Phase II Environmental Site Assessment
Historic Waste Disposal Site
Riverside Light Industrial Park
The City of Red Deer

Prepared For: **The City of Red Deer**
Prepared By: **Tiamat Environmental Consultants Ltd.**
Date: **February 7, 2014**
File: **12-435**

Unit 107, 2719 - 7 Avenue NE, Calgary, Alberta T2A 2L9
T. 403-640-9009 F. 403-640-9006

EXECUTIVE SUMMARY

On behalf of The City of Red Deer, Tiamat Environmental Consultants Ltd. (Tiamat) has conducted a Phase II Environmental Site Assessment within the Riverside Light Industrial Park. This Phase II ESA focusses on determining the relative location and configuration of the area within the light industrial park where historic waste materials were suspected to be buried.

The objective of this ESA is to assess the environmental quality of the subsurface soil and groundwater underlying the site and address concerns identified in a Phase I ESA. This report presents the scope of work, a summary of the results and our professional opinion respecting the environmental quality of the site. This report is intended to complement the Phase I ESA dated October 10, 2013, prepared by Tiamat.

The key results of this Phase II ESA are as follow:

- Dry construction waste mixed with some sanitary waste was encountered at one of the ten testholes advanced across the light industrial park. The buried waste material is interpreted to lie within third party properties. However, there is a reasonable possibility; the waste material extends beneath a portion of the city roadways (46A Avenue and 61 Street) including the intersection of these two streets. The estimated footprint of the historical waste area is 5,500 m^2 (1.36 ac).

- Laboratory results of groundwater samples show a relatively minor level of impact to the local groundwater that is interpreted to be down gradient of the historic waste material. The concentrations are not considered to be an environmental concern relative to the commercial businesses in proximity to the identified waste material or the urban environment.

- Laboratory results of soil vapour show detectable petroleum and chlorinated hydrocarbon vapours. The test was taken during the summer and will not be reflective of soil vapours under frozen ground conditions. The types and relative concentrations of various chemical compounds in the soil vapour from the summer test event are indicative of buried waste but not considered to be an environmental concern to the various commercial properties within the light industrial park.

To better understand and manage the off-site environmental risks associated with this historic waste disposal site, several recommendations are presented in this report.

TABLE OF CONTENTS

TABLE OF CONTINUED…

1.0 INTRODUCTION

On behalf of The City of Red Deer, Tiamat Environmental Consultants Ltd. (Tiamat) presents this Phase II Environmental Site Assessment (ESA) report for a potential historic waste disposal site within the Riverside Light Industrial Park.

The objectives of this Phase II ESA are to determine the presence, the areal extent and the composition of the waste material. This report presents the scope of work, a summary of the results and our professional opinion respecting the subsurface environmental conditions associated with the historic waste materials. This report is intended to complement the Phase I ESA dated October 10, 2013.

1.1 Scope of Work

A summary of the key tasks for this Phase II ESA are outlined below:

Fieldwork

- Identify and locate underground utilities within the work areas on the site;
- Supervise the drilling of testholes (THs) located within the legal property lines of the site;
- Collect the soil samples for laboratory analyses of benzene, toluene, ethylbenzene, xylenes (BTEX), petroleum hydrocarbon fractions F1 (C_6-C_{10}), F2 (>C_{10}-C_{16}), F3 (>C_{16}-C_{34}), F4 (>C_{34}), EPA 8260 list of volatile organic compounds (VOCs), metals, chlorides (Cl^-) and nitrates/nitrites (NO_3^-/NO_2^-);
- Screen the soil cuttings to determine the feasibility to dispose of drill cuttings at a Class II landfill facility. Acceptance parameters for disposal include laboratory analyses of pH, soil flash point, paint filter, total organic carbon (TOC) and TCLP assay for BTEX compounds and metals;
- Each TH is completed with either a groundwater (MW) or vapour (VW) monitoring well or backfilled and abandoned;
- Collect groundwater samples for laboratory analyses of BTEX, hydrocarbon fractions F1, F2, VOCs, total and dissolved metals, Cl^-, sulfate (SO_4), ammonium (NH_4-N), phosphorus (P), TOC, chemical oxygen demand (COD), biochemical oxygen demand (BOD), NO_3^-/NO_2^-, total nitrogen (N), pH, electrical conductivity (EC), adsorbable organic halides (AOXs) and volatile fatty acids;
- Collect vapour samples for laboratory analyses of VOCs, oxygen (O_2), carbon monoxide (CO), carbon dioxide (CO_2), methane (CH_4), nitrogen (N), volatile hydrocarbons and siloxanes or volatile organic silicon compounds (VOSCs);

- Survey each test location for horizontal and vertical control relative to established ASCM (Alberta Survey Control Marker) datums within The City of Red Deer.

Report

- Prepare a report summarising the results including figures, tabulated data and our interpretation of the subsurface environmental conditions resulting from the historic waste disposal site.

2.0 SITE DESCRIPTION & ENVIRONMENTAL SETTING

This section provides general information of the site including a brief description of the location, surrounding land use(s), regional geology, hydrogeology and notable environmental conditions specific to the site.

2.1 Site Description and Environmental Setting

The potential historic waste material (site) is suspected to lie within the Riverside Light Industrial Park. This commercial light industrial park is utilized predominantly for various commercial businesses and light industrial activities. The industrial park lies within the NW 21-38-27 W4M.

The industrial park has been fully subdivided and serviced. Various commercial and light industrial business activities are present. Electrical, cable, sanitary and storm sewer utilities are located along the roadway network within the industrial park. The site is bounded by land designated for environmental preservation to the north and west and a recreation park to the south. Commercial developments are located further to the north and west along Gaetz Avenue. The nearest residential community is west of Gaetz Avenue. A site plan showing the site and the surrounding land uses is presented as Figure 1.

The Red Deer River is located approximately 200 m east of the site; this section of the river flows in a northerly direction.

A review of historical information indicates the historical waste disposal activity occurred between 1961 to the late 1970s, refer to the October 10, 2013 Phase I ESA.

2.2 Notable Environmental Conditions for Special Consideration

Historical information pertaining to the disposal of historic waste prior to and during the development of the Riverside Light Industrial Park appears to be limited.

Within the immediate area of the suspected historic waste, surface run-off appears to be directed along the asphalt paved network of roadways to municipal storm sewers. There are no obvious environmental concerns for surface water run-off or run-on at the site. The area is mapped outside of the 100-year flood fringe (Environment Canada and Alberta Environmental Protection, Edition 1, 1995). Following the recent severe June 2013 flood event, it is recognized the flood fringe may be updated following a review by the provincial authority.

Underground municipal utilities traversing the site include electrical cables, sanitary and storm sewers. Overhead electrical lines are also present throughout the site. The relative locations of underground municipal utilities are shown in Figure 1.

Generally, potential environmental concerns arising from historic waste are grouped into three broad categories:

- Ground stability issue where the historic waste lies;
- Continual generation of soil vapour from the decomposing waste materials; and
- Lateral transport of groundwater which passes through the waste material and ultimately migrates to adjacent properties within the Red Deer River Valley and potentially, the river.

Several geochemical processes and physical settlement occurs as the buried historic waste materials decompose. At this fully developed site, there is no obvious sign of differential settlement resulting from decomposing waste material. The surface topography exhibited by the road network shows no significant settlement occurring in an uneven manner.

Landfill gas is a by-product of a geochemical process associated with the decomposing waste materials. The soil vapours comprising of constituents from landfill gas can migrate in the subsurface. The geochemical process also yields soluble hydrocarbons to the groundwater system with some volatile components capable of degassing into the soil vapour regime.

As surface infiltration percolates through the historic waste materials and contacts the groundwater table, leachate is formed. This leachate is a potentially polluting liquid that can adversely affect the local groundwater system.

Elements of testing in this Phase II ESA is an initial assessment of the subsurface conditions for soil vapour and leachate near the perimeter of the historic waste site relative to existing and potential future land developments.

2.3 Regional Geology and Hydrogeology

A summary of the published geological and hydrogeological information is presented in the October 10, 2013 Phase I ESA report.

Within the immediate area of the historic waste, the Red Deer River is located approximately 200 m east of the site. Based on a local topographic map for this area, regional groundwater flow is expected to be in a east direction towards the Red Deer River. There is no notable environmental concern for surface water run-off or run-on relative to the waste site.

It should be noted that local topography, geology, land development and soil disturbances might influence the local movement and pattern of groundwater. Furthermore, groundwater may also fluctuate from seasonal and climatic conditions.

2.4 Previous Investigations and Historic Perspective

A Phase I ESA for the site was conducted by Tiamat in 2013:

- Phase I Environmental Site Assessment, Historic Waste Disposal Sites, Riverside Light Site, October 10, 2013, prepared by Tiamat.

No previous reports or documentation was available to Tiamat for review. Aerial photographs indicate the potential historic waste disposal activity was suspected to have occurred between 1961 to the late 1970s.

The key results of the 2013 Phase I ESA are as follows:

- Historic information indicates the site and its adjacent lands were undeveloped until the late 1950s. Currently, the site is zoned I1 for light industrial and business use.

- Aerial photographs suggest the historic disposal activity to have occurred between 1961 to the late 1970s, during the development of the light industrial park.

- Information at various regulatory agencies appears to be scarce. There was no obvious indication of any outstanding environmental concern associated with the site.

- The Red Deer River is the closest permanent surface water body and is approximately 200 m to 400 m, more or less, from the north and south limits, respectively of the site.

- Interpreted water source wells within the quarter section of the site indicate records for 22 registered water well records within a quarter section radius (about 805 m) of the site.

- The Waskasoo Park and a natural area bound the west side of The Red Deer River in proximity to the site. A public campground facility (Lions Campground) lies within the Waskasoo Park.

- The site is surrounded by environmental preservation with Parkland Mall located less than 300 m to the northwest on a ground elevation which is notably 5 m to 6 m, more or less, higher than the industrial park. Some residential houses are also present further west of the mall. There are presently no obvious activities on the adjacent lands that are interpreted as an environmental concern relative to the site.

The findings of the 2013 Phase I ESA identify several uncertainties associated with this historic waste disposal site. In consultation with the Management of The City of Red Deer, a recommended Phase II ESA should include an attempt to determine whether waste material is composed of dry waste or municipal sanitary waste. It is understood this information would assist the City to identify whether further efforts are necessary to manage environmental risks associated with historic waste material at this site relative to existing and future land uses within and in the vicinity of this site.

3.0 FIELDWORK

This section describes the fieldwork for this Phase II ESA. A description of the field methods and data quality assurance implemented by Tiamat for this Phase II ESA is provided in Appendix A. Select photographs of testholes and groundwater monitoring wells are presented in Appendix C.

3.1 Underground Line Locates and Testhole Drilling

Prior to drilling, public and private underground utilities within the work area were identified and marked. The subsurface investigation commenced on Monday, June 17 and was completed on Wednesday, June 19, 2013.

A representative of Tiamat supervised an auger drill mounted on a truck rig from Earth Drilling Co. of Calgary, Alberta to advance 152 mm diameter testholes at various locations across the site. The testhole locations were selected with consideration of access for the drill rig. The drilling program is intended to determine whether subsurface waste material is present, its composition and areal footprint.

Each testhole was drilled vertically to depths ranging between 4.6 m to 8.5 m below the ground surface. On completion of drilling either a groundwater monitoring well or soil vapour well was installed, or the testhole was backfilled and abandoned.

Each monitoring well consists of a 51 mm diameter PVC machine slotted screen section and a solid section of pipe. The annulus of the testhole was backfilled with Sil-9 sand to approximately 0.3 m above the screen section followed by granular bentonite to about 0.3 m from the surface. An above ground lockable protective steel well protector was installed at each well location. Subsequent to establishing the depth of the testhole for a soil vapour well, a dedicated soil vapour well was assembled. Typically the soil vapour well consists of a 30 cm 0.020 PVC screen and a 25 mm diameter PVC solid standpipe. The screen section and brass valve assembly are mechanically threaded with stainless steel locking set screws

Each test location was surveyed for horizontal and vertical control by MRAC Surveys Ltd. To ensure the survey coordinates and elevations (via the GPS) of each test location are reasonably accurate, multiple ASCM markers located throughout the City and in proximity to the site were referenced. Elevations for each test location are relative to an established geodetic datum for the ASCM as established by the Alberta Survey Control Network, the relative ASCM information is provided in Appendix A. A summary of the well completion details is presented in Table 1 and the relative locations are shown on Figure 2. A copy of the testhole logs are provided in Appendix B.

The soil profile was visually classified during drilling and bulk grab samples were retrieved at approximately 0.6 m intervals for field screening. In the event significant MSW (municipal solid waste) material is encountered an RKI Eagle 2 capable of simultaneously measuring the combustible and volatile vapour in the testhole at the surface was used. This was to assess whether potential methane and other VOCs were emanating from the testhole at concentrations deemed potentially hazardous for drilling operations. For example, should combustible vapours exceed the lower explosive limit or elevated VOCs, greater than 35 ppm, drilling would temporarily cease until the level of vapours have subsided. Each on-site worker had a dedicated half-mask respirator with organic vapour filter as part of their respective personal protective equipment during drilling.

The drilling protocol for testhole(s) encountering MSW was to advance the drill such that contact is made with the underlying native soil. At locations where MSW was not found, the testhole was advanced to an appropriate depth to install either a soil vapour well or a groundwater well. Solid stem tooling was used in order to properly install the monitoring well as the encountered soil consisted mainly of clay and sand. Drill cuttings were stored in 1 cubic meter capacity tote bags for off-site disposal.

3.2 Site Monitoring and Groundwater Sampling

On Thursday, August 1, 2013, monitoring wells were field tested. Field measurements consisted of headspace vapours and the depth to liquid in each well. Groundwater samples were collected from the three newly installed monitoring wells, one located (MW-02) in an interpreted up-gradient position and two located (MW-01 and MW-03) on the down gradient margin relative to the site.

4.0 RESULTS

The area interpreted to exhibit buried historic waste materials lies beneath a section of a public roadway and (likely) extends onto private land. The waste area lies within the Red Deer River Valley and the nearest residential land use is about 210 m west of the southwest margin of the Riverside Light Industrial Park and is beyond the prescribed 300 m set back to a landfill. The residential properties are also at a ground elevation 5 m to 6 m above this light industrial park.

Accordingly, the commercial/industrial criteria have been referenced to assess the environmental quality of the subsurface soil and groundwater beneath the site. It should be noted the assessment is to illustrate the relative environmental quality and is not intended to infer remedial objectives.

This section summarizes the field observations during drilling and field testing for this Phase II ESA. For clarity, the analytical results for soil, groundwater and soil vapours are discussed in Section 5.

4.1 Soil Profile

Testholes which did not encounter buried waste material generally exhibited a variable soil texture of sand, gravel and clay. Following surficial fill material (sod and loam or asphalt), the soil encountered was either a sand or gravel to a depth of 1.6 m to 6.1 m. Variable amounts of clay fill was encountered in some testholes. Native sand and gravel underlies the fill material. At TH-01, a shale unit was identified to be bedrock.

Where found, the thickness of the soil cover (predominantly sod and loam) ranged from approximately 10 cm to 20 cm. In general, relatively inert construction debris (brick, timber and minor amounts of glass) mixed with clay was encountered mainly in TH-01. Trace to some timber fragments were noted at VW-01, MW-01, MW-03 and TH-10.

The relative location of each testhole is shown on Figure 2. Select cross sections of the interpreted soil stratigraphy are presented as Figure 3. A copy of the testhole logs is presented in Appendix B. Select photographs of the drilling are presented in Appendix C.

To verify the environmental quality of the drill cuttings, soil samples from each soil bag were submitted for laboratory testing. The soil tests performed were to assess whether the drill cuttings can be disposed at The City Waste Management Facility. The analytical results are discussed in Section 5.1.

4.2 Groundwater Conditions

Static depth to groundwater was measured at each monitoring well. The relative groundwater elevations are presented on Table 2. The groundwater elevations are plotted and the interpreted contours are illustrated as Figure 4. The average depth to the groundwater on Thursday August 1, 2013 was 5.1 m below the ground surface. The measured groundwater elevations suggest the local groundwater exhibits a very gentle horizontal gradient with a flow pattern to the east-southeast, towards the Red Deer River.

During sampling of groundwater, the purged water was slightly murky with no unusual odour encountered during purging. General water quality indices were measured during purging and at the time of sampling. A summary of the field measured indices is presented as Table 4A.

Water samples were preserved and submitted to the laboratory for analysis. The results of groundwater laboratory tests are presented in Tables 4B to 4D and discussed in Section 5.2.

4.3 Headspace Vapours

A summary of the concentration of soil vapours as interpreted from headspace measurements from the existing monitoring wells is tabulated in Table 2. The headspace vapours were measured in the groundwater monitoring wells and the soil vapour wells.

Combustible vapours from the headspace of the groundwater monitoring wells ranged between 155 ppm (MW-02) to 510 ppm (MW-01). Volatile vapours from the headspace were not detected, less than 0.1 ppm. Laboratory results for the groundwater samples are discussed in Section 5.2.

Combustible vapours from the soil vapour wells were 1,300 ppm (VW-02) and 1,750 ppm (VW-01). Volatile vapours were not detected at VW-01 and was 1 ppm at VW-02. Laboratory results for the soil vapour samples are discussed in Section 5.3.

The field measured headspace vapours suggest combustible soil vapours to be prominent at VW-01 and VW-02. The combustible soil vapours (up to 14% LEL) appear to be consistent with the laboratory results from the Summa Canisters. The combustible vapours, including methane, may be attributed to the decomposing organic matter within the fill encountered in the subsurface. Decomposing organic matter in a water saturated

environment can yield significant quantities of methane. The concentration of volatile vapours was less than the limit of instrument detection (0.1 ppm) and is considered negligible.

5.0 SUMMARY OF ASSESSMENT

This section further discusses our observations during the field work along with an interpretation of the laboratory results in respect to potentials for an adverse environmental impact.

Buried waste material was encountered in one testhole (TH-01) advanced across the site. The waste material is present within the clay fill and is predominantly construction type waste materials with a minor percentage of sanitary type waste. Foreign material at six other testholes consisted of trace to some wood fragments and one testhole with a piece of discarded plastic. The other three testholes exhibited soil with no obvious waste material.

5.1 Quality of Subsurface Soil

The drill cuttings for this Phase II ESA were stored in a pair of one cubic meter soil bags. A soil sample from each soil bag was submitted for laboratory testing. Analytical results for each soil bag indicate the drill cuttings satisfy the acceptance guidelines for disposal at The City of Red Deer Class II Waste Management Facility.

A summary of the soil test results are presented as Table 3. A copy of the laboratory reports for soil are provided in Appendix A.

Notable buried waste material was encountered at one of the ten testholes. On the basis of the ground disturbance noted on historic aerial photographs and the observations from the testhole drilling program, an interpreted area of the waste is presented on Figures 2 and 4. The interpreted area is estimated to be 5,500 m^2 (1.36 ac) and appears to be situated primarily within third party land. There is a likelihood the noted waste material may extend beneath a portion of the intersection and the bounding roads (46A Avenue and 61 Street). Various underground utilities and overhead electrical lines limited additional test locations within the roadways. Testholes on the north side of 46A Avenue showed a small amount of wood fragments and no obvious waste material.

5.2 Quality of Local Groundwater

For this initial Phase II ESA, three test locations were sampled for groundwater, namely MW-01 to MW-03. MW-02 was located in the interpreted up gradient location and MW-01 and MW-03 were deemed to be at down gradient locations relative to MW-02. The

calculated elevations of the groundwater is presented as Figure 4. On Thursday, August 1, 2013, the average depth to the groundwater was about 5.1 m below the ground surface. The horizontal gradient varies from approximately 0.13 cm/m (southeasterly component) to 0.16 cm/m (eastward component) and is considered to be a gentle gradient.

Field measured water quality indices were recorded during purging and at the time of sampling (August 1, 2013, sunny, no precipitation prior to or during). The groundwater is mildly alkaline with pH ranging between 7.64 and 8.35. Electrical conductivity and total dissolved solids were greatest at MW-03, 1,378 µS/cm and 1,287 mg/L respectively. Purged groundwater was mildly murky with no unusual odour or discolouration. Negative redox potentials were encountered at MW-01 (-11.9 mV) and MW-03 (-68.1 mV), which are indicative of a mild oxidizing condition in the ground water. MW-01 and MW-03 are located down gradient of the interpreted area of historic waste. The redox potential at MW-02, up gradient, was +45.1 mV.

General Water Quality parameters are tabulated in Table 4B, with the exceptions of cadmium and ammonia (as nitrogen) exceeding the referenced Tier 1 Guideline. The relative concentration of ammonia at MW-03 was 16 mg/L; ammonia was not detected at the other well locations. The concentration of ammonia at MW-03 may be indicative of impact by the historic waste material that is immediately upgradient of the monitoring well. Analogously, the concentration of total and Kjeldahl nitrogen at MW-03 exhibited a similar pattern relative to the results from the other monitoring wells. A comparison of Total nitrogen, Kjeldahl nitrogen, nitrate and nitrite at MW-01 suggests nitrates to be the predominant form of dissolved nitrogen in the groundwater at MW-01.

The reported alkalinity ranges from 350 mg/L to 940 mg/L. Typical groundwater has an alkalinity not more than 100 mg/L and seldom exceeds 300 mg/L in a natural setting. Similarly, the concentration of bicarbonates in the groundwater samples may also infer a higher concentration of carbon dioxide in the subsurface.

Table 4C is a tabulation of total and dissolved metals from each groundwater sample. The concentrations of specific metals exceed the referenced Alberta Tier 1 Guideline. The companion dissolved concentration of heavy metals shown in Table 4C were low or not detected, suggesting the reported total concentration as likely naturally occurring in the soil and not in soluble forms. The exceptions are the common cations where the relative concentrations between total and dissolved are of relative magnitude.

VOCs in groundwater were not detected in any monitoring wells. The results are tabulated in Table 4D and a copy of the laboratory reports are presented in Appendix B, attached.

5.3 Interpretation of Soil Vapours

For this Phase II ESA, an initial evaluation of the soil vapour was performed at locations analogous to the groundwater tests. This approach was undertaken to develop a "snap-shot assessment" of the local groundwater and soil vapour relationship, specifically at the interpreted down gradient margin of the historic area of the waste materials.

To reduce uncertainties concerning the assessment of soil vapour, the construction of soil vapour wells, sample collection and laboratory testing of soil vapour was performed in accordance with a standardized practice. Specifically, ASTM D5314-92(2006) Standard Guide for Soil Gas Monitoring in the vadose zone.

Field headspace vapour measurements were performed by an RKI Eagle 2 equipped with dual sensors to concurrently measure combustible and volatile vapours. Combustible vapours at the soil vapour wells, VW-01 and VW-02, were between 1,300 ppm to 1,750 ppm. No notable levels of volatile vapours were detected.

Two (2) soil vapour wells (VW-01 and VW-02) were sampled. Field measurements during purging of vapours in the well headspace as well as measurement of ambient bariometric pressure at each well location is summarised in Table 5A. There was a slight negative pressure differential at VW-01 (-0.34 kPa) and no notable pressure gradient at VW-02 on the day of testing (Thursday, August 1, 2013). Thus, the soil vapours are interpreted to be in a quasi-steady pattern.

Sample collection consisted of two methods of collection. One 1.4 L laboratory certified Summa Canister® and one sterile 1 L Tedlar Bag® sample were used. The sample collected by the Summa Canister® was analysed for general air indices (oxygen, carbon dioxide, carbon monoxide, nitrogen and methane) and a suite of VOCs in accordance with US EPA TO14A for toxic organic compounds in air. The sample collected in the Tedlar Bag® was analysed for volatile organic silicon compounds (VOSCs), commonly referred as siloxanes.

General analytical indices for soil vapour are presented in Table 5B. The results show nitrogen to be the predominant component in the soil vapour. Methane at both well locations were approximately 27.4% (VW-01) and 17.6% (VW-02) by volume. The reported proportions of the main components: oxygen, nitrogen, carbon dioxide and methane appear to be acceptable, total aggregate 100%, more or less.

The concentration of methane at VW-01 and VW-02 appear to be consistent with field instrument measurements for gross combustible vapours.

The composition of other volatiles measured from the soil vapour sample from VW-01 and VW-02 is presented in Table 5C. Petroleum hydrocarbon constituents including BTEX compounds, various VOCs and chlorinated hydrocarbons were detected.

The specific chemicals include:

Petroleum Hydrocarbons
Total BTEX compounds up to 37.64 ppb
Volatile aliphatic compounds ranging from 1.4 mg/m^3 to 3.56 mg/m^3
Extractable aromatic compounds ranging from 0.089 mg/m^3 to 0.157 mg/m^3

Chlorinated Hydrocarbons
Freon 12, chloromethane, vinyl chloride, trichloroethylene (TCE), tetrachloroethylene (PCE) each less than 341 ppb.

Other VOCs
Ethanol, 2-propanol, methyl ethyl ketone, ethyl acetate, styrene, 1,2,4-trimethylbenzene, hexane, heptane, cyclohexane, tetrahydrofuran, 2,2,4-trimethylpentane and carbon disulfide each less than 34.4 ppb.

As shown in Table 5C, volatile aliphatic petroleum hydrocarbons between carbon chain 5 and carbon chain 16 and aromatic hydrocarbon compounds between carbon chain 8 and carbon chain 12 were detected. Hence, semi-volatile petroleum hydrocarbon vapours are present in the subsurface at varying concentrations. It should be noted that the above results do not imply the composition of the soil vapour is a constant as subsurface biodegradation and geochemical reactions are continuous along with influences by climatic factors. In addition, the measured concentrations are influenced by climatic conditions, ground conditions (frozen versus frost-free) and moisture content in the vadose zone, natural biodegradation and geochemical reactions.

Twenty six of the 64 VOCs assayed were detected (about 41%) from the Summa Canister® sample. The 26 VOCs identified in the soil vapour samples include a variety of petroleum and chlorinated hydrocarbons, ketones and other oxygenated volatile hydrocarbons. The results indicate constituents in the soil gas are likely attributed to landfill gas and the decomposing waste materials. The relative concentrations are considered to be relatively low and are not interpreted to be a significant environmental concern for the present land use.

Table 5D presents the results of analyses of the soil vapour sample for siloxanes. Trimethylsilanol and siloxanes D3, D4, D5, D6 and L4 were identified in each soil vapour sample with the maximum concentration of 0.05 ppb. The reported aggregate mass at each well was 1.6375 mg/m^3 (VW-01) and 0.9083 mg/m^3 (VW-02). The calculated volume fraction at each well was 0.1089 ppm (VW-01) and 0.0628 ppm (VW-02). The reported concentrations suggest the presence of waste material, however, the relative concentrations are not deemed to be a significant environmental concern for the various commercial business activities within the light industrial park. It is noted there is currently no food establishments or related business activities within this light industrial park.

Volatile siloxane compounds are considered a significant component of landfill gas. Presently, there are no regulatory guidelines or standards for exposure to siloxane compounds. However, ongoing toxicity studies have implicated exposure to siloxanes by inhalation to be linked to adverse effects to humans. It is anticipated, regulatory guidelines will be developed in the future as further research and toxicity information becomes available.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Observations from the testhole drilling program along with consideration of the areas of ground disturbance from historic aerial photographs, the area of historic waste material is interpreted to be within a contiguous area encompassing about 0.55 ha (1.36 acres), more or less and is located primarily within third party properties. The identified waste material likely extends beneath a portion of the city roadways (46A Avenue and 61 Street) including a portion of the intersection of these two roads.

The results for soil vapour tests indicate various constituents of landfill gas are present in the subsurface. The presence of the various chemical compounds in the soil vapour are relatively low and are not considered to be significant environmental concern relative to the various commercial business activities or the surrounding urban environment. It must be acknowledged, this summer sampling event likely reflects muted concentrations which would likely increase due to the lack of natural venting from the soil under frozen ground conditions.

In order to better understand the off-site environmental risks associated with this historic waste disposal site, several aspects of the data presented in this Phase II ESA deserve some further attention. It is recommended Management at the City of Red Deer consider the following actions:

- Collect groundwater elevations and soil vapour data at a bi-annual interval for at least one standard hydrogeological cycle. Include the three monitoring locations on the section of the east side of Riverside Drive on Lot 4, Block 8, Plan 892 2959. This information is to better understand the local flow pattern and whether an environmental risk may be presented to the Red Deer River hydraulically down gradient from the site.

- Collect a second data set consisting of soil vapour and groundwater chemistry, groundwater levels and headspace measurements during the winter period. The information obtained from this second event would attempt to illustrate the best/worst case for seasonal variability of the soil vapours.

- Develop a site specific risk management plan (RMP) addressing the identified environmental concerns with consideration of the of the potential future land

development opportunities with an emphasis on lands which are deemed down gradient and on lands in proximity to the historic waste disposal area.

- Review all additional data to develop and (when necessary) update/amend the site specific RMP in light of new information.

7.0 STATEMENT OF LIMITATIONS

This Phase II Environmental Site Assessment was conducted on the dates presented within this report. The conditions prevalent and noted at this time must be recognized as having a limited life. Should activities be introduced or practices change, either of which may not be deemed to comply with generally accepted environmental practices, the site conditions would be altered sufficiently for this report to be invalid. This report has been prepared for the use of The City of Red Deer and the approved designates for the specific application described in Section 1.0.

The report has been based in part with information obtained by others. Verification of the results presented by others has not been done. This report has been prepared in accordance with generally accepted environmental engineering practice and no other warranty is made, either expressed or implied. The opinions, conclusions and recommendations presented herein reflect the best judgment of Tiamat As such, Tiamat reserves the right to re-evaluate our conclusions and recommendations presented in this report should new information become available.

Any use by a third party of this report or any reliance by a third party upon the information, records or documents in this report is undertaken solely at the risk and responsibility of such third party. Tiamat shall not in any way be responsible for any damages suffered by a third party due to decisions or actions taken by a third party on the basis of this report.

This report was issued electronically in an encrypted PDF format. Notwithstanding, the file encryption, Tiamat cannot guarantee the contents of this report has not been altered. Should an authenticated copy be required, the reader should contact The City of Red Deer and our office.

8.0 CLOSURE

We trust the information presented herein satisfies your present requirements. Should you have any questions, we invite the reader to contact our office at (403) 640-9009.

Respectfully submitted,
Tiamat Environmental Consultants Ltd.

Per: Jessica A.C. Lee, E.I.T.
Environmental Engineer

Per: Kristen E. Sanger, G.I.T.
Environmental Geoscientist

Per: Leon T. Mah, P.Eng.
Senior Project Engineer

/kjs

The Association of Professional Engineers and Geoscientists of Alberta
Permit To Practice No.: P 7109

References

1. Standard Guide for Soil Gas Monitoring in the Vadose Zone, ASTM D5314-92(2006).

2. B. Slomczynska and T. Slomczynski, "Physico-Chemical and Toxicological Characteristics of Leachates from MSW Landfills," Institute of Environmental Engineering Systems, Warsaw University of Technology, June 2004.

3. P. Kjeldsen, M.A. Barlaz, et al., "Present and Long Term Composition of MSW Landfill Leachate" A Review," Environmental Science and Technology, Volume 32(4) pages 297 - 336, 2002.

4. M.O. Rivett, Gary P. Wealthall, R.A. Dearden, T.A. McAlary, "Review of Unsaturated-Zone Transport and Attenuation of Volatile Organic Compound Plumes Leached from Shallow Source Zones," Journal of Contaminant Hydrology, Edition 123, pages 130 – 156, 2011.

TABLES

Table 1
Groundwater Monitoring and Soil Vapour Well Elevations

Test Location	Well Depth (m)	Elevations				Screen Length (m)
		Ground (m)	Top of Pipe (m)	Screen Interval		
				Bottom	Top	
MW-01	7.6	854.669	854.539	847.069	851.669	4.6
MW-02	8.4	855.257	855.097	846.857	851.457	4.6
MW-03	7.6	854.551	854.461	846.951	851.551	4.6
VW-01	4.6	854.444	854.243	849.844	850.144	0.3
VW-02	6.1	855.329	854.429	849.229	849.529	0.3
TH-01	NA	854.665	- -	- -	- -	- -
TH-04	NA	855.279	- -	- -	- -	- -
TH-07	NA	855.058	- -	- -	- -	- -
TH-08	NA	854.759	- -	- -	- -	- -
TH-10	NA	854.418	- -	- -	- -	- -

Notes:

1) Geodetic elevations are determined from multiple datums, ASCM Nos. 36574 and 124339.
2) MW - Monitoring Well.
3) VW - Soil Vapour Well.
4) TH - Testhole.
5) NA - Not Applicable.
6) - - No value established.

Table 2
Site Monitoring Results

Test Location	Elevations		Groundwater Elevation (m)		Headspace Vapour				Notes
					01/08/13				
	Ground (m)	Top of Pipe (m)	01/08/13		Combustible	Volatile	Combustible	Volatile	
MW-01	854.669	854.539	849.752		510	ND			
MW-02	855.257	855.097	850.004		155	ND			
MW-03	854.551	854.461	849.421		460	ND			
VW-01	854.444	- -	- -	- -	1,750	ND			
VW-02	855.329	- -	- -	- -	1,300	1			
TH-01	854.665	- -	- -	- -	- -	- -	- -	- -	- -
TH-04	855.279	- -	- -	- -	- -	- -	- -	- -	- -
TH-07	855.058	- -	- -	- -	- -	- -	- -	- -	- -
TH-08	854.759	- -	- -	- -	- -	- -	- -	- -	- -
TH-10	854.418	- -	- -	- -	- -	- -	- -	- -	- -

Notes:

1) Measurement of combustible and volatile vapours by RKI Eagle 2. Units ppmv.
   Combustible vapour sensor calibrated to hexane and photoionization detector calibrated to isobutylene.
2) ND - Not Detected, less than the limit of instrument detection.
3) - - No value established.

