R4890369
Nitrate (as N)	36.9		DLDS	0.40	mg/L		29-OCT-19	R4895975
Nitrite (as N)	<0.20		DLDS	0.20	mg/L		29-OCT-19	R4895975
SAR	4.79			0.10	SAR		01-NOV-19	
Sulfate (SO <sub>4</sub> )	3230		DLDS	6.0	mg/L		29-OCT-19	R4895975
TDS (Calculated from EC)	3830			1.0	mg/L		30-OCT-19	
Total Dissolved Solids	5330			80	mg/L		29-OCT-19	R4890264
Total Inorganic Carbon	77.6		DLHC	5.0	mg/L		31-OCT-19	R4895301
Total Organic Carbon	47.3			1.0	mg/L		31-OCT-19	R4895367
Phosphorus (P)-Total	0.0823			0.0050	mg/L		30-OCT-19	R4890071
pH	7.68			0.10	pH		29-OCT-19	R4889818
<b>Alkalinity by Auto. Titration</b>								
Bicarbonate (HCO <sub>3</sub> )	474.			6.1	mg/L		29-OCT-19	R4889818
Hydroxide (OH)	<5.0			5.0	mg/L		29-OCT-19	R4889818
Carbonate (CO <sub>3</sub> )	<5.0			5.0	mg/L		29-OCT-19	R4889818
Alkalinity, Total (as CaCO <sub>3</sub> )	389			5.0	mg/L		29-OCT-19	R4889818
<b>Dissolved Metals in Water by CRC ICPMS</b>								
Dissolved Metals Filtration Location	FIELD						30-OCT-19	R4889919
Calcium (Ca)-Dissolved	446		DLDS	0.25	mg/L		31-OCT-19	R4895289
Iron (Fe)-Dissolved	<0.050		DLDS	0.050	mg/L		31-OCT-19	R4895289
Magnesium (Mg)-Dissolved	357		DLDS	0.025	mg/L		31-OCT-19	R4895289
Manganese (Mn)-Dissolved	0.509		DLDS	0.00050	mg/L		31-OCT-19	R4895289
Potassium (K)-Dissolved	25.4		DLDS	0.25	mg/L		31-OCT-19	R4895289
Sodium (Na)-Dissolved	538		DLDS	0.25	mg/L		31-OCT-19	R4895289
L2372762-9	08-04							
Sampled By:	KSF on 26-OCT-19 @ 12:20							
Matrix:	WATER							
<b>BTEX, F1-F4 and SK Reg. PHC's</b>								
<b>BTEX and F1 (C6-C10)</b>								
Benzene	0.0692			0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906
Toluene	0.00079			0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906
EthylBenzene	<0.00050			0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906
Xylenes	<0.0020			0.0020	mg/L	31-OCT-19	01-NOV-19	R4895906
o-Xylene	<0.00050			0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906
m+p-Xylene	0.0011			0.0010	mg/L	31-OCT-19	01-NOV-19	R4895906
F1(C6-C10)	0.60			0.10	mg/L	31-OCT-19	01-NOV-19	R4895906
F1-BTEX	0.53			0.10	mg/L	31-OCT-19	01-NOV-19	R4895906
Surrogate: 1,4-Difluorobenzene	88.7			70-130	%	31-OCT-19	01-NOV-19	R4895906
Surrogate: 4-Bromofluorobenzene	117.2			70-130	%	31-OCT-19	01-NOV-19	R4895906
Surrogate: 3,4-Dichlorotoluene	79.2			70-130	%	31-OCT-19	01-NOV-19	R4895906
<b>CCME Total Hydrocarbons</b>								
Total Hydrocarbons (C6-C50)	<1.0			1.0	mg/L		02-NOV-19	
<b>Extractable Hydrocarbons by GC-FID</b>								
F2 (C10-C16)	<0.10			0.10	mg/L	01-NOV-19	02-NOV-19	R4896446
F3 (C16-C34)	<0.25			0.25	mg/L	01-NOV-19	02-NOV-19	R4896446
F4 (C34-C50)	<0.25			0.25	mg/L	01-NOV-19	02-NOV-19	R4896446
TEH (C11-C22)	<0.30			0.30	mg/L	01-NOV-19	02-NOV-19	R4896446

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2372762-9 08-04							
Sampled By: KSF on 26-OCT-19 @ 12:20							
Matrix: WATER							
<b>Extractable Hydrocarbons by GC-FID</b>							
TEH (C23-C60)	<0.50		0.50	mg/L	01-NOV-19	02-NOV-19	R4896446
Surrogate: 2-Bromobenzotrifluoride	81.0		60-140	%	01-NOV-19	02-NOV-19	R4896446
<b>Single Metal in Water by ICPMS (Total)</b>							
<b>Total Metals in Water by CRC ICPMS</b>							
Iron (Fe)-Total	3.51	DLDS	0.050	mg/L		31-OCT-19	R4895046
<b>Miscellaneous Parameters</b>							
Acidity (as CaCO <sub>3</sub> )	192		5.0	mg/L		31-OCT-19	R4895888
Ammonia, Total (as N)	0.31	DLHC	0.25	mg/L		31-OCT-19	R4893727
Chemical Oxygen Demand	196		10	mg/L	31-OCT-19	31-OCT-19	R4891155
Chloride (Cl)	213	DLDS	2.0	mg/L		29-OCT-19	R4895975
Conductivity	6220		5.0	uS/cm		29-OCT-19	R4889818
Orthophosphate-Dissolved (as P)	<0.50	DLM	0.50	mg/L	29-OCT-19	29-OCT-19	R4890369
Nitrate (as N)	<0.40	DLDS	0.40	mg/L		29-OCT-19	R4895975
Nitrite (as N)	<0.20	DLDS	0.20	mg/L		29-OCT-19	R4895975
SAR	5.61		0.10	SAR		01-NOV-19	
Sulfate (SO <sub>4</sub> )	3330	DLDS	6.0	mg/L		29-OCT-19	R4895975
TDS (Calculated from EC)	4040		1.0	mg/L		30-OCT-19	
Total Dissolved Solids	5720		80	mg/L		29-OCT-19	R4890264
Total Inorganic Carbon	175	DLHC	5.0	mg/L		31-OCT-19	R4895301
Total Organic Carbon	42.1		1.0	mg/L		31-OCT-19	R4895367
Phosphorus (P)-Total	0.0542		0.0050	mg/L		30-OCT-19	R4890071
pH	7.47		0.10	pH		29-OCT-19	R4889818
<b>Alkalinity by Auto. Titration</b>							
Bicarbonate (HCO <sub>3</sub> )	1130		6.1	mg/L		29-OCT-19	R4889818
Hydroxide (OH)	<5.0		5.0	mg/L		29-OCT-19	R4889818
Carbonate (CO <sub>3</sub> )	<5.0		5.0	mg/L		29-OCT-19	R4889818
Alkalinity, Total (as CaCO <sub>3</sub> )	923		5.0	mg/L		29-OCT-19	R4889818
<b>Dissolved Metals in Water by CRC ICPMS</b>							
Dissolved Metals Filtration Location	FIELD					30-OCT-19	R4889919
Calcium (Ca)-Dissolved	461	DLDS	0.25	mg/L		31-OCT-19	R4895289
Iron (Fe)-Dissolved	2.82	DLDS	0.050	mg/L		31-OCT-19	R4895289
Magnesium (Mg)-Dissolved	384	DLDS	0.025	mg/L		31-OCT-19	R4895289
Manganese (Mn)-Dissolved	11.6	DLHC	0.0010	mg/L		31-OCT-19	R4895289
Potassium (K)-Dissolved	22.0	DLDS	0.25	mg/L		31-OCT-19	R4895289
Sodium (Na)-Dissolved	658	DLDS	0.25	mg/L		31-OCT-19	R4895289
L2372762-10 16-02							
Sampled By: KSF on 26-OCT-19 @ 11:15							
Matrix: WATER							
<b>BTEX, F1-F4 and SK Reg. PHC's</b>							
<b>BTEX and F1 (C6-C10)</b>							
Benzene	0.0182		0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906
Toluene	<0.00050		0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906
EthylBenzene	0.00082		0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906
Xylenes	<0.0020		0.0020	mg/L	31-OCT-19	01-NOV-19	R4895906
o-Xylene	<0.00050		0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906
m+p-Xylene	<0.0010		0.0010	mg/L	31-OCT-19	01-NOV-19	R4895906
F1(C6-C10)	0.49		0.10	mg/L	31-OCT-19	01-NOV-19	R4895906
F1-BTEX	0.47		0.10	mg/L	31-OCT-19	01-NOV-19	R4895906
Surrogate: 1,4-Difluorobenzene	95.0		70-130	%	31-OCT-19	01-NOV-19	R4895906
Surrogate: 4-Bromofluorobenzene	116.1		70-130	%	31-OCT-19	01-NOV-19	R4895906

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2372762-10	16-02							
Sampled By:	KSF on 26-OCT-19 @ 11:15							
Matrix:	WATER							
<b>BTEX and F1 (C6-C10)</b>								
Surrogate: 3,4-Dichlorotoluene	78.8			70-130	%	31-OCT-19	01-NOV-19	R4895906
<b>CCME Total Hydrocarbons</b>								
Total Hydrocarbons (C6-C50)	<1.0			1.0	mg/L		02-NOV-19	
<b>Extractable Hydrocarbons by GC-FID</b>								
F2 (C10-C16)	0.33			0.10	mg/L	01-NOV-19	02-NOV-19	R4896446
F3 (C16-C34)	<0.25			0.25	mg/L	01-NOV-19	02-NOV-19	R4896446
F4 (C34-C50)	<0.25			0.25	mg/L	01-NOV-19	02-NOV-19	R4896446
TEH (C11-C22)	0.34			0.30	mg/L	01-NOV-19	02-NOV-19	R4896446
TEH (C23-C60)	<0.50			0.50	mg/L	01-NOV-19	02-NOV-19	R4896446
Surrogate: 2-Bromobenzotrifluoride	78.6			60-140	%	01-NOV-19	02-NOV-19	R4896446
<b>Single Metal in Water by ICPMS (Total)</b>								
<b>Total Metals in Water by CRC ICPMS</b>								
Iron (Fe)-Total	5.55	DLDS	0.050		mg/L		31-OCT-19	R4895046
<b>Miscellaneous Parameters</b>								
Acidity (as CaCO <sub>3</sub> )	232			5.0	mg/L		31-OCT-19	R4895888
Ammonia, Total (as N)	0.79	DLHC	0.25		mg/L		31-OCT-19	R4893727
Chemical Oxygen Demand	230			10	mg/L	31-OCT-19	31-OCT-19	R4891155
Chloride (Cl)	236	DLDS	5.0		mg/L		29-OCT-19	R4895975
Conductivity	6910			5.0	uS/cm		29-OCT-19	R4889818
Orthophosphate-Dissolved (as P)	<0.50	DLM	0.50		mg/L	29-OCT-19	29-OCT-19	R4890369
Nitrate (as N)	<1.0	DLDS	1.0		mg/L		29-OCT-19	R4895975
Nitrite (as N)	<0.50	DLDS	0.50		mg/L		29-OCT-19	R4895975
SAR	6.70			0.10	SAR		01-NOV-19	
Sulfate (SO <sub>4</sub> )	3830	DLDS	15		mg/L		29-OCT-19	R4895975
TDS (Calculated from EC)	4490			1.0	mg/L		30-OCT-19	
Total Dissolved Solids	6490			80	mg/L		29-OCT-19	R4890264
Total Inorganic Carbon	169	DLHC	5.0		mg/L		31-OCT-19	R4895301
Total Organic Carbon	58.0			1.0	mg/L		31-OCT-19	R4895367
Phosphorus (P)-Total	0.0518			0.0050	mg/L		30-OCT-19	R4890071
pH	7.30			0.10	pH		29-OCT-19	R4889818
<b>Alkalinity by Auto. Titration</b>								
Bicarbonate (HCO <sub>3</sub> )	1070			6.1	mg/L		29-OCT-19	R4889818
Hydroxide (OH)	<5.0			5.0	mg/L		29-OCT-19	R4889818
Carbonate (CO <sub>3</sub> )	<5.0			5.0	mg/L		29-OCT-19	R4889818
Alkalinity, Total (as CaCO <sub>3</sub> )	875			5.0	mg/L		29-OCT-19	R4889818
<b>Dissolved Metals in Water by CRC ICPMS</b>								
Dissolved Metals Filtration Location	FIELD						30-OCT-19	R4889919
Calcium (Ca)-Dissolved	465	DLDS	0.25		mg/L		31-OCT-19	R4895289
Iron (Fe)-Dissolved	5.28	DLDS	0.050		mg/L		31-OCT-19	R4895289
Magnesium (Mg)-Dissolved	424	DLDS	0.025		mg/L		31-OCT-19	R4895289
Manganese (Mn)-Dissolved	16.7	DLHC	0.0020		mg/L		31-OCT-19	R4895289
Potassium (K)-Dissolved	23.3	DLDS	0.25		mg/L		31-OCT-19	R4895289
Sodium (Na)-Dissolved	797	DLDS	0.25		mg/L		31-OCT-19	R4895289
L2372762-11	08-06							
Sampled By:	KSF on 25-OCT-19 @ 16:40							
Matrix:	WATER							
<b>BTEX, F1-F4 and SK Reg. PHC's</b>								
<b>BTEX and F1 (C6-C10)</b>								
Benzene	<0.00050			0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906
Toluene	<0.00050			0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2372762-11 08-06 Sampled By: KSF on 25-OCT-19 @ 16:40 Matrix: WATER <b>BTEX and F1 (C6-C10)</b> EthylBenzene Xylenes o-Xylene m+p-Xylene F1(C6-C10) F1-BTEX Surrogate: 1,4-Difluorobenzene Surrogate: 4-Bromofluorobenzene Surrogate: 3,4-Dichlorotoluene <b>CCME Total Hydrocarbons</b> Total Hydrocarbons (C6-C50) <b>Extractable Hydrocarbons by GC-FID</b> F2 (C10-C16) F3 (C16-C34) F4 (C34-C50) TEH (C11-C22) TEH (C23-C60) Surrogate: 2-Bromobenzotrifluoride	<0.00050  100.8 120.8 85.5  <1.0  0.14 <0.25 <0.25 <0.30 <0.50 82.1	0.00050  0.0020 0.00050 0.0010 0.10 0.10 70-130 70-130 70-130  1.0  0.10 0.25 0.25 0.30 0.50 60-140	mg/L  mg/L mg/L mg/L mg/L mg/L % % %  mg/L  mg/L mg/L mg/L mg/L %  mg/L mg/L mg/L mg/L mg/L %	31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19  01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 02-NOV-19  01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 02-NOV-19  02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19	01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 02-NOV-19  02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19  R4895906 R4895906 R4895906 R4895906 R4895906 R4895906 R4895906  R4895906 R4895906 R4895906 R4895906 R4895906 R4895906  R4896446 R4896446 R4896446 R4896446 R4896446 R4896446		
L2372762-12 17-01 Sampled By: KSF on 26-OCT-19 @ 13:05 Matrix: WATER <b>BTEX, F1-F4 and SK Reg. PHC's</b> <b>BTEX and F1 (C6-C10)</b> Benzene Toluene EthylBenzene Xylenes o-Xylene m+p-Xylene F1(C6-C10) F1-BTEX Surrogate: 1,4-Difluorobenzene Surrogate: 4-Bromofluorobenzene Surrogate: 3,4-Dichlorotoluene <b>CCME Total Hydrocarbons</b> Total Hydrocarbons (C6-C50) <b>Extractable Hydrocarbons by GC-FID</b> F2 (C10-C16) F3 (C16-C34) F4 (C34-C50) TEH (C11-C22) TEH (C23-C60) Surrogate: 2-Bromobenzotrifluoride <b>Single Metal in Water by ICPMS (Total)</b> <b>Total Metals in Water by CRC ICPMS</b> Iron (Fe)-Total <b>Miscellaneous Parameters</b> Acidity (as CaCO <sub>3</sub> ) Ammonia, Total (as N) Chemical Oxygen Demand	0.250 0.00075 0.0250 0.0098 0.00139 0.0085 0.64 0.35 94.2 125.3 78.9 2.4 1.81 <0.25 <0.25 2.00 <0.50 81.2	0.00050  0.00050 0.00050 0.0020 0.00050 0.0010 0.10 0.10 70-130 70-130 70-130  1.0  0.10 0.25 0.25 0.30 0.50 60-140	mg/L  mg/L mg/L mg/L mg/L mg/L mg/L mg/L % % %  mg/L  mg/L mg/L mg/L mg/L %	31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19  01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 02-NOV-19  02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19  R4895906 R4895906 R4895906 R4895906 R4895906 R4895906 R4895906  R4895906 R4895906 R4895906 R4895906 R4895906 R4895906  R4896446 R4896446 R4896446 R4896446 R4896446 R4896446	01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 02-NOV-19  02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19  R4895046 R4895888 R4893727 R4891155		

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2372762-12	17-01							
Sampled By:	KSF on 26-OCT-19 @ 13:05							
Matrix:	WATER							
Chloride (Cl)	256	DLDS	2.0	mg/L		29-OCT-19	R4895975	
Conductivity	5910		5.0	uS/cm		29-OCT-19	R4889818	
Orthophosphate-Dissolved (as P)	<0.50	DLM	0.50	mg/L	29-OCT-19	29-OCT-19	R4890369	
Nitrate (as N)	<0.40	DLDS	0.40	mg/L		29-OCT-19	R4895975	
Nitrite (as N)	<0.20	DLDS	0.20	mg/L		29-OCT-19	R4895975	
SAR	4.35		0.10	SAR		01-NOV-19		
Sulfate (SO4)	2870	DLDS	6.0	mg/L		29-OCT-19	R4895975	
TDS (Calculated from EC)	3840		1.0	mg/L		30-OCT-19		
Total Dissolved Solids	5380		80	mg/L		29-OCT-19	R4890264	
Total Inorganic Carbon	200	DLHC	5.0	mg/L		31-OCT-19	R4895301	
Total Organic Carbon	88.8		1.0	mg/L		31-OCT-19	R4895367	
Phosphorus (P)-Total	0.271	DLHC	0.025	mg/L		30-OCT-19	R4890071	
pH	7.38		0.10	pH		29-OCT-19	R4889818	
<b>Alkalinity by Auto. Titration</b>								
Bicarbonate (HCO3)	1250		6.1	mg/L		29-OCT-19	R4889818	
Hydroxide (OH)	<5.0		5.0	mg/L		29-OCT-19	R4889818	
Carbonate (CO3)	<5.0		5.0	mg/L		29-OCT-19	R4889818	
Alkalinity, Total (as CaCO3)	1020		5.0	mg/L		29-OCT-19	R4889818	
<b>Dissolved Metals in Water by CRC ICPMS</b>								
Dissolved Metals Filtration Location		FIELD					30-OCT-19	R4889919
Calcium (Ca)-Dissolved	504	DLDS	0.25	mg/L		31-OCT-19	R4895289	
Iron (Fe)-Dissolved	37.9	DLDS	0.050	mg/L		31-OCT-19	R4895289	
Magnesium (Mg)-Dissolved	354	DLDS	0.025	mg/L		31-OCT-19	R4895289	
Manganese (Mn)-Dissolved	9.37	DLDS	0.00050	mg/L		31-OCT-19	R4895289	
Potassium (K)-Dissolved	22.8	DLDS	0.25	mg/L		31-OCT-19	R4895289	
Sodium (Na)-Dissolved	519	DLDS	0.25	mg/L		31-OCT-19	R4895289	
L2372762-13	08-11							
Sampled By:	KSF on 27-OCT-19 @ 11:30							
Matrix:	WATER							
<b>BTEX, F1-F4 and SK Reg. PHC's</b>								
<b>BTEX and F1 (C6-C10)</b>								
Benzene	<0.00050		0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906	
Toluene	<0.00050		0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906	
EthylBenzene	<0.00050		0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906	
Xylenes	<0.0020		0.0020	mg/L	31-OCT-19	01-NOV-19	R4895906	
o-Xylene	<0.00050		0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906	
m+p-Xylene	<0.0010		0.0010	mg/L	31-OCT-19	01-NOV-19	R4895906	
F1(C6-C10)	<0.10		0.10	mg/L	31-OCT-19	01-NOV-19	R4895906	
F1-BTEX	<0.10		0.10	mg/L	31-OCT-19	01-NOV-19	R4895906	
Surrogate: 1,4-Difluorobenzene	101.3		70-130	%	31-OCT-19	01-NOV-19	R4895906	
Surrogate: 4-Bromofluorobenzene	109.6		70-130	%	31-OCT-19	01-NOV-19	R4895906	
Surrogate: 3,4-Dichlorotoluene	96.2		70-130	%	31-OCT-19	01-NOV-19	R4895906	
<b>CCME Total Hydrocarbons</b>								
Total Hydrocarbons (C6-C50)	<1.0		1.0	mg/L			02-NOV-19	
<b>Extractable Hydrocarbons by GC-FID</b>								
F2 (C10-C16)	<0.10		0.10	mg/L	01-NOV-19	02-NOV-19	R4896446	
F3 (C16-C34)	<0.25		0.25	mg/L	01-NOV-19	02-NOV-19	R4896446	
F4 (C34-C50)	<0.25		0.25	mg/L	01-NOV-19	02-NOV-19	R4896446	
TEH (C11-C22)	<0.30		0.30	mg/L	01-NOV-19	02-NOV-19	R4896446	
TEH (C23-C60)	<0.50		0.50	mg/L	01-NOV-19	02-NOV-19	R4896446	
Surrogate: 2-Bromobenzotrifluoride	83.1		60-140	%	01-NOV-19	02-NOV-19	R4896446	

