FINAL REPORT: ENVIRONMENTAL COMPLIANCE MONITORING – MEADOWVIEW LANDFILL

2017 Monitoring Program

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1.0 INTRODUCTION

1.1 GENERAL

Stantec Consulting Ltd. (Stantec) was retained by the Municipality of the County of Kings (the Municipality) to perform environmental compliance monitoring at the Meadowview Landfill (the Site). The 2017 program included groundwater, surface water, and fisheries habitat monitoring, completed in accordance with Stantec's proposal dated March 28, 2016. The 2017 environmental compliance monitoring program is comprised of field data collection, analysis, and reporting.

The scope of the 2017 monitoring program differs from previous years and follows the recommendations to reduce monitoring program put forward by Stantec (Stantec Consulting Ltd., 2017 (a)). These scope changes were confirmed with both the Municipality and NSE and are summarized in Section 1.2.1.

1.2 BACKGROUND

The Town of Kentville established a landfill at the Site in the late 1960s. The Municipality took over operations and continued to operate the landfill until it closed on June 30, 1999. Upon closure, the Municipality implemented a Closure Plan, which drew on specifications outlined in the Site Closure Report (Porter Dillon, 1995). The Closure Plan set out the requirements for an environmental monitoring program, which have recently been updated (Section 1.2.1), and which this report serves to satisfy.

1.2.1 2017 Monitoring Plan Update

As part of the 2016 Annual Monitoring Report, Stantec recommended an evaluation of the monitoring network to identify if changes to the scope of the monitoring program were warranted based on available data (Stantec Consulting Ltd, 2017 (b)). Consideration was also given to altering the guidelines and standards that analytical data are compared with to ensure the most appropriate guidelines are used. Stantec completed the monitoring program evaluation in May 2017 and provided the report to both the client and NSE. The recommended scope changes put forth in the monitoring program evaluation were accepted and were thus implemented in the 2017 monitoring program. Some of the primary changes include;

- Groundwater: Remove petroleum hydrocarbon (PHC), volatile organic compound (VOC), and semi-volatile organic compound (SVOC) analysis, and reduce annual sampling to six monitoring wells (MW-4A, MW-22A, MW-22B, MW-22C, MW-25B, and TH-1) and sampling every three years at six monitoring wells (MW-23A, MW-23B, MW-23C, MW-29B, MW-29C, and MW-31A). Implementation of defined action levels that could trigger additional investigative programs for indicator parameters (chloride, conductivity, and ammonia).
- Surface Water: Monitoring locations and frequency to remain unchanged.
- Fish Habitat: Monitoring locations and frequency to remain unchanged.

- Guidelines: Use the Nova Scotia Environment (NSE) Tier 1 Environmental Quality Standards (NS Tier 1 EQS) and/or Tier 2 Pathway Specific Standards (NS Tier 2 PSS) for groundwater and surface water chemistry (NSE , 2013 (a)), (NSE, 2013 (b)).

Discussions with NSE further revealed that environmental compliance monitoring for the Site was not required as the Site is considered a Class 1 Landfill. Planning for the 2017 monitoring program was sufficiently underway at that time, that it warranted the completion of the 2017 monitoring program as prescribed in Stantec's program evaluation report. As environmental compliance monitoring is no longer required from a regulatory perspective, the need for an ongoing monitoring program is re-examined in later sections of this report.

1.3 SITE DESCRIPTION

The Site is located on Brook Street near the Town of Kentville, NS (Figure A-1, Appendix A). The Site is located at Lanzy Road and Brooklyn Street, south of Camp Aldershot in Kentville, and is described by Service Nova Scotia and Municipal Relations' Property Online as PIDs No. 55047310, 55058325, 55047328, 55047369, 55047351, 55049035, 55047336, and 55047476. The monitoring locations used for the environmental monitoring program are situated on land owned by the Municipality and the Department of National Defence (DND).

The topography of the Site and surrounding areas slopes south towards the Cornwallis River. Background, or up-gradient monitoring sites are located north of the former landfill while down-gradient monitoring sites are located to the south between the former landfill and the river. The landscape surrounding the Site is comprised of forested areas intersected by several roads, with marsh and river habitat to the south.

1.4 REGULATORY FRAMEWORK

The historical groundwater and surface water data presented in the 2016 annual monitoring report was screened against the Guidelines for Canadian Drinking Water Quality (GCDWQ) (Health Canada, 2017) and Canadian Environmental Quality Guidelines (issued by the Canadian Council of Ministers of the Environment [CCME] - updates) for Freshwater Aquatic Life (CCME FAL), respectively. As described in Stantec (2017 (a)), the Site is no longer considered as potable due to the connection of the local dwellings to municipal water supply. Accordingly, updated regulatory guidelines are used for the 2017 monitoring program and are described in the sections below.

1.4.1 Groundwater

Groundwater chemistry analytical results are compared to the following specific standards that are applicable to non-potable sites in Nova Scotia, local soil conditions, and the separation distances between monitoring wells and surface water features:

- NS Tier 1 EQS for groundwater (commercial/industrial, non-potable, coarse grained); and
- NS Tier 2 PSS for groundwater >10 m from a fresh surface water body.

1.4.2 Surface Water

Surface water chemistry analytical results are compared to NS Tier 1 EQS for surface water. CCME FAL (CCME updates) are also included for comparison because they have general chemistry parameters. In general, the NS Tier 1 EQS and CCME FAL metals guidance values are identical for common parameters, but the NS Tier 1 EQS has a more comprehensive list of parameters.

1.5 OBJECTIVES AND SCOPE

The scope of the 2017 monitoring program generally consisted of the following;

- groundwater sampling at six monitoring wells (MW),
- surface water sampling at six locations, and
- fisheries habitat monitoring at three locations.

The locations of these sampling points are shown on Figure A-1 (Appendix A). The overall objective of the monitoring program is to track the influence of water emanating from the landfill and identify if concentrations exceed guideline values established to protect relevant receptors. By monitoring the groundwater, surface water and fisheries habitat over time, trends or changes can be identified and where necessary alterations to the monitoring program can be implemented.

Field work was conducted on July 18 and 19, 2017 and analytical results reviewed in the fall of 2017. Based on an initial review of these results, it was determined that an additional round of surface water sampling was required; this was completed on December 18, 2017.

2.0 FIELD INVESTIGATION

2.1 HEALTH AND SAFETY

Stantec prepared and reviewed a project specific risk management strategy prior to the commencement of field work. Relevant safe work practices were reviewed by all Stantec staff that completed field work on this project. During field work, a site safety meeting was conducted by Stantec staff each morning at which a last-minute risk assessment (LMRA) was completed and site conditions assessed. This LMRA form identified potential health and safety risks at the Site that might not have been previously identified during project planning. Copies of all signed health and safety documentation are retained by Stantec in the project file. No health and safety incidents occurred while Stantec was on the Site conducting field work.

2.2 METHODOLOGY

Figure A-1 (Appendix A) provides the location of all sampling points used in 2017. Groundwater, surface water, and fish habitat sampling was conducted on July 18 and 19, 2017. A follow up surface water sampling event, to confirm analytical results, was conducted December 17, 2017.

Samples were collected in laboratory supplied containers and preserved in insulated coolers provided by Maxxam Analytics, of Bedford, NS (Maxxam). Table 1 provides a summary of laboratory analyses conducted on all samples.

Table 1 Meadowview Landfill Monitoring Locations and Analysis

Location	Easting (m)	Northing (m)	General Chemistry and Metals	Fish Habitat and Benthic Invertebrate
Groundwater				
MW-4A	380795	4993550	X	
MW-22A	380036	4993547	X	
MW-22B	380036	4993546	X	
MW-22C	380034	4993546	X	
MW-25B	380242	4993537	X	
TH-1	380612	4993546	X	
MW-40D (MW4A dup)			X	
Surface Water				
SW1	381170	4993232	X	
SW2	381486	4992964	X	
SW3	380817	4993379	X	
SW7*	380015	4993519	X	X
SW7A*	380033	4993444	X	X
REF	377276	4994100	X	X

*** Follow up water quality samples also collected at these locations in December 2017.**

2.2.1 Groundwater

Field staff conducted all groundwater sampling in accordance with Stantec's Standard Operating Procedures (SOPs). Static water levels were measured in each monitoring well from the top of the PVC well casing using a Solinst probe. Monitoring well conditions were noted and the stickup height was measured from the top of the PVC well casing to ground. Water levels were measured prior to any purging or sampling. Each monitoring well was purged using the existing dedicated Waterra tubing and foot valve until dry or three well volumes were removed.

In-situ physical water quality parameters of temperature, pH, dissolved oxygen, and conductivity were measured using a YSI 556 multi meter. Qualitative groundwater descriptions of colour, turbidity, and sheen were also recorded by field staff. Metals samples were field filtered using single use 0.45 µm inline disposable filters.

A single round of groundwater sampling was completed in July 2017.

2.2.2 Surface Water

Field staff conducted all surface water sampling in accordance with Stantec's SOPs. Special care was taken at the sampling locations to not disturb sediment to minimize the amount that entered sample containers. In-situ physical water quality parameters of temperature, pH, dissolved oxygen, and conductivity were measured using a YSI 556 multi meter.

Grab samples were collected in laboratory supplied containers and preserved in insulated coolers provided by Maxxam. Samples were uniquely labeled and control was maintained using chain of custody forms. Sample locations and what each sample was analysed for are shown in Table 1 above.

Two rounds of surface water sampling were completed, the initial sampling event in July 2017 and the follow up sampling event in December 2017 (surface water sample locations SW7 and SW7A only).

2.2.3 Fish Habitat

Benthic sampling, water quality measurements, fish sampling, and habitat characterizations/confirmations were carried out on July 18 and 19, 2017. *In-situ* physical water quality parameters at each site were measured during the surface water sampling event.

Site REF, within Black Brook, was added as a reference along with an additional point (SW7A) on the West Tributary in 2004, and review of abundance and diversity of EPTs (see definition of EPTs in Seciton 3.3.4, below) present there since, suggests that the REF site is below reference condition itself and should only be considered a rough basis for contrast, unlikely being representative of pre-landfill conditions of the West Tributary. In spring 2017, further explorations were undertaken with the objective of identifying more appropriate reference locations. Better locations were not identified, and as such, the same reference site (REF) was sampled in 2017.

2.2.3.1 Fish Sampling

At each of the sites, two conical, wire minnow traps (41 cm x 22 cm; 1 cm x 1 cm mesh; 2.5 cm diameter opening) were baited with cat food and set for approximately 24 hours. During deployment of the minnow traps, considerations of flow levels were taken and exact in-stream positioning varied while assuring submergence of the trap opening. Traps were securely affixed streamside to prevent movement and/or removal of traps from water flow as well as potential scavenging by predators.

2.2.3.2 Benthic Macroinvertebrates Sampling

Methods for benthic macroinvertebrate (BMI) sampling were consistent with those conducted in 2003-2016, as described in the Canadian Aquatic Biomonitoring Network (CABIN) protocol (Reynoldson et al 2003). Prior to 2003, various methods were utilized including; a surber sampler (1 square foot) in 1998-1999, and a 15 x 15 cm square quadrat in 2000-2002. As per CABIN protocol, BMI samples were fixed with 10% buffered formalin in sterile glass jars in the field, thus ceasing organic activity. The following day, BMI samples were transferred to 70% isopropyl alcohol for preservation. All benthic macroinvertebrate samples were submitted to Envirosphere Consultants Ltd., which follows sample

processing and taxonomy, including QA/QC procedures, as laid out within the CABIN Laboratory Methods manual (refer to Appendix H).

Based on CABIN protocols, Black Brook was selected as the Reference Site (REF), but understanding how close it remains to “reference condition” is unclear.

2.2.4 Quality Assurance and Quality Control

Quality assurance and quality control (QA/QC) procedures included following appropriate field methodologies and SOPs. One blind field duplicate sample (MW 4A) was submitted as part of the groundwater monitoring program. All samples were uniquely labelled and control was maintained using chain of custody forms. The laboratories report the results from their own internal QA/QC process, which are included in certificates of analyses provided in Appendices F and H.

3.0 RESULTS

The following sections summarize the results of the 2017 monitoring program.

3.1 GROUNDWATER

3.1.1 Field Results

Table B-1 (Appendix B) provides the in-situ physical parameters and observations collected during well purging. These can be summarized as follows:

- Groundwater elevations ranged from 7.24 to 9.00 meters above sea level (mASL),
- pH ranged from 6.26 to 7.51,
- Water temperature ranged from 10.22 to 12.43 °C,
- Conductivity ranged from 0.339 to 84.0 mS/cm, and
- Monitoring well conditions were generally noted as good or fair.

3.1.2 Analytical Results

Analytical results for the 2017 monitoring program are provided in Tables B-2 and B-3 (Appendix B) and are discussed below. Additionally, results from historical monitoring events at the monitoring wells sampled in 2017 are provided in Tables C-1 through C-12 (Appendix C). Historical analytical chemistry results were provided to Stantec by the consultant responsible for the 2012–2015 monitoring events, WSP Canada Inc. and have not been verified by Stantec (WSP, 2015).

3.1.2.1 General Chemistry and Metals

Laboratory results for general chemistry are listed in Table B-2 and results for metals are listed in Table B-3, both in Appendix B.

Concentrations for general chemistry and metals analysis were found to be below the applicable Tier 1 EQS and Tier 2 PSS, with the following exceptions:

- Arsenic exceeded Tier 2 PSS levels in MW-22A
- Cadmium exceeded Tier 2 PSS levels in MW-40D (MW-4A dup)
- Iron exceeded Tier 2 PSS levels in MW-4A, MW-22A, MW-22B, and TH-1

3.1.3 Trend Analysis

Trends in indicator parameters associated with landfill leachate were analyzed in all monitoring wells sampled in 2017. Indicator parameters were identified in the Site Closure Report (Porter Dillon, 1995) and were further refined in the Monitoring Plan Evaluation (Stantec Consulting Ltd., 2017 (a)). The leachate indicator parameters included ammonia, chloride, and conductivity. Historical analytical results for these three parameters have been plotted according to the monitoring area that the well is located in (Areas 1 to 3 on Figure A-1) and can be seen in leachate indicator Figures D-1 to D-6 (Appendix D). Historical data for all monitoring wells within each monitoring area are included in the trend figures while only those monitoring wells carried forward after the monitoring program review show 2017 data.

Trends noted through a visual assessment of the leachate indicator figures are summarized below:

- Ammonia
  - Area 1 – Ammonia concentrations show generally stable trends (no distinct increase, peak, or decrease) with TH1 and MW-4A showing similar, elevated levels.
  - Area 2 - Ammonia concentrations show generally stable trends (no distinct increase, peak, or decrease) with concentrations increasing from deep (MW-22C) to shallow (MW-22A) wells.
  - No new data collected for ammonia in Area 3.

- Chloride
  - Area 1 – Chloride concentrations continue to show a generally decreasing trend in TH1 and MW-4A while MW-25B shows stable to increasing trends.
  - Area 2 – Chloride concentrations continue to show an increasing trend in MW-22C while MW-22B and MW-22A generally show stable to decreasing trends.
  - No new data collected for chloride in Area 3.

- Conductivity
  - Area 1 – Conductivity levels generally show a decreasing trend in TH1, stable in MW-4A, and increasing trend in MW-25B.
  - Area 2 – Conductivity levels generally show a decreasing trend in MW-22A, stable in MW-22B, and increasing trend in MW-22C.
  - No new data collected for conductivity in Area 3.

Monitoring well nests are comprised of multiple wells drilled to different depths and placed near each other, as is the case with MW-22(A, B, C). The MW-22 set of nested wells showed that the 'B' and 'C' wells generally had the highest concentrations for leachate parameters ('B" more than 'C').

Groundwater elevations over the history of the monitoring program were also evaluated for trends and are shown in Figures D-7 for monitoring wells down-gradient of the Site (Appendix D). Only downgradient wells are shown as this is where all wells carried forward after the monitoring program review are located. Results from the 2017 monitoring event were consistent with historical ranges and showed no discernable trends, which is as expected.

3.1.4 Action Levels

As described in the Monitoring Plan Evaluation (Stantec Consulting Ltd., 2017 (a)), action levels were developed for each of the Indicator Parameters. Action levels are concentration values for indicator parameters which would initiate further response. The generic definition of an action level is an indicator parameter concentration that increases more than three standard deviations from the mean of the historical data (defined here as data collected in 2007 through 2017; the calculation is made using half of the reportable detection limit, where applicable). Table 2 below shows that no indicator parameters exceeded their respective action levels for any of the monitoring well locations sampled in 2017.

Table 2 2017 data and action level comparison for indicator parameters.

Monitoring Location	Dissolved Chloride (mg/L)	Nitrogen (ammonia nitrogen) (mg/L)	Conductivity (uS/cm)
MW-4A			
MW-4A - Action Level	139	109	2463
MW-4A - 2017 Data	31	32	1000
MW-22A			
MW-22A - Action Level	204	48	1506
MW-22A - 2017 Data	35	23	890
MW-22B			
MW-22B - Action Level	291	3.3	2251
MW-22B - 2017 Data	150	1.6	1500
MW-22C			
MW-22C - Action Level	51	13.9	755
MW-22C - 2017 Data	46	<0.05	470
MW-25B			
MW-25B - Action Level	178	0.500	1654
MW-25B - 2017 Data	64	0.052	510
TH1			
TH1 - Action Level	60	79	1565
TH1 - 2017 Data	26	33	1000

3.1.5 QA/QC

QA/QC measures included following appropriate field methodologies and SOPs, and collection of a field duplicate sample from MW-4A. Analysis of the field duplicate was completed for general chemistry and metals. Results for the field duplicate of MW-4A (MW-40D) can be seen in Tables B-2 and B-3 (Appendix B). Relative percent differences (RPD) between MW-4A and MW-40D were calculated and are shown in Tables B-4 and B-5 (Appendix B). RPD values calculated were outside of the generally accepted variance ranges (50% for general chemistry parameters and 80% for metals parameters) for three of the general chemistry parameters and three of the metals parameters. These results do not suggest that there is any significant issue with the analytical quality. However, the need for proper sampling techniques and field notation will be re-iterated before future sampling events. Maxxam also follows laboratory QA/QC procedures which are identified in the laboratory Certificates of Analysis (COA) found in Appendix F.

3.2 SURFACE WATER MONITORING

3.2.1 Field Results

Table B-6 (Appendix B) contains in-situ physical parameters measured at all surface water sampling locations using a YSI 556 multi meter, rented from Pine Environmental of Halifax and these are summarized below;

- pH ranged from 6.44 to 8.72 during the July sampling, and were 10.53 and 11.38 at SW7 and SW7A, respectively in the December samples,
- Water temperature ranged from 13.42 to 20.18 °C in July, and 5.42 and 6.55 °C in December,
- Conductivity ranged from 0.085 to 0.380 mS/cm in July, and 0.111 to 0.496 mS/cm in December,
- Dissolved Oxygen ranged from 4.32 to 9.43 mg/L in July, and 3.45 to 13.50 mg/L in December.

3.2.2 Analytical Results

Analytical results for the 2017 monitoring program are provided in Table B-7 (Appendix B) and are discussed below. Additionally, results from historical monitoring events are provided in Tables C-13 through C-17, Appendix C. Historical analytical chemistry results were provided to Stantec by the consultant responsible for the 2012–2015 monitoring events, WSP Canada Inc. and have not been verified by Stantec.

Results from the July 2017 sampling event showed concentrations for general chemistry and metals analysis were found to be below the applicable Tier 1 EQS Fresh Water and CCME FWAL, with the following exceptions:

- SW1, SW2, and SW3 exceeded both the Tier 1 EQS and CCME FWAL for iron and aluminum, and exceeded only the CCME FWAL (no Tier 1 EQS) for nitrite,
- SW7 exceeded both the Tier 1 EQS and CCME FWAL for iron, exceeded only the CCME FWAL for nitrite, and exceeded only the Tier 1 EQS for aluminum and manganese,

- SW7A exceeded both the Tier 1 EQS and CCME FWAL for iron, copper, cadmium, arsenic, and aluminum. It exceeded only the CCME FWAL for chromium, ammonia, and nitrite. It exceeded only the Tier 1 EQS for vanadium, manganese, lead, cobalt, and barium, and
- REF exceeded both the Tier 1 EQS and CCME FWAL for iron, exceeded only the CCME FWAL for nitrite, and exceeded only the Tier 1 EQS for aluminum.

A review of surface water analytical data shows water quality in the Cornwallis River (SW1, SW2, and SW3) and its tributaries (REF) are of similar quality and report exceedances of aluminum, iron, and nitrites. Water quality in Palmer Brook (SW7 and SW7A) exhibits poorer water quality, especially at SW7A. There is currently not enough historical data from SW7A to develop Action Levels for the indicator parameters discussed for groundwater in Section 3.1. During the July 2017 monitoring event, exceedances were reported for 13 parameters at SW7A while water quality at the next downstream sampling location (SW3) show water quality consistent with background or natural levels. This indicates that surface water adjacent to SW7A may be influenced by the Site and that any impacts (i.e. elevated levels of some parameters) are spatially restricted as their influence is not detected downstream.

2017 Re-sampling

To confirm conditions at SW7A and to confirm that these conditions do differ from the immediately upstream site, SW7, a second field sampling event was conducted in December 2017. The results of this sampling event are included in analytical and historical results tables in both Appendix B and C. A review of this data confirmed that water quality at SW7A is of poorer quality than the immediately upstream SW7 and that impacts from the Site may be impacting this area. It is possible that an area of groundwater upwelling occurs near SW7A and may be causing these elevated concentrations. In reviewing the groundwater results from MWs close to SW7A (MW-22A, 22-B, 22C, and 25D), some of the concentrations at SW7A are significantly higher than those measured in the groundwater samples (such as aluminum, arsenic, chromium, iron, and vanadium), while other parameters have similar concentrations (barium, cadmium and manganese).

Results from the December 2017 sampling event showed concentrations for general chemistry and metals analysis were found to be below the applicable Tier 1 EQS Fresh Water and CCME FWAL, with the following exceptions:

- SW7 exceeded both the Tier 1 EQS and CCME FWAL for iron, exceeded only the CCME FWAL for nitrite, and exceeded only the Tier 1 EQS for aluminum and manganese, and
- SW7A exceeded both the Tier 1 EQS and CCME FWAL for iron, arsenic, and aluminum. It exceeded only the CCME FWAL for ammonia. It exceeded only the Tier 1 EQS for barium, cadmium, cobalt, and manganese.

3.3 FISH HABITAT MONITORING

3.3.1 Field Results

Water quality measurements and minnow trap deployments were conducted on July 18, 2017, with both BMI sampling, and fish and fish habitat sampling/observations occurring on July 19, 2017. Weather on both days was hot (25-30°C) and sunny with little wind. In the two months leading up to July 2017 sampling events, precipitation totals (recorded at Kentville Environment Canada Station) (Environment Canada, 2017) were 110.0 mm (May 2017) and 84.9 mm (June 2017).

3.3.2 Water Quality and Site Habitat Descriptions

Similarities in water quality conditions to those reported from 2007-2015 (WSP, 2015), and additionally in both 2016, and 2017 were observed in both West Tributary and Black Brook. Measuring below the CCME FAL guidelines for both warm and cold water biota, in all life stages, dissolved oxygen concentrations (4.32 mg/L at SW7, and 4.57 mg/L at SW7A) at both the West Tributary sampling locations were also below the 9.23 mg/L measured at the REF site on Black Brook. Measurements of pH from both West Tributary locations were either on the lower end (6.79 at SW7), or below (6.44 at SW7A) the CCME FAL acceptable range of 6.5 - 9.0, with the REF site measuring within this guidance at 8.72. A summary of water quality parameters recorded during 2017 field work is shown in Table E-1 (Appendix E). Observations of physical conditions at each sampling site remain largely unchanged from those presented in previous reports (WSP 2014, 2015 & Stantec 2016). Photographs of the watercourse (views upstream, downstream, and of the left and right riparian zones), and the substrate within it were taken at each site (Appendix G). Influencing diversity of aquatic vegetation and biota, the abundance of fine sediments observed at sites SW7 and SW7A have an inherent low porosity and therefore low levels of sedimentary oxygen associated with it, and presumably cause lowered dissolved oxygen levels within the water during times of low flow (ABL Report 2012, as cited in (WSP, 2015)). Infilling with fine sediment and detritus has rendered the main channel at SW7 nearly inaccessible from either side. Evidence of illegal dumping (e.g., broken toilet, scrap metal) was observed where watercourse at SW7 runs via culvert, under an ATV trail.

Observations of an orange ferromanganese flocculent material previously reported in the West Tributary, especially at SW7A, and identified as being derived from elevated iron and manganese content in groundwater, was once again present in 2017 surveys. Observations of floc within Black Brook, at site REF, were only recorded once in 2010, and is presumed to be from a natural source due to the distance from the landfill and its location within the watershed (WSP, 2015). Observations in 2017 did not indicate any discernible differences to water quality and habitat from previous surveys, and dissolved oxygen levels at sites SW7 and SW7A were once again recorded as being below that required for all stages of life for cold-water biota (i.e. brook trout).

3.3.2.1 Site SW7 (West Tributary)

Site SW7 within the West Tributary was dominated by a riparian wetland with an overstory composed predominantly of alders (*Alnus sp.*), and willow (*Salix spp.*) with patches of serviceberry (*Amelanchier spp.*), alternate-leaved dogwood (*Cornus alternifolia*), red maple (*Acer rubrum*), and the occasional tamarack (*Larix larcina*) interspersed throughout. As the bank transitioned to upland, wild rose (*Rosa rugosa*) and raspberry (*Rubus sp.*) were found. Upland vegetation in a mostly mature, mixed wood forest consisted of a canopy of white pine (*Pinus strobus*), eastern hemlock (*Tsuga Canadensis*), white spruce (*Picea glauca*), red maple, poplars (*Populus spp.*) and red oak (*Quercus rubra*). The upland understory included many ferns such as wood fern (*Dryopeteris carthusiana*), intermediate fern (*D. intermedia*) and bracken fern (*Pteridium aquilinum*), along with various grasses.

Substrate composition within the wetted width of the stream at SW7 consisted of soft, brown, organic, and silty mud with an obvious and significant deposition of ferromagnese floc. Occasional gas releases were observed from substrate. With a mean depth of 0.2 m and wetted width ranging from 2.5 m – 5 m, instream vegetation capitalized on available habitat within slow flows over shallow organic substrates. Calla lily (*Calla palustris*), various sedges (*Carex spp.*), bur-reeds (*Sparganium spp.)*, cat-tails (*Typha sp.*), duckweed (*Lemna sp.*), and grasses were found within the watercourse. The wet areas adjacent to it consisted of jewelweed (*Impatiens capensis*), sensitive fern (*Onoclea sensibilis*), cinnamon fern (*Osmunda cinnamomeum*), vetch (*Vicia sp.*), bindweed (*Convolvulaceae*), horsetails (*Equisetum spp.*), goldenrods (*Solidago spp.*), St. John's Wort (*Hypericum perforatum*), and blue-flag (*Iris versicolor*).

3.3.2.2 Site SW7A (West Tributary)

Serviceberry, dogwood and a high percentage (<40% by count) of alder made-up riparian overstory, which at its upland edge, has an understory of royal fern (*O. regalis*), cinnamon fern, sensitive fern and St. John's Wort. Upland vegetation was comparable to that of SW7.

Multiple channels, with a mean wetted width of approximately 7 m and mean depth of approximately 0.2 m, braided through a soft, organic silty substrate very similar to SW7 with an increase of gaseous releases.

3.3.2.3 REF Site (Black Brook)

Vegetation alongside site REF was heavily modified along its east bank, due to a lawn of the adjacent property. Trees were non-existent in the riparian zone, and grasses and sedges dominated. On the west bank, a thicket of immature maples, alders, wild rose, and raspberry overshadowing the lesser grasses and sedges was noted. Vegetation of stream edges along both sides included sensitive fern and turtlehead (*Chelone glabra*). Instream vegetation included various grasses, blue-flag, watercress (*Nasturtium officinale*) and wild-celery (*Vallisneria americana*).

Black Brook, at the REF site, is a small, sinuous stream composed entirely of riffles and runs throughout the observed stretch. Having a mean wetted width of approximately 2 m and a mean depth of 0.2 m, this entrenched stretch flows via culvert under Brooklyn Street over a substrate composed of sand/gravel riffles, with deposits of organics in the bends of shallow runs.

3.3.3 Fish Sampling

Details of sites sampled, number of minnow traps set, trap hours and catch per unit effort are presented in Table E-2 (Appendix E).

Historically, fish have been captured in minnow traps at sites SW7, SW7A, and REF. In 2017, fish were present in each of the three locations (Table E-3, Appendix E). Multiple individuals (likely of the same species, although not confirmed) of the genus *Gasterosteus* (stickleback) fish, and a Banded Killifish (*Fundulus diaphunus*) (Photo G.9 in Appendix G were captured at site SW7). At site SW7A, multiple specimens (likely of the same species, but not confirmed) of the genus *Gasterosteus* were caught. At the REF site, multiple *Gasterosteus sp.* specimens were contained within the traps. A reduction in overall fish abundance across all sites was observed in 2017 Figure E-1 (Appendix E) from previous years (2007 – 2013 and 2015, ranged from 20-75 specimens) and is comparable to those observed in 2006 (six specimens), 2014 (eight specimens), and 2016 (nine specimens).

Within watercourses at sites SW7, SW7A and the REF site, sampling has indicated that large and/or diverse fish populations are not likely present. Historically only six species of fish have been identified, and in 2017, only 2 species were sampled, with an additional salmonid species, likely Brook Trout (*Salvelinus fontinalis*), observed during benthic sampling at the REF site.

3.3.4 Benthic Macro Invertebrates

Benthic macro-invertebrates (BMI) are a semi-quantitative (due to sub-sampling during laboratory analysis) means of measuring environmental impacts within a watercourse and are used as an important indicator of overall ecological health of aquatic environments. BMI monitoring is utilized for the following reasons:

- They are ubiquitous, and as such, are affected by environmental deviations in a large variety of habitats;
- They are rich in species diversity; thus, the large number of species produce a range of responses;
- They are generally sedentary, allowing for determination of spatial extents of environmental impacts because they are reflecting site conditions in discrete areas of interest;
- They are long-lived, allowing chronologic changes in abundance and age structure to be followed; and
- They integrate conditions temporally, thus providing evidence of trends over long periods of time (Mackie, 2004)

Often preferring slow moving, warm water conditions, the diverse order of Dipterans (collectively known as true flies), along with many other aquatic invertebrates, has one or more juvenile growth stage within the aquatic environment. Some of the more prevalent families of Dipterans occurring (in one or more

stages of development) within any of the three sites combined include; phantom crane flies (Ptychopteridae) and non-biting midges (Chirononmidae), with minimal (<3% by count) occurrences of biting midges (Ceratopogonidae), black flies (Simuliidae), crane flies (Tipulidae), and dagger/balloon flies (Empididae). Watercourses which exhibit dominance by Dipterans are generally indicative of poor fish habitat, often inhabiting those with elevated silt sedimentation and deposition of detritus (decaying organic matter), reducing oxygen levels necessary for fish survival (Mackie 2004). At sites SW7, SW7A, and the REF site, approximately 50% of the combined total invert count (3020 of 6204 individuals) was composed of Dipterans, of which, over 65% (1936 of 3020) were sampled from the REF site Table E-4 (Appendix E).

Highly adapted to, and having a preference for fast-moving, cool temperature aquatic habitats, the orders of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) are collectively referred to as EPT taxa. Being mostly intolerant of contamination and poor water quality conditions, a dominance of EPTs within a given watercourse is generally indicative of good fish habitat consisting of low turbidity, cobble/gravel substrates, and elevated oxygen levels with minimal anthropogenic disturbances (Mackie 2004). The combined count from all three sites of EPTs was approximately 6.5% (404 of 6204) of total invertebrates sampled, of which, approximately 95% (384 of 404) were collected from the REF site. Only 4 EPTs were collected and sampled from SW7A, and none were collected and sampled from SW7. Diptera to EPT ratios exhibited a similar trend to 2015 and 2016 results, in that site SW7A had the highest ratio, and the REF site had the lowest (Figure E-2, Appendix E). An increase in benthic macroinvertebrate abundance at the REF site (3536 specimens) was observed in 2017 from previous years (2015, 2016 ranged from 327 - 838 specimens) (Figure E-3, Appendix E). Results of BMI sampling are summarized in Table E-4 and Figures E-2 and E-3 (Appendix E), with laboratory analysis results found in Appendix H. Historical analytical BMI sampling results were provided to Stantec by the consultant responsible for the 2012 – 2015 monitoring events, WSP Canada Inc. and have not been verified by Stantec. Ratios of Dipterans to EPTs is presented in Figure E-2 (Appendix E).

Comparisons of BMI data collected in 2017 to previous years, indicate that much is the status quo for all three sites. Results of sites SW7 and SW7A still illustrate environmental impacts, putting it into a condition of degradation, beyond that of reference condition. Historical watercourse quality of the West Tributary (sites SW7 and SW7A) is not known preceding initiation of monitoring in 1998.

4.0 CONCLUSIONS

The following conclusions were developed based on the results of the 2017 sampling program and historical data.

4.1 GROUNDWATER MONITORING

Based on the results of the 2017 groundwater monitoring program, the following conclusions can be made:

- Water level elevations ranged from 7.24 to 9.00 mASL during the July 2017 monitoring event. These elevations are consistent with the range of historical water level elevations.
- Groundwater quality for indicator parameters was below Action Levels at all monitoring locations.
- Groundwater quality and trends were generally consistent with historical monitoring events and results generally fall below applicable guidelines (Tier 1 EQS and Tier 2 PSS).

4.2 SURFACE WATER MONITORING

Based on the results of the 2017 surface water monitoring program, the following conclusions can be made:

- Water quality downstream of the Site in the Cornwallis River appeared consistent with upstream water quality (REF).
- Surface water quality in Palmer Brook (SW7 and more particularly SW7A) appears to show some influence from the Site, with multiple parameters reporting concentrations above natural background levels and applicable guidelines (Tier 1 EQS Fresh Water and CCME FWAL). Re-sampling of these two sites confirmed these results.

4.3 FISH HABITAT MONITORING

Ongoing since 1998 at SW7 and 2004 at SW7A and REF sites, monitoring of the Meadowview Landfill at these sites along the West Tributary (SW7 and SW7A) and Black Brook (REF Site) has occurred with the purpose of monitoring impacts to the aquatic environment by the now closed landfill site. Water quality conditions have generally been acceptable for aquatic life, with small variations of parameters over time.

Abundance and species richness within both fish and benthic macroinvertebrate communities have remained consistently low, and mostly stable, with intermittent and temporary variations.

Invertebrate communities within the West Tributary in 2017 exhibited a minor increase (approximately 1-1.5x) over 2016 in abundance of individual organisms and a decrease (approximately 0.5x) in the number of taxa observed. The REF Site exhibited a large increase (approximately 4x) over 2016 in abundance of individual organisms, while taxon richness remained within expected annual variations. Composition of benthic macroinvertebrate communities at both sites SW7 and SW7A indicate they are in a state of degradation, below that of a natural state. Although percentages decreased (10-20%) from 2016 at both SW7 and SW7A, the high abundance of dipterans sampled is indicative of poor water quality as these taxa prefer conditions of poor fish habitat. Percentages of EPTs sampled from sites SW7 and SW7A (0-2%) was lower compared to those from the REF Site (11%).

In terms of fish abundance, communities in 2017 were similar to those reported from previous years, as they were composed of 2 species (*Gasterosteus sp.* & Banded Killifish). A third species (3+ unidentified

salmonids, likely Brook Trout) was observed during benthic sampling at the REF Site. As previously reported (WSP, 2015), both sites SW7 and SW7A are historically connected to the Cornwallis River, but confirmation of continuity and connectivity between these watercourses has not been established, and as such, could contribute to a decrease in fish species diversity.

Reasonable stability in physical conditions over time has been observed at all three sites. With temporary fluctuations expectedly occurring, it appears as though no sign of further improvement or degradation of aquatic environmental conditions has occurred. Water quality is not the only limiting factor in aquatic productivity, but it should be noted that improvements to water quality alone would likely lead to an increase to results of benthic macroinvertebrates and fish community abundance, diversity, and health.

5.0 RECOMMENDATIONS

The following recommendations were developed based on our observations in the field, and conclusions presented in this report. Discussions with NSE in 2017 indicated that annual monitoring was not under their authority for the Site. As a result, Stantec recommends that the Municipality adjust the ongoing monitoring to focus on areas where potential impacts from the Site have been observed. These recommended changes include;

- Fish Habitat Monitoring should not be carried forward into 2018. As no negative impacts on fish habitat or benthic invertebrates have been correlated to the Site and an adequate Reference site is not in use, Fish Habitat Monitoring should only be resumed if degrading groundwater or surface water trends are noted.
- Surface water monitoring should be conducted at SW7, SW7A, and SW3 in 2018. A new surface water monitoring location should be established immediately upstream of the confluence of Palmer Brook and the Cornwallis River (SWA). This will allow for water quality comparison upstream and downstream of potential site impacts.
- Groundwater monitoring should continue as recommended in the monitoring program review (Stantec Consulting Ltd., 2017 (a)).
- Further alterations to the monitoring program can be made based on data from the 2018 monitoring program.

6.0 CLOSURE

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

All information received from the client or third parties in the preparation of this report has been assumed by Stantec to be correct. Stantec assumes no responsibility for any deficiency or inaccuracy in information received from others.

Conclusions made within this report consist of Stantec's professional opinion as of the time of the writing of this report, and are based solely on the scope of work described in the report, the limited data available and the results of the work. They are not a certification of the property's environmental condition. This report should not be construed as legal advice.

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

The locations of any utilities, buildings and structures, and property boundaries illustrated in or described within this report, if any, including pole lines, conduits, water mains, sewers and other surface or sub-surface utilities and structures are not guaranteed. Before starting work, the exact location of all such utilities and structures should be confirmed and Stantec assumes no liability for damage to them.

This report was prepared by Andrew Sullivan, P.Eng. and Dan Lee with review by Maylia Parker, P.Geo., Marc Skinner, Ph.D., and Don Carey, M. Sc., P.Eng.

Regards,

STANTEC CONSULTING LTD.