Table 3
Analytical Results - Soil - Drill Cuttings (Soil Bag)

Parameter	Detection Limit	Soil Bag		Class II Landfill Acceptance Criteria
		1 of 2	2 of 2	
pH	0.10	8.47	8.80	2-12.5
Flash Point (°C)	30.0	>75	>75	>61
Paint Filter Test	-	PASS	PASS	PASS
Total Organic Carbon	0.10	0.85	0.36	- -
Hydrocarbons				
Benzene	0.0050	ND	ND	0.5
Toluene	0.0050	ND	ND	0.5
Ethylbenzene	0.0050	ND	ND	0.5
Xylenes	0.0050	ND	ND	0.5
Leachable Metals				
Antimony (Sb)	5.0	ND	ND	500
Arsenic (As)	0.20	ND	ND	5
Barium (Ba)	5.0	ND	ND	100
Beryllium (Be)	0.50	ND	ND	5
Boron (B)	5.0	ND	ND	500
Cadmium (Cd)	0.050	ND	ND	1
Chromium (Cr)	0.50	ND	ND	5
Cobalt (Co)	5.0	ND	ND	100
Copper (Cu)	5.0	ND	ND	100
Iron (Fe)	5.0	ND	ND	1,000
Lead (Pb)	0.50	ND	ND	5
Mercury (Hg)	0.010	ND	ND	0.2
Nickel (Ni)	0.50	ND	ND	5
Selenium (Se)	0.20	ND	ND	1
Silver (Ag)	0.50	ND	ND	5
Thallium (Tl)	0.50	ND	ND	5
Uranium (U)	1.0	ND	ND	2
Vanadium (V)	5.0	ND	ND	100
Zinc (Zn)	5.0	ND	ND	500
Zirconium (Zr)	5.0	ND	ND	500

Notes:

1) Class II Landfill Acceptance Criteria - per Table 2, Part 4 Schedule to the Alberta User Guide for Waste Managers 3/95. Applicable waste screening for The City of Red Deer Class II Waste Managment Facility.
2) All units are mg/L unless otherwise stated.
3) ND - Not Detected
4) Soil Bags were sampled July 14, 2013.
5) For further laboratory information, refer to the specific laboratory report in Appendix A.

Table 4A
Groundwater Indices Measured Time of Sampling

Monitoring Well	pH	Electrical Conductivity (µS/cm)	Temperature (°C)	Dissolved Oxygen (mg/L)	Total Dissolved Solids (mg/L)	Redox (±mV)
MW-01	8.22	1,025	8.8	0.92	968.50	-11.9
MW-02	7.64	584	9.4	3.47	539.50	+45.1
MW-03	8.35	1,378	8.7	2.29	1,287.00	-68.1

Notes:

1) Samples collected on August 01, 2013.
2) Groundwater indices measured by YSI Pro Plus multi-meter.

Table 4B
Analytical Results - Groundwater - General Water Quality

Parameter	Unit	Detection Limit	MW-01	MW-02	MW-03	Tier 1 Guideline
			08/01/13			
General Water Quality						
Biochemical Oxygen Demand	mg/L	2.0	2.2	ND	2.2	- -
Chemical Oxygen Demand	mg/L	5.0	210	130	190	- -
Conductivity	µS/cm	1.0	1,800	910	2,300	- -
pH	Unitless	NA	7.07	7.48	7.23	6.5-8.5
Total Organic Carbon (C)	mg/L	0.50	5.2	2.9	16	- -
Dissolved Cadmium (Cd)	µg/L	0.0050	0.080	0.040	0.047	- -
Total Cadmium (Cd)	µg/L	0.0050	**0.810**	**0.470**	**0.460**	0.060*
Alkalinity ($CaCO_3$)	mg/L	0.50	620	350	940	- -
Bicarbonate (HCO_3)	mg/L	0.50	750	430	1,100	- -
Carbonate (CO_3)	mg/L	0.50	ND	ND	ND	- -
Hydroxide (OH)	mg/L	0.50	ND	ND	ND	- -
Sulphates (SO_4)	mg/L	1.0	160	39	34	- -
Chlorides (Cl)	mg/L	1.0	110	59	190	- -
Total Ammonia (NH_3-N)	mg/L	0.050 - 0.50	ND	ND	**16**	1.37*
Total Phosphorus (P)	mg/L	0.1	1.8	0.63	0.69	- -
Total Nitrogen (N)	mg/L	0.050	23	2.1	14	- -
Total Kjeldahl Nitrogen (TKN)	mg/L	0.050 - 0.50	2.4	0.86	14	- -
Nitrite (NO_2)	mg/L	0.0030	0.91	ND	ND	- -
Nitrate (NO_3)	mg/L	0.0030 - 0.030	19	1.3	ND	- -
Nitrate plus Nitrite (N)	mg/L	0.0030 - 0.030	20	1.3	ND	- -
Trace Organics						
Acetic Acid	mg/L	50	ND	ND	ND	- -
Formic Acid	mg/L	50	ND	ND	ND	- -
Propionic Acid	mg/L	50	ND	ND	ND	- -
Adsorbable Organic Halogen	mg/L	0.004 - 0.02	0.075	0.055	0.05	- -

Notes:

1) Tier 1 Guideline - Alberta Tier 1 Soil and Groundwater Remediation Guidelines, December 2010 and amendments. Coarse-grained criteria for commercial/industrial land use.
2) * Surface Water Quality Guidelines for Use in Alberta (AENV, 1999) on aquatic life pathway. Canadian Council of Ministers of the Environment (CCME) guidelines are referenced.
3) ND - Not Detected, less than the limit of method detection.
4) - - No value established in the reference criteria.
5) Bold & Shaded - Exceeds the referenced Alberta Tier 1 Guidelines and CCME guidelines.
6) For further laboratory information, refer to the specific laboratory report in Appendix A.

Table 4C
Analytical Results - Groundwater - Metals

Parameter	Detection Limit	MW-01	MW-02	MW-03	Tier 1 Guideline
		01/08/13			
Total Metals					
Aluminum (Al)	0.0030	**21**	**9.3**	**8.7**	0.1*
Antimony (Sb)	0.00060	0.00098	0.00079	0.00087	0.006
Arsenic (As)	0.00020	**0.035**	**0.018**	**0.017**	0.005
Barium (Ba)	0.010	**1.4**	0.53	0.95	1
Beryllium (Be)	0.0010	0.0018	ND	ND	- -
Boron (B)	0.020	0.12	0.061	0.17	1.5
Calcium (Ca)	0.30	350	150	250	- -
Chromium (Cr)	0.0010	**0.049**	**0.019**	**0.021**	0.001*
Cobalt (Co)	0.00030	0.019	0.010	0.017	- -
Copper (Cu)	0.00020	**0.072**	**0.031**	**0.025**	0.003*
Iron (Fe)	0.060	**62**	**24**	**30**	0.3
Lead (Pb)	0.00020	**0.034**	**0.014**	**0.015**	0.004*
Lithium (Li)	0.020	0.075	0.036	0.051	- -
Magnesium (Mg)	0.20	110	48	96	- -
Manganese (Mn)	0.0040	**1.6**	**0.68**	**2.2**	0.05
Molybdenum (Mo)	0.00020	0.0035	0.0030	0.0049	0.073*
Nickel (Ni)	0.00050	0.071	0.032	0.035	0.11*
Phosphorus (P)	0.10	1.8	0.63	0.69	- -
Potassium (K)	0.30	13	7.3	29	- -
Selenium (Se)	0.00020	**0.0020**	**0.0028**	0.00077	0.001
Silicon (Si)	0.10 - 0.50	59	27	31	- -
Silver (Ag)	0.00010	**0.00066**	**0.00031**	**0.00021**	0.0001*
Sodium (Na)	0.50	70	36	150	- -
Strontium (Sr)	0.020	1.2	0.63	1.7	- -
Sulphur (S)	0.20	47	10	11	- -
Thallium (Tl)	0.00020	0.0004	ND	ND	0.0008*
Tin (Sn)	0.0010	0.0012	ND	0.0015	- -
Titanium (Ti)	0.0010	0.29	0.15	0.16	- -
Uranium (U)	0.00010	0.0099	0.0040	0.0047	0.02
Vanadium (V)	0.0010	0.07	0.03	0.025	- -
Zinc (Zn)	0.0030	**0.19**	**0.094**	**0.1**	0.03
Dissolved Metals					
Aluminum (Al)	0.0030	ND	ND	ND	- -
Antimony (Sb)	0.00060	ND	ND	ND	- -
Arsenic (As)	0.00020	0.00033	0.00051	0.0059	- -
Barium (Ba)	0.010	0.15	0.20	0.55	- -
Beryllium (Be)	0.0010	ND	ND	ND	- -
Boron (B)	0.020	0.11	0.057	0.16	- -
Calcium (Ca)	0.30	230	110	210	- -
Chromium (Cr)	0.0010	ND	ND	ND	- -
Cobalt (Co)	0.00030	0.0015	0.00073	0.0092	- -
Copper (Cu)	0.00020	0.0019	0.0021	0.0012	- -
Iron (Fe)	0.060	0.08	ND	4.1	- -
Lead (Pb)	0.00020	ND	ND	ND	- -
Lithium (Li)	0.020	0.035	0.021	0.035	- -
Magnesium (Mg)	0.20	73	35	80	- -
Manganese (Mn)	0.0040	0.22	0.14	1.8	- -
Molybdenum (Mo)	0.00020	0.0013	0.0017	0.0039	- -
Nickel (Ni)	0.00050	0.0086	0.0022	0.012	- -
Phosphorus (P)	0.10	ND	ND	0.13	- -
Potassium (K)	0.30	7.5	4.7	26	- -
Selenium (Se)	0.00020	0.00047	0.0016	0.00028	- -
Silicon (Si)	0.10	6.8	5.2	8.1	- -
Silver (Ag)	0.00010	ND	ND	ND	- -
Sodium (Na)	0.50	68	36	140	- -
Strontium (Sr)	0.020	1.1	0.58	1.7	- -
Sulphur (S)	0.20	44	9.3	9.0	- -
Thallium (Tl)	0.00020	ND	ND	ND	- -
Tin (Sn)	0.0010	ND	ND	ND	- -
Titanium (Ti)	0.0010	ND	ND	ND	- -
Uranium (U)	0.00010	0.0078	0.0028	0.0035	- -
Vanadium (V)	0.0010	ND	ND	ND	- -
Zinc (Zn)	0.0030	ND	ND	0.0077	- -

Notes:

1) Tier 1 Guideline - Alberta Tier 1 Soil and Groundwater Remediation Guidelines, December 2010 and amendments. Coarse-grained criteria for commercial/industrial land use.
2) * Surface Water Quality Guidelines for Use in Alberta (AENV, 1999) on aquatic life pathway. Canadian Council of Ministers of the Environment (CCME) guidelines are referenced.
3) ND - Not Detected, less than the limit of method detection.
4) Unless specified all units are mg/L.
5) - - No value established in the reference criteria.
6) Bold & Shaded - Exceeds the referenced Alberta Tier 1 and CCME guidelines.
7) For further laboratory information, refer to the specific laboratory report in Appendix A.

Table 4D
Analytical Results - Groundwater - VOCs

Parameter	Detection Limit	MW-01	MW-02	MW-03	Tier 1 Guideline
		01/08/13			
Volatile Organic Compounds					
Benzene	0.00040	ND	ND	ND	0.005
Toluene	0.00040	ND	ND	ND	0.024
Ethylbenzene	0.00040	ND	ND	ND	0.0024
Xylenes (Total)	0.00080	ND	ND	ND	0.3
F1 (C_6-C_{10})	0.10	ND	ND	ND	2.2
F2 (C_{10}-C_{16})	0.10	ND	ND	ND	1.1
Trihalomethanes (THMs)	0.0020	ND	ND	ND	0.1
Bromodichloromethane	0.00050	ND	ND	ND	- -
Bromoform	0.00050	ND	ND	ND	- -
Bromomethane	0.0020	ND	ND	ND	- -
Carbon tetrachloride	0.00050	ND	ND	ND	0.005
Chlorobenzene	0.00050	ND	ND	ND	0.0013
Chlorodibromomethane	0.0010	ND	ND	ND	- -
Chloroethane	0.0010	ND	ND	ND	- -
Chloroform	0.00050	ND	ND	ND	0.0018
Chloromethane	0.0020	ND	ND	ND	- -
1,2-dibromoethane	0.00050	ND	ND	ND	- -
1,2-dichlorobenzene	0.00050	ND	ND	ND	0.0007
1,3-dichlorobenzene	0.00050	ND	ND	ND	- -
1,4-dichlorobenzene	0.00050	ND	ND	ND	0.001
1,1-dichloroethane	0.00050	ND	ND	ND	- -
1,2-dichloroethane	0.00050	ND	ND	ND	0.005
1,1-dichloroethene	0.00050	ND	ND	ND	0.014
cis-1,2-dichloroethene	0.00050	ND	ND	ND	- -
trans-1,2-dichloroethene	0.00050	ND	ND	ND	- -
Dichloromethane	0.0020	ND	ND	ND	0.05
1,2-dichloropropane	0.00050	ND	ND	ND	- -
cis-1,3-dichloropropene	0.00050	ND	ND	ND	- -
trans-1,3-dichloropropene	0.00050	ND	ND	ND	- -
Methyl methacrylate	0.00050	ND	ND	ND	0.47
Methyl-tert-butylether (MTBE)	0.00050	ND	ND	ND	0.015
Styrene	0.00050	ND	ND	ND	0.072
1,1,1,2-tetrachloroethane	0.0020	ND	ND	ND	- -
1,1,2,2-tetrachloroethane	0.0020	ND	ND	ND	- -
Tetrachloroethene	0.00050	ND	ND	ND	0.03
1,2,3-trichlorobenzene	0.0010	ND	ND	ND	0.008
1,2,4-trichlorobenzene	0.0010	ND	ND	ND	0.015
1,3,5-trichlorobenzene	0.00050	ND	ND	ND	0.014
1,1,1-trichloroethane	0.00050	ND	ND	ND	- -
1,1,2-trichloroethane	0.00050	ND	ND	ND	- -
Trichloroethene	0.00050	ND	ND	ND	0.005
Trichlorofluoromethane	0.00050	ND	ND	ND	- -
1,2,4-trimethylbenzene	0.00050	ND	ND	ND	- -
1,3,5-trimethylbenzene	0.00050	ND	ND	ND	- -
Vinyl chloride	0.00050	ND	ND	ND	0.002

Notes:

1) Tier 1 Guideline - Alberta Tier 1 Soil and Groundwater Remediation Guidelines, December 2010 and amendments. Coarse-grained criteria for commerical/industrial land use.
2) ND - Not Detected, less than the limit of method detection.
3) Unless specified all units are mg/L
4) - - No value established in the reference criteria.
5) Bold & Shaded - Exceeds the referenced Alberta Tier 1 Guidelines.
6) For further laboratory information, refer to the specific laboratory report in Appendix A.

Table 5A
Summary of Field Parameters Measured During Sampling of Soil Vapour

Parameter	Well Diameter (mm)	Screen Length (cm)	Well Depth (m)	Headspace Volume (cm^3)	Purge Rate (cm^3/min)	Purge Time (min)	Pressure (psi)	
							Ambient	Vapour Well
VW-01	25	30	4.6	2,558.02	943.3	3 min 7 sec	15.08	15.03
VW-02	25	30	6.1	2,994.33	943.3	3 min 36 sec	15.17	15.18

Notes:

1) Measurement of pressure by digital Cole-Parmer absolute pressure gauge.
2) Purge time is elapsed time prior to the collection of a soil vapour sample.
3) Screen set at base of well.
4) Soil vapour sampling was completed July 31, 2013.

Table 5B
Analytical Results - Soil Vapour - General Indices

Parameter	Unit	Detection Limit	VW-01	VW-02
Gauge Pressure				
Following sampling	psi	- -	-4.7	-5.0
Reported by laboratory	psi	- -	-3.6	-3.6
Fixed Gases				
Oxygen	% v/v	0.2 - 0.3	2	5
Nitrogen	% v/v	0.2 - 0.3	50.9	67.0
Carbon monoxide	% v/v	0.2 - 0.3	ND	ND
Methane	% v/v	0.2 - 0.3	27.4	17.6
Carbon dioxide	% v/v	0.2 - 0.3	19.8	10.4

Notes:

1) Soil vapour sample collected on Wednesday, July 31, 2013.
2) ND - Not Detected, less than the limit of method detection.
3) - - No value established in the detection limit and reference criteria.
4) For further information, the reader should refer to the laboratory report in Appendix A.

Table 5C
Analytical Results - Soil Vapour - VOCs

Parameter	Unit	Detection Limit	VW-01	VW-02
			07/31/2013	
Volatile Hydrocarbon Fractions				
Aliphatic >C_5-C_6	µg/m^3	5.0 - 13	205	2,530
Aliphatic >C_6-C_8	µg/m^3	5.0	483	651
Aliphatic >C_8-C_{10}	µg/m^3	5.0	176	106
Aliphatic >C_{10}-C_{12}	µg/m^3	5.0	412	185
Aliphatic >C_{12}-C_{16}	µg/m^3	5.0	125	91.1
Aromatic >C_7-C_8 (TEX Excluded)	µg/m^3	5.0	ND	ND
Aromatic >C_8-C_{10}	µg/m^3	5.0	86.0	47.5
Aromatic >C_{10}-C_{12}	µg/m^3	5.0	71.1	41.7
Aromatic >C_{12}-C_{16}	µg/m^3	5.0	ND	ND
Select Volatile Gases				
Acetylene	ppm	0.21 - 0.26	ND	ND
Ethane	ppm	0.21 - 0.26	1.7	1.3
Ethylene	ppm	0.21 - 0.26	ND	ND
n-Butane	ppm	0.41 - 0.51	ND	0.47
n-Pentane	ppm	0.21 - 0.26	ND	ND
Propane	ppm	0.21 - 0.26	1.1	0.69
Propene	ppm	0.21 - 0.26	ND	ND
Propyne	ppm	0.41 - 0.51	ND	ND
Volatile Organic Compounds				
Dichlorodifluoromethane (FREON 12)	ppbv	0.20 - 0.80	3.34	341
1,2-Dichlorotetrafluoroethane	ppbv	0.17	ND	ND
Chloromethane	ppbv	0.30	0.87	ND
Vinyl chloride	ppbv	0.18	0.60	ND
Chloroethane	ppbv	0.30	ND	ND
1,3-Butadiene	ppbv	0.50	ND	ND
Trichlorofluoromethane (FREON 11)	ppbv	0.20	ND	ND
Ethanol (ethyl alcohol)	ppbv	2.3	34.4	23.5
Trichlorotrifluoroethane	ppbv	0.15	ND	ND
2-Propanol	ppbv	3.0	11.5	6.1
2-Propanone	ppbv	0.80	32.0	19.8
Methyl ethyl ketone (MEK) (2-Butanone)	ppbv	3.0	16.8	12.2
Methyl isobutyl ketone	ppbv	3.2	ND	ND
Methyl butyl ketone (MBK) (2-Hexanone)	ppbv	2.0	ND	ND
Methyl t-butyl ether (MTBE)	ppbv	0.20	ND	ND
Ethyl acetate	ppbv	2.2	2.6	ND
1,1-Dichloroethylene	ppbv	0.25	ND	ND
cis-1,2-Dichloroethylene	ppbv	0.19	ND	ND
trans-1,2-Dichloroethylene	ppbv	0.20	ND	ND
Methylene chloride(Dichloromethane)	ppbv	0.80	ND	ND
Chloroform	ppbv	0.15	ND	ND
Carbon tetrachloride	ppbv	0.30	ND	ND
1,1-Dichloroethane	ppbv	0.20	ND	ND
1,2-Dichloroethane	ppbv	0.20	ND	0.29
Ethylene dibromide	ppbv	0.17	ND	ND
1,1,1-Trichloroethane	ppbv	0.30	ND	ND
1,1,2-Trichloroethane	ppbv	0.15	ND	ND
1,1,2,2-Tetrachloroethane	ppbv	0.20	ND	ND
cis-1,3-Dichloropropene	ppbv	0.18	ND	ND
trans-1,3-Dichloropropene	ppbv	0.17	ND	ND
1,2-Dichloropropane	ppbv	0.40	ND	ND
Bromomethane	ppbv	0.18	ND	ND
Bromoform	ppbv	0.20	ND	ND
Bromodichloromethane	ppbv	0.20	ND	ND
Dibromochloromethane	ppbv	0.20	ND	ND
Trichloroethylene (TCE)	ppbv	0.30	2.23	1.82
Tetrachloroethylene (PCE)	ppbv	0.20	0.64	ND
Benzene	ppbv	0.18	2.93	1.15
Toluene	ppbv	0.20	14.1	11.1
Ethylbenzene	ppbv	0.20	4.01	2.53
p+m-xylene	ppbv	0.37	11.6	7.03
o-xylene	ppbv	0.20	5.01	2.85
Styrene	ppbv	0.20	1.4	0.81
4-Ethyltoluene	ppbv	2.2	ND	ND
1,3,5-Trimethylbenzene	ppbv	3.6 - 8.3	ND	ND
1,2,4-Trimethylbenzene	ppbv	0.50	3.76	2.27
Chlorobenzene	ppbv	0.20	ND	ND
Benzyl chloride	ppbv	1.0	ND	ND
1,3-Dichlorobenzene	ppbv	0.40	ND	ND
1,4-Dichlorobenzene	ppbv	0.40	ND	ND
1,2-Dichlorobenzene	ppbv	0.40	ND	ND
1,2,4-Trichlorobenzene	ppbv	2.0	ND	ND
Hexachlorobutadiene	ppbv	3.0	ND	ND
Hexane	ppbv	0.30	11.4	7.70
Heptane	ppbv	0.30	3.79	1.87
Cyclohexane	ppbv	0.20	34.9	8.60
Tetrahydrofuran	ppbv	0.40	8.14	7.87
1,4-Dioxane	ppbv	2.0	ND	ND
Xylene (Total)	ppbv	0.60	16.6	9.88
Vinyl bromide	ppbv	0.20	ND	ND
Propene	ppbv	220 - 240	ND	ND
2,2,4-Trimethylpentane	ppbv	0.20	4.62	3.52
Carbon disulfide	ppbv	0.50	5.31	3.24
Vinyl acetate	ppbv	0.20	ND	ND

Notes:

1) Results are from sampling performed on Wednesday, July 31, 2013.
2) ND - Not Detected, less than the limit of method detection.
3) - - No value established in the detection limit and reference criteria.
4) For further information, the reader should refer to the laboratory report in Appendix A.

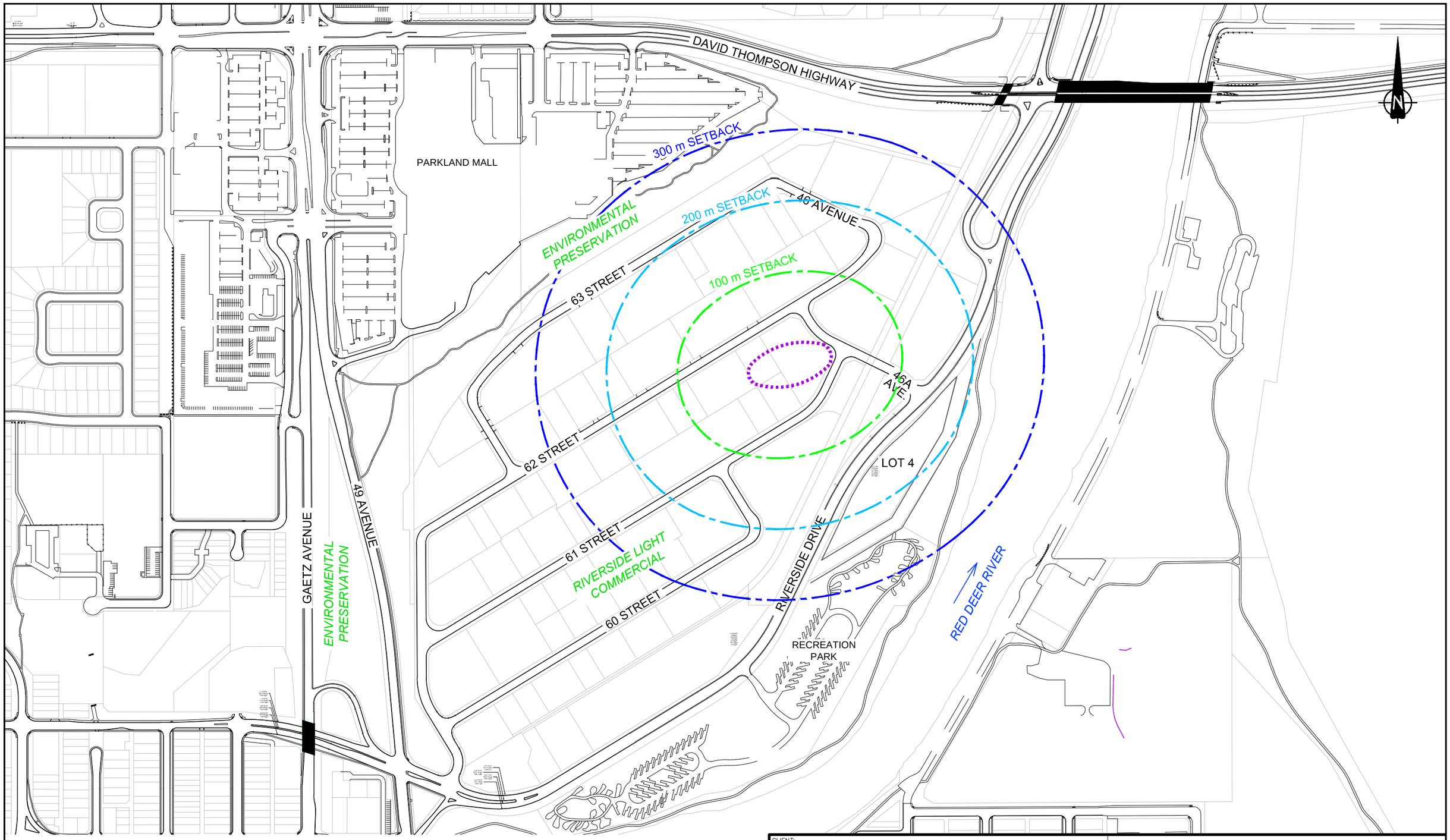
Table 5D
Analytics Results - Soil Vapour - Siloxanes

Parameter	Detection Limit		VW-01		VW-02	
			07/31/2013			
	mg/m³	ppm	mg/m³	ppm	mg/m³	ppm
Trimethylsilyl Fluoride	- -	- -	ND	ND	ND	ND
Tetramethylsilane	0.0001	0.0001	ND	ND	ND	ND
Methoxytrimethylsilane	0.0032	0.0007	ND	ND	ND	ND
Ethoxytrimethylsilane	0.0030 - 0.0031	0.0006	ND	ND	ND	ND
Trimethylsilanol	- -	- -	0.0243	0.0066	0.0172	0.0047
Isopropoxytrimethylsilane	0.0013	0.0002	ND	ND	ND	ND
Trimethoxymethyl Silane #	- -	- -	ND	ND	ND	ND
Hexamethyl Disiloxane - L2	0.0001	0.0001	ND	ND	ND	ND
Propoxytrimethylsilane	0.0035	0.0006	ND	ND	ND	ND
1-Methylbutoxytrimethylsilane *	- -	- -	ND	ND	ND	ND
Butoxytrimethylsilane *	- -	- -	ND	ND	ND	ND
Trimethoxyvinyl Silane #	- -	- -	ND	ND	ND	ND
Hexamethyl Cyclotrisiloxane - D3	- -	- -	0.0212	0.0023	0.0141	0.0016
Octamethyl Trisiloxane - L3	0.0002	0.0001	ND	ND	ND	ND
Triethoxyvinyl Silane #	- -	- -	ND	ND	ND	ND
Triethoxyethyl Silane #	- -	- -	ND	ND	ND	ND
Octamethyl Cyclotetrasiloxane - D4	- -	- -	0.0580	0.0048	0.0250	0.0021
Decamethyl Tetrasiloxane - L4	- -	- -	0.0022	0.0002	0.0009	0.0001
Tetraethylsilicate #	- -	- -	ND	ND	ND	ND
Decamethyl Cyclopentasiloxane - D5	- -	- -	0.8254	0.0545	0.5350	0.3530
Dodecamethyl Pentasiloxane - L5	0.0030	0.0002	ND	ND	ND	ND
Dodecamethyl Cyclohexasiloxane - D6	- -	- -	0.6919	0.0381	0.3017	0.0166
Sum	- -	- -	1.6375	0.1089	0.9083	0.0628

Notes:

1) Soil vapour samples collected on Wednesday, July 31, 2013.
2) ND - Not Detected, less than the limit of method detection.
3) - - No value established in the detection limit and reference criteria.
4) V=200 mL, where V is volume of air/gas sampled.
5) * - Semiquanititative (response factor set at 5).
6) # - Unstable, poor detectability, commercial standards tested.
7) For further information, the reader should refer to the laboratory report in Appendix A.

FIGURES



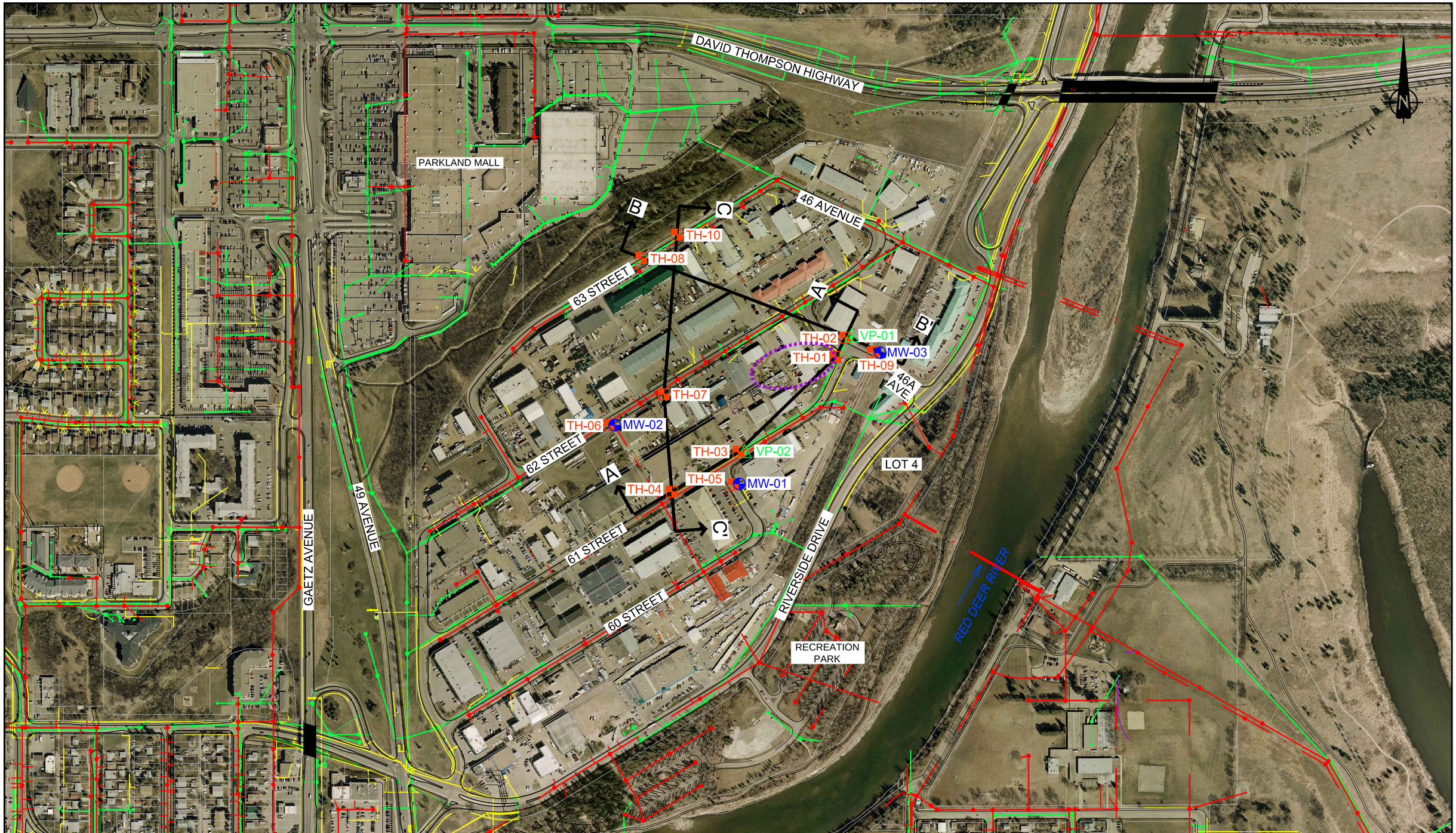
CLIENT: THE CITY OF RED DEER

PROJECT: PHASE II ESA HISTORIC WASTE DISPOSAL SITES
RIVERSIDE LIGHT PTN NW 21-38-27 W4M

TITLE: SITE PLAN SHOWING SURROUNDING LAND USE

Tiamat Environmental Consultants Ltd.

SCALE:	DATE:	PROJECT NO.:	FIGURE NO.:
1 : 5000	April 28/14	12-435	FIGURE 1
DRAWN BY: LCH	CHECKED BY: LTM	CAD FILE NO.: Phase II ESA v1.05.dwg	



SOURCE
2010 ORTHOGRAPHIC IMAGE © COPYRIGHT WITH PERMISSION FROM THE CITY OF RED DEER.

0 50 100 200m
Scale 1:5000

PHASE II TEST LOCATIONS
MW-## GROUNDWATER MONITORING WELL (3)
TH-## TESTHOLE (10)
VW-## SOIL VAPOUR MONITORING WELL (2)

LEGEND
HISTORIC WASTE DISPOSAL
LOT BOUNDARY
CROSS SECTION LOCATION
ELECTRICAL
SANITARY
STORM
WATER

NOTE:
LOCATION OF BURIED UTILITIES ARE APPROXIMATE, ACTUAL LOCATIONS OF THE SHALLOW UTILITIES AND ANY OTHER UTILITIES SHOULD BE VERIFIED PRIOR TO ANY GROUND DISTURBANCE ACTIVITY.