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2372762-13	08-11							
Sampled By:	KSF on 27-OCT-19 @ 11:30							
Matrix:	WATER							
L2372762-14	08-10							
Sampled By:	KSF on 27-OCT-19 @ 10:10							
Matrix:	WATER							
<b>BTEX, F1-F4 and SK Reg. PHC's</b>								
<b>BTEX and F1 (C6-C10)</b>								
Benzene	<0.00050	0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906		
Toluene	<0.00050	0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906		
EthylBenzene	<0.00050	0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906		
Xylenes	<0.0020	0.0020	mg/L	31-OCT-19	01-NOV-19	R4895906		
o-Xylene	<0.00050	0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906		
m+p-Xylene	<0.0010	0.0010	mg/L	31-OCT-19	01-NOV-19	R4895906		
F1(C6-C10)	<0.10	0.10	mg/L	31-OCT-19	01-NOV-19	R4895906		
F1-BTEX	<0.10	0.10	mg/L	31-OCT-19	01-NOV-19	R4895906		
Surrogate: 1,4-Difluorobenzene	100.9	70-130	%	31-OCT-19	01-NOV-19	R4895906		
Surrogate: 4-Bromofluorobenzene	112.8	70-130	%	31-OCT-19	01-NOV-19	R4895906		
Surrogate: 3,4-Dichlorotoluene	89.6	70-130	%	31-OCT-19	01-NOV-19	R4895906		
<b>CCME Total Hydrocarbons</b>								
Total Hydrocarbons (C6-C50)	<1.0	1.0	mg/L			02-NOV-19		
<b>Extractable Hydrocarbons by GC-FID</b>								
F2 (C10-C16)	<0.10	0.10	mg/L	01-NOV-19	02-NOV-19	R4896446		
F3 (C16-C34)	<0.25	0.25	mg/L	01-NOV-19	02-NOV-19	R4896446		
F4 (C34-C50)	<0.25	0.25	mg/L	01-NOV-19	02-NOV-19	R4896446		
TEH (C11-C22)	<0.30	0.30	mg/L	01-NOV-19	02-NOV-19	R4896446		
TEH (C23-C60)	<0.50	0.50	mg/L	01-NOV-19	02-NOV-19	R4896446		
Surrogate: 2-Bromobenzotrifluoride	83.9	60-140	%	01-NOV-19	02-NOV-19	R4896446		
<b>Single Metal in Water by ICPMS (Total)</b>								
<b>Total Metals in Water by CRC ICPMS</b>								
Iron (Fe)-Total	1.30	DLDS	0.050	mg/L		31-OCT-19	R4895046	
<b>Miscellaneous Parameters</b>								
Acidity (as CaCO <sub>3</sub> )	73.2		5.0	mg/L		31-OCT-19	R4895888	
Ammonia, Total (as N)	0.092		0.050	mg/L		01-NOV-19	R4893727	
Chemical Oxygen Demand	129		10	mg/L	31-OCT-19	31-OCT-19	R4891155	
Chloride (Cl)	28.6	DLDS	2.0	mg/L		29-OCT-19	R4895975	
Conductivity	6260		5.0	µS/cm		29-OCT-19	R4889818	
Orthophosphate-Dissolved (as P)	<0.50	DLM	0.50	mg/L	29-OCT-19	29-OCT-19	R4890369	
Nitrate (as N)	<0.40	DLDS	0.40	mg/L		29-OCT-19	R4895975	
Nitrite (as N)	<0.20	DLDS	0.20	mg/L		29-OCT-19	R4895975	
SAR	6.77		0.10	SAR		01-NOV-19		
Sulfate (SO <sub>4</sub> )	3830	DLDS	6.0	mg/L		29-OCT-19	R4895975	
TDS (Calculated from EC)	4070		1.0	mg/L		30-OCT-19		
Total Dissolved Solids	5740		80	mg/L		29-OCT-19	R4890264	
Total Inorganic Carbon	115	DLHC	5.0	mg/L		31-OCT-19	R4895301	
Total Organic Carbon	46.4		1.0	mg/L		31-OCT-19	R4895367	
Phosphorus (P)-Total	0.0194		0.0050	mg/L		30-OCT-19	R4890071	
pH	7.66		0.10	pH		29-OCT-19	R4889818	
<b>Alkalinity by Auto. Titration</b>								
Bicarbonate (HCO <sub>3</sub> )	708.		6.1	mg/L		29-OCT-19	R4889818	
Hydroxide (OH)	<5.0		5.0	mg/L		29-OCT-19	R4889818	
Carbonate (CO <sub>3</sub> )	<5.0		5.0	mg/L		29-OCT-19	R4889818	
Alkalinity, Total (as CaCO <sub>3</sub> )	581		5.0	mg/L		29-OCT-19	R4889818	

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2372762-14 08-10 Sampled By: KSF on 27-OCT-19 @ 10:10 Matrix: WATER <b>Dissolved Metals in Water by CRC ICPMS</b> Dissolved Metals Filtration Location Calcium (Ca)-Dissolved Iron (Fe)-Dissolved Magnesium (Mg)-Dissolved Manganese (Mn)-Dissolved Potassium (K)-Dissolved Sodium (Na)-Dissolved	FIELD 426 1.19 357 4.21 24.4 733	DLDS DLDS DLDS DLDS DLDS DLDS	0.25 0.050 0.025 0.00050 0.25 0.25	mg/L mg/L mg/L mg/L mg/L mg/L		30-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19	R4889919 R4895289 R4895289 R4895289 R4895289 R4895289
L2372762-15 16-05 Sampled By: KSF on 26-OCT-19 @ 15:20 Matrix: WATER <b>BTEX, F1-F4 and SK Reg. PHC's</b> <b>BTEX and F1 (C6-C10)</b> Benzene Toluene EthylBenzene Xylenes o-Xylene m+p-Xylene F1(C6-C10) F1-BTEX Surrogate: 1,4-Difluorobenzene Surrogate: 4-Bromofluorobenzene Surrogate: 3,4-Dichlorotoluene <b>CCME Total Hydrocarbons</b> Total Hydrocarbons (C6-C50) <b>Extractable Hydrocarbons by GC-FID</b> F2 (C10-C16) F3 (C16-C34) F4 (C34-C50) TEH (C11-C22) TEH (C23-C60) Surrogate: 2-Bromobenzotrifluoride	<0.00050 <0.00050 <0.00050 <0.0020 <0.00050 <0.0010 <0.10 <0.10 101.0 122.5 87.2 <1.0 <0.10 <0.25 <0.25 <0.30 <0.50 84.2		0.00050 0.00050 0.00050 0.0020 0.00050 0.0010 0.10 0.10 70-130 70-130 70-130 1.0 mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L %	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L % % % mg/L mg/L mg/L mg/L mg/L mg/L %	31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 01-NOV-19	01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 R4895906	
<b>Single Metal in Water by ICPMS (Total)</b> <b>Total Metals in Water by CRC ICPMS</b> Iron (Fe)-Total <b>Miscellaneous Parameters</b> Acidity (as CaCO <sub>3</sub> ) Ammonia, Total (as N) Chemical Oxygen Demand Chloride (Cl) Conductivity Orthophosphate-Dissolved (as P) Nitrate (as N) Nitrite (as N) SAR Sulfate (SO <sub>4</sub> ) TDS (Calculated from EC) Total Dissolved Solids Total Inorganic Carbon Total Organic Carbon	0.815 69.8 0.051 83 52.0 5530 <0.50 <0.40 <0.20 4.44 3320 3590 5250 123 26.3	DLDS DLDS DLDS DLDS DLDS DLDS DLM DLDS DLDS SAR DLDS DLDS DLHC	0.050 5.0 0.050 10 2.0 5.0 0.50 0.40 0.20 0.10 6.0 1.0 80 5.0 1.0	mg/L mg/L mg/L mg/L mg/L uS/cm mg/L mg/L mg/L SAR mg/L mg/L mg/L mg/L mg/L		31-OCT-19 31-OCT-19 01-NOV-19 31-OCT-19 29-OCT-19 29-OCT-19 29-OCT-19 29-OCT-19 29-OCT-19 01-NOV-19 29-OCT-19 30-OCT-19 29-OCT-19 31-OCT-19 31-OCT-19	R4895046 R4895888 R4893727 R4891155 R4895975 R4889818 R4890369 R4895975 R4895975 R4895975 R4895975 R4895975 R4890264 R4895301 R4895367

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2372762-15 16-05 Sampled By: KSF on 26-OCT-19 @ 15:20 Matrix: WATER <b>Phosphorus (P)-Total</b> pH <b>Alkalinity by Auto. Titration</b> Bicarbonate (HCO3) Hydroxide (OH) Carbonate (CO3) Alkalinity, Total (as CaCO3) <b>Dissolved Metals in Water by CRC ICPMS</b> Dissolved Metals Filtration Location Calcium (Ca)-Dissolved Iron (Fe)-Dissolved Magnesium (Mg)-Dissolved Manganese (Mn)-Dissolved Potassium (K)-Dissolved Sodium (Na)-Dissolved	0.0114 7.68 789. <5.0 <5.0 647 FIELD 438 0.160 358 3.39 25.0 506		0.0050 0.10 6.1 5.0 5.0 5.0 DLDS 0.25 0.050 0.025 0.00050 0.25 0.25	mg/L pH mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L		30-OCT-19 29-OCT-19 29-OCT-19 29-OCT-19 29-OCT-19 29-OCT-19 30-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19	R4890071 R4889818 R4889818 R4889818 R4889818 R4889818 R4889919 R4895289 R4895289 R4895289 R4895289 R4895289 R4895289
L2372762-16 16-06 Sampled By: KSF on 26-OCT-19 @ 14:20 Matrix: WATER <b>BTEX, F1-F4 and SK Reg. PHC's</b> <b>BTEX and F1 (C6-C10)</b> Benzene Toluene EthylBenzene Xylenes o-Xylene m+p-Xylene F1(C6-C10) F1-BTEX Surrogate: 1,4-Difluorobenzene Surrogate: 4-Bromofluorobenzene Surrogate: 3,4-Dichlorotoluene <b>CCME Total Hydrocarbons</b> Total Hydrocarbons (C6-C50) <b>Extractable Hydrocarbons by GC-FID</b> F2 (C10-C16) F3 (C16-C34) F4 (C34-C50) TEH (C11-C22) TEH (C23-C60) Surrogate: 2-Bromobenzotrifluoride <b>Single Metal in Water by ICPMS (Total)</b> <b>Total Metals in Water by CRC ICPMS</b> Iron (Fe)-Total <b>Miscellaneous Parameters</b> Acidity (as CaCO3) Ammonia, Total (as N) Chemical Oxygen Demand Chloride (Cl) Conductivity Orthophosphate-Dissolved (as P) Nitrate (as N)	1.43 0.00259 <0.00050 0.0057 0.00295 0.0027 2.0 <1.0 102.7 123.1 92.3 2.0 <0.10 <0.25 <0.25 <0.30 <0.50 81.4	DLHC DLHC	0.0050 0.00050 0.00050 0.0020 0.00050 0.0010 1.0 1.0 70-130 70-130 70-130 1.1 0.10 0.25 0.25 0.30 0.50 60-140	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L % % % mg/L 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19	31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19 02-NOV-19	R4895906 R4895906 R4895906 R4895906 R4895906 R4895906 R4895906 R4895906 R4895906 R4895906 R4895906 R4895906 R4895906 R4895906 R4895906 R4895906 R4895906 R4896446 R4896446 R4896446 R4896446 R4896446 R4896446 R4896446 R4896446 R4896446 R4896446 R4896446 R4896446 R4896446 R4896446 R4896446 R4896446	

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2372762-16 16-06 Sampled By: KSF on 26-OCT-19 @ 14:20 Matrix: WATER  Nitrite (as N) SAR Sulfate (SO4) TDS (Calculated from EC) Total Dissolved Solids Total Inorganic Carbon Total Organic Carbon Phosphorus (P)-Total pH <b>Alkalinity by Auto. Titration</b> Bicarbonate (HCO3) Hydroxide (OH) Carbonate (CO3) Alkalinity, Total (as CaCO3) <b>Dissolved Metals in Water by CRC ICPMS</b> Dissolved Metals Filtration Location Calcium (Ca)-Dissolved Iron (Fe)-Dissolved Magnesium (Mg)-Dissolved Manganese (Mn)-Dissolved Potassium (K)-Dissolved Sodium (Na)-Dissolved	<0.50 4.85 3360 4240 5560 169 121 0.0471 7.54 1120 <5.0 <5.0 919	DLDS DLDS DLDS DLHC DLHC DLHC FIELD	0.50 0.10 15 1.0 80 5.0 10 0.0050 0.10 6.1 5.0 5.0 5.0	mg/L SAR mg/L mg/L mg/L mg/L mg/L mg/L pH mg/L mg/L mg/L mg/L		29-OCT-19 01-NOV-19 29-OCT-19 30-OCT-19 29-OCT-19 31-OCT-19 31-OCT-19 30-OCT-19 29-OCT-19 29-OCT-19 29-OCT-19 29-OCT-19 29-OCT-19	R4895975 R4895975 R4890264 R4895301 R4895367 R4890071 R4889818 R4889818 R4889818 R4889818 R4889818 R4889818 R4889818 R4889818
L2372762-17 16-04 Sampled By: KSF on 26-OCT-19 @ 09:30 Matrix: WATER  <b>BTEX, F1-F4 and SK Reg. PHC's</b> <b>BTEX and F1 (C6-C10)</b> Benzene Toluene EthylBenzene Xylenes o-Xylene m+p-Xylene F1(C6-C10) F1-BTEX Surrogate: 1,4-Difluorobenzene Surrogate: 4-Bromofluorobenzene Surrogate: 3,4-Dichlorotoluene <b>CCME Total Hydrocarbons</b> Total Hydrocarbons (C6-C50) <b>Extractable Hydrocarbons by GC-FID</b> F2 (C10-C16) F3 (C16-C34) F4 (C34-C50) TEH (C11-C22) TEH (C23-C60) Surrogate: 2-Bromobenzotrifluoride <b>Single Metal in Water by ICPMS (Total)</b> <b>Total Metals in Water by CRC ICPMS</b> Iron (Fe)-Total <b>Miscellaneous Parameters</b>	<0.00050 <0.00050 <0.00050 <0.0020 <0.00050 <0.0010 <0.10 <0.10 101.3 112.0 83.9 <1.0 <0.10 <0.25 <0.25 <0.30 <0.50 81.4		0.00050 0.00050 0.00050 0.0020 0.00050 0.0010 0.10 0.10 70-130 70-130 70-130 1.0 0.10 0.25 0.25 0.30 0.50 60-140	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L % % % mg/L mg/L mg/L mg/L mg/L %	31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 31-OCT-19 02-NOV-19 01-NOV-19 02-NOV-19 02-NOV-19 01-NOV-19 02-NOV-19 02-NOV-19	01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 01-NOV-19 R4895906 R4895906 R4895906 R4895906 R4895906 R4895906 R4895906 R4895906 R4895906 R4895906 R4895906 R4895906 R4896446 R4896446 R4896446 R4896446 R4896446 R4896446 R4896446	
	1.15	DLDS	0.050	mg/L		31-OCT-19	R4895046

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2372762-17 16-04							
Sampled By: KSF on 26-OCT-19 @ 09:30							
Matrix: WATER							
Acidity (as CaCO <sub>3</sub> )	133		5.0	mg/L		31-OCT-19	R4895888
Ammonia, Total (as N)	<0.050		0.050	mg/L		01-NOV-19	R4893727
Chemical Oxygen Demand	165		10	mg/L	31-OCT-19	31-OCT-19	R4891155
Chloride (Cl)	276	DLDS	5.0	mg/L		29-OCT-19	R4895975
Conductivity	6470		5.0	µS/cm		29-OCT-19	R4889818
Orthophosphate-Dissolved (as P)	<0.50	DLM	0.50	mg/L	29-OCT-19	29-OCT-19	R4890369
Nitrate (as N)	<1.0	DLDS	1.0	mg/L		29-OCT-19	R4895975
Nitrite (as N)	<0.50	DLDS	0.50	mg/L		29-OCT-19	R4895975
SAR	5.30		0.10	SAR		01-NOV-19	
Sulfate (SO <sub>4</sub> )	3420	DLDS	15	mg/L		29-OCT-19	R4895975
TDS (Calculated from EC)	4210		1.0	mg/L		30-OCT-19	
Total Dissolved Solids	5780		80	mg/L		29-OCT-19	R4890264
Total Inorganic Carbon	171	DLHC	5.0	mg/L		31-OCT-19	R4895301
Total Organic Carbon	58	DLM	10	mg/L		31-OCT-19	R4895367
Phosphorus (P)-Total	0.0260		0.0050	mg/L		30-OCT-19	R4890071
pH	7.56		0.10	pH		29-OCT-19	R4889818
<b>Alkalinity by Auto. Titration</b>							
Bicarbonate (HCO <sub>3</sub> )	1100		6.1	mg/L		29-OCT-19	R4889818
Hydroxide (OH)	<5.0		5.0	mg/L		29-OCT-19	R4889818
Carbonate (CO <sub>3</sub> )	<5.0		5.0	mg/L		29-OCT-19	R4889818
Alkalinity, Total (as CaCO <sub>3</sub> )	904		5.0	mg/L		29-OCT-19	R4889818
<b>Dissolved Metals in Water by CRC ICPMS</b>							
Dissolved Metals Filtration Location	FIELD					30-OCT-19	R4889919
Calcium (Ca)-Dissolved	480	DLDS	0.25	mg/L		31-OCT-19	R4895289
Iron (Fe)-Dissolved	<0.050	DLDS	0.050	mg/L		31-OCT-19	R4895289
Magnesium (Mg)-Dissolved	410	DLDS	0.025	mg/L		31-OCT-19	R4895289
Manganese (Mn)-Dissolved	0.883	DLDS	0.00050	mg/L		31-OCT-19	R4895289
Potassium (K)-Dissolved	28.2	DLDS	0.25	mg/L		31-OCT-19	R4895289
Sodium (Na)-Dissolved	635	DLDS	0.25	mg/L		31-OCT-19	R4895289
L2372762-18 A001							
Sampled By: KSF on 27-OCT-19 @ 12:55							
Matrix: WATER							
<b>BTEX, F1-F4 and SK Reg. PHC's</b>							
<b>BTEX and F1 (C6-C10)</b>							
Benzene	<0.00050		0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906
Toluene	<0.00050		0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906
EthylBenzene	<0.00050		0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906
Xylenes	<0.0020		0.0020	mg/L	31-OCT-19	01-NOV-19	R4895906
o-Xylene	<0.00050		0.00050	mg/L	31-OCT-19	01-NOV-19	R4895906
m+p-Xylene	<0.0010		0.0010	mg/L	31-OCT-19	01-NOV-19	R4895906
F1(C6-C10)	<0.10		0.10	mg/L	31-OCT-19	01-NOV-19	R4895906
F1-BTEX	<0.10		0.10	mg/L	31-OCT-19	01-NOV-19	R4895906
Surrogate: 1,4-Difluorobenzene	101.2		70-130	%	31-OCT-19	01-NOV-19	R4895906
Surrogate: 4-Bromofluorobenzene	117.2		70-130	%	31-OCT-19	01-NOV-19	R4895906
Surrogate: 3,4-Dichlorotoluene	90.2		70-130	%	31-OCT-19	01-NOV-19	R4895906
<b>CCME Total Hydrocarbons</b>							
Total Hydrocarbons (C6-C50)	<1.0		1.0	mg/L		02-NOV-19	
<b>Extractable Hydrocarbons by GC-FID</b>							
F2 (C10-C16)	<0.10		0.10	mg/L	01-NOV-19	02-NOV-19	R4896446
F3 (C16-C34)	<0.25		0.25	mg/L	01-NOV-19	02-NOV-19	R4896446
F4 (C34-C50)	<0.25		0.25	mg/L	01-NOV-19	02-NOV-19	R4896446