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Appendix A
Figure

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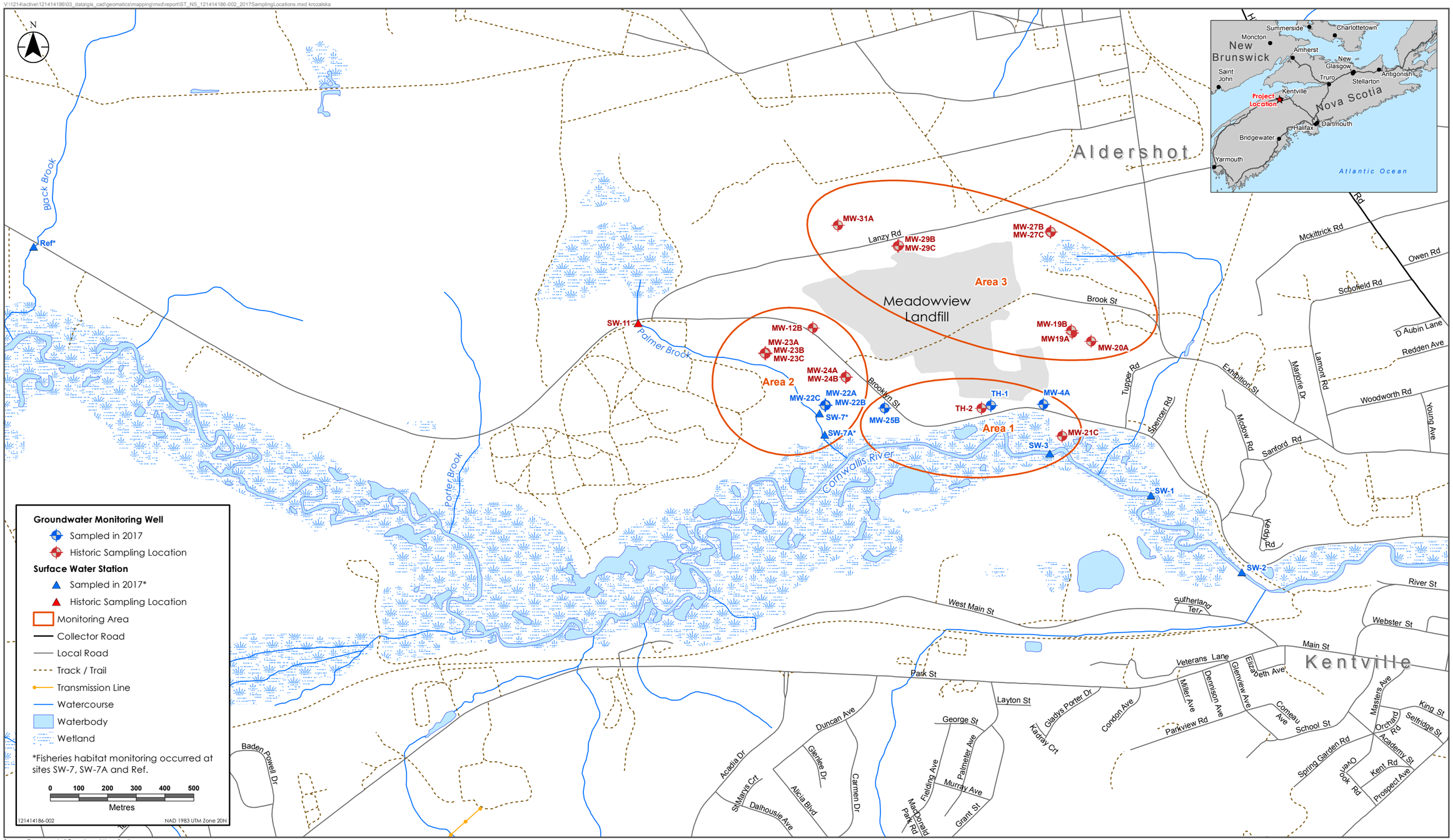

Sources: Government of Canada and Nova Scotia

2017 Sampling Locations

Stantec

ENVIRONMENTAL COMPLIANCE MONITORING – MEADOWVIEW LANDFILL

Figure A-1

Appendix B
Chemistry Tables

Table B-1 Summary of Groundwater Field Measurements
Municipality of Kings County
Meadowview Landfill
Stantec Consulting Ltd. Project No. 121414186

Well ID	Up-gradient or Down-gradient	Well Depth (m)	Top of Casing Elevation* (masl)	Date Sampled	Depth to Water in Well (m)	Water Elevation (masl)	Depth of Water in Well (m)	Volume Purged (L)	pH	Dissolved Oxygen (mg/L)	Temperature (°C)	Conductivity (mS/cm)	Observations
MW-22A	Down-gradient	8.56	11.02	18-Jun-17	2.02	9.00	6.54	40	6.26	2.66	11.74	0.743	Cloudy to clear, good condition
MW-22B	Down-gradient	13.20	11.08	18-Jun-17	2.50	8.58	10.70	100	6.63	0.89	10.79	1.190	Clear, good condition
MW-22C	Down-gradient	24.98	11.05	18-Jun-17	3.78	7.27	21.20	120	7.51	0.34	10.22	0.339	Cloudy to clear, good condition
MW-25B	Down-gradient	13.75	11.46	19-Jun-17	4.22	7.24	9.53	50	7.35	4.29	10.43	84.0	Cloudy, silty, good condition
TH-1	Down-gradient	9.34	13.25	19-Jun-17	5.38	7.87	3.96	25	6.46	1.22	10.31	0.797	Cloudy, good condition
MW-4A	Down-gradient	10.49	11.70	19-Jun-17	4.26	7.44	6.23	12	6.35	3.20	12.43	0.479	Cloudy to clear, DUP (MW-40D) collected

Notes:
*Top of casing elevations taken from Terms of Reference

Table B-2 **2017 General Chemistry Analytical Results for the Groundwater Monitoring Program**
Municipality of Kings County
Meadowview Landfill
Stantec Consulting Ltd. Project No. 121414186

Parameter	Units	RDL	NS Tier 1 EQS	NS Tier 2 PSS	MW-4A	MW-40D (DUP)	MW-22A	MW22A Lab-Dup	MW-22B	MW-22C	MW-25B	TH-1	TH-1 Lab-Dup
Anion Sum	me/L	N/A	-	-	11.3	10.7	9.90	N/A	15.3	4.90	5.28	10.5	N/A
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	1	-	-	520	490	440	N/A	550	180	170	490	N/A
Calculated TDS	mg/L	1	-	-	610	570	590	N/A	830	260	280	580	N/A
Carb. Alkalinity (calc. as CaCO3)	mg/L	1	-	-	<1.0	<1.0	<1.0	N/A	1.3	1.3	<1.0	<1.0	N/A
Cation Sum	me/L	N/A	-	-	11.4	10.3	12.2	N/A	16.2	4.57	5.02	11.0	N/A
Hardness (CaCO3)	mg/L	1	-	-	310	300	250	N/A	610	190	220	270	N/A
Ion Balance (% Difference)	%	N/A	-	-	0.400	1.81	10.2	N/A	2.76	3.48	2.52	2.32	N/A
Langelier Index (@ 20C)	-	N/A	-	-	0.138	0.371	-0.138	N/A	0.914	0.520	0.303	0.454	N/A
Langelier Index (@ 4C)	-	N/A	-	-	-0.110	0.123	-0.386	N/A	0.667	0.270	0.0540	0.207	N/A
Nitrate (N)	mg/L	0.05	-	-	0.76	0.93	<0.050	N/A	0.072	<0.050	0.056	0.063	N/A
Saturation pH (@ 20C)	Units	N/A	-	-	6.79	6.83	6.96	N/A	6.48	7.36	7.32	6.88	N/A
Saturation pH (@ 4C)	Units	N/A	-	-	7.04	7.08	7.21	N/A	6.73	7.61	7.57	7.12	N/A
Total Alkalinity (Total as CaCO3)	mg/L	100	-	-	520 (2)	490 (1)	450	440	550 (2)	180 (2)	170 (2)	490 (2)	N/A
Dissolved Chloride (Cl)	mg/L	1	-	15000	31	27	35	35	150	46	64	26	N/A
Colour	TCU	5	-	-	27	22	63	68	6.8	<5.0	<5.0	<5.0	N/A
Nitrate + Nitrite (N)	mg/L	0.05	-	-	0.78	0.95	<0.050	<0.050	0.072	<0.050	0.056	0.063	N/A
Nitrite (N)	mg/L	0.01	-	-	0.020	0.025	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	N/A
Nitrogen (Ammonia Nitrogen)	mg/L	2.5	-	-	32	32	23	N/A	1.6	<0.050	0.052	33	33
Total Organic Carbon (C)	mg/L	0.5	-	-	30 (1)	27 (2)	17 (1)	N/A	14 (1)	<5.0 (1)	<5.0 (1)	10 (1)	N/A
Orthophosphate (P)	mg/L	0.01	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	N/A
pH	Units	N/A	-	-	6.93	7.20	6.82	N/A	7.39	7.88	7.63	7.33	N/A
Reactive Silica (SiO2)	mg/L	2.5	-	-	28	29	17	17	19	10	11	30	N/A
Dissolved Sulphate (SO4)	mg/L	2			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	N/A
Turbidity	NTU	1	-	-	>1000	>1000	850	N/A	90	54	450	400	N/A
Conductivity	uS/cm	1	-	-	1000	1000	890	N/A	1500	470	510	1000	N/A
Dissolved Calcium	mg/L	0.1	-	-	96	91	75	N/A	200	62	71	83	N/A
Dissolved Magnesium	mg/L	0.1	-	-	18	17	15	N/A	26	9.3	9.9	14	N/A
Phosphorus	mg/L	0.1	-	-	<0.10	<0.10	0.34	N/A	<0.10	<100	<0.10	<0.10	N/A
Potassium	mg/L	0.1	-	-	36	35	23	N/A	8.6	6.6	6.6	32	N/A
Sodium	mg/L	0.1	-	-	33	26	74	N/A	79	12	11	48	N/A

Notes:
(1) Reporting limit was increased due to turbidity
(2) Elevated Reporting limit due to sample matrix
RDL - Reported Detection Limit (updated in 2016)
N/A - Not Applicable
MW-40D = Duplicate of MW-4A
NS Tier 1 EQS = Nova Scotia Tier 1 EQS for groundwater, commercial/industrial, non-potable, coarde grained (NSE 2013a)
NS Tier 2 PSS = Nova Scotia Tier 2 Pathway Specific Standard for groundwater >10 m from fresh surface water (NSE 2013b)

Table B-3 2017 Metals Analytical Results for the Groundwater Monitoring Program
Municipality of Kings County
Meadowview Landfill
Stantec Consulting Ltd. Project No. 121414186

Parameter	Units	RDL	Tier 1 EQS	Tier 2 PSS	MW-4A	MW-40D (DUP)	MW-22A	MW-22B	MW-22C	MW-25B	TH-1
Aluminum	ug/L	5	-	50	6.5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Antimony	ug/L	1	-	200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic	ug/L	1	-	50	47	6.4	**95**	9.5	1.3	1.9	24
Barium	ug/L	10	-	10000	2300	1900	1100	690	8.8	7.6	970
Beryllium	ug/L	1	-	53	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bismuth	ug/L	2	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Boron	ug/L	50	-	12000	330	270	440	490	<50	56	210
Cadmium	ug/L	0.01	-	0.1	0.015	**0.27**	<0.010	0.018	0.019	0.019	<0.010
Calcium	ug/L	100	-	-	96000	91000	75000	200000	62000	71000	83000
Chromium	ug/L	1	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cobalt	ug/L	0.4	-	100	10	11	19	8.4	<0.40	<0.40	4.1
Copper	ug/L	2	-	20	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Iron	ug/L	50	-	3000	**13000**	<50	**49000**	**5100**	230	<50	**13000**
Lead	ug/L	0.5	-	10	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium	ug/L	100	-	-	18000	17000	15000	26000	9300	9900	14000
Manganese	ug/L	2	-	8200	1200	1700	4000	1200	57	11	990
Mercury	ug/L	0.026	-	0.26	-	-	-	-	-	-	-
Molybdenum	ug/L	2	-	730	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel	ug/L	2	-	250	16	22	16	25	<2.0	4.3	4.7
Phosphorus	ug/L	100	-	-	<100	<100	340	<100	<100	<100	<100
Potassium	ug/L	100	-	-	36000	35000	23000	8600	6600	6600	32000
Selenium	ug/L	1	-	10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver	ug/L	0.1	-	1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium	ug/L	100	-	-	33000	26000	74000	79000	12000	11000	48000
Strontium	ug/L	2	-	210000	620	550	420	2000	870	880	380
Thallium	ug/L	0.1	-	8	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin	ug/L	2	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium	ug/L	2	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Uranium	ug/L	0.1	-	3000	<0.10	0.27	<0.10	9.6	34	9.8	<0.10
Vanadium	ug/L	2	-	60	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Zinc	ug/L	5	-	300	11	15	<5.0	<5.0	<5.0	<5.0	<5.0

Notes:
RDL - Reported Detection Limit (updated in 2016)
N/A - Not Applicable
MW-40D = Duplicate of MW-4A
NS Tier 1 EQS = Nova Scotia Tier 1 EQS for groundwater, commercial/industrial, non-potable, coarde grained (NSE 2013a)
NS Tier 2 PSS = Nova Scotia Tier 2 Pathway Specific Standard for groundwater >10 m from fresh surface water (NSE 2013b)
Bold - indicates value exceeds NS PSS

Table B-4

Field Duplicate Analysis for Relative Percent Difference for Ge
for General Chemistry
Municipality of Kings County
Meadowview Landfill
Stantec Consulting Ltd. Project No. 121414186

Parameter	Units	RDL	MW-4A	MW-40D (DUP)	RPD
Anion Sum	me/L	N/A	11.3	10.7	5%
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	1	520	490	6%
Calculated TDS	mg/L	1	610	570	7%
Carb. Alkalinity (calc. as CaCO3)	mg/L	1	<1.0	<1.0	<5xRDL
Cation Sum	me/L	N/A	11.4	10.3	10%
Hardness (CaCO3)	mg/L	1	310	300	3%
Ion Balance (% Difference)	%	N/A	0.400	1.81	128%
Langelier Index (@ 20C)	-	N/A	0.138	0.371	92%
Langelier Index (@ 4C)	-	N/A	-0.110	0.123	3585%
Nitrate (N)	mg/L	0.05	0.76	0.93	20%
Saturation pH (@ 20C)	Units	N/A	6.79	6.83	1%
Saturation pH (@ 4C)	Units	N/A	7.04	7.08	1%
Total Alkalinity (Total as CaCO3)	mg/L	5	520	490	6%
Dissolved Chloride (Cl)	mg/L	1	31	27	14%
Colour	TCU	5	27	22	20%
Nitrate + Nitrite (N)	mg/L	0.05	0.78	0.95	20%
Nitrite (N)	mg/L	0.01	0.020	0.025	22%
Nitrogen (Ammonia Nitrogen)	mg/L	2.5	32	32	0%
Total Organic Carbon (C)	mg/L	0.5	30	27	11%
Orthophosphate (P)	mg/L	0.01	<0.010	<0.010	<5xRDL
pH	Units	N/A	6.93	7.20	4%
Reactive Silica (SiO2)	mg/L	2.5	28	29	4%
Dissolved Sulphate (SO4)	mg/L	2	<2.0	<2.0	<5xRDL
Turbidity	NTU	1	>1000	>1000	<5xRDL
Conductivity	uS/cm	1	1000	1000	0%
Dissolved Calcium	mg/L	0.1	96	91	5%
Dissolved Magnesium	mg/L	0.1	18	17	6%
Phosphorus	mg/L	0.1	<0.10	<0.10	<5xRDL
Potassium	mg/L	0.1	36	35	3%
Sodium	mg/L	0.1	33	26	24%

Notes:
RDL = Reported Detection Limit
RPD = Relative Percent Difference
MW-40D = Duplicate of MW-4A
<5xRDL = Reported when analytical sample results were less than 5 times the RDL.
N/A - Not Applicable
Grey indicates RPD >50%

Table B-5 Field Duplicate analysis for Relative Percent Difference for Metals
Municipality of Kings County
Meadowview Landfill
Stantec Consulting Ltd. Project No. 121414186

Parameter	Units	RDL	MW-4A	MW-40D (DUP)	RPD
Aluminum	ug/L	5	6.5	<5	<5xRDL
Antimony	ug/L	1	<1.0	<1.0	<5xRDL
Arsenic	ug/L	1	47	6.4	152%
Barium	ug/L	10	2300	1900	19%
Beryllium	ug/L	1	<1.0	<1.0	<5xRDL
Bismuth	ug/L	2	<2.0	<2.0	<5xRDL
Boron	ug/L	50	330	270	20%
Cadmium	ug/L	0.01	0.015	0.27	179%
Calcium	ug/L	100	96000	91000	5%
Chromium	ug/L	1	<1.0	<1.0	<5xRDL
Cobalt	ug/L	0.4	10	11	10%
Copper	ug/L	2	<2.0	<2.0	<5xRDL
Iron	ug/L	50	13000	50	198%
Lead	ug/L	0.5	<0.50	<0.50	<5xRDL
Magnesium	ug/L	100	18000	17000	6%
Manganese	ug/L	2	1200	1700	34%
Molybdenum	ug/L	2	<2.0	<2.0	<5xRDL
Nickel	ug/L	2	16	22	32%
Phoshorus	ug/L	100	<100	<100	<5xRDL
Potassium	ug/L	100	36000	35000	3%
Selenium	ug/L	1	<1.0	<1.0	<5xRDL
Silver	ug/L	0.1	<0.10	<0.10	<5xRDL
Sodium	ug/L	100	33000	26000	24%
Strontium	ug/L	2	620	550	12%
Thallium	ug/L	0.1	<0.10	<0.10	<5xRDL
Tin	ug/L	2	<2.0	<2.0	<5xRDL
Titanium	ug/L	2	<2.0	<2.0	<5xRDL
Uranium	ug/L	0.1	<0.10	0.27	<5xRDL
Vanadium	ug/L	2	<2.0	<2.0	<5xRDL
Zinc	ug/L	5	11	15	31%

Notes:
RDL = Reported Detection Limit
RPD = Relative Percent Difference
MW-40D = Duplicate of MW-4A
<5xRDL = Reported when analytical sample results were less than 5 times the RDL.
Grey indicates RPD >5%

Table B-6 Summary of Surface Water Field Measurements
Municipality of Kings County
Meadowview Landfill
Stantec Consulting Ltd. Project No. 121414186

Well ID	Date Sampled	pH	Dissolved Oxygen (mg/L)	Temperature (°C)	Conductivity (mS/cm)	Observations
REF-2	18-Jul-17	8.72	9.23	13.42	0.085	Low Flow
SW 7A	18-Jul-17	6.44	4.57	13.92	0.380	Low Flow
SW 7A	7-Dec-17	11.38	3.45	6.55	0.496	Stagnant Water, maganese sheen, lots of flock iron
SW 7	18-Jul-17	6.79	4.32	13.65	0.177	Low Flow
SW 7	7-Dec-17	10.53	13.50	5.42	0.111	Flowing clear, maganese sheen, lots of organic matter
SW 3	18-Jul-17	7.71	9.43	20.18	0.227	-
SW 2	18-Jul-17	7.64	7.06	20.09	0.232	-
SW 1	18-Jul-17	7.77	7.95	20.16	0.232	-

Table B-7 **2017 Surface Water Monitoring Analytical Results**
Municipality of Kings County
Meadowview Landfill
Stantec Consulting Ltd. Project No. 121414186

Parameter	Unit	RDL	Tier 1 EQS Fresh Water	CCME FWAL	SW1	SW2	SW3	SW3 Lab-Dup	SW7	SW7 Lab-Dup	SW7	SW7A	SW7A	SW7A Lab-Dup	REF
Sampling Date	-	-	-	-	18-Jul-17	18-Jul-17	18-Jul-17	18-Jul-17	18-Jul-17	18-Jul-17	7-Dec-17	18-Jul-17	7-Dec-17	7-Dec-17	18-Jul-17
Dissolved Organic Carbon	mg/L	0.5	-	-	-	280	-	-	-	-		-		N/A	-
pH	-	-	-	6.5-9.0	7.67	7.70	7.64	N/A	7.43	N/A	7.4	7.10	6.95	N/A	7.44
Reactive Silica as SiO2	mg/L	0.5	-	-	6.4	6.6	6.6	N/A	11	N/A	11	12	17	N/A	12
Chloride	mg/L	1	-	120	32	32	32	N/A	21	N/A	18	29	35	N/A	6.3
Fluoride	mg/L	0.1	-	0.12	-	-	-	-	-	-	-	-	-	-	-
Sulphate	mg/L	2	-	-	22	22	21	N/A	3.6	N/A	4.6	2.8	<2.0	N/A	<2.0
Alkalinity	mg/L	5	-	-	65	66	65	N/A	71	N/A	57	150	290	N/A	46
True Color	TCU	5	-	(1)	12	12	13	N/A	30	N/A	17	<5.0	5.3	N/A	53
Turbidity	NTU	0.1	-	(2)	5.3	4.3	26	30	5.2	N/A	1.2	>1000	330	330	1.3
Electrical Conductivity	uS/cm	1	-	-	280	280	270	N/A	200	N/A	170	380	650	N/A	100
Nitrate + Nitrite as N	mg/L	0.05	-	-	2.0	2.0	2.0	N/A	0.15	N/A	0.11	0.28	<0.050	N/A	0.080
Nitrate as N	mg/L	0.05	-	13	0.013	0.012	0.012	N/A	<0.010	N/A	0.11	<0.010	<0.050	N/A	<0.010
Nitrite as N	mg/L	0.01	-	0.06	2.0	2.0	2.0	N/A	0.15	N/A	<0.010	0.28	<0.010	N/A	0.080
Ammonia as N	mg/L	0.03	-	2.22 (3)	0.10	0.10	0.10	N/A	0.75	N/A	0.48	17	15	N/A	0.078
Total Organic Carbon	mg/L	0.5	-	-	2.5	2.7	2.7	N/A	3.2	3.5	2.4	76	20[a]	N/A	6.0
Ortho-Phosphate as P	mg/L	0.01	-	-	0.011	0.014	0.013	N/A	<0.010	N/A	<0.010	<0.010	<0.010	N/A	0.023
Total Sodium	ug/L	100	-	-	16000	15000	15000	N/A	12000	N/A	11000	32000	31000	N/A	5200
Total Potassium	ug/L	100	-	-	2000	1900	1900	N/A	1900	N/A	1700	24000	21000	N/A	670
Total Calcium	ug/L	100	-	-	33000	32000	32000	N/A	21000	N/A	18000	58000	53000	N/A	14000
Total Magnesium	ug/L	100	-	-	3700	3500	3500	N/A	2400	N/A	1800	15000	12000	N/A	1000
Total Phosphorous	ug/L	100	-	(4)	120	<100	<100	N/A	<100	N/A	<100	4300	890	N/A	<100
Bicarb. Alkalinity (as CaCO3)	mg/L	1	-	-	65	66	64	N/A	71	N/A	57	150	290	N/A	46
Carb. Alkalinity (as CaCO3)	mg/L	1	-	-	<1.0	<1.0	<1.0	N/A	<1.0	N/A	<1.0	<1.0	<1.0	N/A	<1.0
Hydroxide	mg/L	5	-	-	-	-	-	-	-	-		-			-
Calculated TDS	mg/L	1	-	-	160	160	160	N/A	120	N/A	100	540	430	N/A	67
Hardness	mg/L	1	-	-	98	95	94	N/A	63	N/A	52	200	180	N/A	40
Langelier Index (@20C)	NA	-	-	-	-0.376	-0.342	-0.424	N/A	-0.742	N/A	-0.941	-0.442	-0.318	N/A	-1.07
Langelier Index (@ 4C)	NA	-	-	-	-0.627	-0.592	-0.674	N/A	-0.993	N/A	-1.19	-0.689	-0.566	N/A	-1.32
Saturation pH (@ 20C)	NA	-	-	-	8.04	8.05	8.06	N/A	8.18	N/A	8.34	7.54	7.27	N/A	8.51
Saturation pH (@ 4C)	NA	-	-	-	8.29	8.30	8.31	N/A	8.43	N/A	8.59	7.79	7.51	N/A	8.76
Anion Sum	me/L	-	-	-	2.81	2.82	2.79	N/A	2.09	N/A	1.75	3.89	6.76	N/A	1.10
Cation sum	me/L	-	-	-	2.72	2.62	2.60	N/A	1.95	N/A	1.59	16.1	9.02	N/A	1.05
% Difference/ Ion Balance (NS)	%	-	-	-	1.63	3.68	3.53	N/A	3.47	N/A	4.79	61.1	14.3	N/A	2.33
Total Aluminum	ug/L	5	5	100 (5)	**190**	**170**	**120**	N/A	**19**	N/A	**10**	**1800**	**210**	N/A	**64**
Total Antimony	ug/L	1	20	-	<1.0	<1.0	<1.0	N/A	<1.0	N/A	<1.0	<1.0	<1.0	N/A	<1.0
Total Arsenic	ug/L	1	5	5	1.5	1.3	1.5	N/A	2.2	N/A	1	**720**	**160**	N/A	1.4
Total Barium	ug/L	1	1000	-	34	32	31	N/A	160	N/A	91	**3000**	**1100**	N/A	25
Total Beryllium	ug/L	1	5.3	-	<1.0	<1.0	<1.0	N/A	<1.0	N/A	<1.0	<1.0	<1.0	N/A	<1.0
Total Bismuth	ug/L	2	-	-	<2.0	<2.0	<2.0	N/A	<2.0	N/A	<2.0	<2.0	<2.0	N/A	<2.0
Total Boron	ug/L	50	1200	1500	<50	<50	<50	N/A	<50	N/A	<50	250	220	N/A	<50
Total Cadmium	ug/L	0.01	0.01	0.09	<0.010	<0.010	<0.010	N/A	<0.010	N/A	<0.010	**0.10**	**0.013**	N/A	<0.010
Total Chromium	ug/L	1	-	8.9	<1.0	<1.0	<1.0	N/A	<1.0	N/A	<1.0	9.7	2.5	N/A	<1.0
Total Cobalt	ug/L	0.4	10	-	<0.40	<0.40	<0.40	N/A	0.48	N/A	<0.40	**35**	**10**	N/A	<0.40
Total Copper	ug/L	2	2	(6)	<2.0	<2.0	<2.0	N/A	<2.0	N/A	<2.0	**6.4**	<2.0	N/A	<2.0
Total Iron	ug/L	50	300	300	**650**	**520**	**560**	N/A	**1600**	N/A	**700**	**250000**	**68000**	N/A	**310**
Total Lead	ug/L	0.5	1	(6)	<0.50	<0.50	<0.50	N/A	<0.50	N/A	<0.50	**5.4**	0.82	N/A	<0.50
Total Manganese	ug/L	2	820	-	120	100	120	N/A	**1800**	N/A	420	**5700**	**3100**	N/A	59
Mercury	ug/L	0.026	0.026	0.026	-	-	-	-	-	-	-	-	-	-	-
Total Molybdenum	ug/L	2	73	73	<2.0	<2.0	<2.0	N/A	<2.0	N/A	<2.0	9.2	<2.0	N/A	<2.0
Total Nickel	ug/L	2	25	(6)	<2.0	<2.0	<2.0	N/A	<2.0	N/A	<2.0	25	6	N/A	<2.0
Total Selenium	ug/L	1	1	1	<1.0	<1.0	<1.0	N/A	<1.0	N/A	<1.0	<1.0	<1.0	N/A	<1.0
Total Silver	ug/L	0.1	0.1	0.25	<0.10	<0.10	<0.10	N/A	<0.10	N/A	<0.10	<0.10	<0.10	N/A	<0.10
Total Strontium	ug/L	2	21000	-	120	120	120	N/A	47	N/A	34	390	310	N/A	34
Total Thallium	ug/L	0.1	0.8	0.8	<0.10	<0.10	<0.10	N/A	<0.10	N/A	<0.10	<0.10	<0.10	N/A	<0.10
Total Tin	ug/L	2	-	-	<2.0	<2.0	<2.0	N/A	<2.0	N/A	<2.0	<2.0	<2.0	N/A	<2.0
Total Titanium	ug/L	2	-	-	4.9	7.4	3.3	N/A	<2.0	N/A	<2.0	39	4.4	N/A	<2.0
Total Uranium	ug/L	0.1	300	15	1.1	1.0	1.0	N/A	<0.10	N/A	<0.10	0.29	<0.10	N/A	<0.10
Total Vanadium	ug/L	2	6	-	<2.0	<2.0	<2.0	N/A	<2.0	N/A	<2.0	**20**	2.4	N/A	<2.0
Total Zinc	ug/L	5	30	30	<5.0	<5.0	<5.0	N/A	<5.0	N/A	<5.0	19	<5.0	N/A	<5.0

Notes:
RDL – Reported Detection Limit
CCME FWAL = Canadian Council of Ministers of the Environment – Freshwater Aquatic Life Long Term Exposure
Tier 1 EQS = Tier 1 Environmental Quality Standards For Surface Water. From Nova Scotia's Contaminated Sites Regulations (July 2013) Notification of Contamination Protocol, Table 3; Fresh Water
Grey indicates exceedance in CCME FWAL
Bold = indicates value exceeds the Tier 1 EQS
#[a]: Reporting limit increased due to turbidity
(1) The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration
(2) High flow or turbid waters: Maximum increase of 8 NTUs from background levels at any one time when background levels are between 8 and 80 NTUs. Should not increase more than 10% of background levels when background is > 80 NTUs.
(3) For ph of 7.5 and temperature of 15.
(4) Refer to CCME Fact Sheet - Phosphorus: Canadian Guidance Framework for the Management of Freshwater Systems
(5) Guideline value dependent on pH. Value given is for pH ≥ 6.5
(6) Guidelines requiring equations were calculated by the CCME website, using water hardness values to determine guidelines

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Appendix C
Historical Chemistry Tables

TABLE C-1

GROUNDWATER GENERAL CHEMISTRY - MW-4A
Municipality of the County of Kings
Meadowview Landfill, Kentville, NS
Stantec Consulting Ltd. Project No. 121414186

Compound	Units	RDL	NS Tier 1 EQS	NS Tier 2 PSS	Sep-93	8-Mar-95	21-Mar-96	21-Mar-96	16-Apr-97	6-Apr-98	5-May-99	5-May-99	26-Jul-00	26-Jul-00 Field Dup.	Aug-01	Sep-02	19-Aug-03	19-Aug-03 MW-40D DUP	25-Aug-04	25-Aug-04 MW-40D	25-Aug-04 MW-40D DUP	18-Aug-05	18-Aug-05 MW-40D
Anion Sum	me/L	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19.8	23.1	22.8	19.2	20.8
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	1	-	-	737	621	452	429	696	681	720	718	685	664	737	679.49	739	799	799	911	911	810	890
Calculated TDS	mg/L	1	-	-	968		545	520	900	835	856	845	862	820	1150	907.36	1100	1170	1030	1190	1200	1080	1110
Carb. Alkalinity (calc. as CaCO3)	mg/L	1	-	-	0.28	0	0.2	0.2	< 1	0.3	0.3	0.3	< 1	< 1	1	0.51	< 1	1	<1	9	9	ND	ND
Cation Sum	me/L	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18.8	22	22.7	22	21.4
Hardness (CaCO3)	mg/L	1	-	-	703	565	389	374	598	508	567	577	597	519	751	538.12	576	602	547	631	663	580	580
Ion Balance (% Difference)	%	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.57	2.42	0.13	6.68	1.52
Langelier Index (@ 20C)	-	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	1.72	1.74	0.329	0.374
Langelier Index (@ 4C)	-	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	1.32	1.34	0.083	0.128
Nitrate (N)	mg/L	0.05	-	-															0.06	<0.05	<0.05	ND	ND
Saturation pH (@ 20C)	Units	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.4	6.28	6.26	6.37	6.33
Saturation pH (@ 4C)	Units	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.8	6.68	6.66	6.62	6.57
Total Alkalinity (Total as CaCO3)	mg/L	100	-	-	737	621	452	429	696	681	720	718	686	664	738	680	740	800	800	920	920	810	890
Dissolved Chloride (Cl)	mg/L	1	-	15000	109	110	31.9	32	99.2	83.1	72.9	72.1	86.8	84.8	222	157	150	160	130	160	150	95	94
Colour	TCU	5	-	-	160	55	130	70	17	20	100	93	11	10	15	98	26	37	18	19	19	34	31
Nitrate + Nitrite (N)	mg/L	0.05	-	-	< 0.05	< 0.05	0.11	0.17	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.06	<0.05	1.66	< 0.05	< 0.05	0.08	<0.05	<0.05	ND	ND
Nitrite (N)	mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02	<0.01	<0.01	ND	ND
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	-	-	13.2	11.2	11.3	10.7	16.8	18.4	10.6	10.3	27.5	26.6	31.4	<0.1	39	39	42	52	49	49	45
Total Organic Carbon (C)	mg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			ND	ND
Orthophosphate (P)	mg/L	0.01	-	-	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.04	<0.3	0.04	0.01	0.06	0.06	<0.01	ND	0.01
pH	Units	N/A	-	-	6.6	6.7	6.6	6.6	7	6.7	6.6	6.7	7	6.8	7.3	6.9	7	7.2	6.9	8	8	6.7	6.7
Reactive Silica (SiO2)	mg/L	2.5	-	-	49	49.5	26.5	27	48	44.4	44.4	44.8	38.4	37.5	41.1	44.1	37	36	35	36	36	38	37
Dissolved Sulphate (SO4)	mg/L	2	-	-	< 2	< 2	< 2	2	< 2	< 2	< 2	< 2	3	2	8	4.3	10	15	7	8	8	16	16
Turbidity	NTU	1	-	-	300	> 1000	3.2	3.9	1.6	3	20.9	18.8	0.4	0.4	>1000	>1000	755	322	55.1	>1000	>1000	>1000	>1000
Conductivity	uS/cm	1	-	-	1820	1680	968	963	1570	1580	1620	1580	1740	1650	2420	1630	1540	2260	2150	2350	2390	1800	1900
Dissolved Organic Carbon	mg/L	0.5	-	-	24	22.2	7.5	7.5	19	15.8	1600	1570	17.1	17.6	19.1	-	-	-	<50	<500	<500	-	-
Dissolved Calcium	mg/L	0.1	-	-	210	173	128	120	179	158	179	176	191	164	227	169	182	191	170	196	207	190	190
Dissolved Magnesium	mg/L	0.1	-	-	43.4	32.3	16.9	18	36.8	25.9	34.1	33.5	29.2	26.6	44.8	28.2	29.5	30.4	29.8	34.4	35.5	25	26
Phosphorus	mg/L	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	ND	ND
Potassium	mg/L	0.1	-	-	8.8	7.9	14	11.8	11.9	9.6	7.9	7.6	19.9	26.2	14.7	18.3	15.7	17	17.7	17.5	18.3	17	17
Sodium	mg/L	0.1	-	-	87.8	83.2	39.7	37.6	83.6	78.4	70	64.4	46.1	45.7	107	76.8	181	192	102	120	127	140	140

Notes:

(1) Reporting limit was increased due to turbidity.

RDL - Reported Detection Limit (updated in 2016)

ND - Values below RDL

Bold indicates exceedance of NS Tier 1 EQS

Bold and shaded indicates exceedance of NS Tier 2 EQS

MW-40D = Duplicate of MW-4A

Action Level = average between 2007 and 2016 (excluding duplicates) plus three standard deviations

NS Tier 1 EQS = Nova Scotia Tier 1 EQS for groundwater, commercial/industrial, non-potable, coarde grained (NSE 2013a)

NS Tier 2 PSS = Nova Scotia Tier 2 Pathway Specific Standard for groundwater >10 m from fresh surface water (NSE 2013b)

TABLE C-1

GROUNDWATER GENERAL CHEMISTRY - MW-4A
Municipality of the County of Kings
Meadowview Landfill, Kentville, NS
Stantec Consulting Ltd. Project No. 121414186

Compound	Units	RDL	NS Tier 1 EQS	NS Tier 2 PSS	23-Nov-06	1-Aug-07	1-Aug-07 MW-4ALF	28-Jul-08	28-Jul-08 Dup-A	10-Aug-09	27-Jul-10	27-Jul-10 MW- 40D	21-Sep-11	4-Oct-12	4-Jul-13	4-Jul-13 MW-40D	19-Aug-14	19-Aug-14 MW-40D	21-Jul-15	21-Jul-15 MW-40D	14-Jul-16	19-Jul-17	19-Jul-17 MW-40DDUP
Anion Sum	me/L	N/A	-	-	18.6	19.4	16.2	15.8	17.9	19.7	17.4	17.8	16	16.0	17.0	17.1	15.6	15.3	15.8	15.8	14.1	11.3	10.7
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	1	-	-	753	812	649	670	770	856	765	782	722	753	751	751	712	708	703	706	650	520	490
Calculated TDS	mg/L	1	-	-	1060	1110	1030	943	1020	1050	885	892	865	902	898	897	875	868	920	911	780	610	570
Carb. Alkalinity (calc. as CaCO3)	mg/L	1	-	-	1	<1	<1	<1	<1	<1	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<1.0	<1.0	<1.0
Cation Sum	me/L	N/A	-	-	22.2	23.5	24.1	20.6	21.1	19.9	17.3	17.1	18.3	20.8	18.3	18.2	19	19.3	21.2	20.7	15.6	11.4	10.3
Hardness (CaCO3)	mg/L	1	-	-	610	670	680	540	540	570	425	421	442	493	467	464	407	420	555	536	350	310	300
Ion Balance (% Difference)	%	N/A	-	-	8.76	9.7	19.8	13.3	8.11	0.280	0.3	1.9	1.9	13.0	3.7	3.3	9.9	11.6	14.6	13.3	5.360	0.4	1.81
Langelier Index (@ 20C)	-	N/A	-	-	0.751	0.638	0.575	0.443	0.624	0.459	0.51	0.42	0.5	0.52	0.42	0.56	0.49	0.5	0.18	0.25	0.508	0.138	0.371
Langelier Index (@ 4C)	-	N/A	-	-	0.506	0.393	0.329	0.197	0.378	0.213	0.19	0.1	0.18	0.20	0.10	0.24	0.17	0.18	-0.14	-0.07	0.262	-0.11	0.123
Nitrate (N)	mg/L	0.05	-	-	ND	-	-	0.05	0.05	0.07	0.09	0.11	0.38	0.32	0.48	0.47	<0.05	<0.05	0.08	0.1	<0.050	0.76	0.93
Saturation pH (@ 20C)	Units	N/A	-	-	6.41	6.34	6.42	6.50	6.45	6.40	6.69	6.68	6.7	6.68	6.66	6.66	6.75	6.73	6.64	6.65	6.70	6.79	6.83
Saturation pH (@ 4C)	Units	N/A	-	-	6.65	6.59	6.66	6.74	6.69	6.65	7.01	7	7.02	7.00	6.98	6.98	7.07	7.05	6.96	6.97	6.95	7.04	7.08
Total Alkalinity (Total as CaCO3)	mg/L	100	-	-	750	810	650	670	770	860	765	782	722	753	751	751	712	708	703	706	650	520 (2)	490 (1)
Dissolved Chloride (Cl)	mg/L	1	-	15000	120	110	110	84	88	92	71	72	54	33	68	69	49	40	59	58	38	31	27
Colour	TCU	5	-	-	25	23	21	17	19	21	11	14	17	18	17	18	6	12	10	18	11	27	22
Nitrate + Nitrite (N)	mg/L	0.05	-	-	ND	<0.05	<0.05	0.05	0.05	0.07	0.09	0.11	0.38	0.32	0.48	0.47	<0.05	<0.05	0.08	0.1	<0.050	0.78	0.95
Nitrite (N)	mg/L	0.01	-	-	ND	-	-	<0.01	<0.01	ND	<0.05	<0.05	<0.05	<0.25	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.010	0.02	0.025
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	-	-	46	46	46	49	47	38	60.4	65	63.2	85.9	59.0	58.6	76.3	76.4	64.2	63.8	74	32	32
Total Organic Carbon (C)	mg/L	0.5	-	-	22	22	19	26	27	21 (1)	23.7	83.7	30	<0.5	80.1	72.8	23.9	19.6	<0.5	<0.5	19 (1)	30 (1)	27 (2)
Orthophosphate (P)	mg/L	0.01	-	-	0.01	<0.01	0.01	0.01	0.01	0.01	0.02	0.03	0.02	0.02	0.01	0.02	0.02	0.02	<0.01	<0.01	0.034	<0.010	<0.010
pH	Units	N/A	-	-	7.16	6.98	6.99	6.94	7.07	6.86	7.2	7.1	7.1	7.2	7.1	7.2	7.24	7.23	6.82	6.9	7.21	6.93	7.2
Reactive Silica (SiO2)	mg/L	2.5	-	-	38	40	40	37	37	37	36.1	34.1	34.1	35.5	38.9	37.7	34.6	33.7	36	35.2	35	28	29
Dissolved Sulphate (SO4)	mg/L	2	-	-	6	4	3	<2	<2	ND	5	5	2	<10	3	3	<2	<2	2	2	<2.0	<2.0	<2.0
Turbidity	NTU	1	-	-	350	290	210	>1000	>1000	480	176	3930	3200	640	5610	5150	869	1150	3730	5750	>1000	>1000	>1000
Conductivity	uS/cm	1	-	-	2100	2000	2000	1900	1900	1900	1760	1950	1480	1550	1640	1650	1640	1620	1610	1550	1400	1000	1000
Dissolved Organic Carbon	mg/L	0.5	-	-	-	-	-	-	-	-	8.9	54.2	54.2	<0.5	10.4	<0.5	23.9	18	<0.5	<0.5	-		
Dissolved Calcium	mg/L	0.1	-	-	190	210	210	170	170	170	127	129	132	135	140	139	121	125	158	152	100	96	91
Dissolved Magnesium	mg/L	0.1	-	-	34	36	36	31	31	36	26.1	23.9	27.2	37.9	28.4	28.3	25.4	26.2	39	38.1	23	18	17
Phosphorus	mg/L	0.1	-	-	ND	-	-	0.2	0.1	0.1	0.1	<0.1	<0.1	<0.02	0.06	0.06	0.18	0.22	<0.02	<0.02	0.12	<0.10	<0.10
Potassium	mg/L	0.1	-	-	26	23	22	37	43	45	30.5	29	41.9	52.2	40.8	40.8	61.7	62.9	63	63	50	36	35
Sodium	mg/L	0.1	-	-	140	130	140	110	120	93	73.1	63.7	75	79.4	70.7	70.7	75.9	75.7	67	66.3	33	33	26

Notes:

(1) Reporting limit was increased due to turbidity.