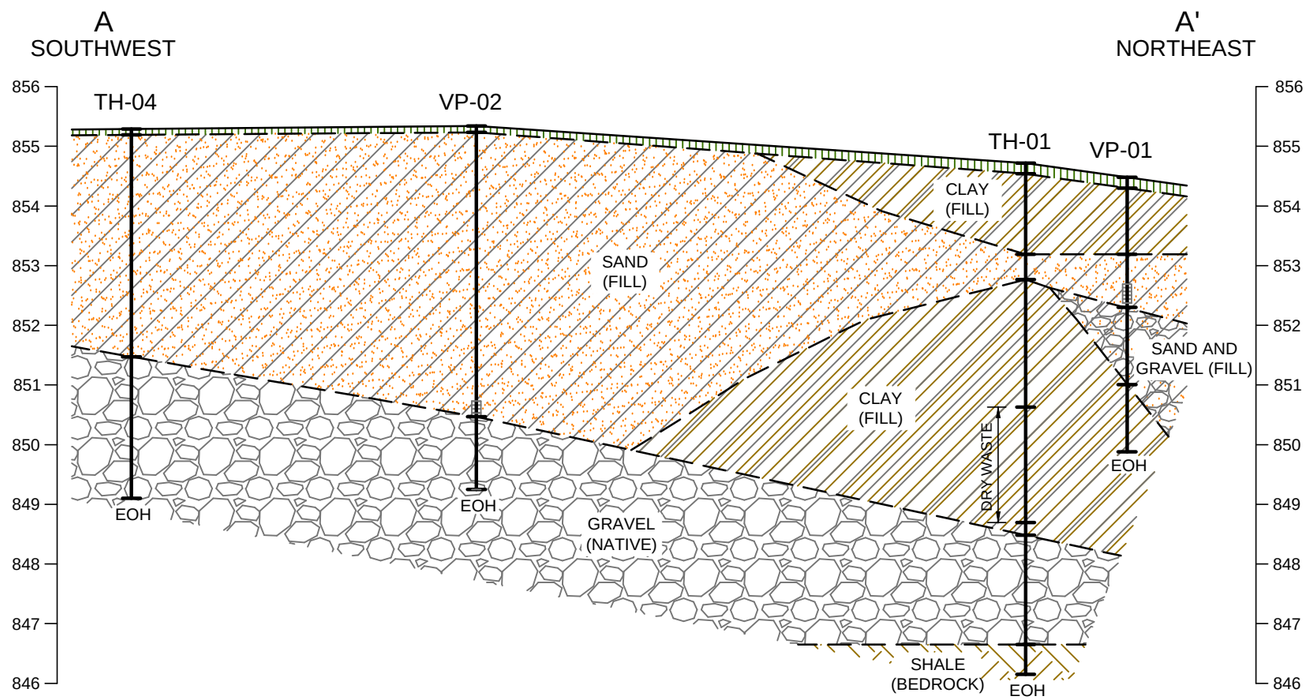
CLIENT: THE CITY OF RED DEER

PROJECT: PHASE II ESA HISTORIC WASTE DISPOSAL SITES
RIVERSIDE LIGHT PTN NW 21-38-27 W4M

TITLE: PHASE II ESA TEST LOCATIONS AND INTERPRETED EXTENT OF WASTE

Tiamat Environmental Consultants Ltd.

SCALE:	DATE:	PROJECT NO.:	FIGURE NO.:
1 : 5000	April 10/14	12-435	FIGURE 2
DRAWN BY: LCH	CHECKED BY: LTM	CAD FILE NO.: Phase II ESA v1.04.dwg	



0 2 5 10m

Vertical Scale 1:200

0 20 50 100m

Horizontal Scale 1:2000

NOTE:

THE GEOLOGIC AND STRATIGRAPHIC SECTIONS SHOWN ON THIS DRAWING ARE INTERPRETED FROM BOREHOLE LOGS. STRATIGRAPHY IS KNOWN WITH CERTAINTY ONLY AT THE BOREHOLE LOCATIONS. ACTUAL STRATIGRAPHY AND GEOLOGIC CONDITIONS BETWEEN BOREHOLES MAY VARY FROM THAT INDICATED ON THIS DRAWING.

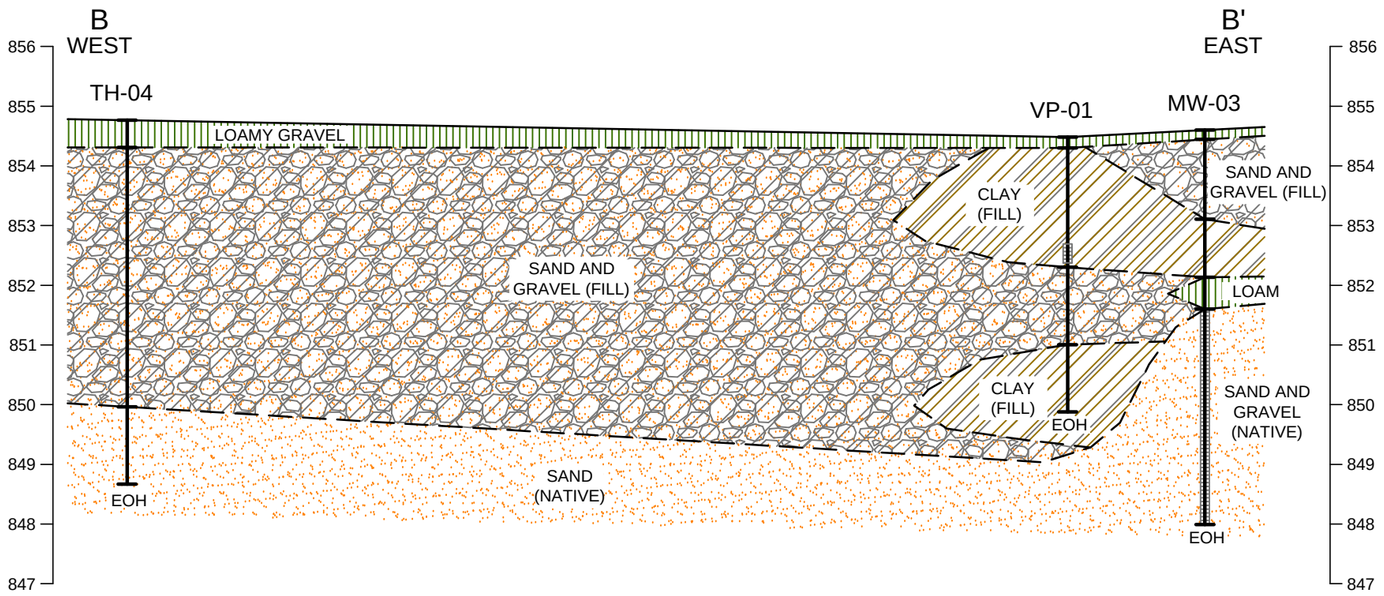
CLIENT: THE CITY OF RED DEER

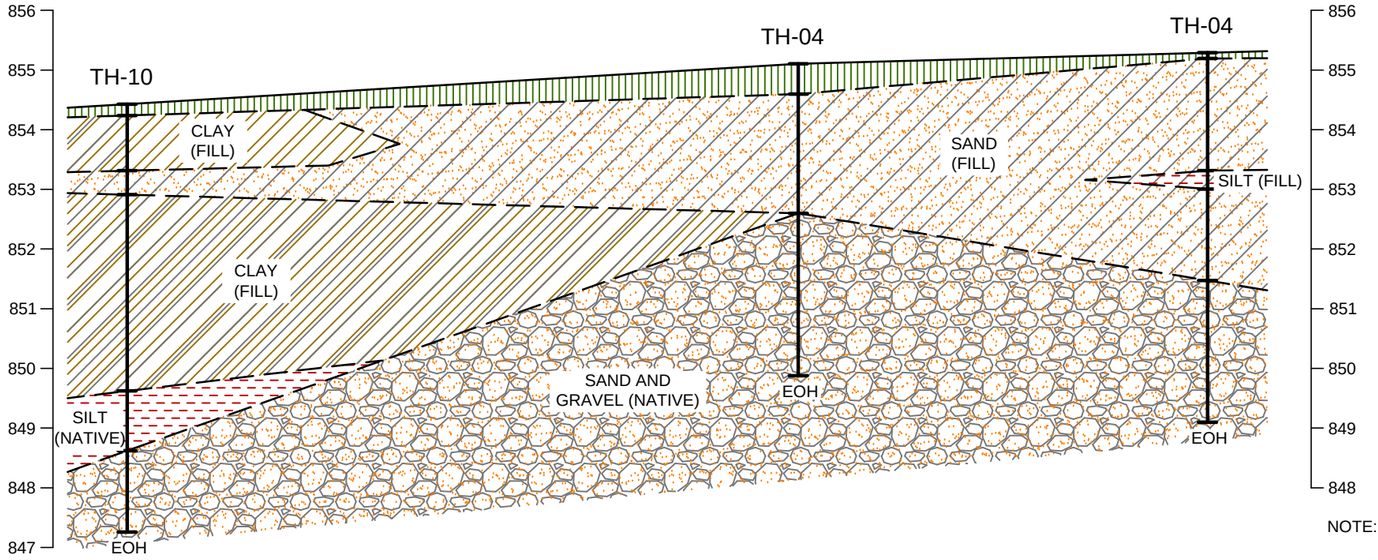
PROJECT: PHASE II ESA HISTORIC WASTE DISPOSAL SITES
RIVERSIDE LIGHT PTN NW 21-38-27 W4M

TITLE: CROSS SECTION A - A'

Tiamat Environmental Consultants Ltd.

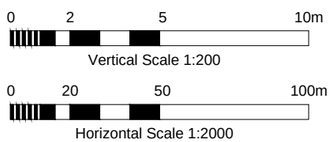
SCALE:	DATE:	PROJECT NO.:	FIGURE NO.:
AS SHOWN	April 10/14	12-435	FIGURE 3A
DRAWN BY: LCH	CHECKED BY: LTM	CAD FILE NO.: Phase II ESA Sections v1.02	





NOTE:

THE GEOLOGIC AND STRATIGRAPHIC SECTIONS SHOWN ON THIS DRAWING ARE INTERPRETED FROM BOREHOLE LOGS. STRATIGRAPHY IS KNOWN WITH CERTAINTY ONLY AT THE BOREHOLE LOCATIONS. ACTUAL STRATIGRAPHY AND GEOLOGIC CONDITIONS BETWEEN BOREHOLES MAY VARY FROM THAT INDICATED ON THIS DRAWING.



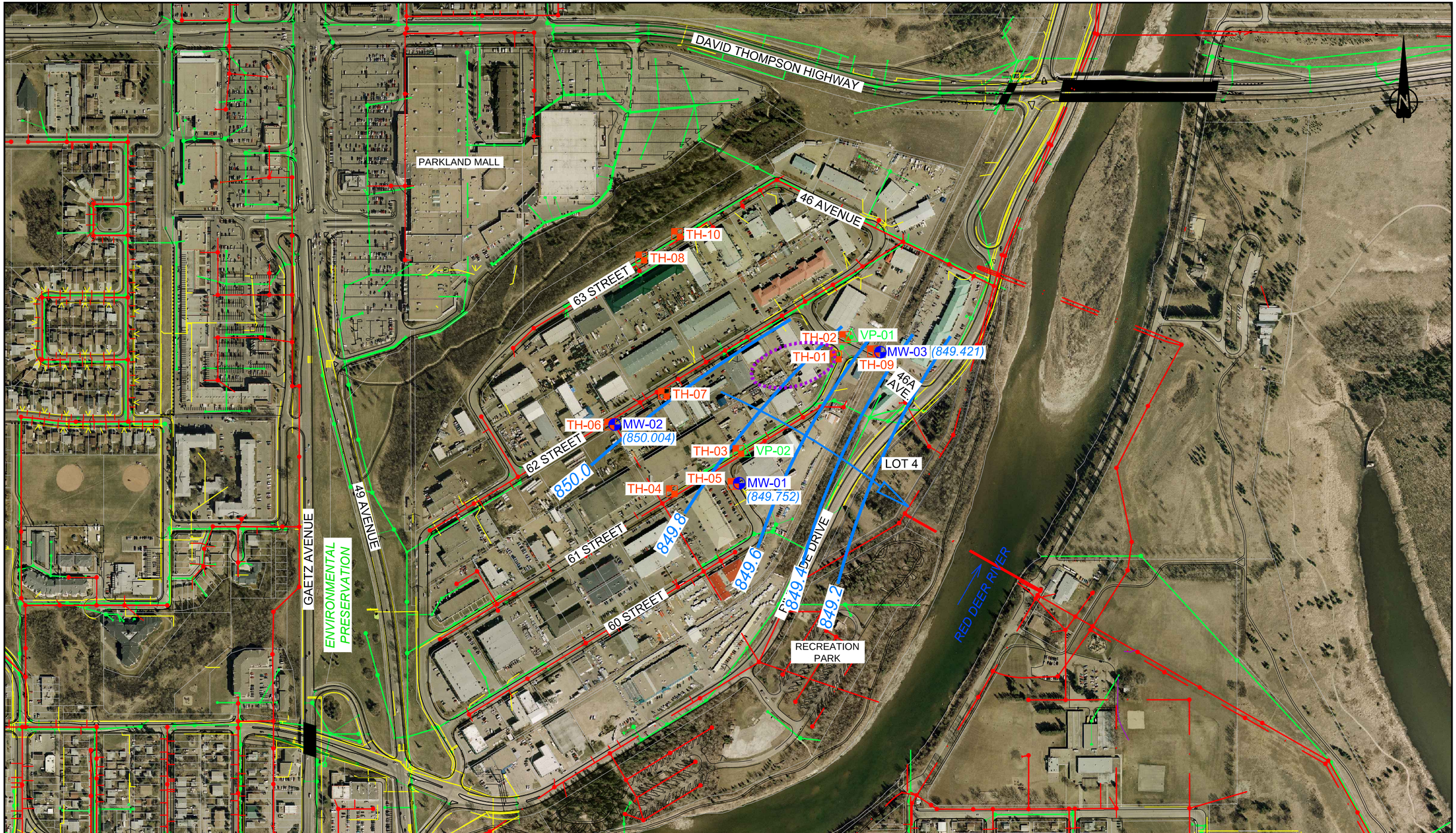
CLIENT: THE CITY OF RED DEER

PROJECT: PHASE II ESA HISTORIC WASTE DISPOSAL SITES
RIVERSIDE LIGHT PTN NW 21-38-27 W4M

TITLE: CROSS SECTIONS B - B' AND C - C'

Tiamat Environmental Consultants Ltd.

SCALE:	DATE:	PROJECT NO.:	FIGURE NO.:
AS SHOWN	April 10/14	12-435	FIGURE 3B
DRAWN BY: LCH	CHECKED BY: LTM	CAD FILE NO.: Phase II ESA Sections v1.02	



SOURCE
2010 ORTHOGRAPHIC IMAGE © COPYRIGHT WITH PERMISSION FROM THE CITY OF RED DEER.

0 50 100 200m
Scale 1:5000

GROUNDWATER DATA
(850.150) GROUNDWATER ELEVATION (m) AUGUST 1, 2013
INTERPRETED GROUNDWATER CONTOUR (m)
INTERPRETED GROUNDWATER FLOW DIRECTION

PHASE II TEST LOCATIONS
MW-## GROUNDWATER MONITORING WELL (3)
TH-## TESTHOLE (10)
VW-## SOIL VAPOUR MONITORING WELL (2)

LEGEND
HISTORIC WASTE DISPOSAL
LOT BOUNDARY
ELECTRICAL
SANITARY
STORM
WATER

NOTE:
LOCATION OF BURIED UTILITIES ARE APPROXIMATE, ACTUAL LOCATIONS OF THE SHALLOW UTILITIES AND ANY OTHER UTILITIES SHOULD BE VERIFIED PRIOR TO ANY GROUND DISTURBANCE ACTIVITY.

CLIENT: THE CITY OF RED DEER

PROJECT: PHASE II ESA HISTORIC WASTE DISPOSAL SITES
RIVERSIDE LIGHT PTN NW 21-38-27 W4M

TITLE: INTERPRETED GROUNDWATER ELEVATIONS
AUGUST 1, 2013

Tiamat Environmental Consultants Ltd.

SCALE:	DATE:	PROJECT NO.:	FIGURE NO.:
1 : 5000	April 10/14	12-435	FIGURE 4
DRAWN BY: LCH	CHECKED BY: LTM	CAD FILE NO.: Phase II ESA v1.04.dwg	

APPENDIX A

FIELD PROTOCOLS AND ANALYTICAL DATA, ASCM INFORMATION AND LABORATORY REPORTS

Field Protocols for Soil, Groundwater and Soil Vapour

Monitoring Headspace Vapours and Liquid Levels

Headspace Vapours

Headspace vapours were measured with an RKI Eagle II portable dual sensor gas meter. The combustible vapour sensor is calibrated to hexane; the volatile vapour sensor is calibrated to isobutylene. The sample pump operates at a flow rate of about 944 ml/minute and the instrument response time is rated at 90% reading within 30 seconds, more or less.

Below is a list of the general headspace vapour monitoring protocol employed by Tiamat staff.

1. Allow the combustible and volatile sensors in the RKI Eagle II to stabilize after turning the instrument on. Typically, the instrument will stabilize within 3 to 5 minutes. Check the display voltage for the instrument is within the specified normal operating range. Should the display not show zero in ambient air, verify there are no interfering sources of Volatile Organic Compound (VOC) or combustible vapours and perform an instrument "fresh air zero" in a fresh air environment.

2. Prior to measuring headspace vapours, the monitoring well screw caps were loosened just before monitoring was conducted.

3. The probe tip of the RKI Eagle II was inserted into the top section of the monitoring well using a gloved hand. The gloved hand is held against the top of the monitoring well to limit influences of air currents at the ground surface mixing with the headspace during the period of measurement. Measurement is for a minimum of 30 seconds and maximum of approximately 2 minutes.

4. The highest reading from each sensor of the RKI Eagle was recorded in ppm, unless otherwise noted.

5. Should a low oxygen alarm activate during the measurement period, monitor the display and withdraw the probe tip once the reading has peaked. Observe the reading while the probe draws fresh air. Record the maximum reading. Repeat this if necessary.

Liquid Levels

Liquid levels are measured by a Heron electronic oil-water interface meter. The interface probe is lowered into the monitoring well until an audible signal is established by the probe. Liquid readings are taken during the lowering of the probe to minimize effects of surface tension and potential erroneous readings. The measurement is taken to the highest point on the monitoring well pipe.

The interface probe is washed with a detergent solution and thoroughly rinsed with clean water between each monitoring well.

Measurement of Water Quality Indices

Standard water quality parameters (pH, electrical conductivity, temperature, dissolved oxygen, total dissolved solids and redox potential) were field measured by a YSI Pro Plus multi-meter. The multi-meter is calibrated prior to each sampling event. Calibration is performed and documented in-house at Tiamat and re-checked by an independent third-party service provider between every third or fourth in-house instrument calibration event. Calibration and service records are maintained on file.

Groundwater Sampling

Groundwater sampling is conducted using either a disposable polyethylene bailer or portable stainless steel submersible pump. The specific sample pump utilizes a low flow sampling technique to minimize losses of VOCs by degassing during collection of water sample. In circumstances where insufficient water is present in a groundwater monitoring well, a dedicated polyethylene bailer is used.

Sampling by Disposable Polyethylene Bailer

Field procedures to perform groundwater sampling using a disposable polyethylene bailer are as follow:

1. Loosen the well screw caps and measure the liquid level with a Heron interface probe. Lower the interface probe to the highest side of the monitoring well pipe and take the first reading when an audible signal is established. The probe is rinsed with a detergent solution and clean water between each well.

2. Measure the nylon string to an approximate length of about 1 m or so greater than the expected sampling depth.

3. Tie the string to the bailer, make a big loop at the other end of the string and tie it to the sampler's hand.

4. Lower the bailer into the well, bail the stagnant water and dispose into a pail. Note subjectively any attributes of the purged ground water such as, odour, colour and phase-separate liquid.

5. During and following purging, the water indices (pH, electrical conductivity, temperature, dissolved O_2, total dissolved solids, and redox) are measured by a YSI multi-meter using a sample container and bailer or a flow cell and pump combination.

6. Repeat steps 4-5 until pH, electrical conductivity and temperature exhibit less than 10% variation, indicating a stabilized groundwater condition.

7. Once the indices indicate a stabilized state, water samples are bottled into laboratory supplied bottles and preservatives as per the laboratory instruction.

8. Note the approximate volume of water extracted, the visual quality of water, any unusual odour or discolouration and the water indices at the time of sample collection.

9. New bailer, nylon string and disposable nitrile gloves are used at each well to prevent cross contamination and preserve sample integrity.

Low Flow Sampling

Field procedures to perform low flow sampling are as follow:

1. Loosen the well screw caps and measure the liquid level with a Heron interface probe. Lower the interface probe to the highest side of the monitoring well pipe and take the first reading when an audible signal is established. The probe will be rinsed with a detergent solution and clean water between each well.

2. Once the liquid level is measured, the distance between the bottom of the monitoring well and the liquid level is calculated. The pump will be set near the middle of the water column in order to avoid stirring of sediments at the bottom of the well.

3. The required length of the Teflon tubing is determined by adding the length of the middle water column and an additional length to allow for water discharge into a pail. If the monitoring well is an aboveground casing, the length of the aboveground casing will be added as well.

4. New Teflon tubing is used at each well to avoid cross contamination.

5. Set up 12 V Monsoon stainless steel submersible pump and flow controller with Teflon tubing. Slowly lower the pump to the middle of the water column.

6. Adjust the voltage on the flow controller to acquire the required flow rate. Measure the liquid level using the interface probe from time to time. Minimal drawdown is attained once the liquid level drops and stays within the 10% range of the first measurement.

7. Once the required flow rate is achieved, attach the Teflon tubing to the inlet of the flow cell with the YSI multi-meter probe and measure the indices with the YSI multi-meter. Connect a discharge Teflon tube to the outlet of the flow cell to allow for water to discharge from the flow cell into a pail.

8. Collect groundwater samples after pH, electrical conductivity and temperature stabilize within 10% variation. Apply preservatives as per the laboratory instruction.

9. After collecting samples, transfer the pump into a clean pail filled with clean water and let it run for a moment to remove entrapped sediments. Then run the pump in a second pail to ensure thorough flush following the first rinse.

10. To avoid confusion, label pails in the sequence where the pump is rinsed. Replace with clean water in the pail as required.

Groundwater Sample Handling

The laboratory requires six (6) 40 ml clear glass vials and two (2) 250 ml amber bottles for analyses of Volatile Organic Compounds (VOCs), Benzene, Toluene, Ethylbenzene, Xylenes (BTEX), petroleum hydrocarbon fractions F1 and F2. Check the white preservative tablets are present in each 40 ml vial and 250 ml amber bottle. As well, once filled and capped, confirm each vial and bottle exhibits no notable headspace. If necessary, discard and resample with new vials and bottles.

A 45 micron filter is used to field filter groundwater for analyses of dissolved metals. The filter outlet is placed on top of a sample bottle while water is decanted through a dedicated Teflon tubing attached to the inlet of the filter. Laboratory provided nitric acid is used to preserve the sample. New filter and Teflon tubing are used for each well location.

During field sampling disposable nitrile gloves are worn during sampling and changed between wells. In the event where suspicious cross-contamination occurs, nitrile gloves and sampling bottles are discarded and replaced. Each set of samples is properly labelled and bagged into a dedicated poly bag to prevent potential cross contamination between sample bottles from different well locations. Samples are stored in a cooler with ice to maintain temperature at about 5^{o} C. The coolers are dropped off at a secure laboratory depot with a completed chain of custody at the end of each sampling day for delivery to the laboratory in Calgary, Alberta.

Soil Sampling During Drilling

Soil samples were collected during the advancement of testholes using solid stem auger, hollow stem auger or ODEX tooling. A Geoprobe or small track or truck-mounted drill rig was determined pending the presence of soft ground and the ability to access test locations in a confined or steep slope (more than 10%).

Solid stem auger was used at most of the sites to enable collection of representative soil samples. However, in cases where the test location lies near the river bank or on top of gravels, hollow stem auger or ODEX was employed to drill through the hard sediments and prevent sloughing and enable the installation of a groundwater or soil vapour monitoring well.

When waste material is noted in soil, the drilling continues to the depth where the waste ends and/or the native soil is encountered to ensure complete profiling of the waste

material. Bulk soil samples underlying the waste were collected for laboratory analyses; soil samples from each soil bag were also submitted for laboratory analyses. Pending laboratory results, drill cuttings in the soil bags may be disposed at The City of Red Deer Waste Management Facility.

Sampling Soil Vapour Using Summa Canister®

1. Unlock the steel well casing and remove the brass cap from the vapour probe valve. Connect the lab provided Teflon tubing with Swagelok® fitting to the probe valve. Hand-tighten the fitting plus ¼ additional turn using a 9/16 inch wrench. To avoid damage and short circuit of the Swagelok®, care should be taken to avoid over tightening the Swagelok® fitting.

2. Connect the probe tip of the RKI Eagle II with the Teflon tubing attached to the vapour probe. Open the vapour valve to allow the vapour to flow into the monitoring instrument.

3. Start the stop watch to count the purge time. The purge time is calculated by dividing the volume of the 1 inch PVC pipe with the flow rate of the RKI Eagle II.

4. For sites with heavy municipal solid waste (MSW) i.e. Lindsay Thurber Comprehensive High School, McKenzie Trail, Montfort, Red Deer College and Red Deer Motors, a minimum of three (3) equivalent volumes of soil vapour are purged prior to collecting a well vapour sample.

5. Record combustible and volatile vapours between the initial 30 seconds to two (2) minutes during purging.

6. Using the digital Cole-Palmer absolute pressure gauge, record the ambient and probe barometric pressures. The probe pressure is measured by connecting the gauge tip with the Teflon tubing attached to the vapour probe. The vapour probe and the pressure gauge should be on during the measurement.

7. Remove the brass cap from the 1.4 L Summa Canister® valve with a 9/16 inch wrench.

8. Attach the flow controller to the canister and remove the brass cap from the gauge adapter. Hand tighten the fittings and tighten another ¼ turn using a 9/16 wrench.

9. Open the valve, record the canister vacuum (this should read between -29 to -25 in Hg and close the valve.

10. Connect the adapter with the Teflon tubing to the vapour probe. Hand-tighten the fitting and tighten another ¼ turn using a 9/16 inch wrench.

11. Open the vapour probe and open the canister valve. Check the gauge periodically to ensure sample flow rate is acceptable.

12. When the vacuum reads about -5 inches Hg, close the vapour probe and the valve, disassemble the flow controller and the Teflon tubing, then place the protective brass cap back on the canister valve. Hand tighten the cap and perform another ¼ turn using a 9/16 inch wrench.

13. It is always a good practice to maintain some vacuum in the canister following sampling. The residual vacuum serves as a check for the integrity of the canister during transport to the laboratory.

14. Record the canister and the flow controller serial numbers on the field sheet and the chain of custody.

15. A dedicated set of Teflon tubing, Swagelok® fitting and gauge with flow controller assembly must be used at each sample well location to prevent cross contamination.

Sampling Soil Vapour Using Tedlar Bag®

1. Place the 1 L Tedlar Bag® inside the lung box. Connect the Tedlar Bag® nozzle with the tubing attached to the brass nipple inside the lung box.

2. Perform a full turn counter clockwise to open the valve and go another ¼ turn clockwise. This is to ensure that the valve is properly opened for sampling.

3. Connect the Teflon tubing attached to the vapour probe with the exterior brass nipple on the lung box.

4. Connect the other exterior brass nipple of the lung box to the SKC pump. Ensure the lung box is closed to prevent air leak during sampling.

5. Open the vapour probe valve and activate the SKC pump. The pump will evacuate the lung box causing the Tedlar Bag® to expand drawing a sample of soil vapour.

6. The SKC pump was set at a flow rate of 0.5 L/min and the volume of the lung box is 4 L. The estimated sampling time is approximately 8 minutes. Check the Tedlar Bag® at about 8 minutes or periodically to verify the progress of sample collection.

7. When the Tedlar Bag® is approximately 80% full, close the bag valve by turning it clockwise until it is tight. Then turn off the SKC pump and close the vapour probe. To ensure the bag is sufficiently filled, repeat steps 5-7, if necessary.

8. Avoid over filling the Tedlar Bag®. This will prevent damage to the bag if exposure to change of temperature, altitude and barometric pressure occurs during transport by ground and/or air.

Validation of Analytical Data

Alberta Environment and Sustainable Resource Development (ESRD), formerly Alberta Environment, implemented a Laboratory Data Quality Assurance Policy in October 2001. This policy requires laboratories providing environmental analytical data to meet the accreditation standards set by ESRD. ALS Canada Ltd. and Maxxam Analytics are each accredited by Standards Council of Canada (SCC), which is administered by the Canadian Association for Laboratory Accreditation Inc. (CALA). This accreditation demonstrates ALS Canada Ltd. Laboratories and Maxxam Analytics have consistent laboratory procedures and quality controls meeting national and international standards for staff training, equipment maintenance and documentation of parameters. The laboratory protocols must be maintained to demonstrate the in lab quality assurance/quality control (QA/QC) procedures are consistently maintained and are paramount to the integrity and reliability of the reported results.

A data quality review was performed for all analytical results reported. The data quality review comprised of the following actions by Tiamat.

- Ensure the Chain of Custody form are properly completed and signed;
- Ensure the requested analyses were performed and reported for the correct samples;
- Calculate and review relative percent differences (RPD), where available, to assess the laboratory precision and analytical variability for each batch of samples;
- Perform independent review of the internal quality control (QC) and quality assurance (QA) practices for the laboratory;
- Confirm the applicable holding times and extraction times for each sample have been met by the laboratory;
- Identify and resolve additional data quality issues with the laboratory.

The Chain of Custody forms submitted for each work order for this project appeared to be properly completed. The Chain of Custody forms show the sample temperature (where applicable) upon receipt at the laboratory and the appropriate sample custody signatures.

Laboratory QC protocols include surrogate recoveries, laboratory duplicates, method blanks, matrix spikes and reference materials, where applicable. QC results published

with the sample report comply with the prescribed laboratory QC limits. Thus, analytical results are deemed to be within acceptable variability and a corresponding acceptable level of precision and accuracy.

Tiamat reviews all QA/QC outcomes published with the respective laboratory reports. Discrepancies are reported to the laboratory for follow-up. The laboratory's analytical processes for the specific testing program for this project appear to be acceptable.

The holding times experienced by all samples submitted met the recommended holding time limit for the specified parameter where applicable. Overall, the review and data validation process indicates the analytical results are valid and reliable.

For the Riverside Light Industrial Park, a total of 3 groundwater samples, 2 Summa Canister® and 2 Tedlar Bags® were collected for this Phase II ESA. Note, duplicate Tedlar Bag® samples were collected for QA/QC purposes.

Sample containers were provided by the laboratory. Collected samples are appropriately packed in sample coolers and shipped from Red Deer to Calgary by a third-party courier contracted by the respective laboratory. It is presumed the courier handles the sample coolers with appropriate care. There were no reported issues with the samples upon receipt at the laboratory.

Tiamat applies a uniform field protocol consistent with industry practice to ensure the integrity of each sample collected for laboratory analysis. Coupled with the in-house laboratory control measures implemented by each laboratory, the overall QA/QC objectives are deemed to be satisfied.

Field Duplicate Evaluation

An evaluation of duplicate variation is undertaken to assess the precision of field sampling and laboratory analyses. For comparison, the relative percent difference (RPD) is calculated.

RPD is defined as the absolute difference between two results divided by the average of the two results multiplied by one hundred. Where one result is below detection limit, and its duplicate result is above detection limit, the non-detect concentration is assigned the detection limit for the purposes of calculating RPD.

Groundwater duplicates should be taken during groundwater sampling events at an average of every ten (10) samples or about 10% of the sample set.
For groundwater samples, the objective for RPD values is to be not more than 20%.

Field Blank Assessment

A field blank is a sample of laboratory-supplied reverse osmosis water poured into a laboratory supplied sample container in the field and shipped to the laboratory with the field samples using a unique sample identifier. The purpose of a field blank is to assess potential cross contamination from field conditions during sampling. For this initial

assessment, no previous site specific analyte data was available, thus field blanks were not deemed to be necessary.

Trip Blank Assessment

A trip blank is a clean sample container of reverse osmosis water that is taken to the sampling site and transported back to the laboratory for analysis without having been exposed to sampling procedures. The trip blanks prepared by the laboratory are kept within the sample containers at all times and never opened in the field. Analyses of trip blanks indicate whether a sample was contaminated during shipment from the laboratory to the field and from the field to the laboratory. Tiamat's standard sample bottle procedure is to have each set of sample bottles placed into clean new plastic bags. This prevents direct contact between other sample bottles in the sample cooler.

Field Duplicates

Duplicate samples are samples collected sequentially at the time of sampling. Generally the same compounds should be detected in both samples. For this initial assessment, there have been no history of problematic analytical parameters and field duplicates were not warranted.

Laboratory Quality Control

The following sections outline the quality control measures which the laboratory implements. Generally, Maxxam's and ALS's QA/QC samples were tested at least once per analytical batch.

Laboratory Duplicate Assessment

Lab duplicates are two separate aliquots of water (from one location but from different vials) that are analysed in the laboratory to assess laboratory analytical precision. For comparison between duplicates a calculation of relative percent difference (RPD) was carried out by the laboratory. No laboratory duplicate had any analytes with an RPD greater than the laboratory control limits. This quantitatively affirms the QA/QC and the precision of a sample result.

Matrix Spike Assessment

A matrix spike is a sample prepared by adding a known mass of a target analyte(s) to a specified amount of sample (matrix). Spiked samples are used to determine the effect of the matrix on a method's recovery efficiency. The laboratory states their control limits based on 99% confidence interval in the quality control report section of the laboratory analytical report. Control limits for recoveries are often statistically determined by the method, but under some conditions may revert to standard method limits.

Generally, matrix spike recoveries for groundwater tests were within laboratory control limits. The results of matrix spike recovery confirm the protocols and the acceptable limits established by the laboratory for precision and accuracy was met.

Terms and Conditions for use of Alberta Survey Control Marker Data

1. The distribution of this digital data is provided as a service to the user and is under copyright to the Government of Alberta.

2. Redistribution of the data in whole or in part, whether alone or part of a value added product, is not permitted without the prior written consent of Alberta Sustainable Resource Development on behalf of the Minister of Alberta Sustainable Resource Development, Government of Alberta.

3. In view of the dated nature of the data, it is the responsibility of the user of the data:
   a) Confirm with the Alberta Sustainable Resource Development whether later versions are available before making use of the data.
   b) Advise users of the age and status of the data if the Minister permits the user to provide the data to other users.

4. The user agrees that the data and each part thereof, any formatting or presentation thereof, any storage media on which it is provided, and any communication of any kind, incidental or in relation thereto, is provided to the user by the Minister and the Crown without warranty or representation as to any matter including but not limited to whether the data and storage media is correct, accurate or free from error, defect, danger, or hazard, and whether it is otherwise useful or suitable for any use the user may make of it.

5. The Crown in right of Alberta, the Minister and their employees and agents, shall not be liable for any claims, costs, losses, or damages, including any special, indirect, incidental or consequential loss or damage, which the user may incur or experience as a result of the use or possession of the data or associated storage media.