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2372762-18 A001 Sampled By: KSF on 27-OCT-19 @ 12:55 Matrix: WATER <b>Extractable Hydrocarbons by GC-FID</b> TEH (C11-C22) <0.30 0.30 mg/L 01-NOV-19 02-NOV-19 R4896446 TEH (C23-C60) <0.50 0.50 mg/L 01-NOV-19 02-NOV-19 R4896446 Surrogate: 2-Bromobenzotrifluoride 82.3 60-140 % 01-NOV-19 02-NOV-19 R4896446							
L2372762-19 B001 Sampled By: KSF on 26-OCT-19 @ 13:00 Matrix: WATER <b>BTEX, F1-F4 and SK Reg. PHC's</b> <b>BTEX and F1 (C6-C10)</b> Benzene 0.261 0.00050 mg/L 31-OCT-19 01-NOV-19 R4895906 Toluene 0.00080 0.00050 mg/L 31-OCT-19 01-NOV-19 R4895906 EthylBenzene 0.0254 0.00050 mg/L 31-OCT-19 01-NOV-19 R4895906 Xylenes 0.0102 0.0020 mg/L 31-OCT-19 01-NOV-19 R4895906 o-Xylene 0.00149 0.00050 mg/L 31-OCT-19 01-NOV-19 R4895906 m+p-Xylene 0.0087 0.0010 mg/L 31-OCT-19 01-NOV-19 R4895906 F1(C6-C10) 0.63 0.10 mg/L 31-OCT-19 01-NOV-19 R4895906 F1-BTEX 0.34 0.10 mg/L 31-OCT-19 01-NOV-19 R4895906 Surrogate: 1,4-Difluorobenzene 94.7 70-130 % 31-OCT-19 01-NOV-19 R4895906 Surrogate: 4-Bromofluorobenzene 120.7 70-130 % 31-OCT-19 01-NOV-19 R4895906 Surrogate: 3,4-Dichlorotoluene 93.4 70-130 % 31-OCT-19 01-NOV-19 R4895906 <b>CCME Total Hydrocarbons</b> Total Hydrocarbons (C6-C50) 2.7 1.0 mg/L 02-NOV-19 <b>Extractable Hydrocarbons by GC-FID</b> F2 (C10-C16) 2.06 0.10 mg/L 01-NOV-19 02-NOV-19 R4896446 F3 (C16-C34) <0.25 0.25 mg/L 01-NOV-19 02-NOV-19 R4896446 F4 (C34-C50) <0.25 0.25 mg/L 01-NOV-19 02-NOV-19 R4896446 TEH (C11-C22) 2.30 0.30 mg/L 01-NOV-19 02-NOV-19 R4896446 TEH (C23-C60) <0.50 0.50 mg/L 01-NOV-19 02-NOV-19 R4896446 Surrogate: 2-Bromobenzotrifluoride 83.7 60-140 % 01-NOV-19 02-NOV-19 R4896446							

## Reference Information

**Sample Parameter Qualifier Key:**

Qualifier	Description
B	Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

**Test Method References:**

ALS Test Code	Matrix	Test Description	Method Reference**
ACIDITY-AUTO-TITR-ED	Water	Acidity - auto-potentiometric titration	APHA 2310 B - Potentiometric Titration
		Acidity is the capacity of a water sample to react with strong base. It can be measured by titration with a strong base to a designated pH endpoint, usually 8.3.	
ALK-PCT-SK	Water	Alkalinity by Auto. Titration	APHA 2320 Alkalinity
		This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.	
BTX,F1-SK	Water	BTEX and F1 (C6-C10)	EPA 8260C/5021A and CWS PHC Tier 1
		The water sample, with added reagents, is heated in a sealed vial to equilibrium. The headspace from the vial is transferred into a gas chromatograph. BTEX Target compound concentrations are measured using mass spectrometry detection. The instrumental portion of F1 analysis is carried out in accordance with the Canada Wide Standard for Petroleum Hydrocarbons in Soil - Tier 1 Method.	
C-TOT-INORG-CL	Water	Total Inorganic Carbon	APHA 5310 B-Instrumental
		Sample is injected into a heated reaction chamber where it is acidified converting all inorganic carbon to CO <sub>2</sub> , which is then transported in the carrier gas stream and measured via a non-dispersive infrared analyzer.	
C-TOT-ORG-CL	Water	Total Organic Carbon	APHA 5310 B-Instrumental
		Sample is acidified and purged to remove inorganic carbon, then injected into a heated reaction chamber where organic carbon is oxidized to CO <sub>2</sub> which is then transported in the carrier gas stream and measured via a non-dispersive infrared analyzer.	
C6-C50-CALC-SK	Water	CCME Total Hydrocarbons	CCME CWS-PHC, Pub #1310, Dec 2001
		Analytical methods used for analysis of CCME Petroleum Hydrocarbons have been validated and comply with the Reference Method for the CWS PHC.	
		Hydrocarbon results are expressed on a dry weight basis.	
		In cases where results for both F4 and F4G are reported, the greater of the two results must be used in any application of the CWS PHC guidelines and the gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.	
		In samples where BTEX and F1 were analyzed , F1-BTEX represents a value where the sum of Benzene, Toluene, Ethylbenzene and total Xylenes has been subtracted from F1.	
		In samples where PAHs, F2 and F3 were analyzed, F2-Naphth represents the result where Naphthalene has been subtracted from F2. F3-PAH represents a result where the sum of Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Phenanthrene, and Pyrene has been subtracted from F3.	
		Unless otherwise qualified, the following quality control criteria have been met for the F1 hydrocarbon range:	
		1. All extraction and analysis holding times were met.	
		2. Instrument performance showing response factors for C6 and C10 within 30% of the response factor for toluene.	
		3. Linearity of gasoline response within 15% throughout the calibration range.	
		Unless otherwise qualified, the following quality control criteria have been met for the F2-F4 hydrocarbon ranges:	
		1. All extraction and analysis holding times were met.	
		2. Instrument performance showing C10, C16 and C34 response factors within 10% of their average.	
		3. Instrument performance showing the C50 response factor within 30% of the average of the C10, C16 and C34 response factors.	
		4. Linearity of diesel or motor oil response within 15% throughout the calibration range.	
CL-L-IC-N-SK	Water	Chloride in Water by IC (Low Level)	EPA 300.1 (mod)
		Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.	
COD-SK	Water	Chemical Oxygen Demand	APHA 5220 D-Micro Colorimetry
		Sample aliquots are placed in closed culture tubes with a digestion solution containing dichromate. The tubes are digested at 150–5°C for 2 hours. Oxygen consumed is measured against standards at 420nm with a spectrophotometer.	

## Reference Information

**Test Method References:**

<b>ALS Test Code</b>	<b>Matrix</b>	<b>Test Description</b>	<b>Method Reference**</b>
EC-PCT-SK	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.			
MET-D-CCMS-SK	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B / EPA 6020A
This procedure involves preliminary filtration through a 0.45 um filter followed by instrumental analysis using collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).			
MET-T-CCMS-SK	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)
This procedure involves preliminary digestion with concentrated nitric acid followed by instrumental analysis using collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).			
NH3-F-CL	Water	Ammonia by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NO2-IC-N-SK	Water	Nitrite in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-IC-N-SK	Water	Nitrate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
P-T-COL-CL	Water	Total P in Water by Colour	APHA 4500-P PHOSPHORUS
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.			
PH-PCT-SK	Water	pH by Meter (Automated)	APHA 4500-H pH Value
This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode			
It is recommended that this analysis be conducted in the field.			
PO4-DO-COL-SK	Water	Diss. Orthophosphate in Water by Colour	APHA 4500-P PHOSPHORUS
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.			
SAR-CALC-SK	Water	SAR	CSSS 18.4-Calulation
SO4-IC-N-SK	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
TDS-CALC-SK	Water	TDS (Calculated)	APHA 1030E
TDS-SK	Water	Total Dissolved Solids	APHA 2540 C
An aliquot of sample is filtered using a glass fibre filter and the filtrate evaporated to dryness at 180 – 2°C in a pre-weighed dish. The dish plus residue is cooled and weighed to constant weight. Total dissolved solids (TDS) is determined by difference.			
TEH-WS-SK	Water	Extractable Hydrocarbons by GC-FID	EPA 3511/CCME PHC CWS-GC-FID
Petroleum Hydrocarbons (F2-F4) in Water Method is adapted from US EPA Method 3511: Organic Compounds in Water by Micro-extraction" (Nov 2002) with instrumental analysis as per the "Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil - Tier 1 Method" (CCMS, Dec 2000) Water samples (in their entirety) are extracted using hexane prior to capillary column gas chromatography with flame ionization detection (GC/FID).			

\*\* ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

<b>Laboratory Definition Code</b>	<b>Laboratory Location</b>
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA
CL	ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA

**Chain of Custody Numbers:**

## Reference Information

**Test Method References:**

ALS Test Code	Matrix	Test Description	Method Reference**
19-2019150927			

**GLOSSARY OF REPORT TERMS**

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

*Test results reported relate only to the samples as received by the laboratory.*

*UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.*

*Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.*



# Quality Control Report

Workorder: L2372762

Report Date: 04-NOV-19

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**Client:** Wood Environment & Infrastructure Solutions (Regina)  
#1 - 1727 Francis Street  
REGINA SK S4N 7N2

Contact: Kent Muderewich



## Quality Control Report

Workorder: L2372762

Report Date: 04-NOV-19

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>CL-L-IC-N-SK</b>								
	Water							
Batch	R4895975							
WG3204534-1	DUP	L2372762-9						
Chloride (Cl)		213	211		mg/L	1.1	20	29-OCT-19
WG3204534-3	LCS							
Chloride (Cl)			101.8		%		90-110	29-OCT-19
WG3204534-2	MB							
Chloride (Cl)			<0.10		mg/L		0.1	29-OCT-19
WG3204534-4	MS	L2372762-8						
Chloride (Cl)			N/A	MS-B	%		-	29-OCT-19
<b>COD-SK</b>								
	Water							
Batch	R4891148							
WG3205610-2	LCS	KHP_100						
Chemical Oxygen Demand			102.7		%		85-115	31-OCT-19
WG3205610-3	MB							
Chemical Oxygen Demand			<10		mg/L		10	31-OCT-19
Batch	R4891155							
WG3205708-2	LCS	KHP_100						
Chemical Oxygen Demand			104.0		%		85-115	31-OCT-19
WG3205708-3	MB							
Chemical Oxygen Demand			<10		mg/L		10	31-OCT-19
<b>EC-PCT-SK</b>								
	Water							
Batch	R4889818							
WG3204829-1	DUP	L2372762-9						
Conductivity		6220	6260		uS/cm	0.6	10	29-OCT-19
WG3204829-2	LCS	PCT						
Conductivity			100.6		%		90-110	29-OCT-19
WG3204829-3	MB							
Conductivity			<5.0		uS/cm		5	29-OCT-19
<b>MET-D-CCMS-SK</b>								
	Water							
Batch	R4895289							
WG3204965-3	CRM	TMRM_20						
Calcium (Ca)-Dissolved			93.4		%		80-120	31-OCT-19
Iron (Fe)-Dissolved			107.9		%		80-120	31-OCT-19
Magnesium (Mg)-Dissolved			101.3		%		80-120	31-OCT-19
Manganese (Mn)-Dissolved			104.7		%		80-120	31-OCT-19
Potassium (K)-Dissolved			107.8		%		80-120	31-OCT-19
Sodium (Na)-Dissolved			96.3		%		80-120	31-OCT-19
WG3204965-1	MB							

## Quality Control Report

Workorder: L2372762

Report Date: 04-NOV-19

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed	
<b>MET-D-CCMS-SK</b> Water									
Batch R4895289									
WG3204965-1 MB									
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	31-OCT-19	
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	31-OCT-19	
Magnesium (Mg)-Dissolved			0.0090	B	mg/L		0.005	31-OCT-19	
Manganese (Mn)-Dissolved			<0.00010		mg/L		0.0001	31-OCT-19	
Potassium (K)-Dissolved			<0.050		mg/L		0.05	31-OCT-19	
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	31-OCT-19	
<b>MET-T-CCMS-SK</b> Water									
Batch R4895046									
WG3204699-3 CRM		TMRM_20							
Iron (Fe)-Total			97.4		%		80-120	31-OCT-19	
WG3204699-1 MB									
Iron (Fe)-Total			<0.010		mg/L		0.01	31-OCT-19	
WG3204699-4 MS		L2372762-16							
Iron (Fe)-Total			93.0		%		70-130	31-OCT-19	
<b>NH3-F-CL</b> Water									
Batch R4893727									
WG3207428-14 LCS									
Ammonia, Total (as N)			107.7		%		85-115	31-OCT-19	
WG3207428-13 MB									
Ammonia, Total (as N)			<0.050		mg/L		0.05	31-OCT-19	
<b>NO2-IC-N-SK</b> Water									
Batch R4895975									
WG3204534-1 DUP		L2372762-9							
Nitrite (as N)			<0.20	<0.20	RPD-NA	mg/L	N/A	20	29-OCT-19
WG3204534-3 LCS									
Nitrite (as N)			101.6		%		90-110	29-OCT-19	
WG3204534-2 MB									
Nitrite (as N)			<0.010		mg/L		0.01	29-OCT-19	
WG3204534-4 MS		L2372762-8							
Nitrite (as N)			103.3		%		75-125	29-OCT-19	
<b>NO3-IC-N-SK</b> Water									
Batch R4895975									
WG3204534-1 DUP		L2372762-9							
Nitrate (as N)			<0.40	<0.40	RPD-NA	mg/L	N/A	20	29-OCT-19
WG3204534-3 LCS									
Nitrate (as N)			102.0		%		90-110	29-OCT-19	

## Quality Control Report

Workorder: L2372762

Report Date: 04-NOV-19

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO3-IC-N-SK	Water							
Batch R4895975								
WG3204534-2 MB								
Nitrate (as N)			<0.020		mg/L		0.02	29-OCT-19
WG3204534-4 MS	L2372762-8			N/A	MS-B	%	-	29-OCT-19
Nitrate (as N)								
P-T-COL-CL	Water							
Batch R4890071								
WG3205931-10 LCS								
Phosphorus (P)-Total			93.0		%		80-120	30-OCT-19
WG3205931-9 MB								
Phosphorus (P)-Total			<0.0050		mg/L		0.005	30-OCT-19
PH-PCT-SK	Water							
Batch R4889818								
WG3204829-1 DUP	L2372762-9							
pH		7.47	7.41	J	pH	0.06	0.2	29-OCT-19
WG3204829-2 LCS	PCT							
pH			6.86		pH		6.76-6.96	29-OCT-19
PO4-DO-COL-SK	Water							
Batch R4890369								
WG3204563-2 DUP	L2372762-14							
Orthophosphate-Dissolved (as P)		<0.50	<0.50	RPD-NA	mg/L	N/A	20	29-OCT-19
WG3204563-4 LCS	0.5PPM-P							
Orthophosphate-Dissolved (as P)			103.1		%		80-120	29-OCT-19
WG3204563-1 MB								
Orthophosphate-Dissolved (as P)			<0.050		mg/L		0.05	29-OCT-19
SO4-IC-N-SK	Water							
Batch R4895975								
WG3204534-1 DUP	L2372762-9							
Sulfate (SO4)		3330	3280		mg/L	1.5	20	29-OCT-19
WG3204534-3 LCS								
Sulfate (SO4)			102.7		%		90-110	29-OCT-19
WG3204534-2 MB								
Sulfate (SO4)			<0.30		mg/L		0.3	29-OCT-19
WG3204534-4 MS	L2372762-8			N/A	MS-B	%	-	29-OCT-19
Sulfate (SO4)								
TDS-SK	Water							

## Quality Control Report

Workorder: L2372762

Report Date: 04-NOV-19

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>TDS-SK</b> <b>Water</b>								
Batch	R4890264							
WG3204744-2 DUP		L2372762-8						
Total Dissolved Solids		5330	5230		mg/L	1.9	20	29-OCT-19
WG3204744-3 LCS		41-SOLIDS-TDS_LCS						
Total Dissolved Solids			99.7		%		85-115	29-OCT-19
WG3204744-1 MB								
Total Dissolved Solids			<10		mg/L		10	29-OCT-19
<b>TEH-WS-SK</b> <b>Water</b>								
Batch	R4896446							
WG3205034-2 LCS								
F2 (C10-C16)			116.5		%		70-130	02-NOV-19
F3 (C16-C34)			98.0		%		70-130	02-NOV-19
F4 (C34-C50)			106.1		%		70-130	02-NOV-19
TEH (C11-C22)			102.9		%		70-130	02-NOV-19
TEH (C23-C60)			109.5		%		70-130	02-NOV-19
WG3205034-1 MB								
F2 (C10-C16)			<0.10		mg/L		0.1	02-NOV-19
F3 (C16-C34)			<0.25		mg/L		0.25	02-NOV-19
F4 (C34-C50)			<0.25		mg/L		0.25	02-NOV-19
TEH (C11-C22)			<0.30		mg/L		0.3	02-NOV-19
TEH (C23-C60)			<0.50		mg/L		0.5	02-NOV-19

# Quality Control Report

Workorder: L2372762

Report Date: 04-NOV-19

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## Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

## Sample Parameter Qualifier Definitions:

Qualifier	Description
B	Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

# Quality Control Report

Workorder: L2372762

Report Date: 04-NOV-19

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## Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
<b>Physical Tests</b>							
pH by Meter (Automated)							
	1	26-OCT-19 10:25	29-OCT-19 17:00	0.25	78	hours	EHTR-FM
	3	25-OCT-19 14:45	29-OCT-19 17:00	0.25	98	hours	EHTR-FM
	5	25-OCT-19 14:40	29-OCT-19 17:00	0.25	98	hours	EHTR-FM
	8	25-OCT-19 10:05	29-OCT-19 17:00	0.25	103	hours	EHTR-FM
	9	26-OCT-19 12:20	29-OCT-19 17:00	0.25	77	hours	EHTR-FM
	10	26-OCT-19 11:15	29-OCT-19 17:00	0.25	78	hours	EHTR-FM
	12	26-OCT-19 13:05	29-OCT-19 17:00	0.25	76	hours	EHTR-FM
	14	27-OCT-19 10:10	29-OCT-19 17:00	0.25	55	hours	EHTR-FM
	15	26-OCT-19 15:20	29-OCT-19 17:00	0.25	74	hours	EHTR-FM
	16	26-OCT-19 14:20	29-OCT-19 17:00	0.25	75	hours	EHTR-FM
	17	26-OCT-19 09:30	29-OCT-19 17:00	0.25	79	hours	EHTR-FM
<b>Anions and Nutrients</b>							
Diss. Orthophosphate in Water by Colour							
	3	25-OCT-19 14:45	29-OCT-19 13:12	3	4	days	EHTL
	5	25-OCT-19 14:40	29-OCT-19 13:12	3	4	days	EHTL
	8	25-OCT-19 10:05	29-OCT-19 13:13	3	4	days	EHTR
Nitrate in Water by IC							
	3	25-OCT-19 14:45	29-OCT-19 14:00	3	4	days	EHTL
	5	25-OCT-19 14:40	29-OCT-19 14:00	3	4	days	EHTL
	8	25-OCT-19 10:05	29-OCT-19 14:00	3	4	days	EHTR
Nitrite in Water by IC							
	3	25-OCT-19 14:45	29-OCT-19 14:00	3	4	days	EHTL
	5	25-OCT-19 14:40	29-OCT-19 14:00	3	4	days	EHTL
	8	25-OCT-19 10:05	29-OCT-19 14:00	3	4	days	EHTR

## Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.

EHTR: Exceeded ALS recommended hold time prior to sample receipt.

EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.

EHT: Exceeded ALS recommended hold time prior to analysis.

Rec. HT: ALS recommended hold time (see units).

## Notes\*:

Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.

Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2372762 were received on 28-OCT-19 11:48.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

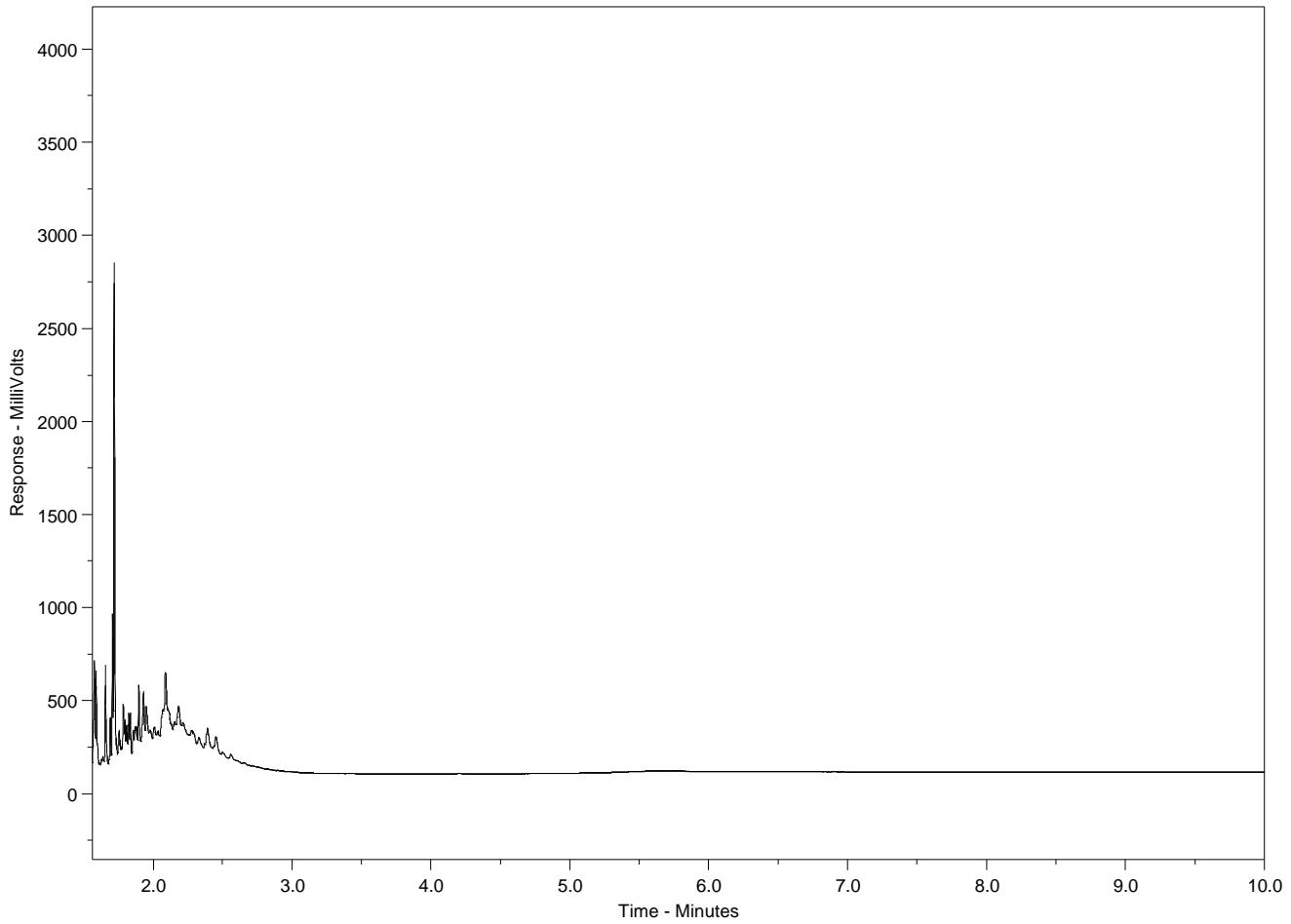
The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

# CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT



ALS Sample ID: L2372762-1  
Client ID: 16-03



F2				F3		F4	
nC10	nC16			nC34		nC50	
174°C	287°C			481°C		575°C	
346°F	549°F			898°F		1067°F	
← Gasoline →				← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →							

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

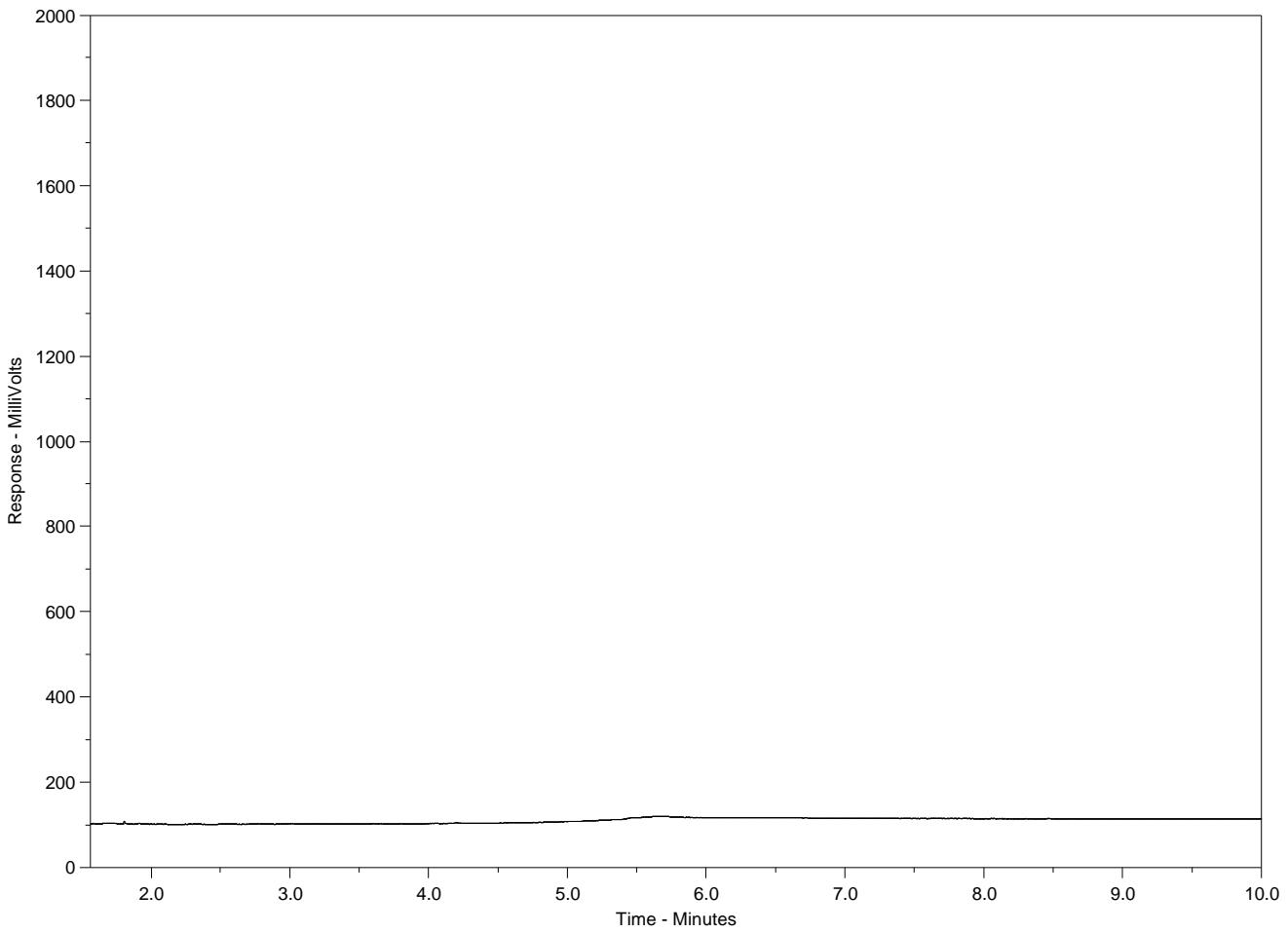
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at [www.alsglobal.com](http://www.alsglobal.com).

# CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT



**ALS Sample ID:** L2372762-2  
**Client ID:** 17-06



F2				F3		F4			
nC10	nC16			nC34		nC50			
174°C	287°C			481°C		575°C			
346°F	549°F			898°F		1067°F			
← Gasoline →				← Motor Oils/ Lube Oils/ Grease →					
← Diesel/ Jet Fuels →									

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

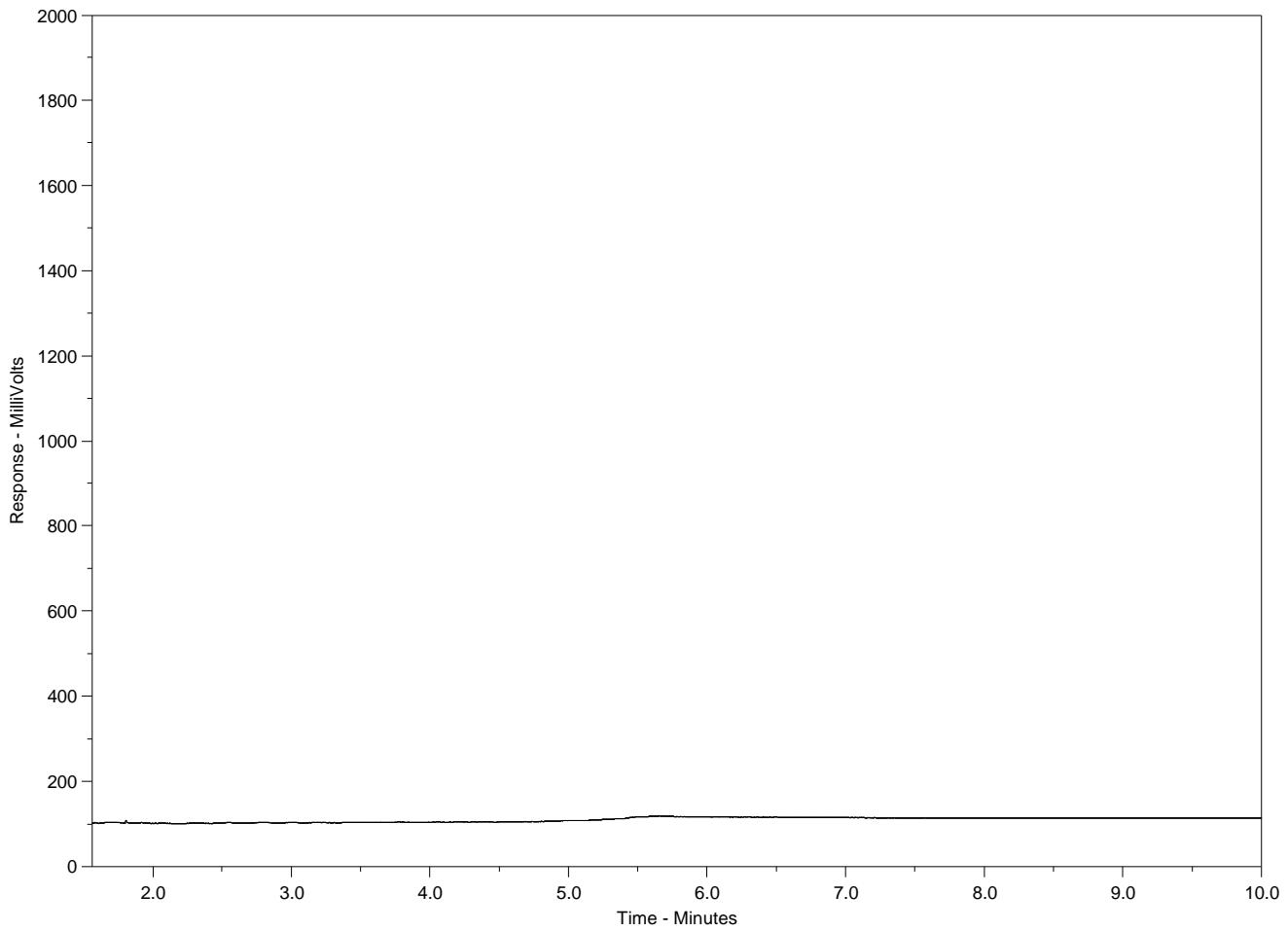
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at [www.alsglobal.com](http://www.alsglobal.com).

# CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT



**ALS Sample ID:** L2372762-3  
**Client ID:** 17-07



F2				F3				F4			
nC10	nC16			nC34		nC50					
174°C	287°C			481°C		575°C					
346°F	549°F			898°F		1067°F		Motor Oils/ Lube Oils/ Grease			
← Gasoline →				← Diesel/ Jet Fuels →							

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

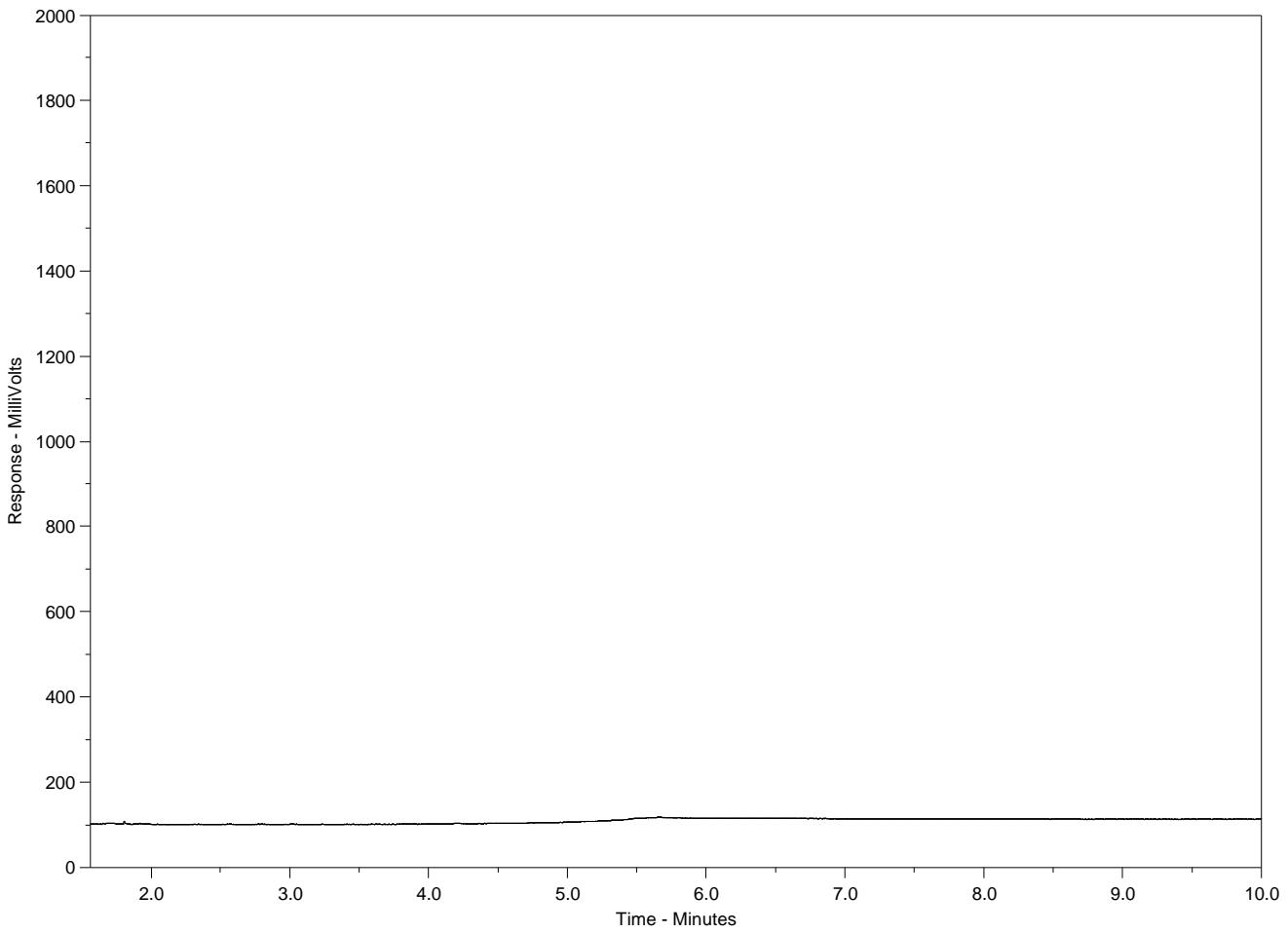
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at [www.alsglobal.com](http://www.alsglobal.com).

# CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT



**ALS Sample ID:** L2372762-4  
**Client ID:** 17-05



F2				F3				F4			
nC10	nC16			nC34		nC50					
174°C	287°C			481°C		575°C					
346°F	549°F			898°F		1067°F		Motor Oils/ Lube Oils/ Grease			
← Gasoline →				← Diesel/ Jet Fuels →							

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

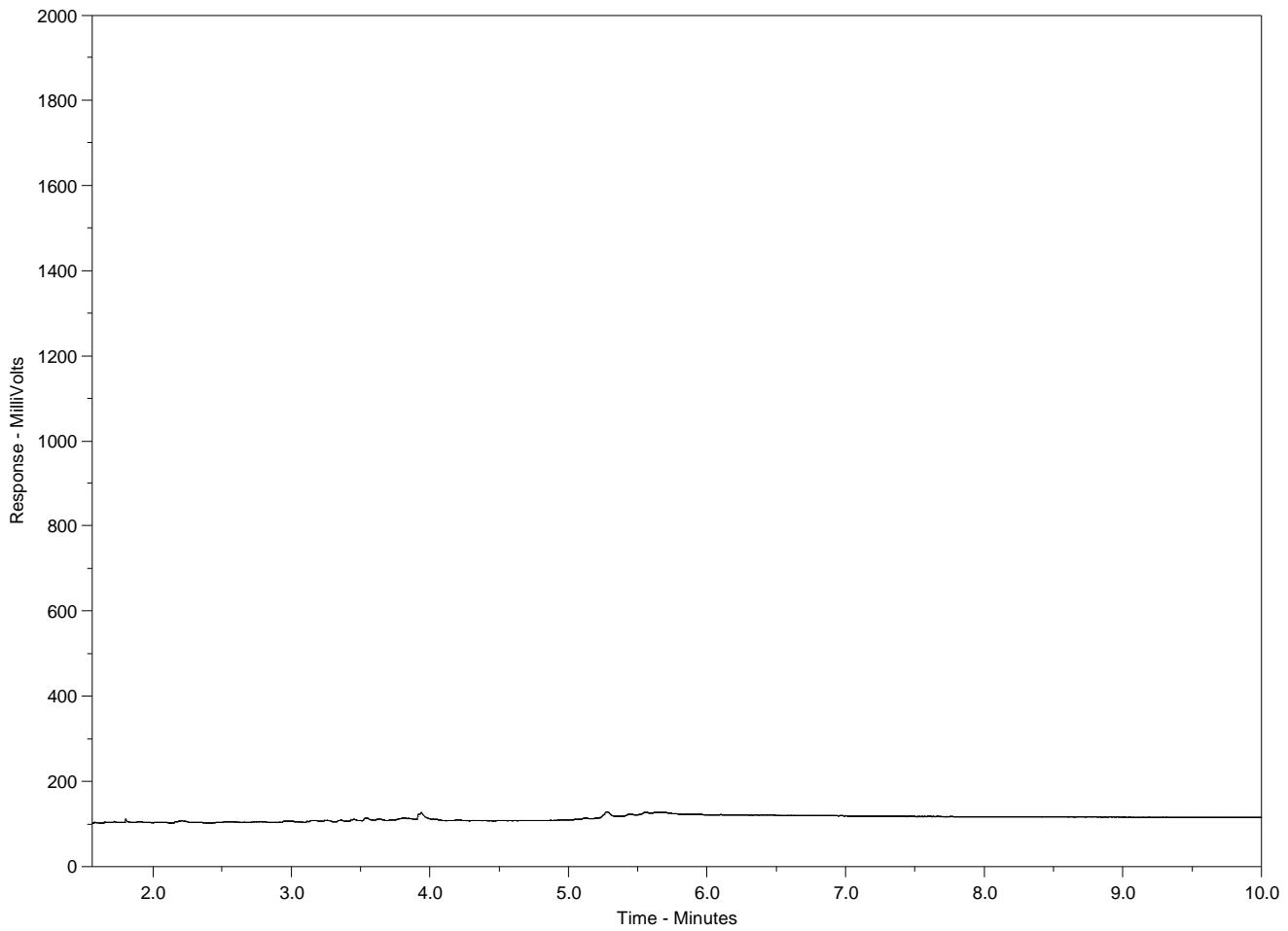
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at [www.alsglobal.com](http://www.alsglobal.com).

# CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT



ALS Sample ID: L2372762-5  
Client ID: 17-04



F2				F3				F4			
nC10	nC16			nC34		nC50					
174°C	287°C			481°C		575°C					
346°F	549°F			898°F		1067°F		Motor Oils/ Lube Oils/ Grease			
← Gasoline →				← Diesel/ Jet Fuels →				→			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

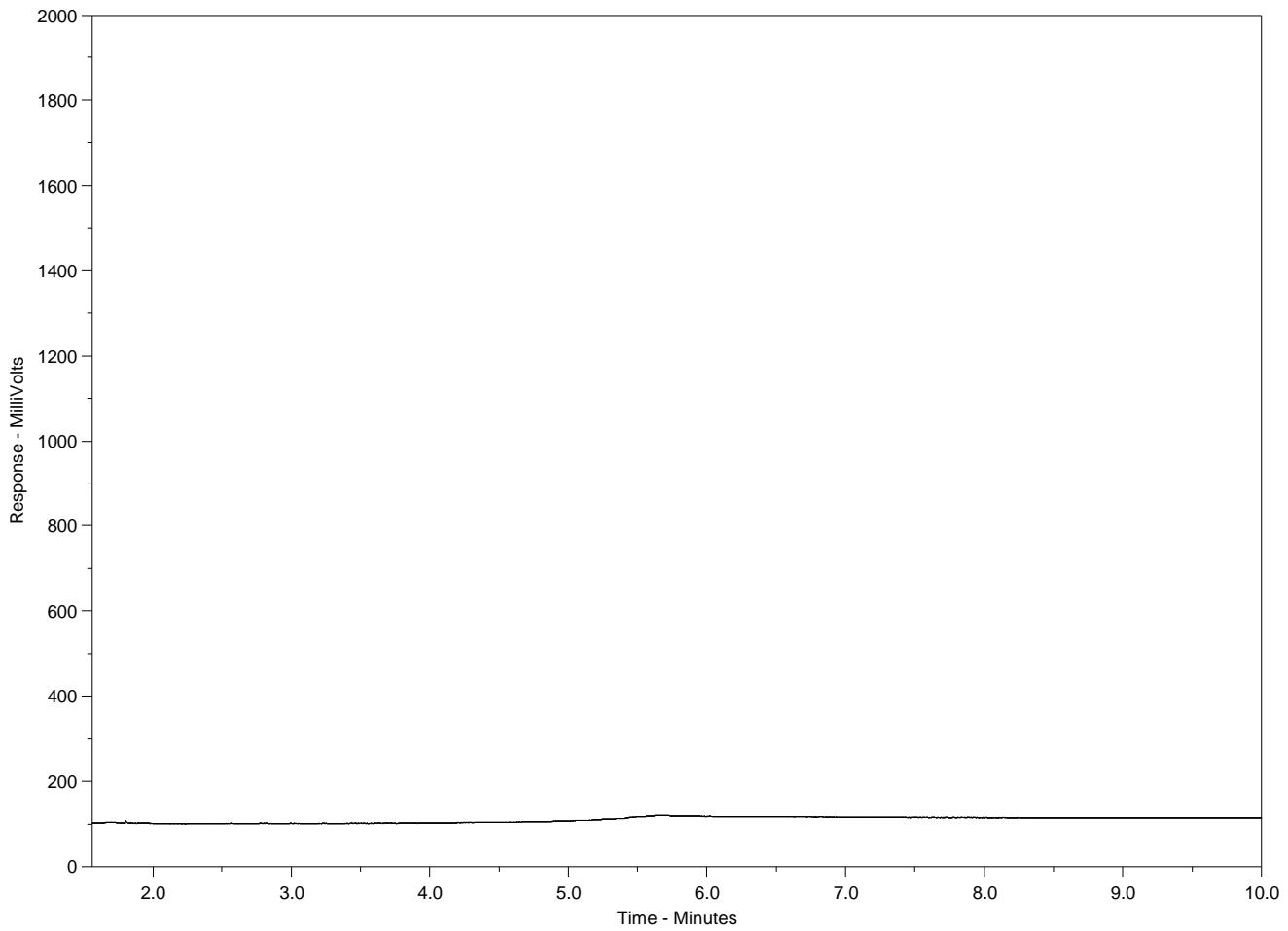
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at [www.alsglobal.com](http://www.alsglobal.com).

# CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT



**ALS Sample ID:** L2372762-6  
**Client ID:** 17-03



F2				F3		F4			
nC10	nC16			nC34		nC50			
174°C	287°C			481°C		575°C			
346°F	549°F			898°F		1067°F			
← Gasoline →				← Motor Oils/ Lube Oils/ Grease →					
← Diesel/ Jet Fuels →									

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

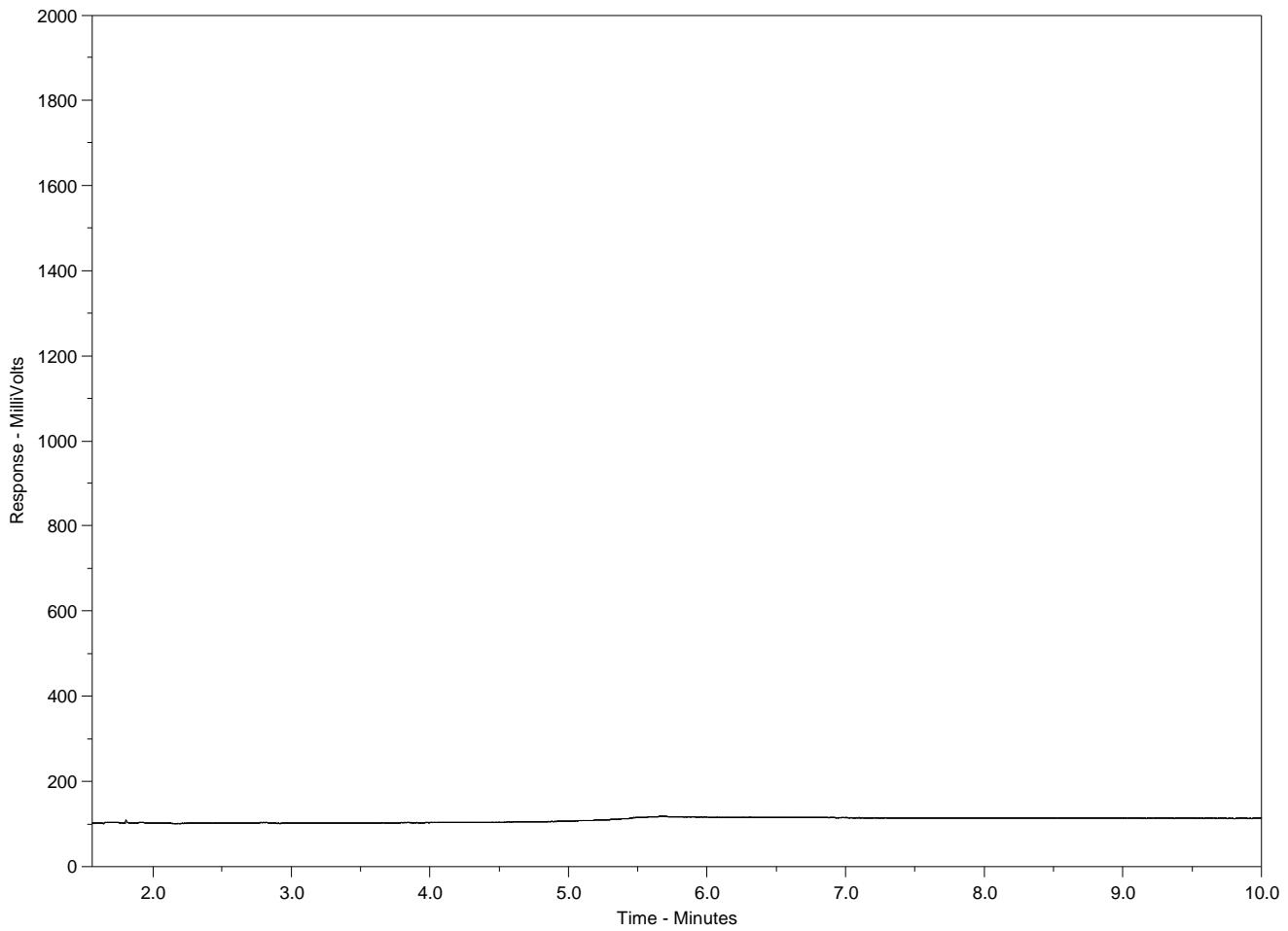
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at [www.alsglobal.com](http://www.alsglobal.com).

# CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT



**ALS Sample ID:** L2372762-7  
**Client ID:** 17-02



F2				F3		F4			
nC10	nC16			nC34		nC50			
174°C	287°C			481°C		575°C			
346°F	549°F			898°F		1067°F			
← Gasoline →				← Motor Oils/ Lube Oils/ Grease →					
← Diesel/ Jet Fuels →									

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

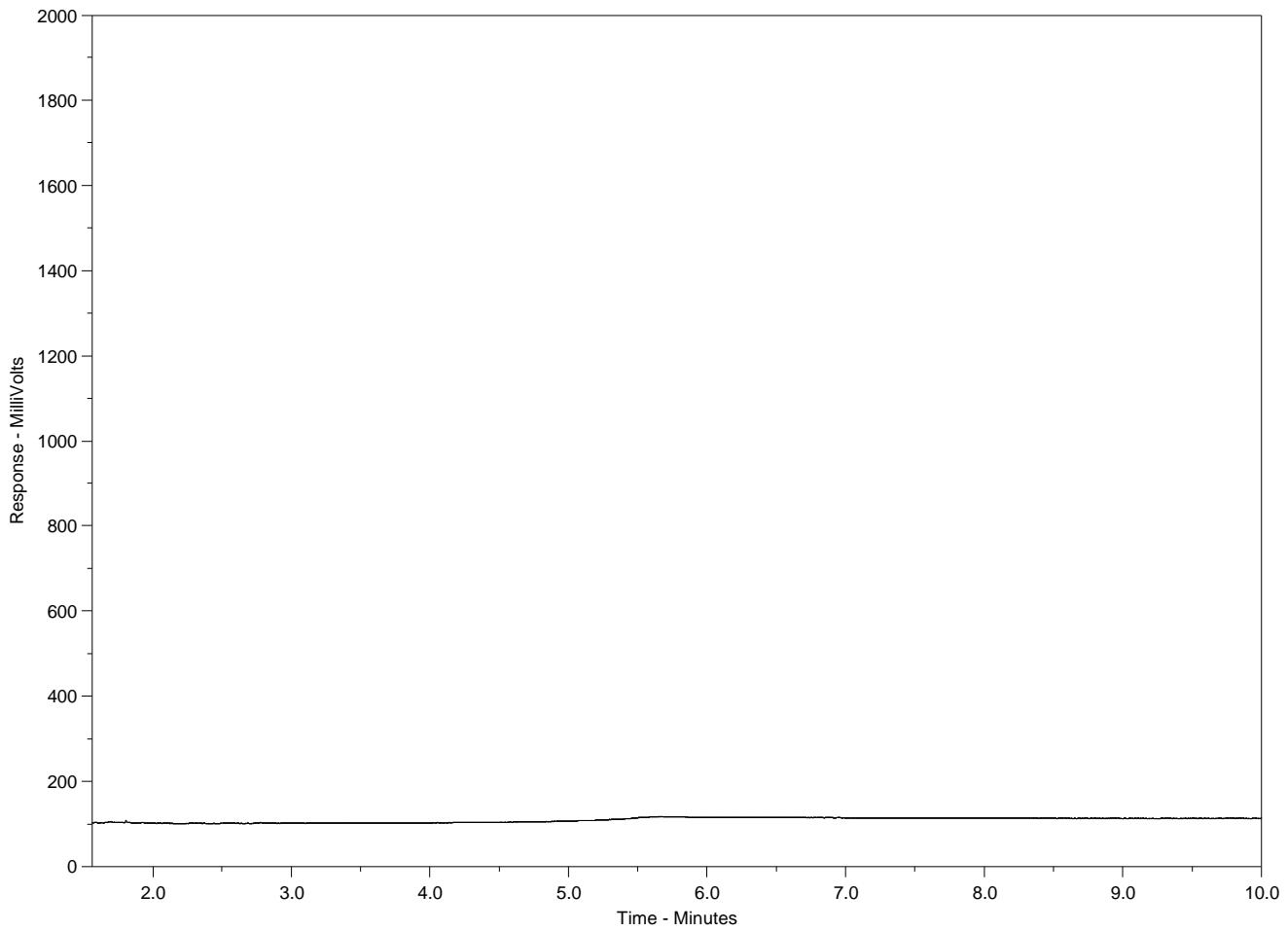
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at [www.alsglobal.com](http://www.alsglobal.com).

# CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT



ALS Sample ID: L2372762-8  
Client ID: 09-04



F2				F3		F4			
nC10	nC16			nC34		nC50			
174°C	287°C			481°C		575°C			
346°F	549°F			898°F		1067°F			
← Gasoline →				← Motor Oils/ Lube Oils/ Grease →					
← Diesel/ Jet Fuels →									

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

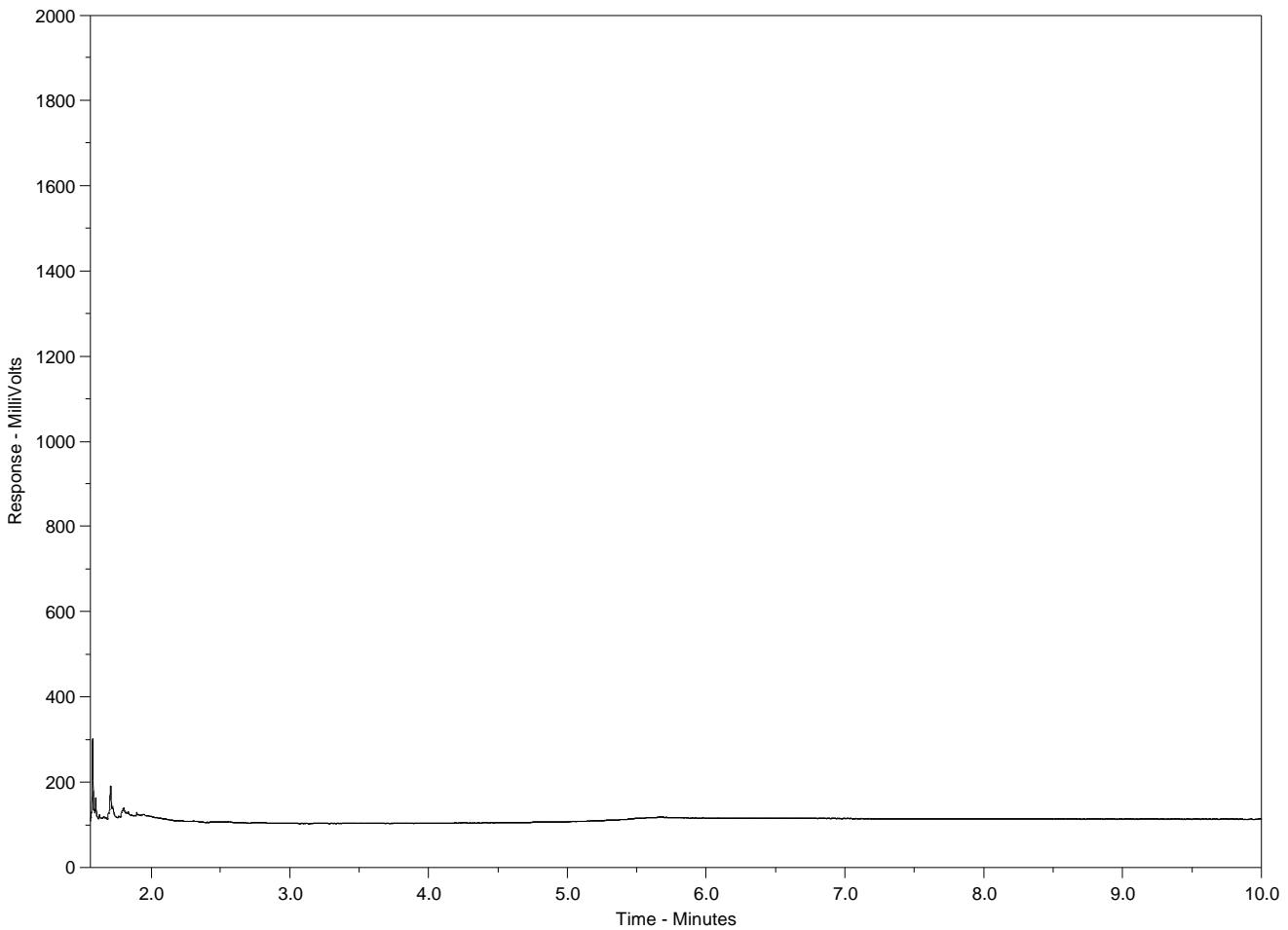
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at [www.alsglobal.com](http://www.alsglobal.com).

# CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT



**ALS Sample ID:** L2372762-9  
**Client ID:** 08-04



F2				F3				F4			
nC10	nC16			nC34		nC50					
174°C	287°C			481°C		575°C					
346°F	549°F			898°F		1067°F		Motor Oils/ Lube Oils/ Grease			
← Gasoline →				← Diesel/ Jet Fuels →							

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

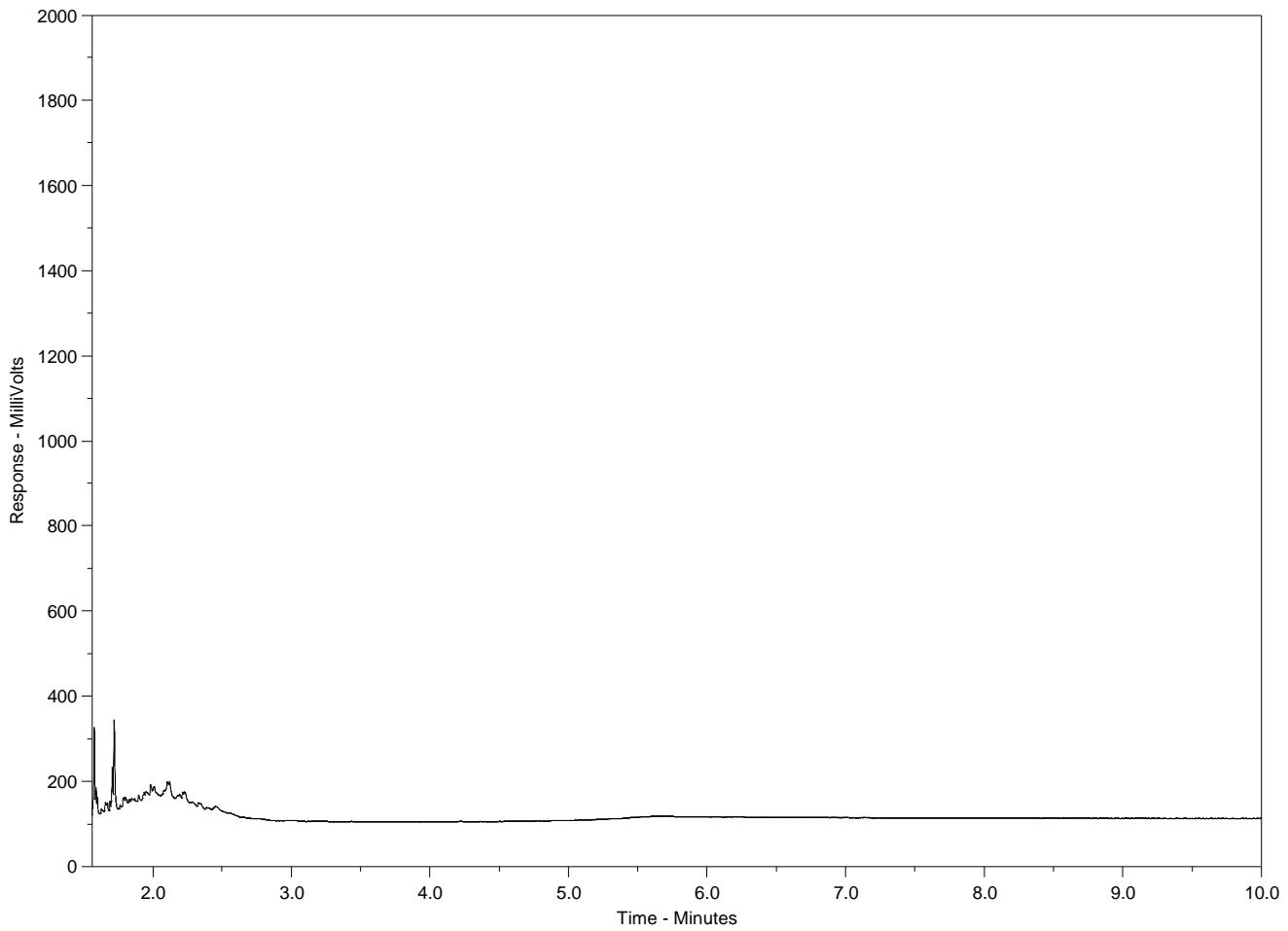
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at [www.alsglobal.com](http://www.alsglobal.com).

# CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT



ALS Sample ID: L2372762-10  
Client ID: 16-02



F2				F3		F4	
nC10	nC16			nC34		nC50	
174°C	287°C			481°C		575°C	
346°F	549°F			898°F		1067°F	
← Gasoline →				← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →							

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

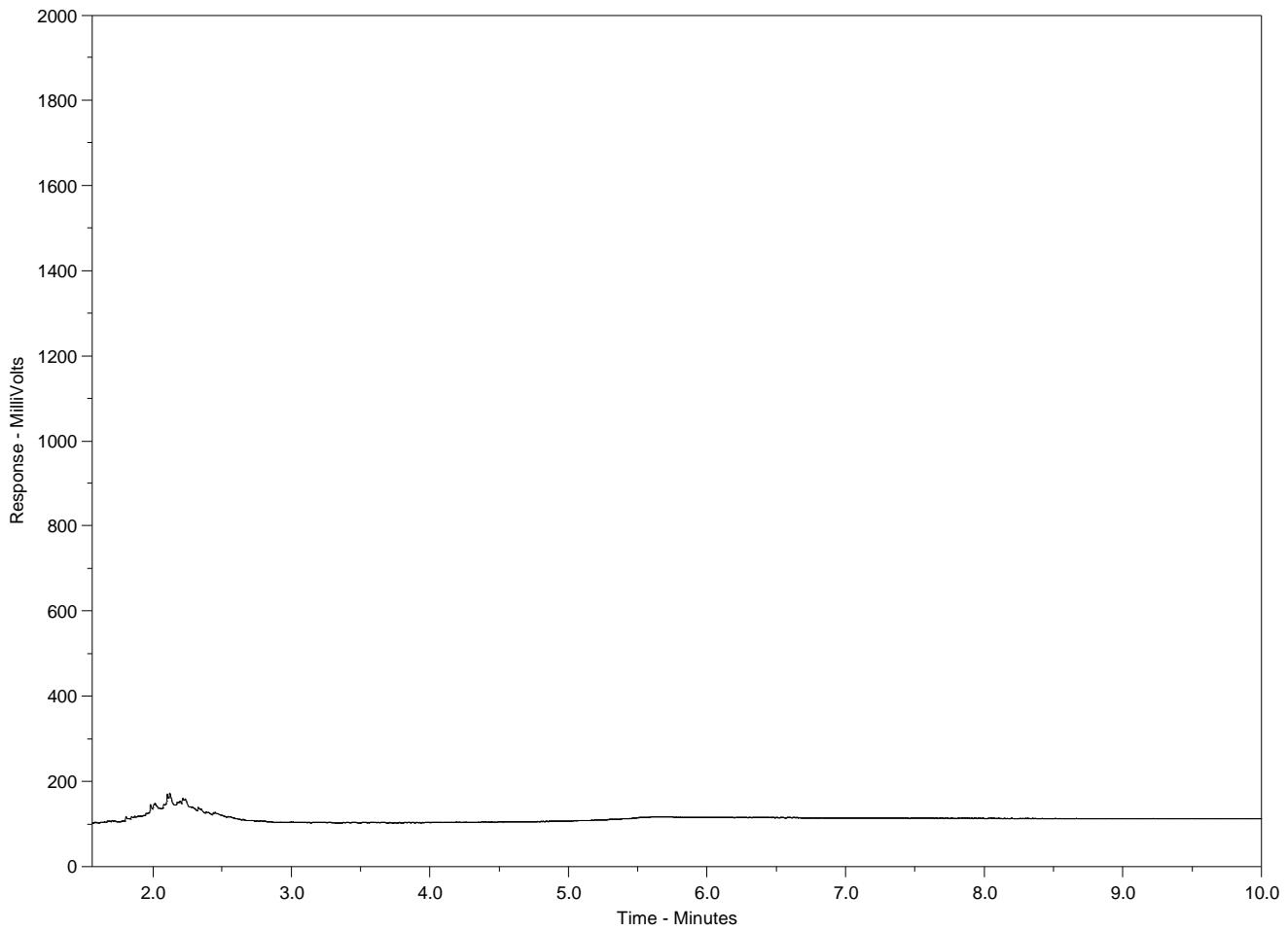
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at [www.alsglobal.com](http://www.alsglobal.com).

# CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT



ALS Sample ID: L2372762-11  
Client ID: 08-06



F2				F3				F4			
nC10	nC16			nC34		nC50					
174°C	287°C			481°C		575°C					
346°F	549°F			898°F		1067°F		Motor Oils/ Lube Oils/ Grease			
← Gasoline →				← Diesel/ Jet Fuels →							

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

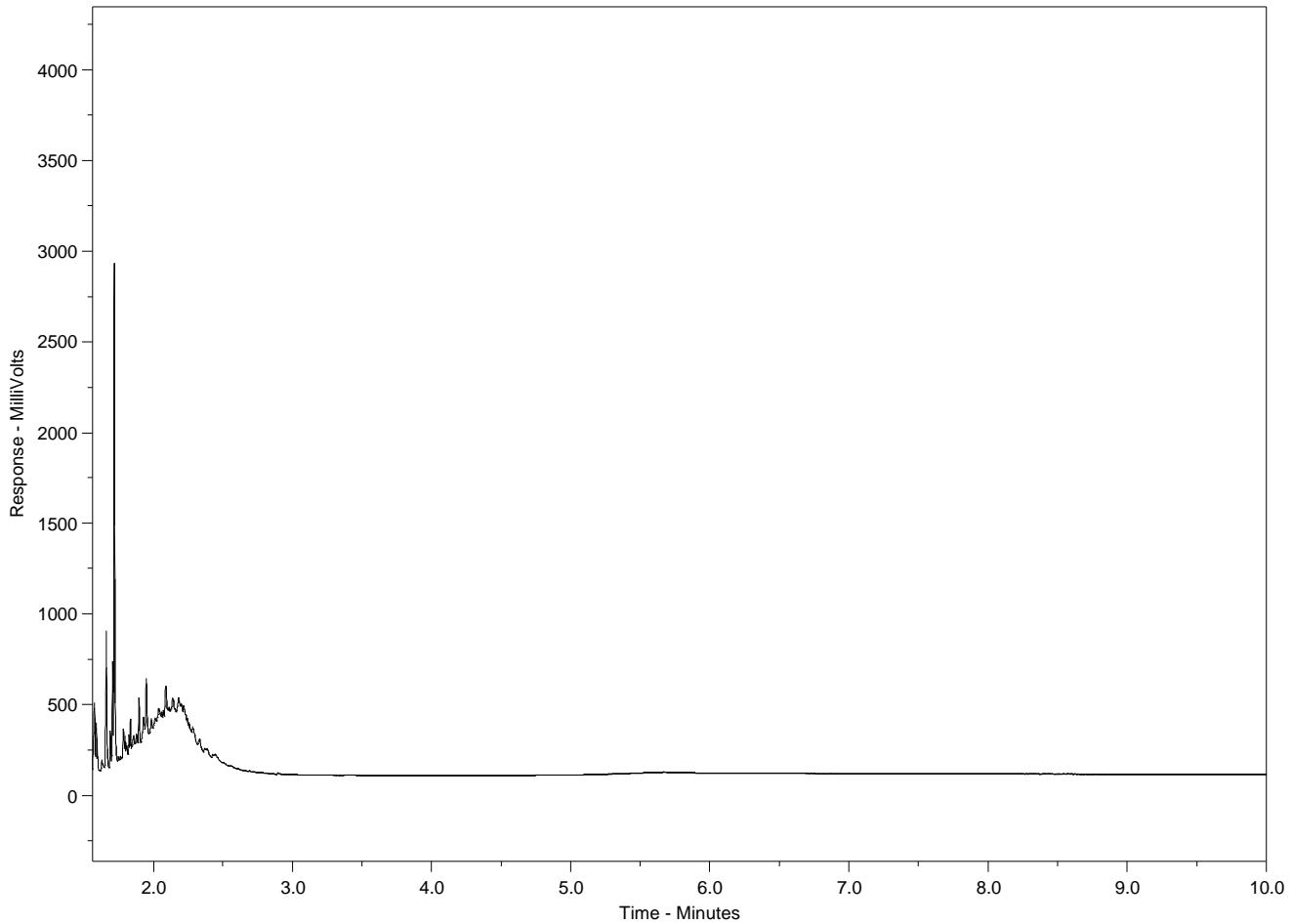
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at [www.alsglobal.com](http://www.alsglobal.com).

# CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT



ALS Sample ID: L2372762-12  
Client ID: 17-01



F2				F3				F4			
nC10	nC16			nC34		nC50					
174°C	287°C			481°C		575°C					
346°F	549°F			898°F		1067°F		Motor Oils/ Lube Oils/ Grease			
← Gasoline →				← Diesel/ Jet Fuels →							

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

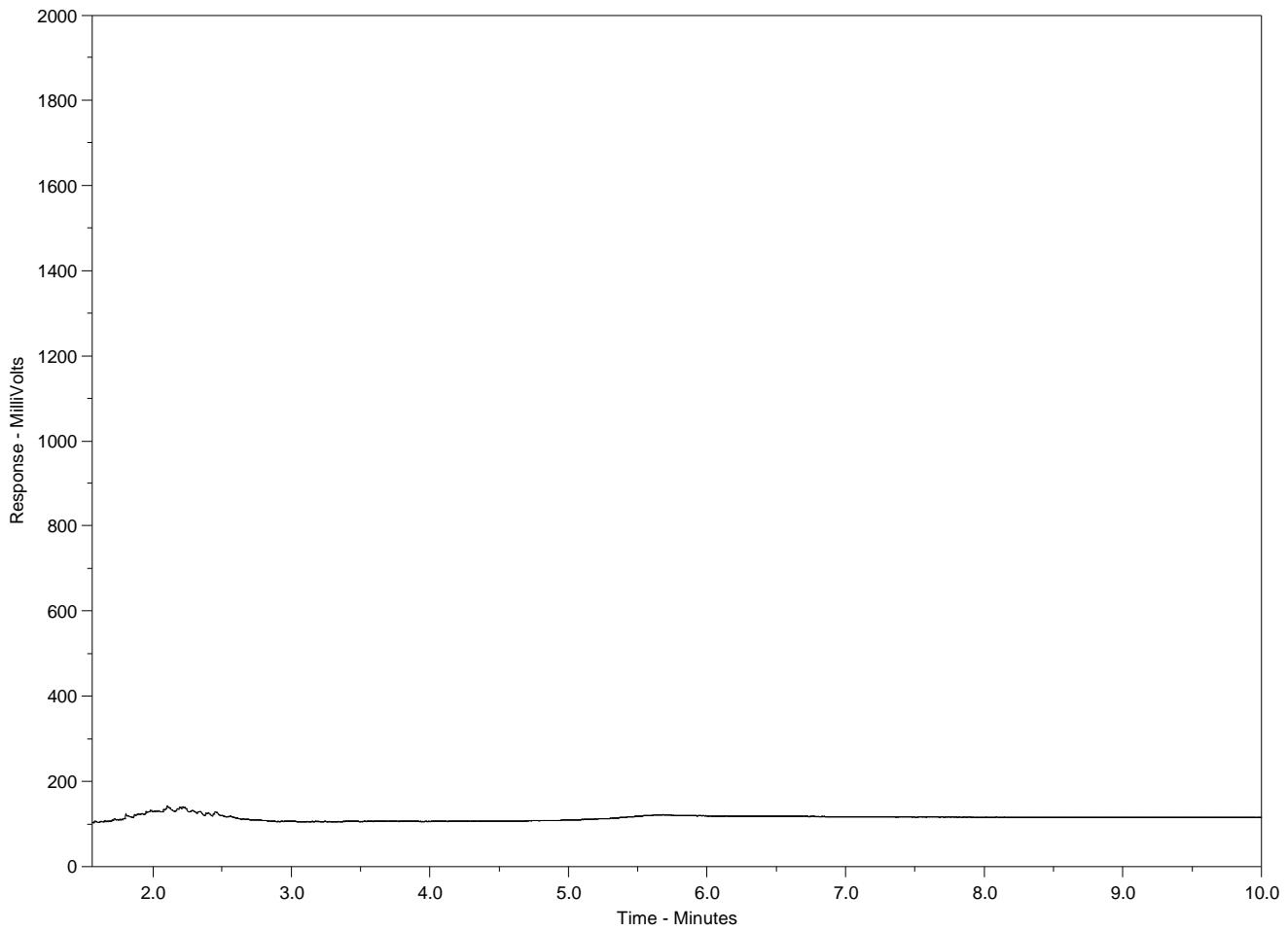
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at [www.alsglobal.com](http://www.alsglobal.com).

# CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT



**ALS Sample ID:** L2372762-13  
**Client ID:** 08-11



F2				F3		F4			
nC10	nC16			nC34		nC50			
174°C	287°C			481°C		575°C			
346°F	549°F			898°F		1067°F			
← Gasoline →				← Motor Oils/ Lube Oils/ Grease →					
← Diesel/ Jet Fuels →									

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

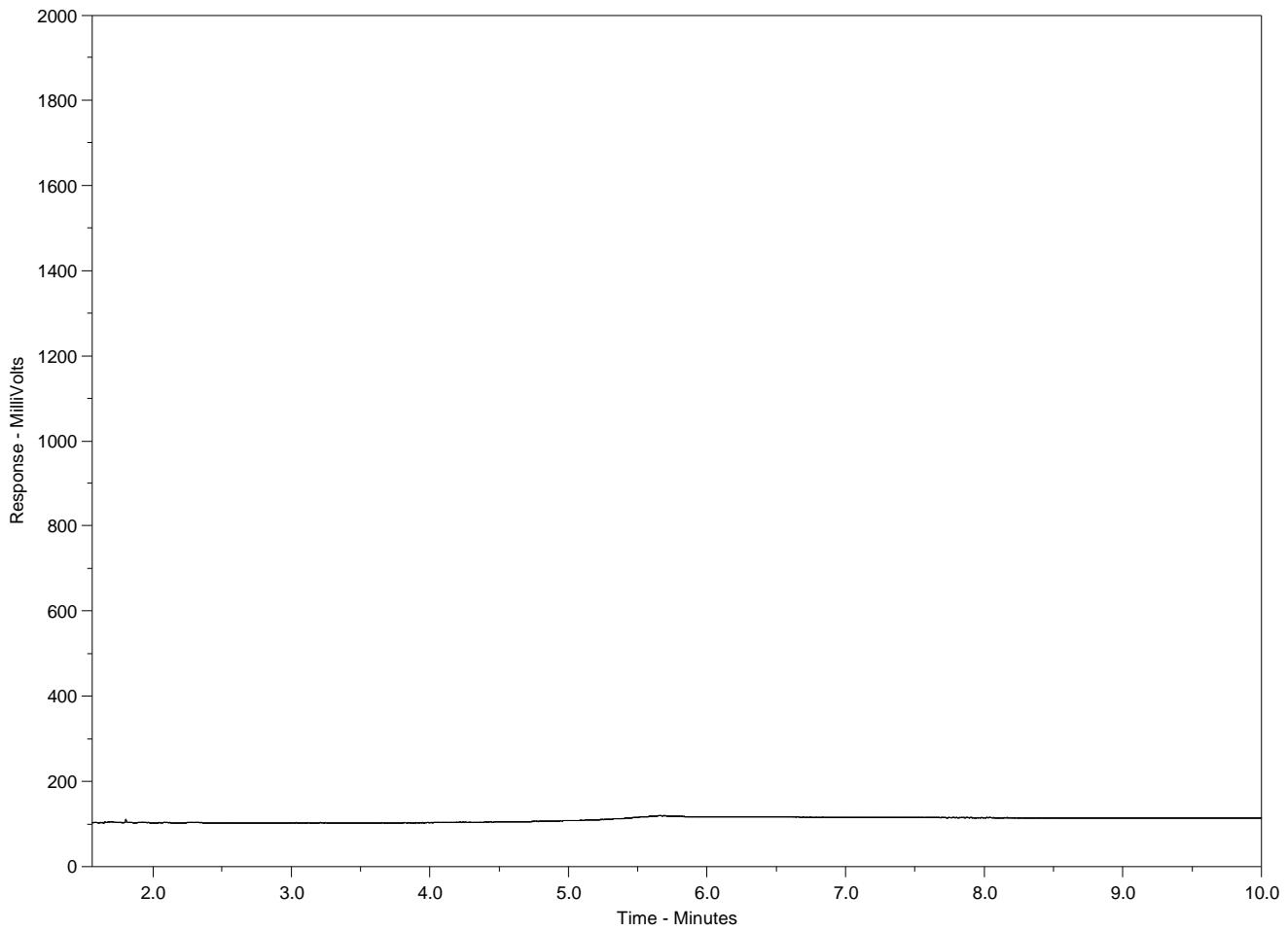
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at [www.alsglobal.com](http://www.alsglobal.com).

# CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT



ALS Sample ID: L2372762-14  
Client ID: 08-10



F2				F3		F4			
nC10	nC16			nC34		nC50			
174°C	287°C			481°C		575°C			
346°F	549°F			898°F		1067°F			
← Gasoline →				← Motor Oils/ Lube Oils/ Grease →					
← Diesel/ Jet Fuels →									

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

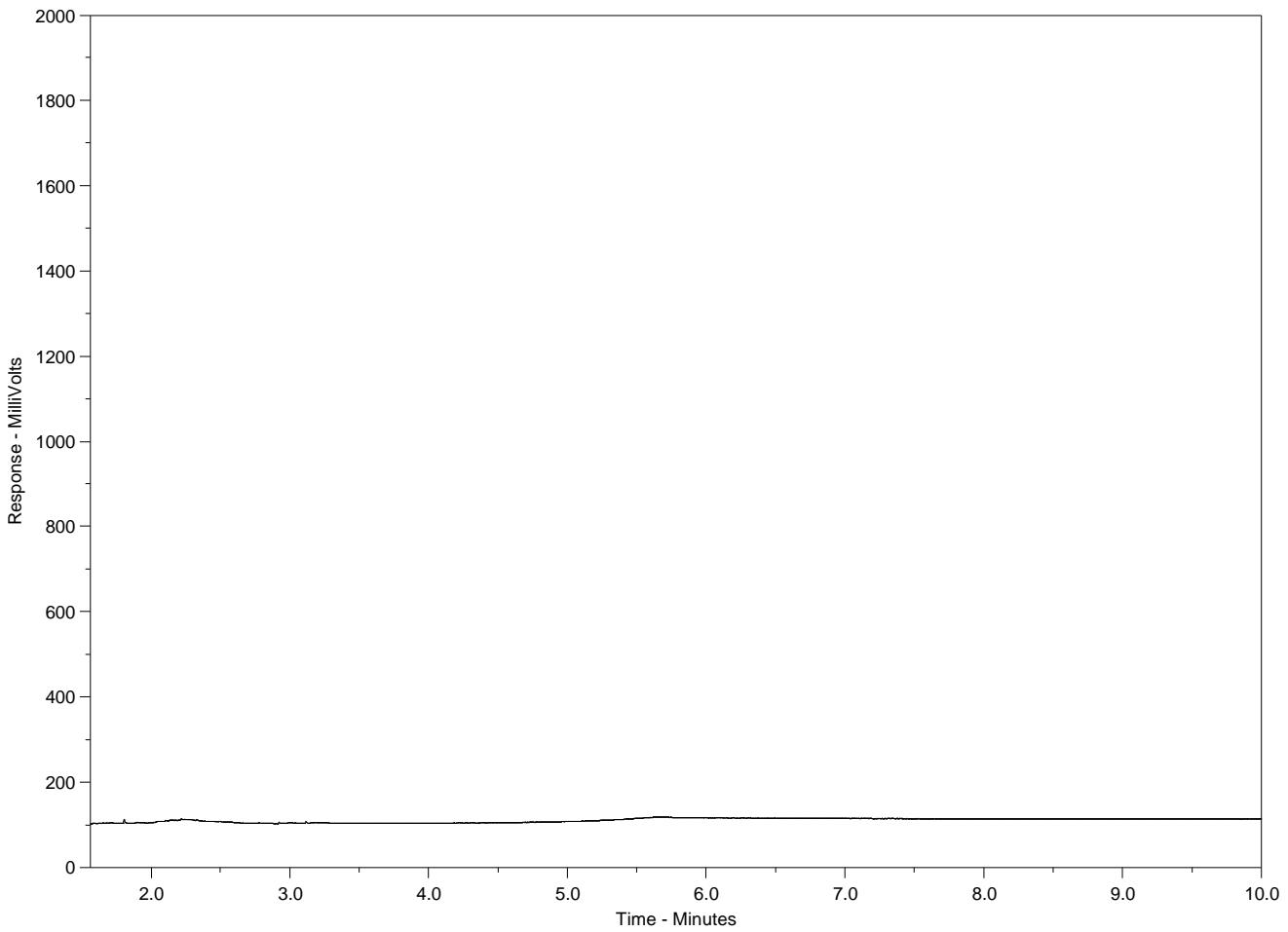
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at [www.alsglobal.com](http://www.alsglobal.com).

# CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT



**ALS Sample ID:** L2372762-15  
**Client ID:** 16-05



Retention Time Ranges (Approximate)			
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
← Gasoline →		← Motor Oils/ Lube Oils/ Grease →	
← Diesel/ Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

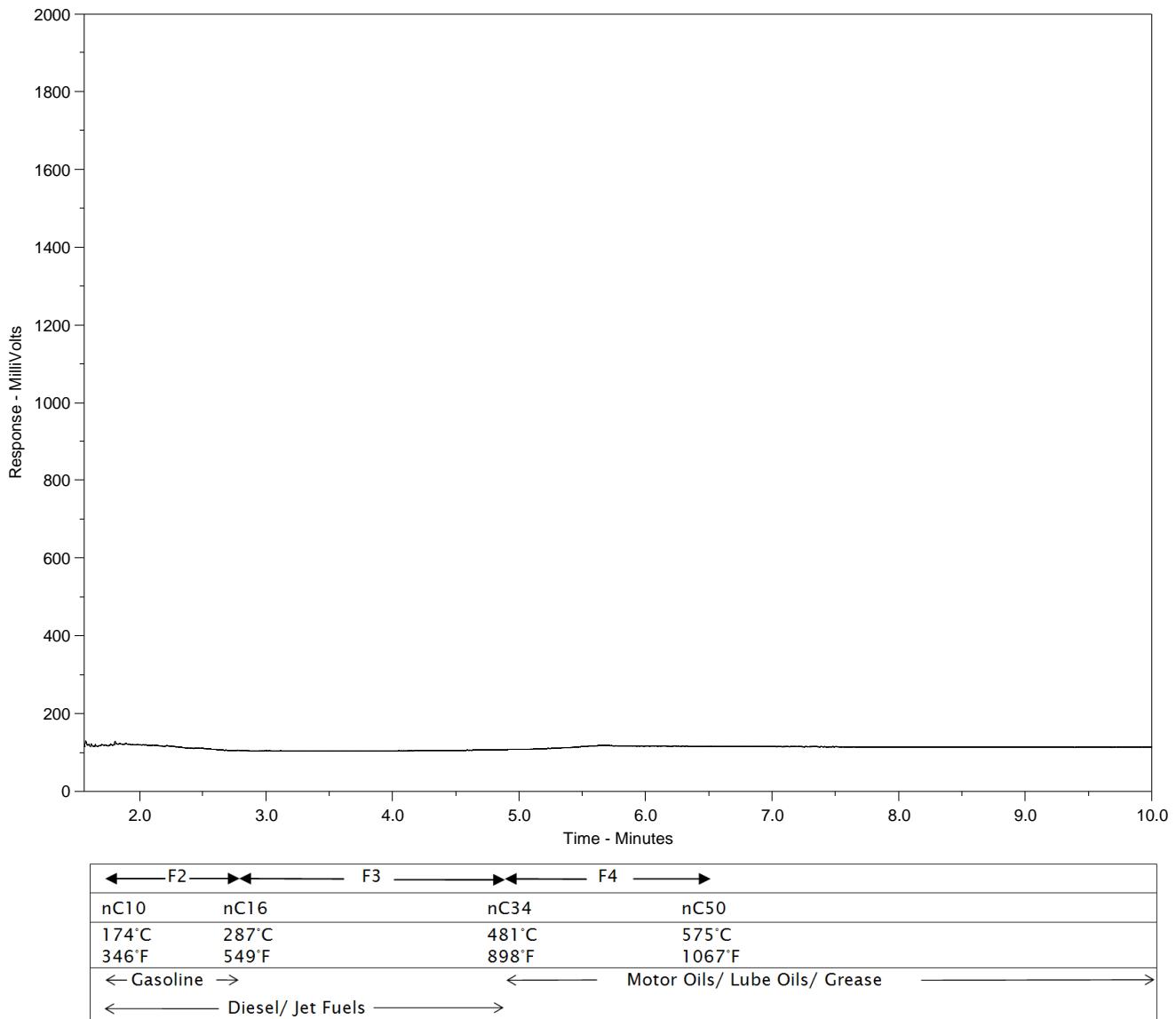
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at [www.alsglobal.com](http://www.alsglobal.com).

# CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT



ALS Sample ID: L2372762-16  
Client ID: 16-06



The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

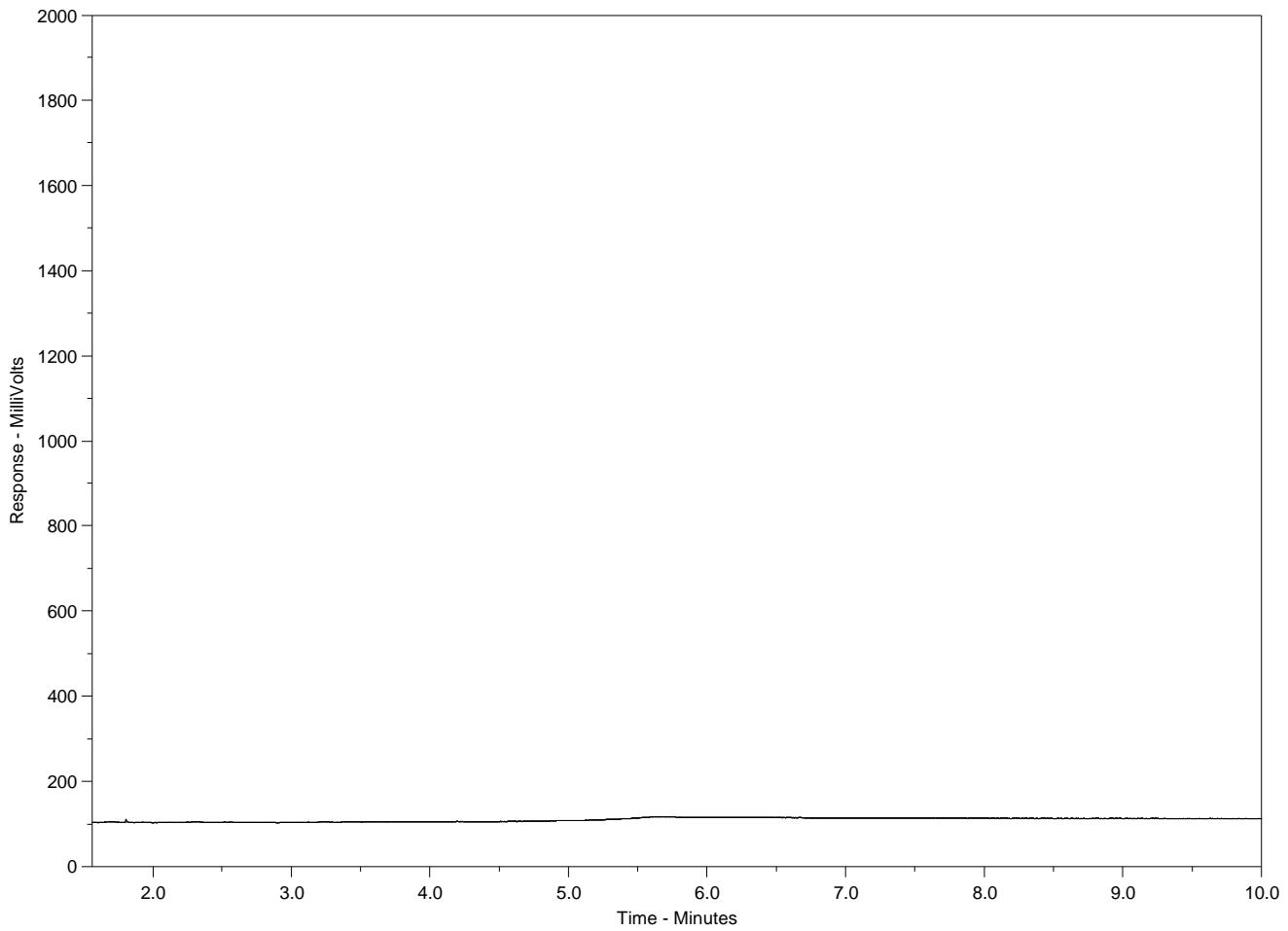
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at [www.alsglobal.com](http://www.alsglobal.com).

# CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT



ALS Sample ID: L2372762-17  
Client ID: 16-04



F2				F3				F4			
nC10	nC16			nC34		nC50					
174°C	287°C			481°C		575°C					
346°F	549°F			898°F		1067°F		Motor Oils/ Lube Oils/ Grease			
← Gasoline →				← Diesel/ Jet Fuels →							

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

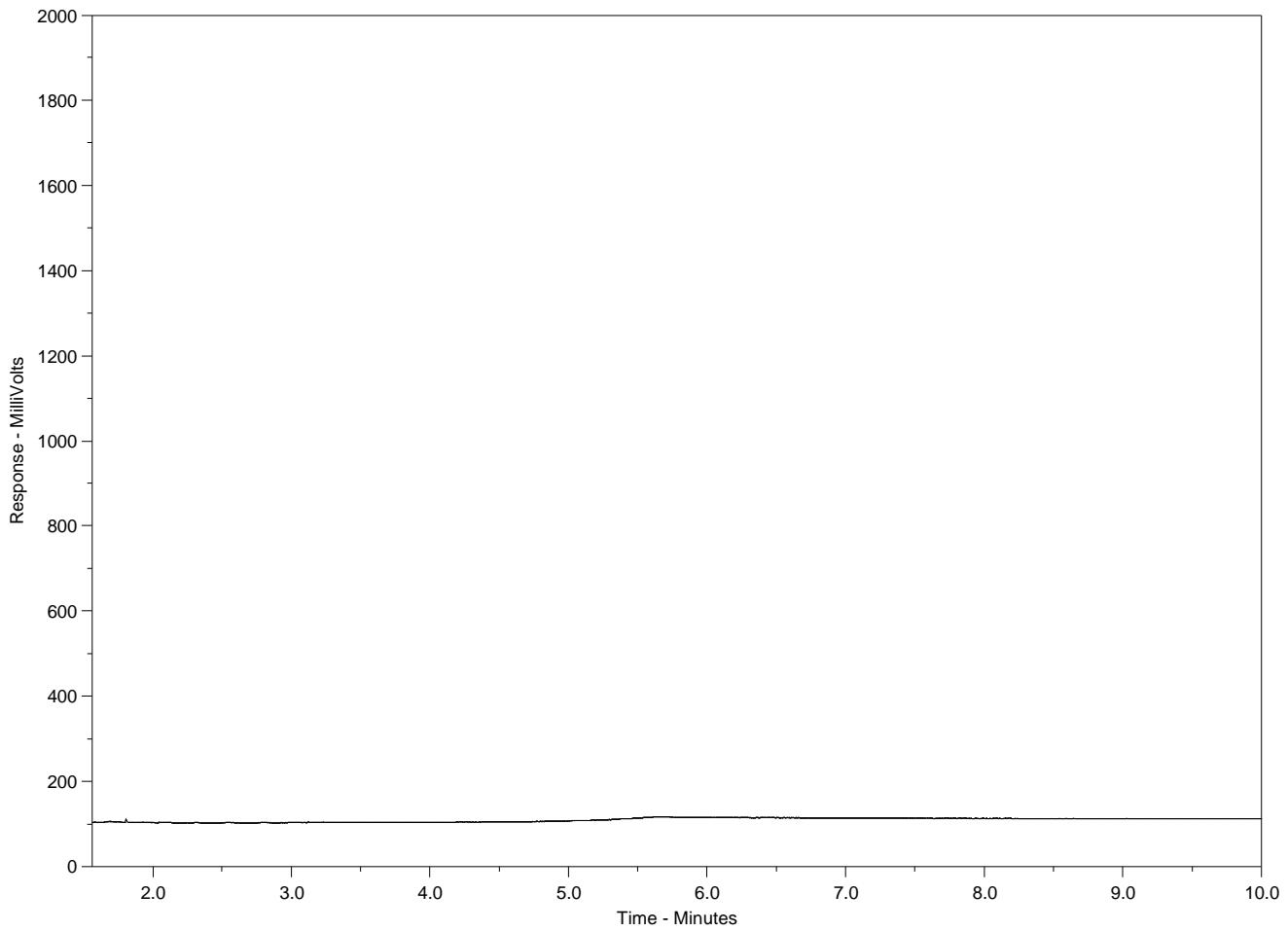
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at [www.alsglobal.com](http://www.alsglobal.com).

# CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT



ALS Sample ID: L2372762-18  
Client ID: A001



F2				F3		F4			
nC10	nC16			nC34		nC50			
174°C	287°C			481°C		575°C			
346°F	549°F			898°F		1067°F			
← Gasoline →				← Motor Oils/ Lube Oils/ Grease →					
← Diesel/ Jet Fuels →									

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

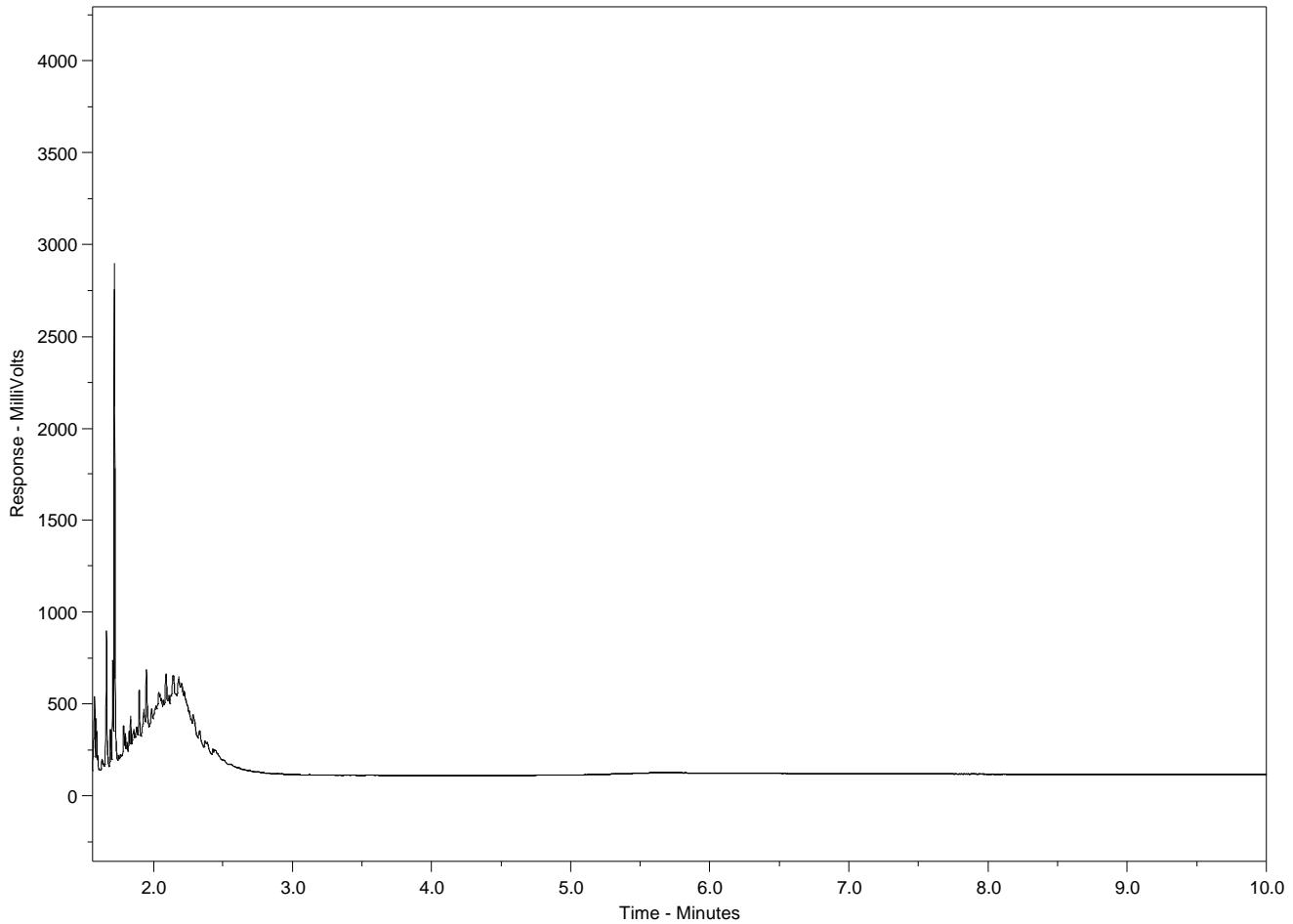
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at [www.alsglobal.com](http://www.alsglobal.com).

# CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT



ALS Sample ID: L2372762-19  
Client ID: B001



F2				F3				F4			
nC10	nC16			nC34			nC50				
174°C	287°C			481°C			575°C				
346°F	549°F			898°F			1067°F				
← Gasoline →				← Motor Oils/ Lube Oils/ Grease				→			
← Diesel/ Jet Fuels →											

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR library can be found at [www.alsglobal.com](http://www.alsglobal.com).



Chain of Custody (COC) / A

### Request Form



[www.alsglobal.com](http://www.alsglobal.com)

Canada Toll-Free: 1 800 668 9878

**ATTIX ALS barcode label here**  
(lab use only)

COC Number: 19-2019150927

Page 1 of 2

<b>Report To</b> Contact and company name below will appear on the final report		<b>Report Format / Distribution</b>		Select Service Level Below - Please confirm all EPA/TATS with your AM, surcharges will apply	
Company:	Wood	Select Report Format:	<input checked="" type="checkbox"/> PDF <input type="checkbox"/> EXCEL <input type="checkbox"/> EDI [DIGITAL]	Regular [R]	= Standard TAT if received by 3 pm, business days, no surcharges apply
Contact:	Kent Modrachwich		<input type="checkbox"/> EDI [DIGITAL]	4 day [P-4]	<input checked="" type="checkbox"/> Standard TAT if received by 1 PM, business days, no surcharges apply
Phone:	306-700-4992		<input type="checkbox"/> Company Results to Criteria on Report - provide details below if box checked	3 day [P-3]	<input type="checkbox"/> Same Day Weekend or <input type="checkbox"/> Statutory holiday [E-O]
			<input type="checkbox"/> Provide Details Below	2 day [P-2]	<input type="checkbox"/>
Street:	#1-1727 Francis St.				
City/Province:	Regina, Saskatchewan				
Postal Code:	S4N 7N2				
<b>Invoice To</b>	Same as Report To <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO				
	Copy of Invoice with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO				
Company:	Wood	Select Invoice Distribution:	<input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX	Data and Time Required for All EPA/TAT:	
Contact:	Subrina Godien	Email 1		For tests that can not be performed according to the service level selected, you will be contacted.	
	Email 2			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (FP) below	
	Email 3	Jane.Pavovsky@woodplc.com		Analysis Request:	
<b>Project Information</b>					
ULS Account # / Quote #:	Q65333	Oil and Gas Required Fields (client use)			
Job #:	ZEF0803019	AEC/Cust. Center:	PO#	Number of Containers	
O/A FE:	3612	Major/Minor Code:	Routing Code:		
SD:	Location:				
<b>ALS Lab Work Order # (lab use only)</b>		ALS Contact:	Sampler:	KSF	
<b>ALS Sample #</b> (lab use only)		<b>Sample Identification and/or Coordinates (This description will appear on the report)</b>	<b>Date</b> (dd-mm-yy)	<b>Time</b> (hh:mm)	<b>Sample Type</b>
16-03			26-Oct-19	10:25	GTEX - F1
17-06			25-Oct-19	11:00	Water <input checked="" type="checkbox"/> R <input type="checkbox"/> R <input type="checkbox"/> R <input checked="" type="checkbox"/> R
17-07			25-Oct-19	14:45	Water <input checked="" type="checkbox"/> R <input type="checkbox"/> R <input type="checkbox"/> R <input checked="" type="checkbox"/> R
17-05			25-Oct-19	13:20	Water <input checked="" type="checkbox"/> R <input type="checkbox"/> R <input type="checkbox"/> R <input checked="" type="checkbox"/> R
17-04			25-Oct-19	14:40	Water <input checked="" type="checkbox"/> R <input type="checkbox"/> R <input type="checkbox"/> R <input checked="" type="checkbox"/> R
17-03			25-Oct-19	15:40	Water <input checked="" type="checkbox"/> R <input type="checkbox"/> R <input type="checkbox"/> R <input checked="" type="checkbox"/> R
17-02			27-Oct-19	12:55	Water <input checked="" type="checkbox"/> R <input type="checkbox"/> R <input type="checkbox"/> R <input checked="" type="checkbox"/> R
					4
<b>SAMPLE CONDITION AS RECEIVED (lab use only)</b>					
<b>Drinking Water (DW) Samples<sup>1</sup> (client use)</b>		<b>Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below</b> (electronic COC only)			
Are samples taken from a Regulated DW System?		<input type="checkbox"/> Frozen <input type="checkbox"/> SIF Observations Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Ice Packs <input type="checkbox"/> Ice Cubes <input type="checkbox"/> Custody seal intact Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Cooling Initiated			
Are samples for human drinking water use?		One Dissolved Metals is Filtered and Preserved, the other dissolved metals is not preserved and not filtered			
<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	<input checked="" type="checkbox"/> NOSHIPMENT RELEASE (client use)	INITIAL SHIPMENT RECEPTION (lab use only)	FINAL SHIPMENT RECEPTION (lab use only)		
	Received by: 	Date: 28 Oct 19	Time: 11:00	Received by:	Date:

**REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION**

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.  
If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form



COC Number: 19-2019150927



**Chain of Custody (COC) Request**

L2372762-COFC

(lab use only)

here

Page 2 of 2

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Report To		Report Format / Distribution		Select Service Level Below - Please confirm all E&P/TAT with your AM. surcharges will apply	
Company:	Wood	Select Report Format:	Quality Control (QC) Report With Reference to Report	<input type="checkbox"/> E&P (DIGITAL)	<input checked="" type="checkbox"/> Regular [R]
Contact:	Kent Mudrewich			<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	<input type="checkbox"/> Standard TAT if specified by client/agency/TAT/no surcharges apply
Phone:	306-780-4992			<input type="checkbox"/> 3 day [P-3]	<input type="checkbox"/> Same Day, Weekend or Statutory holiday [E-0]
Address:	Company address below will appear on the final report			<input type="checkbox"/> 2 day [P-2]	<input type="checkbox"/> <small>if specified by client/agency/TAT/no surcharges apply</small>
City/Province:	#1-1727 Francis St.				
Postal Code:	SAN 7N2				
Invoice To:	Same as Report To				
	Copy of Invoice with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO				
Company:	Wood				
Contact:	Sabrina Godden				
Project Information	Q65333				
ALS Account # / Quote #:	Q65333				
Ob #:	ZE0803919				
VO / AFE:	3612				
SD:	Location:				
ALS Lab Work Order # (lab use only)	ALS Contact:	Sampler:	KSF		
ALS Sample # (lab use only)	Sample Identification and/or Coordinates <small>(This description will appear on the report)</small>	Date <small>(dd-mm-yy)</small>	Time <small>(hh:mm)</small>	Sample Type	
09-04		25-Oct-19	10:05	Water	R R R R P
08-04		26-Oct-19	12:20	Water	R R R R R
16-02		26-Oct-19	11:15	Water	R R R R R
08-06		25-Oct-19	16:40	Water	R R R R R
17-01		26-Oct-19	13:05	Water	R R R R R
08-11		27-Oct-19	11:30	Water	R R R R R
08-10		27-Oct-19	10:10	Water	R R R R R
16-05		26-Oct-19	15:20	Water	R R R R R
16-05		26-Oct-19	14:20	Water	R R R R R
16-04		26-Oct-19	9:30	Water	R R R R R
A001		27-Oct-19	12:55	Water	R R R R R
B001		26-Oct-19	13:00	Water	R R R R R
Number of Containers					
SAMPLE CONDITION AS RECEIVED (lab use only)					
Drinking Water (DW) Samples <sup>1</sup> (client use)		Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below			
Are samples taken from a Regulated DW System?		<input type="checkbox"/> Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/> Ice Packs <input type="checkbox"/> Ice Cubes <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/> Cooling Initiated <input type="checkbox"/>			
Are samples for human drinking water use?		One Dissolved Metals is Filtered and Preserved, the other dissolved metals is not preserved and not filtered			
<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> NOSHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)		FINAL SHIPMENT RECEPTION (lab use only)	
		Received by: RW	Date: 28 Oct 19 Time: 11:00	Received by:	Date: Time:

**REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION**

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

For tests that can not be performed according to the service level selected, you will be contacted.