RDL - Reported Detection Limit (updated in 2016)

ND - Values below RDL

Bold indicates exceedance of NS Tier 1 EQS

Bold and shaded indicates exceedance of NS Tier 2 EQS

MW-40D = Duplicate of MW-4A

Action Level = average between 2007 and 2016 (excluding duplicates) plus three standard deviations

NS Tier 1 EQS = Nova Scotia Tier 1 EQS for groundwater, commercial/industrial, non-potable, coarde grained (NSE 2013a)

NS Tier 2 PSS = Nova Scotia Tier 2 Pathway Specific Standard for groundwater >10 m from fresh surface water (NSE 2013b)

TABLE C-1

GROUNDWATER GENERAL CHEMISTRY - MW-4A
Municipality of the County of Kings
Meadowview Landfill, Kentville, NS
Stantec Consulting Ltd. Project No. 121414186

Compound	Units	RDL	NS Tier 1 EQS	NS Tier 2 PSS	Average 2007 through 2017	Action Level
Anion Sum	me/L	N/A	-	-	-	-
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	1	-	-	-	-
Calculated TDS	mg/L	1	-	-	-	-
Carb. Alkalinity (calc. as CaCO3)	mg/L	1	-	-	-	-
Cation Sum	me/L	N/A	-	-	-	-
Hardness (CaCO3)	mg/L	1	-	-	-	-
Ion Balance (% Difference)	%	N/A	-	-	-	-
Langelier Index (@ 20C)	-	N/A	-	-	-	-
Langelier Index (@ 4C)	-	N/A	-	-	-	-
Nitrate (N)	mg/L	0.05	-	-	-	-
Saturation pH (@ 20C)	Units	N/A	-	-	-	-
Saturation pH (@ 4C)	Units	N/A	-	-	-	-
Total Alkalinity (Total as CaCO3)	mg/L	100	-	-	-	-
Dissolved Chloride (Cl)	mg/L	1	-	15000	63	139
Colour	TCU	5	-	-	-	-
Nitrate + Nitrite (N)	mg/L	0.05	-	-	-	-
Nitrite (N)	mg/L	0.01	-	-	-	-
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	-	-	59	109
Total Organic Carbon (C)	mg/L	0.5	-	-	-	-
Orthophosphate (P)	mg/L	0.01	-	-	-	-
pH	Units	N/A	-	-	-	-
Reactive Silica (SiO2)	mg/L	2.5	-	-	-	-
Dissolved Sulphate (SO4)	mg/L	2	-	-	-	-
Turbidity	NTU	1	-	-	-	-
Conductivity	uS/cm	1	-	-	1625	2463
Dissolved Organic Carbon	mg/L	0.5	-	-	-	-
Dissolved Calcium	mg/L	0.1	-	-	-	-
Dissolved Magnesium	mg/L	0.1	-	-	-	-
Phosphorus	mg/L	0.1	-	-	-	-
Potassium	mg/L	0.1	-	-	-	-
Sodium	mg/L	0.1	-	-	-	-

Notes:
(1) Reporting limit was increased due to turbidity.
RDL - Reported Detection Limit (updated in 2016)
ND - Values below RDL
Bold indicates exceedance of NS Tier 1 EQS
Bold and shaded indicates exceedance of NS Tier 2 EQS
MW-40D = Duplicate of MW-4A
Action Level = average between 2007 and 2016 (excluding duplicates) plus three standard deviations
NS Tier 1 EQS = Nova Scotia Tier 1 EQS for groundwater, commercial/industrial, non-potable, coarde grained (NSE 2013a)
NS Tier 2 PSS = Nova Scotia Tier 2 Pathway Specific Standard for groundwater >10 m from fresh surface water (NSE 2013b)

TABLE C-2 **GROUNDWATER GENERAL CHEMISTRY - MW-22A**
Municipality of the County of Kings
Meadowview Landfill, Kentville, NS
Stantec Consulting Ltd. Project No. 121414186

Compound	Units	RDL	NS Tier 1 EQS	NS Tier 2 PSS	Sep-93	8-Mar-95	20-Mar-96	16-Apr-97	6-Apr-98	5-May-99	26-Jul-00	26-Jul-00 Lab Dup.	Aug-01	Sept-02	19-Aug-03	25-Aug-04	18-Aug-05	18-Aug-05 MW-22A Dup	23-Nov-06	16-Aug-07	28-Jul-08	10-Aug-09	27-Jul-10	21-Sep-11	4-Oct-12	5-Jul-13	19-Aug-14	22-Jul-15	14-Jul-16	18-Jul-17	18-Jul-17 Lab-Dup	Average 2007 through 2017	Action Level
Anion Sum	me/L	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	22.8	15.7	-	15	13	10.3	10.4	7.79	9.13	347	9.46	6.95	8.43	4.53	9.9	-	-	-
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	1	-	-	309	1080	1020	1010	1030	1130	1020	1020	1170	931.24	99	879	689	-	597	524	460	450	72	395	347	411	328	379	170	440	-	-	-
Calculated TDS	mg/L	1	-	-	495	-	1590	1610	1570	1620	1550	1560	1540	1215.26	133	1110	836	-	834	774	611	574	413	501	416	527	409	516	240	590	-	-	-
Carb. Alkalinity (calc. as CaCO3)	mg/L	1	-	-	0.07	0	0.6	< 1	0.8	2.7	< 1	2	3	1.75	< 1	<1	ND	-	ND	<1	<1	<1	<10	<10	<10	<10	<10	<10	1.4	<1.0	-	-	-
Cation Sum	me/L	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	18.8	16	-	16.3	16.3	12.8	10.7	5.57	9.86	8.85	10.80	9.1	11.3	4.46	12.2	-	-	-
Hardness (CaCO3)	mg/L	1	-	-	325	858	879	762	712	666	611	617	516	397.23	93.8	467	380	-	360	360	270	250	71.7	223	282	244	212	256	190	250	-	-	-
Ion Balance (% Difference)	%	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	9.71	0.883	-	3.93	11.4	10.6	1.51	16.6	3.8	7.6	6.5	13.4	14.6	0.78	10.2	-	-	-
Langelier Index (@ 20C)	-	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	0.38	-0.141	-	-0.101	0.19	-0.0290	-0.165	-1.61	-0.19	-0.22	-0.38	-0.37	-0.63	0.554	-0.138	-	-	-
Langelier Index (@ 4C)	-	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	-0.02	-0.388	-	-0.348	-0.057	-0.276	-0.413	-1.93	-0.51	-0.54	-0.70	-0.69	-0.95	0.304	-0.386	-	-	-
Nitrate (N)	mg/L	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.05	ND	-	ND	-	<0.05	<0.05	9.48	0.18	0.20	<0.05	<0.05	<0.05	<0.050	<0.050	-	-	-
Saturation pH (@ 20C)	Units	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	6.52	6.68	-	6.76	6.8	6.96	6.97	8.51	7.19	7.22	7.18	7.33	7.13	7.39	6.96	-	-	-
Saturation pH (@ 4C)	Units	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	6.92	6.93	-	7.01	7.05	7.21	7.21	8.83	7.51	7.54	7.50	7.65	7.45	7.64	7.21	-	-	-
Total Alkalinity (Total as CaCO3)	mg/L	100	-	-	309	1080	1020	1010	1030	1130	1020	1020	1170	933	100	880	690	710	600	520	460	450	72	395	-	411	328	379	170	450	440	-	-
Dissolved Chloride (Cl)	mg/L	1	-	15000	99.3	330	312	350	309	311	273	278	223	176	13	180	68	68	110	89	39	50	193	43	23	44	14	30	40	35	35	55	204
Colour	TCU	5	-	-	45	32	140	34	45	28	31	32	26	334	< 5	44	35	30	16	11	9	10	<5	132	<5	7	64	10	<5.0	63	68	-	-
Nitrate + Nitrite (N)	mg/L	0.05	-	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.05	<0.06	< 0.05	<0.05	ND	-	ND	<0.05	<0.05	<0.05	9.48	0.18	0.20	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	-	-
Nitrite (N)	mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	0.04	ND	ND	ND	-	<0.01	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.010	<0.010	<0.010	-	-
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	-	-	4.4	32	34.5	39	60	69.5	69.5	71.4	72	<0.1	< 0.05	58	42	-	31	31	27	19	6.02	22.3	-	19.4	20.4	12	<0.050	23	-	16	48
Total Organic Carbon (C)	mg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	12	-	-	15	11	10	8	4.7	18.6	3.0	38.7	10	<0.5	1.6	17 (1)	-	-	-
Orthophosphate (P)	mg/L	0.01	-	-	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.07	0.01	<0.01	<0.3	< 0.01	<0.01	ND	ND	ND	<0.01	<0.01	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	<0.01	0.013	<0.010	<0.010	-	-
pH	Units	N/A	-	-	6.4	6.6	6.8	7	6.9	7.4	7	7.2	7.4	7.3	7.9	6.9	6.54	-	6.66	6.99	6.93	6.8	6.9	7	7.0	6.8	6.96	6.5	7.94	6.82	-	-	-
Reactive Silica (SiO2)	mg/L	2.5	-	-	14.2	23	24	21	19.5	20.3	18	18	17.6	20.5	8.5	19	21	20	21	19	20	19	12.1	17.2	18.6	18.4	18.1	16.8	10	17	17	-	-
Dissolved Sulphate (SO4)	mg/L	2	-	-	4	< 2	< 2	3	< 2	< 2	5	7	2	3.5	< 2	7	ND	ND	ND	<2	<2	<2	11	<2	<2	<2	<2	<2	<2.0	<2.0	<2.0	-	-
Turbidity	NTU	1	-	-	342	671	66	6.3	6.4	3.1	4	4.8	>1000	96	0.6	666	490	-	400	500	400	450	469	256	272	385	233	4780	0.87	850	-	-	-
Conductivity	uS/cm	1	-	-	971	2860	2840	3130	3180	3510	3140	3190	3260	2180	235	2000	1400	-	1500	1300	1000	990	887	852	707	920	740	854	440	890	-	871	1506
Dissolved Organic Carbon	mg/L	0.5	-	-	36.3	44.5	35.1	38.5	34	3270	41.5	41	31.1	49	-	294	-	-	-	-	-	-	2.3	12.6	<0.5	13.2	<0.5	<0.5	-	-	-	-	-
Dissolved Calcium	mg/L	0.1	-	-	105	229	230	201	179	163	156	158	127	104	30.3	117	100	100	98	99	74	73	19.3	73.4	77.2	73.4	62.8	89.3	61	75	-	-	-
Magnesium	mg/L	0.1	-	-	15.2	69.6	74	63.2	64.3	63	53.8	54	48.7	33.4	4.4	42.5	30	30	28	28	20	17	5.7	9.6	21.6	14.7	13.4	7.9	9.2	15	-	-	-
Phosphorus	mg/L	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	ND	ND	ND	-	0.2	0.2	<0.1	<0.01	<0.02	0.18	0.31	<0.02	<0.1	0.34	-	-	-
Potassium	mg/L	0.1	-	-	5.9	23.9	34.1	38.2	50.7	68.6	69	70.3	72.8	51	4.9	52.3	43	43	42	37	36	30	14.5	25.3	25.6	21.9	25.6	22.1	6.3	23	-	-	-
Sodium	mg/L	0.1	-	-	59.9	208	252	276	254	225	270	267	258	267	9.4	91.2	83	82	120	96	78	50	76.2	22.4	52.7	41.4	30.3	41.9	12	74	-	-	-

Notes:
RDL - Reported Detection Limit (updated in 2016)
ND - Values below RDL
Bold indicates exceedance of NS Tier 1 EQS
Bold and shaded indicates exceedance of NS Tier 2 EQS
Action Level = average between 2007 and 2016 (excluding duplicates) plus three standard deviations
NS Tier 1 EQS = Nova Scotia Tier 1 EQS for groundwater, commercial/industrial, non-potable, coarde grained (NSE 2013a)
NS Tier 2 PSS = Nova Scotia Tier 2 Pathway Specific Standard for groundwater >10 m from fresh surface water (NSE 2013b)

TABLE C-3 **GROUNDWATER GENERAL CHEMISTRY - MW-22B**
Municipality of the County of Kings
Meadowview Landfill, Kentville, NS
Stantec Consulting Ltd. Project No. 121414186

Compound	Units	RDL	NS Tier 1 EQS	NS Tier 2 PSS	Sep-93	20-Dec-94	8-Mar-95	20-Mar-96	16-Apr-97	6-Apr-98	5-May-99	26-Jul-00	Aug-01	Sept-02	19-Aug-03	25-Aug-04	18-Aug-05	23-Nov-06	16-Aug-07	28-Jul-08	10-Aug-09	27-Jul-10	21-Sep-11	4-Oct-12	5-Jul-13	19-Aug-14	22-Jul-15	14-Jul-16	18-Jul-17	Average 2007 through 2017	Action Level
Anion Sum	me/L	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	23.2	22.8	10.2	14.6	14.5	16.5	20	19	19.8	18.9	15.7	16.9	17.9	15.3	-	-
Bicarb. Alkalinity (calc. as CaC	mg/L	1	-	-	683	703	856	725	762	596	445	710	683	780.66	399	789	797	444	404	428	519	704	693	710	691	632	612	690	550	-	-
Calculated TDS	mg/L	1	-	-	1010	-	-	982	1090	972	831	1180	1110	1109.66	987	1190	1210	549	982	929	954	1070	1020	1050	982	887	939	930	830	-	-
Carb. Alkalinity (calc. as CaCO	mg/L	1	-	-	0.51	1	1	2.7	3.6	0.9	1.1	1	2	2.32	1	<1	ND	ND	<1	<1	<1	<10	<10	<10	<10	<10	<10	<10	1.3	1.3	-	-
Cation Sum	me/L	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	21.8	23.6	10.2	24.5	21.9	20.2	22.1	21	21.5	19.2	19.8	19.9	17.6	16.2	-	-
Hardness (CaCO3)	mg/L	1	-	-	624	726	865	793	882	812	661	968	845	684.38	892	856	940	260	950	830	780	842	812	827	724	762	746	690	610	-	-
Ion Balance (% Difference)	%	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	2.97	1.68	0.148	25.3	20.2	10.1	4.8	5	4.0	0.9	11.5	8.2	0.76	2.76	-	-
Langelier Index (@ 20C)	-	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	0.92	0.796	-0.252	0.913	0.786	0.713	0.9	0.99	1.19	0.84	1.04	0.52	0.965	0.914	-	-
Langelier Index (@ 4C)	-	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	0.52	0.551	-0.5	0.667	0.540	0.467	0.58	0.67	0.87	0.52	0.72	0.2	0.719	0.667	-	-
Nitrate (N)	mg/L	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.05	0.05	1.5	-	<0.05	0.08	0.14	0.08	0.33	0.59	<0.05	<0.05	0.12	0.072	-	-
Saturation pH (@ 20C)	Units	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	6.18	6.14	6.97	6.44	6.46	6.41	6.4	6.41	6.41	6.46	6.47	6.47	6.34	6.48	-	-
Saturation pH (@ 4C)	Units	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	6.58	6.39	7.22	6.68	6.71	6.65	6.72	6.73	6.73	6.78	6.79	6.79	6.58	6.73	-	-
Total Alkalinity (Total as CaCO	mg/L	100	-	-	684	704	857	728	766	597	446	711	685	783	400	790	800 (1)	440	400	430	520	704	693	710	691	632	612	690	550 (2)	-	-
Dissolved Chloride (Cl)	mg/L	1	-	15000	166	143	162	152	215	224	231	282	287	287	280	260	240	42	230	210	220	210	182	199	178	110	165	150	150	182	291
Colour	TCU	5	-	-	13	86	12	15	8	15	10	11	19	90	43	13	22	7	16	10	13	15	14	9	11	10	<5	13	6.8	-	-
Nitrate + Nitrite (N)	mg/L	0.05	-	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.05	<0.06	< 0.05	<0.05	0.07	1.5	<0.05	<0.05	0.080	0.14	0.08	0.33	0.59	<0.05	<0.05	0.12	0.072	-	-
Nitrite (N)	mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.01	0.02	0.03	-	<0.01	<0.01	<0.05	<0.05	<0.25	<0.05	<0.05	<0.05	<0.010	<0.010	-	-
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	-	-	4.1	0.48	0.08	0.17	< 0.05	0.15	< 0.05	0.37	<0.05	<0.1	0.18	0.62	0.06	27	0.28	0.38	0.24	1.1	1.34	1.95	2.25	1.56	1.82	1.2	1.6	1.2	3.3
Total Organic Carbon (C)	mg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	23	9.3	20	17	19	38	24.6	<0.5	32.6	23.2	9.2	1.3	14 (1)	-	-
Orthophosphate (P)	mg/L	0.01	-	-	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	<0.01	<0.3	< 0.01	0.01	ND	ND	<0.01	<0.01	<0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01	0.019	<0.010	-	-
pH	Units	N/A	-	-	6.9	7	7.1	7.6	7.7	7.2	7.4	7.3	7.5	7.5	7.5	7.1	6.94	6.72	7.35	7.25	7.12	7.3	7.4	7.6	7.3	7.51	6.99	7.3	7.39	-	-
Reactive Silica (SiO2)	mg/L	2.5	-	-	13.6	13.6	15.5	17.1	17.1	16.2	15	16.2	14.8	17.1	12	17	18	19	17	18	18	18.5	20.3	18.6	18.9	17.8	15.9	19	19	-	-
Dissolved Sulphate (SO4)	mg/L	2	-	-	14	< 2	< 2	< 2	< 2	< 2	< 2	2	3	<2.0	11	<2	ND	ND	<2	<2	<2	<2	<2	<10	<2	<2	<2	<2.0	<2.0	-	-
Turbidity	NTU	1	-	-	459	< 1000	420	14.7	0.4	2.4	1.7	0.3	>1000	26	> 1000	>1000	180	390	190	180	330	265	147	69.6	138.0	4170	589	120	90	-	-
Conductivity	uS/cm	1	-	-	1810	1770	2190	1810	1900	2050	1840	2520	2450	2150	2500	2490	1900	1100	1800	1900	1800	2070	1680	1720	1740	1670	1440	1600	1500	1720	2251
Dissolved Organic Carbon	mg/L	0.5	-	-	106	99	250	12.1	18.4	14.7	1710	24.4	16.4	28.3	-	<500	-	-	-	-	-	37.6	27	<0.5	<0.5	23.4	9.2	-	-	-	-
Dissolved Calcium	mg/L	0.1	-	-	207	242	291	262	293	270	209	316	270	219	298	286	320	72	320	280	260	280	274	270	245	259	270	230	200	-	-
Magnesium	mg/L	0.1	-	-	26	29.5	33.7	33.1	36.5	33.4	33.7	43.4	41.5	33.4	36	34.4	36	18	37	33	31	34.7	31.1	37.2	27.3	28.1	17.5	27	26	-	-
Phosphorus	mg/L	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	ND	ND	-	<0.1	<0.1	<0.1	<0.1	<0.02	<0.02	<0.02	<0.02	<0.1	<0.10	-	-
Potassium	mg/L	0.1	-	-	14.1	7.5	7.5	7.7	8	7.4	8.5	9.4	8.4	8.3	11.4	8.3	8	35	8.7	14	8.2	5.6	5.6	6.1	8.4	9.4	4.9	8.1	8.6	-	-
Sodium	mg/L	0.1	-	-	152	90.1	76.8	71.1	59.7	60.2	64.4	80.8	69.8	73	98.5	103	100	46	110	100	92	98.1	89.7	103	84.8	84.7	93.1	78	79	-	-

Notes:
RDL - Reported Detection Limit (updated in 2016)
ND - Values below RDL
Bold indicates exceedance of NS Tier 1 EQS
Bold and shaded indicates exceedance of NS Tier 2 EQS
Action Level = average between 2007 and 2016 (excluding duplicates) plus three standard deviations
NS Tier 1 EQS = Nova Scotia Tier 1 EQS for groundwater, commercial/industrial, non-potable, coarde grained (NSE 2013a)
NS Tier 2 PSS = Nova Scotia Tier 2 Pathway Specific Standard for groundwater >10 m from fresh surface water (NSE 2013b)

TABLE C-4 **GROUNDWATER GENERAL CHEMISTRY - MW-22C**
Municipality of the County of Kings
Meadowview Landfill, Kentville, NS
Stantec Consulting Ltd. Project No. 121414186

Compound	Units	RDL	NS Tier 1 EQS	NS Tier 2 PSS	Sep-93	8-Mar-95	20-Mar-96	16-Apr-97	6-Apr-98	5-May-99	26-Jul-00	Aug-01	Sept-02	19-Aug-03	25-Aug-04	18-Aug-05	23-Nov-06	16-Aug-07	28-Jul-08	10-Aug-09	27-Jul-10	21-Sep-11	4-Oct-12	5-Jul-13	19-Aug-14	22-Jul-15	14-Jul-16	18-Jul-17	Average 2007 through 2017	Action Level
Anion Sum	me/L	N/A	-	-	-	-	-	-	-	-	-	-	-	-	2.28	2.4	2.82	3.09	3.49	3.56	3.46	3.26	3.87	3.94	3.41	3.68	7.69	4.9	-	-
Bicarb. Alkalinity (calc. as CaC	mg/L	1	-	-	41.6	42	43.5	67.7	75.4	87.4	117	97	101.99	819	95	99.4	112	123	137	137	133	126	147	145	131	133	350	180	-	-
Calculated TDS	mg/L	1	-	-	60	-	58	91	102	117	148	128	131.53	1110	128	137	158	175	195	193	173	176	199	207	193	202	450	260	-	-
Carb. Alkalinity (calc. as CaCO	mg/L	1	-	-	0.31	0	0.4	< 1	0.6	0.5	< 1	<1	0.96	< 1	<1	ND	ND	<1	1	<1	<10	<10	<10	<10	<10	<10	<10	<1.0	1.3	-	-
Cation Sum	me/L	N/A	-	-	-	-	-	-	-	-	-	-	-	-	2.36	2.65	3.03	3.42	3.78	3.62	3.24	3.74	3.90	4.12	4.34	4.35	8.89	4.57	-	-
Hardness (CaCO3)	mg/L	1	-	-	29	32	42	59.4	69	82	113	86.3	88.59	506	89.5	100	120	130	150	150	134	162	162	163	183	190	190	190	-	-
Ion Balance (% Difference)	%	N/A	-	-	-	-	-	-	-	-	-	-	-	-	1.55	4.92	3.71	5.07	3.99	0.84	3.2	6.9	0.4	2.2	12	8.4	7.24	3.48	-	-
Langelier Index (@ 20C)	-	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-0.41	-0.306	-0.102	0.19	0.417	0.047	0.15	0.33	0.17	0.25	0.35	0.03	-0.139	0.52	-	-
Langelier Index (@ 4C)	-	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-0.81	-0.557	-0.352	-0.06	0.167	-0.203	-0.17	0.01	-0.15	-0.07	0.03	-0.29	-0.388	0.27	-	-
Nitrate (N)	mg/L	0.05	-	-	-	-	-	-	-	-	-	-	-	-	<0.05	ND	ND	-	<0.05	<0.05	0.09	0.07	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	-	-
Saturation pH (@ 20C)	Units	N/A	-	-	-	-	-	-	-	-	-	-	-	-	8.01	7.83	7.73	7.68	7.58	7.57	7.85	7.77	7.73	7.74	7.73	7.68	7.13	7.36	-	-
Saturation pH (@ 4C)	Units	N/A	-	-	-	-	-	-	-	-	-	-	-	-	8.41	8.08	7.98	7.93	7.83	7.82	8.17	8.09	8.05	8.06	8.05	8	7.38	7.61	-	-
Total Alkalinity (Total as CaCO	mg/L	100	-	-	42	42	44	68	76	88	118	98	103	820	95	100	110	120	140	140	133	126	147	145	131	133	350	180 (2)	-	-
Dissolved Chloride (Cl)	mg/L	1	-	15000	4.4	5	5.4	6.3	8.1	10.1	11.8	11.9	11.2	140	12	14	20	22	26	29	28	26	33	37	28	36	25	46	31	51
Colour	TCU	5	-	-	< 3	5	15	21	24	7	< 5	<5	68	25	8	ND	ND	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	26	<5.0	-	-
Nitrate + Nitrite (N)	mg/L	0.05	-	-	< 0.05	< 0.05	0.06	< 0.05	< 0.05	< 0.05	< 0.05	0.08	<0.06	< 0.05	<0.05	ND	ND	<0.05	<0.05	<0.05	0.09	0.07	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	-	-
Nitrite (N)	mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	<0.01	ND	ND	-	<0.01	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.010	<0.010	-	-
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	-	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.19	<0.1	49	<0.05	ND	ND	<0.05	<0.05	<0.05	0.07	<0.05	<0.03	0.04	<0.03	<0.03	14	<0.050	1.3	13.9
Total Organic Carbon (C)	mg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	0.6	0.9	1.1	1.5	<5	2.9	2.6	0.8	7.9	4.6	3.6	9.5	<5.0 (1)	-	-
Orthophosphate (P)	mg/L	0.01	-	-	< 0.01	< 0.01	0.02	0.02	< 0.01	< 0.01	0.02	0.02	<0.3	< 0.01	0.11	ND	ND	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.016	<0.010	-	-
pH	Units	N/A	-	-	7.9	7.9	8	7.7	7.9	7.8	7.7	8	8	7	7.6	7.52	7.63	7.87	8.00	7.62	8	8.1	7.9	8.0	8.08	7.71	7	7.88	-	-
Reactive Silica (SiO2)	mg/L	2.5	-	-	8.3	8.1	8.3	9	8.3	8.1	7.6	8.4	8.8	19	8.6	8.7	8.9	9	9.4	9.4	9.7	9.5	9.9	9.8	9.6	9.2	15	10	-	-
Dissolved Sulphate (SO4)	mg/L	2	-	-	2	2	< 2	< 2	2	2	2	4	3.5	6	<2	ND	ND	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	<2.0	-	-
Turbidity	NTU	1	-	-	1.5	505	41	17	5.2	3.8	0.2	398	12	322	3.2	2.2	1.3	3.8	1.1	16	1.3	15.8	4.9	41.5	8.6	70.1	450	54	-	-
Conductivity	uS/cm	1	-	-	99	98	107	155	174	205	262	224	230	2330	230	230	280	300	350	360	367	312	372	395	385	382	730	470	402	755
Dissolved Organic Carbon	mg/L	0.5	-	-	9.9	0.8	< 0.5	< 0.05	< 0.05	214	< 0.5	<0.5	1.2	-	1.2	-	-	-	-	-	1.5	2.7	<0.5	1.7	<0.5	3.4	-	-	-	-
Dissolved Calcium	mg/L	0.1	-	-	9.2	10.4	13.7	19	22.2	26.1	36.5	27.3	28.6	132	28.9	34	39	41	46	47	43.8	55.2	52.5	52.4	59.1	64.9	60	62	-	-
Magnesium	mg/L	0.1	-	-	1.4	1.5	2	2.9	3.3	4.1	5.4	4.4	4.17	42.8	4.2	4.8	5.9	6	7.1	7.1	6.1	5.9	7.5	7.8	8.5	6.9	8.6	9.3	-	-
Phosphorus	mg/L	0.1	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	ND	ND	-	<0.1	<0.1	<0.1	<0.1	<0.02	<0.02	0.02	<0.02	0.28	<100	-	-
Potassium	mg/L	0.1	-	-	2.9	2.9	2.9	3.6	4.2	4.1	5	4.4	4.5	61.7	4.7	4.9	5.4	5.8	8.1	6.1	4.8	5	5.3	6.5	6.9	5.1	16	6.6	-	-
Sodium	mg/L	0.1	-	-	7.1	6	6.8	7.6	8.1	9.9	8.8	8.2	8.9	151	10.2	10	11	17	15	12	9.6	8.3	12.1	15.7	11.6	9.3	52	12	-	-

Notes:

RDL - Reported Detection Limit (updated in 2016)

ND - Values below RDL

Bold indicates exceedance of NS Tier 1 EQS

Bold and shaded indicates exceedance of NS Tier 2 EQS

Action Level = average between 2007 and 2016 (excluding duplicates) plus three standard deviations

NS Tier 1 EQS = Nova Scotia Tier 1 EQS for groundwater, commercial/industrial, non-potable, coarde grained (NSE 2013a)

NS Tier 2 PSS = Nova Scotia Tier 2 Pathway Specific Standard for groundwater >10 m from fresh surface water (NSE 2013b)

TABLE C-5 **GROUNDWATER GENERAL CHEMISTRY - MW-25B**
Municipality of the County of Kings
Meadowview Landfill, Kentville, NS
Stantec Consulting Ltd. Project No. 121414186

Compound	Units	RDL	Sep-93	NS Tier 1 EQS	NS Tier 2 PSS	8-Mar-95	19-Mar-96	16-Apr-97	6-Apr-98	5-May-99	26-Jul-00	Aug-01	Aug-01 Duplicate	Sept-02	19-Aug-03	25-Aug-04	18-Aug-05	23-Nov-06	16-Aug-07	16-Aug-07 Dup B	28-Jul-08	10-Aug-09	28-Jul-10	21-Sep-11	4-Oct-12	8-Jul-13	19-Aug-14	22-Jul-15	14-Jul-16	19-Jul-17	Average 2007 through 2017	Action Level
Anion Sum	me/L	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	5.03	2.9	10	8.45	1.37	3.55	6.35	11.7	1.95	9.49	6.28	9.57	8.63	10.8	5.28	-	-
Bicarb. Alkalinity (calc. as CaC	mg/L	1	75.4	-	-	143	44.5	49.8	91.4	46	42	42	41	43.63	229	180	102	344	274	63	120	215	393	62	333	204	353	292	380	170	-	-
Calculated TDS	mg/L	1	111	-	-		67	69	137	74	74	68	68	69.17	369	261	164	541	480	89	232	352	560	100	454	331	515	484	560	280	-	-
Carb. Alkalinity (calc. as CaCO	mg/L	1	0.56	-	-	1	0.4	< 1	0.5	0.9	< 1	<1	<1	0.33	1	<1	ND	ND	2	<1	<1	<1	<10	<10	<10	<10	<10	<10	<1.0	<1.0	-	-
Cation Sum	me/L	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	4.6	3.14	10.6	10	1.55	5.20	7.03	9.62	1.81	7.93	6.62	10.8	10.8	10.2	5.02	-	-
Hardness (CaCO3)	mg/L	1	71	-	-	166	44	40.8	105	47.3	52.3	40.7	40.4	41.33	321	199	130	470	440	5	190	300	421	74.8	337	279	460	466	440	220	-	-
Ion Balance (% Difference)	%	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	4.42	3.89	2.72	8.6	6.16	18.9	5.08	9.7	3.9	8.9	2.6	6.2	11.2	2.72	2.52	-	-
Langelier Index (@ 20C)	-	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-0.589	0.448	1.08	-1.36	-0.0140	0.267	0.59	-0.4	0.61	0.11	0.68	0.22	0.694	0.303	-	-
Langelier Index (@ 4C)	-	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	-0.39	-0.84	0.2	0.836	-1.61	-0.264	0.018	0.27	-0.72	0.29	-0.21	0.36	-0.1	0.446	0.054	-	-
Nitrate (N)	mg/L	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.05	ND	ND	-	-	<0.05	<0.05	0.09	0.11	0.06	<.05	<0.05	<0.05	<0.050	0.056	-	-
Saturation pH (@ 20C)	Units	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	7.39	7.7	6.74	6.86	9.33	7.53	7.1	6.91	8.4	7.09	7.36	6.93	7.01	6.73	7.32	-	-
Saturation pH (@ 4C)	Units	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	7.79	7.95	6.99	7.1	9.58	7.78	7.35	7.23	8.72	7.41	7.68	7.25	7.33	6.98	7.57	-	-
Total Alkalinity (Total as CaCO	mg/L	25	76	-	-	144	45	50	92	47	42	42	41	44	230	180	100	340	280	64	120	220	393	62	333	204	353	292	380	170 (2)	-	-
Dissolved Chloride (Cl)	mg/L	1	11.5	-	15000	32.1	5.2	5.4	21	10.4	9.1	10.4	9.9	9.7	74	49	30	110	100	3	41	72	135	25	100	78	89	99	110	64	83	178
Colour	TCU	5	< 3	-	-	5	8	40	6	24	15	<5	<5	176	6	5	ND	6	6	<5	9	6	8	<5	<5	<5	<5	5	<5.0	<5.0	-	-
Nitrate + Nitrite (N)	mg/L	0.05	< 0.05	-	-	< 0.05	0.08	0.06	< 0.05	< 0.05	0.06	<0.05	<0.05	0.52	< 0.05	<0.05	ND	ND	<0.05	0.1	<0.05	<0.05	0.09	0.11	0.06	<.05	<0.05	<0.05	<0.050	0.056	-	-
Nitrite (N)	mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.01	ND	ND	-	-	<0.01	<0.01	<0.05	<0.05	<0.05	<.05	<0.05	<0.05	<0.010	<0.010	-	-
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	< 0.05	-	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.05	<0.05	<0.1	0.09	0.22	0.06	ND	<0.05	0.08	<0.05	<0.05	<0.05	<0.05	<0.03	0.03	0.04	0.5	<0.050	0.052	0.07	0.50
Total Organic Carbon (C)	mg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND	6	14	4	1.9	<5	12.6	1.2	<0.5	2.8	4.4	3.8	9.4 (2)	<5.0 (1)	-	-
Orthophosphate (P)	mg/L	0.01	< 0.01	-	-	< 0.01	0.01	0.01	< 0.01	< 0.01	0.04	<0.01	<0.01	<0.3	0.01	<0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.021	<0.010	-	-
pH	Units	N/A	7.9	-	-	7.7	8	7.5	7.8	8.3	7.8	7.9	7.9	7.9	7.8	7.4	7.11	7.19	7.94	7.97	7.52	7.37	7.5	8	7.7	7.47	7.61	7.23	7.43	7.63	-	-
Reactive Silica (SiO2)	mg/L	0.5	9	-	-	11	7.8	8.1	9	7.8	7.2	7.8	7.7	7.6	13	11	9.2	15	14	11	9.5	12	15.9	8.4	14.3	11.7	15.1	11.8	15	11	-	-
Dissolved Sulphate (SO4)	mg/L	2	4	-	-	< 2	2	< 2	< 2	< 2	5	<2	4	<2.0	< 2	<2	ND	ND	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	<2.0	-	-
Turbidity	NTU	0.1	0.8	-	-	798	8.3	22	4	30.4	4	835	339	95	99.2	95.4	220	330	210	190	290	160	55	111	113	4070	699	956	1.5	450	-	-
Conductivity	uS/cm	1	190	-	-	370	111	108	249	124	121	116	115	124	780	495	280	960	920	130	370	640	1190	197	889	614	1040	839	970	510	744	1654
Dissolved Organic Carbon	mg/L	0.5	2.4	-	-	1.8	< 0.5	< 0.5	0.3	132	1.2	<0.5	0.6	0.6	-	<5	-	-	-	-	-	-	11.6	1.8	<0.5	<0.5	4.4	3.3	-		-	-
Dissolved Calcium	mg/L	0.1	23.3	-	-	55.1	14.4	13.2	33.7	15.3	17	13	12.9	13.5	107	65.5	45	160	150	1.6	61	100	144	25	109	92.3	153	152	150	71	-	-
Magnesium	mg/L	0.1	3.2	-	-	6.8	2	1.9	5.1	2.2	2.4	2	2	1.85	13.1	8.7	5.5	18	18	0.2	8.1	13	15	3	15.7	11.8	18.9	20.9	18	9.9	-	-
Phosphorus	mg/L	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	ND	ND	-	-	<0.1	<0.1	<0.1	<0.1	<0.02	0.02	0.04	<0.02	<0.1	<0.10	-	-
Potassium	mg/L	0.1	5.3	-	-	6	3.5	3.6	4.8	3.4	3.9	3.6	3.6	3.8	6.4	5.8	4.7	7	7.7	1.8	14	7.6	5.2	4	4.6	7.0	8.6	5.1	6.6	6.6	-	-
Sodium	mg/L	0.1	9.3	-	-	6.1	4.6	3.9	5.6	4.6	3.8	3.6	3.5	3.8	15.5	10.4	7.5	24	24	32	26	18	24	4.8	24.5	19.6	28.8	30.2	29	11	-	-

Notes:
RDL - Reported Detection Limit (updated in 2016)
ND - Values below RDL
Bold indicates exceedance of NS Tier 1 EQS
Bold and shaded indicates exceedance of NS Tier 2 EQS
Action Level = average between 2007 and 2016 (excluding duplicates) plus three standard deviations
NS Tier 1 EQS = Nova Scotia Tier 1 EQS for groundwater, commercial/industrial, non-potable, coarde grained (NSE 2013a)
NS Tier 2 PSS = Nova Scotia Tier 2 Pathway Specific Standard for groundwater >10 m from fresh surface water (NSE 2013b)

TABLE C-6 **GROUNDWATER GENERAL CHEMISTRY - TH-1**
Municipality of the County of Kings
Meadowview Landfill, Kentville, NS
Stantec Consulting Ltd. Project No. 121414186