SURVEYING AND MAPPING DIVISION
Alberta Survey Control Marker (ASCM) Information
MASCOT DSS-1

Horz Datum NAD83 Updated: 1994-05-24 — ASCM 36574
Latitude 52 17 43.12829 dms — Marker Installed 67-03
Longitude 113 47 52.26311 dms — Tablet Markings 793+16.23.4
Horz Class INTEGRATED , ORDER 2 — Date Printed 2013-08-21
Last Updated 2003-03-12 — Mapsheet Name RED DEER
Vert Datum CVD28 Updated: 1983-12-08 — Mapsheet Number 5793 + 016
Elevation 850.471 m — For current information call Geodetic Survey
Vert Class INTEGRATED , SPIRIT LEVELS — (780) 427-3143 FAX: (780) 427-1493 — Marker Condition GOOD 92-02-20

3TM COORDINATES

Scale Factor 0.999900 At Ref Mer 114

Northing 5795642.746 m
Easting 13790.274 m
Convergence 0 09 35.77 dms
Station Ellipsoid Factor 0.999870
Station Combined Factor 0.999772

GEOID DATA (GSD95) Updated: 96-01-06

Component	Magnitude	Std Dev
Meridian Defl,XI(+N)	2.1 s	2 s
Prime Vert Defl,ETA(+E)	4.4 s	2 s
Geoid_Ellip Separation	-18.29 m	1 m

COORDINATE HISTORY	HORZ	VERT
Originating Project	70033	70033
Published	83-12-08	83-12-08
Revising Project	NAD83	
Published	94-05-24	
Revising Project		
Published		
Revising Project		
Published		

NON COORDINATE REVISIONS

1971-05-19 FIRST MARKER LOCATION DESCRIPTION ENTERED
2003-03-12 "MAPSHEET NAME" AND/OR "MAPSHEET NO" CHANGED

HISTORICAL/OTHER MARKER NAMES

OLD ASC # 57933 16 62

HISTORY 57933 16 62

ADJACENT MARKERS (calculated) Updated: 1994-06-07

ASCM To	Tablet Markings	Horizontal Distance (m)	Std Dev (cm)	PPM/ Order	Grid/ Grnd Factor	Grid Bearing (dms)	Std Dev (s)	T-t Corr (s)
67884	793+16.23.3	427.874	1	28/1	0.999774	29 42 37.77	2.4	0.01
14266	793+16.24.3	444.161	1	40/2	0.999769	297 38 36.48	3.4	0.01
39024	793+16.91	474.231	1	38/2	0.999770	292 23 06.92	3.2	0.01
124339	793+16.103	483.134	1	29/2	0.999771	186 38 49.27	2.5	-0.02
225466	793+16.96	491.603	1	45/2	0.999770	249 07 53.21	3.6	-0.01
266627	793+16.90	530.988	1	38/2	0.999770	301 13 12.35	3.1	0.01

MARKER TYPE Updated: 1992-03-27

ASC BRASS TABLET MKD 793+16.23.4 ON 7.0CM HEAVY WALL STEEL PIPE.
9 CM BGL IN A MH & COVER, LANDSCAPED

MARKER LOCATION Updated: 1988-12-01

LOCATED ON THE WEST SIDE OF RIVERSIDE DRIVE - SOUTH OF 42 AVENUE SHOWN ON PLAN #5495 MCL; 7.0 M NORTH OF CENTRE LINE OF RIVERSIDE DRIVE; 117.7 M SOUTH OF CENTRE LINE OF STORM SEWER CROSSING MARKED WITH SIGN "AUTHORIZED VEHICLES ONLY BEYOND THIS POINT"; COUNTER SUNK IN STEEL SLEEVE WITH REMOVABLE LID.

MARKER CONDITION COMMENTS	Inspected	Updated
MARKER REPORTED IN GOOD CONDITION	1992-02-20	1992-03-27
MARKER REPORTED IN GOOD CONDITION.	1989-02-08	1989-06-07
MARKER REPORTED IN GOOD CONDITION.	1988-11-24	1988-12-01

COORDINATE HISTORY COMMENTS

HORZ 94-05-24 ALBERTA NAD83 READJUSTMENT

VERT

SURVEYING AND MAPPING DIVISION
Alberta Survey Control Marker (ASCM) Information
MASCOT DSS-1

Horz Datum NAD83 Updated: 1994-05-24 — ASCM 124339
Latitude 52 17 27.60973 dms — Marker Installed 82-12
Longitude 113 47 55.28404 dms — Tablet Markings 793+16.103
Horz Class INTEGRATED , ORDER 2 — Date Printed 2013-08-21
Last Updated 2003-03-12 — Mapsheet Name RED DEER
Vert Datum CVD28 Updated: 1984-07-04 — Mapsheet Number 5793 + 016
Elevation 854.345 m — For current information call Geodetic Survey
Vert Class INTEGRATED , SPIRIT LEVELS — (780) 427-3143 FAX: (780) 427-1493 — Marker Condition GOOD 92-02-20

3TM COORDINATES

Scale Factor 0.999900 At Ref Mer 114

Northing 5795162.970 m
Easting 13734.363 m
Convergence 0 09 33.34 dms
Station Ellipsoid Factor 0.999869
Station Combined Factor 0.999771

GEOID DATA (GSD95) Updated: 96-01-06

Component	Magnitude	Std Dev
Meridian Defl,XI(+N)	2.1 s	2 s
Prime Vert Defl,ETA(+E)	4.3 s	2 s
Geoid_Ellip Separation	-18.28 m	1 m

COORDINATE HISTORY	HORZ	VERT
Originating Project	82042	82042
Published	84-07-04	84-07-04
Revising Project	NAD83	
Published	94-05-24	
Revising Project		
Published		
Revising Project		
Published		

NON COORDINATE REVISIONS

1984-07-04 FIRST MARKER LOCATION DESCRIPTION ENTERED
2003-03-12 "MAPSHEET NAME" AND/OR "MAPSHEET NO" CHANGED

HISTORICAL/OTHER MARKER NAMES

OLD ASC # 57933 16 103

HISTORY 57933 16 103

ADJACENT MARKERS (calculated) Updated: 1994-06-06

ASCM To	Tablet Markings	Horizontal Distance (m)	Std Dev (cm)	PPM/ Order	Grid/ Grnd Factor	Grid Bearing (dms)	Std Dev (s)	T-t Corr (s)
109843	793+16.104	314.801	1	73/2	0.999771	271 14 35.24	6.1	0.00
257030	085220	323.950	1	52/2	0.999769	216 07 36.98	4.3	-0.01
424036	424036	342.931	1	38/2	0.999769	177 09 24.74	3.1	-0.01
84251	793+16.13.2	373.193	1	40/2	0.999770	132 41 32.09	3.3	-0.01
41491	793+16.105	389.892	1	51/2	0.999771	243 18 24.12	4.3	-0.01
119826	793+16.97	473.445	1	40/2	0.999771	292 28 34.59	3.4	0.01

MARKER TYPE Updated: 1992-03-27

ASC BRASS TABLET ON A 5CM X 250CM HEAVY WALL SQ STEEL PIPE WITH HELIX.
FLUSH WITH GROUND. 1 GP, LANDSCAPED

MARKER LOCATION Updated: 1989-06-07

LOCATED ON THE WEST SIDE OF RIVERSIDE DRIVE AND NORTH OF 67 STREET (BRIDGE) RIGHT OF WAY NEAR THE NORTH SIDE OF CURVE IN RIVERSIDE DRIVE; ON THE EAST SIDE OF RAIL ROAD ABUTMENT IN GRAVEL; 3.0 M EAST OF EAST RAIL; 25.35 M SOUTH OF ANCHOR POLE FOR POWER POLE #856; 34.0 M WEST OF CENTRE LINE OF RIVERSIDE DRIVE; 52.4 M SOUTH OF FD I AT SOUTH POINT OF LOT 21, BLOCK 1, PLAN #782-2383; 23.3 M WEST OF THIRD LIGHT STANDARD NORTH OF BRIDGE ON OFF RAMP.

MARKER CONDITION COMMENTS	Inspected	Updated
MARKER REPORTED IN GOOD CONDITION	1992-02-20	1992-03-27
MARKER REPORTED IN GOOD CONDITION.	1989-02-08	1989-06-07
MARKER REPORTED IN GOOD CONDITION.	1988-11-24	1988-12-01

COORDINATE HISTORY COMMENTS

HORZ 94-05-24 ALBERTA NAD83 READJUSTMENT

VERT

SOIL REPORTS

Riverside Light

TIAMAT ENVIRONMENTAL
ATTN: LEON MAH
UNIT 107, 2719 - 7TH AVENUE NE
CALGARY AB T2A 2L9

Date Received: 28-JUN-13
Report Date: 16-JUL-13 14:53 (MT)
Version: FINAL

Client Phone: 403-640-9009

Certificate of Analysis

Lab Work Order #: L1324834

Project P.O. #: NOT SUBMITTED
Job Reference: 12-435
C of C Numbers: 10-317479
Legal Site Desc:

Monica Gibson
Account Manager

ALS LABORATORY GROUP CHEMICAL ANALYSIS REPORT

Lab ID	Sample ID	Test Description	Result	Qualifier	D.L.	Units	Extracted	Analyzed	By
L1324834-1	RIVERSIDE LIGHT COMPOSITE SOIL BAG #1								
Sample Date: JAL/ LTM on 26-JUN-13									
Matrix:	SOIL								
		Total Organic Carbon	0.85		0.1	%	12-JUL-13	12-JUL-13	XHY
		Class II Landfill Pkg w/ Paint Filter							
		Paint Filter Test	PASS					06-JUL-13	NPA
		Flash Point	>75		30	Deg. C		06-JUL-13	NPA
		Mercury (Hg)-Leachate	<0.010		0.01	mg/L		08-JUL-13	SHT
		pH	8.47		0.1	pH		08-JUL-13	KJAY
		TCLP Leachable Metals							
		Silver (Ag)-Leachable	<0.50		0.5	mg/L		06-JUL-13	LGR
		Arsenic (As)-Leachable	<0.20		0.2	mg/L		06-JUL-13	LGR
		Boron (B)-Leachable	<5.0		5	mg/L		06-JUL-13	LGR
		Barium (Ba)-Leachable	<5.0		5	mg/L		06-JUL-13	LGR
		Beryllium (Be)-Leachable	<0.50		0.5	mg/L		06-JUL-13	LGR
		Cadmium (Cd)-Leachable	<0.050		0.05	mg/L		06-JUL-13	LGR
		Cobalt (Co)-Leachable	<5.0		5	mg/L		06-JUL-13	LGR
		Chromium (Cr)-Leachable	<0.50		0.5	mg/L		06-JUL-13	LGR
		Copper (Cu)-Leachable	<5.0		5	mg/L		06-JUL-13	LGR
		Iron (Fe)-Leachable	<5.0		5	mg/L		06-JUL-13	LGR
		Nickel (Ni)-Leachable	<0.50		0.5	mg/L		06-JUL-13	LGR
		Lead (Pb)-Leachable	<0.50		0.5	mg/L		06-JUL-13	LGR
		Antimony (Sb)-Leachable	<5.0		5	mg/L		06-JUL-13	LGR
		Selenium (Se)-Leachable	<0.20		0.2	mg/L		06-JUL-13	LGR
		Thallium (Tl)-Leachable	<0.50		0.5	mg/L		06-JUL-13	LGR
		Uranium (U)-Leachable	<1.0		1	mg/L		06-JUL-13	LGR
		Vanadium (V)-Leachable	<5.0		5	mg/L		06-JUL-13	LGR
		Zinc (Zn)-Leachable	<5.0		5	mg/L		06-JUL-13	LGR
		Zirconium (Zr)-Leachable	<5.0		5	mg/L		06-JUL-13	LGR
		TCLP Leachable BTEX							
		Benzene	<0.0050		0.005	mg/L	06-JUL-13	06-JUL-13	VVS
		Toluene	<0.0050		0.005	mg/L	06-JUL-13	06-JUL-13	VVS
		Ethylbenzene	<0.0050		0.005	mg/L	06-JUL-13	06-JUL-13	VVS
		Xylenes	<0.0050		0.005	mg/L	06-JUL-13	06-JUL-13	VVS
L1324834-2	RIVERSIDE LIGHT COMPOSITE SOIL BAG #2								
Sample Date: JAL/ LTM on 26-JUN-13									
Matrix:	SOIL								
		Total Organic Carbon	0.36		0.1	%	12-JUL-13	12-JUL-13	XHY
		Class II Landfill Pkg w/ Paint Filter							
		Flash Point	>75		30	Deg. C		06-JUL-13	NPA
		Paint Filter Test	PASS					06-JUL-13	NPA
		pH	8.80		0.1	pH		08-JUL-13	KJAY
		Mercury (Hg)-Leachate	<0.010		0.01	mg/L		08-JUL-13	SHT
		TCLP Leachable Metals							
		Silver (Ag)-Leachable	<0.50		0.5	mg/L		06-JUL-13	LGR
		Arsenic (As)-Leachable	<0.20		0.2	mg/L		06-JUL-13	LGR
		Boron (B)-Leachable	<5.0		5	mg/L		06-JUL-13	LGR
		Barium (Ba)-Leachable	<5.0		5	mg/L		06-JUL-13	LGR
		Beryllium (Be)-Leachable	<0.50		0.5	mg/L		06-JUL-13	LGR
		Cadmium (Cd)-Leachable	<0.050		0.05	mg/L		06-JUL-13	LGR

ALS LABORATORY GROUP CHEMICAL ANALYSIS REPORT

Lab ID	Sample ID	Test Description	Result	Qualifier	D.L.	Units	Extracted	Analyzed	By
L1324834-2	RIVERSIDE LIGHT COMPOSITE SOIL BAG #2								
Sample Date:	JAL/ LTM on 26-JUN-13								
Matrix:	SOIL								
		Class II Landfill Pkg w/ Paint Filter							
		TCLP Leachable Metals							
		Cobalt (Co)-Leachable	<5.0		5	mg/L		06-JUL-13	LGR
		Chromium (Cr)-Leachable	<0.50		0.5	mg/L		06-JUL-13	LGR
		Copper (Cu)-Leachable	<5.0		5	mg/L		06-JUL-13	LGR
		Iron (Fe)-Leachable	<5.0		5	mg/L		06-JUL-13	LGR
		Nickel (Ni)-Leachable	<0.50		0.5	mg/L		06-JUL-13	LGR
		Lead (Pb)-Leachable	<0.50		0.5	mg/L		06-JUL-13	LGR
		Antimony (Sb)-Leachable	<5.0		5	mg/L		06-JUL-13	LGR
		Selenium (Se)-Leachable	<0.20		0.2	mg/L		06-JUL-13	LGR
		Thallium (Tl)-Leachable	<0.50		0.5	mg/L		06-JUL-13	LGR
		Uranium (U)-Leachable	<1.0		1	mg/L		06-JUL-13	LGR
		Vanadium (V)-Leachable	<5.0		5	mg/L		06-JUL-13	LGR
		Zinc (Zn)-Leachable	<5.0		5	mg/L		06-JUL-13	LGR
		Zirconium (Zr)-Leachable	<5.0		5	mg/L		06-JUL-13	LGR
		TCLP Leachable BTEX							
		Benzene	<0.0050		0.005	mg/L	06-JUL-13	06-JUL-13	VVS
		Toluene	<0.0050		0.005	mg/L	06-JUL-13	06-JUL-13	VVS
		Ethylbenzene	<0.0050		0.005	mg/L	06-JUL-13	06-JUL-13	VVS
		Xylenes	<0.0050		0.005	mg/L	06-JUL-13	06-JUL-13	VVS

Methodology Reference

ALS Test Code	Test Description	Methodology Reference (In-House Standard Operating Procedures which Generally Follow:)
NO2-SAR-CL	Nitrite-N	APHA 4110 B - ION CHROMATOGRAPHY
HG-TCLP-CL	Mercury (Hg) - TCLP	APHA 3112 B-AAS Cold Vapor
F2-4-TMB-CL	CCME F2-4 Hydrocarbons	CCME CWS-PHC Dec-2000 - Pub# 1310
HG-200.2-CVAA-ED	Mercury in Soil by CVAAS	EPA 200.2/245.1
NO3-SAR-CL	Nitrate-N	APHA 4110 B - IC
SAL-MG/KG-CALC-CL	Salinity in mg/kg	Manual Calculation
SAT-PCNT-CL	% Saturation	CSSS 18.2-Calculation
BTX-TCLP-CL	TCLP Leachable BTEX	EPA 5030/8015& 8260-P&T GC-MS/FID
CL-SAR-CL	Chloride (Cl) (Saturated Paste)	CSSS CH15/EPA300.1
C-TOT-ORG-LECO-SK	Organic Carbon by combustion method	SSSA (1996) p. 973
FLASH-PMCC-AUTO-CL	Pensky-Martens Closed Cup Flashpoint	ASTM D-93-10a Flash point tester
MET-200.2-CCMS-ED	Metals in Soil by CRC ICPMS	EPA 200.2/6020A
PREP-200.2-ED	Acid Digestion Prep for Metals in Soil	EPA 200.2
PREP-MOISTURE-CL	% Moisture	Oven dry 105C-Gravimetric
VOC-8260-CL	EPA 8260 Volatile Organics	SW 846 8260-GC-MS
PAINT FILTER-CL	Paint Filter Test	EPA SW846-9095
PH-1:2-CL	pH (1:2 Soil:Water Extraction)	CSSS 16.3 - pH of 1:2 water extract
BTXS,F1-CL	BTEX, Styrene and F1 (C6-C10)	CCME CWS-PHC Dec-2000 - Pub# 1310
MET-TCLP-ICP-CL	TCLP Leachable Metals	EPA SW846 METHODS 1311 AND 6010B
B-HOTW-CL	Available Boron, Hot Water	APHA 3120/CSSS 9.2.2-ICP-OES
CR-CR6-3060-ED	Chromium, Hexavalent (Cr +6)	APHA 3500-CR C, EPA 3060A ALKALINE
F1-4-CALC-CL	CCME Total Hydrocarbons	CCME CWS-PHC Dec-2000 - Pub# 1310

Sample Parameter Qualifier key listed:

Qualifier	Description
DLA	Detection Limit adjusted for required dilution

GROUNDWATER REPORTS

Maxxam

Success Through Science®

Your Project #: 12-435
Site Location: RIVERSIDE LIGHT
Your C.O.C. #: A078664

Attention:JESSICA LEE

TIAMAT ENVIRONMENTAL CONSULTANTS
Unit #107,
2719-7 Avenue NE
CALGARY, AB
CANADA T2A 2L9

Report Date: 2013/12/12
This report supersedes all previous reports with the same Maxxam job number

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B367060
Received: 2013/08/02, 07:30

Sample Matrix: Water
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Acetic Acid, Formic Acid, Propionic Acid	3	N/A	2013/08/08	CAL SOP-00063	Dionex #031181, R05
Alkalinity @25C (pp, total), CO3,HCO3,OH	3	N/A	2013/08/03	AB SOP-00005	SM 2320-B
Organic Halogen (Adsorbable) (1)	3	N/A	2013/08/09	PTC SOP-00250	Coulometric - Titr.
Biochemical Oxygen Demand	3	2013/08/02	2013/08/07	AB SOP-00017	SM 5210 B
BTEX/F1 in Water by HS GC/MS	3	N/A	2013/08/06	AB SOP-00039	CCME, EPA 8260C
Cadmium - low level CCME - Dissolved	3	N/A	2013/08/08	AB SOP-00043	EPA 200.8
Cadmium - low level CCME (Total)	2	2013/08/02	2013/08/08	AB SOP-00043	EPA 200.8
Cadmium - low level CCME (Total)	1	2013/08/02	2013/08/09	AB SOP-00043	EPA 200.8
Chloride by Automated Colourimetry	3	N/A	2013/08/07	AB SOP-00020	SM 4500 Cl-G
Chemical Oxygen Demand	3	N/A	2013/08/07	AB SOP-00016	SM 5220-D
Conductivity @25C	3	N/A	2013/08/03	AB SOP-00005	SM 2510-B
CCME Hydrocarbons in Water (F2; C10-C16)	1	2013/08/06	2013/08/07	AB SOP-00040AB SOP-000	EPA3510C/CCME PHCCWS
CCME Hydrocarbons in Water (F2; C10-C16)	2	2013/08/06	2013/08/08	AB SOP-00040AB SOP-000	EPA3510C/CCME PHCCWS
Elements by ICP - Dissolved	3	N/A	2013/08/07	AB SOP-00042	EPA 200.7
Elements by ICP - Total	3	2013/08/07	2013/08/07	AB SOP-00042	EPA 200.7
Elements by ICPMS - Dissolved	3	N/A	2013/08/08	AB SOP-00043	EPA 200.8
Elements by ICPMS - Total	3	2013/08/07	2013/08/08	AB SOP-00043	EPA 200.8
Nitrogen (total), Calc. TKN, NO3, NO2	3	N/A	2013/08/07	AB WI-00065	SM 4500-N A
Ammonia-N (Total)	3	N/A	2013/08/07	AB SOP-00007	EPA 350.1
Nitrate and Nitrite	2	N/A	2013/08/06	AB SOP-00023	SM4110B
Nitrate and Nitrite	1	N/A	2013/08/07	AB SOP-00023	SM4110B
Nitrate + Nitrite-N (calculated)	2	N/A	2013/08/06	AB SOP-00023	SM 4110-B
Nitrate + Nitrite-N (calculated)	1	N/A	2013/08/07	AB SOP-00023	SM 4110-B
Nitrogen, (Nitrite, Nitrate) by IC	3	N/A	2013/08/03	AB SOP-00023	SM 4110-B
pH @25°C (Alkalinity titrator)	3	N/A	2013/08/03	AB SOP-00005	SM 4500-H+B
Sulphate by Automated Colourimetry	3	N/A	2013/08/07	AB SOP-00018	SM 4500 SO4-E
Total Trihalomethanes Calculation	3	N/A	2013/08/08	CAL SOP-00104	EPA 8260 C
Total Kjeldahl Nitrogen	3	2013/08/07	2013/08/07	AB SOP-00008	EPA 351.1, 351.2
Carbon (Total Organic) (2)	3	N/A	2013/08/07	CAL SOP-00077	MMCW 119
VOCs in Water by HS GC/MS (Std List)	3	N/A	2013/08/07	CAL SOP-00227	EPA 8260 C

Remarks:

All Blank values are reported. Associated data are not blank corrected.
'MDL' = Method Detection Limit, '<' = Less than MDL, '---' Not Analyzed

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Your Project #: 12-435
Site Location: RIVERSIDE LIGHT
Your C.O.C. #: A078664

Attention:JESSICA LEE

TIAMAT ENVIRONMENTAL CONSULTANTS
Unit #107,
2719-7 Avenue NE
CALGARY, AB
CANADA T2A 2L9

Report Date: 2013/12/12
This report supersedes all previous reports with the same Maxxam job number

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B367060
Received: 2013/08/02, 07:30

Solids results are based on dry weight except Biota Analyses & Special Waste Oil & Grease
Organic analyses are not corrected for extraction recovery standards except for Isotope Dilution methods, (i.e. CARB 429 PAH, all PCDD/F and DBD/DBF analyses)
All CCME results met required criteria unless otherwise stated in the report. All data on final reports are validated by technical personnel. Signature on file at the laboratory. Deviations from Reference Method for the Canada-wide Standard for Petroleum Hydrocarbons in Soil-Tier 1 Method:
F2/F3/F4 data reported using validated cold solvent extraction instead of Soxhlet extraction
All Groundwater samples except BTEX/VOC's or Purgeable Hydrocarbons are decanted and/or filtered prior to analysis unless otherwise mandated by regulatory agency
All analysis data reported was generated when the analytical methods were in statistical control and criteria for spike recoveries, reference material recoveries, method blanks data and duplicate precision were met unless otherwise stated

Reporting results to two significant figures at the RDL is to permit statistical evaluation and is not intended to be an indication of analytical precision.

Methods used by Maxxam are based upon those found in 'Standard Methods for the Examination of Water and Wastewater', 22nd Edition, published by the American Public Health Association, or on US EPA, protocols found in the ' Test Methods for Evaluating Solid Waste, Physical/Chemical Method, SW846, 3rd Edition. Other procedures are based on the methodologies accepted by the appropriate regulatory agency. Methodology briefs are available by written request.

All work recorded herein has been done in accordance with normal professional standards using accepted testing methodologies, quality assurance and quality control procedures except where otherwise agreed to by the client and testing company in writing. Liability for any and all use of these test results shall be limited to the actual cost of the pertinent analysis done. There is no other warranty expressed or implied. Your samples will be retained at Maxxam for a period of 60 days from receipt of data or as per contract.

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

(1) This test was performed by Maxxam Edmonton Petroleum
(2) TOC present in the sample should be considered as non-purgeable TOC.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Kayla Brassard, Project Manager
Email: KBrassard@maxxam.ca
Phone# (403)735-2258

==========

Maxxam Job #: B367060
Report Date: 2013/12/12

TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE LIGHT

AT1 BTEX AND F1-F2 (WATER)

Maxxam ID		HC0071	HC0072	HC0073		
Sampling Date		2013/08/01	2013/08/01	2013/08/01		
COC Number		A078664	A078664	A078664		
	Units	MW-01	MW-02	MW-03	RDL	QC Batch
Hydrocarbons						
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	0.10	7046697
Volatiles						
Benzene	ug/L	<0.40	<0.40	<0.40	0.40	7051829
Toluene	ug/L	<0.40	<0.40	<0.40	0.40	7051829
Ethylbenzene	ug/L	<0.40	<0.40	<0.40	0.40	7051829
m & p-Xylene	ug/L	<0.80	<0.80	<0.80	0.80	7051829
o-Xylene	ug/L	<0.40	<0.40	<0.40	0.40	7051829
Xylenes (Total)	ug/L	<0.80	<0.80	<0.80	0.80	7051829
F1 (C6-C10) - BTEX	ug/L	<100	<100	<100	100	7051829
(C6-C10)	ug/L	<100	<100	<100	100	7051829
Surrogate Recovery (%)						
1,4-Difluorobenzene (sur.)	%	102	99	104		7051829
4-BROMOFLUOROBENZENE (sur.)	%	99	102	96		7051829
D4-1,2-DICHLOROETHANE (sur.)	%	99	99	100		7051829
O-TERPHENYL (sur.)	%	128	122	119		7046697
RDL = Reportable Detection Limit						

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B367060
Report Date: 2013/12/12

TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE LIGHT

REGULATED METALS (CCME/AT1) - DISSOLVED

Maxxam ID		HC0071	HC0071	HC0072	HC0073		
Sampling Date		2013/08/01	2013/08/01	2013/08/01	2013/08/01		
COC Number		A078664	A078664	A078664	A078664		
	Units	MW-01	MW-01 Lab-Dup	MW-02	MW-03	RDL	QC Batch
Elements							
Aluminum (Al)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	0.0030	7057489
Antimony (Sb)	mg/L	<0.00060	<0.00060	<0.00060	<0.00060	0.00060	7057489
Arsenic (As)	mg/L	0.00033	0.00032	0.00051	0.0059	0.00020	7057489
Barium (Ba)	mg/L	0.15		0.20	0.55	0.010	7057490
Beryllium (Be)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	7057489
Boron (B)	mg/L	0.11		0.057	0.16	0.020	7057490
Calcium (Ca)	mg/L	230		110	210	0.30	7057490
Chromium (Cr)	mg/L	<0.0010	0.0014	<0.0010	<0.0010	0.0010	7057489
Cobalt (Co)	mg/L	0.0015	0.0015	0.00073	0.0092	0.00030	7057489
Copper (Cu)	mg/L	0.0019	0.0021	0.0021	0.0012	0.00020	7057489
Iron (Fe)	mg/L	0.080		<0.060	4.1	0.060	7057490
Lead (Pb)	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	0.00020	7057489
Lithium (Li)	mg/L	0.035		0.021	0.035	0.020	7057490
Magnesium (Mg)	mg/L	73		35	80	0.20	7057490
Manganese (Mn)	mg/L	0.22		0.14	1.8	0.0040	7057490
Molybdenum (Mo)	mg/L	0.0013	0.0014	0.0017	0.0039	0.00020	7057489
Nickel (Ni)	mg/L	0.0086	0.0089	0.0022	0.012	0.00050	7057489
Phosphorus (P)	mg/L	<0.10		<0.10	0.13	0.10	7057490
Potassium (K)	mg/L	7.5		4.7	26	0.30	7057490
Selenium (Se)	mg/L	0.00047	0.00044	0.0016	0.00028	0.00020	7057489
Silicon (Si)	mg/L	6.8		5.2	8.1	0.10	7057490
Silver (Ag)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	7057489
Sodium (Na)	mg/L	68		36	140	0.50	7057490
Strontium (Sr)	mg/L	1.1		0.58	1.7	0.020	7057490
Sulphur (S)	mg/L	44		9.3	9.0	0.20	7057490
Thallium (Tl)	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	0.00020	7057489
Tin (Sn)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	7057489
Titanium (Ti)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	7057489
Uranium (U)	mg/L	0.0078	0.0075	0.0028	0.0035	0.00010	7057489
Vanadium (V)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	7057489
Zinc (Zn)	mg/L	<0.0030	0.0031	<0.0030	0.0077	0.0030	7057489
Low Level Elements							
Cadmium (Cd)	ug/L	0.080		0.040	0.047	0.0050	7046381

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

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B367060
Report Date: 2013/12/12

TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE LIGHT

REGULATED METALS (CCME/AT1) - TOTAL

Maxxam ID		HC0071	HC0072	HC0073		
Sampling Date		2013/08/01	2013/08/01	2013/08/01		
COC Number		A078664	A078664	A078664		
	Units	MW-01	MW-02	MW-03	RDL	QC Batch
Elements						
Aluminum (Al)	mg/L	21	9.3	8.7	0.0030	7057234
Antimony (Sb)	mg/L	0.00098	0.00079	0.00087	0.00060	7057234
Arsenic (As)	mg/L	0.035	0.018	0.017	0.00020	7057234
Barium (Ba)	mg/L	1.4	0.53	0.95	0.010	7057243
Beryllium (Be)	mg/L	0.0018	<0.0010	<0.0010	0.0010	7057234
Boron (B)	mg/L	0.12	0.061	0.17	0.020	7057243
Calcium (Ca)	mg/L	350	150	250	0.30	7057243
Chromium (Cr)	mg/L	0.049	0.019	0.021	0.0010	7057234
Cobalt (Co)	mg/L	0.019	0.010	0.017	0.00030	7057234
Copper (Cu)	mg/L	0.072	0.031	0.025	0.00020	7057234
Iron (Fe)	mg/L	62	24	30	0.060	7057243
Lead (Pb)	mg/L	0.034	0.014	0.015	0.00020	7057234
Lithium (Li)	mg/L	0.075	0.036	0.051	0.020	7057243
Magnesium (Mg)	mg/L	110	48	96	0.20	7057243
Manganese (Mn)	mg/L	1.6	0.68	2.2	0.0040	7057243
Molybdenum (Mo)	mg/L	0.0035	0.0030	0.0049	0.00020	7057234
Nickel (Ni)	mg/L	0.071	0.032	0.035	0.00050	7057234
Phosphorus (P)	mg/L	1.8	0.63	0.69	0.10	7057243
Potassium (K)	mg/L	13	7.3	29	0.30	7057243
Selenium (Se)	mg/L	0.0020	0.0028	0.00077	0.00020	7057234
Silicon (Si)	mg/L	59	27	31	0.10	7057243
Silver (Ag)	mg/L	0.00066	0.00031	0.00021	0.00010	7057234
Sodium (Na)	mg/L	70	36	150	0.50	7057243
Strontium (Sr)	mg/L	1.2	0.63	1.7	0.020	7057243
Sulphur (S)	mg/L	47	10	11	0.20	7057243
Thallium (Tl)	mg/L	0.00040	<0.00020	<0.00020	0.00020	7057234
Tin (Sn)	mg/L	0.0012	<0.0010	0.0015	0.0010	7057234
Titanium (Ti)	mg/L	0.29	0.15	0.16	0.0010	7057234
Uranium (U)	mg/L	0.0099	0.0040	0.0047	0.00010	7057234
Vanadium (V)	mg/L	0.067	0.030	0.025	0.0010	7057234
Zinc (Zn)	mg/L	0.19	0.094	0.10	0.0030	7057234
Low Level Elements						
Cadmium (Cd)	ug/L	0.81	0.47	0.46	0.0050	7045788
RDL = Reportable Detection Limit						

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B367060
Report Date: 2013/12/12

TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE LIGHT

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		HC0071		HC0072		HC0073		
Sampling Date		2013/08/01		2013/08/01		2013/08/01		
COC Number		A078664		A078664		A078664		
	Units	MW-01	RDL	MW-02	RDL	MW-03	RDL	QC Batch
Calculated Parameters								
Nitrate (NO3)	mg/L	86	0.13	5.5	0.013	<0.013	0.013	7046384
Nitrate plus Nitrite (N)	mg/L	20	0.030	1.3	0.0030	<0.0030	0.0030	7046345
Nitrite (NO2)	mg/L	3.0	0.0099	<0.0099	0.0099	<0.0099	0.0099	7046384
Demand Parameters								
Biochemical Oxygen Demand	mg/L	2.2	2.0	<2.0	2.0	2.2	2.0	7046543
Chemical Oxygen Demand	mg/L	210	5.0	130	5.0	190	5.0	7054227
Misc. Inorganics								
Conductivity	uS/cm	1800	1.0	910	1.0	2300	1.0	7046994
pH	pH	7.07		7.48		7.23		7046993
Organic Carbon (C)	mg/L	5.2	0.50	2.9	0.50	16	0.50	7056880
Anions								
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	<0.50	0.50	<0.50	0.50	7046990
Alkalinity (Total as CaCO3)	mg/L	620	0.50	350	0.50	940	0.50	7046990
Bicarbonate (HCO3)	mg/L	750	0.50	430	0.50	1100	0.50	7046990
Carbonate (CO3)	mg/L	<0.50	0.50	<0.50	0.50	<0.50	0.50	7046990
Hydroxide (OH)	mg/L	<0.50	0.50	<0.50	0.50	<0.50	0.50	7046990
Sulphate (SO4)	mg/L	160	1.0	39	1.0	34	1.0	7054149
Chloride (Cl)	mg/L	110	1.0	59	1.0	190	1.0	7054104
Nutrients								
Ammonia (N)	mg/L	<0.050	0.050	<0.050	0.050	16 (1)	0.50	7053981
Nitrogen (N)	mg/L	23	0.050	2.1	0.050	14	0.050	7046499
Total Kjeldahl Nitrogen	mg/L	2.4 (2)	0.25	0.86	0.050	14 (2)	0.50	7056189
Nitrite (N)	mg/L	0.91	0.0030	<0.0030	0.0030	<0.0030	0.0030	7047026
Nitrate (N)	mg/L	19 (2)	0.030	1.3	0.0030	<0.0030	0.0030	7047026
Organic Acids								
Acetic Acid	mg/L	<50	50	<50	50	<50	50	7049414
Formic Acid	mg/L	<50	50	<50	50	<50	50	7049414
Propionic Acid	mg/L	<50	50	<50	50	<50	50	7049414
Misc. Organics								
Organic halogen	mg/L	0.075	0.004	0.055	0.004	0.05	0.02	7029167

RDL = Reportable Detection Limit

(1) Detection limits raised due to dilution to bring analyte within the calibrated range. Ammonia greater than TKN. Results are within acceptable limits of precision.