For

Analysis Request

Oct-2019-2019

## Quality Assurance/Quality Control

### Laboratory QA/QC

The laboratory incorporates various QA/QC procedures to validate the accuracy of the laboratory results and assess the possibility of false positives attributed to analytical equipment contributions and laboratory control samples. The laboratory QA/QC includes the completion of laboratory blanks, blank spikes and blank spike recovery. A summary of QA/QC findings is presented in the attached laboratory results.

### Field QA/QC

The following guidance on relative percent difference is provided in the MEnv Guidance Document: Impacted Sites (2014):

*Precision is a quality control measure that can be used to evaluate duplicate environmental samples. It can be applied to both field duplicates, to assess the consistency of samples collected in the field, or to laboratory duplicates to assess the precision of the sample laboratory analysis. The RPD should be assessed with the characteristics of the analytical method and instrumentation used to determine laboratory concentrations, that is, with respect to the method detection limit (MDL) for the specific substance of concern (New Jersey Dept. of Environmental Protection 2014).*

*When evaluating sample duplicates precision may be considered poor if RPD values are outside of a reasonable range, even with sample heterogeneity considered (ANZECC 1996; USEPA 1990; USEPA 1997). Various values are proposed in the literature for acceptable values of RPD. Some reference manuals designate analyte specific values for acceptable RPD (Perket 1986). It is possible to establish a program specific value of RPD by collecting a sufficient number of duplicate samples (Csuros 1994), and each laboratory will have its own RPD acceptability values. As a general rule, RPD values of less than 20 per cent indicate good correlation where the concentrations are greater than five times the MDL. Data yielding RPD values greater than 20 per cent should be viewed with caution and RPD values of 50 per cent indicate a lack of sample representativeness (BC Ministry of Water Land and Air Protection 2003; Mitchell 2006).*

The RPD is calculated for specific parameters using the following equation:

$$\text{Field Duplicate RPD (\%)} = \frac{|C_1 - C_2|}{(C_1 + C_2)/2} \times 100$$

where: RPD = relative percent difference

C1 = first of two observed values from the field duplicate analysis

C2 = second of two observed values from the field duplicate analysis

RPD values can be calculated for parameters that contain detectable concentrations at least five times greater than the laboratory method detection limit.

Two duplicate groundwater sample sets were submitted as part of the field program. RPDs were calculated for benzene, ethylbenzene, xylenes and PHC Fraction F2 for duplicate sample set 17-01/B001. RPDs were not calculated for the remaining PHC parameters in the duplicate sets due to concentrations being less than five times the MDL.

The calculated RPDs for the groundwater sample sets were as follows:

- 17-01/B001: 1.57% to 12.91%

# Appendix H

## CCME NCSCS Score

**CCME National Classification System for Contaminated Sites (2008) version 1.3**  
**Pre-Screening Checklist**

<b>Question</b>	<b>Response (yes / no)</b>	<b>Comment</b>
1. Are <b>Radioactive material, Bacterial contamination or Biological hazards</b> likely to be present at the site?	No	If yes, do not proceed through the NCSCS. Contact applicable regulatory agency immediately.
2. Are there <b>no contamination exceedances</b> (known or suspected)?  Determination of exceedances may be based on: 1) CCME environmental quality guidelines; 2) equivalent provincial guidelines/standards if no CCME guideline exists for a specific chemical in a relevant medium; or 3) toxicity benchmarks derived from the literature for chemicals not covered by CCME or provincial guidelines/standards; or 4) background concentration.	No	If yes ( <i>i.e.</i> , there are no exceedances), do not proceed through the NCSCS.
3. Have <b>partial/incompleted or no environmental site investigations</b> been conducted for the Site?	No	If yes, do not proceed through the NCSCS.
4. Is there direct and significant evidence of <b>impacts to humans</b> at the site, or off-site due to migration of contaminants from the site?	No	If yes, automatically rate the site as Class 1, a priority for remediation or risk management, regardless of the total score obtained should one be calculated.
5. Is there direct and significant evidence of <b>impacts to ecological receptors</b> at the site, or off-site due to migration of contaminants from the site?	No	Some low levels of impact to ecological receptors are considered acceptable, particularly on commercial and industrial land uses. However, if ecological effects are considered to be severe, the site may be categorized as Class 1, regardless of the numerical total NCSCS score. For the purpose of application of the NCSCS, effects that would be considered severe include observed effects on survival, growth or reproduction which could threaten the viability of a population of ecological receptors at the site. Other evidence that qualifies as severe adverse effects may be determined based on professional judgement and in consultation with the relevant jurisdiction.
6. Are there indicators of significant <b>adverse effects in the exposure zone</b> ( <i>i.e.</i> , the zone in which receptors may come into contact with contaminants)? Some examples are as follows:  -Hydrocarbon sheen or NAPL in the exposure zone -Severely stressed biota or devoid of biota; -Presence of material at ground surface or sediment with suspected high concentration of contaminants such as ore tailings, sandblasting grit, slag, and coal tar.	Yes	To answer “yes”, two scenarios should be satisfied: (1) there has to be a high probability that receptors will be exposed to the contaminant source in the near future, and (2) the predicted impacts to ecological receptors after exposure must be significant (see question 5). A low probability of exposure resulting in significant impacts, or a high probability of exposure but with only low to moderate effects expected should not result in a Class 1 designation, neither would a low probability of exposure resulting in low-to-moderate effects.  If yes, automatically rate the site as Class 1, a priority for remediation or risk management, regardless of the total score obtained should one be calculated.
7. Do measured concentrations of volatiles or unexploded ordnances represent an <b>explosion hazard</b> ?	No	If yes, do not proceed through the NCSCS. Do not continue until the safety risks have been addressed. Consult your jurisdiction's occupational health and safety guidance or legislation on explosive hazards and measurement of lower explosive limits.

**CCME National Classification System for Contaminated Sites (2008) version 1.3**  
**Summary of Site Conditions**

<b>Site:</b>	Site will be identified by:	Civic Address
Civic Address: <i>(or other description of location)</i>	Railway Avenue and Second Avenue, Lang	
Site Common Name: <i>(if applicable)</i>		
Code identifier: <i>(e.g., FCSI 8-digit identifier)</i>		
Site Owner or Custodian: <i>(Organization and Contact Person)</i>	Cross Country Co-operative Association Limtied	
Legal description or metes and bounds:		
Approximate Site area:		
Parcel Identifier(s) [PID]: <i>(or Parcel Identification Numbers [PIN] if untitled Crown land)</i>		
Centre of site: <i>(provide latitude/longitude or UTM coordinates)</i>	Latitude: <u>49</u> degrees <u>55</u> min <u>12</u> secs; Longitude: <u>104</u> degrees <u>22</u> min <u>31</u> secs  UTM Coordinate: Northing _____ Easting _____	
Site Land Use:	Current:	
	Proposed:	
<b>Site Plan</b>	<b>To delineate the bounds of the Site a site plan MUST be attached. The plan must be drawn to scale indicating the boundaries in relation to well-defined reference points and/or legal descriptions. Delineation of the contamination should also be indicated on the site plan.</b>	
Provide a brief description of the Site:	The Site is located at the intersection of Railway Avenue and Second Avenue in Lang, Saskatchewan. The Site is comprised of a grass covered surface with a concrete pad located on the southeast portion of the Site, a portion of a concrete foundation on the central portion of the Site, a metal support structure on the northwest portion of the Site and a power pole located on the south central portion of the Site. The former bulk plant facilities included two UST nests located on the south central and southeast portion of the Site, an AST tank farm located on the north central portion of the Site, an oil warehouse building located on the northwest portion of the Site and a remediation equipment area with water tank located to the east of the former tank farm.	

**CCME National Classification System for Contaminated Sites (2008) version 1.3**  
**Summary of Site Conditions**

Affected media and Contaminants of Potential Concern (COPC):	BTEX, PHC Fractions F1 to F4 in soil and groundwater
--	--

Please fill in the "letter" that best describes the level of information available for the site being assessed:

Site Letter Grade

**C**

***If letter grade is F, do not continue, you must have a minimum of a Phase I Environmental Site Assessment or equivalent.***

Scoring Completed By:	Kent Muderewich
Date Scoring Completed:	11/25/2019

**CCME National Classification System (2008) version 1.3**

**Score Summary**

Site: Railway Avenue and Second Avenue, Lang

Scores from individual worksheets are tallied in this worksheet.

Refer to this sheet after filling out the revised NCSCS completely.

**I. Contaminant Characteristics**

	Known	Potential
1. Residency Media	4	---
2. Chemical Hazard	8	---
3. Contaminant Exceedance Factor	8	---
4. Contaminant Quantity	6	---
5. Modifying Factors	2	1

Raw Total Score **28**      1  
 Raw Combined Total Score (Known + Potential) **29**  
**Adjusted Total Score (Raw Combined Total/40\*33)** **23.9** (max 33)

**II. Migration Potential**

	Known	Potential
1. Groundwater Movement	12	---
2. Surface Water Movement	---	6.1
3. Soil	12	---
4. Vapour	---	8
5. Sediment Movement	0	---
6. Modifying Factors	0	---

Raw Total Score **24**      14.1  
 Raw Combined Total Score (Known + Potential) **38.1**  
**Adjusted Total Score (Raw Combined Total/64\*33)** **19.6** (max 33)

**III. Exposure**

	Known	Potential
1. Human Receptors	---	
A. Known Impact		
B. Potential		
a. Land Use		1
b. Accessibility		1
c. Exposure Route		
i. Direct Contact		3
ii. Inhalation		6
iii. Ingestion		5.5
2. Human Receptors Modifying Factors	0	---
Raw Total Human Score	0	16.5
Raw Combined Total Human Score (Known + Potential)	16.5	
Adjusted Total Human Score	16.5	(maximum 22)
3. Ecological Receptors	---	
A. Known Impact		
B. Potential		
a. Terrestrial		4.5
b. Aquatic		4
4. Ecological Receptors Modifying Factors	0	1
Raw Total Ecological Score	0	9.5
Raw Combined Total Ecological Score (Known + Potential)	9.5	
Adjusted Total Ecological Score	9.5	(maximum 18)
5. Other Receptors	0	---
Total Other Receptors Score (Known + Potential)	0	
Total Exposure Score (Human + Ecological + Other)	26	
<b>Adjusted Total Score (Total Exposure/46*34)</b>	<b>19.2</b>	(maximum 34)

**Site Score**

<b>Site Letter Grade</b>	<b>C</b>
<b>Certainty Percentage</b>	<b>75%</b>
<b>% Responses that are "Do Not Know"</b>	<b>12%</b>
<b>Total NCSCS Score for site</b>	<b>62.8</b>
<b>Site Classification Category</b>	<b>2</b>

Site Classification Categories\*:

- Class 1 - High Priority for Action (Total NCS Score >70)
- Class 2 - Medium Priority for Action (Total NCS Score 50 - 69.9)
- Class 3 - Low Priority for Action (Total NCS Score 37 - 49.9)
- Class N - Not a Priority for Action (Total NCS Score <37)
- Class INS - Insufficient Information ( $\geq 15\%$  of responses are "Do Not Know", or a site letter grade of F has been assigned)

\* NOTE: The term "action" in the above categories does not necessarily refer to remediation, but could also include risk assessment, risk management or further site characterization and data collection.

# Appendix I

## General Limitations

## LIMITATIONS

1. The work performed in the preparation of this report and the conclusions presented are subject to the following:
  - (a) The Standard Terms and Conditions which form a part of our Professional Services Contract;
  - (b) The Scope of Services;
  - (c) Time and Budgetary limitations as described in our Contract; and
  - (d) The Limitations stated herein.
2. No other warranties or representations, either expressed or implied, are made as to the professional services provided under the terms of our Contract, or the conclusions presented.
3. The conclusions presented in this report were based, in part, on visual observations of the Site and attendant structures. Our conclusions cannot and are not extended to include those portions of the Site or structures, which are not reasonably available, in Wood's opinion, for direct observation.
4. The environmental conditions at the Site were assessed, within the limitations set out above, having due regard for applicable environmental regulations as of the date of the inspection. A review of compliance by past owners or occupants of the Site with any applicable local, provincial or federal by-laws, orders-in-council, legislative enactments and regulations was not performed.
5. The Site history research included obtaining information from third parties and employees or agents of the owner. No attempt has been made to verify the accuracy of any information provided, unless specifically noted in our report.
6. Where testing was performed, it was carried out in accordance with the terms of our contract providing for testing. Other substances, or different quantities of substances testing for, may be present on Site and may be revealed by different or other testing not provided for in our contract.
7. Because of the limitations referred to above, different environmental conditions from those stated in our report may exist. Should such different conditions be encountered, Wood must be notified in order that it may determine if modifications to the conclusions in the report are necessary.
8. The utilization of Wood's services during the implementation of any remedial measures will allow Wood to observe compliance with the conclusions and recommendations contained in the report. Wood's involvement will also allow for changes to be made as necessary to suit field conditions as they are encountered.
9. This report is for the sole use of the party to whom it is addressed unless expressly stated otherwise in the report or contract. Any use which any third party makes of the report, in whole or the part, or any reliance thereon or decisions made based on any information or conclusions in the report is the sole responsibility of such third party. Wood accepts no responsibility whatsoever for damages or loss of any nature or kind suffered by any such third party as a result of actions taken or not taken or decisions made in reliance on the report or anything set out therein.
10. This report is not to be given over to any third party for any purpose whatsoever without the written permission of Wood.

**Wood Environment & Infrastructure Solutions, a Division of Wood Canada Limited**

# Appendix J

## Qualified Person Certificate



## Qualified Person Certificate

September 2015 | CSB | CSB19001

This form is to be used by a qualified person when providing an opinion to the minister on aspects such as an environmental protection plan, environmental sampling, operating plan or design plan under the Saskatchewan Environmental Code.

The form helps ensure consistent information is provided to the minister and provides direction to the qualified person and the regulated community.

### A. General Information

For assistance completing this form or for more information, please contact our Client Service Office:

Email: [centre.inquiry@gov.sk.ca](mailto:centre.inquiry@gov.sk.ca)

Tel (toll free in North America): 1-800-567-4224

Tel (Regina): 306-787-2584

For assistance on technical aspects related to certificate requirements please contact the RBR and Code Management Branch:

Email: [saskcodesecretariat@gov.sk.ca](mailto:saskcodesecretariat@gov.sk.ca)

**Once completed:**

All certificates (except for Water Main or Sewage Main) should be submitted to the Ministry of Environment through:

Online Services: <https://envonline.gov.sk.ca/login/>

Water Main and Sewage Main chapter related certificates should be submitted to the Water Security Agency through:

Email: [WSA.EngineeringandApprovals@wsask.ca](mailto:WSA.EngineeringandApprovals@wsask.ca)

Fax: 306-787-0780

**Mail:**

Environmental and Municipal Management Services Division  
Engineering Approvals Unit  
Water Security Agency  
420 – 2365 Albert Street  
Regina, SK S4P 4K1

### B. Qualified Person Contact Information

Name

Business Name

Address

Address

City/Town  Province  Postal Code

Country

Phone Number  Email

**Qualified Person Designation Number**   
(if applicable)

**On-line services transaction number**   
that this submission will be associated to  
(provided by organization)

## C. Organization Contact Information

Contact Name	<input type="text"/>				
Organization Name	<input type="text"/>				
Address	<input type="text"/>				
Address	<input type="text"/>				
City/Town	<input type="text"/>	Province	<input type="text"/>	Postal Code	<input type="text"/>
Country	<input type="text"/>				
Phone Number	<input type="text"/>	Email	<input type="text"/>		

## D. Certification

I do hereby certify that:

*Select chapter name*

1. I am a qualified person as that term is defined in the  
of the Saskatchewan Environmental Code.
  
2. To the best of my knowledge and the best of my professional ability, recognizing the standard of care  
expected of a professional doing this work, it is my professional opinion that: (select opinion(s) applicable to  
chapter specified in section 1)

### Corrective Action Plan Chapter

The methods and components in the environmental protection plan, if carried out in accordance with that  
plan, will satisfy the results-based objective described in section 2-1 of the chapter.

Any endpoint selected in the corrective action plan:

- properly addresses the substances of potential concern; and
- is appropriate for the use, proposed use or exposure scenarios with respect to the environmentally  
impacted site.

The laboratory analysis procedures produce accurate, precise and reliable results.

The quality assurance and quality control for sampling and analytical procedures produce accurate,  
precise and reliable results.

### Hydrostatic Testing Chapter

The methods and components in the environmental protection plan, if carried out in accordance with that  
plan, will satisfy the results-based objective described in section 2-1 of the chapter.

The quality assurance and quality control for sampling and analytical procedures produce accurate,  
precise and reliable results.

### Industrial Source (Air Quality) Chapter

The methods and components in the environmental protection plan, if carried out in accordance with that  
plan, will satisfy the results-based objective described in section 1-8 of the chapter.

The quality assurance and quality control for sampling and analytical procedures produce accurate, precise  
and reliable results.

## **Sewage Main Chapter**

The methods and components in the environmental protection plan, if carried out in accordance with that plan, will satisfy the results-based objective described in section 2-1 of the chapter.

The sewage main design plan, if carried out in accordance with that plan, will satisfy the requirements set out in subsection (2) of the Sewage Main Chapter.

Monitoring and commissioning requirements:

- there is no physical cross-connection between a sewage main and a water main that could permit the passage of any sewage or contaminated water into a supply of water that is intended for human consumption or a human consumptive use;
- there is no physical cross-connection between a sewage main and surface water or groundwater, unless otherwise approved by the minister;
- there is no physical interconnection between a sewage main and a storm sewer in a manner that would allow sewage in the sewage main to be discharged through the storm sewer;
- the sewage main is constructed to a sufficient depth to protect against freezing and to receive sewage from basements without flooding;
- the infiltration and exfiltration rate for pressure testing of polyvinyl chloride sewage mains and fittings does not exceed 4.6 litres per millimetre diameter of pipe per kilometre length per day; and
- the sewage main is designed and constructed to create a local environment free of odour complaints.

The quality assurance and quality control for sampling and analytical procedures produce accurate, precise and reliable results.

## **Site Assessment Chapter**

The methods and components in the environmental protection plan, if carried out in accordance with that plan, will satisfy the results-based objective described in section 2-1 of the chapter.

The report satisfies the requirements set out in the CAN/CSA-Z769-00 (R2008) - Phase II Environmental Site Assessment standard.

The quality assurance and quality control for sampling and analytical procedures produce accurate, precise and reliable results.

## **Water Main Chapter**

The methods and components in the environmental protection plan, if carried out in accordance with that plan, will satisfy the results-based objective described in section 2-1 of the chapter.

The water main design plan, if carried out in accordance with that plan, will satisfy the requirements set out in subsection (2).

Monitoring and commissioning requirements:

- the requirements for commissioning a water main set out in the Waterwork Start-Up Standard have been met;
- the water in the water main meets the concentration limits for the parameters set out in Table 3 in the Appendix of The Waterworks and Sewage Works Regulations, within the timelines set out in that Table;
- to ensure that the water meets the chemical treatment standards set out in clause 27(6)(b) of *The Waterworks and Sewage Works Regulations* when the water main is commissioned;
- to ensure that the water meets the microbial and bacteriological standards set out in subsection 29(3) of *The Waterworks and Sewage Works Regulations* when the water main is commissioned; and
- a pressure test of the water main has been conducted and the water main has passed that pressure test.

The quality assurance and quality control for sampling and analytical procedures produce accurate, precise and reliable results.

**3. I have the following qualifications and thereby fulfill the requirements to be a qualified person for the chapter mentioned in section 1: (select one)**

A person licensed to practise professional engineering or professional geoscience pursuant to *The Engineering and Geoscience Professions Act*.

A person who is a practising member as defined in *The Agrologists Act, 1994*.

A person who is an applied science technologist or certified technician pursuant to *The Saskatchewan Applied Science Technologists and Technicians Act*.

An operator who holds at least the corresponding certificate for the classification of the waterworks or sewage works that is set out in the Saskatchewan Water and Wastewater.

An individual who is designated by the minister.

**4. I have the following additional information to provide: (additional information)**

**5. The information submitted was prepared by me, or under my direct supervision, or was prepared by a third party(ies) and has been reviewed and accepted by me; and was prepared in accordance with an appropriate quality assurance/quality control system that ensured qualified personnel properly gathered and evaluated all the information contained in and underlying this submission.**

**6. In providing the opinion in section 2 and any additional information in section 4 I have:**

- a) taken all reasonable and prudent action to ensure that the certificate or opinion does not contain any misrepresentation;
- b) disclosed all material facts; and
- c) complied with any applicable professional standards.

**7. I am aware that this Qualified Person Certificate and any additional information submitted is deemed to be public information unless otherwise prescribed.**

**8. I am aware that a contravention of section 6:**

- a) could result in prosecution;
- b) could result in the imposition of an administrative penalty; and
- c) could result in a complaint to the professional association to which the qualified person belongs.

**Signature of Applicant**

**Date of Application**

**Professional seal, association member number  
or ministry qualified person designation number  
(if applicable)**