Compound	Units	RDL	NS Tier 1 EQS	NS Tier 2 PSS	Sep-93	8-Mar-95	19-Mar-96	16-Apr-97	6-Apr-98	5-May-99	26-Jul-00	Aug-01	Sept-02	19-Aug-03	25-Aug-04	25-Aug-04 DUP	18-Aug-05	18-Aug-05 TH1 Dup	23-Nov-06	16-Aug-07	28-Jul-08	10-Aug-09	27-Jul-10	21-Sep-11	4-Oct-12	4-Jul-13	19-Aug-14	22-Jul-15	14-Jul-16	19-Jul-17	Average 2007 through 2017	Action Level
Anion Sum	me/L	N/A	-	-	-	-	-	-	-	-	-	-	-	-	17.1	17.1	16.9	-	15.1	11.8	13.7	12.9	12.2	11.4	11.6	11.0	9.55	9.49	10.2	10.5	-	-
Bicarb. Alkalinity (calc. as CaC	mg/L	1	-	-	1100	1020	1080	1140	999	995	934	836	937.77	655	741	743	755	-	666	516	625	588	552	529	537	502	453	442	470	490	-	-
Calculated TDS	mg/L	1	-	-	1450		1400	1430	1270	1240	1220	1160	1116.86	903	903	907	882	-	819	744	737	694	679	612	645	634	533	518	580	580	-	-
Carb. Alkalinity (calc. as CaCO	mg/L	1	-	-	2.06	1	1.6	4.3	1.2	0.9	1	5	2.21	5	9	7	ND	-	ND	<1	1	<1	<10	<10	<10	<10	<10	<10	<1.0	<1.0	-	-
Cation Sum	me/L	N/A	-	-	-	-	-	-	-	-	-	-	-	-	16.6	16.9	16.3	-	15.6	16.9	13.6	12.5	14.1	12.6	14.1	13.9	11.5	10.4	11.6	11	-	-
Hardness (CaCO3)	mg/L	1	-	-	634	546	636	650	550	531	533	556	479.61	409	362	369	380	-	350	380	290	290	257	294	312	262	273	279	280	270	-	-
Ion Balance (% Difference)	%	N/A	-	-	-	-	-	-	-	-	-	-	-	-	1.64	0.69	1.78	-	1.5	17.8	0.400	1.85	7.4	5.2	9.8	11.6	9.3	4.4	6.1	2.32	-	-
Langelier Index (@ 20C)	-	N/A	-	-	-	-	-	-	-	-	-	-	-	-	1.5	1.41	0.346	-	0.361	0.453	0.563	0.446	0.45	0.62	0.42	0.46	0.48	0.09	0.451	0.454	-	-
Langelier Index (@ 4C)	-	N/A	-	-	-	-	-	-	-	-	-	-	-	-	1.1	1.01	0.099	-	0.114	0.206	0.317	0.199	0.13	0.3	0.10	0.14	0.16	-0.23	0.203	0.207	-	-
Nitrate (N)	mg/L	0.05	-	-	-	-	-	-	-	-	-	-	-	-	<0.05	<0.05	ND	-	0.55	-	<0.05	0.34	2.94	0.29	0.54	<0.05	<0.05	<0.05	<0.050	0.063	-	-
Saturation pH (@ 20C)	Units	N/A	-	-	-	-	-	-	-	-	-	-	-	-	6.6	6.59	6.57	-	6.66	6.73	6.76	6.78	7.05	6.98	6.98	7.06	7.07	7.01	6.86	6.88	-	-
Saturation pH (@ 4C)	Units	N/A	-	-	-	-	-	-	-	-	-	-	-	-	7	6.99	6.82	-	6.91	6.97	7.00	7.03	7.37	7.3	7.30	7.38	7.39	7.33	7.11	7.12	-	-
Total Alkalinity (Total as CaCO	mg/L	100	-	-	1100	1020	1080	1140	1000	996	935	841	940	660	750	750	760	750	670	520	630	590	552	529	537	502	453	442	470	490 (2)	-	-
Dissolved Chloride (Cl)	mg/L	1	-	15000	203	198	169	164	150	143	133	136	117	91	74	73	62	61	60	51	41	36	31	26	28	34	15	23	27	26	31	60
Colour	TCU	5	-	-	31	90	70	27	27	27	20	21	128	25	16	17	18	18	15	13	15	21	11	9	13	11	<5	8	7.6	<5.0	-	-
Nitrate + Nitrite (N)	mg/L	0.05	-	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.08	<0.06	< 0.05	<0.05	<0.05	ND	-	0.57	<0.05	<0.05	1.3	2.94	0.29	0.69	<0.05	<0.05	<0.05	<0.050	0.063	-	-
Nitrite (N)	mg/L	0.01	-	-	-	-	-	-	-	-	-	-	-	-	<0.01	0.01	ND	ND	0.02	-	<0.01	0.95	<0.05	<0.05	0.15	<0.05	<0.05	<0.05	<0.010	<0.010	-	-
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	-	-	48.9	71	67	62.5	72.5	72.1	73.4	72.4	<0.1	58	54	55	49	-	50	54	42	32	58.3	43.8	58.3	44.0	37.6	16.7	40	33	42	79
Total Organic Carbon (C)	mg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11	-	13	11	11	19	25.9	4.9	20.4	11.9	<0.5	<0.5	7.4 (1)	10 (1)	-	-
Orthophosphate (P)	mg/L	0.01	-	-	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.01	<0.01	<0.3	< 0.01	0.01	<0.01	ND	ND	ND	<0.01	<0.01	<0.01	0.02	0.02	0.01	0.01	0.01	<0.01	0.027	<0.010	-	-
pH	Units	N/A	-	-	7.3	7	7.2	7.6	7.1	7.1	7.1	7.8	7.4	7.9	8.1	8	6.92	-	7.02	7.18	7.32	7.23	7.5	7.6	7.4	7.5	7.55	7.1	7.31	7.33	-	-
Reactive Silica (SiO2)	mg/L	2.5	-	-	19.8	27.6	28.5	28	26.9	27.9	27.8	29.5	31.1	30	30	30	30	30	31	32	32	30	28.8	22.6	30.9	32.5	28.6	24.5	31	30	-	-
Dissolved Sulphate (SO4)	mg/L	2	-	-	2	< 2	< 2	3	< 2	< 2	5	9	3.3	7	<2	<2	ND	ND	3	<2	2	3	4	2	2	2	3	<2	<2.0	<2.0	-	-
Turbidity	NTU	1	-	-	308	524	12.5	0.8	1.3	1.3	0.3	375	36	330	302	294	230	-	210	220	220	84	127	240	286	232	2880	1160	160	400	-	-
Conductivity	uS/cm	1	-	-	2980	2710	2700	2520	2590	2590	2590	2590	2050	1380	1800	1810	1500	-	1400	1400	1300	1200	1270	1080	1090	1080	1020	940	1000	1000	1125	1565
Dissolved Organic Carbon	mg/L	0.5	-	-	58	46	38.7	36	30	30	27	22.6	34.9	-	<50	<50	-	-	-	-	-	-	21.2	0.8	15.2	<0.5	<0.5	<0.5	-	-	-	-
Dissolved Calcium	mg/L	0.1	-	-	248	169	197	199	171	167	164	170	152	126	112	114	120	-	110	120	91	89	76.2	92.6	91.6	81.6	85.4	100	88	83	-	-
Magnesium	mg/L	0.1	-	-	3.5	30.1	34.9	37.3	29.8	27.6	29.9	31.9	24.3	23	20.1	20.5	20	-	19	20	16	15	16.1	15.2	20.3	14.2	14.6	7.2	16	14	-	-
Phosphorus	mg/L	0.1	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	ND	-	ND	-	<0.1	<0.1	<0.1	<0.1	<0.02	0.05	0.1	<0.02	0.1	<0.10	-	-
Potassium	mg/L	0.1	-	-	19.4	35.9	41.7	45.2	42.1	42	52.6	51.6	49.1	47.8	45.9	45.8	43	-	46	45	43	43	45	39	39.8	35.1	39	37.7	33	32	-	-
Sodium	mg/L	0.1	-	-	230	176	188	186	159	138	149	132	176	107	99	101	94	-	87	87	73	68	77.4	51.7	61.4	96.4	44.7	47.8	41	48	-	-

Notes:
(1) Reporting limit was increased due to turbidity.
RDL - Reported Detection Limit (updated in 2016)
ND - Values below RDL
Bold indicates exceedance of NS Tier 1 EQS
Bold and shaded indicates exceedance of NS Tier 2 EQS
Action Level = average between 2007 and 2016 (excluding duplicates) plus three standard deviations
NS Tier 1 EQS = Nova Scotia Tier 1 EQS for groundwater, commercial/industrial, non-potable, coarde grained (NSE 2013a)
NS Tier 2 PSS = Nova Scotia Tier 2 Pathway Specific Standard for groundwater >10 m from fresh surface water (NSE 2013b)

TABLE C-7 **GROUNDWATER METALS CHEMISTRY - MW-4A**
Municipality of the County of Kings
Meadowview Landfill, Kentville, NS
Stantec Consulting Ltd. Project No. 121414186

Compound	Units	RDL*	NS Tier 1 EQS	NS Tier 2 PSS	Sep-93	21-Mar-96	16-Apr-97	6-Apr-98	5-May-99	26-Jul-00	26-Jul-00 Dup.	Aug-01	Sep-02	Sep-02 Duplicate	19-Aug-03	25-Aug-04	25-Aug-04 MW-40D	25-Aug-04 Lab Dup	18-Aug-05	18-Aug-05 MW-40D	23-Nov-06	1-Aug-07	16-Aug-07 MW-4ALF
Aluminum	ug/L	5	-	50	9	13	33	33	< 5	**4000**	**2500**	14	<20	<20	*< 100*	*<100*	*<100*	*<101*	*<100*	*<100*	ND	<50	<50
Antimony	ug/L	1	-	200	3	< 2	< 2	< 2	< 2	< 20	< 20	<2	<0.4	<0.4	< 20	<20	<20	<21	<20	<20	ND	<20	<20
Arsenic	ug/L	1	-	50	**170**	39	**93**	**81**	**59**	**100**	**67**	33	**61.9**	**64.4**	23	<20	25	24	**51**	47	ND	**76**	**69**
Barium	ug/L	10	-	10000	2900	1800	2700	2300	2200	3300	2900	1400	4560	4570	2800	2800	3200	3200	3200	3200	3000	3760	3860
Beryllium	ug/L	1	-	53	< 5	< 5	< 5	< 5	< 5	< 50	< 50	<5	<0.5	<0.5	< 20	<20	<20	<20	<20	<20	ND	<20	<20
Bismuth	ug/L	2	-	-	-	-	-	-	-	-	-	-	-	-	< 20	<20	<20	<20	<20	<20	ND	<20	<20
Boron	ug/L	50	-	12000	540	250	400	420	440	390	390	200	450	450	780	660	790	860	980	990	900	845	867
Cadmium	ug/L	0.01	-	0.1	*< 0.5*	*< 0.3*	*< 0.3*	*< 0.3*	*< 0.3*	**1.6**	**1.1**	0.09	*<0.3*	*<0.3*	*< 3*	*<3*	*<3*	*<3*	*<3*	*<3*	ND	**0.21**	*<0.17*
Chromium	ug/L	1	-	-	4	5	< 2	4	5	24	< 20	<2	2	3	< 20	<20	<20	<20	<20	<20	ND	<20	<20
Cobalt	ug/L	0.4	-	100	29	21	26	22	20	91	56	15	21	22	20	24	24	23	17	18	18	14.8	13.8
Copper	ug/L	2	-	20	< 10	3	3	4	< 2	63	37	2	10	11	< 20	<20	<20	<20	<20	<20	ND	<20	<20
Iron	ug/L	50	-	3000	**24800**	**20000**	**28000**	**22000**	**13000**	**210000**	**94000**	**14000**	**25000**	**25500**	< 500	<500	1300	1300	**11000**	**7800**	ND	**20500**	**20900**
Lead	ug/L	0.5	-	10	0.1	0.4	0.4	0.5	< 0.5	**51**	**29**	<.5	<1	<1	< 5	<5	<5	<5	<5	<5	ND	<5.0	<5.0
Manganese	ug/L	2	-	8200	420	5400	900	890	450	**33000**	**17000**	3500	785	811	480	1100	550	550	480	470	540	493	481
Mercury	ug/L	0.026	-	0.26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	ug/L	2	-	730	< 2	< 2	< 2	< 2	< 2	< 20	< 20	<2	<4	<4	< 20	<20	<20	<20	<20	<20	ND	<20	<20
Nickel	ug/L	2	-	250	47	28	36	39	26	120	69	12	41	42	50	56	68	69	48	51	45	32	31
Selenium	ug/L	1	-	10	< 2	< 2	< 2	< 2	< 2	< 10	< 10	<1	2	3	*< 20*	*<20*	*<20*	*<20*	*<20*	*<20*	ND	<10	<10
Silver	ug/L	0.1	-	1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	*< 5*	*< 5*	<0.1	*<2*	*<2*	*< 5*	*<5*	*<5*	*<5*	*<5*	*<5*	ND	<1.0	<1.0
Strontium	ug/L	2	-	210000	730	370	580	510	580	600	550	350	859	876	950	940	1100	1100	960	960	1000	1080	1090
Thallium	ug/L	0.1	-	8	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 1	< 1	<0.1	<0.8	<0.8	< 1	<1	<1	<1	<1	<1	ND	<1.0	<1.0
Tin	ug/L	2	-	-	< 2	< 2	< 2	< 2	< 2	< 20	< 20	<2	,20	<20	< 20	<20	<20	<20	<20	<20	ND	<20	<20
Titanium	ug/L	2	-	-	-	-	-	-	-	-	-	-	-	-	< 20	<20	<20	<20	<20	<20	ND	<20	<20
Uranium	ug/L	0.1	-	3000	0.1	0.1	0.2	0.2	0.1	6.6	3.5	0.2	0.21	0.21	< 1	<1	<1	<1	<1	<1	1	1.2	<1.0
Vanadium	ug/L	2	-	60	< 2	< 2	< 2	< 2	< 2	50	22	<2	4	5	< 20	<20	<20	<20	<20	<20	ND	<20	<20
Zinc	ug/L	5	-	300	< 10	43	21	14	12	< 200	< 200	22	7	7	< 50	<50	<50	<50	<50	<50	ND	<50	<50

Notes:

RDL - Reported Detection Limit (updated in 2016, except for Mercury)

Bold indicates exceedance of NS Tier 1 EQS

Bold and shaded indicates exceedance of NS Tier 2 EQS

Shaded and italics indicates the detection limit exceeds NS Tier 2 PSS

MW-40D = Duplicate of MW-4A

NS Tier 1 EQS = Nova Scotia Tier 1 EQS for groundwater, commercial/industrial, non-potable, coarde grained (NSE 2013a)
NS Tier 2 PSS = Nova Scotia Tier 2 Pathway Specific Standard for groundwater >10 m from fresh surface water (NSE 2013b)

TABLE C-7 **GROUNDWATER METALS CHEMISTRY - MW-4A**
Municipality of the County of Kings
Meadowview Landfill, Kentville, NS
Stantec Consulting Ltd. Project No. 121414186

Compound	Units	RDL*	NS Tier 1 EQS	NS Tier 2 PSS	28-Jul-08	28-Jul-08 Dup-A	12-Aug-09	12-Aug-09 MW-40D	27-Jul-10	27-Jul-10 MW-40D	21-Sep-11	4-Oct-12	4-Jul-13	4-Jul-13 MW-40D	19-Aug-14	19-Aug-14 MW-40D	21-Jul-15	21-Jul-15 MW-40D	14-Jul-16	19-Jul-17	19-Jul-17 MW-40D
Aluminum	ug/L	5	-	50	<50	<50	<50	<50	<10	<10	<10	<5	**347**	**62**	10	10	<5	<5	<5.0	6.5	<5.0
Antimony	ug/L	1	-	200	<20	<20	<20	<20	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0	<1.0	<1.0
Arsenic	ug/L	1	-	50	**68**	**68**	**67**	**62**	**122**	**117**	**57**	43	**66**	**64**	**89**	**90**	**84**	**82**	**64**	47	6.4
Barium	ug/L	10	-	10000	3740	3990	4030	3760	2900	3000	3250	3420	3170	3200	4090	3980	4090	4110	3300	2300	1900
Beryllium	ug/L	1	-	53	<20	<20	<20	<20	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0	<1.0	<1.0
Bismuth	ug/L	2	-	-	<20	<20	<20	<20	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	<2.0	<2.0
Boron	ug/L	50	-	12000	734	727	548	565	624	610	690	773	591	681	726	704	801	651	390	330	270
Cadmium	ug/L	0.01	-	0.1	*<0.17*	*<0.17*	*<0.17*	*<0.17*	*<0.3*	*<0.3*	*<0.3*	**0.452**	*<0.017*	0.029	<0.017	<0.017	<0.017	<0.017	<0.010	0.015	**0.27**
Chromium	ug/L	1	-	-	<20	<20	<10	<10	2	3	<2	<1	3	<1	<1	<1	3	3	<1.0	<1.0	<1.0
Cobalt	ug/L	0.4	-	100	15.6	15.6	15.8	15.5	6	7	7	9	11	11	10	10	6	6	12	10	11
Copper	ug/L	2	-	20	35	<20	<20	<20	<2	<2	<2	<2	<2	3	4	<2	<2	<2	<2.0	<2.0	<2.0
Iron	ug/L	50	-	3000	**18800**	**18600**	**16600**	**17600**	**14400**	**15200**	**15900**	<50	**17400**	**17200**	**15600**	**14800**	**25900**	**24400**	**19000**	**13000**	<50
Lead	ug/L	0.5	-	10	<5.0	<5.0	<5.0	<5.0	1.9	1.8	<0.5	<0.5	<0.5	<0.5	3.4	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50
Manganese	ug/L	2	-	8200	497	515	497	520	384	407	641	702	541	513	430	443	657	633	550	1200	1700
Mercury	ug/L	0.026	-	0.26	-	-	-	-	-	-	-	-	0.101	<0.026	0.029	<0.026	<0.026	<0.026	-	-	-
Molybdenum	ug/L	2	-	730	<20	<20	<20	<20	<2	<2	<2	5	<2	<2	<2	<2	<2	<2	<2.0	<2.0	<2.0
Nickel	ug/L	2	-	250	33	33	32	28	17	15	15	39	27	25	19	18	9	9	18	16	22
Selenium	ug/L	1	-	10	<10	<10	<10	<10	3	3	<2	2	<1	<1	<1	<1	7	7	<1.0	<1.0	<1.0
Silver	ug/L	0.1	-	1	<1.0	<1.0	<1.0	<1.0	<0.5	<0.5	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	<0.10	<0.10
Strontium	ug/L	2	-	210000	970	1010	1040	1040	865	875	823	872	980	974	845	853	974	936	770	620	550
Thallium	ug/L	0.1	-	8	<1.0	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	<0.10	<0.10
Tin	ug/L	2	-	-	<20	<20	<20	<20	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	<2.0	<2.0
Titanium	ug/L	2	-	-	<20	<20	<20	<20	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	<2.0	<2.0
Uranium	ug/L	0.1	-	3000	<1.0	<1.0	<1.0	<1.0	<0.1	0.1	<0.1	0.6	0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.10	<0.10	0.27
Vanadium	ug/L	2	-	60	<20	<20	<20	<20	4	4	2	<2	<2	<2	<2	<2	2	3	<2.0	<2.0	<2.0
Zinc	ug/L	5	-	300	<50	<50	<50	<50	10	<5	<5	<5	35	20	9	<5	9	8	7.2	11	15

Notes:

RDL - Reported Detection Limit (updated in 2016, except for Mercury)

Bold indicates exceedance of NS Tier 1 EQS

Bold and shaded indicates exceedance of NS Tier 2 EQS

Shaded and italics indicates the detection limit exceeds NS Tier 2 PSS

MW-40D = Duplicate of MW-4A

NS Tier 1 EQS = Nova Scotia Tier 1 EQS for groundwater, commercial/industrial, non-potable, coarde grained (NSE 2013a)
NS Tier 2 PSS = Nova Scotia Tier 2 Pathway Specific Standard for groundwater >10 m from fresh surface water (NSE 2013b)

TABLE C-8 **GROUNDWATER METALS CHEMISTRY - MW-22A**
Municipality of the County of Kings
Meadowview Landfill, Kentville, NS
Stantec Consulting Ltd. Project No. 121414186

Compound	Units	RDL*	NS Tier 1 EQS	NS Tier 2 PSS	Sep-93	20-Mar-96	16-Apr-97	6-Apr-98	5-May-99	26-Jul-00	26-Jul-00 Lab Dup.	Aug-01	Sept-02	19-Aug-03	25-Aug-04	18-Aug-05	23-Nov-06	16-Aug-07	28-Jul-08	10-Aug-09	27-Jul-10	21-Sep-11	4-Oct-12	5-Jul-13	19-Aug-14	22-Jul-15	14-Jul-16	19-Jul-17
Aluminum	ug/L	5	-	50	5	*< 100*	< 10	< 10	< 10	**1000**	**3700**	**120**	20	< 10	<10	*<100*	ND	<5.0	<5.0	12.4	<10	<10	<5	21	<5	<5	<5.0	<5.0
Antimony	ug/L	1	-	200	9	< 20	< 2	< 2	< 2	< 20	< 20	<2	<0.4	< 2	<2	<20	ND	<2.0	<2.0	<2.0	<2	<2	<2	<2	<2	<2	<1.0	<1.0
Arsenic	ug/L	1	-	50	36	< 20	**100**	**110**	**97**	**61**	**92**	**110**	**106**	2	<2	27	ND	**101**	**104**	**111**	<2	**107**	<2	75	**88**	**106**	1.4	**95**
Barium	ug/L	1	-	10000	990	1800	4100	4000	4000	4300	4600	3500	602	6	150	1300	920	1230	1080	1090	357	815	730	938	910	1110	8.6	1100
Beryllium	ug/L	1	-	53	< 5	< 50	< 5	< 5	< 5	< 50	< 50	<5	<0.5	< 2	<2	<20	ND	<2.0	<2.0	<2.0	<2	<2	<2	<2	<2	<2	<1.0	<1.0
Bismuth	ug/L	2	-	-	-	-	-	-	-	-	-	-	-	< 2	<2	<20	ND	<2.0	<2.0	<2.0	<2	<2	<2	<2	<2	<2	<2.0	<2.0
Boron	ug/L	50	-	12000	160	1000	1300	1400	1600	1800	1800	2100	830	7	780	470	630	387	429	295	135	212	336	291	229	322	<50	440
Cadmium	ug/L	0.01	-	0.1	*< 0.5*	*< 0.5*	*< 0.3*	*< 0.3*	*< 0.3*	*< 1*	*< 1*	0.05	*<0.3*	*< 0.3*	*<0.3*	*<3*	ND	0.023	<0.017	**0.358**	*<0.3*	*<0.3*	<0.017	0.022	<0.017	<0.017	<0.010	75000
Chromium	ug/L	1	-	-	5	< 20	2	10	6	< 20	< 20	2	3	< 2	<2	<20	ND	2.2	3.3	1.4	3	<2	1	<1	<1	2	<1.0	<1.0
Cobalt	ug/L	0.4	-	100	35	50	48	33	37	38	45	26	21	< 1	3	26	28	23	19.3	23.3	<1	18	18	26	17	16	<0.40	19
Copper	ug/L	2	-	20	10	< 20	< 2	2	7	**40**	**90**	4	21	< 2	<2	<20	ND	<2.0	<2.0	<2.0	<2	<2	<2	<2	<2	<2	<2.0	<2.0
Iron	ug/L	50	-	3000	**118000**	1500	**76000**	**50000**	**50000**	**30000**	**53000**	**39000**	**41500**	< 50	1100	**22000**	**16000**	**45900**	**33700**	**37000**	<50	**56100**	990	**56000**	**36900**	**74400**	200	**49000**
Lead	ug/L	0.5	-	10	0.2	< 1	0.5	< 0.5	< 0.5	**11**	**29**	1.1	<1	< 0.5	<0.5	<5	ND	<0.50	<0.50	<0.50	1.4	0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50
Manganese	ug/L	2	-	8200	2290	4800	7200	4100	4300	3700	4800	3200	2740	39	350	3600	3300	4220	2570	4330	656	4800	5030	4220	3020	7770	57	4000
Mercury	ug/L	0.026	-	0.26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.049	<0.026	<0.026	-	-
Molybdenum	ug/L	2	-	730	< 2	< 20	3	3	3	< 20	< 20	3	<4	< 2	<2	<20	ND	<2.0	<2.0	<2.0	<2	<2	<2	<2	<2	<2	<2.0	<2.0
Nickel	ug/L	2	-	250	29	60	48	47	49	53	60	44	30	< 2	4	25	25	18	17.3	15.4	3	9	12	19	10	10	<2.0	16
Selenium	ug/L	1	-	10	< 2	*< 20*	< 2	< 2	< 2	< 10	< 10	<1	1	< 2	<2	*<20*	ND	<1.0	<1.0	<1.0	<2	<2	<1	<1	<1	2	<1.0	<1.0
Silver	ug/L	0.1	-	1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	*< 5*	*< 5*	<0.1	*<2*	< 0.5	<0.5	*<5*	ND	<0.10	<0.10	<0.10	<0.5	<0.5	<0.1	<0.1	<0.1	<0.1	<0.10	<0.10
Strontium	ug/L	2	-	210000	300	940	1100	1100	1200	1000	1100	1000	906	420	84	670	560	521	475	436	154	411	415	418	327	392	850	420
Thallium	ug/L	0.1	-	8	< 0.1	< 0.1	< 0.1	< 0.1	0.1	< 1	< 1	0.1	<0.8	< 0.1	<0.1	<1	ND	<0.10	<0.10	<0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	<0.10
Tin	ug/L	2	-	-	< 2	< 20	< 2	< 2	< 2	< 20	< 20	<2	<20	< 2	<2	<20	ND	<2.0	<2.0	<2.0	<2	<2	<2	<2	<2	<2	<2.0	<2.0
Titanium	ug/L	2	-	-	-	-	-	-	-	-	-	-	-	< 2	<2	<20	ND	<2.0	<2.0	<2.0	<2	<2	<2	<2	<2	<2	<2.0	<2.0
Uranium	ug/L	0.1	-	3000	0.1	< 0.1	0.2	0.3	0.4	3.2	5	1.2	1.04	10	0.1	<1	ND	<0.10	<0.10	0.12	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	33	<0.10
Vanadium	ug/L	2	-	60	< 2	< 2	3	3	2	< 20	< 20	4	6	< 2	<2	<20	ND	<2.0	<2.0	<2.0	<2	3	3	<2	<2	2	<2.0	<2.0
Zinc	ug/L	5	-	300	20	< 50	9	11	24	< 200	< 200	10	10	< 5	<5	160	ND	22.4	5.5	<5.0	5	5	<5	23	8	<5	<5.0	<5.0

Notes:

RDL - Reported Detection Limit (updated in 2016, except for Mercury)

Bold indicates exceedance of NS Tier 1 EQS

Bold and shaded indicates exceedance of NS Tier 2 EQS

Shaded and italics indicates the detection limit exceeds NS Tier 2 PSS

NS Tier 1 EQS = Nova Scotia Tier 1 EQS for groundwater,
commercial/industrial, non-potable, coarde grained (NSE 2013a)

NS Tier 2 PSS = Nova Scotia Tier 2 Pathway Specific Standard for groundwater
>10 m from fresh surface water (NSE 2013b)

TABLE C-9 **GROUNDWATER METALS CHEMISTRY - MW-22B**
Municipality of the County of Kings
Meadowview Landfill, Kentville, NS
Stantec Consulting Ltd. Project No. 121414186

Compound	Units	RDL*	NS Tier 1 EQS	NS Tier 2 PSS	Sep-93	20-Mar-96	16-Apr-97	6-Apr-98	5-May-99	26-Jul-00	Aug-01	Sept-02	19-Aug-03	25-Aug-04	18-Aug-05	23-Nov-06	16-Aug-07	28-Jul-08	10-Aug-09	27-Jul-10	21-Sep-11	4-Oct-12	5-Jul-13	19-Aug-14	22-Jul-15	14-Jul-16	19-Jul-17
Aluminum	ug/L	5	-	50	5	**260**	26	< 20	30	**2300**	<50	<20	*< 100*	*<100*	*<100*	ND	<50	<50	<50	<10	<10	<5	29	<5	<5	<5.0	<5.0
Antimony	ug/L	1	-	200	12	< 2	< 2	< 2	< 2	< 20	<20	<0.4	< 20	<20	<20	ND	<20	<20	<20	<2	<2	<2	<2	<2	<2	<1.0	<1.0
Arsenic	ug/L	1	-	50	10	13	15	4	7	22	<20	14.2	< 20	<20	<20	ND	<20	<20	<20	41	**57**	12	23	26	36	4.1	9.5
Barium	ug/L	1	-	10000	1400	420	520	350	510	900	580	548	720	590	510	1000	596	581	572	735	3250	672	734	896	814	700	690
Beryllium	ug/L	1	-	53	< 5	< 5	< 5	< 5	< 5	< 50	<50	<0.5	< 20	<20	<20	ND	<20	<20	<20	<2	<2	<2	<2	<2	<2	<1.0	<1.0
Bismuth	ug/L	2	-	-	-	-	-	-	-	-	-	-	< 20	<20	<20	ND	<20	<20	<20	<2	<2	<2	<2	<2	<2	<2.0	<2.0
Boron	ug/L	50	-	12000	320	120	160	180	250	330	370	280	440	600	500	350	567	504	470	601	690	726	541	480	449	460	490
Cadmium	ug/L	0.01	-	0.1	*< 0.5*	*< 0.5*	*< 0.3*	*< 0.3*	*< 0.3*	*< 1*	*0.5*	*<0.3*	*< 3*	*<3*	*<3*	ND	<0.17	<0.17	**0.8**	*<0.3*	*<0.3*	0.023	<0.017	<0.017	<0.017	0.052	0.018
Chromium	ug/L	1	-	-	2	8	< 2	< 2	2	< 20	<20	<2	< 20	<20	<20	3	<20	<20	<10	4	<2	3	<1	<1	8	<1.0	<1.0
Cobalt	ug/L	0.4	-	100	34	22	11	5	8	23	10	6	17	15	13	24	10.4	9.5	9.6	10	7	10	16	13	9	9.5	8.4
Copper	ug/L	2	-	20	10	14	< 2	2	4	**31**	<20	9	< 20	<20	<20	ND	<20	<20	<20	<2	<2	<2	<2	<2	<2	<2.0	<2.0
Iron	ug/L	50	-	3000	**3200**	**9900**	**14000**	720	1600	**18000**	**8800**	**11500**	1300	<500	2400	**7100**	**10100**	**8820**	**8690**	**15500**	**15900**	<50	**14200**	**10400**	**14200**	2700	**5100**
Lead	ug/L	0.5	-	10	0.2	2	1.1	< 0.5	0.9	**22**	<5.0	<1	< 5	<5	<5	ND	<5.0	<5.0	<5.0	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50
Manganese	ug/L	2	-	8200	5280	3100	4300	270	1700	6900	2400	736	4300	4400	4500	4100	4070	4180	3650	4490	641	4520	4260	4270	4870	3400	1200
Mercury	ug/L	0.026	-	0.26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.026	<0.026	<0.026	-	-
Molybdenum	ug/L	2	-	730	20	6	5	3	4	< 20	<20	<4	23	<20	<20	ND	<20	<20	<20	<2	<2	<2	<2	<2	<2	<2.0	<2.0
Nickel	ug/L	2	-	250	80	20	15	14	28	38	26	24	77	36	30	17	32	28	27	22	15	22	35	25	16	25	25
Selenium	ug/L	1	-	10	4	< 2	< 2	< 2	< 2	< 10	<10	3	*< 20*	*<20*	*<20*	ND	<10	<10	<10	5	<2	3	2	<1	11	<1.0	<1.0
Silver	ug/L	0.1	-	1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	*< 5*	<1	*<2*	*< 5*	*<5*	*<5*	ND	<1.0	<1.0	<1.0	<0.5	<0.5	<0.1	<0.1	<0.1	<0.1	<0.10	<0.10
Strontium	ug/L	2	-	210000	1500	2400	2500	2400	2300	3000	2900	2840	3100	2800	2500	450	2540	2460	2410	2280	823	2190	1990	2030	1970	2000	2000
Thallium	ug/L	0.1	-	8	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 1	<1	<0.8	< 1	<1	<1	ND	<1.0	<1.0	<1.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	<0.10
Tin	ug/L	2	-	-	< 2	< 2	< 2	< 2	< 2	< 20	<20	<20	< 20	<20	<20	ND	<20	<20	<20	<2	<2	<2	<2	<2	<2	<2.0	<2.0
Titanium	ug/L	2	-	-	-	-	-	-	-	-	-	-	< 20	<20	<20	ND	<20	<20	<20	<2	<2	<2	<2	<2	<2	<2.0	<2.0
Uranium	ug/L	0.1	-	3000	2	2.8	3.9	1.8	7.6	13	7.1	4.1	75	15	9.6	0.1	9.9	12.0	11	3.3	<0.1	22.2	5.0	11.5	7.8	12	9.6
Vanadium	ug/L	2	-	60	< 2	3	< 2	< 2	< 2	< 20	<20	3	< 20	<20	<20	ND	<20	<20	<20	5	2	3	<2	<2	3	<2.0	<2.0
Zinc	ug/L	5	-	300	20	53	9	11	18	170	24	7	< 50	<50	<50	14	<50	<50	<50	<5	<5	<5	12	17	<5	8	<5.0

Notes:

RDL - Reported Detection Limit (updated in 2016, except for Mercury)

Bold indicates exceedance of NS Tier 1 EQS

Bold and shaded indicates exceedance of NS Tier 2 EQS

Shaded and italics indicates the detection limit exceeds NS Tier 2 PSS

NS Tier 1 EQS = Nova Scotia Tier 1 EQS for groundwater, commercial/industrial, non-potable, coarde grained (NSE 2013a)

NS Tier 2 PSS = Nova Scotia Tier 2 Pathway Specific Standard for groundwater >10 m from fresh surface water (NSE 2013b)

TABLE C-10 GROUNDWATER METALS CHEMISTRY - MW-22C
Municipality of the County of Kings
Meadowview Landfill, Kentville, NS
Stantec Consulting Ltd. Project No. 121414186

Compound	Units	RDL*	NS Tier 1 EQS	NS Tier 2 PSS	Sep-93	20-Mar-96	16-Apr-97	8-Apr-98	5-May-99	26-Jul-00	Aug-01	Sept-02	19-Aug-03	25-Aug-04	18-Aug-05	23-Nov-06	16-Aug-07	28-Jul-08	10-Aug-09	27-Jul-10	21-Sep-11	4-Oct-12	5-Jul-13	19-Aug-14	22-Jul-15	14-Jul-16	19-Jul-17
Aluminum	ug/L	5	-	50	18	**170**	**170**	**69**	**110**	**260**	19	<20	*< 100*	<10	ND	44	5.2	<5.0	<5.0	<10	<10	<5	18	6	<5	<5.0	<5.0
Antimony	ug/L	1	-	200	6	< 2	< 2	< 2	< 2	< 2	<2	<0.4	< 20	<2	ND	ND	<2.0	<2.0	<2.0	<2	<2	<2	<2	<2	<2	<1.0	<1.0
Arsenic	ug/L	1	-	50	< 20	2	< 2	2	2	3	2	2	32	2	ND	ND	<2.0	2.2	<2.0	2	<2	<2	<2	<2	2	62	1.3
Barium	ug/L	1	-	10000	6	13	6	5	61	19	11	12	1900	8	6.7	9	10.9	8.5	7.5	7	5	6	25	8	7	710	8.8
Beryllium	ug/L	1	-	53	< 5	< 5	< 5	< 5	< 5	< 5	<5	<0.5	< 20	<2	ND	ND	<2.0	<2.0	<2.0	<2	<2	<2	<2	<2	<2	<1.0	<1.0
Bismuth	ug/L	2	-	-	-	-	-	-	-	-	-	-	< 20	<2	ND	ND	<2.0	<2.0	<2.0	<2	<2	<2	<2	<2	<2	<2.0	<2.0
Boron	ug/L	50	-	12000	10	12	9	12	21	< 20	12	<100	1200	9	8.9	9	13.5	9.9	9.4	10	10	25	48	12	17	370	<50
Cadmium	ug/L	0.01	-	0.1	*< 0.5*	*< 0.5*	*< 0.3*	*< 0.3*	*< 0.3*	*< 0.1*	0.02	*<0.3*	*< 3*	*<0.3*	ND	**0.3**	0.019	0.027	0.025	*<0.3*	*<0.3*	<0.017	<0.017	<0.017	<0.017	<0.010	62000
Chromium	ug/L	1	-	-	< 2	3	< 2	< 2	< 2	< 2	<2	<2	< 20	<2	ND	ND	<2.0	<2.0	2.5	<2	<2	1	<1	<1	1	<1.0	<1.0
Cobalt	ug/L	0.4	-	100	< 1	1	1	1	1	1	0.4	<1	28	<1	ND	ND	<0.40	<0.40	<0.40	<1	<1	<1	<1	<1	<1	15	<0.40
Copper	ug/L	2	-	20	10	15	2	4	9	14	<2	6	< 20	<2	ND	ND	<2.0	<2.0	<2.0	2	<2	<2	35	<2	<2	<2.0	<2.0
Iron	ug/L	50	-	3000	60	210	120	120	230	250	20	110	**23000**	<50	ND	ND	109	156	145	176	135	<50	150	156	94	**41000**	230
Lead	ug/L	0.5	-	10	0.1	1.1	0.6	0.7	0.5	1.2	<0.5	<1	< 5	<0.5	ND	ND	<0.50	<0.50	<0.50	1.5	<0.5	<0.5	2	<0.5	<0.5	<0.50	<0.50
Manganese	ug/L	2	-	8200	40	41	15	15	93	94	100	83	3800	24	ND	46	62.4	54.2	51.4	47	47	10	51	44	43	3300	57
Mercury	ug/L	0.026	-	0.26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.087	<0.026	<0.026	-	-
Molybdenum	ug/L	2	-	730	< 2	< 2	< 2	< 2	< 2	< 2	<2	<4	< 20	<2	ND	ND	<2.0	<2.0	<2.0	<2	<2	<2	<2	<2	<2	<2.0	<2.0
Nickel	ug/L	2	-	250	< 2	2	< 2	< 2	2	2	<2	<3	35	<2	ND	ND	<2.0	<2.0	<2.0	<2	<2	<2	3	<2	<2	12	<2.0
Selenium	ug/L	1	-	10	< 2	< 2	< 2	< 2	< 2	< 1	<1	<1	< 20	<2	ND	ND	<1.0	<1.0	<1.0	<2	<2	<1	<1	<1	2	<1.0	<1.0
Silver	ug/L	0.1	-	1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	<0.1	*<2*	*< 5*	<0.5	ND	ND	<0.10	<0.10	<0.10	<0.5	<0.5	<0.1	<0.1	<0.1	<0.1	<0.10	<0.10
Strontium	ug/L	2	-	210000	130	150	230	270	330	460	380	429	850	400	400	470	534	589	630	580	753	721	740	697	786	280	12000
Thallium	ug/L	0.1	-	8	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	<0.1	<0.8	< 1	<0.1	ND	ND	<0.10	<0.10	<0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	870
Tin	ug/L	2	-	-	< 2	< 2	< 2	< 2	< 2	< 2	<2	<20	< 20	<2	ND	ND	<2.0	<2.0	<2.0	<2	<2	<2	<2	<2	<2	<2.0	<0.10
Titanium	ug/L	2	-	-	-	-	-	-	-	-	-	-	< 20	<2	ND	ND	<2.0	<2.0	<2.0	<2	<2	<2	<2	<2	<2	<2.0	<2.0
Uranium	ug/L	0.1	-	3000	1.5	5.1	8.3	7.2	8.7	12	40	20.8	< 1	8.6	28	24	19.4	18.7	23.8	17	25.2	26.5	27.4	33.6	34.7	<0.10	<2.0
Vanadium	ug/L	2	-	60	< 2	2	< 2	< 2	< 2	6	4	3	< 20	<2	6.4	ND	<2.0	<2.0	<2.0	<2	<2	<2	<2	<2	<2	<2.0	34
Zinc	ug/L	5	-	300	< 10	37	5	22	18	13	6	7	< 50	<5	ND	5	50.8	10.8	<5.0	<5	<5	<5	29	6	<5	<5.0	<2.0

Notes:

RDL - Reported Detection Limit (updated in 2016, except for Mercury)

Bold indicates exceedance of NS Tier 1 EQS

Bold and shaded indicates exceedance of NS Tier 2 EQS

Shaded and italics indicates the detection limit exceeds NS Tier 2 PSS

NS Tier 1 EQS = Nova Scotia Tier 1 EQS for groundwater, commercial/industrial, non-potable, coarde grained (NSE 2013a)

NS Tier 2 PSS = Nova Scotia Tier 2 Pathway Specific Standard for groundwater >10 m from fresh surface water (NSE 2013b)

TABLE C-11 GROUNDWATER METALS CHEMISTRY - MW-25B
Municipality of the County of Kings
Meadowview Landfill, Kentville, NS
Stantec Consulting Ltd. Project No. 121414186