(2) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B367060
Report Date: 2013/12/12

TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE LIGHT

VOLATILE ORGANICS BY GC-MS (WATER)

Maxxam ID		HC0071	HC0072	HC0073		
Sampling Date		2013/08/01	2013/08/01	2013/08/01		
COC Number		A078664	A078664	A078664		
	Units	MW-01	MW-02	MW-03	RDL	QC Batch
Volatiles						
Total Trihalomethanes	ug/L	<2.0	<2.0	<2.0	2.0	7045085
Bromodichloromethane	ug/L	<0.50	<0.50	<0.50	0.50	7054234
Bromoform	ug/L	<0.50	<0.50	<0.50	0.50	7054234
Bromomethane	ug/L	<2.0	<2.0	<2.0	2.0	7054234
Carbon tetrachloride	ug/L	<0.50	<0.50	<0.50	0.50	7054234
Chlorobenzene	ug/L	<0.50	<0.50	<0.50	0.50	7054234
Chlorodibromomethane	ug/L	<1.0	<1.0	<1.0	1.0	7054234
Chloroethane	ug/L	<1.0	<1.0	<1.0	1.0	7054234
Chloroform	ug/L	<0.50	<0.50	<0.50	0.50	7054234
Chloromethane	ug/L	<2.0	<2.0	<2.0	2.0	7054234
1,2-dibromoethane	ug/L	<0.50	<0.50	<0.50	0.50	7054234
1,2-dichlorobenzene	ug/L	<0.50	<0.50	<0.50	0.50	7054234
1,3-dichlorobenzene	ug/L	<0.50	<0.50	<0.50	0.50	7054234
1,4-dichlorobenzene	ug/L	<0.50	<0.50	<0.50	0.50	7054234
1,1-dichloroethane	ug/L	<0.50	<0.50	<0.50	0.50	7054234
1,2-dichloroethane	ug/L	<0.50	<0.50	<0.50	0.50	7054234
1,1-dichloroethene	ug/L	<0.50	<0.50	<0.50	0.50	7054234
cis-1,2-dichloroethene	ug/L	<0.50	<0.50	<0.50	0.50	7054234
trans-1,2-dichloroethene	ug/L	<0.50	<0.50	<0.50	0.50	7054234
Dichloromethane	ug/L	<2.0	<2.0	<2.0	2.0	7054234
1,2-dichloropropane	ug/L	<0.50	<0.50	<0.50	0.50	7054234
cis-1,3-dichloropropene	ug/L	<0.50	<0.50	<0.50	0.50	7054234
trans-1,3-dichloropropene	ug/L	<0.50	<0.50	<0.50	0.50	7054234
Methyl methacrylate	ug/L	<0.50	<0.50	<0.50	0.50	7054234
Methyl-tert-butylether (MTBE)	ug/L	<0.50	<0.50	<0.50	0.50	7054234
Styrene	ug/L	<0.50	<0.50	<0.50	0.50	7054234
1,1,1,2-tetrachloroethane	ug/L	<2.0	<2.0	<2.0	2.0	7054234
1,1,2,2-tetrachloroethane	ug/L	<2.0	<2.0	<2.0	2.0	7054234
Tetrachloroethene	ug/L	<0.50	<0.50	<0.50	0.50	7054234
1,2,3-trichlorobenzene	ug/L	<1.0	<1.0	<1.0	1.0	7054234
1,2,4-trichlorobenzene	ug/L	<1.0	<1.0	<1.0	1.0	7054234
1,3,5-trichlorobenzene	ug/L	<0.50	<0.50	<0.50	0.50	7054234
1,1,1-trichloroethane	ug/L	<0.50	<0.50	<0.50	0.50	7054234
1,1,2-trichloroethane	ug/L	<0.50	<0.50	<0.50	0.50	7054234
Trichloroethene	ug/L	<0.50	<0.50	<0.50	0.50	7054234
Trichlorofluoromethane	ug/L	<0.50	<0.50	<0.50	0.50	7054234
RDL = Reportable Detection Limit						

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B367060
Report Date: 2013/12/12

TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE LIGHT

VOLATILE ORGANICS BY GC-MS (WATER)

Maxxam ID		HC0071	HC0072	HC0073		
Sampling Date		2013/08/01	2013/08/01	2013/08/01		
COC Number		A078664	A078664	A078664		
	Units	**MW-01**	**MW-02**	**MW-03**	**RDL**	**QC Batch**
1,2,4-trimethylbenzene	ug/L	<0.50	<0.50	<0.50	0.50	7054234
1,3,5-trimethylbenzene	ug/L	<0.50	<0.50	<0.50	0.50	7054234
Vinyl chloride	ug/L	<0.50	<0.50	<0.50	0.50	7054234
Surrogate Recovery (%)						
1,4-Difluorobenzene (sur.)	%	99	99	101		7054234
4-BROMOFLUOROBENZENE (sur.)	%	95	94	94		7054234
D4-1,2-DICHLOROETHANE (sur.)	%	100	97	104		7054234
RDL = Reportable Detection Limit						

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B367060
Report Date: 2013/12/12

TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE LIGHT

GENERAL COMMENTS

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

Package 1	5.3°C

RESULTS OF CHEMICAL ANALYSES OF WATER Comments

Sample HC0320-02 Acetic Acid, Formic Acid, Propionic Acid: Detection limits raised due to sample matrix.
Sample HC0071-02 Acetic Acid, Formic Acid, Propionic Acid: Detection limits raised due to sample matrix.
Sample HC0072-02 Acetic Acid, Formic Acid, Propionic Acid: Detection limits raised due to sample matrix.
Sample HC0073-02 Acetic Acid, Formic Acid, Propionic Acid: Detection limits raised due to sample matrix.

Results relate only to the items tested.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B367060
Report Date: 2013/12/12

TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE LIGHT

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
7029167	MN2	QC Standard	Organic halogen	2013/08/09		86	%	84 - 111
7029167	MN2	Method Blank	Organic halogen	2013/08/09	<0.5		mg/L	
7046543	LS0	Spiked Blank	Biochemical Oxygen Demand	2013/08/07		86	%	85 - 115
7046543	LS0	Method Blank	Biochemical Oxygen Demand	2013/08/07	<2.0		mg/L	
7046543	LS0	RPD	Biochemical Oxygen Demand	2013/08/07	NC		%	20
7046697	NK3	Matrix Spike	O-TERPHENYL (sur.)	2013/08/07		108	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2013/08/07		NC	%	50 - 130
7046697	NK3	Spiked Blank	O-TERPHENYL (sur.)	2013/08/07		113	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2013/08/07		94	%	70 - 130
7046697	NK3	Method Blank	O-TERPHENYL (sur.)	2013/08/07		117	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2013/08/07	<0.10		mg/L	
7046697	NK3	RPD	F2 (C10-C16 Hydrocarbons)	2013/08/07	NC		%	40
7046990	CT6	Spiked Blank	Alkalinity (Total as CaCO3)	2013/08/03		95	%	80 - 120
7046990	CT6	Method Blank	Alkalinity (PP as CaCO3)	2013/08/03	<0.50		mg/L	
			Alkalinity (Total as CaCO3)	2013/08/03	<0.50		mg/L	
			Bicarbonate (HCO3)	2013/08/03	<0.50		mg/L	
			Carbonate (CO3)	2013/08/03	<0.50		mg/L	
			Hydroxide (OH)	2013/08/03	<0.50		mg/L	
7046990	CT6	RPD	Alkalinity (PP as CaCO3)	2013/08/03	NC		%	20
			Alkalinity (Total as CaCO3)	2013/08/03	2.8		%	20
			Bicarbonate (HCO3)	2013/08/03	2.8		%	20
			Carbonate (CO3)	2013/08/03	NC		%	20
			Hydroxide (OH)	2013/08/03	NC		%	20
7046993	CT6	Spiked Blank	pH	2013/08/03		101	%	97 - 102
7046993	CT6	RPD	pH	2013/08/03	0.06		%	5
7046994	CT6	Spiked Blank	Conductivity	2013/08/03		103	%	90 - 110
7046994	CT6	Method Blank	Conductivity	2013/08/03	<1.0		uS/cm	
7046994	CT6	RPD	Conductivity	2013/08/03	1		%	20
7047026	CT6	Matrix Spike	Nitrite (N)	2013/08/03		93	%	80 - 120
			Nitrate (N)	2013/08/03		NC	%	80 - 120
7047026	CT6	Spiked Blank	Nitrite (N)	2013/08/03		96	%	90 - 110
			Nitrate (N)	2013/08/03		98	%	90 - 110
7047026	CT6	Method Blank	Nitrite (N)	2013/08/03	<0.0030		mg/L	
			Nitrate (N)	2013/08/03	<0.0030		mg/L	
7047026	CT6	RPD	Nitrite (N)	2013/08/03	NC		%	20
			Nitrate (N)	2013/08/03	0.07		%	20
7049414	FM0	Matrix Spike	Acetic Acid	2013/08/08		103	%	70 - 130
			Formic Acid	2013/08/08		112	%	70 - 130
			Propionic Acid	2013/08/08		91	%	70 - 130
7049414	FM0	Spiked Blank	Acetic Acid	2013/08/08		117	%	70 - 130
			Formic Acid	2013/08/08		109	%	70 - 130
			Propionic Acid	2013/08/08		104	%	70 - 130
7049414	FM0	Method Blank	Acetic Acid	2013/08/08	<0.50		mg/L	
			Formic Acid	2013/08/08	<0.50		mg/L	
			Propionic Acid	2013/08/08	<0.50		mg/L	
7049414	FM0	RPD	Acetic Acid	2013/08/08	NC		%	40
			Formic Acid	2013/08/08	NC		%	40
			Propionic Acid	2013/08/08	NC		%	40
7051829	WZ0	Matrix Spike	1,4-Difluorobenzene (sur.)	2013/08/07		103	%	70 - 130
			4-BROMOFLUOROBENZENE (sur.)	2013/08/07		105	%	70 - 130
			D4-1,2-DICHLOROETHANE (sur.)	2013/08/07		111	%	70 - 130
			Benzene	2013/08/07		104	%	70 - 130
			Toluene	2013/08/07		101	%	70 - 130
			Ethylbenzene	2013/08/07		120	%	70 - 130
			m & p-Xylene	2013/08/07		118	%	70 - 130
			o-Xylene	2013/08/07		115	%	70 - 130
			(C6-C10)	2013/08/07		87	%	70 - 130
7051829	WZ0	Spiked Blank	1,4-Difluorobenzene (sur.)	2013/08/06		105	%	70 - 130
			4-BROMOFLUOROBENZENE (sur.)	2013/08/06		108	%	70 - 130
			D4-1,2-DICHLOROETHANE (sur.)	2013/08/06		105	%	70 - 130
			Benzene	2013/08/06		108	%	70 - 130
			Toluene	2013/08/06		107	%	70 - 130
			Ethylbenzene	2013/08/06		113	%	70 - 130
			m & p-Xylene	2013/08/06		121	%	70 - 130

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B367060
Report Date: 2013/12/12

TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE LIGHT

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
			o-Xylene	2013/08/06		118	%	70 - 130
			(C6-C10)	2013/08/06		92	%	70 - 130
7051829	WZ0	Method Blank	1,4-Difluorobenzene (sur.)	2013/08/06		111	%	70 - 130
			4-BROMOFLUOROBENZENE (sur.)	2013/08/06		96	%	70 - 130
			D4-1,2-DICHLOROETHANE (sur.)	2013/08/06		100	%	70 - 130
			Benzene	2013/08/06	<0.40		ug/L	
			Toluene	2013/08/06	<0.40		ug/L	
			Ethylbenzene	2013/08/06	<0.40		ug/L	
			m & p-Xylene	2013/08/06	<0.80		ug/L	
			o-Xylene	2013/08/06	<0.40		ug/L	
			Xylenes (Total)	2013/08/06	<0.80		ug/L	
			F1 (C6-C10) - BTEX	2013/08/06	<100		ug/L	
			(C6-C10)	2013/08/06	<100		ug/L	
7051829	WZ0	RPD	Benzene	2013/08/07	NC		%	40
			Toluene	2013/08/07	NC		%	40
			Ethylbenzene	2013/08/07	NC		%	40
			m & p-Xylene	2013/08/07	NC		%	40
			o-Xylene	2013/08/07	NC		%	40
			Xylenes (Total)	2013/08/07	NC		%	40
			F1 (C6-C10) - BTEX	2013/08/07	NC		%	40
			(C6-C10)	2013/08/07	NC		%	40
7053981	IA0	Matrix Spike	Ammonia (N)	2013/08/07		101(1)	%	80 - 120
7053981	IA0	Spiked Blank	Ammonia (N)	2013/08/07		99	%	80 - 120
7053981	IA0	Method Blank	Ammonia (N)	2013/08/07	<0.050		mg/L	
7053981	IA0	RPD	Ammonia (N)	2013/08/07	NC		%	20
7054104	ZI	Matrix Spike	Chloride (Cl)	2013/08/07		105	%	80 - 120
7054104	ZI	Spiked Blank	Chloride (Cl)	2013/08/07		105	%	80 - 120
7054104	ZI	Method Blank	Chloride (Cl)	2013/08/07	<1.0		mg/L	
7054104	ZI	RPD	Chloride (Cl)	2013/08/07	NC		%	20
7054149	ZI	Matrix Spike	Sulphate (SO4)	2013/08/07		NC	%	80 - 120
7054149	ZI	Spiked Blank	Sulphate (SO4)	2013/08/07		107	%	80 - 120
7054149	ZI	Method Blank	Sulphate (SO4)	2013/08/07	<1.0		mg/L	
7054149	ZI	RPD	Sulphate (SO4)	2013/08/07	0.5		%	20
7054227	TSJ	Matrix Spike	Chemical Oxygen Demand	2013/08/07		96	%	80 - 120
7054227	TSJ	Spiked Blank	Chemical Oxygen Demand	2013/08/07		98	%	80 - 120
7054227	TSJ	Method Blank	Chemical Oxygen Demand	2013/08/07	<5.0		mg/L	
7054227	TSJ	RPD	Chemical Oxygen Demand	2013/08/07	NC		%	20
7054234	MJ0	Matrix Spike	1,4-Difluorobenzene (sur.)	2013/08/07		114	%	70 - 130
			4-BROMOFLUOROBENZENE (sur.)	2013/08/07		110	%	70 - 130
			D4-1,2-DICHLOROETHANE (sur.)	2013/08/07		123	%	70 - 130
			Bromodichloromethane	2013/08/07		98	%	70 - 130
			Bromoform	2013/08/07		97	%	70 - 130
			Bromomethane	2013/08/07		82	%	70 - 130
			Carbon tetrachloride	2013/08/07		102	%	70 - 130
			Chlorobenzene	2013/08/07		89	%	70 - 130
			Chlorodibromomethane	2013/08/07		93	%	70 - 130
			Chloroethane	2013/08/07		83	%	70 - 130
			Chloroform	2013/08/07		95	%	70 - 130
			Chloromethane	2013/08/07		79	%	70 - 130
			1,2-dibromoethane	2013/08/07		90	%	70 - 130
			1,2-dichlorobenzene	2013/08/07		87	%	70 - 130
			1,3-dichlorobenzene	2013/08/07		85	%	70 - 130
			1,4-dichlorobenzene	2013/08/07		85	%	70 - 130
			1,1-dichloroethane	2013/08/07		92	%	70 - 130
			1,2-dichloroethane	2013/08/07		96	%	70 - 130
			1,1-dichloroethene	2013/08/07		96	%	70 - 130
			cis-1,2-dichloroethene	2013/08/07		93	%	70 - 130
			trans-1,2-dichloroethene	2013/08/07		92	%	70 - 130
			Dichloromethane	2013/08/07		92	%	70 - 130
			1,2-dichloropropane	2013/08/07		94	%	70 - 130
			cis-1,3-dichloropropene	2013/08/07		95	%	70 - 130
			trans-1,3-dichloropropene	2013/08/07		95	%	70 - 130
			Methyl methacrylate	2013/08/07		98	%	70 - 130
			Methyl-tert-butylether (MTBE)	2013/08/07		87	%	70 - 130

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B367060
Report Date: 2013/12/12

TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE LIGHT

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
			Styrene	2013/08/07		97	%	70 - 130
			1,1,1,2-tetrachloroethane	2013/08/07		94	%	70 - 130
			1,1,2,2-tetrachloroethane	2013/08/07		87	%	70 - 130
			Tetrachloroethene	2013/08/07		95	%	70 - 130
			1,2,3-trichlorobenzene	2013/08/07		96	%	70 - 130
			1,2,4-trichlorobenzene	2013/08/07		96	%	70 - 130
			1,3,5-trichlorobenzene	2013/08/07		96	%	70 - 130
			1,1,1-trichloroethane	2013/08/07		95	%	70 - 130
			1,1,2-trichloroethane	2013/08/07		97	%	70 - 130
			Trichloroethene	2013/08/07		92	%	70 - 130
			Trichlorofluoromethane	2013/08/07		87	%	70 - 130
			1,2,4-trimethylbenzene	2013/08/07		97	%	70 - 130
			1,3,5-trimethylbenzene	2013/08/07		99	%	70 - 130
			Vinyl chloride	2013/08/07		71	%	70 - 130
7054234	MJ0	Spiked Blank	1,4-Difluorobenzene (sur.)	2013/08/07		115	%	70 - 130
			4-BROMOFLUOROBENZENE (sur.)	2013/08/07		106	%	70 - 130
			D4-1,2-DICHLOROETHANE (sur.)	2013/08/07		111	%	70 - 130
			Bromodichloromethane	2013/08/07		103	%	70 - 130
			Bromoform	2013/08/07		104	%	70 - 130
			Bromomethane	2013/08/07		87	%	70 - 130
			Carbon tetrachloride	2013/08/07		106	%	70 - 130
			Chlorobenzene	2013/08/07		93	%	70 - 130
			Chlorodibromomethane	2013/08/07		99	%	70 - 130
			Chloroethane	2013/08/07		86	%	70 - 130
			Chloroform	2013/08/07		99	%	70 - 130
			Chloromethane	2013/08/07		83	%	70 - 130
			1,2-dibromoethane	2013/08/07		95	%	70 - 130
			1,2-dichlorobenzene	2013/08/07		90	%	70 - 130
			1,3-dichlorobenzene	2013/08/07		87	%	70 - 130
			1,4-dichlorobenzene	2013/08/07		89	%	70 - 130
			1,1-dichloroethane	2013/08/07		96	%	70 - 130
			1,2-dichloroethane	2013/08/07		101	%	70 - 130
			1,1-dichloroethene	2013/08/07		98	%	70 - 130
			cis-1,2-dichloroethene	2013/08/07		97	%	70 - 130
			trans-1,2-dichloroethene	2013/08/07		96	%	70 - 130
			Dichloromethane	2013/08/07		97	%	70 - 130
			1,2-dichloropropane	2013/08/07		98	%	70 - 130
			cis-1,3-dichloropropene	2013/08/07		100	%	70 - 130
			trans-1,3-dichloropropene	2013/08/07		96	%	70 - 130
			Methyl methacrylate	2013/08/07		106	%	70 - 130
			Methyl-tert-butylether (MTBE)	2013/08/07		92	%	70 - 130
			Styrene	2013/08/07		101	%	70 - 130
			1,1,1,2-tetrachloroethane	2013/08/07		98	%	70 - 130
			1,1,2,2-tetrachloroethane	2013/08/07		92	%	70 - 130
			Tetrachloroethene	2013/08/07		98	%	70 - 130
			1,2,3-trichlorobenzene	2013/08/07		99	%	70 - 130
			1,2,4-trichlorobenzene	2013/08/07		98	%	70 - 130
			1,3,5-trichlorobenzene	2013/08/07		99	%	70 - 130
			1,1,1-trichloroethane	2013/08/07		98	%	70 - 130
			1,1,2-trichloroethane	2013/08/07		102	%	70 - 130
			Trichloroethene	2013/08/07		94	%	70 - 130
			Trichlorofluoromethane	2013/08/07		90	%	70 - 130
			1,2,4-trimethylbenzene	2013/08/07		100	%	70 - 130
			1,3,5-trimethylbenzene	2013/08/07		101	%	70 - 130
			Vinyl chloride	2013/08/07		75	%	70 - 130
7054234	MJ0	Method Blank	1,4-Difluorobenzene (sur.)	2013/08/07		99	%	70 - 130
			4-BROMOFLUOROBENZENE (sur.)	2013/08/07		96	%	70 - 130
			D4-1,2-DICHLOROETHANE (sur.)	2013/08/07		97	%	70 - 130
			Bromodichloromethane	2013/08/07	<0.50		ug/L	
			Bromoform	2013/08/07	<0.50		ug/L	
			Bromomethane	2013/08/07	<2.0		ug/L	
			Carbon tetrachloride	2013/08/07	<0.50		ug/L	
			Chlorobenzene	2013/08/07	<0.50		ug/L	
			Chlorodibromomethane	2013/08/07	<1.0		ug/L	

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B367060
Report Date: 2013/12/12

TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE LIGHT

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
			Chloroethane	2013/08/07	<1.0		ug/L	
			Chloroform	2013/08/07	<0.50		ug/L	
			Chloromethane	2013/08/07	<2.0		ug/L	
			1,2-dibromoethane	2013/08/07	<0.50		ug/L	
			1,2-dichlorobenzene	2013/08/07	<0.50		ug/L	
			1,3-dichlorobenzene	2013/08/07	<0.50		ug/L	
			1,4-dichlorobenzene	2013/08/07	<0.50		ug/L	
			1,1-dichloroethane	2013/08/07	<0.50		ug/L	
			1,2-dichloroethane	2013/08/07	<0.50		ug/L	
			1,1-dichloroethene	2013/08/07	<0.50		ug/L	
			cis-1,2-dichloroethene	2013/08/07	<0.50		ug/L	
			trans-1,2-dichloroethene	2013/08/07	<0.50		ug/L	
			Dichloromethane	2013/08/07	<2.0		ug/L	
			1,2-dichloropropane	2013/08/07	<0.50		ug/L	
			cis-1,3-dichloropropene	2013/08/07	<0.50		ug/L	
			trans-1,3-dichloropropene	2013/08/07	<0.50		ug/L	
			Methyl methacrylate	2013/08/07	<0.50		ug/L	
			Methyl-tert-butylether (MTBE)	2013/08/07	<0.50		ug/L	
			Styrene	2013/08/07	<0.50		ug/L	
			1,1,1,2-tetrachloroethane	2013/08/07	<2.0		ug/L	
			1,1,2,2-tetrachloroethane	2013/08/07	<2.0		ug/L	
			Tetrachloroethene	2013/08/07	<0.50		ug/L	
			1,2,3-trichlorobenzene	2013/08/07	<1.0		ug/L	
			1,2,4-trichlorobenzene	2013/08/07	<1.0		ug/L	
			1,3,5-trichlorobenzene	2013/08/07	<0.50		ug/L	
			1,1,1-trichloroethane	2013/08/07	<0.50		ug/L	
			1,1,2-trichloroethane	2013/08/07	<0.50		ug/L	
			Trichloroethene	2013/08/07	<0.50		ug/L	
			Trichlorofluoromethane	2013/08/07	<0.50		ug/L	
			1,2,4-trimethylbenzene	2013/08/07	<0.50		ug/L	
			1,3,5-trimethylbenzene	2013/08/07	<0.50		ug/L	
			Vinyl chloride	2013/08/07	<0.50		ug/L	
7054234	MJ0	RPD	1,2-dibromoethane	2013/08/07	NC		%	40
			1,2-dichloroethane	2013/08/07	0.4		%	40
7056189	SK9	Matrix Spike	Total Kjeldahl Nitrogen	2013/08/07		94	%	80 - 120
7056189	SK9	QC Standard	Total Kjeldahl Nitrogen	2013/08/07		97	%	75 - 125
7056189	SK9	Spiked Blank	Total Kjeldahl Nitrogen	2013/08/07		96	%	80 - 120
7056189	SK9	Method Blank	Total Kjeldahl Nitrogen	2013/08/07	<0.050		mg/L	
7056189	SK9	RPD	Total Kjeldahl Nitrogen	2013/08/07	1.7		%	20
7056880	RW8	Matrix Spike	Organic Carbon (C)	2013/08/07		107	%	80 - 120
7056880	RW8	Spiked Blank	Organic Carbon (C)	2013/08/07		112	%	80 - 120
7056880	RW8	Method Blank	Organic Carbon (C)	2013/08/07	<0.50		mg/L	
7056880	RW8	RPD	Organic Carbon (C)	2013/08/07	NC		%	20
7057234	TDB	Matrix Spike	Aluminum (Al)	2013/08/08		NC	%	80 - 120
			Antimony (Sb)	2013/08/08		106	%	80 - 120
			Arsenic (As)	2013/08/08		98	%	80 - 120
			Beryllium (Be)	2013/08/08		96	%	80 - 120
			Chromium (Cr)	2013/08/08		101	%	80 - 120
			Cobalt (Co)	2013/08/08		102	%	80 - 120
			Copper (Cu)	2013/08/08		98	%	80 - 120
			Lead (Pb)	2013/08/08		95	%	80 - 120
			Molybdenum (Mo)	2013/08/08		106	%	80 - 120
			Nickel (Ni)	2013/08/08		98	%	80 - 120
			Selenium (Se)	2013/08/08		91	%	80 - 120
			Silver (Ag)	2013/08/08		104	%	80 - 120
			Thallium (Tl)	2013/08/08		93	%	80 - 120
			Tin (Sn)	2013/08/08		102	%	80 - 120
			Titanium (Ti)	2013/08/08		103	%	80 - 120
			Uranium (U)	2013/08/08		100	%	80 - 120
			Vanadium (V)	2013/08/08		102	%	80 - 120
			Zinc (Zn)	2013/08/08		97	%	80 - 120
7057234	TDB	Spiked Blank	Aluminum (Al)	2013/08/08		99	%	80 - 120
			Antimony (Sb)	2013/08/08		102	%	80 - 120
			Arsenic (As)	2013/08/08		97	%	80 - 120

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B367060
Report Date: 2013/12/12

TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE LIGHT

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
			Beryllium (Be)	2013/08/08		96	%	80 - 120
			Chromium (Cr)	2013/08/08		101	%	80 - 120
			Cobalt (Co)	2013/08/08		102	%	80 - 120
			Copper (Cu)	2013/08/08		102	%	80 - 120
			Lead (Pb)	2013/08/08		98	%	80 - 120
			Molybdenum (Mo)	2013/08/08		102	%	80 - 120
			Nickel (Ni)	2013/08/08		101	%	80 - 120
			Selenium (Se)	2013/08/08		92	%	80 - 120
			Silver (Ag)	2013/08/08		104	%	80 - 120
			Thallium (Tl)	2013/08/08		94	%	80 - 120
			Tin (Sn)	2013/08/08		98	%	80 - 120
			Titanium (Ti)	2013/08/08		98	%	80 - 120
			Uranium (U)	2013/08/08		100	%	80 - 120
			Vanadium (V)	2013/08/08		103	%	80 - 120
			Zinc (Zn)	2013/08/08		96	%	80 - 120
7057234	TDB	Method Blank	Aluminum (Al)	2013/08/08	<0.0030		mg/L	
			Antimony (Sb)	2013/08/08	<0.00060		mg/L	
			Arsenic (As)	2013/08/08	<0.00020		mg/L	
			Beryllium (Be)	2013/08/08	<0.0010		mg/L	
			Chromium (Cr)	2013/08/08	<0.0010		mg/L	
			Cobalt (Co)	2013/08/08	<0.00030		mg/L	
			Copper (Cu)	2013/08/08	<0.00020		mg/L	
			Lead (Pb)	2013/08/08	<0.00020		mg/L	
			Molybdenum (Mo)	2013/08/08	<0.00020		mg/L	
			Nickel (Ni)	2013/08/08	<0.00050		mg/L	
			Selenium (Se)	2013/08/08	<0.00020		mg/L	
			Silver (Ag)	2013/08/08	0.00015, RDL=0.00		mg/L	
			Thallium (Tl)	2013/08/08	<0.00020		mg/L	
			Tin (Sn)	2013/08/08	<0.0010		mg/L	
			Titanium (Ti)	2013/08/08	<0.0010		mg/L	
			Uranium (U)	2013/08/08	<0.00010		mg/L	
			Vanadium (V)	2013/08/08	<0.0010		mg/L	
			Zinc (Zn)	2013/08/08	<0.0030		mg/L	
7057234	TDB	RPD	Aluminum (Al)	2013/08/08	23.5(2)		%	20
			Antimony (Sb)	2013/08/08	NC		%	20
			Arsenic (As)	2013/08/08	NC		%	20
			Beryllium (Be)	2013/08/08	NC		%	20
			Chromium (Cr)	2013/08/08	NC		%	20
			Cobalt (Co)	2013/08/08	NC		%	20
			Copper (Cu)	2013/08/08	NC		%	20
			Lead (Pb)	2013/08/08	NC		%	20
			Molybdenum (Mo)	2013/08/08	NC		%	20
			Nickel (Ni)	2013/08/08	NC		%	20
			Selenium (Se)	2013/08/08	NC		%	20
			Silver (Ag)	2013/08/08	NC		%	20
			Thallium (Tl)	2013/08/08	NC		%	20
			Tin (Sn)	2013/08/08	NC		%	20
			Titanium (Ti)	2013/08/08	NC		%	20
			Uranium (U)	2013/08/08	7.3		%	20
			Vanadium (V)	2013/08/08	NC		%	20
			Zinc (Zn)	2013/08/08	NC		%	20
7057243	STI	Matrix Spike	Barium (Ba)	2013/08/07		99	%	80 - 120
			Boron (B)	2013/08/07		115	%	80 - 120
			Calcium (Ca)	2013/08/07		NC	%	80 - 120
			Iron (Fe)	2013/08/07		106	%	80 - 120
			Lithium (Li)	2013/08/07		103	%	80 - 120
			Magnesium (Mg)	2013/08/07		103	%	80 - 120
			Manganese (Mn)	2013/08/07		102	%	80 - 120
			Phosphorus (P)	2013/08/07		103	%	80 - 120
			Potassium (K)	2013/08/07		106	%	80 - 120
			Silicon (Si)	2013/08/07		120	%	80 - 120
			Sodium (Na)	2013/08/07		103	%	80 - 120
			Strontium (Sr)	2013/08/07		101	%	80 - 120
7057243	STI	Spiked Blank	Barium (Ba)	2013/08/07		94	%	80 - 120

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B367060
Report Date: 2013/12/12

TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE LIGHT

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
			Boron (B)	2013/08/07		113	%	80 - 120
			Calcium (Ca)	2013/08/07		100	%	80 - 120
			Iron (Fe)	2013/08/07		96	%	80 - 120
			Lithium (Li)	2013/08/07		98	%	80 - 120
			Magnesium (Mg)	2013/08/07		98	%	80 - 120
			Manganese (Mn)	2013/08/07		98	%	80 - 120
			Phosphorus (P)	2013/08/07		96	%	80 - 120
			Potassium (K)	2013/08/07		101	%	80 - 120
			Silicon (Si)	2013/08/07		110	%	80 - 120
			Sodium (Na)	2013/08/07		99	%	80 - 120
			Strontium (Sr)	2013/08/07		97	%	80 - 120
7057243	STI	Method Blank	Barium (Ba)	2013/08/07	<0.010		mg/L	
			Boron (B)	2013/08/07	0.026, RDL=0.020		mg/L	
			Calcium (Ca)	2013/08/07	<0.30		mg/L	
			Iron (Fe)	2013/08/07	<0.060		mg/L	
			Lithium (Li)	2013/08/07	<0.020		mg/L	
			Magnesium (Mg)	2013/08/07	<0.20		mg/L	
			Manganese (Mn)	2013/08/07	<0.0040		mg/L	
			Phosphorus (P)	2013/08/07	<0.10		mg/L	
			Potassium (K)	2013/08/07	<0.30		mg/L	
			Silicon (Si)	2013/08/07	<0.10		mg/L	
			Sodium (Na)	2013/08/07	<0.50		mg/L	
			Strontium (Sr)	2013/08/07	<0.020		mg/L	
			Sulphur (S)	2013/08/07	<0.20		mg/L	
7057243	STI	RPD	Barium (Ba)	2013/08/07	NC		%	20
			Boron (B)	2013/08/07	NC		%	20
			Calcium (Ca)	2013/08/07	0.03		%	20
			Iron (Fe)	2013/08/07	NC		%	20
			Lithium (Li)	2013/08/07	NC		%	20
			Magnesium (Mg)	2013/08/07	0.4		%	20
			Manganese (Mn)	2013/08/07	NC		%	20
			Phosphorus (P)	2013/08/07	NC		%	20
			Potassium (K)	2013/08/07	NC		%	20
			Silicon (Si)	2013/08/07	2.1		%	20
			Sodium (Na)	2013/08/07	1.7		%	20
			Strontium (Sr)	2013/08/07	1.1		%	20
			Sulphur (S)	2013/08/07	0.3		%	20
7057489	TDB	Matrix Spike [HC0071]	Aluminum (Al)	2013/08/08		93	%	80 - 120
			Antimony (Sb)	2013/08/08		91	%	80 - 120
			Arsenic (As)	2013/08/08		104	%	80 - 120
			Beryllium (Be)	2013/08/08		98	%	80 - 120
			Chromium (Cr)	2013/08/08		99	%	80 - 120
			Cobalt (Co)	2013/08/08		94	%	80 - 120
			Copper (Cu)	2013/08/08		89	%	80 - 120
			Lead (Pb)	2013/08/08		90	%	80 - 120
			Molybdenum (Mo)	2013/08/08		107	%	80 - 120
			Nickel (Ni)	2013/08/08		93	%	80 - 120
			Selenium (Se)	2013/08/08		104	%	80 - 120
			Silver (Ag)	2013/08/08		88	%	80 - 120
			Thallium (Tl)	2013/08/08		91	%	80 - 120
			Tin (Sn)	2013/08/08		96	%	80 - 120
			Titanium (Ti)	2013/08/08		98	%	80 - 120
			Uranium (U)	2013/08/08		101	%	80 - 120
			Vanadium (V)	2013/08/08		104	%	80 - 120
			Zinc (Zn)	2013/08/08		94	%	80 - 120
7057489	TDB	Spiked Blank	Aluminum (Al)	2013/08/08		92	%	80 - 120
			Antimony (Sb)	2013/08/08		81	%	80 - 120
			Arsenic (As)	2013/08/08		101	%	80 - 120
			Beryllium (Be)	2013/08/08		95	%	80 - 120
			Chromium (Cr)	2013/08/08		94	%	80 - 120
			Cobalt (Co)	2013/08/08		94	%	80 - 120
			Copper (Cu)	2013/08/08		96	%	80 - 120
			Lead (Pb)	2013/08/08		94	%	80 - 120
			Molybdenum (Mo)	2013/08/08		96	%	80 - 120