Compound	Units	RDL*	NS Tier 1 EQS	NS Tier 2 PSS	Sep-93	19-Mar-96	16-Apr-97	6-Apr-98	5-May-99	26-Jul-00	Aug-01	Aug-01 Duplicate	Sept-02	19-Aug-03	25-Aug-04	18-Aug-05	23-Nov-06	16-Aug-07	16-Aug-07 Dup A	28-Jul-08	10-Aug-09	28-Jul-10	21-Sep-11	4-Oct-12	8-Jul-13	19-Aug-14	22-Jul-15	14-Jul-16	19-Jul-17
Aluminum	ug/L	5	-	50	7	22	**160**	39	50	**450**	26	19	<20	< 10	<10	ND	ND	6.3	**98.4**	<5.0	<5.0	<10	<10	<5	15	9	<5	<5.0	<5.0
Antimony	ug/L	1	-	200	2	< 2	< 2	< 2	< 2	< 2	<2	<2	<0.4	< 2	<2	ND	ND	<2.0	<2.0	<2.0	<2.0	<2	<2	<2	<2	<2	<2	<2	<1.0	<1.0
Arsenic	ug/L	1	-	50	< 2	2	2	< 2	2	2	2	2	1.5	< 2	<2	ND	3	2	<2.0	<2.0	2.8	5	<2	3	3	5	8	3.6	1.9
Barium	ug/L	1	-	10000	12	23	5	11	16	11	6	5	5.3	24	13	7.2	42	22.1	<5.0	11.3	12.7	29	<5	27	14	77	35	27	7.6
Beryllium	ug/L	1	-	53	< 5	< 5	< 5	< 5	< 5	< 5	<5	<5	<0.5	< 2	<2	ND	ND	<2.0	<2.0	<2.0	<2.0	<2	<2	<2	<2	<2	<2	<1.0	<1.0
Bismuth	ug/L	2	-	-	-	-	-	-	-	-	-	-	-	< 2	<2	ND	ND	<2.0	<2.0	<2.0	<2.0	<2	<2	<2	<2	<2	<2	<2.0	<2.0
Boron	ug/L	50	-	12000	14	11	10	12	18	7	7	6	<100	63	41	21	140	93.4	11.8	44.0	78.9	186	18	170	100	162	165	160	56
Cadmium	ug/L	0.01	-	0.1	*< 0.5*	*< 0.5*	*< 0.3*	*< 0.3*	*< 0.3*	0.1	0.03	0.03	*<0.3*	*< 0.3*	*<0.3*	ND	ND	0.029	<0.017	<0.017	0.065	*<0.3*	1	**0.512**	**0.449**	<0.017	0.02	0.021	0.019
Chromium	ug/L	1	-	-	2	< 2	< 2	< 2	2	< 2	<2	<2	<2	< 2	<2	ND	2	<2.0	<2.0	<2.0	<1.0	3	<2	3	<1	<1	4	<1.0	<1.0
Cobalt	ug/L	0.4	-	100	< 0.1	< 1	1	1	< 1	< 1	<0.4	<0.4	<1	< 1	<1	ND	ND	0.5	<0.40	<0.40	<0.40	<1	<1	<1	<1	2	1	0.84	<0.40
Copper	ug/L	2	-	20	< 10	6	< 2	4	2	**21**	9	6	5	< 2	<2	ND	ND	<2.0	<2.0	<2.0	<2.0	<2	<2	<2	<2	<2	<2	<2.0	<2.0
Iron	ug/L	50	-	3000	30	18	130	57	80	200	<20	<20	<100	< 50	<50	ND	ND	<50	57	<50	<50	<50	<50	<50	<50	3270	83	<50	<50
Lead	ug/L	0.5	-	10	0.1	0.4	0.4	< 0.5	< 0.5	1.4	<0.5	<0.5	<1	< 0.5	<0.5	ND	ND	<0.50	<0.50	<0.50	<0.50	1.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50
Manganese	ug/L	2	-	8200	150	3	16	7	56	32	34	32	7	30	17	19	140	86.2	10.3	60.4	35.8	250	8	283	<2	1410	435	300	11
Mercury	ug/L	0.026	-	0.26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.026	<0.026	<0.026	-	-
Molybdenum	ug/L	2	-	730	35	< 2	< 2	< 2	< 2	< 2	<2	<2	<4	< 2	<2	ND	ND	<2.0	<2.0	<2.0	<2.0	<2	<2	<2	<2	<2	<2	<2.0	<2.0
Nickel	ug/L	2	-	250	8	< 2	< 2	< 2	< 2	2	<2	<2	<3	3	2	ND	8	7.2	<2.0	3.8	6	10	<2	8	10	11	9	11	6600
Selenium	ug/L	1	-	10	< 2	< 2	< 2	< 2	< 2	< 1	<1	<1	<1	< 2	<2	ND	ND	<1.0	<1.0	<1.0	<1.0	4	<2	2	<1	<1	10	<1.0	<1.0
Silver	ug/L	0.1	-	1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	<0.1	<0.1	<2	< 0.5	<0.5	ND	ND	<0.1	<0.10	<0.10	<0.10	<0.5	<0.5	<0.1	<0.1	<0.1	<0.1	<0.10	<0.10
Strontium	ug/L	2	-	210000	240	140	150	370	180	190	170	160	230	1100	780	440	1500	1310	23.2	632	1180	1510	262	1030	917	1520	1480	1600	880
Thallium	ug/L	0.1	-	8	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	<0.1	<0.1	<0.8	< 0.1	<0.1	ND	ND	<0.1	<0.10	<0.10	<0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	<0.10
Tin	ug/L	2	-	-	< 2	< 2	< 2	< 2	< 2	< 2	<2	<2	<20	< 2	<2	ND	ND	<2.0	<2.0	<2.0	<2.0	<2	<2	<2	<2	<2	<2	<2.0	<2.0
Titanium	ug/L	2	-	-	-	-	-	-	-	-	-	-	-	< 2	<2	ND	2	<2.0	<2.0	<2.0	<2.0	<2	<2	<2	<2	<2	<2	<2.0	<2.0
Uranium	ug/L	0.1	-	3000	1	3	2.9	4.3	2.7	3	3	2.8	2.98	9.8	5.9	4.6	15	13	<0.10	4.40	10.6	18.2	3.1	9.5	9.6	14	15.9	17	9.8
Vanadium	ug/L	2	-	60	< 2	2	2	< 2	2	2	<2	<2	<2	< 2	<2	ND	ND	<2.0	<2.0	<2.0	<2.0	3	<2	2	<2	<2	<2	<2.0	<2.0
Zinc	ug/L	5	-	300	< 10	18	5	11	6	14	7	6	4	5	<5	ND	ND	12.5	<5.0	23.3	<5.0	<5	8	6	10	6	<5	<5.0	<5.0

Notes:

RDL - Reported Detection Limit (updated in 2016, except for Mercury)

Bold indicates exceedance of NS Tier 1 EQS

Bold and shaded indicates exceedance of NS Tier 2 EQS

Shaded and italics indicates the detection limit exceeds NS Tier 2 PSS

NS Tier 1 EQS = Nova Scotia Tier 1 EQS for groundwater, commercial/industrial, non-potable, coarde grained (NSE 2013a)

NS Tier 2 PSS = Nova Scotia Tier 2 Pathway Specific Standard for groundwater >10 m from fresh surface water (NSE 2013b)

TABLE C-12 GROUNDWATER METALS CHEMISTRY - TH-1
Municipality of the County of Kings
Meadowview Landfill, Kentville, NS
Stantec Consulting Ltd. Project No. 121414186

Compound	Units	RDL*	NS Tier 1 EQS	NS Tier 2 PSS	Sep-93	19-Mar-96	16-Apr-97	6-Apr-98	5-May-99	26-Jul-00	Aug-01	Sept-02	19-Aug-03	25-Aug-04	25-Aug-04 Lab DUP	18-Aug-05	23-Nov-06	16-Aug-07	28-Jul-08	28-Jul-08 Dup-B	10-Aug-09	27-Jul-10	21-Sep-11	4-Oct-12	4-Jul-13	20-Aug-14	22-Jul-15	14-Jul-16	19-Jul-17
Aluminum	ug/L	5	-	50	5	**70**	< 10	< 10	< 10	**130**	<50	<20	< 10	*<100*	*<100*	ND	ND	<5.0	<5.0	<5.0	<5.0	<10	<10	<5	37	5	<5	<5.0	<5.0
Antimony	ug/L	1	-	200	4	< 2	< 2	< 2	< 2	< 20	<20	<0.4	< 2	<20	<20	ND	ND	<2.0	<2.0	<2.0	<2.0	<2	<2	<2	<2	<2	<2	<1.0	<1.0
Arsenic	ug/L	1	-	50	43	26	34	8	27	27	30	22.6	10	<20	<20	11	4	35.9	49.7	43.1	36	35	25	10	28	33	21	26	24
Barium	ug/L	1	-	10000	3800	3300	3400	2800	2800	3100	3100	2460	2000	1600	1700	1400	1200	1500	1400	1400	1370	1030	1210	1090	1030	1170	1130	1000	970
Beryllium	ug/L	1	-	53	< 5	< 5	< 5	< 5	< 5	< 50	<50	<0.5	< 2	<20	<20	ND	ND	<2.0	<2.0	<2.0	<2.0	<2	<2	<2	<2	<2	<2	<1.0	<1.0
Bismuth	ug/L	2	-	-	-	-	-	-	-	-	-	-	< 2	<20	<20	ND	ND	<2.0	<2.0	<2.0	<2.0	<2	<2	<2	<2	<2	<2	<2.0	<2.0
Boron	ug/L	50	-	12000	1200	1000	950	1000	920	900	870	650	610	630	670	500	450	351	344	350	323	363	254	365	2210	244	240	220	210
Cadmium	ug/L	0.01	-	0.1	**0.5**	**1**	*< 0.3*	*< 0.3*	*< 0.3*	*< 1*	0.1	*<0.3*	*< 0.3*	*<3*	*<3*	ND	ND	<0.017	0.059	0.047	0.089	<0.3	**1**	<0.017	<0.017	<0.017	0.023	<0.010	<0.010
Chromium	ug/L	1	-	-	7	5	5	4	7	< 20	<20	<2	3	<20	<20	3.3	3	<2.0	3.4	2.2	1.7	<2	<2	1	7	<1	1	<1.0	<1.0
Cobalt	ug/L	0.4	-	100	21	17	18	14	14	12	16	10	16	12	13	9.9	16	7.89	11.2	10.7	8.29	4	5	4	6	6	4	6.3	4.1
Copper	ug/L	2	-	20	< 10	7	< 2	2	< 2	< 20	<20	15	< 2	<20	<20	ND	ND	<2.0	4.1	2.1	<2.0	<2	<2	<2	<2	<2	<2	<2.0	<2.0
Iron	ug/L	50	-	3000	**25300**	**13000**	**23000**	120	**13000**	**23000**	**26000**	**15200**	80	<500	<500	1700	78	**14100**	**12100**	**11900**	**11600**	**8630**	**9710**	<50	**11800**	**10400**	**14000**	**12000**	**13000**
Lead	ug/L	0.5	-	10	0.3	1	0.2	< 0.5	< 0.5	< 5	<5	<1	< 0.5	<5	<5	ND	ND	<0.50	<0.50	<0.50	<0.50	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50
Manganese	ug/L	2	-	8200	1740	1400	1600	1400	1300	1500	1500	1280	1100	990	1000	950	750	855	774	759	841	774	1030	1000	913	914	1200	1100	990
Mercury	ug/L	0.026	-	0.26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.026	<0.026	<0.026	-	-
Molybdenum	ug/L	2	-	730	2	2	2	< 2	< 2	< 20	<20	<4	2	<20	<20	ND	4	<2.0	4.9	4.8	<2.0	<2	<2	<2	<2	<2	<2	<2.0	<2.0
Nickel	ug/L	2	-	250	41	29	33	21	18	< 20	21	16	25	<20	<20	15	25	10.8	21.8	20.3	8.9	6	5	5	9	5	4	6.5	4.7
Selenium	ug/L	1	-	10	< 2	< 2	< 2	< 2	< 2	< 10	<10	2	< 2	<20	<20	ND	ND	<1.0	<1.0	<1.0	<1.0	<2	<2	1	<1	<1	4	<1.0	<1.0
Silver	ug/L	0.1	-	1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 5	<1	<2	< 0.5	<5	<5	ND	ND	<0.10	<0.10	<0.10	<0.10	<0.5	<0.5	<0.1	<0.1	<0.1	<0.1	<0.10	<0.10
Strontium	ug/L	2	-	210000	920	790	840	800	770	860	840	873	690	570	590	520	470	439	429	415	425	430	434	413	384	376	400	400	380
Thallium	ug/L	0.1	-	8	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 1	<1	<0.8	< 0.1	<1	<1	ND	ND	<0.10	<0.10	<0.10	<0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	<0.10
Tin	ug/L	2	-	-	3	3	2	2	2	< 20	<20	<20	2	<20	<20	ND	3	<2.0	<2.0	<2.0	<2.0	<2	<2	<2	<2	<2	<2	<2.0	<2.0
Titanium	ug/L	2	-	-	-	-	-	-	-	-	-	-	< 2	<20	<20	ND	ND	<2.0	<2.0	<2.0	<2.0	<2	<2	<2	<2	<2	<2	<2.0	<2.0
Uranium	ug/L	0.1	-	3000	0.5	1	0.4	0.2	0.2	< 1	<1	0.18	0.2	<1	<1	0.1	0.5	<0.10	0.15	0.13	<0.10	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.10	<0.10
Vanadium	ug/L	2	-	60	2	2	3	< 2	< 2	< 20	<20	4	< 2	<20	<20	ND	ND	<2.0	<2.0	<2.0	<2.0	3	3	<2	<2	<2	<2	<2.0	<2.0
Zinc	ug/L	5	-	300	180	44	12	6	9	27	<20	7	7	<50	<50	ND	ND	27.6	6.4	17.6	<5.0	8	<5	6	15	<5	<5	<5.0	<5.0

Notes:

RDL - Reported Detection Limit (updated in 2016, except for Mercury)

Bold indicates exceedance of NS Tier 1 EQS

Bold and shaded indicates exceedance of NS Tier 2 EQS

Shaded and italics indicates the detection limit exceeds NS Tier 2 PSS

NS Tier 1 EQS = Nova Scotia Tier 1 EQS for groundwater, commercial/industrial, non-potable, coarde grained (NSE 2013a)

NS Tier 2 PSS = Nova Scotia Tier 2 Pathway Specific Standard for groundwater >10 m from fresh surface water (NSE 2013b)

Table C.13 - SW-1 Surface Water Inorganic Chemistry & Metals

Compound	Units	DL	Tier 1 EQS Fresh Water	CCME-FAL	May-96	Sep-96	Nov-96	May-97	Oct-97	Sep-98	Jul-00	1-Aug	1-Aug Duplicate	2-Sep	1-Aug-03	25-Aug-04	14-Jan-06	23-Nov-06	1-Aug-07	11-Aug-09	1-Jul-13	19-Jul-17
Alkalinity (as CaCO3)	mg/L	5	-	-	35	69	40	38	57	55	60	62	63	52	57	64	27	46	57	57		65
Ammonia (as N)	mg/L	0.05	-	2.22 (3)	< 0.05	0.11	< 0.05	< 0.05	0.09	0.09	0.15	0.15	0.15	<0.1	0.08	<0.05	0.05	0.14	0.06	0.08		0.10
Anion Sum	me/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.46	1.55	2.19	2.8	2.78		2.81
Bicarbonate (as CaCO3)	mg/L	1	-	-	34.9	68.8	39.9	37.9	56.9	54.9	60	62	62	51.66	57	64	27	46	56	57		65
Calcium	mg/L	0.1	-	-	22.4	32.1	22.7	22.7	38	35	29.3	29.3	28.9	30.7	31.1	38.8	18	28	34	32		33
Carbonate (as CaCO3)	mg/L	1	-	-	< 0.1	< 1	< 1	< 1	0.1	0.1	< 1	<1	<1	0.31	< 1	<1	<1	ND	<1	<1		<1.0
Cation Sum	me/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.46	1.64	2.30	3.01	2.70		2.72
Chloride	mg/L	1	-	120	19.5	30.4	18.5	18.2	57	145	155	34.9	34.9	32	30	43	22	26	38	38		32
Color	TCU	5	-	(1)	30	20	29	34	18	17	71	8	6	73	21	9	23	18	12	19		12
Conductivity (RCAp)	uS/cm	1	-	-	188	273	197	200	400	778	690	274	273	291	279	387	160	230	290	290		280
Dissolved Organic Carbon	mg/L	-	-	-	5.5		3.6	5.6	1.5	2.8	6.9	1.4	1.4	6		1.9	-	-	-	-		-
Hardness (as CaCO3)	mg/L	-	-	-	67	95	69	68.2	118	132	96.2	88.8	87.8	9.29	93.3	114	55	85	100	94		98
Ion Balance	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.06	2.66	2.25	3.61	1.46		1.63
Langelier Index (@ 20C)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-0.46	-2.08	-0.860	-0.478	-0.567		-0.376
Langelier Index (@ 4C)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-0.86	-2.33	-1.11	-0.728	-0.817		-0.627
Magnesium	mg/L	0.1	-	-	2.7	3.6	3	2.8	5.5	10.9	5.6	3.8	3.8	3.31	3.8	4.1	2.5	3.5	4.2	3.6		3.7
Nitrate	mg/L	0.05	-	13	-	-	-	-	-	-	-	-	-	-	-	1.83	1.6	1.9	-	1.8		0.013
Nitrate + Nitrite (as N)	mg/L	0.05	-	-	1.69	1.74	1.66	1.12	1.81	1.52	< 0.05	1.91	1.95	2.09	1.9	1.9	1.6	1.9	1.9	1.9		2.0
Nitrite	mg/L	0.01	-	0.06	-	-	-	-	-	-	-	-	-	-	-	0.07	ND	0.02	-	0.02	0.11	2.0
Orthophosphate	mg/L	0.01	-	-	0.05	0.09	0.05	0.03	0.08	0.1	0.11	0.04	0.03	<0.3	0.09	0.18	0.04	0.06	0.05	0.05		0.011
pH	-	-	-	(6.5-9.0)	7.3	7.4	7.2	7.5	7.4	7.4	7.1	7.8	7.9	7.8	7.5	7.6	6.58	7.39	7.61	7.55		7.67
Phosphorus	mg/L	0.2	-	(4)	-	-	-	-	-	-	-	-	-	-	-	0.2	<0.1	0.1	-	<0.1		0.120
Potassium	mg/L	0.1	-	-	1.3	2.6	1.8	1.6	3.6	6	3.9	2.2	2.2	3.1	2.9	3.4	1.9	2.2	2.6	2.2		2
Reactive Silica (as SiO2)	mg/L	0.5	-	-	5.4	7.4	8.8	4.3	5.6	7.6	6.5	5.3	5.3	8.9	10	5.8	6.5	9.4	6.4	8.3		6.4
Saturation pH (@ 20C)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.06	8.66	8.25	8.09	8.12		8.04
Saturation pH (@ 4C)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.46	8.91	8.50	8.34	8.37		8.29
Sodium	mg/L	0.1	-	-	9.9	14.8	9.4	10.8	31	76.7	91	15.2	14.8	13.5	16.4	25.1	11	12	20	17		16
Sulphate	mg/L	2	-	-	18	21	25	17	29	41	9	19	19	28.6	18	40	13	19	23	20		22
TDS (Calculated)	mg/L	1	-	-	-	-	-	-	-	-	337	156	156	153.4	155	207	99	138	171	165		160
Total Organic Carbon (C)	mg/L	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-		5.1	3.3	2.6	3.1		2.5
Turbidity	NTU	0.1	-	(2)	4.1	1.3	1.9	1.6	4.4	4.2	1.8	2.2	2.1	7.1	4.9	2.7	10	2.8	8.8	1.6		5.3
			-																			
Aluminum	ug/L	10	5	100 (5)	**76**	**64**	**85**	**39**	**319**	**1000**	**1900**	**39**	**33**	**70**	**10**	**10**	**160**	**200**	**169**	**50.5**	**285**	**190**
Antimony	ug/L	2	20	-	< 2	< 2	< 2	< 2	-	< 20	< 2	<2	<2	<0.4	< 2	<2	ND	ND	<2.0	<2.0	<2	<1.0
Arsenic	ug/L	2	5	5	< 2	< 2	< 2	< 2	-	< 20	3	<2	2	1.9	2	2	ND	ND	<2.0	<2.0	<2	1.5
Barium	ug/L	5	1000	-	23	49	**3000**	19	40	53	210	41	42	43.3	32	36	21	31	33.5	34.6	30	34
Beryllium	ug/L	2	5.3	-	< 5	< 5	< 5	< 5	< 5	< 5	< 5	<5	<5	<0.5	< 2	<2	ND	ND	<2.0	<2.0	<2	<1.0
Bismuth	ug/L	2	-	-	-	-	-	-	-	-	-	-	-	-	< 2	<2	ND	ND	<2.0	<2.0	<2	<2.0
Boron	ug/L	5	1200	1500	12	19	8	10	20	54	32	16	17	<100	16	22	11	12	15.2	14.0	21	<50
Cadmium	ug/L	0.3	0.01	0.09	**< 0.3**	**< 0.3**	**< 0.3**	**< 0.3**	**< 5**	**< 3**	**0.3**	**0.02**	**0.02**	**<0.3**	**< 0.3**	**<0.3**	ND	ND	**<0.017**	**0.026**	**<0.017**	<0.010
Chromium	ug/L	2	-	8.9	< 2	< 2	< 2	< 2	< 5	32	3	<2	<2	<2	< 2	<2	ND	ND	<2.0	<1.0	<1	<1.0
Cobalt	ug/L	1	10	-	< 1	< 1	< 1	< 1	< 5	**< 10**	1	<0.4	<0.4	<1	< 1	<1	ND	ND	<0.40	<0.40	<1	<0.40
Copper	ug/L	2	2	(6)	**19**	< 2	< 2	< 2	**< 10**	**< 20**	**9**	<2	<2	**3**	< 2	<2	ND	ND	<2.0	<2.0	**3**	<2.0
Iron	ug/L	50	300	300	**310**	**600**	270	**330**	**480**	**2500**	**3600**	**510**	**490**	**740**	**510**	120	210	**610**	**425**	**426**	**760**	**650**
Lead	ug/L	0.5	1	(6)	0.2	0.2	0.2	< 1	**< 2.5**	**< 5**	**19**	<0.5	<0.5	<1	< 0.5	<0.5	ND	ND	<0.50	<0.50	<0.5	<0.50
Manganese	ug/L	2	820	-	45	140	41	19	150	230	400	190	170	236	290	50	12	86	62	107	99	120
Molybdenum	ug/L	2	73	73	< 2	< 2	< 2	< 2	< 10	< 20	< 2	3	3	<4	< 2	<2	ND	ND	<2.0	<2.0	<2	<2.0
Nickel	ug/L	2	25	25-150 (6)	47	< 2	< 2	< 2	< 10	< 20	2	<2	<2	<3	< 2	<2	ND	ND	<2.0	<2.0	<2	<2.0
Selenium	ug/L	2	1	1	**< 2**	**< 2**	**< 2**	**< 2**	-	**< 20**	< 1	<1	<1	<1	**< 2**	**<2**	ND	ND	<1.0	<1.0	<1	<1.0
Silver	ug/L	0.5	0.1	0.25	**< 0.5**	**< 0.5**	**< 0.5**	**< 0.5**	**< 3**	**< 5**	**< 0.5**	<0.1	<0.1	**<2**	**< 0.5**	**<0.5**	ND	ND	<0.10	<0.10	<0.1	<0.10
Strontium	ug/L	5	21000	-	75	100	71	72	-	170	140	100	100	159	110	170	57	88	108	111	109	120
Thallium	ug/L	0.1	0.8	0.8	< 0.1	< 0.1	< 0.1	< 0.1	-	**< 1**	< 0.1	<0.1	<0.1	<0.8	< 0.1	<0.1	ND	ND	<0.10	<0.10	<0.1	<0.10
Tin	ug/L	2	-	-	< 2	< 2	< 2	< 2	< 50	< 20	< 2	<2	<2	<20	< 2	<2	ND	ND	<2.0	<2.0	<2	<2.0
Titanium	ug/L	2	-	-	-	-	-	-	-	-	-	-	-	-	< 2	<2	6	7	4.0	<2.0	6	4.9
Uranium	ug/L	0.1	300	15	0.5	0.7	0.4	0.6	-	< 1	1	0.9	1	0.57	0.5	1	0.2	0.7	0.68	0.73	0.7	1.1
Vanadium	ug/L	2	6	-	< 2	< 2	< 2	< 2	**< 10**	**< 20**	**7**	<2	<2	<2	< 2	<2	ND	ND	<2.0	<2.0	<2	<2.0
Zinc	ug/L	5	30	30	13	8	13	< 2	< 10	< 20	**80**	4	3	4	< 5	<5	ND	6	5.4	6.1	<5	<5.0
Fluoride	mg/L	5	-	0.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.4	-
Hydroxide	mg/L	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<5	-

Notes:
RDL – Reported Detection Limit
CCME FWAL = Canadian Council of Ministers of the Environment – Freshwater Aquatic Life Long Term Exposure
Tier 1 EQS = Tier 1 Environmental Quality Standards For Surface Water. From Nova Scotia's Contaminated Sites Regulations (July 2013) Notification of Contamination Protocol, Table 3; Fresh Water
Grey indicates exceedance in CCME FWAL
Bold = indicates value exceeds the Tier 1 EQS
#[R]: Reporting limit increased due to turbidity
(1) The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration
(2) High flow or turbid waters: Maximum increase of 8 NTUs from background levels at any one time when background levels are between 8 and 80 NTUs. Should not increase more than 10% of background levels when background is > 80 NTUs.
(3) For ph of 7.5 and temperature of 15.
(4) Refer to CCME Fact Sheet - Phosphorus: Canadian Guidance Framework for the Management of Freshwater Systems
(5) Guideline value dependent on pH. Value given is for pH ≥ 6.5
(6) Guidelines requiring equations were calculated by the CCME website, using water hardness values to determine guidelines

Appendix D
Groundwater Chemistry Trend Analysis

Figure D-1: Area 1 - Ammonia
Meadowview Landfill, Kentville, NS

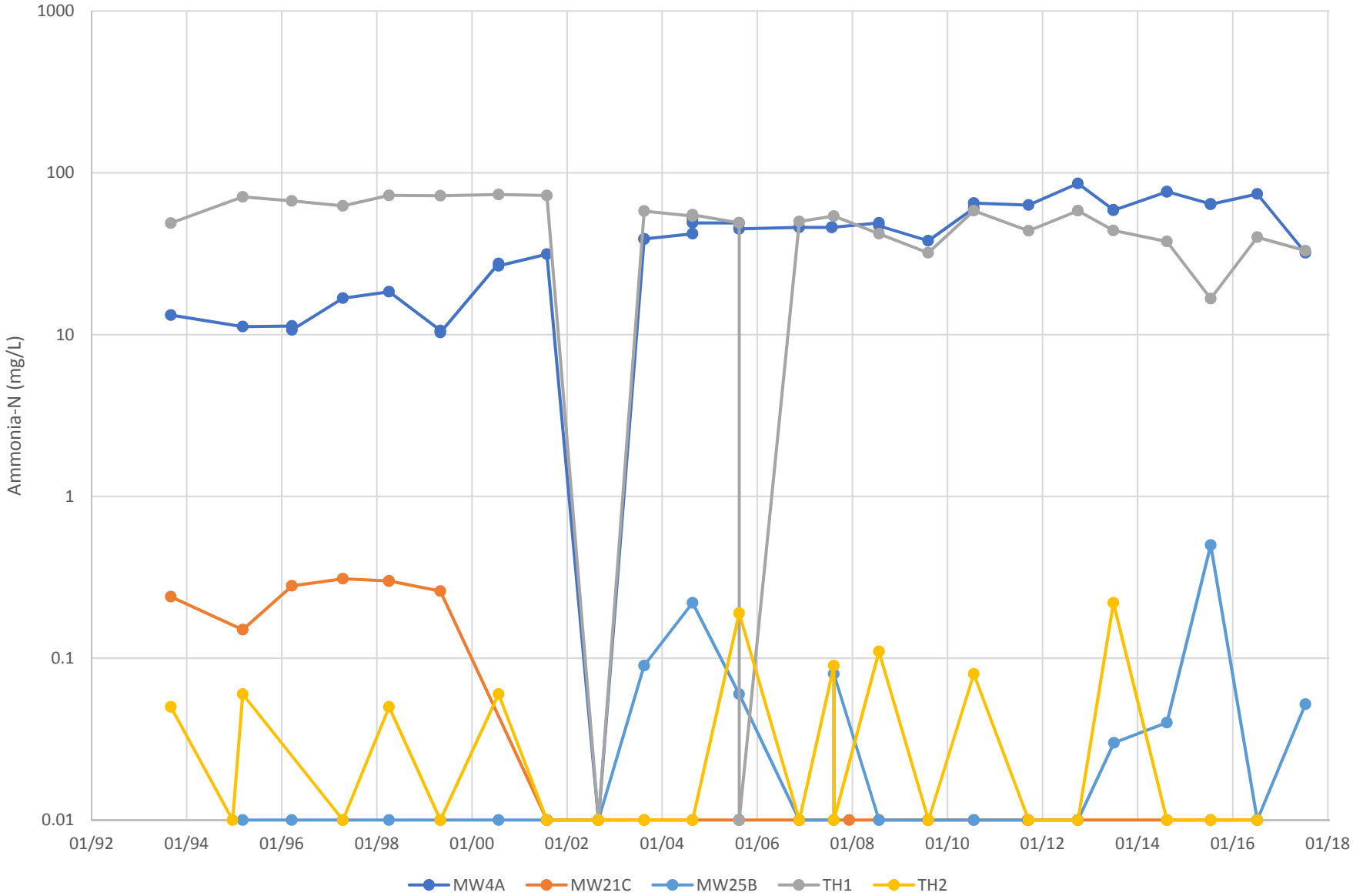


Figure D-2: Area 2 - Ammonia
Meadowview Landfill, Kentville, NS

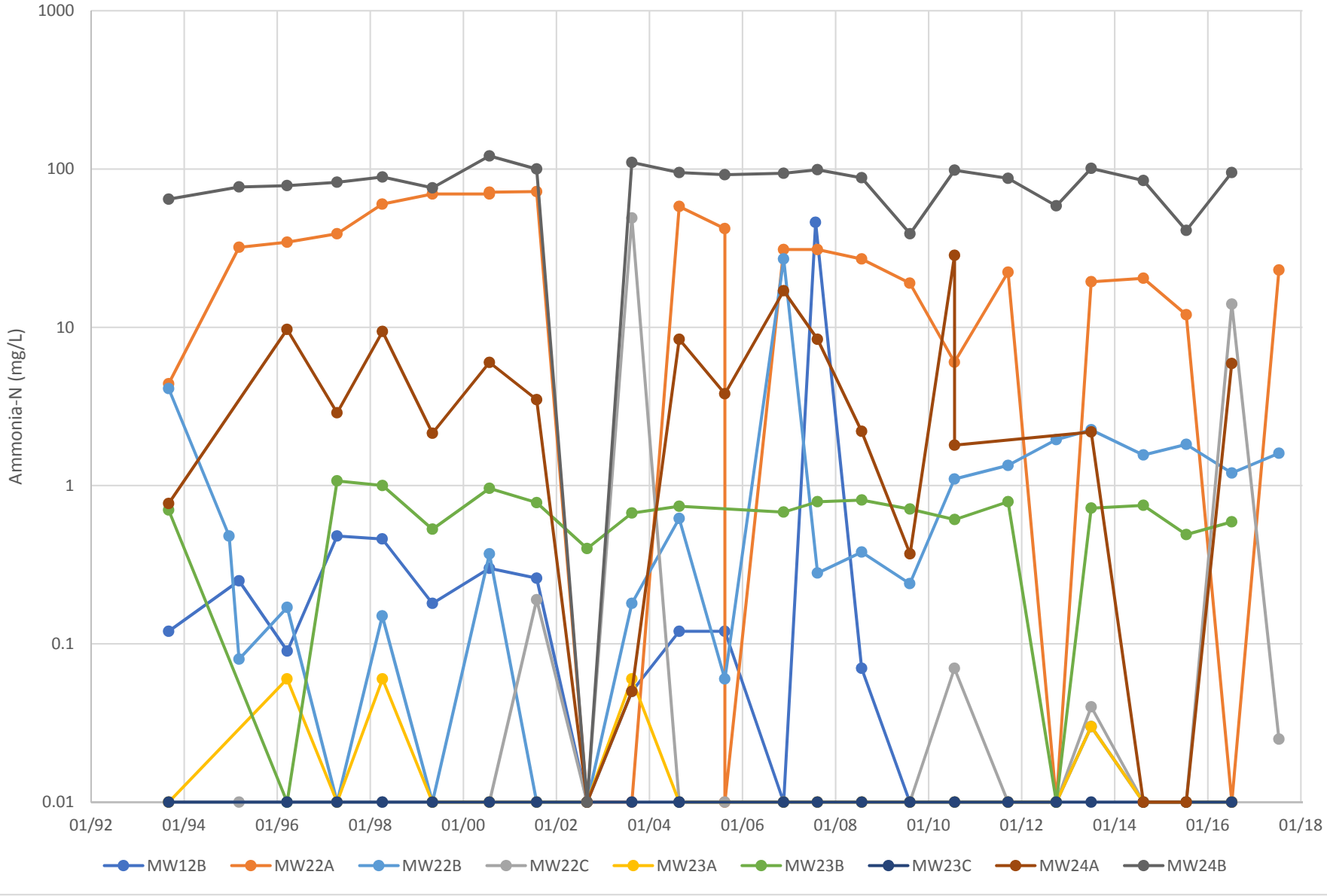


Figure D-3: Area 1 - Chloride
Meadowview Landfill, Kentville, NS

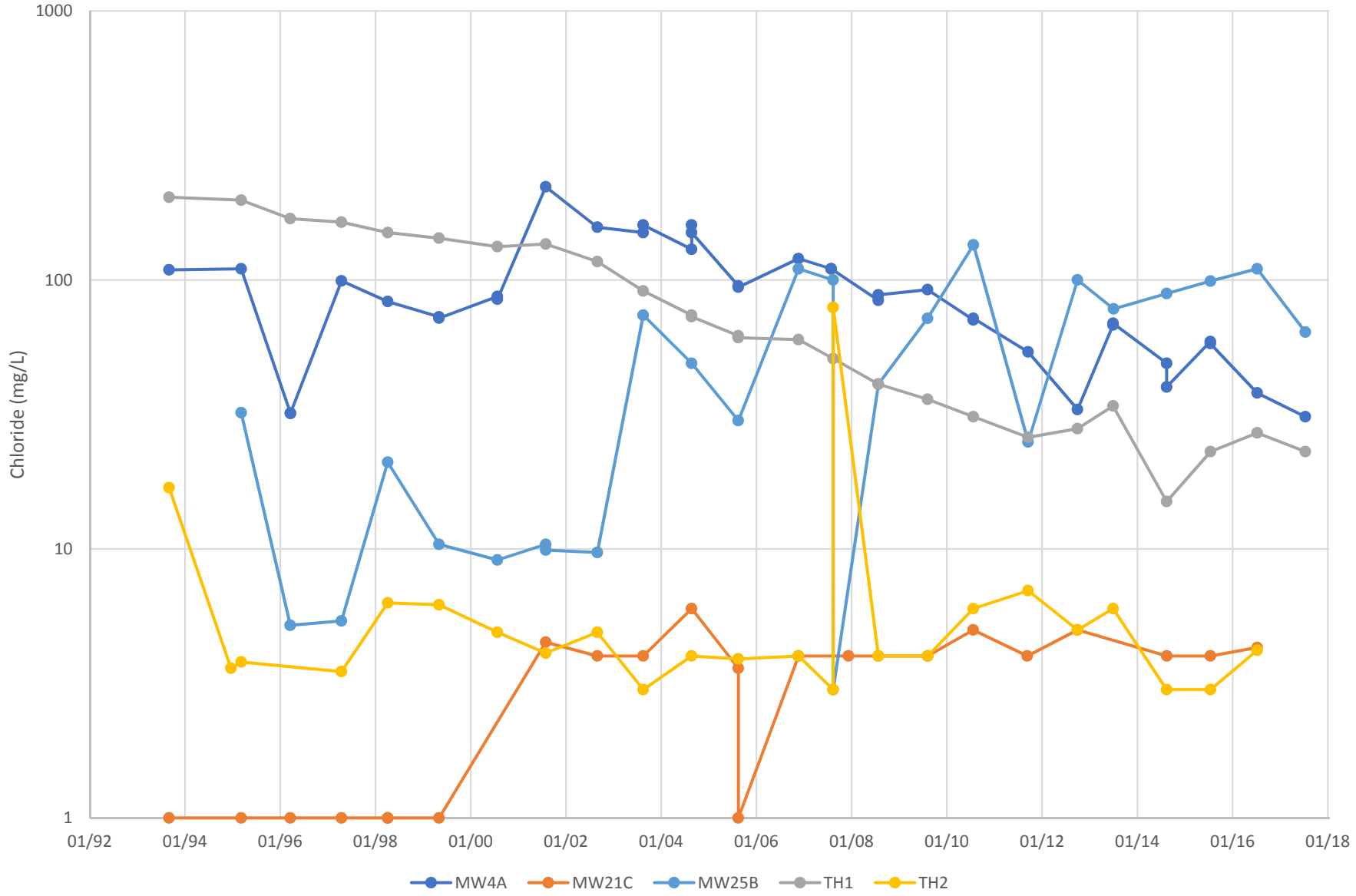


Figure D-4: Area 2 - Chloride
Meadowview Landfill, Kentville, NS

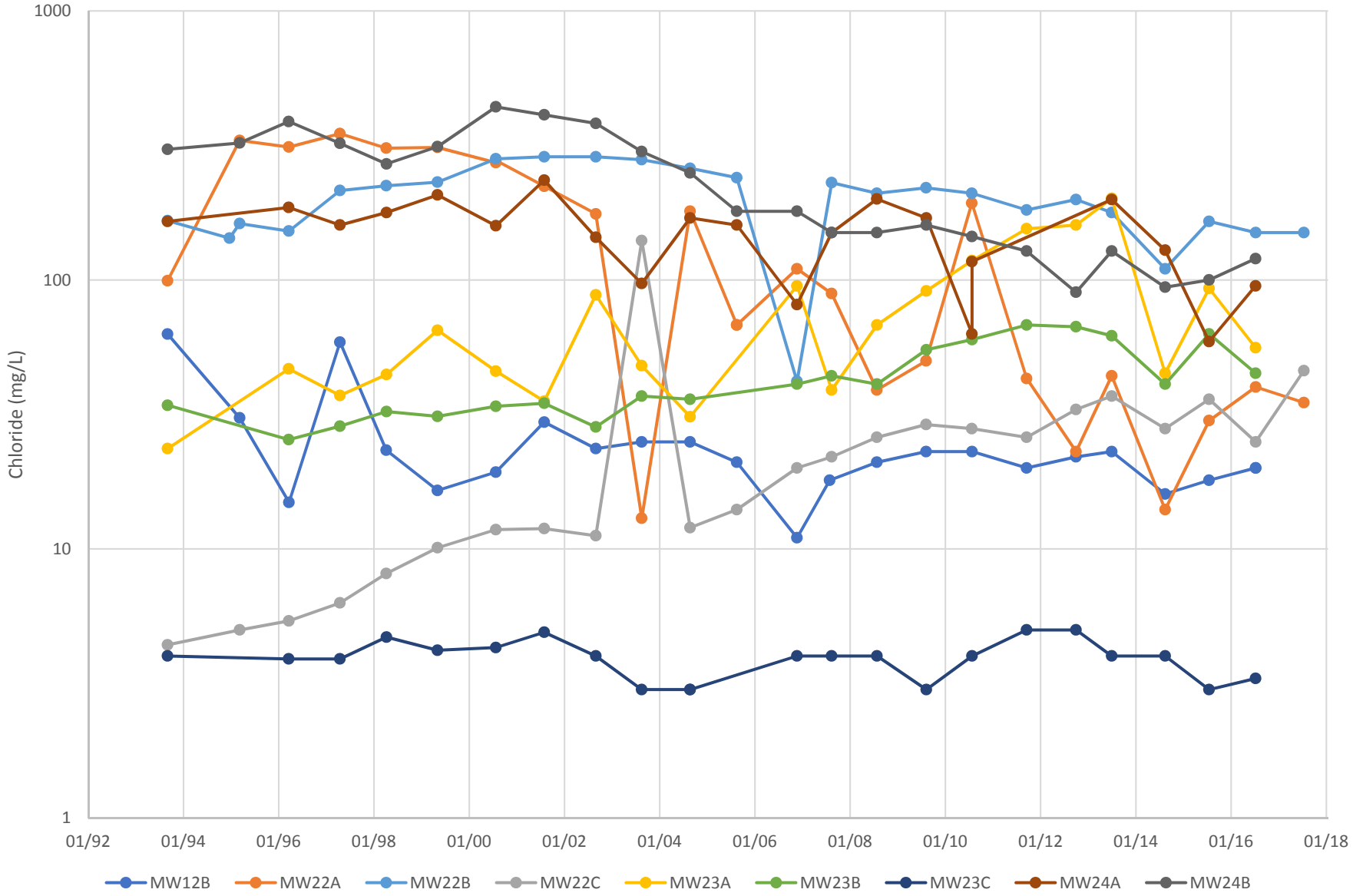


Figure D-5: Area 1 - Conductivity
Meadowview Landfill, Kentville, NS

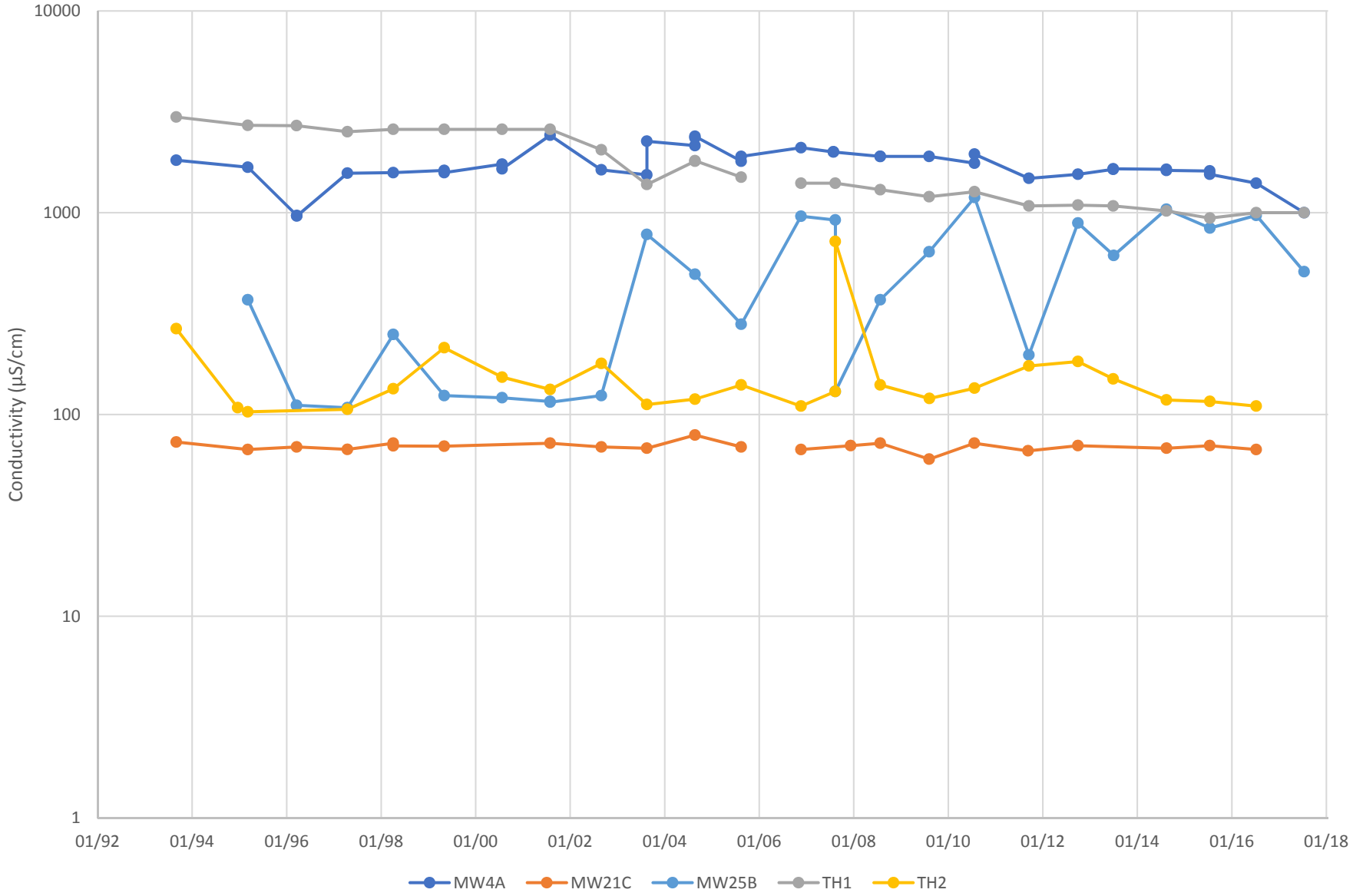


Figure D-6: Area 2 - Conductivity
Meadowview Landfill, Kentville, NS

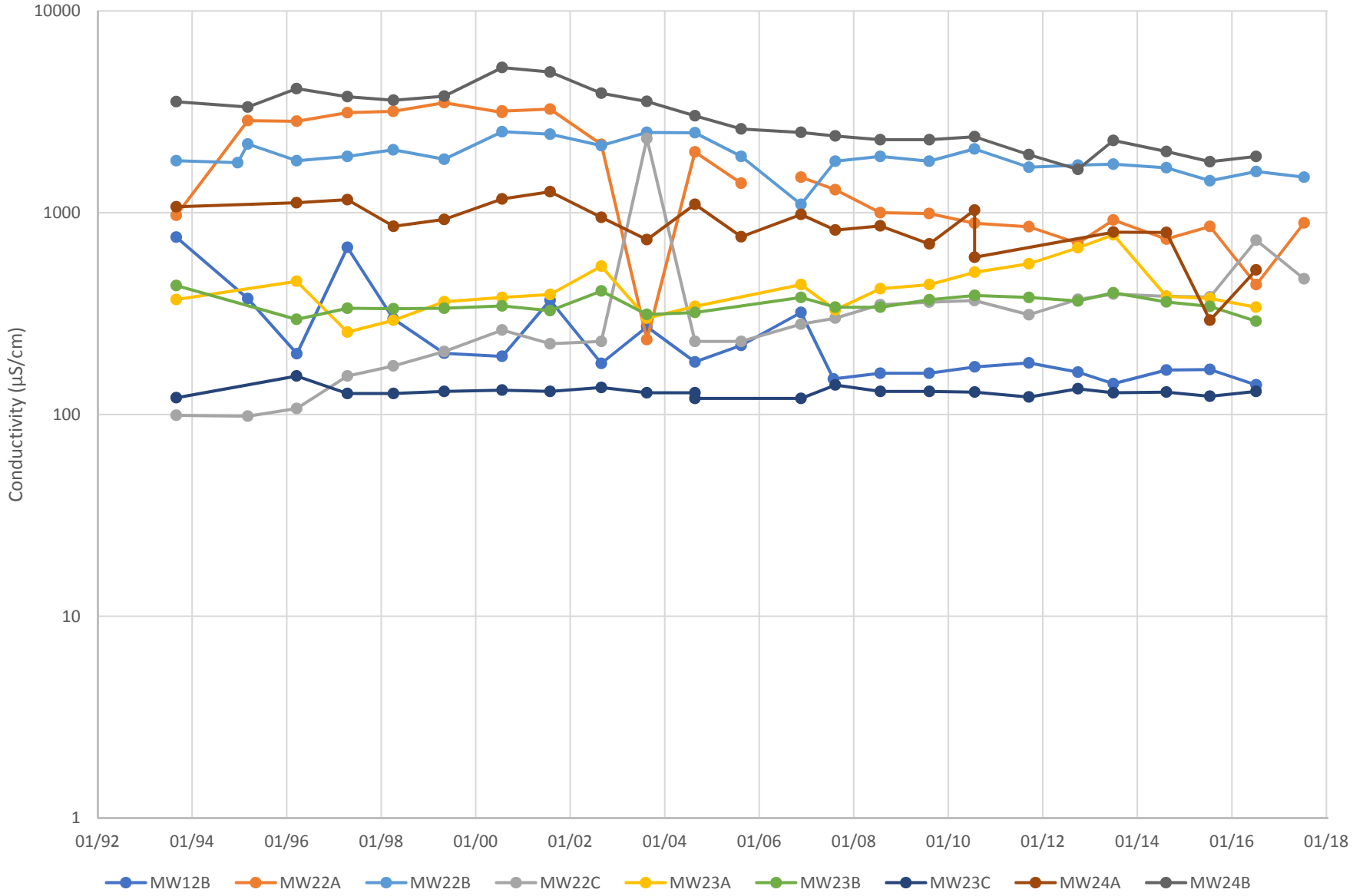
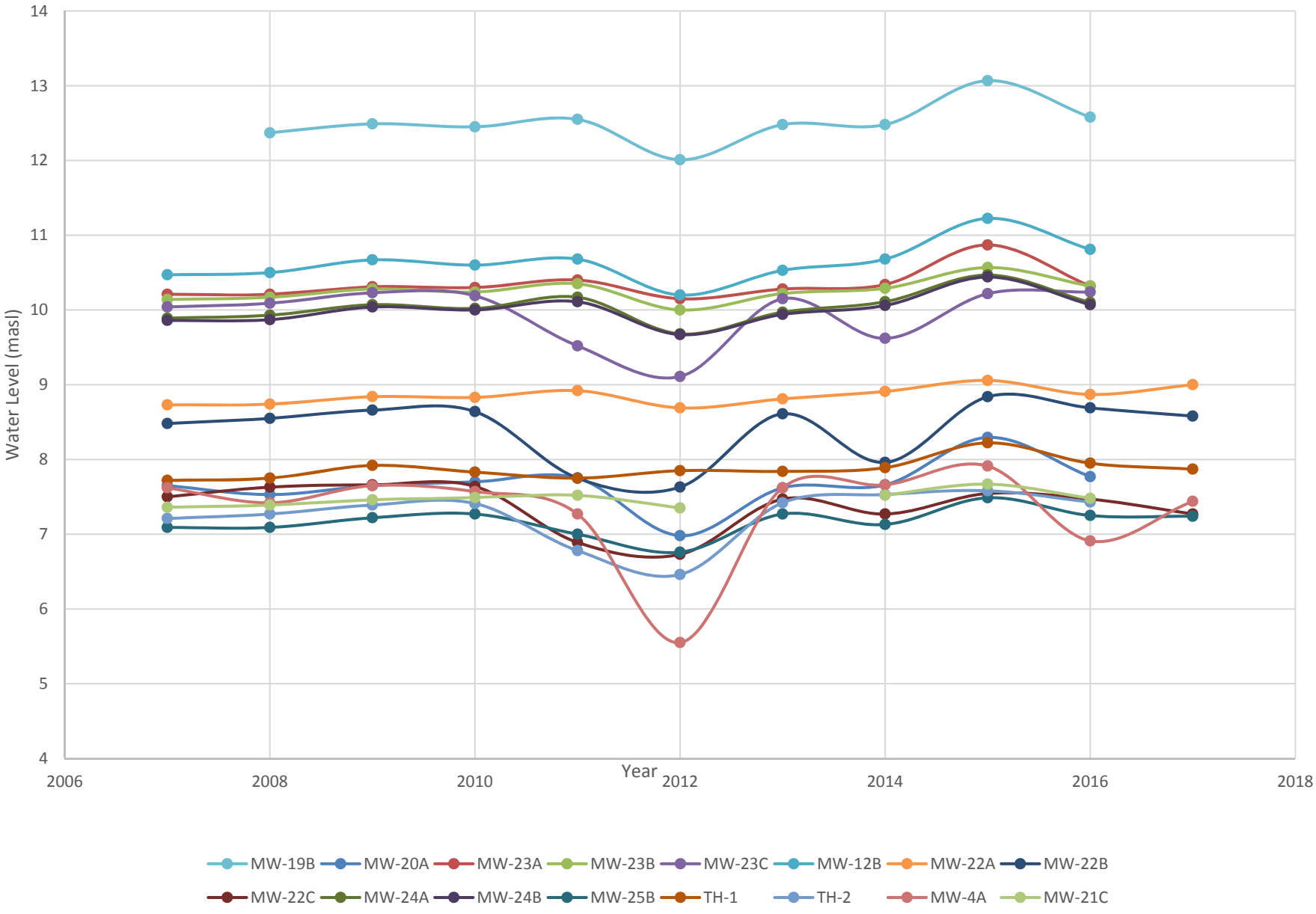


Figure D-7 - Historical Results of Groundwater Elevation in Down-gradient Monitoring Wells



Appendix E
Fish And Benthic Invertebrate Data

Table E-1 Summary of Water Quality Measurements at the Fish Habitat Sampling Sites

	SW7	SW7A	Reference	CCME Water Quality Guidelines for the Protection fo Aquatic LIfe (Freshwater)(FAL)
Time (24 hr) on July 18	10:30	10:15	9:00	N/A
Water Temperature (°C)	13.65	13.92	13.42	Thermal additions to receiving waters should be such that short-term exposure to maximum temperature is not exceeded, while long-term exposures should not exceed maximum weekly average temperatures.
pH (pH units)	6.79	6.44	8.72	6.5-9.0
Dissolved Oxygen (mg/L)	4.32	4.57	9.23	Lowest acceptable dissolved oxygen concentration: for warm water biota: early life stages = 6 mg/L, for warm water biota: other life stages = 5.5 mg/L ,for cold water biota: early life stages = 9.5 mg/L, for cold water biota: other life stages = 6.5 mg/L
Conductivity (mS/cm)	0.177	0.38	0.085	No Data
Turbidity (NTU)	0	0	0	No Data

Table E-2 Sampling Information for Fish Traps

Minnow Trap Site (2 traps each)(Y)	Start Time (July 18, 2017)	End Time (July 19, 2017)	Total Time in Minutes	Total Time in Hours (Z)	Total Fish Caught in Trap (X)	Catch per Unit Effort (Fish per trap per hour) = X/Y/Z
SW7	10:30	12:15	1545	25.75	1	0.02
SW7A	10:15	13:15	1620	27.00	4	0.07
Reference (Black Brook)	9:00	10:45	1545	25.75	4	0.08

Table E-3 Summary of Fish Captures

Site	Species Caught	Number Caught (2015)	Number Caught (2016)	Number Caught (2017)	Comments (2017 Fork Lengths)
SW7	*Gasterosteus* sp.	0	1	3	46, 47, 58 mm
	Banded Killifish	0	0	1	63 mm (Total Length)
SW7A	*Gasterosteus* sp.	12	7	4	47, 50, 50, 51 mm
REF	*Gasterosteus* sp.	9	1	3	45, 46, 47 mm
	Brook Trout	1	0	0	-
	White-nosed sucker	0	0	0	-
Total Individuals Caught		22	9	11	
Total Number of Species Caught		2	1	2	In addtion to fish caught, 3+ salmonids (likely Brook trout) were observed during sampling at REF site.

Table E-4 Summary of benthic macroinvertebrates (BMI) sampled (2014-2016)

Taxa	Refererence				SW7				SW7A			
	2015*	2016	2017	Mean	2015*	2016	2017	Mean	2015*	2016	2017	Mean
Acariformes (Acarina)	20	0	0	10	1	0	0	1	-	0	0	1
Amphipoda	10	144	288	113	2	2	0	2	-	0	0	0
Bivalvia	6	0	0	2	11	0	0	12	1	0	0	0
Coelenterata	6	0	0	3	1	0	0	0	1	0	0	0
Coleoptera	-	14	32	8	-	14	0	14	-	4	0	4
Collembola	2	0	0	1	-	22	4	22	-	8	4	8
Copepoda	13	10	16	11	18	8	12	19	15	36	112	47
Diptera	209	354	1936	664	225	682	268	345	68	1052	816	520
Ephemeroptera	31	10	64	47	4	18	12	14	-	0	0	0
Eulamellibranchia	-	0	0	0	-	0	0	0	-	0	0	0
Gastropoda	-	4	0	4	-	0	0	1	-	0	0	0
Hemiptera	-	8	0	8	-	2	0	2	-	0	0	0
Hirudinea	1	4	8	3	-	0	0	0	-	0	24	0
Hydrachnidia	-	144	608	144	-	4	12	4	-	20	8	20
Megaloptera	1	2	8	2	5	70	4	21	5	164	176	87
Nematoda	6	0	0	4	2	10	0	4	2	0	0	1
Odonata	-	2	8	2	-	0	0	0	-	0	0	0
Oligochaeta	3	10	96	29	102	86	116	80	213	328	416	255
Ostracoda	3	0	0	2	40	126	36	54	51	128	32	70
Other	-	4	24	4	-	2	0	2	-	0	0	0
Plecoptera	4	84	240	83	-	0	0	0	-	0	0	0
Sphaeriidae	-	24	128	24	-	196	272	196	-	272	336	272
Trichoptera	12	20	80	30	-	4	4	4	-	0	4	2
Abundance (total # of organisms)	327	838	3536	493	411	1246	740	667	356	2012	1928	892
% EPT	14	14	11	19	1	2	2	3	-	0	0	0
% Diptera	64	42	55	52	55	55	36	56	19	52	42	39
Diptera : EPT Ratio	4	3	5	4	56	31	17	35	68	1052	204	441
Taxon Richness (# of taxa, excluding Other) [1]	28	29	29	28	16	26	13	19	9	16	15	13

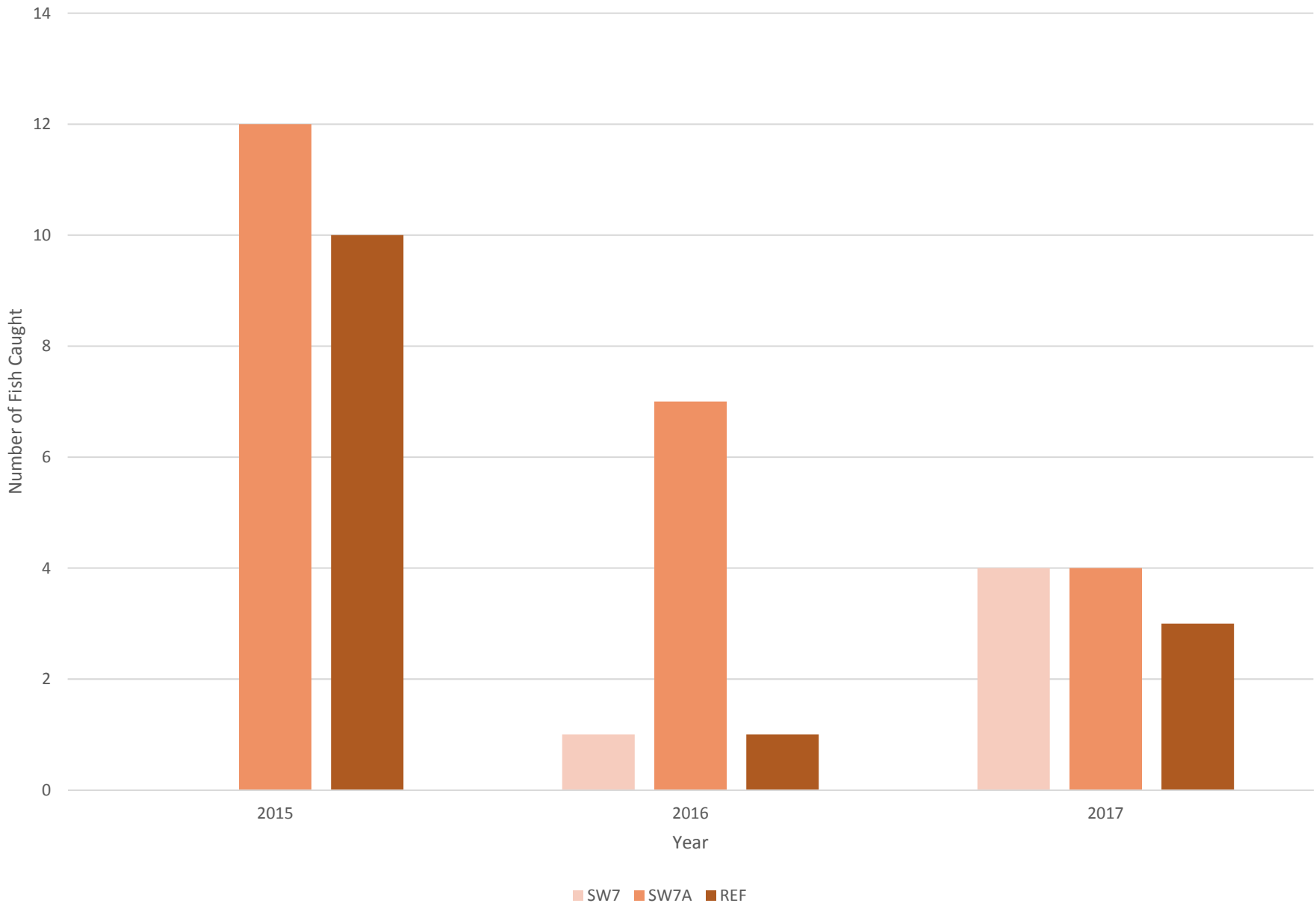
* denotes data from previous assessments as presented in WSP 2014,2015

[1] - Taxon list is condensed , full list available within Envirosphere 2017 BMI report (Appendix H). Total values as reported within BMI report.

Table E-5 Complete WQM Measurements at Fish Habitat Sampling Sites

Date	Time	Site	Water Temperature (°C)	pH (pH units)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	Conductivity (ms/cm)	Oxygen-reduction Potential (ORP)(mV)
18-Jul-17	10:30	SW7	13.65	6.79	4.32	0	0.177	0.6
18-Jul-17	10:15	SW7A	13.92	6.44	4.57	0	0.38	-126
18-Jul-17	9:00	REF	13.42	8.72	9.23	0	0.085	28

Figure E-1 - Total Number of Fish Captured at Monitoring Sites 2015-2017



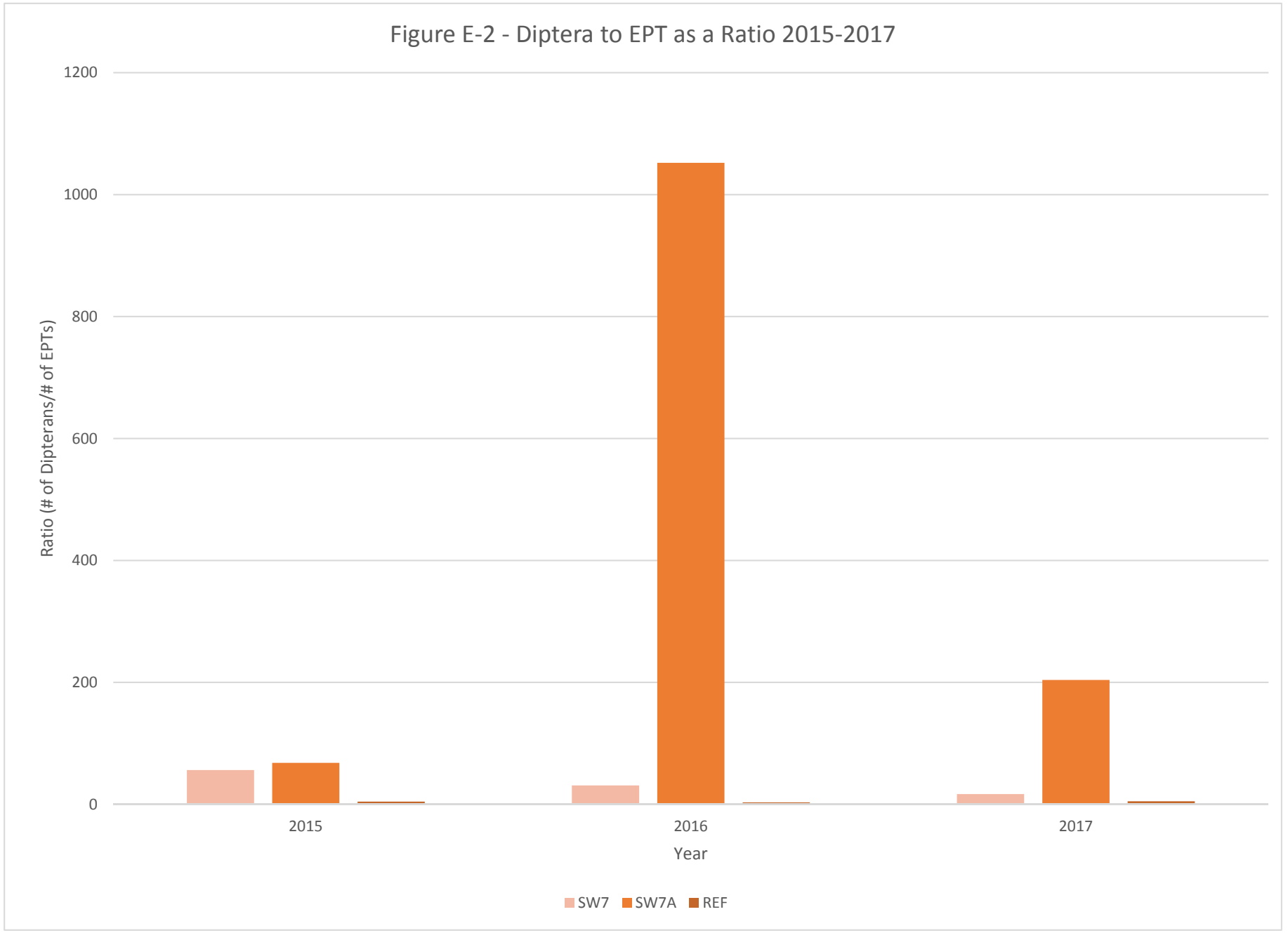
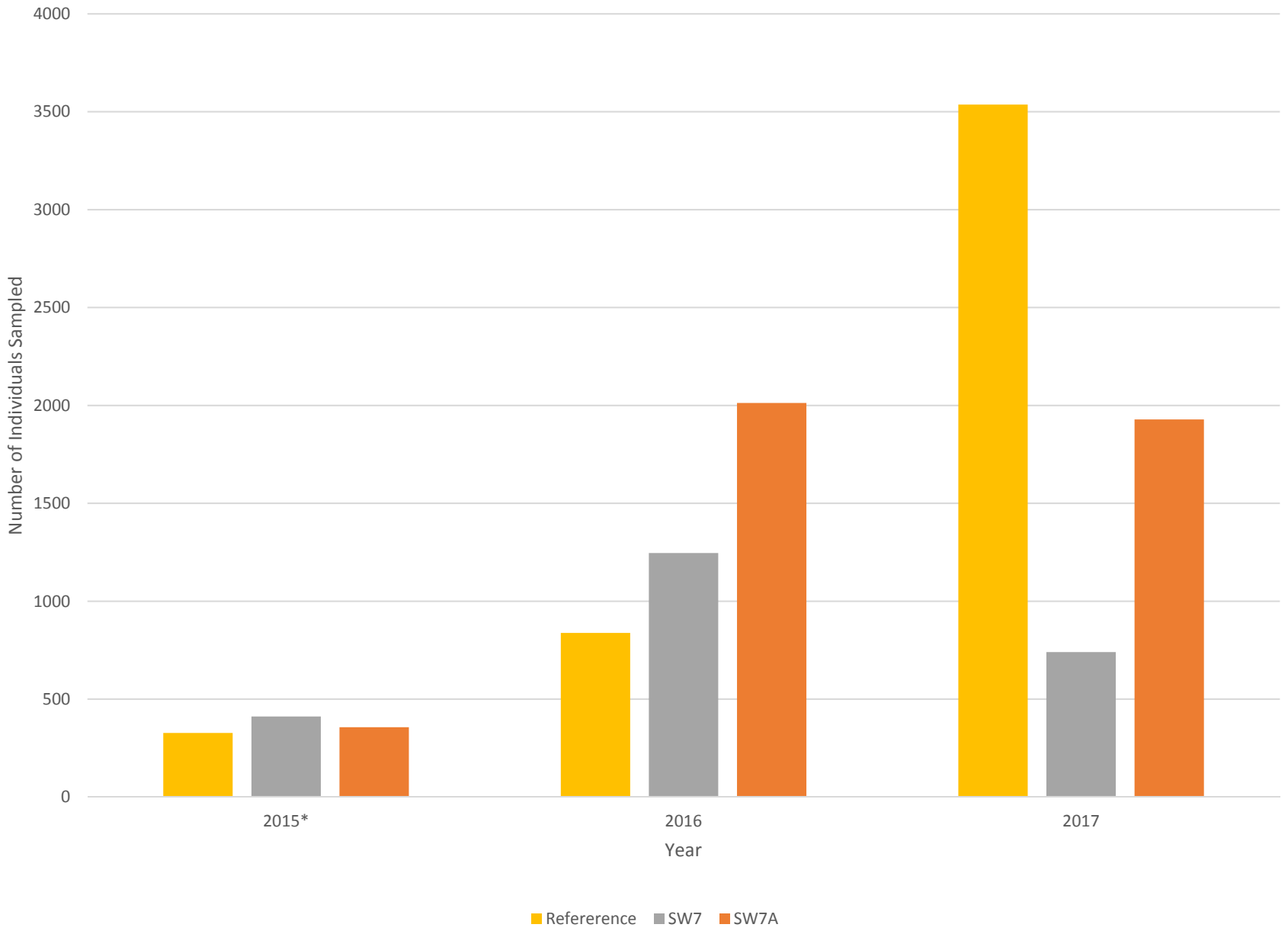


Figure E-2 - Diptera to EPT as a Ratio 2015-2017
1200
1000
800
600
400
200
0
Ratio (# of Dipterans/# of EPTs)
2015
2016
2017
Year
SW7
SW7A
REF

Figure E-3 - Abundance of Benthic Macroinvertebrates Sampled, 2015-2017



Appendix F
Lab Certificates

Maxxam
A Bureau Veritas Group Company

Your Project #: 121414186
Your C.O.C. #: 620235-01-01, 620235-02-01

Attention:John Kozuskanich

Stantec Consulting Ltd
40 Highfield Park Drive
Suite 102
Dartmouth, NS
B3A 0A3

Report Date: 2017/07/27
Report #: R4616827
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7F4245
Received: 2017/07/19, 12:26

Sample Matrix: Water
Samples Received: 13

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Carbonate, Bicarbonate and Hydroxide	13	N/A	2017/07/24	N/A	SM 22 4500-CO2 D
Alkalinity	9	N/A	2017/07/25	ATL SOP 00013	EPA 310.2 R1974 m
Alkalinity	4	N/A	2017/07/26	ATL SOP 00013	EPA 310.2 R1974 m
Chloride	13	N/A	2017/07/25	ATL SOP 00014	SM 22 4500-Cl- E m
Colour	13	N/A	2017/07/25	ATL SOP 00020	SM 22 2120C m
Conductance - water	13	N/A	2017/07/24	ATL SOP 00004	SM 22 2510B m
Hardness (calculated as CaCO3)	5	N/A	2017/07/24	ATL SOP 00048	SM 22 2340 B
Hardness (calculated as CaCO3)	6	N/A	2017/07/25	ATL SOP 00048	SM 22 2340 B
Hardness (calculated as CaCO3)	1	N/A	2017/07/26	ATL SOP 00048	SM 22 2340 B
Hardness (calculated as CaCO3)	1	N/A	2017/07/27	ATL SOP 00048	SM 22 2340 B
Metals Water Diss. MS (1)	1	N/A	2017/07/26	ATL SOP 00058	EPA 6020A R1 m
Metals Water Diss. MS (as rec'd)	5	N/A	2017/07/24	ATL SOP 00058	EPA 6020A R1 m
Metals Water Diss. MS (as rec'd)	1	N/A	2017/07/26	ATL SOP 00058	EPA 6020A R1 m
Metals Water Total MS	5	2017/07/21	2017/07/21	ATL SOP 00058	EPA 6020A R1 m
Metals Water Total MS	1	2017/07/21	2017/07/24	ATL SOP 00058	EPA 6020A R1 m
Ion Balance (% Difference)	12	N/A	2017/07/26	N/A	Auto Calc.
Ion Balance (% Difference)	1	N/A	2017/07/27	N/A	Auto Calc.
Anion and Cation Sum	2	N/A	2017/07/25	N/A	Auto Calc.
Anion and Cation Sum	10	N/A	2017/07/26	N/A	Auto Calc.
Anion and Cation Sum	1	N/A	2017/07/27	N/A	Auto Calc.
Nitrogen Ammonia - water	2	N/A	2017/07/24	ATL SOP 00015	EPA 350.1 R2 m
Nitrogen Ammonia - water	5	N/A	2017/07/25	ATL SOP 00015	EPA 350.1 R2 m
Nitrogen Ammonia - water	6	N/A	2017/07/26	ATL SOP 00015	EPA 350.1 R2 m
Nitrogen - Nitrate + Nitrite	13	N/A	2017/07/25	ATL SOP 00016	USGS SOPINCF0452.2 m
Nitrogen - Nitrite	13	N/A	2017/07/26	ATL SOP 00017	SM 22 4500-NO2- B m
Nitrogen - Nitrate (as N)	13	N/A	2017/07/26	ATL SOP 00018	ASTM D3867-16
pH (2)	13	N/A	2017/07/24	ATL SOP 00003	SM 22 4500-H+ B m
Phosphorus - ortho	13	N/A	2017/07/26	ATL SOP 00021	EPA 365.2 m
Sat. pH and Langelier Index (@ 20C)	12	N/A	2017/07/26	ATL SOP 00049	Auto Calc.

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Your Project #: 121414186
Your C.O.C. #: 620235-01-01, 620235-02-01

Attention:John Kozuskanich

Stantec Consulting Ltd
40 Highfield Park Drive
Suite 102
Dartmouth, NS
B3A 0A3

Report Date: 2017/07/27
Report #: R4616827
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7F4245
Received: 2017/07/19, 12:26

Sample Matrix: Water
Samples Received: 13

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Sat. pH and Langelier Index (@ 20C)	1	N/A	2017/07/27	ATL SOP 00049	Auto Calc.
Sat. pH and Langelier Index (@ 4C)	12	N/A	2017/07/26	ATL SOP 00049	Auto Calc.
Sat. pH and Langelier Index (@ 4C)	1	N/A	2017/07/27	ATL SOP 00049	Auto Calc.
Reactive Silica	13	N/A	2017/07/25	ATL SOP 00022	EPA 366.0 m
Sulphate	13	N/A	2017/07/25	ATL SOP 00023	ASTMD516-11 m
Total Dissolved Solids (TDS calc)	12	N/A	2017/07/26	N/A	Auto Calc.
Total Dissolved Solids (TDS calc)	1	N/A	2017/07/27	N/A	Auto Calc.
Organic carbon - Total (TOC) (3)	4	N/A	2017/07/21	ATL SOP 00037	SM 22 5310C m
Organic carbon - Total (TOC) (3)	9	N/A	2017/07/25	ATL SOP 00037	SM 22 5310C m
Turbidity	13	N/A	2017/07/24	ATL SOP 00011	EPA 180.1 R2 m

Remarks:

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

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

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

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Your Project #: 121414186
Your C.O.C. #: 620235-01-01, 620235-02-01

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40 Highfield Park Drive
Suite 102
Dartmouth, NS
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CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7F4245
Received: 2017/07/19, 12:26

(1) Sample filtered in laboratory prior to analysis for dissolved metals.
(2) The APHA Standard Method require pH to be analyzed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the APHA Standard Method holding time.
(3) TOC / DOC present in the sample should be considered as non-purgeable TOC / DOC.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Marie Muise, Key Account Specialist
Email: MMuise@maxxam.ca
Phone# (902)420-0203 Ext:253
==========
This report has been generated and distributed using a secure automated process.
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B7F4245
Report Date: 2017/07/27

Stantec Consulting Ltd
Client Project #: 121414186
Sampler Initials: DJC

ATL. RCAP-MS DISSOLVED (LABFILT) IN W

Maxxam ID		EUA828		
Sampling Date		2017/07/19 10:30		
COC Number		620235-01-01		
	UNITS	**MW-40D(DUP)**	**RDL**	**QC Batch**
Calculated Parameters				
Anion Sum	me/L	10.7	N/A	5082380
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	490	1.0	5082376
Calculated TDS	mg/L	570	1.0	5082383
Carb. Alkalinity (calc. as CaCO3)	mg/L	<1.0	1.0	5082376
Cation Sum	me/L	10.3	N/A	5082380
Hardness (CaCO3)	mg/L	300	1.0	5082378
Ion Balance (% Difference)	%	1.81	N/A	5082379
Langelier Index (@ 20C)	N/A	0.371	N/A	5082381
Langelier Index (@ 4C)	N/A	0.123	N/A	5082382
Nitrate (N)	mg/L	0.93	0.050	5082767
Saturation pH (@ 20C)	N/A	6.83	N/A	5082381
Saturation pH (@ 4C)	N/A	7.08	N/A	5082382
Inorganics				
Total Alkalinity (Total as CaCO3)	mg/L	490 (1)	100	5087284
Dissolved Chloride (Cl)	mg/L	27	1.0	5087287
Colour	TCU	22	5.0	5087296
Nitrate + Nitrite (N)	mg/L	0.95	0.050	5087299
Nitrite (N)	mg/L	0.025	0.010	5087307
Nitrogen (Ammonia Nitrogen)	mg/L	32	2.5	5088632
Total Organic Carbon (C)	mg/L	27 (2)	25	5088710
Orthophosphate (P)	mg/L	<0.010	0.010	5087302
pH	pH	7.20	N/A	5086754
Reactive Silica (SiO2)	mg/L	29	1.0	5087293
Dissolved Sulphate (SO4)	mg/L	<2.0	2.0	5087288
Turbidity	NTU	>1000	1.0	5086845
Conductivity	uS/cm	1000	1.0	5086756
Metals				
Dissolved Aluminum (Al)	ug/L	<5.0	5.0	5088639
Dissolved Antimony (Sb)	ug/L	<1.0	1.0	5088639
Dissolved Arsenic (As)	ug/L	6.4	1.0	5088639
Dissolved Barium (Ba)	ug/L	1900	10	5088639
Dissolved Beryllium (Be)	ug/L	<1.0	1.0	5088639

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable
(1) Elevated reporting limit due to sample matrix.
(2) Reporting limit was increased due to turbidity.