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B367060
Report Date: 2013/12/12

TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE LIGHT

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
			Nickel (Ni)	2013/08/08		95	%	80 - 120
			Selenium (Se)	2013/08/08		104	%	80 - 120
			Silver (Ag)	2013/08/08		95	%	80 - 120
			Thallium (Tl)	2013/08/08		95	%	80 - 120
			Tin (Sn)	2013/08/08		89	%	80 - 120
			Titanium (Ti)	2013/08/08		89	%	80 - 120
			Uranium (U)	2013/08/08		102	%	80 - 120
			Vanadium (V)	2013/08/08		96	%	80 - 120
			Zinc (Zn)	2013/08/08		102	%	80 - 120
7057489	TDB	Method Blank	Aluminum (Al)	2013/08/08	<0.0030		mg/L	
			Antimony (Sb)	2013/08/08	<0.00060		mg/L	
			Arsenic (As)	2013/08/08	<0.00020		mg/L	
			Beryllium (Be)	2013/08/08	<0.0010		mg/L	
			Chromium (Cr)	2013/08/08	<0.0010		mg/L	
			Cobalt (Co)	2013/08/08	<0.00030		mg/L	
			Copper (Cu)	2013/08/08	<0.00020		mg/L	
			Lead (Pb)	2013/08/08	<0.00020		mg/L	
			Molybdenum (Mo)	2013/08/08	<0.00020		mg/L	
			Nickel (Ni)	2013/08/08	<0.00050		mg/L	
			Selenium (Se)	2013/08/08	<0.00020		mg/L	
			Silver (Ag)	2013/08/08	<0.00010		mg/L	
			Thallium (Tl)	2013/08/08	<0.00020		mg/L	
			Tin (Sn)	2013/08/08	<0.0010		mg/L	
			Titanium (Ti)	2013/08/08	<0.0010		mg/L	
			Uranium (U)	2013/08/08	<0.00010		mg/L	
			Vanadium (V)	2013/08/08	<0.0010		mg/L	
			Zinc (Zn)	2013/08/08	<0.0030		mg/L	
7057489	TDB	RPD [HC0071]	Aluminum (Al)	2013/08/08	NC		%	20
			Antimony (Sb)	2013/08/08	NC		%	20
			Arsenic (As)	2013/08/08	NC		%	20
			Beryllium (Be)	2013/08/08	NC		%	20
			Chromium (Cr)	2013/08/08	NC		%	20
			Cobalt (Co)	2013/08/08	NC		%	20
			Copper (Cu)	2013/08/08	6.5		%	20
			Lead (Pb)	2013/08/08	NC		%	20
			Molybdenum (Mo)	2013/08/08	1.5		%	20
			Nickel (Ni)	2013/08/08	2.7		%	20
			Selenium (Se)	2013/08/08	NC		%	20
			Silver (Ag)	2013/08/08	NC		%	20
			Thallium (Tl)	2013/08/08	NC		%	20
			Tin (Sn)	2013/08/08	NC		%	20
			Titanium (Ti)	2013/08/08	NC		%	20
			Uranium (U)	2013/08/08	2.8		%	20
			Vanadium (V)	2013/08/08	NC		%	20
			Zinc (Zn)	2013/08/08	NC		%	20
7057490	YK1	Matrix Spike	Barium (Ba)	2013/08/08		108	%	80 - 120
			Boron (B)	2013/08/08		109	%	80 - 120
			Calcium (Ca)	2013/08/08		112	%	80 - 120
			Iron (Fe)	2013/08/08		115	%	80 - 120
			Lithium (Li)	2013/08/08		109	%	80 - 120
			Magnesium (Mg)	2013/08/08		107	%	80 - 120
			Manganese (Mn)	2013/08/08		110	%	80 - 120
			Phosphorus (P)	2013/08/08		110	%	80 - 120
			Potassium (K)	2013/08/08		112	%	80 - 120
			Silicon (Si)	2013/08/08		112	%	80 - 120
			Sodium (Na)	2013/08/08		106	%	80 - 120
			Strontium (Sr)	2013/08/08		108	%	80 - 120
7057490	YK1	Spiked Blank	Barium (Ba)	2013/08/08		101	%	80 - 120
			Boron (B)	2013/08/08		101	%	80 - 120
			Calcium (Ca)	2013/08/08		105	%	80 - 120
			Iron (Fe)	2013/08/08		108	%	80 - 120
			Lithium (Li)	2013/08/08		103	%	80 - 120
			Magnesium (Mg)	2013/08/08		100	%	80 - 120
			Manganese (Mn)	2013/08/08		103	%	80 - 120

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B367060
Report Date: 2013/12/12

TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE LIGHT

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
			Phosphorus (P)	2013/08/08		104	%	80 - 120
			Potassium (K)	2013/08/08		104	%	80 - 120
			Silicon (Si)	2013/08/08		105	%	80 - 120
			Sodium (Na)	2013/08/08		98	%	80 - 120
			Strontium (Sr)	2013/08/08		101	%	80 - 120
7057490	YK1	Method Blank	Barium (Ba)	2013/08/07	<0.010		mg/L	
			Boron (B)	2013/08/07	<0.020		mg/L	
			Calcium (Ca)	2013/08/07	<0.30		mg/L	
			Iron (Fe)	2013/08/07	<0.060		mg/L	
			Lithium (Li)	2013/08/07	<0.020		mg/L	
			Magnesium (Mg)	2013/08/07	<0.20		mg/L	
			Manganese (Mn)	2013/08/07	<0.0040		mg/L	
			Phosphorus (P)	2013/08/07	<0.10		mg/L	
			Potassium (K)	2013/08/07	<0.30		mg/L	
			Silicon (Si)	2013/08/07	<0.10		mg/L	
			Sodium (Na)	2013/08/07	<0.50		mg/L	
			Strontium (Sr)	2013/08/07	<0.020		mg/L	
			Sulphur (S)	2013/08/07	<0.20		mg/L	
7057490	YK1	RPD	Barium (Ba)	2013/08/07	NC		%	20
			Boron (B)	2013/08/07	NC		%	20
			Calcium (Ca)	2013/08/07	0.3		%	20
			Iron (Fe)	2013/08/07	NC		%	20
			Lithium (Li)	2013/08/07	NC		%	20
			Magnesium (Mg)	2013/08/07	0.7		%	20
			Manganese (Mn)	2013/08/07	NC		%	20
			Phosphorus (P)	2013/08/07	NC		%	20
			Potassium (K)	2013/08/07	NC		%	20
			Silicon (Si)	2013/08/07	0.1		%	20
			Sodium (Na)	2013/08/07	NC		%	20
			Strontium (Sr)	2013/08/07	NC		%	20
			Sulphur (S)	2013/08/07	1.1		%	20

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

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

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

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

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

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

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.

NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

(1) Dissolved greater than total. Reanalysis yields similar results.

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

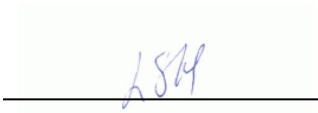
Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B367060
Report Date: 2013/12/12

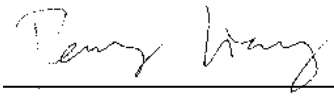
TIAMAT ENVIRONMENTAL CONSULTANTS
Client Project #: 12-435
Site Location: RIVERSIDE LIGHT

VALIDATION SIGNATURE PAGE

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



Luba Shymushovska, Senior Analyst, Organic Department



Peng Liang, Analyst II

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

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam

Calgary: 4000 19st St. NE, T2E 6P8. Ph: (403) 291-3077, Fax: (403) 735-2240, Toll free: (800) 386-7247
Edmonton: 9331 - 48 Street, T6B 2R4. Ph: (780) 577-7100, Fax: (780) 450-4187, Toll free: (877) 465-8889
www.maxxamanalytics.com

Chain of Custody

A078664

Page: 1 of 1

	Invoice To: C/O Report Address ☑	Report To: Same as Invoice ☑
Company:	TIAMAT ENVIRONMENTAL	
Contact:	JESSICA LEE	
Address:	107, 2719 7 AVE NE	
	Prov: AB PC: T2A 2L9	Prov: PC:
Contact #s:	Ph: 403-640-9009 Cell: 403-903-6917	Ph: Cell:

Report Distribution (E-Mail):
jessica@tiamatgroup.ca
kelly@tiamatgroup.ca

REGULATORY GUIDELINES:
☐ AT1
☐ CCME
☐ Regulated Drinking Water
☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

PO #:
Project # / Name: 12-935
Site Location: RIVERSIDE LIGHT
Quote #: B30497
Sampled By: JAC/KJS

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ☑ REGULAR (5 to 7 Days)

See reverse for package specifics

	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity 4	Assessment ICP Metals	Basic Class II Landfill	WATER: VOCs 8260 ☐BTEX F1	☐BTEX F1-F2	☐Routine Water: ☐Turb ☐F-	☐TOC, ☐DOC ☐BOD	Regulated Metals (CCME / AT1): Total	Dissolved	☐Total ☐Dissolved: Mercury	Other Analysis: Chlorides, SO4, NH4-N,	P, Alkalinity	Nitrate/Nitrite as N	Total N, pH / EC	ABN, Volatile Petro carbs	Styrenes	VOCs TO-15	O2, CO, CO2, CH4, N2	HC & Aliphatics	HOLD - Do not Analyze	# of Containers Submitted
1	MW-01		GW	13/08/01 PM							✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓			
2	MW-02		↓	↓							✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓			
3	MW-03		↓	↓							✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓			
4	VW-02		VAP	13/08/01 AM																								
5																												
6																												
7																												
8																												
9																												
10																												
11																												
12																												

2-Aug-13 07:30
B367060
ACI INS-0082

Please indicate Filtered, Preserved or Both (F, P, F/P) → F/P

Relinquished By (Signature/Print): JESSICA LEE	Date (YY/MM/DD): 13/08/01	Time (24:00): 1940
Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):
Special Instructions:		# of Jars Used & Not Submitted

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #:		
JOSH KINGSBURY		07:30	Custody Seal	Temperature	Ice
Lab Comments: 2013/08/02			NO	5, 5, 6	YES

AB FCD-00331 Rev3 2010/05

Maxxam Analytics International Corporation o/a Maxxam Analytics

SOIL VAPOUR REPORTS

Success Through Science®

Your Project #: 12-435
Site Location: RIVERSIDE LIGHT
Your C.O.C. #: na

Attention: Jessica Lee
Tiamat Environmental
107, 2719-7 Ave. NE
Calgary, AB
CANADA T2A 2L9

Report Date: 2013/08/25

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B3C9298
Received: 2013/08/07, 10:40

Sample Matrix: AIR
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
BTEX Fractionation in Air (TO-15mod)	1	N/A	2013/08/14	BRL SOP-00304	EPA TO-15mod
Canister Pressure (TO-15)	1	N/A	2013/08/14	BRL SOP-00304	EPA TO-15
Light Hydrocarbons	1	N/A	2013/08/21	CAM SOP-00227	GC/FID
Matrix Gases	1	N/A	2013/08/22	CAM SOP-00225, CAM SOP-00209	ASTM D1946-90
Volatile Organics in Air (TO-15) (1)	1	N/A	2013/08/14	BRL SOP-00304	EPA TO-15

(1) Air sampling canisters have been cleaned in accordance with U.S. EPA Method TO14A. At the end of the cleaning, evacuation, and pressurization cycles, one canister was selected and was pressurized with Zero Air. This canister was then analyzed via TO14A on a GC/MS. The canister must have been found to contain <0.2 ppbv concentration of all target analytes in order for the batch to have been considered clean. Each canister also underwent a leak check prior to shipment.

Please Note: SUMMA® canister samples will be retained by Maxxam for a period of 5 calendar days or as contractually agreed from the date of this report, after which time they will be cleaned for reuse. If you require a longer sample storage period, please contact your service representative.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Theresa Stephenson, Project Manager
Email: TStephenson@maxxam.ca
Phone# (905) 817-5763

==========

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

Maxxam Analytics Inc. is a NELAC accredited laboratory. Certificate # CANA001. Use of the NELAC logo however does not insure that

Your Project #: 12-435
Site Location: RIVERSIDE LIGHT
Your C.O.C. #: na

Attention: Jessica Lee
Tiamat Environmental
107, 2719-7 Ave. NE
Calgary, AB
CANADA T2A 2L9

Report Date: 2013/08/25

CERTIFICATE OF ANALYSIS

Total cover pages: 2

Maxxam Job #: B3C9298
Report Date: 2013/08/25

Tiamat Environmental
Client Project #: 12-435
Site Location: RIVERSIDE LIGHT

RESULTS OF ANALYSES OF AIR

Maxxam ID		SO1706		
Sampling Date		2013/07/31		
COC Number		na		
	Units	**HC6544-01\VW-01**	**RDL**	**QC Batch**
Gas				
Acetylene	ppm	ND	0.26	3322553
Ethane	ppm	1.7	0.26	3322553
Ethylene	ppm	ND	0.26	3322553
n-Butane	ppm	ND	0.51	3322553
n-Pentane	ppm	ND	0.26	3322553
Propane	ppm	1.1	0.26	3322553
Propene	ppm	ND	0.26	3322553
Propyne	ppm	ND	0.51	3322553
Volatile Organics				
Pressure on Receipt	psig	(-3.6)	N/A	3317031

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B3C9298
Report Date: 2013/08/25

Tiamat Environmental
Client Project #: 12-435
Site Location: RIVERSIDE LIGHT

COMPRESSED GAS PARAMETERS (AIR)

Maxxam ID		SO1706		
Sampling Date		2013/07/31		
COC Number		na		
	Units	**HC6544-01\VW-01**	**RDL**	**QC Batch**
Fixed Gases				
Oxygen	% v/v	2.0	0.3	3324319
Nitrogen	% v/v	50.9	0.3	3324319
Carbon Monoxide	% v/v	ND	0.3	3324319
Methane	% v/v	27.4	0.3	3324319
Carbon Dioxide	% v/v	19.8	0.3	3324319

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B3C9298
Report Date: 2013/08/25

Tiamat Environmental
Client Project #: 12-435
Site Location: RIVERSIDE LIGHT

VOLATILE ORGANIC HYDROCARBONS BY GC/MS (AIR)

Maxxam ID		SO1706		
Sampling Date		2013/07/31		
COC Number		na		
	Units	**HC6544-01\VW-01**	**RDL**	**QC Batch**
Volatile Organics				
Aliphatic >C5-C6	ug/m3	205	5.0	3319686
Aliphatic >C6-C8	ug/m3	483	5.0	3319686
Aliphatic >C8-C10	ug/m3	176	5.0	3319686
Aliphatic >C10-C12	ug/m3	412	5.0	3319686
Aliphatic >C12-C16	ug/m3	125	5.0	3319686
Aromatic >C7-C8 (TEX Excluded)	ug/m3	ND	5.0	3319686
Aromatic >C8-C10	ug/m3	86.0	5.0	3319686
Aromatic >C10-C12	ug/m3	71.1	5.0	3319686
Aromatic >C12-C16	ug/m3	ND	5.0	3319686

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B3C9298
Report Date: 2013/08/25

Tiamat Environmental
Client Project #: 12-435
Site Location: RIVERSIDE LIGHT

VOLATILE ORGANICS BY GC/MS (AIR)

Maxxam ID		SO1706				
Sampling Date		2013/07/31				
COC Number		na				
	Units	**HC6544-01\VW-01**	**RDL**	**ug/m3**	**DL (ug/m3)**	**QC Batch**
Volatile Organics						
Dichlorodifluoromethane (FREON 12)	ppbv	3.34	0.20	16.5	0.989	3317067
1,2-Dichlorotetrafluoroethane	ppbv	<0.17	0.17	<1.19	1.19	3317067
Chloromethane	ppbv	0.87	0.30	1.81	0.620	3317067
Vinyl Chloride	ppbv	0.60	0.18	1.54	0.460	3317067
Chloroethane	ppbv	<0.30	0.30	<0.792	0.792	3317067
1,3-Butadiene	ppbv	<0.50	0.50	<1.11	1.11	3317067
Trichlorofluoromethane (FREON 11)	ppbv	<0.20	0.20	<1.12	1.12	3317067
Ethanol (ethyl alcohol)	ppbv	34.4	2.3	64.8	4.33	3317067
Trichlorotrifluoroethane	ppbv	<0.15	0.15	<1.15	1.15	3317067
2-propanol	ppbv	11.5	3.0	28.4	7.37	3317067
2-Propanone	ppbv	32.0	0.80	75.9	1.90	3317067
Methyl Ethyl Ketone (2-Butanone)	ppbv	16.8	3.0	49.6	8.85	3317067
Methyl Isobutyl Ketone	ppbv	<3.2	3.2	<13.1	13.1	3317067
Methyl Butyl Ketone (2-Hexanone)	ppbv	<2.0	2.0	<8.19	8.19	3317067
Methyl t-butyl ether (MTBE)	ppbv	<0.20	0.20	<0.721	0.721	3317067
Ethyl Acetate	ppbv	2.6	2.2	9.47	7.93	3317067
1,1-Dichloroethylene	ppbv	<0.25	0.25	<0.991	0.991	3317067
cis-1,2-Dichloroethylene	ppbv	<0.19	0.19	<0.753	0.753	3317067
trans-1,2-Dichloroethylene	ppbv	<0.20	0.20	<0.793	0.793	3317067
Methylene Chloride(Dichloromethane)	ppbv	<0.80	0.80	<2.78	2.78	3317067
Chloroform	ppbv	<0.15	0.15	<0.732	0.732	3317067
Carbon Tetrachloride	ppbv	<0.30	0.30	<1.89	1.89	3317067
1,1-Dichloroethane	ppbv	<0.20	0.20	<0.809	0.809	3317067
1,2-Dichloroethane	ppbv	<0.20	0.20	<0.809	0.809	3317067
Ethylene Dibromide	ppbv	<0.17	0.17	<1.31	1.31	3317067
1,1,1-Trichloroethane	ppbv	<0.30	0.30	<1.64	1.64	3317067
1,1,2-Trichloroethane	ppbv	<0.15	0.15	<0.818	0.818	3317067
1,1,2,2-Tetrachloroethane	ppbv	<0.20	0.20	<1.37	1.37	3317067
cis-1,3-Dichloropropene	ppbv	<0.18	0.18	<0.817	0.817	3317067
trans-1,3-Dichloropropene	ppbv	<0.17	0.17	<0.772	0.772	3317067
1,2-Dichloropropane	ppbv	<0.40	0.40	<1.85	1.85	3317067
Bromomethane	ppbv	<0.18	0.18	<0.699	0.699	3317067
Bromoform	ppbv	<0.20	0.20	<2.07	2.07	3317067

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: B3C9298
Report Date: 2013/08/25

Tiamat Environmental
Client Project #: 12-435
Site Location: RIVERSIDE LIGHT

VOLATILE ORGANICS BY GC/MS (AIR)

Maxxam ID		SO1706				
Sampling Date		2013/07/31				
COC Number		na				
	Units	**HC6544-01\VW-01**	**RDL**	**ug/m3**	**DL (ug/m3)**	**QC Batch**
Bromodichloromethane	ppbv	<0.20	0.20	<1.34	1.34	3317067
Dibromochloromethane	ppbv	<0.20	0.20	<1.70	1.70	3317067
Trichloroethylene	ppbv	2.23	0.30	12.0	1.61	3317067
Tetrachloroethylene	ppbv	0.64	0.20	4.34	1.36	3317067
Benzene	ppbv	2.93	0.18	9.36	0.575	3317067
Toluene	ppbv	14.1	0.20	53.1	0.753	3317067
Ethylbenzene	ppbv	4.01	0.20	17.4	0.868	3317067
p+m-Xylene	ppbv	11.6	0.37	50.3	1.61	3317067
o-Xylene	ppbv	5.01	0.20	21.7	0.868	3317067
Styrene	ppbv	1.40	0.20	5.97	0.852	3317067
4-ethyltoluene	ppbv	<2.2	2.2	<10.8	10.8	3317067
1,3,5-Trimethylbenzene	ppbv	<8.3	8.3	<40.8	40.8	3317067
1,2,4-Trimethylbenzene	ppbv	3.76	0.50	18.5	2.46	3317067
Chlorobenzene	ppbv	<0.20	0.20	<0.921	0.921	3317067
Benzyl chloride	ppbv	<1.0	1.0	<5.18	5.18	3317067
1,3-Dichlorobenzene	ppbv	<0.40	0.40	<2.40	2.40	3317067
1,4-Dichlorobenzene	ppbv	<0.40	0.40	<2.40	2.40	3317067
1,2-Dichlorobenzene	ppbv	<0.40	0.40	<2.40	2.40	3317067
1,2,4-Trichlorobenzene	ppbv	<2.0	2.0	<14.8	14.8	3317067
Hexachlorobutadiene	ppbv	<3.0	3.0	<32.0	32.0	3317067
Hexane	ppbv	11.4	0.30	40.1	1.06	3317067
Heptane	ppbv	3.79	0.30	15.5	1.23	3317067
Cyclohexane	ppbv	34.9	0.20	120	0.688	3317067
Tetrahydrofuran	ppbv	8.14	0.40	24.0	1.18	3317067
1,4-Dioxane	ppbv	<2.0	2.0	<7.21	7.21	3317067
Xylene (Total)	ppbv	16.6	0.60	72.0	2.61	3317067
Vinyl Bromide	ppbv	<0.20	0.20	<0.875	0.875	3317067
Propene	ppbv	<220	220	<372	372	3317067
2,2,4-Trimethylpentane	ppbv	4.62	0.20	21.6	0.934	3317067
Carbon Disulfide	ppbv	5.31	0.50	16.6	1.56	3317067
Vinyl Acetate	ppbv	<0.20	0.20	<0.704	0.704	3317067
Surrogate Recovery (%)						
Bromochloromethane	%	102		N/A	N/A	3317067
D5-Chlorobenzene	%	90		N/A	N/A	3317067

N/A = Not Applicable
QC Batch = Quality Control Batch

Maxxam Job #: B3C9298
Report Date: 2013/08/25

Tiamat Environmental
Client Project #: 12-435
Site Location: RIVERSIDE LIGHT

VOLATILE ORGANICS BY GC/MS (AIR)

Maxxam ID		SO1706				
Sampling Date		2013/07/31				
COC Number		na				
	Units	**HC6544-01\VW-01**	**RDL**	**ug/m3**	**DL (ug/m3)**	**QC Batch**
Difluorobenzene	%	103		N/A	N/A	3317067

N/A = Not Applicable
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B3C9298
Report Date: 2013/08/25

Tiamat Environmental
Client Project #: 12-435
Site Location: RIVERSIDE LIGHT

Test Summary

Maxxam ID SO1706
Sample ID HC6544-01\VW-01
Matrix AIR

Collected 2013/07/31
Shipped
Received 2013/08/07

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
BTEX Fractionation in Air (TO-15mod)	GC/MS	3319686	N/A	2013/08/14	Jie Wu
Canister Pressure (TO-15)	PRES	3317031	N/A	2013/08/14	Jie Wu
Light Hydrocarbons	GC/FID	3322553	N/A	2013/08/21	Vijay Lad
Matrix Gases	GC/TCD	3324319	N/A	2013/08/22	Tonghui (Jenny) Chen
Volatile Organics in Air (TO-15)	GC/MS	3317067	N/A	2013/08/14	Jie Wu

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B3C9298
Report Date: 2013/08/25

Tiamat Environmental
Client Project #: 12-435
Site Location: RIVERSIDE LIGHT

GENERAL COMMENTS

ws:3317067
Ethanol exceeds 130% recovery criteria in Reference Standard. It meets %RSD criteria in the Continuing Calibration Standard. Data was accepted and flagged.

Light Hydrocarbon/Matrix Gas Analysis: Canister was pressurized with Helium to enable sampling. Results and DLs adjusted accordingly.

Matrix Gas Analysis: Results normalized to 100% dry volume.

Sample SO1706-01: Increased DL further for propene and 1,3,5-trimethylbenzene due to possible interference.

Results relate only to the items tested.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Tiamat Environmental
Attention: Jessica Lee
Client Project #: 12-435
P.O. #:
Site Location: RIVERSIDE LIGHT

Quality Assurance Report

Maxxam Job Number: GB3C9298

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	%Recovery	Units	QC Limits
3317067	JIW	Spiked Blank	Bromochloromethane	2013/08/14		101	%	60 - 140
			D5-Chlorobenzene	2013/08/14		111	%	60 - 140
			Difluorobenzene	2013/08/14		107	%	60 - 140
			Dichlorodifluoromethane (FREON 12)	2013/08/14		108	%	70 - 130
			1,2-Dichlorotetrafluoroethane	2013/08/14		115	%	70 - 130
			Chloromethane	2013/08/14		113	%	70 - 130
			Vinyl Chloride	2013/08/14		107	%	70 - 130
			Chloroethane	2013/08/14		100	%	70 - 130
			1,3-Butadiene	2013/08/14		109	%	70 - 130
			Trichlorofluoromethane (FREON 11)	2013/08/14		103	%	70 - 130
			Ethanol (ethyl alcohol)	2013/08/14		141 (1)	%	70 - 130
			Trichlorotrifluoroethane	2013/08/14		97	%	70 - 130
			2-propanol	2013/08/14		118	%	70 - 130
			2-Propanone	2013/08/14		107	%	70 - 130
			Methyl Ethyl Ketone (2-Butanone)	2013/08/14		109	%	70 - 130
			Methyl Isobutyl Ketone	2013/08/14		110	%	70 - 130
			Methyl Butyl Ketone (2-Hexanone)	2013/08/14		115	%	70 - 130
			Methyl t-butyl ether (MTBE)	2013/08/14		106	%	70 - 130
			Ethyl Acetate	2013/08/14		114	%	70 - 130
			1,1-Dichloroethylene	2013/08/14		103	%	70 - 130
			cis-1,2-Dichloroethylene	2013/08/14		106	%	70 - 130
			trans-1,2-Dichloroethylene	2013/08/14		104	%	70 - 130
			Methylene Chloride(Dichloromethane)	2013/08/14		99	%	70 - 130
			Chloroform	2013/08/14		102	%	70 - 130
			Carbon Tetrachloride	2013/08/14		99	%	70 - 130
			1,1-Dichloroethane	2013/08/14		105	%	70 - 130
			1,2-Dichloroethane	2013/08/14		106	%	70 - 130
			Ethylene Dibromide	2013/08/14		100	%	70 - 130
			1,1,1-Trichloroethane	2013/08/14		100	%	70 - 130
			1,1,2-Trichloroethane	2013/08/14		97	%	70 - 130
			1,1,2,2-Tetrachloroethane	2013/08/14		98	%	70 - 130
			cis-1,3-Dichloropropene	2013/08/14		104	%	70 - 130
			trans-1,3-Dichloropropene	2013/08/14		111	%	70 - 130
			1,2-Dichloropropane	2013/08/14		100	%	70 - 130
			Bromomethane	2013/08/14		96	%	70 - 130
			Bromoform	2013/08/14		95	%	70 - 130
			Bromodichloromethane	2013/08/14		102	%	70 - 130
			Dibromochloromethane	2013/08/14		99	%	70 - 130
			Trichloroethylene	2013/08/14		92	%	70 - 130
			Tetrachloroethylene	2013/08/14		94	%	70 - 130
			Benzene	2013/08/14		97	%	70 - 130
			Toluene	2013/08/14		99	%	70 - 130
			Ethylbenzene	2013/08/14		97	%	70 - 130
			p+m-Xylene	2013/08/14		97	%	70 - 130
			o-Xylene	2013/08/14		100	%	70 - 130
			Styrene	2013/08/14		102	%	70 - 130
			4-ethyltoluene	2013/08/14		99	%	70 - 130
			1,3,5-Trimethylbenzene	2013/08/14		99	%	70 - 130
			1,2,4-Trimethylbenzene	2013/08/14		102	%	70 - 130
			Chlorobenzene	2013/08/14		95	%	70 - 130
			Benzyl chloride	2013/08/14		101	%	70 - 130
			1,3-Dichlorobenzene	2013/08/14		103	%	70 - 130
			1,4-Dichlorobenzene	2013/08/14		100	%	70 - 130
			1,2-Dichlorobenzene	2013/08/14		97	%	70 - 130
			1,2,4-Trichlorobenzene	2013/08/14		117	%	70 - 130

This document is in electronic format, hard copy is available on request.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Tiamat Environmental
Attention: Jessica Lee
Client Project #: 12-435
P.O. #:
Site Location: RIVERSIDE LIGHT

Quality Assurance Report (Continued)

Maxxam Job Number: GB3C9298

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	%Recovery	Units	QC Limits
3317067	JIW	Spiked Blank	Hexachlorobutadiene	2013/08/14		110	%	70 - 130
			Hexane	2013/08/14		111	%	70 - 130
			Heptane	2013/08/14		109	%	70 - 130
			Cyclohexane	2013/08/14		105	%	70 - 130
			Tetrahydrofuran	2013/08/14		118	%	70 - 130
			1,4-Dioxane	2013/08/14		106	%	70 - 130
			Xylene (Total)	2013/08/14		98	%	70 - 130
			Vinyl Bromide	2013/08/14		94	%	70 - 130
			Propene	2013/08/14		106	%	70 - 130
			2,2,4-Trimethylpentane	2013/08/14		102	%	70 - 130
			Carbon Disulfide	2013/08/14		104	%	70 - 130
			Vinyl Acetate	2013/08/14		115	%	70 - 130
		Method Blank	Bromochloromethane	2013/08/14		92	%	60 - 140
			D5-Chlorobenzene	2013/08/14		84	%	60 - 140
			Difluorobenzene	2013/08/14		96	%	60 - 140
			Dichlorodifluoromethane (FREON 12)	2013/08/14	ND, RDL=0.20		ppbv	
			1,2-Dichlorotetrafluoroethane	2013/08/14	ND, RDL=0.17		ppbv	
			Chloromethane	2013/08/14	ND, RDL=0.30		ppbv	
			Vinyl Chloride	2013/08/14	ND, RDL=0.18		ppbv	
			Chloroethane	2013/08/14	ND, RDL=0.30		ppbv	
			1,3-Butadiene	2013/08/14	ND, RDL=0.50		ppbv	
			Trichlorofluoromethane (FREON 11)	2013/08/14	ND, RDL=0.20		ppbv	
			Ethanol (ethyl alcohol)	2013/08/14	ND, RDL=2.3		ppbv	
			Trichlorotrifluoroethane	2013/08/14	ND, RDL=0.15		ppbv	
			2-propanol	2013/08/14	ND, RDL=3.0		ppbv	
			2-Propanone	2013/08/14	ND, RDL=0.80		ppbv	
			Methyl Ethyl Ketone (2-Butanone)	2013/08/14	ND, RDL=3.0		ppbv	
			Methyl Isobutyl Ketone	2013/08/14	ND, RDL=3.2		ppbv	
			Methyl Butyl Ketone (2-Hexanone)	2013/08/14	ND, RDL=2.0		ppbv	
			Methyl t-butyl ether (MTBE)	2013/08/14	ND, RDL=0.20		ppbv	
			Ethyl Acetate	2013/08/14	ND, RDL=2.2		ppbv	
			1,1-Dichloroethylene	2013/08/14	ND, RDL=0.25		ppbv	
			cis-1,2-Dichloroethylene	2013/08/14	ND, RDL=0.19		ppbv	
			trans-1,2-Dichloroethylene	2013/08/14	ND, RDL=0.20		ppbv	
			Methylene Chloride(Dichloromethane)	2013/08/14	ND, RDL=0.80		ppbv	
			Chloroform	2013/08/14	ND, RDL=0.15		ppbv	
			Carbon Tetrachloride	2013/08/14	ND, RDL=0.30		ppbv	
			1,1-Dichloroethane	2013/08/14	ND, RDL=0.20		ppbv	
			1,2-Dichloroethane	2013/08/14	ND, RDL=0.20		ppbv	
			Ethylene Dibromide	2013/08/14	ND, RDL=0.17		ppbv	
			1,1,1-Trichloroethane	2013/08/14	ND, RDL=0.30		ppbv	
			1,1,2-Trichloroethane	2013/08/14	ND, RDL=0.15		ppbv	
			1,1,2,2-Tetrachloroethane	2013/08/14	ND, RDL=0.20		ppbv	
			cis-1,3-Dichloropropene	2013/08/14	ND, RDL=0.18		ppbv	
			trans-1,3-Dichloropropene	2013/08/14	ND, RDL=0.17		ppbv	
			1,2-Dichloropropane	2013/08/14	ND, RDL=0.40		ppbv	
			Bromomethane	2013/08/14	ND, RDL=0.18		ppbv	
			Bromoform	2013/08/14	ND, RDL=0.20		ppbv	
			Bromodichloromethane	2013/08/14	ND, RDL=0.20		ppbv	
			Dibromochloromethane	2013/08/14	ND, RDL=0.20		ppbv	
			Trichloroethylene	2013/08/14	ND, RDL=0.30		ppbv	
			Tetrachloroethylene	2013/08/14	ND, RDL=0.20		ppbv	
			Benzene	2013/08/14	ND, RDL=0.18		ppbv	
			Toluene	2013/08/14	ND, RDL=0.20		ppbv	
			Ethylbenzene	2013/08/14	ND, RDL=0.20		ppbv	

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Tiamat Environmental
Attention: Jessica Lee
Client Project #: 12-435
P.O. #:
Site Location: RIVERSIDE LIGHT

Quality Assurance Report (Continued)

Maxxam Job Number: GB3C9298

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	%Recovery	Units	QC Limits
3317067	JIW	Method Blank	p+m-Xylene	2013/08/14	ND, RDL=0.37		ppbv	
			o-Xylene	2013/08/14	ND, RDL=0.20		ppbv	
			Styrene	2013/08/14	ND, RDL=0.20		ppbv	
			4-ethyltoluene	2013/08/14	ND, RDL=2.2		ppbv	
			1,3,5-Trimethylbenzene	2013/08/14	ND, RDL=0.50		ppbv	
			1,2,4-Trimethylbenzene	2013/08/14	ND, RDL=0.50		ppbv	
			Chlorobenzene	2013/08/14	ND, RDL=0.20		ppbv	
			Benzyl chloride	2013/08/14	ND, RDL=1.0		ppbv	
			1,3-Dichlorobenzene	2013/08/14	ND, RDL=0.40		ppbv	
			1,4-Dichlorobenzene	2013/08/14	ND, RDL=0.40		ppbv	
			1,2-Dichlorobenzene	2013/08/14	ND, RDL=0.40		ppbv	
			1,2,4-Trichlorobenzene	2013/08/14	ND, RDL=2.0		ppbv	
			Hexachlorobutadiene	2013/08/14	ND, RDL=3.0		ppbv	
			Hexane	2013/08/14	ND, RDL=0.30		ppbv	
			Heptane	2013/08/14	ND, RDL=0.30		ppbv	
			Cyclohexane	2013/08/14	ND, RDL=0.20		ppbv	
			Tetrahydrofuran	2013/08/14	ND, RDL=0.40		ppbv	
			1,4-Dioxane	2013/08/14	ND, RDL=2.0		ppbv	
			Xylene (Total)	2013/08/14	ND, RDL=0.60		ppbv	
			Vinyl Bromide	2013/08/14	ND, RDL=0.20		ppbv	
			Propene	2013/08/14	ND, RDL=0.30		ppbv	
			2,2,4-Trimethylpentane	2013/08/14	ND, RDL=0.20		ppbv	
			Carbon Disulfide	2013/08/14	ND, RDL=0.50		ppbv	
			Vinyl Acetate	2013/08/14	ND, RDL=0.20		ppbv	
		RPD - Sample/Sample Dup	Dichlorodifluoromethane (FREON 12)	2013/08/14	NC		%	25
			1,2-Dichlorotetrafluoroethane	2013/08/14	NC		%	25
			Chloromethane	2013/08/14	NC		%	25
			Chloroethane	2013/08/14	NC		%	25
			1,3-Butadiene	2013/08/14	NC		%	25
			Trichlorofluoromethane (FREON 11)	2013/08/14	NC		%	25
			Ethanol (ethyl alcohol)	2013/08/14	NC		%	25
			Trichlorotrifluoroethane	2013/08/14	NC		%	25
			2-propanol	2013/08/14	NC		%	25
			2-Propanone	2013/08/14	4.5		%	25
			Methyl Ethyl Ketone (2-Butanone)	2013/08/14	NC		%	25
			Methyl Isobutyl Ketone	2013/08/14	NC		%	25
			Methyl Butyl Ketone (2-Hexanone)	2013/08/14	NC		%	25
			Methyl t-butyl ether (MTBE)	2013/08/14	NC		%	25
			Ethyl Acetate	2013/08/14	NC		%	25
			1,1-Dichloroethylene	2013/08/14	NC		%	25
			cis-1,2-Dichloroethylene	2013/08/14	NC		%	25
			trans-1,2-Dichloroethylene	2013/08/14	NC		%	25
			Methylene Chloride(Dichloromethane)	2013/08/14	NC		%	25
			Chloroform	2013/08/14	NC		%	25
			Carbon Tetrachloride	2013/08/14	NC		%	25
			1,1-Dichloroethane	2013/08/14	NC		%	25
			1,2-Dichloroethane	2013/08/14	NC		%	25
			Ethylene Dibromide	2013/08/14	NC		%	25
			1,1,1-Trichloroethane	2013/08/14	NC		%	25
			1,1,2-Trichloroethane	2013/08/14	NC		%	25
			1,1,2,2-Tetrachloroethane	2013/08/14	NC		%	25
			cis-1,3-Dichloropropene	2013/08/14	NC		%	25
			trans-1,3-Dichloropropene	2013/08/14	NC		%	25

This document is in electronic format, hard copy is available on request.