Maxxam Job #: B7F4245
Report Date: 2017/07/27

Stantec Consulting Ltd
Client Project #: 121414186
Sampler Initials: DJC

ATL. RCAP-MS DISSOLVED (LABFILT) IN W

Maxxam ID		EUA828		
Sampling Date		2017/07/19 10:30		
COC Number		620235-01-01		
	UNITS	**MW-40D(DUP)**	**RDL**	**QC Batch**
Dissolved Bismuth (Bi)	ug/L	<2.0	2.0	5088639
Dissolved Boron (B)	ug/L	270	50	5088639
Dissolved Cadmium (Cd)	ug/L	0.27	0.010	5088639
Dissolved Calcium (Ca)	ug/L	91000	100	5088639
Dissolved Chromium (Cr)	ug/L	<1.0	1.0	5088639
Dissolved Cobalt (Co)	ug/L	11	0.40	5088639
Dissolved Copper (Cu)	ug/L	<2.0	2.0	5088639
Dissolved Iron (Fe)	ug/L	<50	50	5088639
Dissolved Lead (Pb)	ug/L	<0.50	0.50	5088639
Dissolved Magnesium (Mg)	ug/L	17000	100	5088639
Dissolved Manganese (Mn)	ug/L	1700	2.0	5088639
Dissolved Molybdenum (Mo)	ug/L	<2.0	2.0	5088639
Dissolved Nickel (Ni)	ug/L	22	2.0	5088639
Dissolved Phosphorus (P)	ug/L	<100	100	5088639
Dissolved Potassium (K)	ug/L	35000	100	5088639
Dissolved Selenium (Se)	ug/L	<1.0	1.0	5088639
Dissolved Silver (Ag)	ug/L	<0.10	0.10	5088639
Dissolved Sodium (Na)	ug/L	26000	100	5088639
Dissolved Strontium (Sr)	ug/L	550	2.0	5088639
Dissolved Thallium (Tl)	ug/L	<0.10	0.10	5088639
Dissolved Tin (Sn)	ug/L	<2.0	2.0	5088639
Dissolved Titanium (Ti)	ug/L	<2.0	2.0	5088639
Dissolved Uranium (U)	ug/L	0.27	0.10	5088639
Dissolved Vanadium (V)	ug/L	<2.0	2.0	5088639
Dissolved Zinc (Zn)	ug/L	15	5.0	5088639

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B7F4245
Report Date: 2017/07/27

Stantec Consulting Ltd
Client Project #: 121414186
Sampler Initials: DJC

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID		EUA830	EUA831		EUA832	EUA832		
Sampling Date		2017/07/18 12:15	2017/07/18 11:50		2017/07/18 11:30	2017/07/18 11:30		
COC Number		620235-01-01	620235-01-01		620235-01-01	620235-01-01		
	UNITS	**SW1**	**SW2**	**QC Batch**	**SW3**	**SW3 Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters								
Anion Sum	me/L	2.81	2.82	5082380	2.79	N/A	N/A	5082380
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	65	66	5082376	64	N/A	1.0	5082376
Calculated TDS	mg/L	160	160	5082383	160	N/A	1.0	5082383
Carb. Alkalinity (calc. as CaCO3)	mg/L	<1.0	<1.0	5082376	<1.0	N/A	1.0	5082376
Cation Sum	me/L	2.72	2.62	5082380	2.60	N/A	N/A	5082380
Hardness (CaCO3)	mg/L	98	95	5082378	94	N/A	1.0	5082378
Ion Balance (% Difference)	%	1.63	3.68	5082379	3.53	N/A	N/A	5082379
Langelier Index (@ 20C)	N/A	-0.376	-0.342	5082381	-0.424	N/A	N/A	5082381
Langelier Index (@ 4C)	N/A	-0.627	-0.592	5082382	-0.674	N/A	N/A	5082382
Nitrate (N)	mg/L	2.0	2.0	5082767	2.0	N/A	0.050	5082767
Saturation pH (@ 20C)	N/A	8.04	8.05	5082381	8.06	N/A	N/A	5082381
Saturation pH (@ 4C)	N/A	8.29	8.30	5082382	8.31	N/A	N/A	5082382
Inorganics								
Total Alkalinity (Total as CaCO3)	mg/L	65	66	5087284	65	N/A	5.0	5087284
Dissolved Chloride (Cl)	mg/L	32	32	5087287	32	N/A	1.0	5087287
Colour	TCU	12	12	5087296	13	N/A	5.0	5087296
Nitrate + Nitrite (N)	mg/L	2.0	2.0	5087299	2.0	N/A	0.050	5087299
Nitrite (N)	mg/L	0.013	0.012	5087307	0.012	N/A	0.010	5087307
Nitrogen (Ammonia Nitrogen)	mg/L	0.10	0.10	5088632	0.10	N/A	0.050	5088632
Total Organic Carbon (C)	mg/L	2.5	2.7	5088710	2.7	N/A	0.50	5088710
Orthophosphate (P)	mg/L	0.011	0.014	5087302	0.013	N/A	0.010	5087302
pH	pH	7.67	7.70	5086754	7.64	N/A	N/A	5086747
Reactive Silica (SiO2)	mg/L	6.4	6.6	5087293	6.6	N/A	0.50	5087293
Dissolved Sulphate (SO4)	mg/L	22	22	5087288	21	N/A	2.0	5087288
Turbidity	NTU	5.3	4.3	5086845	26	30	0.10	5086839
Conductivity	uS/cm	280	280	5086756	270	N/A	1.0	5086748
Metals								
Total Aluminum (Al)	ug/L	190	170	5084052	120	N/A	5.0	5084052
Total Antimony (Sb)	ug/L	<1.0	<1.0	5084052	<1.0	N/A	1.0	5084052
Total Arsenic (As)	ug/L	1.5	1.3	5084052	1.5	N/A	1.0	5084052
Total Barium (Ba)	ug/L	34	32	5084052	31	N/A	1.0	5084052
Total Beryllium (Be)	ug/L	<1.0	<1.0	5084052	<1.0	N/A	1.0	5084052
Total Bismuth (Bi)	ug/L	<2.0	<2.0	5084052	<2.0	N/A	2.0	5084052

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

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Maxxam Job #: B7F4245
Report Date: 2017/07/27

Stantec Consulting Ltd
Client Project #: 121414186
Sampler Initials: DJC

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID		EUA830	EUA831		EUA832	EUA832		
Sampling Date		2017/07/18 12:15	2017/07/18 11:50		2017/07/18 11:30	2017/07/18 11:30		
COC Number		620235-01-01	620235-01-01		620235-01-01	620235-01-01		
	UNITS	**SW1**	**SW2**	**QC Batch**	**SW3**	**SW3 Lab-Dup**	**RDL**	**QC Batch**
Total Boron (B)	ug/L	<50	<50	5084052	<50	N/A	50	5084052
Total Cadmium (Cd)	ug/L	<0.010	<0.010	5084052	<0.010	N/A	0.010	5084052
Total Calcium (Ca)	ug/L	33000	32000	5084052	32000	N/A	100	5084052
Total Chromium (Cr)	ug/L	<1.0	<1.0	5084052	<1.0	N/A	1.0	5084052
Total Cobalt (Co)	ug/L	<0.40	<0.40	5084052	<0.40	N/A	0.40	5084052
Total Copper (Cu)	ug/L	<2.0	<2.0	5084052	<2.0	N/A	2.0	5084052
Total Iron (Fe)	ug/L	650	520	5084052	560	N/A	50	5084052
Total Lead (Pb)	ug/L	<0.50	<0.50	5084052	<0.50	N/A	0.50	5084052
Total Magnesium (Mg)	ug/L	3700	3500	5084052	3500	N/A	100	5084052
Total Manganese (Mn)	ug/L	120	100	5084052	120	N/A	2.0	5084052
Total Molybdenum (Mo)	ug/L	<2.0	<2.0	5084052	<2.0	N/A	2.0	5084052
Total Nickel (Ni)	ug/L	<2.0	<2.0	5084052	<2.0	N/A	2.0	5084052
Total Phosphorus (P)	ug/L	120	<100	5084052	<100	N/A	100	5084052
Total Potassium (K)	ug/L	2000	1900	5084052	1900	N/A	100	5084052
Total Selenium (Se)	ug/L	<1.0	<1.0	5084052	<1.0	N/A	1.0	5084052
Total Silver (Ag)	ug/L	<0.10	<0.10	5084052	<0.10	N/A	0.10	5084052
Total Sodium (Na)	ug/L	16000	15000	5084052	15000	N/A	100	5084052
Total Strontium (Sr)	ug/L	120	120	5084052	120	N/A	2.0	5084052
Total Thallium (Tl)	ug/L	<0.10	<0.10	5084052	<0.10	N/A	0.10	5084052
Total Tin (Sn)	ug/L	<2.0	<2.0	5084052	<2.0	N/A	2.0	5084052
Total Titanium (Ti)	ug/L	4.9	7.4	5084052	3.3	N/A	2.0	5084052
Total Uranium (U)	ug/L	1.1	1.0	5084052	1.0	N/A	0.10	5084052
Total Vanadium (V)	ug/L	<2.0	<2.0	5084052	<2.0	N/A	2.0	5084052
Total Zinc (Zn)	ug/L	<5.0	<5.0	5084052	<5.0	N/A	5.0	5084052

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

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Maxxam Job #: B7F4245
Report Date: 2017/07/27

Stantec Consulting Ltd
Client Project #: 121414186
Sampler Initials: DJC

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID		EUA840	EUA840			EUA841		
Sampling Date		2017/07/18 09:00	2017/07/18 09:00			2017/07/18 10:15		
COC Number		620235-02-01	620235-02-01			620235-02-01		
	UNITS	**SW7**	**SW7 Lab-Dup**	**RDL**	**QC Batch**	**SW7A**	**RDL**	**QC Batch**
Calculated Parameters								
Anion Sum	me/L	2.09	N/A	N/A	5082380	3.89	N/A	5082910
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	71	N/A	1.0	5082376	150	1.0	5082906
Calculated TDS	mg/L	120	N/A	1.0	5082383	540	1.0	5082913
Carb. Alkalinity (calc. as CaCO3)	mg/L	<1.0	N/A	1.0	5082376	<1.0	1.0	5082906
Cation Sum	me/L	1.95	N/A	N/A	5082380	16.1	N/A	5082910
Hardness (CaCO3)	mg/L	63	N/A	1.0	5082378	200	1.0	5082908
Ion Balance (% Difference)	%	3.47	N/A	N/A	5082379	61.1	N/A	5082909
Langelier Index (@ 20C)	N/A	-0.742	N/A	N/A	5082381	-0.442	N/A	5082911
Langelier Index (@ 4C)	N/A	-0.993	N/A	N/A	5082382	-0.689	N/A	5082912
Nitrate (N)	mg/L	0.15	N/A	0.050	5082767	0.28	0.050	5082767
Saturation pH (@ 20C)	N/A	8.18	N/A	N/A	5082381	7.54	N/A	5082911
Saturation pH (@ 4C)	N/A	8.43	N/A	N/A	5082382	7.79	N/A	5082912
Inorganics								
Total Alkalinity (Total as CaCO3)	mg/L	71	N/A	5.0	5087284	150	25	5087284
Dissolved Chloride (Cl)	mg/L	21	N/A	1.0	5087287	29	1.0	5087287
Colour	TCU	30	N/A	5.0	5087296	<5.0	5.0	5087296
Nitrate + Nitrite (N)	mg/L	0.15	N/A	0.050	5087299	0.28	0.050	5087299
Nitrite (N)	mg/L	<0.010	N/A	0.010	5087307	<0.010	0.010	5087307
Nitrogen (Ammonia Nitrogen)	mg/L	0.75	N/A	0.050	5088632	17	0.75	5088632
Total Organic Carbon (C)	mg/L	3.2	3.5	0.50	5088710	76 (1)	25	5088710
Orthophosphate (P)	mg/L	<0.010	N/A	0.010	5087302	<0.010	0.010	5087302
pH	pH	7.43	N/A	N/A	5086754	7.10	N/A	5086754
Reactive Silica (SiO2)	mg/L	11	N/A	0.50	5087293	12	0.50	5087293
Dissolved Sulphate (SO4)	mg/L	3.6	N/A	2.0	5087288	2.8	2.0	5087288
Turbidity	NTU	5.2	N/A	0.10	5086845	>1000	1.0	5086839
Conductivity	uS/cm	200	N/A	1.0	5086756	380	1.0	5086756
Metals								
Total Aluminum (Al)	ug/L	19	N/A	5.0	5084052	1800	5.0	5084052
Total Antimony (Sb)	ug/L	<1.0	N/A	1.0	5084052	<1.0	1.0	5084052
Total Arsenic (As)	ug/L	2.2	N/A	1.0	5084052	720	10	5084052
Total Barium (Ba)	ug/L	160	N/A	1.0	5084052	3000	10	5084052
Total Beryllium (Be)	ug/L	<1.0	N/A	1.0	5084052	<1.0	1.0	5084052

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Reporting limit was increased due to turbidity.

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Maxxam Job #: B7F4245
Report Date: 2017/07/27

Stantec Consulting Ltd
Client Project #: 121414186
Sampler Initials: DJC

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID		EUA840	EUA840			EUA841		
Sampling Date		2017/07/18 09:00	2017/07/18 09:00			2017/07/18 10:15		
COC Number		620235-02-01	620235-02-01			620235-02-01		
	UNITS	**SW7**	**SW7 Lab-Dup**	**RDL**	**QC Batch**	**SW7A**	**RDL**	**QC Batch**
Total Bismuth (Bi)	ug/L	<2.0	N/A	2.0	5084052	<2.0	2.0	5084052
Total Boron (B)	ug/L	<50	N/A	50	5084052	250	50	5084052
Total Cadmium (Cd)	ug/L	<0.010	N/A	0.010	5084052	0.10	0.010	5084052
Total Calcium (Ca)	ug/L	21000	N/A	100	5084052	58000	100	5084052
Total Chromium (Cr)	ug/L	<1.0	N/A	1.0	5084052	9.7	1.0	5084052
Total Cobalt (Co)	ug/L	0.48	N/A	0.40	5084052	35	0.40	5084052
Total Copper (Cu)	ug/L	<2.0	N/A	2.0	5084052	6.4	2.0	5084052
Total Iron (Fe)	ug/L	1600	N/A	50	5084052	250000	500	5084052
Total Lead (Pb)	ug/L	<0.50	N/A	0.50	5084052	5.4	0.50	5084052
Total Magnesium (Mg)	ug/L	2400	N/A	100	5084052	15000	100	5084052
Total Manganese (Mn)	ug/L	1800	N/A	2.0	5084052	5700	2.0	5084052
Total Molybdenum (Mo)	ug/L	<2.0	N/A	2.0	5084052	9.2	2.0	5084052
Total Nickel (Ni)	ug/L	<2.0	N/A	2.0	5084052	25	2.0	5084052
Total Phosphorus (P)	ug/L	<100	N/A	100	5084052	4300	100	5084052
Total Potassium (K)	ug/L	1900	N/A	100	5084052	24000	100	5084052
Total Selenium (Se)	ug/L	<1.0	N/A	1.0	5084052	<1.0	1.0	5084052
Total Silver (Ag)	ug/L	<0.10	N/A	0.10	5084052	<0.10	0.10	5084052
Total Sodium (Na)	ug/L	12000	N/A	100	5084052	32000	100	5084052
Total Strontium (Sr)	ug/L	47	N/A	2.0	5084052	390	2.0	5084052
Total Thallium (Tl)	ug/L	<0.10	N/A	0.10	5084052	<0.10	0.10	5084052
Total Tin (Sn)	ug/L	<2.0	N/A	2.0	5084052	<2.0	2.0	5084052
Total Titanium (Ti)	ug/L	<2.0	N/A	2.0	5084052	39	2.0	5084052
Total Uranium (U)	ug/L	<0.10	N/A	0.10	5084052	0.29	0.10	5084052
Total Vanadium (V)	ug/L	<2.0	N/A	2.0	5084052	20	2.0	5084052
Total Zinc (Zn)	ug/L	<5.0	N/A	5.0	5084052	19	5.0	5084052

RDL = Reportable Detection Limit
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N/A = Not Applicable

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Maxxam Job #: B7F4245
Report Date: 2017/07/27

Stantec Consulting Ltd
Client Project #: 121414186
Sampler Initials: DJC

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID		EUA842		
Sampling Date		2017/07/18 10:30		
COC Number		620235-02-01		
	UNITS	**REF**	**RDL**	**QC Batch**
Calculated Parameters				
Anion Sum	me/L	1.10	N/A	5082910
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	46	1.0	5082906
Calculated TDS	mg/L	67	1.0	5082913
Carb. Alkalinity (calc. as CaCO3)	mg/L	<1.0	1.0	5082906
Cation Sum	me/L	1.05	N/A	5082910
Hardness (CaCO3)	mg/L	40	1.0	5082908
Ion Balance (% Difference)	%	2.33	N/A	5082909
Langelier Index (@ 20C)	N/A	-1.07	N/A	5082911
Langelier Index (@ 4C)	N/A	-1.32	N/A	5082912
Nitrate (N)	mg/L	0.080	0.050	5082767
Saturation pH (@ 20C)	N/A	8.51	N/A	5082911
Saturation pH (@ 4C)	N/A	8.76	N/A	5082912
Inorganics				
Total Alkalinity (Total as CaCO3)	mg/L	46	5.0	5087284
Dissolved Chloride (Cl)	mg/L	6.3	1.0	5087287
Colour	TCU	53	25	5087296
Nitrate + Nitrite (N)	mg/L	0.080	0.050	5087299
Nitrite (N)	mg/L	<0.010	0.010	5087307
Nitrogen (Ammonia Nitrogen)	mg/L	0.078	0.050	5088632
Total Organic Carbon (C)	mg/L	6.0	0.50	5088710
Orthophosphate (P)	mg/L	0.023	0.010	5087302
pH	pH	7.44	N/A	5086754
Reactive Silica (SiO2)	mg/L	12	0.50	5087293
Dissolved Sulphate (SO4)	mg/L	<2.0	2.0	5087288
Turbidity	NTU	1.3	0.10	5086845
Conductivity	uS/cm	100	1.0	5086756
Metals				
Total Aluminum (Al)	ug/L	64	5.0	5084052
Total Antimony (Sb)	ug/L	<1.0	1.0	5084052
Total Arsenic (As)	ug/L	1.4	1.0	5084052
Total Barium (Ba)	ug/L	25	1.0	5084052
Total Beryllium (Be)	ug/L	<1.0	1.0	5084052
Total Bismuth (Bi)	ug/L	<2.0	2.0	5084052
Total Boron (B)	ug/L	<50	50	5084052

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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Maxxam Job #: B7F4245
Report Date: 2017/07/27

Stantec Consulting Ltd
Client Project #: 121414186
Sampler Initials: DJC

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID		EUA842		
Sampling Date		2017/07/18 10:30		
COC Number		620235-02-01		
	UNITS	**REF**	**RDL**	**QC Batch**
Total Cadmium (Cd)	ug/L	<0.010	0.010	5084052
Total Calcium (Ca)	ug/L	14000	100	5084052
Total Chromium (Cr)	ug/L	<1.0	1.0	5084052
Total Cobalt (Co)	ug/L	<0.40	0.40	5084052
Total Copper (Cu)	ug/L	<2.0	2.0	5084052
Total Iron (Fe)	ug/L	310	50	5084052
Total Lead (Pb)	ug/L	<0.50	0.50	5084052
Total Magnesium (Mg)	ug/L	1000	100	5084052
Total Manganese (Mn)	ug/L	59	2.0	5084052
Total Molybdenum (Mo)	ug/L	<2.0	2.0	5084052
Total Nickel (Ni)	ug/L	<2.0	2.0	5084052
Total Phosphorus (P)	ug/L	<100	100	5084052
Total Potassium (K)	ug/L	670	100	5084052
Total Selenium (Se)	ug/L	<1.0	1.0	5084052
Total Silver (Ag)	ug/L	<0.10	0.10	5084052
Total Sodium (Na)	ug/L	5200	100	5084052
Total Strontium (Sr)	ug/L	34	2.0	5084052
Total Thallium (Tl)	ug/L	<0.10	0.10	5084052
Total Tin (Sn)	ug/L	<2.0	2.0	5084052
Total Titanium (Ti)	ug/L	<2.0	2.0	5084052
Total Uranium (U)	ug/L	<0.10	0.10	5084052
Total Vanadium (V)	ug/L	<2.0	2.0	5084052
Total Zinc (Zn)	ug/L	<5.0	5.0	5084052

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B7F4245
Report Date: 2017/07/27

Stantec Consulting Ltd
Client Project #: 121414186
Sampler Initials: DJC

AT. RCAP-MS DISSOLVED (FIELDFILT) IN W

Maxxam ID		EUA823	EUA823			EUA824		
Sampling Date		2017/07/18 13:30	2017/07/18 13:30			2017/07/18 13:50		
COC Number		620235-01-01	620235-01-01			620235-01-01		
	UNITS	**MW-22A**	**MW-22A Lab-Dup**	**RDL**	**QC Batch**	**MW-22B**	**RDL**	**QC Batch**
Calculated Parameters								
Anion Sum	me/L	9.90	N/A	N/A	5082380	15.3	N/A	5082380
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	440	N/A	1.0	5082376	550	1.0	5082376
Calculated TDS	mg/L	590	N/A	1.0	5082383	830	1.0	5082383
Carb. Alkalinity (calc. as CaCO3)	mg/L	<1.0	N/A	1.0	5082376	1.3	1.0	5082376
Cation Sum	me/L	12.2	N/A	N/A	5082380	16.2	N/A	5082380
Hardness (CaCO3)	mg/L	250	N/A	1.0	5082378	610	1.0	5082378
Ion Balance (% Difference)	%	10.2	N/A	N/A	5082379	2.76	N/A	5082379
Langelier Index (@ 20C)	N/A	-0.138	N/A	N/A	5082381	0.914	N/A	5082381
Langelier Index (@ 4C)	N/A	-0.386	N/A	N/A	5082382	0.667	N/A	5082382
Nitrate (N)	mg/L	<0.050	N/A	0.050	5082767	0.072	0.050	5082767
Saturation pH (@ 20C)	N/A	6.96	N/A	N/A	5082381	6.48	N/A	5082381
Saturation pH (@ 4C)	N/A	7.21	N/A	N/A	5082382	6.73	N/A	5082382
Inorganics								
Total Alkalinity (Total as CaCO3)	mg/L	450	440	25	5087284	550 (1)	130	5087284
Dissolved Chloride (Cl)	mg/L	35	35	1.0	5087287	150	1.0	5087287
Colour	TCU	63	68	10	5087296	6.8	5.0	5087296
Nitrate + Nitrite (N)	mg/L	<0.050	<0.050	0.050	5087299	0.072	0.050	5087299
Nitrite (N)	mg/L	<0.010	<0.010	0.010	5087307	<0.010	0.010	5087307
Nitrogen (Ammonia Nitrogen)	mg/L	23	N/A	1.0	5084195	1.6	0.050	5084195
Total Organic Carbon (C)	mg/L	17 (2)	N/A	5.0	5084509	14 (2)	5.0	5084509
Orthophosphate (P)	mg/L	<0.010	<0.010	0.010	5087302	<0.010	0.010	5087302
pH	pH	6.82	N/A	N/A	5086754	7.39	N/A	5086747
Reactive Silica (SiO2)	mg/L	17	17	0.50	5087293	19	0.50	5087293
Dissolved Sulphate (SO4)	mg/L	<2.0	<2.0	2.0	5087288	<2.0	2.0	5087288
Turbidity	NTU	850	N/A	1.0	5086845	90	0.10	5086845
Conductivity	uS/cm	890	N/A	1.0	5086756	1500	1.0	5086748
Metals								
Dissolved Aluminum (Al)	ug/L	<5.0	N/A	5.0	5086994	<5.0	5.0	5086994
Dissolved Antimony (Sb)	ug/L	<1.0	N/A	1.0	5086994	<1.0	1.0	5086994
Dissolved Arsenic (As)	ug/L	95	N/A	1.0	5086994	9.5	1.0	5086994
Dissolved Barium (Ba)	ug/L	1100	N/A	1.0	5086994	690	1.0	5086994

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Elevated reporting limit due to sample matrix.
(2) Reporting limit was increased due to turbidity.

Maxxam Job #: B7F4245
Report Date: 2017/07/27

Stantec Consulting Ltd
Client Project #: 121414186
Sampler Initials: DJC

AT. RCAP-MS DISSOLVED (FIELDFILT) IN W

Maxxam ID		EUA823	EUA823			EUA824		
Sampling Date		2017/07/18 13:30	2017/07/18 13:30			2017/07/18 13:50		
COC Number		620235-01-01	620235-01-01			620235-01-01		
	UNITS	**MW-22A**	**MW-22A Lab-Dup**	**RDL**	**QC Batch**	**MW-22B**	**RDL**	**QC Batch**
Dissolved Beryllium (Be)	ug/L	<1.0	N/A	1.0	5086994	<1.0	1.0	5086994
Dissolved Bismuth (Bi)	ug/L	<2.0	N/A	2.0	5086994	<2.0	2.0	5086994
Dissolved Boron (B)	ug/L	440	N/A	50	5086994	490	50	5086994
Dissolved Cadmium (Cd)	ug/L	<0.010	N/A	0.010	5086994	0.018	0.010	5086994
Dissolved Calcium (Ca)	ug/L	75000	N/A	100	5086994	200000	100	5086994
Dissolved Chromium (Cr)	ug/L	<1.0	N/A	1.0	5086994	<1.0	1.0	5086994
Dissolved Cobalt (Co)	ug/L	19	N/A	0.40	5086994	8.4	0.40	5086994
Dissolved Copper (Cu)	ug/L	<2.0	N/A	2.0	5086994	<2.0	2.0	5086994
Dissolved Iron (Fe)	ug/L	49000	N/A	50	5086994	5100	50	5086994
Dissolved Lead (Pb)	ug/L	<0.50	N/A	0.50	5086994	<0.50	0.50	5086994
Dissolved Magnesium (Mg)	ug/L	15000	N/A	100	5086994	26000	100	5086994
Dissolved Manganese (Mn)	ug/L	4000	N/A	2.0	5086994	1200	2.0	5086994
Dissolved Molybdenum (Mo)	ug/L	<2.0	N/A	2.0	5086994	<2.0	2.0	5086994
Dissolved Nickel (Ni)	ug/L	16	N/A	2.0	5086994	25	2.0	5086994
Dissolved Phosphorus (P)	ug/L	340	N/A	100	5086994	<100	100	5086994
Dissolved Potassium (K)	ug/L	23000	N/A	100	5086994	8600	100	5086994
Dissolved Selenium (Se)	ug/L	<1.0	N/A	1.0	5086994	<1.0	1.0	5086994
Dissolved Silver (Ag)	ug/L	<0.10	N/A	0.10	5086994	<0.10	0.10	5086994
Dissolved Sodium (Na)	ug/L	74000	N/A	100	5086994	79000	100	5086994
Dissolved Strontium (Sr)	ug/L	420	N/A	2.0	5086994	2000	2.0	5086994
Dissolved Thallium (Tl)	ug/L	<0.10	N/A	0.10	5086994	<0.10	0.10	5086994
Dissolved Tin (Sn)	ug/L	<2.0	N/A	2.0	5086994	<2.0	2.0	5086994
Dissolved Titanium (Ti)	ug/L	<2.0	N/A	2.0	5086994	<2.0	2.0	5086994
Dissolved Uranium (U)	ug/L	<0.10	N/A	0.10	5086994	9.6	0.10	5086994
Dissolved Vanadium (V)	ug/L	<2.0	N/A	2.0	5086994	<2.0	2.0	5086994
Dissolved Zinc (Zn)	ug/L	<5.0	N/A	5.0	5086994	<5.0	5.0	5086994

RDL = Reportable Detection Limit
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Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

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Maxxam Job #: B7F4245
Report Date: 2017/07/27

Stantec Consulting Ltd
Client Project #: 121414186
Sampler Initials: DJC

AT. RCAP-MS DISSOLVED (FIELDFILT) IN W

Maxxam ID		EUA825			EUA826			EUA827		
Sampling Date		2017/07/18 14:15			2017/07/19 08:30			2017/07/19 10:30		
COC Number		620235-01-01			620235-01-01			620235-01-01		
	UNITS	**MW-22C**	**RDL**	**QC Batch**	**MW-25B**	**RDL**	**QC Batch**	**MW-4A**	**RDL**	**QC Batch**
Calculated Parameters										
Anion Sum	me/L	4.90	N/A	5082380	5.28	N/A	5082380	11.3	N/A	5082380
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	180	1.0	5082376	170	1.0	5082376	520	1.0	5082376
Calculated TDS	mg/L	260	1.0	5082383	280	1.0	5082383	610	1.0	5082383
Carb. Alkalinity (calc. as CaCO3)	mg/L	1.3	1.0	5082376	<1.0	1.0	5082376	<1.0	1.0	5082376
Cation Sum	me/L	4.57	N/A	5082380	5.02	N/A	5082380	11.4	N/A	5082380
Hardness (CaCO3)	mg/L	190	1.0	5082378	220	1.0	5082378	310	1.0	5082378
Ion Balance (% Difference)	%	3.48	N/A	5082379	2.52	N/A	5082379	0.400	N/A	5082379
Langelier Index (@ 20C)	N/A	0.520	N/A	5082381	0.303	N/A	5082381	0.138	N/A	5082381
Langelier Index (@ 4C)	N/A	0.270	N/A	5082382	0.0540	N/A	5082382	-0.110	N/A	5082382
Nitrate (N)	mg/L	<0.050	0.050	5082767	0.056	0.050	5082767	0.76	0.050	5082767
Saturation pH (@ 20C)	N/A	7.36	N/A	5082381	7.32	N/A	5082381	6.79	N/A	5082381
Saturation pH (@ 4C)	N/A	7.61	N/A	5082382	7.57	N/A	5082382	7.04	N/A	5082382
Inorganics										
Total Alkalinity (Total as CaCO3)	mg/L	180 (1)	25	5087284	170 (1)	25	5087284	520 (1)	100	5087284
Dissolved Chloride (Cl)	mg/L	46	1.0	5087287	64	1.0	5087287	31	1.0	5087287
Colour	TCU	<5.0	5.0	5087296	<5.0	5.0	5087296	27	5.0	5087296
Nitrate + Nitrite (N)	mg/L	<0.050	0.050	5087299	0.056	0.050	5087299	0.78	0.050	5087299
Nitrite (N)	mg/L	<0.010	0.010	5087307	<0.010	0.010	5087307	0.020	0.010	5087307
Nitrogen (Ammonia Nitrogen)	mg/L	<0.050	0.050	5088632	0.052	0.050	5088632	32	1.5	5088632
Total Organic Carbon (C)	mg/L	<5.0 (2)	5.0	5084509	<5.0 (2)	5.0	5084509	30 (2)	25	5088710
Orthophosphate (P)	mg/L	<0.010	0.010	5087302	<0.010	0.010	5087302	<0.010	0.010	5087302
pH	pH	7.88	N/A	5086754	7.63	N/A	5086754	6.93	N/A	5086747
Reactive Silica (SiO2)	mg/L	10	0.50	5087293	11	0.50	5087293	28	1.0	5087293
Dissolved Sulphate (SO4)	mg/L	<2.0	2.0	5087288	<2.0	2.0	5087288	<2.0	2.0	5087288
Turbidity	NTU	54	0.10	5086839	450	1.0	5086845	>1000	1.0	5086839
Conductivity	uS/cm	470	1.0	5086756	510	1.0	5086756	1000	1.0	5086748
Metals										
Dissolved Aluminum (Al)	ug/L	<5.0	5.0	5086994	<5.0	5.0	5086994	6.5	5.0	5086994
Dissolved Antimony (Sb)	ug/L	<1.0	1.0	5086994	<1.0	1.0	5086994	<1.0	1.0	5086994
Dissolved Arsenic (As)	ug/L	1.3	1.0	5086994	1.9	1.0	5086994	47	1.0	5086994
Dissolved Barium (Ba)	ug/L	8.8	1.0	5086994	7.6	1.0	5086994	2300	10	5086994
Dissolved Beryllium (Be)	ug/L	<1.0	1.0	5086994	<1.0	1.0	5086994	<1.0	1.0	5086994

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable
(1) Elevated reporting limit due to sample matrix.
(2) Reporting limit was increased due to turbidity.

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Maxxam Job #: B7F4245
Report Date: 2017/07/27

Stantec Consulting Ltd
Client Project #: 121414186
Sampler Initials: DJC

AT. RCAP-MS DISSOLVED (FIELDFILT) IN W

Maxxam ID		EUA825			EUA826			EUA827		
Sampling Date		2017/07/18 14:15			2017/07/19 08:30			2017/07/19 10:30		
COC Number		620235-01-01			620235-01-01			620235-01-01		
	UNITS	**MW-22C**	**RDL**	**QC Batch**	**MW-25B**	**RDL**	**QC Batch**	**MW-4A**	**RDL**	**QC Batch**
Dissolved Bismuth (Bi)	ug/L	<2.0	2.0	5086994	<2.0	2.0	5086994	<2.0	2.0	5086994
Dissolved Boron (B)	ug/L	<50	50	5086994	56	50	5086994	330	50	5086994
Dissolved Cadmium (Cd)	ug/L	0.019	0.010	5086994	0.019	0.010	5086994	0.015	0.010	5086994
Dissolved Calcium (Ca)	ug/L	62000	100	5086994	71000	100	5086994	96000	100	5086994
Dissolved Chromium (Cr)	ug/L	<1.0	1.0	5086994	<1.0	1.0	5086994	<1.0	1.0	5086994
Dissolved Cobalt (Co)	ug/L	<0.40	0.40	5086994	<0.40	0.40	5086994	10	0.40	5086994
Dissolved Copper (Cu)	ug/L	<2.0	2.0	5086994	<2.0	2.0	5086994	<2.0	2.0	5086994
Dissolved Iron (Fe)	ug/L	230	50	5086994	<50	50	5086994	13000	50	5086994
Dissolved Lead (Pb)	ug/L	<0.50	0.50	5086994	<0.50	0.50	5086994	<0.50	0.50	5086994
Dissolved Magnesium (Mg)	ug/L	9300	100	5086994	9900	100	5086994	18000	100	5086994
Dissolved Manganese (Mn)	ug/L	57	2.0	5086994	11	2.0	5086994	1200	2.0	5086994
Dissolved Molybdenum (Mo)	ug/L	<2.0	2.0	5086994	<2.0	2.0	5086994	<2.0	2.0	5086994
Dissolved Nickel (Ni)	ug/L	<2.0	2.0	5086994	4.3	2.0	5086994	16	2.0	5086994
Dissolved Phosphorus (P)	ug/L	<100	100	5086994	<100	100	5086994	<100	100	5086994
Dissolved Potassium (K)	ug/L	6600	100	5086994	6600	100	5086994	36000	100	5086994
Dissolved Selenium (Se)	ug/L	<1.0	1.0	5086994	<1.0	1.0	5086994	<1.0	1.0	5086994
Dissolved Silver (Ag)	ug/L	<0.10	0.10	5086994	<0.10	0.10	5086994	<0.10	0.10	5086994
Dissolved Sodium (Na)	ug/L	12000	100	5086994	11000	100	5086994	33000	100	5086994
Dissolved Strontium (Sr)	ug/L	870	2.0	5086994	880	2.0	5086994	620	2.0	5086994
Dissolved Thallium (Tl)	ug/L	<0.10	0.10	5086994	<0.10	0.10	5086994	<0.10	0.10	5086994
Dissolved Tin (Sn)	ug/L	<2.0	2.0	5086994	<2.0	2.0	5086994	<2.0	2.0	5086994
Dissolved Titanium (Ti)	ug/L	<2.0	2.0	5086994	<2.0	2.0	5086994	<2.0	2.0	5086994
Dissolved Uranium (U)	ug/L	34	0.10	5086994	9.8	0.10	5086994	<0.10	0.10	5086994
Dissolved Vanadium (V)	ug/L	<2.0	2.0	5086994	<2.0	2.0	5086994	<2.0	2.0	5086994
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	5086994	<5.0	5.0	5086994	11	5.0	5086994

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B7F4245
Report Date: 2017/07/27

Stantec Consulting Ltd
Client Project #: 121414186
Sampler Initials: DJC

AT. RCAP-MS DISSOLVED (FIELDFILT) IN W

Maxxam ID		EUA829	EUA829		
Sampling Date		2017/07/19 09:30	2017/07/19 09:30		
COC Number		620235-01-01	620235-01-01		
	UNITS	**TH-1**	**TH-1 Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters					
Anion Sum	me/L	10.5	N/A	N/A	5082380
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	490	N/A	1.0	5082376
Calculated TDS	mg/L	580	N/A	1.0	5082383
Carb. Alkalinity (calc. as CaCO3)	mg/L	<1.0	N/A	1.0	5082376
Cation Sum	me/L	11.0	N/A	N/A	5082380
Hardness (CaCO3)	mg/L	270	N/A	1.0	5082378
Ion Balance (% Difference)	%	2.32	N/A	N/A	5082379
Langelier Index (@ 20C)	N/A	0.454	N/A	N/A	5082381
Langelier Index (@ 4C)	N/A	0.207	N/A	N/A	5082382
Nitrate (N)	mg/L	0.063	N/A	0.050	5082767
Saturation pH (@ 20C)	N/A	6.88	N/A	N/A	5082381
Saturation pH (@ 4C)	N/A	7.12	N/A	N/A	5082382
Inorganics					
Total Alkalinity (Total as CaCO3)	mg/L	490 (1)	N/A	100	5087284
Dissolved Chloride (Cl)	mg/L	26	N/A	1.0	5087287
Colour	TCU	<5.0	N/A	5.0	5087296
Nitrate + Nitrite (N)	mg/L	0.063	N/A	0.050	5087299
Nitrite (N)	mg/L	<0.010	N/A	0.010	5087307
Nitrogen (Ammonia Nitrogen)	mg/L	33	33	2.5	5088632
Total Organic Carbon (C)	mg/L	10 (2)	N/A	5.0	5088710
Orthophosphate (P)	mg/L	<0.010	N/A	0.010	5087302
pH	pH	7.33	N/A	N/A	5086754
Reactive Silica (SiO2)	mg/L	30	N/A	1.0	5087293
Dissolved Sulphate (SO4)	mg/L	<2.0	N/A	2.0	5087288
Turbidity	NTU	400	N/A	1.0	5086845
Conductivity	uS/cm	1000	N/A	1.0	5086756
Metals					
Dissolved Aluminum (Al)	ug/L	<5.0	N/A	5.0	5086994
Dissolved Antimony (Sb)	ug/L	<1.0	N/A	1.0	5086994
Dissolved Arsenic (As)	ug/L	24	N/A	1.0	5086994
Dissolved Barium (Ba)	ug/L	970	N/A	1.0	5086994

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Elevated reporting limit due to sample matrix.
(2) Reporting limit was increased due to turbidity.

Maxxam Job #: B7F4245
Report Date: 2017/07/27

Stantec Consulting Ltd
Client Project #: 121414186
Sampler Initials: DJC

AT. RCAP-MS DISSOLVED (FIELDFILT) IN W

Maxxam ID		EUA829	EUA829		
Sampling Date		2017/07/19 09:30	2017/07/19 09:30		
COC Number		620235-01-01	620235-01-01		
	UNITS	**TH-1**	**TH-1 Lab-Dup**	**RDL**	**QC Batch**
Dissolved Beryllium (Be)	ug/L	<1.0	N/A	1.0	5086994
Dissolved Bismuth (Bi)	ug/L	<2.0	N/A	2.0	5086994
Dissolved Boron (B)	ug/L	210	N/A	50	5086994
Dissolved Cadmium (Cd)	ug/L	<0.010	N/A	0.010	5086994
Dissolved Calcium (Ca)	ug/L	83000	N/A	100	5086994
Dissolved Chromium (Cr)	ug/L	<1.0	N/A	1.0	5086994
Dissolved Cobalt (Co)	ug/L	4.1	N/A	0.40	5086994
Dissolved Copper (Cu)	ug/L	<2.0	N/A	2.0	5086994
Dissolved Iron (Fe)	ug/L	13000	N/A	50	5086994
Dissolved Lead (Pb)	ug/L	<0.50	N/A	0.50	5086994
Dissolved Magnesium (Mg)	ug/L	14000	N/A	100	5086994
Dissolved Manganese (Mn)	ug/L	990	N/A	2.0	5086994
Dissolved Molybdenum (Mo)	ug/L	<2.0	N/A	2.0	5086994
Dissolved Nickel (Ni)	ug/L	4.7	N/A	2.0	5086994
Dissolved Phosphorus (P)	ug/L	<100	N/A	100	5086994
Dissolved Potassium (K)	ug/L	32000	N/A	100	5086994
Dissolved Selenium (Se)	ug/L	<1.0	N/A	1.0	5086994
Dissolved Silver (Ag)	ug/L	<0.10	N/A	0.10	5086994
Dissolved Sodium (Na)	ug/L	48000	N/A	100	5086994
Dissolved Strontium (Sr)	ug/L	380	N/A	2.0	5086994
Dissolved Thallium (Tl)	ug/L	<0.10	N/A	0.10	5086994
Dissolved Tin (Sn)	ug/L	<2.0	N/A	2.0	5086994
Dissolved Titanium (Ti)	ug/L	<2.0	N/A	2.0	5086994
Dissolved Uranium (U)	ug/L	<0.10	N/A	0.10	5086994
Dissolved Vanadium (V)	ug/L	<2.0	N/A	2.0	5086994
Dissolved Zinc (Zn)	ug/L	<5.0	N/A	5.0	5086994

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

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GENERAL COMMENTS

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

Package 1	6.3°C

Sample MW-40D (DUP) EUA828 was lab filtered as per John Kozuskanich due to particulate in the client supplied field filtered metals bottle.

Sample EUA823 [MW-22A] : Poor RCAp Ion Balance due to sample matrix. Possibly due to fine particulate matter. Anion sum does not include contribution from Total Organic Carbon.

Sample EUA841 [SW7A] : Poor RCAp Ion Balance due to sample matrix. Excess cations due to presence of turbidity.

Sample EUA842 [REF] : Poor RCAp Ion Balance due to sample matrix. Excess cations due to presence of turbidity.

Results relate only to the items tested.