Tiamat Environmental
Attention: Jessica Lee
Client Project #: 12-435
P.O. #:
Site Location: RIVERSIDE LIGHT

Quality Assurance Report (Continued)

Maxxam Job Number: GB3C9298

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	%Recovery	Units	QC Limits
3317067	JIW	RPD - Sample/Sample Dup	1,2-Dichloropropane	2013/08/14	NC		%	25
			Bromomethane	2013/08/14	NC		%	25
			Bromoform	2013/08/14	NC		%	25
			Bromodichloromethane	2013/08/14	NC		%	25
			Dibromochloromethane	2013/08/14	NC		%	25
			Trichloroethylene	2013/08/14	NC		%	25
			Tetrachloroethylene	2013/08/14	NC		%	25
			Benzene	2013/08/14	NC		%	25
			Toluene	2013/08/14	NC		%	25
			Ethylbenzene	2013/08/14	NC		%	25
			p+m-Xylene	2013/08/14	NC		%	25
			o-Xylene	2013/08/14	NC		%	25
			Styrene	2013/08/14	NC		%	25
			4-ethyltoluene	2013/08/14	NC		%	25
			1,3,5-Trimethylbenzene	2013/08/14	NC		%	25
			1,2,4-Trimethylbenzene	2013/08/14	NC		%	25
			Chlorobenzene	2013/08/14	NC		%	25
			Benzyl chloride	2013/08/14	NC		%	25
			1,3-Dichlorobenzene	2013/08/14	NC		%	25
			1,4-Dichlorobenzene	2013/08/14	NC		%	25
			1,2-Dichlorobenzene	2013/08/14	NC		%	25
			1,2,4-Trichlorobenzene	2013/08/14	NC		%	25
			Hexachlorobutadiene	2013/08/14	NC		%	25
			Hexane	2013/08/14	NC		%	25
			Heptane	2013/08/14	NC		%	25
			Cyclohexane	2013/08/14	NC		%	25
			Tetrahydrofuran	2013/08/14	NC		%	25
			1,4-Dioxane	2013/08/14	NC		%	25
			Xylene (Total)	2013/08/14	NC		%	25
			Vinyl Bromide	2013/08/14	NC		%	25
			Propene	2013/08/14	NC		%	25
			2,2,4-Trimethylpentane	2013/08/14	NC		%	25
			Carbon Disulfide	2013/08/14	NC		%	25
			Vinyl Acetate	2013/08/14	NC		%	25
3319686	JIW	Method Blank	Aliphatic >C5-C6	2013/08/14	ND, RDL=5.0		ug/m3	
			Aliphatic >C6-C8	2013/08/14	ND, RDL=5.0		ug/m3	
			Aliphatic >C8-C10	2013/08/14	ND, RDL=5.0		ug/m3	
			Aliphatic >C10-C12	2013/08/14	ND, RDL=5.0		ug/m3	
			Aliphatic >C12-C16	2013/08/14	ND, RDL=5.0		ug/m3	
			Aromatic >C7-C8 (TEX Excluded)	2013/08/14	ND, RDL=5.0		ug/m3	
			Aromatic >C8-C10	2013/08/14	ND, RDL=5.0		ug/m3	
			Aromatic >C10-C12	2013/08/14	ND, RDL=5.0		ug/m3	
			Aromatic >C12-C16	2013/08/14	ND, RDL=5.0		ug/m3	
3322553	VLA	Method Blank	Acetylene	2013/08/21	ND, RDL=0.1		ppm	
			Ethane	2013/08/21	ND, RDL=0.1		ppm	
			Ethylene	2013/08/21	ND, RDL=0.1		ppm	
			n-Butane	2013/08/21	ND, RDL=0.2		ppm	
			n-Pentane	2013/08/21	ND, RDL=0.1		ppm	
			Propane	2013/08/21	ND, RDL=0.1		ppm	
			Propene	2013/08/21	ND, RDL=0.1		ppm	
			Propyne	2013/08/21	ND, RDL=0.2		ppm	
		RPD - Sample/Sample Dup	Acetylene	2013/08/21	NC		%	20

This document is in electronic format, hard copy is available on request.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Tiamat Environmental
Attention: Jessica Lee
Client Project #: 12-435
P.O. #:
Site Location: RIVERSIDE LIGHT

Quality Assurance Report (Continued)

Maxxam Job Number: GB3C9298

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	%Recovery	Units	QC Limits
3322553	VLA	RPD - Sample/Sample Dup	Ethane	2013/08/21	NC		%	20
			Ethylene	2013/08/21	NC		%	20
			n-Butane	2013/08/21	NC		%	20
			n-Pentane	2013/08/21	NC		%	20
			Propane	2013/08/21	NC		%	20
			Propene	2013/08/21	NC		%	20
			Propyne	2013/08/21	NC		%	20
3324319	TJC	Method Blank	Oxygen	2013/08/22	ND, RDL=0.1		% v/v	
			Nitrogen	2013/08/22	ND, RDL=0.1		% v/v	
			Carbon Monoxide	2013/08/22	ND, RDL=0.1		% v/v	
			Methane	2013/08/22	ND, RDL=0.1		% v/v	
			Carbon Dioxide	2013/08/22	ND, RDL=0.1		% v/v	
		RPD - Sample/Sample Dup	Oxygen	2013/08/22	0.1		%	20
			Nitrogen	2013/08/22	0.1		%	20
			Methane	2013/08/22	NC		%	20
			Carbon Dioxide	2013/08/22	0		%	20

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.
(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

This document is in electronic format, hard copy is available on request.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam

Success Through Science®

Your Project #: 12-435
Site Location: RIVERSIDE LIGHT
Your C.O.C. #: na

Attention: Jessica Lee
Tiamat Environmental
107, 2719-7 Ave. NE
Calgary, AB
CANADA T2A 2L9

Report Date: 2013/08/25

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B3C9302
Received: 2013/08/07, 09:50

Sample Matrix: AIR
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
BTEX Fractionation in Air (TO-15mod)	1	N/A	2013/08/14	BRL SOP-00304	EPA TO-15mod
Canister Pressure (TO-15)	1	N/A	2013/08/14	BRL SOP-00304	EPA TO-15
Light Hydrocarbons	1	N/A	2013/08/21	CAM SOP-00227	GC/FID
Matrix Gases	1	N/A	2013/08/22	CAM SOP-00225, CAM SOP-00209	ASTM D1946-90
Volatile Organics in Air (TO-15) (1)	1	N/A	2013/08/14	BRL SOP-00304	EPA TO-15

(1) Air sampling canisters have been cleaned in accordance with U.S. EPA Method TO14A. At the end of the cleaning, evacuation, and pressurization cycles, one canister was selected and was pressurized with Zero Air. This canister was then analyzed via TO14A on a GC/MS. The canister must have been found to contain <0.2 ppbv concentration of all target analytes in order for the batch to have been considered clean. Each canister also underwent a leak check prior to shipment.

Please Note: SUMMA® canister samples will be retained by Maxxam for a period of 5 calendar days or as contractually agreed from the date of this report, after which time they will be cleaned for reuse. If you require a longer sample storage period, please contact your service representative.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Theresa Stephenson, Project Manager
Email: TStephenson@maxxam.ca
Phone# (905) 817-5763

==========

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

Maxxam Analytics Inc. is a NELAC accredited laboratory. Certificate # CANA001. Use of the NELAC logo however does not insure that

Your Project #: 12-435
Site Location: RIVERSIDE LIGHT
Your C.O.C. #: na

Attention: Jessica Lee
Tiamat Environmental
107, 2719-7 Ave. NE
Calgary, AB
CANADA T2A 2L9

Report Date: 2013/08/25

CERTIFICATE OF ANALYSIS

Total cover pages: 2

Maxxam Job #: B3C9302
Report Date: 2013/08/25

Tiamat Environmental
Client Project #: 12-435
Site Location: RIVERSIDE LIGHT

RESULTS OF ANALYSES OF AIR

Maxxam ID		SO1714		
Sampling Date		2013/08/01		
COC Number		na		
	Units	**HC0074-01\VW-02**	**RDL**	**QC Batch**
Gas				
Acetylene	ppm	ND	0.21	3322553
Ethane	ppm	1.3	0.21	3322553
Ethylene	ppm	ND	0.21	3322553
n-Butane	ppm	0.47	0.41	3322553
n-Pentane	ppm	ND	0.21	3322553
Propane	ppm	0.69	0.21	3322553
Propene	ppm	ND	0.21	3322553
Propyne	ppm	ND	0.41	3322553
Volatile Organics				
Pressure on Receipt	psig	(-3.6)	N/A	3317031

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B3C9302
Report Date: 2013/08/25

Tiamat Environmental
Client Project #: 12-435
Site Location: RIVERSIDE LIGHT

COMPRESSED GAS PARAMETERS (AIR)

Maxxam ID		SO1714		
Sampling Date		2013/08/01		
COC Number		na		
	Units	**HC0074-01\VW-02**	**RDL**	**QC Batch**
Fixed Gases				
Oxygen	% v/v	5.0	0.2	3324319
Nitrogen	% v/v	67.0	0.2	3324319
Carbon Monoxide	% v/v	ND	0.2	3324319
Methane	% v/v	17.6	0.2	3324319
Carbon Dioxide	% v/v	10.4	0.2	3324319

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B3C9302
Report Date: 2013/08/25

Tiamat Environmental
Client Project #: 12-435
Site Location: RIVERSIDE LIGHT

VOLATILE ORGANIC HYDROCARBONS BY GC/MS (AIR)

Maxxam ID		SO1714		
Sampling Date		2013/08/01		
COC Number		na		
	Units	**HC0074-01\VW-02**	**RDL**	**QC Batch**
Volatile Organics				
Benzene	ug/m3	3.7	1.2	3319686
Toluene	ug/m3	41.6	1.6	3319686
Ethylbenzene	ug/m3	11.0	1.6	3319686
Total Xylenes	ug/m3	42.8	2.2	3319686
Aliphatic >C5-C6	ug/m3	2530 (1)	13	3319686
Aliphatic >C6-C8	ug/m3	651	5.0	3319686
Aliphatic >C8-C10	ug/m3	106	5.0	3319686
Aliphatic >C10-C12	ug/m3	185	5.0	3319686
Aliphatic >C12-C16	ug/m3	91.1	5.0	3319686
Aromatic >C7-C8 (TEX Excluded)	ug/m3	ND	5.0	3319686
Aromatic >C8-C10	ug/m3	47.5	5.0	3319686
Aromatic >C10-C12	ug/m3	41.7	5.0	3319686
Aromatic >C12-C16	ug/m3	ND	5.0	3319686
Surrogate Recovery (%)				
1,4-Difluorobenzene	%	113		3319686
Bromochloromethane	%	110		3319686
D5-Chlorobenzene	%	102		3319686

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
(1) A 2.5x dilution was analyzed. The DL was adjusted accordingly.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B3C9302
Report Date: 2013/08/25

Tiamat Environmental
Client Project #: 12-435
Site Location: RIVERSIDE LIGHT

VOLATILE ORGANICS BY GC/MS (AIR)

Maxxam ID		SO1714				
Sampling Date		2013/08/01				
COC Number		na				
	Units	**HC0074-01\VW-02**	**RDL**	**ug/m3**	**DL (ug/m3)**	**QC Batch**
Volatile Organics						
Dichlorodifluoromethane (FREON 12)	ppbv	341	0.80	1690	3.96	3317067
1,2-Dichlorotetrafluoroethane	ppbv	<0.17	0.17	<1.19	1.19	3317067
Chloromethane	ppbv	<0.30	0.30	<0.620	0.620	3317067
Vinyl Chloride	ppbv	<0.18	0.18	<0.460	0.460	3317067
Chloroethane	ppbv	<0.30	0.30	<0.792	0.792	3317067
1,3-Butadiene	ppbv	<0.50	0.50	<1.11	1.11	3317067
Trichlorofluoromethane (FREON 11)	ppbv	<0.20	0.20	<1.12	1.12	3317067
Ethanol (ethyl alcohol)	ppbv	23.5	2.3	44.3	4.33	3317067
Trichlorotrifluoroethane	ppbv	<0.15	0.15	<1.15	1.15	3317067
2-propanol	ppbv	6.1	3.0	15.0	7.37	3317067
2-Propanone	ppbv	19.8	0.80	47.1	1.90	3317067
Methyl Ethyl Ketone (2-Butanone)	ppbv	12.2	3.0	36.0	8.85	3317067
Methyl Isobutyl Ketone	ppbv	<3.2	3.2	<13.1	13.1	3317067
Methyl Butyl Ketone (2-Hexanone)	ppbv	<2.0	2.0	<8.19	8.19	3317067
Methyl t-butyl ether (MTBE)	ppbv	<0.20	0.20	<0.721	0.721	3317067
Ethyl Acetate	ppbv	<2.2	2.2	<7.93	7.93	3317067
1,1-Dichloroethylene	ppbv	<0.25	0.25	<0.991	0.991	3317067
cis-1,2-Dichloroethylene	ppbv	<0.19	0.19	<0.753	0.753	3317067
trans-1,2-Dichloroethylene	ppbv	<0.20	0.20	<0.793	0.793	3317067
Methylene Chloride(Dichloromethane)	ppbv	<0.80	0.80	<2.78	2.78	3317067
Chloroform	ppbv	<0.15	0.15	<0.732	0.732	3317067
Carbon Tetrachloride	ppbv	<0.30	0.30	<1.89	1.89	3317067
1,1-Dichloroethane	ppbv	<0.20	0.20	<0.809	0.809	3317067
1,2-Dichloroethane	ppbv	0.29	0.20	1.19	0.809	3317067
Ethylene Dibromide	ppbv	<0.17	0.17	<1.31	1.31	3317067
1,1,1-Trichloroethane	ppbv	<0.30	0.30	<1.64	1.64	3317067
1,1,2-Trichloroethane	ppbv	<0.15	0.15	<0.818	0.818	3317067
1,1,2,2-Tetrachloroethane	ppbv	<0.20	0.20	<1.37	1.37	3317067
cis-1,3-Dichloropropene	ppbv	<0.18	0.18	<0.817	0.817	3317067
trans-1,3-Dichloropropene	ppbv	<0.17	0.17	<0.772	0.772	3317067
1,2-Dichloropropane	ppbv	<0.40	0.40	<1.85	1.85	3317067
Bromomethane	ppbv	<0.18	0.18	<0.699	0.699	3317067
Bromoform	ppbv	<0.20	0.20	<2.07	2.07	3317067

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B3C9302
Report Date: 2013/08/25

Tiamat Environmental
Client Project #: 12-435
Site Location: RIVERSIDE LIGHT

VOLATILE ORGANICS BY GC/MS (AIR)

Maxxam ID		SO1714				
Sampling Date		2013/08/01				
COC Number		na				
	Units	**HC0074-01\VW-02**	**RDL**	**ug/m3**	**DL (ug/m3)**	**QC Batch**
Bromodichloromethane	ppbv	<0.20	0.20	<1.34	1.34	3317067
Dibromochloromethane	ppbv	<0.20	0.20	<1.70	1.70	3317067
Trichloroethylene	ppbv	1.82	0.30	9.76	1.61	3317067
Tetrachloroethylene	ppbv	<0.20	0.20	<1.36	1.36	3317067
Benzene	ppbv	1.15	0.18	3.68	0.575	3317067
Toluene	ppbv	11.1	0.20	41.6	0.753	3317067
Ethylbenzene	ppbv	2.53	0.20	11.0	0.868	3317067
p+m-Xylene	ppbv	7.03	0.37	30.5	1.61	3317067
o-Xylene	ppbv	2.85	0.20	12.4	0.868	3317067
Styrene	ppbv	0.81	0.20	3.45	0.852	3317067
4-ethyltoluene	ppbv	<2.2	2.2	<10.8	10.8	3317067
1,3,5-Trimethylbenzene	ppbv	<3.6	3.6	<17.6	17.6	3317067
1,2,4-Trimethylbenzene	ppbv	2.27	0.50	11.2	2.46	3317067
Chlorobenzene	ppbv	<0.20	0.20	<0.921	0.921	3317067
Benzyl chloride	ppbv	<1.0	1.0	<5.18	5.18	3317067
1,3-Dichlorobenzene	ppbv	<0.40	0.40	<2.40	2.40	3317067
1,4-Dichlorobenzene	ppbv	<0.40	0.40	<2.40	2.40	3317067
1,2-Dichlorobenzene	ppbv	<0.40	0.40	<2.40	2.40	3317067
1,2,4-Trichlorobenzene	ppbv	<2.0	2.0	<14.8	14.8	3317067
Hexachlorobutadiene	ppbv	<3.0	3.0	<32.0	32.0	3317067
Hexane	ppbv	7.70	0.30	27.1	1.06	3317067
Heptane	ppbv	1.87	0.30	7.68	1.23	3317067
Cyclohexane	ppbv	8.60	0.20	29.6	0.688	3317067
Tetrahydrofuran	ppbv	7.87	0.40	23.2	1.18	3317067
1,4-Dioxane	ppbv	<2.0	2.0	<7.21	7.21	3317067
Xylene (Total)	ppbv	9.88	0.60	42.9	2.61	3317067
Vinyl Bromide	ppbv	<0.20	0.20	<0.875	0.875	3317067
Propene	ppbv	<240	240	<406	406	3317067
2,2,4-Trimethylpentane	ppbv	3.52	0.20	16.5	0.934	3317067
Carbon Disulfide	ppbv	3.24	0.50	10.1	1.56	3317067
Vinyl Acetate	ppbv	<0.20	0.20	<0.704	0.704	3317067
Surrogate Recovery (%)						
Bromochloromethane	%	110		N/A	N/A	3317067
D5-Chlorobenzene	%	102		N/A	N/A	3317067

N/A = Not Applicable
QC Batch = Quality Control Batch

Maxxam Job #: B3C9302
Report Date: 2013/08/25

Tiamat Environmental
Client Project #: 12-435
Site Location: RIVERSIDE LIGHT

VOLATILE ORGANICS BY GC/MS (AIR)

Maxxam ID		SO1714				
Sampling Date		2013/08/01				
COC Number		na				
	Units	**HC0074-01\VW-02**	**RDL**	**ug/m3**	**DL (ug/m3)**	**QC Batch**
Difluorobenzene	%	113		N/A	N/A	3317067

N/A = Not Applicable
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B3C9302
Report Date: 2013/08/25

Tiamat Environmental
Client Project #: 12-435
Site Location: RIVERSIDE LIGHT

Test Summary

Maxxam ID SO1714
Sample ID HC0074-01\VW-02
Matrix AIR

Collected 2013/08/01
Shipped
Received 2013/08/07

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
BTEX Fractionation in Air (TO-15mod)	GC/MS	3319686	N/A	2013/08/14	Jie Wu
Canister Pressure (TO-15)	PRES	3317031	N/A	2013/08/14	Jie Wu
Light Hydrocarbons	GC/FID	3322553	N/A	2013/08/21	Vijay Lad
Matrix Gases	GC/TCD	3324319	N/A	2013/08/22	Tonghui (Jenny) Chen
Volatile Organics in Air (TO-15)	GC/MS	3317067	N/A	2013/08/14	Jie Wu

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B3C9302
Report Date: 2013/08/25

Tiamat Environmental
Client Project #: 12-435
Site Location: RIVERSIDE LIGHT

GENERAL COMMENTS

ws:3317067
Ethanol exceeds 130% recovery criteria in Reference Standard. It meets %RSD criteria in the Continuing Calibration Standard. Data was accepted and flagged.

Light Hydrocarbon/Matrix Gas Analysis: Canister was pressurized with Helium to enable sampling. Results and DLs adjusted accordingly.

Matrix Gas Analysis: Results normalized to 100% dry volume.

Sample SO1714-01: Increased DL further for propene and 1,3,5-trimethylbenzene due to possible interference.

A 4x dilution was analyzed for dichlordifluoromethane. The DL was adjusted accordingly.

Results relate only to the items tested.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Tiamat Environmental
Attention: Jessica Lee
Client Project #: 12-435
P.O. #:
Site Location: RIVERSIDE LIGHT

Quality Assurance Report

Maxxam Job Number: GB3C9302

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	%Recovery	Units	QC Limits
3317067	JIW	Spiked Blank	Bromochloromethane	2013/08/14		101	%	60 - 140
			D5-Chlorobenzene	2013/08/14		111	%	60 - 140
			Difluorobenzene	2013/08/14		107	%	60 - 140
			Dichlorodifluoromethane (FREON 12)	2013/08/14		108	%	70 - 130
			1,2-Dichlorotetrafluoroethane	2013/08/14		115	%	70 - 130
			Chloromethane	2013/08/14		113	%	70 - 130
			Vinyl Chloride	2013/08/14		107	%	70 - 130
			Chloroethane	2013/08/14		100	%	70 - 130
			1,3-Butadiene	2013/08/14		109	%	70 - 130
			Trichlorofluoromethane (FREON 11)	2013/08/14		103	%	70 - 130
			Ethanol (ethyl alcohol)	2013/08/14		141 (1)	%	70 - 130
			Trichlorotrifluoroethane	2013/08/14		97	%	70 - 130
			2-propanol	2013/08/14		118	%	70 - 130
			2-Propanone	2013/08/14		107	%	70 - 130
			Methyl Ethyl Ketone (2-Butanone)	2013/08/14		109	%	70 - 130
			Methyl Isobutyl Ketone	2013/08/14		110	%	70 - 130
			Methyl Butyl Ketone (2-Hexanone)	2013/08/14		115	%	70 - 130
			Methyl t-butyl ether (MTBE)	2013/08/14		106	%	70 - 130
			Ethyl Acetate	2013/08/14		114	%	70 - 130
			1,1-Dichloroethylene	2013/08/14		103	%	70 - 130
			cis-1,2-Dichloroethylene	2013/08/14		106	%	70 - 130
			trans-1,2-Dichloroethylene	2013/08/14		104	%	70 - 130
			Methylene Chloride(Dichloromethane)	2013/08/14		99	%	70 - 130
			Chloroform	2013/08/14		102	%	70 - 130
			Carbon Tetrachloride	2013/08/14		99	%	70 - 130
			1,1-Dichloroethane	2013/08/14		105	%	70 - 130
			1,2-Dichloroethane	2013/08/14		106	%	70 - 130
			Ethylene Dibromide	2013/08/14		100	%	70 - 130
			1,1,1-Trichloroethane	2013/08/14		100	%	70 - 130
			1,1,2-Trichloroethane	2013/08/14		97	%	70 - 130
			1,1,2,2-Tetrachloroethane	2013/08/14		98	%	70 - 130
			cis-1,3-Dichloropropene	2013/08/14		104	%	70 - 130
			trans-1,3-Dichloropropene	2013/08/14		111	%	70 - 130
			1,2-Dichloropropane	2013/08/14		100	%	70 - 130
			Bromomethane	2013/08/14		96	%	70 - 130
			Bromoform	2013/08/14		95	%	70 - 130
			Bromodichloromethane	2013/08/14		102	%	70 - 130
			Dibromochloromethane	2013/08/14		99	%	70 - 130
			Trichloroethylene	2013/08/14		92	%	70 - 130
			Tetrachloroethylene	2013/08/14		94	%	70 - 130
			Benzene	2013/08/14		97	%	70 - 130
			Toluene	2013/08/14		99	%	70 - 130
			Ethylbenzene	2013/08/14		97	%	70 - 130
			p+m-Xylene	2013/08/14		97	%	70 - 130
			o-Xylene	2013/08/14		100	%	70 - 130
			Styrene	2013/08/14		102	%	70 - 130
			4-ethyltoluene	2013/08/14		99	%	70 - 130
			1,3,5-Trimethylbenzene	2013/08/14		99	%	70 - 130
			1,2,4-Trimethylbenzene	2013/08/14		102	%	70 - 130
			Chlorobenzene	2013/08/14		95	%	70 - 130
			Benzyl chloride	2013/08/14		101	%	70 - 130
			1,3-Dichlorobenzene	2013/08/14		103	%	70 - 130
			1,4-Dichlorobenzene	2013/08/14		100	%	70 - 130
			1,2-Dichlorobenzene	2013/08/14		97	%	70 - 130
			1,2,4-Trichlorobenzene	2013/08/14		117	%	70 - 130

This document is in electronic format, hard copy is available on request.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Tiamat Environmental
Attention: Jessica Lee
Client Project #: 12-435
P.O. #:
Site Location: RIVERSIDE LIGHT

Quality Assurance Report (Continued)

Maxxam Job Number: GB3C9302

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	%Recovery	Units	QC Limits
3317067	JIW	Spiked Blank	Hexachlorobutadiene	2013/08/14		110	%	70 - 130
			Hexane	2013/08/14		111	%	70 - 130
			Heptane	2013/08/14		109	%	70 - 130
			Cyclohexane	2013/08/14		105	%	70 - 130
			Tetrahydrofuran	2013/08/14		118	%	70 - 130
			1,4-Dioxane	2013/08/14		106	%	70 - 130
			Xylene (Total)	2013/08/14		98	%	70 - 130
			Vinyl Bromide	2013/08/14		94	%	70 - 130
			Propene	2013/08/14		106	%	70 - 130
			2,2,4-Trimethylpentane	2013/08/14		102	%	70 - 130
			Carbon Disulfide	2013/08/14		104	%	70 - 130
			Vinyl Acetate	2013/08/14		115	%	70 - 130
		Method Blank	Bromochloromethane	2013/08/14		92	%	60 - 140
			D5-Chlorobenzene	2013/08/14		84	%	60 - 140
			Difluorobenzene	2013/08/14		96	%	60 - 140
			Dichlorodifluoromethane (FREON 12)	2013/08/14	ND, RDL=0.20		ppbv	
			1,2-Dichlorotetrafluoroethane	2013/08/14	ND, RDL=0.17		ppbv	
			Chloromethane	2013/08/14	ND, RDL=0.30		ppbv	
			Vinyl Chloride	2013/08/14	ND, RDL=0.18		ppbv	
			Chloroethane	2013/08/14	ND, RDL=0.30		ppbv	
			1,3-Butadiene	2013/08/14	ND, RDL=0.50		ppbv	
			Trichlorofluoromethane (FREON 11)	2013/08/14	ND, RDL=0.20		ppbv	
			Ethanol (ethyl alcohol)	2013/08/14	ND, RDL=2.3		ppbv	
			Trichlorotrifluoroethane	2013/08/14	ND, RDL=0.15		ppbv	
			2-propanol	2013/08/14	ND, RDL=3.0		ppbv	
			2-Propanone	2013/08/14	ND, RDL=0.80		ppbv	
			Methyl Ethyl Ketone (2-Butanone)	2013/08/14	ND, RDL=3.0		ppbv	
			Methyl Isobutyl Ketone	2013/08/14	ND, RDL=3.2		ppbv	
			Methyl Butyl Ketone (2-Hexanone)	2013/08/14	ND, RDL=2.0		ppbv	
			Methyl t-butyl ether (MTBE)	2013/08/14	ND, RDL=0.20		ppbv	
			Ethyl Acetate	2013/08/14	ND, RDL=2.2		ppbv	
			1,1-Dichloroethylene	2013/08/14	ND, RDL=0.25		ppbv	
			cis-1,2-Dichloroethylene	2013/08/14	ND, RDL=0.19		ppbv	
			trans-1,2-Dichloroethylene	2013/08/14	ND, RDL=0.20		ppbv	
			Methylene Chloride(Dichloromethane)	2013/08/14	ND, RDL=0.80		ppbv	
			Chloroform	2013/08/14	ND, RDL=0.15		ppbv	
			Carbon Tetrachloride	2013/08/14	ND, RDL=0.30		ppbv	
			1,1-Dichloroethane	2013/08/14	ND, RDL=0.20		ppbv	
			1,2-Dichloroethane	2013/08/14	ND, RDL=0.20		ppbv	
			Ethylene Dibromide	2013/08/14	ND, RDL=0.17		ppbv	
			1,1,1-Trichloroethane	2013/08/14	ND, RDL=0.30		ppbv	
			1,1,2-Trichloroethane	2013/08/14	ND, RDL=0.15		ppbv	
			1,1,2,2-Tetrachloroethane	2013/08/14	ND, RDL=0.20		ppbv	
			cis-1,3-Dichloropropene	2013/08/14	ND, RDL=0.18		ppbv	
			trans-1,3-Dichloropropene	2013/08/14	ND, RDL=0.17		ppbv	
			1,2-Dichloropropane	2013/08/14	ND, RDL=0.40		ppbv	
			Bromomethane	2013/08/14	ND, RDL=0.18		ppbv	
			Bromoform	2013/08/14	ND, RDL=0.20		ppbv	
			Bromodichloromethane	2013/08/14	ND, RDL=0.20		ppbv	
			Dibromochloromethane	2013/08/14	ND, RDL=0.20		ppbv	
			Trichloroethylene	2013/08/14	ND, RDL=0.30		ppbv	
			Tetrachloroethylene	2013/08/14	ND, RDL=0.20		ppbv	
			Benzene	2013/08/14	ND, RDL=0.18		ppbv	
			Toluene	2013/08/14	ND, RDL=0.20		ppbv	
			Ethylbenzene	2013/08/14	ND, RDL=0.20		ppbv	

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Tiamat Environmental
Attention: Jessica Lee
Client Project #: 12-435
P.O. #:
Site Location: RIVERSIDE LIGHT

Quality Assurance Report (Continued)

Maxxam Job Number: GB3C9302

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	%Recovery	Units	QC Limits
3317067	JIW	Method Blank	p+m-Xylene	2013/08/14	ND, RDL=0.37		ppbv	
			o-Xylene	2013/08/14	ND, RDL=0.20		ppbv	
			Styrene	2013/08/14	ND, RDL=0.20		ppbv	
			4-ethyltoluene	2013/08/14	ND, RDL=2.2		ppbv	
			1,3,5-Trimethylbenzene	2013/08/14	ND, RDL=0.50		ppbv	
			1,2,4-Trimethylbenzene	2013/08/14	ND, RDL=0.50		ppbv	
			Chlorobenzene	2013/08/14	ND, RDL=0.20		ppbv	
			Benzyl chloride	2013/08/14	ND, RDL=1.0		ppbv	
			1,3-Dichlorobenzene	2013/08/14	ND, RDL=0.40		ppbv	
			1,4-Dichlorobenzene	2013/08/14	ND, RDL=0.40		ppbv	
			1,2-Dichlorobenzene	2013/08/14	ND, RDL=0.40		ppbv	
			1,2,4-Trichlorobenzene	2013/08/14	ND, RDL=2.0		ppbv	
			Hexachlorobutadiene	2013/08/14	ND, RDL=3.0		ppbv	
			Hexane	2013/08/14	ND, RDL=0.30		ppbv	
			Heptane	2013/08/14	ND, RDL=0.30		ppbv	
			Cyclohexane	2013/08/14	ND, RDL=0.20		ppbv	
			Tetrahydrofuran	2013/08/14	ND, RDL=0.40		ppbv	
			1,4-Dioxane	2013/08/14	ND, RDL=2.0		ppbv	
			Xylene (Total)	2013/08/14	ND, RDL=0.60		ppbv	
			Vinyl Bromide	2013/08/14	ND, RDL=0.20		ppbv	
			Propene	2013/08/14	ND, RDL=0.30		ppbv	
			2,2,4-Trimethylpentane	2013/08/14	ND, RDL=0.20		ppbv	
			Carbon Disulfide	2013/08/14	ND, RDL=0.50		ppbv	
			Vinyl Acetate	2013/08/14	ND, RDL=0.20		ppbv	
		RPD - Sample/Sample Dup	Dichlorodifluoromethane (FREON 12)	2013/08/14	NC		%	25
			1,2-Dichlorotetrafluoroethane	2013/08/14	NC		%	25
			Chloromethane	2013/08/14	NC		%	25
			Chloroethane	2013/08/14	NC		%	25
			1,3-Butadiene	2013/08/14	NC		%	25
			Trichlorofluoromethane (FREON 11)	2013/08/14	NC		%	25
			Ethanol (ethyl alcohol)	2013/08/14	NC		%	25
			Trichlorotrifluoroethane	2013/08/14	NC		%	25
			2-propanol	2013/08/14	NC		%	25
			2-Propanone	2013/08/14	4.5		%	25
			Methyl Ethyl Ketone (2-Butanone)	2013/08/14	NC		%	25
			Methyl Isobutyl Ketone	2013/08/14	NC		%	25
			Methyl Butyl Ketone (2-Hexanone)	2013/08/14	NC		%	25
			Methyl t-butyl ether (MTBE)	2013/08/14	NC		%	25
			Ethyl Acetate	2013/08/14	NC		%	25
			1,1-Dichloroethylene	2013/08/14	NC		%	25
			cis-1,2-Dichloroethylene	2013/08/14	NC		%	25
			trans-1,2-Dichloroethylene	2013/08/14	NC		%	25
			Methylene Chloride(Dichloromethane)	2013/08/14	NC		%	25
			Chloroform	2013/08/14	NC		%	25
			Carbon Tetrachloride	2013/08/14	NC		%	25
			1,1-Dichloroethane	2013/08/14	NC		%	25
			1,2-Dichloroethane	2013/08/14	NC		%	25
			Ethylene Dibromide	2013/08/14	NC		%	25
			1,1,1-Trichloroethane	2013/08/14	NC		%	25
			1,1,2-Trichloroethane	2013/08/14	NC		%	25
			1,1,2,2-Tetrachloroethane	2013/08/14	NC		%	25
			cis-1,3-Dichloropropene	2013/08/14	NC		%	25
			trans-1,3-Dichloropropene	2013/08/14	NC		%	25

This document is in electronic format, hard copy is available on request.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Tiamat Environmental
Attention: Jessica Lee
Client Project #: 12-435
P.O. #:
Site Location: RIVERSIDE LIGHT

Quality Assurance Report (Continued)

Maxxam Job Number: GB3C9302

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	%Recovery	Units	QC Limits
3317067	JIW	RPD - Sample/Sample Dup	1,2-Dichloropropane	2013/08/14	NC		%	25
			Bromomethane	2013/08/14	NC		%	25
			Bromoform	2013/08/14	NC		%	25
			Bromodichloromethane	2013/08/14	NC		%	25
			Dibromochloromethane	2013/08/14	NC		%	25
			Trichloroethylene	2013/08/14	NC		%	25
			Tetrachloroethylene	2013/08/14	NC		%	25
			Benzene	2013/08/14	NC		%	25
			Toluene	2013/08/14	NC		%	25
			Ethylbenzene	2013/08/14	NC		%	25
			p+m-Xylene	2013/08/14	NC		%	25
			o-Xylene	2013/08/14	NC		%	25
			Styrene	2013/08/14	NC		%	25
			4-ethyltoluene	2013/08/14	NC		%	25
			1,3,5-Trimethylbenzene	2013/08/14	NC		%	25
			1,2,4-Trimethylbenzene	2013/08/14	NC		%	25
			Chlorobenzene	2013/08/14	NC		%	25
			Benzyl chloride	2013/08/14	NC		%	25
			1,3-Dichlorobenzene	2013/08/14	NC		%	25
			1,4-Dichlorobenzene	2013/08/14	NC		%	25
			1,2-Dichlorobenzene	2013/08/14	NC		%	25
			1,2,4-Trichlorobenzene	2013/08/14	NC		%	25
			Hexachlorobutadiene	2013/08/14	NC		%	25
			Hexane	2013/08/14	NC		%	25
			Heptane	2013/08/14	NC		%	25
			Cyclohexane	2013/08/14	NC		%	25
			Tetrahydrofuran	2013/08/14	NC		%	25
			1,4-Dioxane	2013/08/14	NC		%	25
			Xylene (Total)	2013/08/14	NC		%	25
			Vinyl Bromide	2013/08/14	NC		%	25
			Propene	2013/08/14	NC		%	25
			2,2,4-Trimethylpentane	2013/08/14	NC		%	25
			Carbon Disulfide	2013/08/14	NC		%	25
			Vinyl Acetate	2013/08/14	NC		%	25
3319686	JIW	Spiked Blank	1,4-Difluorobenzene	2013/08/14		107	%	60 - 140
			Bromochloromethane	2013/08/14		101	%	60 - 140
			D5-Chlorobenzene	2013/08/14		111	%	60 - 140
			Benzene	2013/08/14		97	%	70 - 130
			Toluene	2013/08/14		99	%	70 - 130
			Ethylbenzene	2013/08/14		97	%	70 - 130
			Total Xylenes	2013/08/14		98	%	70 - 130
		Method Blank	1,4-Difluorobenzene	2013/08/14		96	%	60 - 140
			Bromochloromethane	2013/08/14		92	%	60 - 140
			D5-Chlorobenzene	2013/08/14		84	%	60 - 140
			Benzene	2013/08/14	ND, RDL=1.2		ug/m3	
			Toluene	2013/08/14	ND, RDL=1.6		ug/m3	
			Ethylbenzene	2013/08/14	ND, RDL=1.6		ug/m3	
			Total Xylenes	2013/08/14	ND, RDL=2.2		ug/m3	
			Aliphatic >C5-C6	2013/08/14	ND, RDL=5.0		ug/m3	
			Aliphatic >C6-C8	2013/08/14	ND, RDL=5.0		ug/m3	
			Aliphatic >C8-C10	2013/08/14	ND, RDL=5.0		ug/m3	
			Aliphatic >C10-C12	2013/08/14	ND, RDL=5.0		ug/m3	
			Aliphatic >C12-C16	2013/08/14	ND, RDL=5.0		ug/m3	

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Tiamat Environmental
Attention: Jessica Lee
Client Project #: 12-435
P.O. #:
Site Location: RIVERSIDE LIGHT

Quality Assurance Report (Continued)

Maxxam Job Number: GB3C9302

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	%Recovery	Units	QC Limits
3319686	JIW	Method Blank	Aromatic >C7-C8 (TEX Excluded)	2013/08/14	ND, RDL=5.0		ug/m3	
			Aromatic >C8-C10	2013/08/14	ND, RDL=5.0		ug/m3	
			Aromatic >C10-C12	2013/08/14	ND, RDL=5.0		ug/m3	
			Aromatic >C12-C16	2013/08/14	ND, RDL=5.0		ug/m3	
3322553	VLA	Method Blank	Acetylene	2013/08/21	ND, RDL=0.1		ppm	
			Ethane	2013/08/21	ND, RDL=0.1		ppm	
			Ethylene	2013/08/21	ND, RDL=0.1		ppm	
			n-Butane	2013/08/21	ND, RDL=0.2		ppm	
			n-Pentane	2013/08/21	ND, RDL=0.1		ppm	
			Propane	2013/08/21	ND, RDL=0.1		ppm	
			Propene	2013/08/21	ND, RDL=0.1		ppm	
			Propyne	2013/08/21	ND, RDL=0.2		ppm	
		RPD - Sample/Sample Dup	Acetylene	2013/08/21	NC		%	20
			Ethane	2013/08/21	NC		%	20
			Ethylene	2013/08/21	NC		%	20
			n-Butane	2013/08/21	NC		%	20
			n-Pentane	2013/08/21	NC		%	20
			Propane	2013/08/21	NC		%	20
			Propene	2013/08/21	NC		%	20
			Propyne	2013/08/21	NC		%	20
3324319	TJC	Method Blank	Oxygen	2013/08/22	ND, RDL=0.1		% v/v	
			Nitrogen	2013/08/22	ND, RDL=0.1		% v/v	
			Carbon Monoxide	2013/08/22	ND, RDL=0.1		% v/v	
			Methane	2013/08/22	ND, RDL=0.1		% v/v	
			Carbon Dioxide	2013/08/22	ND, RDL=0.1		% v/v	
		RPD - Sample/Sample Dup	Oxygen	2013/08/22	0.1		%	20
			Nitrogen	2013/08/22	0.1		%	20
			Methane	2013/08/22	NC		%	20
			Carbon Dioxide	2013/08/22	0		%	20

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.
(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

This document is in electronic format, hard copy is available on request.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

REPORT OF ANALYSIS: Maxxam Analytics - B3C8489/B3C8505/B3C8538/B3C8549 - Selected Siloxanes (TIVA)

REPORT: 13033/13034/13035/13036si (Method -SCANATD-GC-MSD Cryogenic Oven Control)

	DESCRIPTION	13081205	13081205	13081205	13081205	13081206	13081206	13081206	13081206
CAS #	COMPOUND	SN8287-01 HC6544 VM-01 V=200mL	SN8287-01 HC6544 VM-01 V=200mL	Silicon Equivalent	Silicon Equivalent	SN8334-01 HC0074 VW-02 V=200mL	SN8334-01 HC0074 VW-02 V=200mL	Silicon Equivalent	Silicon Equivalent
		mg/m³	ppm	mg/m³	ppm	mg/m³	ppm	mg/m³	ppm
420-56-4	Trimethylsilyl Fluoride	ND	ND	ND	ND	ND	ND	ND	ND
75-76-3	Tetramethylsilane	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
1825-61-2	Methoxytrimethylsilane	<0.0032	<0.0007	<0.0009	<0.0007	<0.0032	<0.0007	<0.0009	<0.0007
1825-62-3	Ethoxytrimethylsilane	<0.0031	<0.0006	<0.0007	<0.0006	<0.0030	<0.0006	<0.0007	<0.0006
1066-40-6	Trimethylsilanol	0.0243	0.0066	0.0076	0.0066	0.0172	0.0047	0.0054	0.0047
1825-64-5	Isopropoxytrimethylsilane	<0.0013	<0.0002	<0.0003	<0.0002	<0.0013	<0.0002	<0.0003	<0.0002
1185-55-3	Trimethoxymethyl Silane #	ND	ND	ND	ND	ND	ND	ND	ND
107-46-0	Hexamethyl Disiloxane - L2	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
1825-63-4	Propoxytrimethylsilane	<0.0035	<0.0006	<0.0007	<0.0006	<0.0035	<0.0006	<0.0007	<0.0006
1825-67-8	1-Methylbutoxytrimethylsilane *	ND	ND	ND	ND	ND	ND	ND	ND
1825-65-6	Butoxytrimethylsilane *	ND	ND	ND	ND	ND	ND	ND	ND
2768-02-7	Trimethoxyvinyl Silane #	ND	ND	ND	ND	ND	ND	ND	ND
541-05-9	Hexamethyl Cyclotrisiloxane - D3	0.0212	0.0023	0.0080	0.0070	0.0141	0.0016	0.0054	0.0047
107-51-7	Octamethyl Trisiloxane - L3	<0.0002	<0.0001	<0.0001	<0.0001	<0.0002	<0.0001	<0.0001	<0.0001
78-08-0	Triethoxyvinyl Silane #	ND	ND	ND	ND	ND	ND	ND	ND
78-07-9	Triethoxyethyl Silane #	ND	ND	ND	ND	ND	ND	ND	ND
556-67-2	Octamethyl Cyclotetrasiloxane - D4	0.0580	0.0048	0.0220	0.0191	0.0250	0.0021	0.0095	0.0082
141-62-8	Decamethyl Tetrasiloxane - L4	0.0022	0.0002	0.0008	0.0007	0.0009	0.0001	0.0003	0.0003
78-10-4	Tetraethylsilicate #	ND	ND	ND	ND	ND	ND	ND	ND
541-02-6	Decamethyl Cyclopentasiloxane - D	0.8254	0.0545	0.3127	0.2724	0.5350	0.0353	0.2027	0.1765
141-63-9	Dodecamethyl Pentasiloxane - L5	<0.0030	<0.0002	<0.0011	<0.0009	<0.0030	<0.0002	<0.0011	<0.0009
540-97-6	Dodecamethyl Cyclohexasiloxane -	0.6919	0.0381	0.2621	0.2283	0.3017	0.0166	0.1143	0.0996
	Sum	1.6375	0.1089	0.6170	0.5375	0.9083	0.0628	0.3413	0.2973

< (ND) = Characteristic ions are not present therefore Not Detected
< (TRACE) = Characteristic ions present but too low to be quantified
V = Volume of air/gas sampled
* = Semiquantitative (Response Factor set at 5)
# = Unstable, poor detectability, commercial standards tested

APPENDIX B

TESTHOLE LOGS

TERMS USED ON BOREHOLE LOGS

Terminology Common Soil Genesis

Rootmat	vegetation roots and moss with organic matter and topsoil typically forming a mattress at the ground surface.
Topsoil	mixture of soil and humus capable of supporting good vegetative growth
Peat	fibrous aggregate of visible and invisible fragments of decayed organic matter
Loam	silty sand or sand mixed with silt and organics
Till	unstratified glacial deposit which may range from clay to boulders
Fill	any materials below the surface identified as placed by excavation activities (excluding buried services)

Common Soil Structure

Slickensided	Having inclined planes of weakness that are slick and glossy in appearance.
Fissured	Containing shrinkage cracks, frequently filled with fine sand or silt; usually more or less vertical.
Laminated	Composed of thin layers of varying color and texture.
Interbedded	Composed of alternate layers of different soil types.
Calcareous	Containing appreciable quantities of calcium carbonate.
Well Graded	Having wide range in grain sizes and substantial amounts of intermediate particle sizes.
Poorly graded	Predominantly of one grain size, or having a range of sizes with some intermediate sizes missing.
Homogeneous	same color and appearance throughout
Stratified	composed of alternating successions of different soil types, eg. silt and sand
Lensed	inclusion of small pockets of different soils
Laminated	alternating layers of varying material or color with the layers less than 6 mm thick
Layer	thickness > 75mm
Seam	thickness between 2 mm and 75 mm
Parting	thickness <2 mm

Grain Size and Plasticity

Description of soils on the basis of grain size and plasticity is based on the Unified Soil Classification System (USCS) (ASTM D-2487). The classification excludes particles larger than 76 mm (3 inches). This system provides a ground symbol (eg., SM) and group name (eg., silty SAND) for identification. Note: terminology describing materials in the absence of laboratory analysis is based on a visual method (ASTM D-2488).

Descriptors for soil materials outside the USCS (eg., particles larger that 76 mm, visible organic matter, construction debris) is based on the (visually estimated) proportion of these materials present:

Trace, or occasional	Less than approximately 10%
Some	Approximately 10 – 20%
Frequent	Greater than approximately 20%

Solid lines between soil strata indicate the interpreted boundary between different soil types. Dashed line between soil strata indicates the contact between different soil units has been inferred.

Consistency of Cohesive Soils (Fine-Grained Soils)

Fine-grained soils (major portion passing 0.075mm sieve): includes (1) inorganic and organic silts and clays. (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as estimated from laboratory or in-situ tests.

The standard nomenclature to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by in situ tests, penetrometer tests, unconfined compression tests, or occasionally by standard penetration tests.

Standard Penetration Test 'N-Value'

The Standard Penetration Test provides an "N-value; the number of blows of a 64 kg (140 pound) hammer falling 760 mm (30 inches) required to drive a 51 mm (2 inch) O.D. split spoon sampler 305 mm (one foot) into the soil. For split spoon samples where insufficient penetration is achieved and 'N' values cannot be determined, the number of blows is reported over sampler penetration in millimeters; e.g. blows/penetration = 50/75.

Consistency	Unconfined Compressive Strength (kPa)	N-Value
Very Soft	<25	<2
Soft	25-50	2-4
Firm	50-100	4-8
Stiff	100-200	8-15
Very Stiff	200-400	15-30
Hard	>400	>30

NOTE: Slackened and fissured clays may have lower unconfined compressive strengths than shown above, because of naturally occurring planes of weakness or cracks in the soil.

Density of Cohesionless Soils (Coarse-grained Soils)

Coarse-grained soils (major portion retained on 0.075 mm sieve): includes (1) clean gravels and sands, and (2) silty or clayey gravels and sands. Condition is rated according to relative density, as inferred from laboratory or in-situ tests.

The standard terminology to describe cohesionless soils includes the compactness (former "relative density"), as determined by laboratory test or by the Standard Penetration Test 'N-Value'.

Density	N Value (Blows per 0.3m)	Relative Density - % Compactness
Very Loose	0-4	0-20
Loose	4-10	20-40
Compact	10-30	40-75
Dense	30-50	75-90
Very Dense	>50	90-100

PROJECT: Phase II ESA Historic Waste Disposal Sites	**BOREHOLE No.:** TH-01
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger/ODEX
LOCATION: Riverside Light Industrial Park	**GROUND ELEVATION:** 854.665 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 06/17/2013

Sample Type: Shelby Tube | Split Spoon | Core | Disturbed | No Recovery

Backfill Type: Bentonite | Silica Sand | Grout | Pea Gravel | Drill Cuttings | Bentonite : Sand

Notes: Testhole is located in the grassed area at southwest corner of 46A Avenue and 61 Street.

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)		Well Details
0.0	Sod and loam - silty, sandy, moist, dark olive. (~ 15 cm thick).						
	Clay (fill) - firm, silty, trace sand, trace pebbles, trace loam, moist, olive.						
1.0	becomes olive grey at 1.1 m.						
	Sand - loose to compact, trace silt, trace oxides, trace gravel, moist, olive.						
2.0	timber fragments and trace glass fragments at 2.4 m.						
3.0	becomes loamy - firm, trace gravel, trace masonry brick fragments, musky odor, moist, dark olive to black.						
4.0	becomes sandy - compact, gravel, grey at 4.9 m.						
5.0	gravelly, sandy, trace wood fragments, musty odor, wet. becomes wet at 5.2 m.						
6.0	trace timber at 6.1 m.						
	Gravel (native) - compact, sandy, silty, some loam, trace wood fragments, wet, grey.						
	switch to ODEX at 6.7 m.						
7.0							
8.0	Shale (bedrock) - soft, weak, highly weathered, damp, grey.						
	End of hole at 8.5 m. Backfilled with ~ 50:50 bentonite and silica sand to 0.3 m depth.						
9.0	Capped with loamy soil.						
10.0							
11.0							
12.0							

Tiamat Environmental Consultants Ltd.

Slough :	Completion Depth (m): 8.5
Depth to Groundwater :	Checked By: LTM
Logged By: LTM	Page: 1 of 1

PROJECT: Phase II ESA Historic Waste Disposal Sites	**BOREHOLE No.:** VW-01
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger
LOCATION: Riverside Light Industrial Park	**GROUND ELEVATION:** 854.444 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 06/17/2013

Sample Type: Shelby Tube | Split Spoon | Core | Disturbed | No Recovery

Backfill Type: Bentonite | Silica Sand | Grout | Pea Gravel | Drill Cuttings | Bentonite : Sand

Notes: Soil Vapour Well is at northwest corner of 46A Avenue and 61 Street, on grassed boulevard.

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)		Well Details
0.0	Sod and loam - loose, silty, trace sand, moist, dark olive (~ 15 cm thick).						
	Clay (fill) - stiff, silty, loamy, some gravel, moist, olive.						
1.0	wood fragments with loam and sand at 2 m.						
2.0	Sand and gravel (fill) - compact, moist, olive.						
3.0	No obvious waste material.						
	Clay (fill) - firm, silty, some loam, trace loam, trace wood fragments, trace gravel, trace sand, moist, olive grey.						
4.0	End of hole at 4.6 m. 25 mm diameter 30 cm length 020 PVC screen. Flush mount bolt-down steel casing set in concrete.						
5.0							
6.0							
7.0							
8.0							
9.0							
10.0							
11.0							
12.0							

Tiamat Environmental Consultants Ltd.

Slough :	Completion Depth (m): 4.6
Depth to Groundwater :	Checked By: LTM
Logged By: LTM	Page: 1 of 1

PROJECT: Phase II ESA Historic Waste Disposal Sites	**BOREHOLE No.:** VW-02
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger/ODEX
LOCATION: Riverside Light Industrial Park	**GROUND ELEVATION:** 855.329 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 06/17/2013

Sample Type: Shelby Tube | Split Spoon | Core | Disturbed | No Recovery

Backfill Type: Bentonite | Silica Sand | Grout | Pea Gravel | Drill Cuttings | Bentonite : Sand

Notes: Soil Vapour Well is at 61 Street on grass boulevard across from 4622 - 61 Street.

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)	Well Details
0.0	Sod and loam - soft, sand, silty, trace rootlets, moist, olive brown. (~ 8 cm thick). Sand (fill) - loose, trace silts, moist, light olive.					
1.0	Loam - firm, silty, some sand, trace clay, moist, dark olive. wood fragments at 1.1 m. mixture of loam, sand, clay, silt, trace gravel, musty odor, moist, dark olive.					
2.0						
3.0	Sand - loose to compact, trace silt, damp, olive grey. No obvious waste material. becomes silty at 3.8 m.					
4.0						
5.0	Gravel (native) - dense, sandy, trace silt, damp to moist, dark olive.					
6.0	End of hole at 6.1 m. 25 mm diameter 30 cm length 020 PVC screen. Flush mount bolt-down steel casing set in concrete.					
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						

Tiamat Environmental Consultants Ltd.

Slough : 0.9 m	Completion Depth (m): 6.1
Depth to Groundwater :	Checked By: LTM
Logged By: LTM	Page: 1 of 1

PROJECT: Phase II ESA Historic Waste Disposal Sites	**BOREHOLE No.:** TH-04
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger
LOCATION: Riverside Light Industrial Park	**GROUND ELEVATION:** 855.279 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 06/17/2013

Sample Type: Shelby Tube | Split Spoon | Core | Disturbed | No Recovery

Backfill Type: Bentonite | Silica Sand | Grout | Pea Gravel | Drill Cuttings | Bentonite : Sand

Notes: Testhole is located on boulevard at Unit #1, 4622 - 61 Street.

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)		Well Details
0.0	Sod and loam - silty, sandy, trace rootlets, moist, dark olive. (~ 8 cm thick).						
	Sand (fill) - firm, silty, some loam, trace rootlets, moist, dark olive.						
	becomes silt, some loam, trace clay, trace gravel, moist, dark olive at 0.4 m.						
1.0	No obvious waste material.						
	Sand (fill) - loose, some loam, trace silt, damp, dark olive.						
2.0	becomes silty at 2 m to 2.3 m.						
	becomes light olive brown at 3 m.						
3.0							
4.0	No obvious waste material.						
	Gravel (native) - dense, sandy, moist to wet, olive.						
5.0							
6.0	End of hole at 6.1 m. Backfilled with ~ 50:50 bentonite and silica sand to 0.3 m depth. Capped with loamy sand, silt to surface.						
7.0							
8.0							
9.0							
10.0							
11.0							
12.0							

Tiamat Environmental Consultants Ltd.

Slough :	Completion Depth (m): 6.1
Depth to Groundwater :	Checked By: LTM
Logged By: LTM	Page: 1 of 1

PROJECT: Phase II ESA Historic Waste Disposal Sites	**BOREHOLE No.:** MW-01
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger/ODEX
LOCATION: Riverside Light Industrial Park	**GROUND ELEVATION:** 854.669 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 06/18/2013

Sample Type: Shelby Tube | Split Spoon | Core | Disturbed | No Recovery

Backfill Type: Bentonite | Silica Sand | Grout | Pea Gravel | Drill Cuttings | Bentonite : Sand

Notes: Groundwater Monitoring Well on 47 Avenue roadway, east of 61 Street.

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)	Well Details
0.0	Asphalt pavement (~ 7 cm thick). Gravel (fill) - compact, sandy, silty, some clay, moist, olive.					
1.0	Clay (fill) - stiff to firm, some loam, moist, olive. No obvious waste material.					
2.0	Sand (fill) - compact, silty, some pebbles, trace organics (rootlets, wood chips), moist, olive.					
	Sand (native) - compact, trace silt, moist, olive.					
3.0						
4.0	becomes silty at 4.1 m. becomes wet at 4.4 m.					
	Sand and gravel (native) - compact to dense, trace silt, wet, olive.					
5.0	Shale (bedrock) - weak, highly weathered, moist, blue-grey.					
6.0						
7.0						
	End of hole at 7.6 m. 51 mm diameter 4.6 m length 010 PVC screen. Flush mount bolt-down steel casing set in concrete.					
8.0						
9.0						
10.0						
11.0						
12.0						

Tiamat Environmental Consultants Ltd.

Slough :	Completion Depth (m): 7.6
Depth to Groundwater :	Checked By: LTM
Logged By: JAL/LTM	Page: 1 of 1

PROJECT: Phase II ESA Historic Waste Disposal Sites	**BOREHOLE No.:** MW-02
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger/ODEX
LOCATION: Riverside Light Industrial Park	**GROUND ELEVATION:** 855.257 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 06/18/2013

Sample Type: Shelby Tube | Split Spoon | Core | Disturbed | No Recovery

Backfill Type: Bentonite | Silica Sand | Grout | Pea Gravel | Drill Cuttings | Bentonite : Sand

Notes: Groundwater Monitoring Well is at Unit #6, 4669 - 62 Street ~ 0.5 m from curb face in gravel boulevard.

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)		Well Details
0.0	Gravel (fill) - compact, silty, some sand, moist, olive.						
	Sand (fill) - compact, silty, trace loam, moist, olive to dark olive.						
1.0	No obvious waste material.						
	Sand and gravel (native) - dense, trace silt, damp, olive.						
2.0							
3.0							
4.0							
5.0							
6.0	becomes wet at 6.1 m.						
	Clay - soft, trace silt, wet, olive.						
7.0							
8.0	Sand - compact, trace gravel, wet, olive.						
	End of hole at 8.4 m. 51 mm diameter 010 PVC screen. 3.0 m solid PVC pipe.						
9.0	Flush mount bolt-down steel casing set in concrete.						
10.0							
11.0							
12.0							

Tiamat Environmental Consultants Ltd.

Slough :	Completion Depth (m): 8.4
Depth to Groundwater :	Checked By: LTM
Logged By: JAL/LTM	Page: 1 of 1

PROJECT: Phase II ESA Historic Waste Disposal Sites	**BOREHOLE No.:** TH-07
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger
LOCATION: Riverside Light Industrial Park	**GROUND ELEVATION:** 855.058 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 06/18/2013

Sample Type: Shelby Tube | Split Spoon | Core | Disturbed | No Recovery

Backfill Type: Bentonite | Silica Sand | Grout | Pea Gravel | Drill Cuttings | Bentonite : Sand

Notes: Testhole is located in front of 4645 - 62 Street on grassed boulevard.

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)		Well Details
0.0	Sod - loam. (~ 8 cm thick).						
	Loam - gravelly, silty, trace clay, damp, olive.						
	Sand (fill) - compact, trace silt, moist, olive.						
1.0							
	Loamy gravel (fill) - compact, some sand, trace organics, trace silt, moist, dark olive.						
2.0	No obvious waste material.						
	Sand (native) - compact, trace silt, moist, olive.						
3.0	Sand and gravel (native) - dense, trace silt, damp, olive.						
4.0							
5.0	End of hole at 5.2 m. Backfilled with ~ 50:50 bentonite and silica sand to 0.3 m depth. Capped with loam, silt to surface.						
6.0							
7.0							
8.0							
9.0							
10.0							
11.0							
12.0							

Tiamat Environmental Consultants Ltd.

Slough :	Completion Depth (m): 5.2
Depth to Groundwater :	Checked By: LTM
Logged By: LTM	Page: 1 of 1

PROJECT: Phase II ESA Historic Waste Disposal Sites	**BOREHOLE No.:** TH-08
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger
LOCATION: Riverside Light Industrial Park	**GROUND ELEVATION:** 854.759 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 06/18/2013

Sample Type: Shelby Tube | Split Spoon | Core | Disturbed | No Recovery

Backfill Type: Bentonite | Silica Sand | Grout | Pea Gravel | Drill Cuttings | Bentonite : Sand

Notes: Testhole is located on grassed area, west side of 62 Street across from 4645 - 62 Street.

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)		Well Details
0.0	Sod - loam. (~ 8 cm thick).						
	Loamy gravel - silty, some sand, trace organics, moist, dark olive.						
	Sand and gravel (fill) - compact, silty, moist, olive.						
	Sand (fill) - compact, silty, trace clay, moise, dark olive.						
1.0							
2.0	trace plastic fragments at 2.4 m.						
3.0	becomes loose and wet at 3.4 m. No obvious waste material.						
	trace oxides at 3.8 m.						
4.0							
	Sand (native) - compact, clean, wet, olive.						
5.0							
6.0	End of hole at 6.1 m. Backfilled with ~ 50:50 bentonite and silica sand to 0.3 m depth. Capped with loamy soil, silt to surface.						
7.0							
8.0							
9.0							
10.0							
11.0							
12.0							

Tiamat Environmental Consultants Ltd.

Slough :	Completion Depth (m): 6.1
Depth to Groundwater :	Checked By: LTM
Logged By: LTM	Page: 1 of 1

PROJECT: Phase II ESA Historic Waste Disposal Sites	**BOREHOLE No.:** MW-03
PROJECT No.: 12-435	**DRILL TYPE:** SS Auger/ODEX
LOCATION: Riverside Light Industrial Park	**GROUND ELEVATION:** 854.551 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 06/19/2013

Sample Type: Shelby Tube | Split Spoon | Core | Disturbed | No Recovery

Backfill Type: Bentonite | Silica Sand | Grout | Pea Gravel | Drill Cuttings | Bentonite : Sand

Notes: Groundwater Monitoring Well on north side of 46 Avenue ~ 3 m west of the CN track R/W on grassed boulevard

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)		Well Details
0.0	Sod - loam, silty, sandy, moist, dark olive. (~ 15 cm thick) Sand and gravel (fill) - compact, trace organics, trace clay, moist, olive.						
1.0	Clay (fill) - firm, sandy, trace silts, trace organics, moist, olive. wood fragments at 1.8 m to 2.4 m.						
2.0	Loam - firm, silty, sandy, damp, dark olive. some oxides at 2.9 m. No obvious waste material.						
3.0	Sand (native) - loose to compact, trace silts, damp, light olive.						
	Sand and gravels - compact to dense, trace silt, olive.						
4.0							
5.0	Gravel - compact, wet at 5.2 m.						
	Clay at 5.5 m to 5.8 m.						
6.0							
7.0	End of hole at 7.6 m. 51 mm diameter 4.6 m length 010 PVC screen. 3.0 m solid PVC pipe. Flush mount bolt-down steel casing set in concrete.						
8.0							
9.0							
10.0							
11.0							
12.0							

Tiamat Environmental Consultants Ltd.

Slough :	Completion Depth (m): 7.6
Depth to Groundwater :	Checked By: LTM
Logged By: LTM	Page: 1 of 1

PROJECT: Phase II ESA Historic Waste Disposal Sites	**BOREHOLE No.:** TH-10
PROJECT No.: 12-435	**DRILL TYPE:** ODEX
LOCATION: Riverside Light Industrial Park	**GROUND ELEVATION:** 854.418 m
CLIENT: The City of Red Deer	**COMPLETION DATE:** 06/19/2013

Sample Type: Shelby Tube | Split Spoon | Core | Disturbed | No Recovery

Backfill Type: Bentonite | Silica Sand | Grout | Pea Gravel | Drill Cuttings | Bentonite : Sand

Notes: Testhole is on west side of 62 Street in grassed boulevard across from 4645 - 62 Street.

Depth (m)	Soil Description	Sample Type	Sample No.	SPT (N)	Combustible Soil Vapours (ppm)		Well Details
0.0	Sod - loam, silty, sandy, trace organics, moist, dark olive.						
	Clay (fill) - firm, silty, some gravel, trace sand, moist, light olive.						
1.0	trace wood fragments at 1.1 m.						
	Sandy loam - wood chips, trace organics, damp to moist, dark olive.						
	Clay (fill) - firm, trace sand, trace gravel, trace oxides, moist, olive.						
2.0	trace organics at 2.1 m.						
3.0							
4.0							
	No obvious waste material.						
	Silt (native) - firm, sand, moist, olive.						
5.0							
	Sand and gravel - compact, trace silt, wet, olive.						
6.0	End of hole at 6.1 m. Backfilled with ~ 50:50 bentonite and silica sand to 0.3 m depth. Capped with loamy soil to surface.						
7.0							
8.0							
9.0							
10.0							
11.0							
12.0							

Tiamat Environmental Consultants Ltd.

Slough :	Completion Depth (m): 6.1
Depth to Groundwater :	Checked By: LTM
Logged By: LTM	Page: 1 of 1

APPENDIX C

SELECT PHOTOGRAPHS

Photograph No. 1: View of location of TH-01 and soil bag.

Photograph No. 2: View of MSW on the auger from a depth of 1.5 m to 3 m at TH-01.

Photograph No. 3: View of MSW on the auger from a depth of 3 m to 4.6 m at TH-01.

Photograph No. 4: View of drill cuttings at TH-01. Note wood fragments only mixed with cuttings from 5 m to 6.1 m.

Photograph No. 5: View of set-up for drilling at MW-01.

Photograph No. 6: Drilling TH-03, looking westward.

Photograph No. 7: Drilling using ODEX tooling next to 62 Street, looking southwest.

Photograph No. 8: View of completed MW-02.

Photograph No. 9: Drill at MW-03, looking northward.

Photograph No. 10: View of location of TH-07 and soil bag after drilling.

Photograph No. 11: View of TH-08 looking southwest.

Photograph No. 12: Small amount of wood fragments in the drill cuttings from a depth of 1.5 m to 3 m at TH-10. No other waste material encountered.