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Maxxam Job #: B7F4245
Report Date: 2017/07/27

QUALITY ASSURANCE REPORT

Stantec Consulting Ltd
Client Project #: 121414186
Sampler Initials: DJC

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5084052	Total Aluminum (Al)	2017/07/21	96	80 - 120	101	80 - 120	<5.0	ug/L	NC	20		
5084052	Total Antimony (Sb)	2017/07/21	101	80 - 120	101	80 - 120	<1.0	ug/L	NC	20		
5084052	Total Arsenic (As)	2017/07/21	94	80 - 120	98	80 - 120	<1.0	ug/L	3.5	20		
5084052	Total Barium (Ba)	2017/07/21	NC	80 - 120	97	80 - 120	<1.0	ug/L	2.0	20		
5084052	Total Beryllium (Be)	2017/07/21	98	80 - 120	100	80 - 120	<1.0	ug/L	NC	20		
5084052	Total Bismuth (Bi)	2017/07/21	93	80 - 120	102	80 - 120	<2.0	ug/L	NC	20		
5084052	Total Boron (B)	2017/07/21	98	80 - 120	98	80 - 120	<50	ug/L	NC	20		
5084052	Total Cadmium (Cd)	2017/07/21	100	80 - 120	104	80 - 120	<0.010	ug/L	0.31	20		
5084052	Total Calcium (Ca)	2017/07/21	NC	80 - 120	103	80 - 120	<100	ug/L	1.6	20		
5084052	Total Chromium (Cr)	2017/07/21	93	80 - 120	97	80 - 120	<1.0	ug/L	NC	20		
5084052	Total Cobalt (Co)	2017/07/21	91	80 - 120	100	80 - 120	<0.40	ug/L	NC	20		
5084052	Total Copper (Cu)	2017/07/21	88	80 - 120	98	80 - 120	<2.0	ug/L	NC	20		
5084052	Total Iron (Fe)	2017/07/21	97	80 - 120	102	80 - 120	<50	ug/L	NC	20		
5084052	Total Lead (Pb)	2017/07/21	91	80 - 120	99	80 - 120	<0.50	ug/L	0.26	20		
5084052	Total Magnesium (Mg)	2017/07/21	NC	80 - 120	105	80 - 120	<100	ug/L	3.7	20		
5084052	Total Manganese (Mn)	2017/07/21	NC	80 - 120	99	80 - 120	<2.0	ug/L	2.6	20		
5084052	Total Molybdenum (Mo)	2017/07/21	104	80 - 120	102	80 - 120	<2.0	ug/L	10	20		
5084052	Total Nickel (Ni)	2017/07/21	91	80 - 120	99	80 - 120	<2.0	ug/L	NC	20		
5084052	Total Phosphorus (P)	2017/07/21	100	80 - 120	103	80 - 120	<100	ug/L	NC	20		
5084052	Total Potassium (K)	2017/07/21	96	80 - 120	104	80 - 120	<100	ug/L	2.8	20		
5084052	Total Selenium (Se)	2017/07/21	94	80 - 120	99	80 - 120	<1.0	ug/L	NC	20		
5084052	Total Silver (Ag)	2017/07/21	97	80 - 120	100	80 - 120	<0.10	ug/L	NC	20		
5084052	Total Sodium (Na)	2017/07/21	NC	80 - 120	104	80 - 120	<100	ug/L	0.82	20		
5084052	Total Strontium (Sr)	2017/07/21	NC	80 - 120	101	80 - 120	<2.0	ug/L	1.6	20		
5084052	Total Thallium (Tl)	2017/07/21	96	80 - 120	103	80 - 120	<0.10	ug/L	NC	20		
5084052	Total Tin (Sn)	2017/07/21	101	80 - 120	102	80 - 120	<2.0	ug/L	NC	20		
5084052	Total Titanium (Ti)	2017/07/21	98	80 - 120	99	80 - 120	<2.0	ug/L	NC	20		
5084052	Total Uranium (U)	2017/07/21	105	80 - 120	108	80 - 120	<0.10	ug/L	7.6	20		
5084052	Total Vanadium (V)	2017/07/21	95	80 - 120	100	80 - 120	<2.0	ug/L	NC	20		
5084052	Total Zinc (Zn)	2017/07/21	92	80 - 120	99	80 - 120	<5.0	ug/L	NC	20		
5084195	Nitrogen (Ammonia Nitrogen)	2017/07/24	105	80 - 120	106	80 - 120	<0.050	mg/L	6.1	20		

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5084509	Total Organic Carbon (C)	2017/07/21	105	80 - 120	106	80 - 120	<0.50	mg/L	1.1	20		
5086747	pH	2017/07/24							0.35	N/A	101	97 - 103
5086748	Conductivity	2017/07/24			103	80 - 120	1.6, RDL=1.0	uS/cm	1.8	25		
5086754	pH	2017/07/24							1.7	N/A	101	97 - 103
5086756	Conductivity	2017/07/24			102	80 - 120	1.8, RDL=1.0	uS/cm	0.40	25		
5086839	Turbidity	2017/07/24			100	80 - 120	<0.10	NTU	12	20	110	80 - 120
5086845	Turbidity	2017/07/24			100	80 - 120	<0.10	NTU	2.1	20	110	80 - 120
5086994	Dissolved Aluminum (Al)	2017/07/24	101	80 - 120	100	80 - 120	<5.0	ug/L	NC	20		
5086994	Dissolved Antimony (Sb)	2017/07/24	97	80 - 120	97	80 - 120	<1.0	ug/L	NC	20		
5086994	Dissolved Arsenic (As)	2017/07/24	97	80 - 120	96	80 - 120	<1.0	ug/L	NC	20		
5086994	Dissolved Barium (Ba)	2017/07/24	97	80 - 120	97	80 - 120	<1.0	ug/L	1.3	20		
5086994	Dissolved Beryllium (Be)	2017/07/24	106	80 - 120	104	80 - 120	<1.0	ug/L	NC	20		
5086994	Dissolved Bismuth (Bi)	2017/07/24	98	80 - 120	101	80 - 120	<2.0	ug/L	NC	20		
5086994	Dissolved Boron (B)	2017/07/24	104	80 - 120	104	80 - 120	<50	ug/L	NC	20		
5086994	Dissolved Cadmium (Cd)	2017/07/24	100	80 - 120	99	80 - 120	<0.010	ug/L	NC	20		
5086994	Dissolved Calcium (Ca)	2017/07/24	NC	80 - 120	101	80 - 120	<100	ug/L	0.65	20		
5086994	Dissolved Chromium (Cr)	2017/07/24	99	80 - 120	98	80 - 120	<1.0	ug/L	NC	20		
5086994	Dissolved Cobalt (Co)	2017/07/24	101	80 - 120	102	80 - 120	<0.40	ug/L	4.9	20		
5086994	Dissolved Copper (Cu)	2017/07/24	98	80 - 120	101	80 - 120	<2.0	ug/L	NC	20		
5086994	Dissolved Iron (Fe)	2017/07/24	100	80 - 120	103	80 - 120	<50	ug/L	0.98	20		
5086994	Dissolved Lead (Pb)	2017/07/24	98	80 - 120	97	80 - 120	<0.50	ug/L	NC	20		
5086994	Dissolved Magnesium (Mg)	2017/07/24	NC	80 - 120	103	80 - 120	<100	ug/L	1.7	20		
5086994	Dissolved Manganese (Mn)	2017/07/24	NC	80 - 120	100	80 - 120	<2.0	ug/L	0.75	20		
5086994	Dissolved Molybdenum (Mo)	2017/07/24	102	80 - 120	100	80 - 120	<2.0	ug/L	NC	20		
5086994	Dissolved Nickel (Ni)	2017/07/24	99	80 - 120	101	80 - 120	<2.0	ug/L	NC	20		
5086994	Dissolved Phosphorus (P)	2017/07/24	106	80 - 120	104	80 - 120	<100	ug/L	NC	20		
5086994	Dissolved Potassium (K)	2017/07/24	102	80 - 120	104	80 - 120	<100	ug/L	0.013	20		
5086994	Dissolved Selenium (Se)	2017/07/24	99	80 - 120	98	80 - 120	<1.0	ug/L	NC	20		
5086994	Dissolved Silver (Ag)	2017/07/24	100	80 - 120	97	80 - 120	<0.10	ug/L	NC	20		
5086994	Dissolved Sodium (Na)	2017/07/24	101	80 - 120	103	80 - 120	<100	ug/L	6.7	20		
5086994	Dissolved Strontium (Sr)	2017/07/24	97	80 - 120	97	80 - 120	<2.0	ug/L	1.2	20		

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5086994	Dissolved Thallium (Tl)	2017/07/24	101	80 - 120	101	80 - 120	<0.10	ug/L	NC	20		
5086994	Dissolved Tin (Sn)	2017/07/24	103	80 - 120	99	80 - 120	<2.0	ug/L	NC	20		
5086994	Dissolved Titanium (Ti)	2017/07/24	100	80 - 120	102	80 - 120	<2.0	ug/L	NC	20		
5086994	Dissolved Uranium (U)	2017/07/24	104	80 - 120	102	80 - 120	<0.10	ug/L	0.25	20		
5086994	Dissolved Vanadium (V)	2017/07/24	102	80 - 120	101	80 - 120	<2.0	ug/L	NC	20		
5086994	Dissolved Zinc (Zn)	2017/07/24	99	80 - 120	101	80 - 120	<5.0	ug/L	NC	20		
5087284	Total Alkalinity (Total as CaCO3)	2017/07/25	NC	80 - 120	106	80 - 120	<5.0	mg/L	1.6	25		
5087287	Dissolved Chloride (Cl)	2017/07/25	NC	80 - 120	104	80 - 120	<1.0	mg/L	0.12	25	106	80 - 120
5087288	Dissolved Sulphate (SO4)	2017/07/25	95	80 - 120	97	80 - 120	<2.0	mg/L	NC	25		
5087293	Reactive Silica (SiO2)	2017/07/25	NC	80 - 120	102	80 - 120	<0.50	mg/L	1.6	25		
5087296	Colour	2017/07/25			101	80 - 120	<5.0	TCU	7.3	20		
5087299	Nitrate + Nitrite (N)	2017/07/25	95	80 - 120	99	80 - 120	<0.050	mg/L	NC	25		
5087302	Orthophosphate (P)	2017/07/26	94	80 - 120	97	80 - 120	<0.010	mg/L	NC	25		
5087307	Nitrite (N)	2017/07/26	95	80 - 120	100	80 - 120	<0.010	mg/L	NC	25		
5088632	Nitrogen (Ammonia Nitrogen)	2017/07/26	NC	80 - 120	104	80 - 120	<0.050	mg/L	1.1	20		
5088639	Dissolved Aluminum (Al)	2017/07/25	101	80 - 120	114	80 - 120	<5.0	ug/L	3.7	20		
5088639	Dissolved Antimony (Sb)	2017/07/25	99	80 - 120	99	80 - 120	<1.0	ug/L				
5088639	Dissolved Arsenic (As)	2017/07/25	97	80 - 120	101	80 - 120	<1.0	ug/L	NC	20		
5088639	Dissolved Barium (Ba)	2017/07/25	97	80 - 120	103	80 - 120	<1.0	ug/L				
5088639	Dissolved Beryllium (Be)	2017/07/25	101	80 - 120	104	80 - 120	<1.0	ug/L				
5088639	Dissolved Bismuth (Bi)	2017/07/25	99	80 - 120	99	80 - 120	<2.0	ug/L				
5088639	Dissolved Boron (B)	2017/07/25	99	80 - 120	102	80 - 120	<50	ug/L	NC	20		
5088639	Dissolved Cadmium (Cd)	2017/07/25	98	80 - 120	100	80 - 120	<0.010	ug/L	NC	20		
5088639	Dissolved Calcium (Ca)	2017/07/25	101	80 - 120	115	80 - 120	<100	ug/L				
5088639	Dissolved Chromium (Cr)	2017/07/25	99	80 - 120	103	80 - 120	<1.0	ug/L	NC	20		
5088639	Dissolved Cobalt (Co)	2017/07/25	98	80 - 120	103	80 - 120	<0.40	ug/L				
5088639	Dissolved Copper (Cu)	2017/07/25	97	80 - 120	102	80 - 120	<2.0	ug/L	NC	20		
5088639	Dissolved Iron (Fe)	2017/07/25	NC	80 - 120	116	80 - 120	<50	ug/L	0.47	20		
5088639	Dissolved Lead (Pb)	2017/07/25	99	80 - 120	103	80 - 120	<0.50	ug/L	NC	20		
5088639	Dissolved Magnesium (Mg)	2017/07/25	98	80 - 120	117	80 - 120	<100	ug/L				
5088639	Dissolved Manganese (Mn)	2017/07/25	NC	80 - 120	103	80 - 120	<2.0	ug/L	0.38	20		

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5088639	Dissolved Molybdenum (Mo)	2017/07/25	101	80 - 120	98	80 - 120	<2.0	ug/L	NC	20		
5088639	Dissolved Nickel (Ni)	2017/07/25	98	80 - 120	103	80 - 120	<2.0	ug/L	NC	20		
5088639	Dissolved Phosphorus (P)	2017/07/25	106	80 - 120	117	80 - 120	<100	ug/L				
5088639	Dissolved Potassium (K)	2017/07/25	96	80 - 120	113	80 - 120	<100	ug/L				
5088639	Dissolved Selenium (Se)	2017/07/25	99	80 - 120	100	80 - 120	<1.0	ug/L	NC	20		
5088639	Dissolved Silver (Ag)	2017/07/25	97	80 - 120	101	80 - 120	<0.10	ug/L	NC	20		
5088639	Dissolved Sodium (Na)	2017/07/25	99	80 - 120	114	80 - 120	<100	ug/L				
5088639	Dissolved Strontium (Sr)	2017/07/25	94	80 - 120	103	80 - 120	<2.0	ug/L				
5088639	Dissolved Thallium (Tl)	2017/07/25	101	80 - 120	99	80 - 120	<0.10	ug/L	NC	20		
5088639	Dissolved Tin (Sn)	2017/07/25	102	80 - 120	99	80 - 120	<2.0	ug/L				
5088639	Dissolved Titanium (Ti)	2017/07/25	99	80 - 120	108	80 - 120	<2.0	ug/L				
5088639	Dissolved Uranium (U)	2017/07/25	102	80 - 120	105	80 - 120	<0.10	ug/L	NC	20		
5088639	Dissolved Vanadium (V)	2017/07/25	100	80 - 120	104	80 - 120	<2.0	ug/L				
5088639	Dissolved Zinc (Zn)	2017/07/25	100	80 - 120	104	80 - 120	<5.0	ug/L	1.4	20		
5088710	Total Organic Carbon (C)	2017/07/25	103	80 - 120	100	80 - 120	<0.50	mg/L	6.8	20		

N/A = Not Applicable

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

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

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

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

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

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

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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Maxxam Job #: B7F4245
Report Date: 2017/07/27

Stantec Consulting Ltd
Client Project #: 121414186
Sampler Initials: DJC

VALIDATION SIGNATURE PAGE

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

Kevin MacDonald, Inorganics Supervisor

Mike MacGillivray, Scientific Specialist (Inorganics)

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Your Project #: 121414186
Your C.O.C. #: 641847-01-01

Attention:Andrew Sullivan

Stantec Consulting Ltd
40 Highfield Park Drive
Suite 102
Dartmouth, NS
B3A 0A3

Report Date: 2017/12/14
Report #: R4909864
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7R8185
Received: 2017/12/07, 11:30

Sample Matrix: Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Carbonate, Bicarbonate and Hydroxide	2	N/A	2017/12/12	N/A	SM 22 4500-CO2 D
Alkalinity	2	N/A	2017/12/13	ATL SOP 00013	EPA 310.2 R1974 m
Chloride	2	N/A	2017/12/12	ATL SOP 00014	SM 22 4500-Cl- E m
Colour	2	N/A	2017/12/14	ATL SOP 00020	SM 22 2120C m
Conductance - water	2	N/A	2017/12/12	ATL SOP 00004	SM 22 2510B m
Hardness (calculated as CaCO3)	1	N/A	2017/12/12	ATL SOP 00048	SM 22 2340 B
Hardness (calculated as CaCO3)	1	N/A	2017/12/13	ATL SOP 00048	SM 22 2340 B
Metals Water Total MS	1	2017/12/11	2017/12/11	ATL SOP 00058	EPA 6020A R1 m
Metals Water Total MS	1	2017/12/11	2017/12/13	ATL SOP 00058	EPA 6020A R1 m
Ion Balance (% Difference)	2	N/A	2017/12/14	N/A	Auto Calc.
Anion and Cation Sum	2	N/A	2017/12/13	N/A	Auto Calc.
Nitrogen Ammonia - water	2	N/A	2017/12/12	ATL SOP 00015	EPA 350.1 R2 m
Nitrogen - Nitrate + Nitrite	2	N/A	2017/12/13	ATL SOP 00016	USGS SOPINCF0452.2 m
Nitrogen - Nitrite	2	N/A	2017/12/12	ATL SOP 00017	SM 22 4500-NO2- B m
Nitrogen - Nitrate (as N)	2	N/A	2017/12/13	ATL SOP 00018	ASTM D3867-16
pH (1)	2	N/A	2017/12/12	ATL SOP 00003	SM 22 4500-H+ B m
Phosphorus - ortho	2	N/A	2017/12/13	ATL SOP 00021	SM 22 4500-P E m
Sat. pH and Langelier Index (@ 20C)	2	N/A	2017/12/14	ATL SOP 00049	Auto Calc.
Sat. pH and Langelier Index (@ 4C)	2	N/A	2017/12/14	ATL SOP 00049	Auto Calc.
Reactive Silica	2	N/A	2017/12/14	ATL SOP 00022	EPA 366.0 m
Sulphate	2	N/A	2017/12/13	ATL SOP 00023	ASTM D516-16 m
Total Dissolved Solids (TDS calc)	2	N/A	2017/12/14	N/A	Auto Calc.
Organic carbon - Total (TOC) (2)	2	N/A	2017/12/14	ATL SOP 00037	SM 22 5310C m
Turbidity	2	N/A	2017/12/12	ATL SOP 00011	EPA 180.1 R2 m

Remarks:

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

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using

Your Project #: 121414186
Your C.O.C. #: 641847-01-01

Attention:Andrew Sullivan

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40 Highfield Park Drive
Suite 102
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Report Date: 2017/12/14
Report #: R4909864
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7R8185
Received: 2017/12/07, 11:30

accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected.

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

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

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

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

(1) The APHA Standard Method require pH to be analyzed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the APHA Standard Method holding time.
(2) TOC / DOC present in the sample should be considered as non-purgeable TOC / DOC.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Marie Muise, Key Account Specialist
Email: MMuise@maxxam.ca
Phone# (902)420-0203 Ext:253

==========

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Maxxam Job #: B7R8185
Report Date: 2017/12/14

Stantec Consulting Ltd
Client Project #: 121414186
Sampler Initials: DB

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID		FSJ427		FSJ428	FSJ428		
Sampling Date		2017/12/07		2017/12/07	2017/12/07		
COC Number		641847-01-01		641847-01-01	641847-01-01		
	UNITS	**SW7**	**RDL**	**SW7A**	**SW7A Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters							
Anion Sum	me/L	1.75	N/A	6.76	N/A	N/A	5306188
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	57	1.0	290	N/A	1.0	5305666
Calculated TDS	mg/L	100	1.0	430	N/A	1.0	5306189
Carb. Alkalinity (calc. as CaCO3)	mg/L	<1.0	1.0	<1.0	N/A	1.0	5305666
Cation Sum	me/L	1.59	N/A	9.02	N/A	N/A	5306188
Hardness (CaCO3)	mg/L	52	1.0	180	N/A	1.0	5306186
Ion Balance (% Difference)	%	4.79	N/A	14.3	N/A	N/A	5306187
Langelier Index (@ 20C)	N/A	-0.941	N/A	-0.318	N/A	N/A	5305673
Langelier Index (@ 4C)	N/A	-1.19	N/A	-0.566	N/A	N/A	5305674
Nitrate (N)	mg/L	0.11	0.050	<0.050	N/A	0.050	5306135
Saturation pH (@ 20C)	N/A	8.34	N/A	7.27	N/A	N/A	5305673
Saturation pH (@ 4C)	N/A	8.59	N/A	7.51	N/A	N/A	5305674
Inorganics							
Total Alkalinity (Total as CaCO3)	mg/L	57	5.0	290	N/A	25	5310921
Dissolved Chloride (Cl)	mg/L	18	1.0	35	N/A	1.0	5310922
Colour	TCU	17	5.0	5.3	N/A	5.0	5310935
Nitrate + Nitrite (N)	mg/L	0.11	0.050	<0.050	N/A	0.050	5310946
Nitrite (N)	mg/L	<0.010	0.010	<0.010	N/A	0.010	5310947
Nitrogen (Ammonia Nitrogen)	mg/L	0.48	0.050	15	N/A	0.50	5311427
Total Organic Carbon (C)	mg/L	2.4	0.50	20 (1)	N/A	5.0	5315476
Orthophosphate (P)	mg/L	<0.010	0.010	<0.010	N/A	0.010	5310943
pH	pH	7.40	N/A	6.95	N/A	N/A	5310583
Reactive Silica (SiO2)	mg/L	11	0.50	17	N/A	0.50	5310929
Dissolved Sulphate (SO4)	mg/L	4.6	2.0	<2.0	N/A	2.0	5310928
Turbidity	NTU	1.2	0.10	330	330	1.0	5310629
Conductivity	uS/cm	170	1.0	650	N/A	1.0	5310584
Metals							
Total Aluminum (Al)	ug/L	10	5.0	210	N/A	5.0	5308719
Total Antimony (Sb)	ug/L	<1.0	1.0	<1.0	N/A	1.0	5308719
Total Arsenic (As)	ug/L	1.0	1.0	160	N/A	1.0	5308719
Total Barium (Ba)	ug/L	91	1.0	1100	N/A	1.0	5308719
Total Beryllium (Be)	ug/L	<1.0	1.0	<1.0	N/A	1.0	5308719
Total Bismuth (Bi)	ug/L	<2.0	2.0	<2.0	N/A	2.0	5308719

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Reporting limit was increased due to turbidity.

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Maxxam Job #: B7R8185
Report Date: 2017/12/14

Stantec Consulting Ltd
Client Project #: 121414186
Sampler Initials: DB

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID		FSJ427		FSJ428	FSJ428		
Sampling Date		2017/12/07		2017/12/07	2017/12/07		
COC Number		641847-01-01		641847-01-01	641847-01-01		
	UNITS	**SW7**	**RDL**	**SW7A**	**SW7A Lab-Dup**	**RDL**	**QC Batch**
Total Boron (B)	ug/L	<50	50	220	N/A	50	5308719
Total Cadmium (Cd)	ug/L	<0.010	0.010	0.013	N/A	0.010	5308719
Total Calcium (Ca)	ug/L	18000	100	53000	N/A	100	5308719
Total Chromium (Cr)	ug/L	<1.0	1.0	2.5	N/A	1.0	5308719
Total Cobalt (Co)	ug/L	<0.40	0.40	10	N/A	0.40	5308719
Total Copper (Cu)	ug/L	<2.0	2.0	<2.0	N/A	2.0	5308719
Total Iron (Fe)	ug/L	700	50	68000	N/A	500	5308719
Total Lead (Pb)	ug/L	<0.50	0.50	0.82	N/A	0.50	5308719
Total Magnesium (Mg)	ug/L	1800	100	12000	N/A	100	5308719
Total Manganese (Mn)	ug/L	420	2.0	3100	N/A	2.0	5308719
Total Molybdenum (Mo)	ug/L	<2.0	2.0	<2.0	N/A	2.0	5308719
Total Nickel (Ni)	ug/L	<2.0	2.0	6.0	N/A	2.0	5308719
Total Phosphorus (P)	ug/L	<100	100	890	N/A	100	5308719
Total Potassium (K)	ug/L	1700	100	21000	N/A	100	5308719
Total Selenium (Se)	ug/L	<1.0	1.0	<1.0	N/A	1.0	5308719
Total Silver (Ag)	ug/L	<0.10	0.10	<0.10	N/A	0.10	5308719
Total Sodium (Na)	ug/L	11000	100	31000	N/A	100	5308719
Total Strontium (Sr)	ug/L	34	2.0	310	N/A	2.0	5308719
Total Thallium (Tl)	ug/L	<0.10	0.10	<0.10	N/A	0.10	5308719
Total Tin (Sn)	ug/L	<2.0	2.0	<2.0	N/A	2.0	5308719
Total Titanium (Ti)	ug/L	<2.0	2.0	4.4	N/A	2.0	5308719
Total Uranium (U)	ug/L	<0.10	0.10	<0.10	N/A	0.10	5308719
Total Vanadium (V)	ug/L	<2.0	2.0	2.4	N/A	2.0	5308719
Total Zinc (Zn)	ug/L	<5.0	5.0	<5.0	N/A	5.0	5308719

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

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Maxxam Job #: B7R8185
Report Date: 2017/12/14

Stantec Consulting Ltd
Client Project #: 121414186
Sampler Initials: DB

GENERAL COMMENTS

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

Package 1	4.7°C

Sample FSJ428 [SW7A] : Poor RCAp Ion Balance due to sample matrix. Excess cations due to presence of turbidity.

Results relate only to the items tested.

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Maxxam Job #: B7R8185
Report Date: 2017/12/14

QUALITY ASSURANCE REPORT

Stantec Consulting Ltd
Client Project #: 121414186
Sampler Initials: DB

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5308719	Total Aluminum (Al)	2017/12/11	99	80 - 120	101	80 - 120	<5.0	ug/L	1.4	20		
5308719	Total Antimony (Sb)	2017/12/11	100	80 - 120	97	80 - 120	<1.0	ug/L	NC	20		
5308719	Total Arsenic (As)	2017/12/11	98	80 - 120	97	80 - 120	<1.0	ug/L	NC	20		
5308719	Total Barium (Ba)	2017/12/11	96	80 - 120	94	80 - 120	<1.0	ug/L	0.045	20		
5308719	Total Beryllium (Be)	2017/12/11	101	80 - 120	97	80 - 120	<1.0	ug/L	2.1	20		
5308719	Total Bismuth (Bi)	2017/12/11	98	80 - 120	99	80 - 120	<2.0	ug/L				
5308719	Total Boron (B)	2017/12/11	105	80 - 120	101	80 - 120	<50	ug/L	NC	20		
5308719	Total Cadmium (Cd)	2017/12/11	103	80 - 120	100	80 - 120	<0.010	ug/L	6.6	20		
5308719	Total Calcium (Ca)	2017/12/11	NC	80 - 120	104	80 - 120	<100	ug/L	0.98	20		
5308719	Total Chromium (Cr)	2017/12/11	96	80 - 120	95	80 - 120	<1.0	ug/L	NC	20		
5308719	Total Cobalt (Co)	2017/12/11	99	80 - 120	98	80 - 120	<0.40	ug/L	NC	20		
5308719	Total Copper (Cu)	2017/12/11	NC	80 - 120	97	80 - 120	<2.0	ug/L	0.28	20		
5308719	Total Iron (Fe)	2017/12/11	102	80 - 120	103	80 - 120	<50	ug/L	NC	20		
5308719	Total Lead (Pb)	2017/12/11	97	80 - 120	97	80 - 120	<0.50	ug/L	2.4	20		
5308719	Total Magnesium (Mg)	2017/12/11	106	80 - 120	105	80 - 120	<100	ug/L	0.52	20		
5308719	Total Manganese (Mn)	2017/12/11	98	80 - 120	98	80 - 120	<2.0	ug/L	1.3	20		
5308719	Total Molybdenum (Mo)	2017/12/11	102	80 - 120	99	80 - 120	<2.0	ug/L	NC	20		
5308719	Total Nickel (Ni)	2017/12/11	98	80 - 120	98	80 - 120	<2.0	ug/L	NC	20		
5308719	Total Phosphorus (P)	2017/12/11	106	80 - 120	104	80 - 120	<100	ug/L				
5308719	Total Potassium (K)	2017/12/11	99	80 - 120	98	80 - 120	<100	ug/L	2.6	20		
5308719	Total Selenium (Se)	2017/12/11	103	80 - 120	98	80 - 120	<1.0	ug/L	NC	20		
5308719	Total Silver (Ag)	2017/12/11	99	80 - 120	97	80 - 120	<0.10	ug/L	NC	20		
5308719	Total Sodium (Na)	2017/12/11	102	80 - 120	102	80 - 120	<100	ug/L	1.1	20		
5308719	Total Strontium (Sr)	2017/12/11	NC	80 - 120	99	80 - 120	<2.0	ug/L	2.5	20		
5308719	Total Thallium (Tl)	2017/12/11	100	80 - 120	98	80 - 120	<0.10	ug/L	NC	20		
5308719	Total Tin (Sn)	2017/12/11	100	80 - 120	98	80 - 120	<2.0	ug/L	NC	20		
5308719	Total Titanium (Ti)	2017/12/11	99	80 - 120	101	80 - 120	<2.0	ug/L	NC	20		
5308719	Total Uranium (U)	2017/12/11	104	80 - 120	102	80 - 120	<0.10	ug/L	0.52	20		
5308719	Total Vanadium (V)	2017/12/11	98	80 - 120	96	80 - 120	<2.0	ug/L	NC	20		
5308719	Total Zinc (Zn)	2017/12/11	NC	80 - 120	99	80 - 120	<5.0	ug/L	9.5	20		
5310583	pH	2017/12/12							0.99	N/A	100	97 - 103

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Maxxam Job #: B7R8185
Report Date: 2017/12/14

QUALITY ASSURANCE REPORT(CONT'D)

Stantec Consulting Ltd
Client Project #: 121414186
Sampler Initials: DB

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5310584	Conductivity	2017/12/12			99	80 - 120	1.5, RDL=1.0	uS/cm	0.75	25		
5310629	Turbidity	2017/12/12			92	80 - 120	<0.10	NTU	0.97	20	95	80 - 120
5310921	Total Alkalinity (Total as CaCO3)	2017/12/13	NC	80 - 120	114	80 - 120	<5.0	mg/L	4.0 (1)	25		
5310922	Dissolved Chloride (Cl)	2017/12/12	NC	80 - 120	107	80 - 120	<1.0	mg/L	1.3	25	111	80 - 120
5310928	Dissolved Sulphate (SO4)	2017/12/13	103	80 - 120	102	80 - 120	<2.0	mg/L	2.5	25		
5310929	Reactive Silica (SiO2)	2017/12/14	98	80 - 120	98	80 - 120	<0.50	mg/L				
5310935	Colour	2017/12/14			89	80 - 120	<5.0	TCU	2.9	20		
5310943	Orthophosphate (P)	2017/12/13	91	80 - 120	95	80 - 120	<0.010	mg/L				
5310946	Nitrate + Nitrite (N)	2017/12/13	102	80 - 120	100	80 - 120	<0.050	mg/L				
5310947	Nitrite (N)	2017/12/12	101	80 - 120	100	80 - 120	<0.010	mg/L	NC	25		
5311427	Nitrogen (Ammonia Nitrogen)	2017/12/12	101	80 - 120	103	80 - 120	<0.050	mg/L	NC	20		
5315476	Total Organic Carbon (C)	2017/12/14	101	80 - 120	106	80 - 120	<0.50	mg/L	1.5	20		

N/A = Not Applicable

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

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

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

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

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

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

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Elevated reporting limit due to sample matrix.

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Maxxam Job #: B7R8185
Report Date: 2017/12/14

Stantec Consulting Ltd
Client Project #: 121414186
Sampler Initials: DB

VALIDATION SIGNATURE PAGE

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

Kevin MacDonald, Inorganics Supervisor

Mike MacGillivray, Scientific Specialist (Inorganics)

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

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Appendix G
Photos

Photo G. 1 Upstream view of REF site at Black Brook. July 19, 2017

Photo G. 2 Downstream view of REF site at Black Brook. July 19, 2017

Photo G. 3 Left bank view of REF site at Black Brook. July 19, 2017

Photo G. 4 Right bank view of REF site at Black Brook. July 19, 2017

Photo G. 5 *Gasterosteus sp.* (46 mm) Caught in REF site at Black Brook. July 17, 2017

Photo G. 6 Upstream/Left bank view of SW7 site at West Tributary. July 17, 2017

Photo G. 7 Downstream view of SW7 site at West Tributary. July 17, 2017

Photo G. 8 Right bank view of SW7 site at West Tributary. July 17, 2017

Photo G. 9 *Fundulus diaphanus* (63 mm) Caught in SW7 site at West Tributary. July 17, 2017

Photo G. 10 Upstream view of SW7A site at West Tributary. July 17, 2017

Photo G. 11 Downstream view of SW7A site at West Tributary. July 17, 2017

Appendix H
Benthic Invertebrate Lab Report

ANALYSIS OF BENTHIC INVERTEBRATE SPECIES COMPOSITION IN KICKNET (D-NET) SAMPLES— MEADOWVIEW LANDFILL (Project #121414186)

Report to:

Stantec
Dartmouth, Nova Scotia

September 2017

By

Envirosphere Consultants Limited
Windsor, Nova Scotia

Lab Number: 2017-41

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ANALYSIS OF BENTHIC INVERTEBRATE SPECIES COMPOSITION IN KICKNET (D-NET) SAMPLES –MEADOWVIEW LANDFILL–

for

Stantec
Dartmouth, Nova Scotia

September 2017

INTRODUCTION

Stantec provided three 'kicknet (d-net)' samples to Envirosphere Consultants Limited, Windsor, Nova Scotia on July 19, 2017 for biological analysis (identification and assessment for biological species composition and abundance). The three samples (2 x 3L and 1 x 2L) contained organisms in preservative collected from three sites on July 19, 2017. The results of the analysis are presented in this report.

METHODS

SUB-SAMPLING

Prior to sorting, samples and sub-samples were rinsed on a 0.5 mm 20 cm diameter circular sieve to remove preservative. To ensure efficiency processing, samples were then sub-sampled by dividing the sample in four or eight, by weight. The sample was spread evenly in the sieve and divided, with fourths or eighths transferred in their entirety into plastic trays. The trays with contents were weighed and verified to be within 0.5 to 1.0 gram of each other to ensure even distribution of the material. One of the trays was randomly selected for sorting and identification, and the others were held until the final sample analysis was completed, to allow an opportunity for further analysis if necessary to ensure adequate counts for interpretation. Final counts and biomass for the sub-samples were extrapolated to 100%, based on the sub-sample percentage (i.e. 12.5% or 25%). Sub-sampling can affect measures of animal abundance and biomass by increasing variability, and may lead to slightly reduced estimates of taxon richness compared to whole samples.

SORTING AND IDENTIFICATION

Sub-samples were examined at 6 to 6.4x magnification on a stereomicroscope, with a final brief check at 16x. Organisms were removed, and subsequently stored in labeled vials in 70% isopropyl alcohol. Sorting efficiency for lab personnel is checked periodically by re-sorting samples, to ensure average recovery levels of 90% or better. Wet weight biomass (grams per sample) was estimated for each sample by weighing animals to the nearest milligram at the time of sorting, after blotting to remove surface water.

Organisms were identified to an appropriate taxonomic level, typically to genus, using conventional literature for the groups involved (see Attachment 1). Organisms were identified by Heather Levy (B.Sc. Honours) and verified by Valerie Kendall (M.Env.Sc.) of Envirosphere Consultants. Sorting of animals from the samples,

identification, total number of animals of each type (taxonomic group), as well as total abundance, were determined for each sample. These numbers were used to calculate several indices of benthic community health, which can be compared between sites and, with time, at each site (an index of community health is like a body mass index or an IQ, which gives a single number that can be used to compare individuals or things). Indices calculated are all commonly used in studies of this kind and include: EPT Ratio (ratio of abundance of mayflies (Ephemeroptera), caddisflies (Trichoptera), and stoneflies (Plecoptera), to total numbers of organisms); Total Abundance (number of animals in the sample and per unit area); and Taxon Richness (number of taxa per sample) (Table 2). Abundance in kicknet samples was expressed on a per sample basis. All organisms present were included in estimates, with the exception of organisms listed as 'other' (Table 2).

RESULTS

Sediment descriptions for samples are presented in Table 1. Species identifications, abundance, and biomass measures are presented in Table 2.

Samples were dominated in numbers by fly larvae (Diptera), principally midges (Chironomidae), at all sites; juvenile bivalves (Mollusca) and aquatic worms (Oligochaeta) at sites 7 and 7A; and by water mites (Hydrachnidia), stonefly larvae (Plecoptera), and the amphipod, *Hyalella azteca*, at Site Reference. Dobsonfly/alderfly larvae (Megaloptera), aquatic worms (Oligochaeta), crustaceans, water mites, juvenile bivalves, and caddisfly larvae (Trichoptera) occurred at all sites. Mayfly (Ephemeroptera), springtails (Collembola) and leeches (Hirudinea) occurred at two of the three sites, and stonefly larvae (Plecoptera), aquatic beetles (Coleoptera), and dragonfly/damselfly larvae (Odonata) occurred at one of the three sites (Reference). Overall abundance was low to moderate (740 – 3512 individuals/m^2) and taxon richness moderate to high (13 – 29 taxa). EPT ratios, which indicate high water quality due to the requirement of the component EPT taxa for clean, oxygenated water, were low to moderate at sites (0.2 – 10.9 %); highest at Reference site.

Table 1. Characteristics of sediments in kicknet samples, Meadowview Landfill, Stantec, collected July 19, 2017.

Sample	Sediment Description
Site 7	Silt with occasional sand and organics (woody, leafy and other organic debris) as well as animal casings. Occasional bits of plastic present.
Site 7A	Woody, leafy and other organic debris with silt, and fine to medium sand. An oil/industrial smell was associated with the sample.
Reference	Medium to fine sand and occasional silt; woody, leafy & other organic debris, as well as animal casings. Occasional bits of refuse present.

Grain size classes: cobble = 6.4 cm and larger; pebble/gravel = 4 mm to 6.4 cm; sand = 0.063 mm to 2 mm; silt = 0.004 mm to 0.063 mm; clay = <0.004 mm.

Table 2. Species composition in kick-net samples from Meadowview Landfill, Stantec. Collected July 19, 2017.			
Site Number	**Site 7**	**Site 7A**	**Reference**
Sample Date	07/19/17	07/19/17	07/19/17
	Abundance per Sample		
INSECTA			
Diptera			
Certapogonidae-*Probezzia/bezzia* sp.	0	0	80
Chironomidae larvae	264	748	1744
Chironomidae pupae	0	0	16
Empididae larvae	0	8	32
Ptychopteridae unidentified	4	60	0
Simuliidae larvae	0	0	40
Simuliidae pupae	0	0	8
Tipulidae-*Dicranota* sp.	0	0	16
Ephemeroptera			
Ephemerellidae-*Eurylophella* sp.	0	0	32
Ephemeroptera	12	0	32
Plecoptera			
Plecoptera	0	0	240
Trichoptera			
Hydropsychidae	0	0	16
Lepidostomatidae-*Lepidostoma* sp.	0	0	24
Limnephilidae-sp. A	0	4	0
Limnephilidae-sp. B	0	0	16
Phryganeidae-*Oligostomis* sp	4	0	8
Polycentropodidae-*Phylocentropus* sp.	0	0	16
Megaloptera			
Sialidae-*Sialis* sp.	4	176	8
Odonata			
Cordulegastridae-*Cordulegaster* sp.	0	0	8
Coleoptera			
Dytiscidae-*Ilybius* sp.	0	0	8
Dytiscidae-*Potamonectes* sp.	0	0	16
Elmidae adult	0	0	8
Collembola			
Collembola (springtail)	4	4	0
Hirudinea			
Helobdella stagnalis	0	20	8
Hirudinea sp. A	0	4	0
Mollusca			
Sphaeriidae-*Pisidium* sp.	76	28	0
Sphaeriidae juvenile	196	308	128
Crustacea			
Amphipoda-*Hyalella azteca*	0	0	288
Copepoda	12	112	16

Table 2. Species composition in kick-net samples from Meadowview Landfill, Stantec. Collected July 19, 2017.			
Site Number	**Site 7**	**Site 7A**	**Reference**
Sample Date	07/19/17	07/19/17	07/19/17
	Abundance per Sample		
INSECTA			
Ostracoda	36	32	0
Oligochaeta			
Oligochaete unidentified	116	416	96
Hydrachnidia			
Hydrachnidia sp. A	8	4	536
Hydrachnidia sp. B	4	0	16
Hydrachnidia sp. C	0	4	0
Hydrachnidia sp. D	0	0	32
Hydrachnidia sp. E	0	0	8
Hydrachnidia sp. F	0	0	8
Hydrachnidia sp. G	0	0	8
Other			
Diptera-emergent (winged)	0	0	8
Arachnid	0	0	16
Summary (excluding Other)			
Abundance (total # of organisms)	740	1928	3512
Taxon Richness (# of taxa)	13	15	29
EPT Ratio (%)	2.2	0.2	10.9
Biomass (grams wet weight)	0.378	2.87	7.77

ATTACHMENT 1 – TAXONOMIC LITERATURE

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