April 2017

QIKIQ15 BAFFIN REGION DEW LINE SITE MONITORING

2016 FOX-4 Monitoring Report

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Executive Summary

Golder Associates Ltd. (Golder) has been contracted by Public Services and Procurement Canada (PSPC), on behalf of the Department of National Defence (DND), to complete the 2015-2018 Distant Early Warning (DEW) Line Sites Landfill Monitoring Program in the Baffin Region of Nunavut. The five DEW Line sites that were monitored in 2016 as part of the QIKIQ15 contract are FOX-2, FOX-3, FOX-4, FOX-5 and DYE-M. These sites are all now in the Post-Construction Monitoring Phase of their remedial program.

This Monitoring Report presents the 2016 post-construction inspection and monitoring results for five landfills at FOX-4: the Non-Hazardous Waste Landfill and Tier II Disposal Facility, Helipad West Landfill, Station Area Landfill, Pallet Line Landfill and Tanner Bay Landfill. The 2016 monitoring event was Year 18 for FOX-4; the initial environmental cleanup and demolition of old facilities at the FOX-4 site took place between 1996 and 1999. A second round of environmental cleanup and maintenance was completed between 2011 and 2013 to address certain elements of the Cooperation Agreement that were not addressed during the initial FOX-4 cleanup. FOX-4 was last monitored in 2014.

Non-Hazardous Waste Landfill and Tier II Disposal Facility

Based on the visual inspection, there were no indications of instability at the the Non-Hazardous Waste Landfill and Tier II Disposal Facility. No sloughing or exposed waste was observed. A new crack was observed on the slope between the Non-Hazardous Waste Landfill and Tier II Disposal Facility crest surfaces that was assigned an “Acceptable” severity rating because there is minimal risk of slope failure and waste exposure. Previously observed occasional minor self-armouring erosion on the landfill slopes does not appear to be deteriorating with time. Isolated locations with minor settlement, debris, tire tracks and rough grading were observed on the landfill surfaces, however these are not considered of concern. Overall, the physical performance of this landfill was assessed as “Acceptable”.

Concentrations of metals in soil were highest overall at the deep sample location MW11-1. At this location, the concentrations of cadmium, lead and chromium were greater than those reported in 2014 and the concentrations of copper, nickel, cobalt, cadmium, zinc and chromium exceeded their baseline mean concentrations plus 3σ; the concentration of arsenic was equal to its baseline mean concentration plus 3σ. Cadmium was the most commonly noted exceedance in 2016, and at all soil sampling locations, cadmium was greater than the concentrations observed in 2014.

Modified TPH concentrations in soil (maximum of 491 mg/kg in the deep sample at MW12-08) were detected at the shallow and deep MW11-03 sample locations, the shallow MW11-04 sample location and the shallow and deep MW12-08 shallow and deep sample locations. The concentrations of modified TPH at the shallow and deep MW12-08 sample locations were greater than the concentrations reported in 2014. No detectable concentrations of mercury or PCB were noted in any of the soil samples in 2016.

The highest concentrations of metals in groundwater were observed at MW11-02. At this location, the concentrations of nickel, cobalt and zinc were greater than those reported in previous years and the concentrations of cobalt and zinc exceeded their baseline mean concentrations plus 3σ. At all other locations, the concentrations of most metals were lower than those reported in 2014. No detectable concentrations of chromium, mercury, PHC or PCB were noted in any of the groundwater samples in 2016.

Comparison of groundwater elevations based on estimated grade elevation and the measured water depth in the wells indicates that groundwater in was highest to the north at MW11-01, and lowest towards the west at MW12-07. The water levels at MW11-02, MW11-03 and MW12-08 indicate there is generally a western gradient in the area of the landfills. This is consistent with local grades.

Overall, it was noted that the soil sampling location with the most exceedances of the baseline mean plus 3σ (entirely metals), MW11-01, was located upgradient of the landfills. The only groundwater sample with exceedances of the baseline mean plus 3σ was MW11-02, located between the landfills and in an area where ponded water and staining are noted. This could potentially reflect impact from the landfills. Metals concentrations for a number of the soil (notably cadmium) and groundwater sampling results were greater than in 2014. Fewer than seven samples have been collected for trend confirmation and therefore additional data are required to confirm an increasing trend.

No modifications to the ongoing monitoring program at this landfill are recommended. Additional data is required to assess if the observed increases in 2016 relate to impact from the landfills or reflect variations in natural conditions.

Helipad West Landfill

Based on the visual inspection, there were no indications of instability at the the Helipad West Landfill. No sloughing or exposed waste was observed. A new tension crack was observed at the top of the west slope that was assigned a “Marginal” severity rating because it is at the top of a fairly large slope that was recently regraded. Occasional minor self-armouring erosion observed on the landfill slopes does not appear to be deteriorating with time. Isolated locations with minor settlement, sink holes and debris were observed at the landfill, however these are not considered a concern. The sink holes do not appear to be caused by groundwater flow, permafrost thaw or settlement of the subsurface. They appear to be simply caused by sand and gravel washing into voids of the adjacent boulder rockfill, as a result of the gravel cover not being filter compatible with the boulder rockfill. The overall physical performance of this landfill was assessed as “Marginal” because of the newly observed tension crack near the top of the west slope.

Concentrations of metals in soil were highest overall at the shallow sample location MW98-01, located downgradient of the south side of the landfill. Metals concentrations at this location were relatively stable at this location from 1999 to 2013, but increased in 2014 and 2016. The concentrations of most metals observed in 2016 represent new historical maxima and the concentrations of copper, nickel, cobalt, zinc and chromium exceeded their baseline mean concentration plus 3σ. At MW98-02, MW98-03 and MW98-06, the concentrations of most metals were less than or similar to those reported in previous years.

PHC were detected at the shallow and deep MW98-03 locations, the shallow MW98-06 location and the shallow MW98-02 location at modified TPH concentrations of between 54 mg/kg and 3,358 mg/kg. The modified TPH concentration reported at MW98-02 in 2016 exceeded the baseline mean concentration plus 3σ and represents a new historical maximum concentration. No detectable concentrations of cadmium, mercury or PCB were noted in any of the samples in 2016.

At MW98-02, the concentrations of all metals and PHC in groundwater were lower in comparison to those reported in recent years. No cadmium, chromium, mercury or PCB were detected at this location in 2016.

Overall, it was noted that a number of the soil sampling results (e.g., metals at MW98-01 and PHC at MW98-02) were greater than in previous years; this may be reflective of an ongoing impact from the landfill. No modifications to the ongoing monitoring program at this landfill are recommended.

Station Area Landfill

The Station Area Non-Hazardous Waste Landfill had no observed cracking, exposed waste or indications of slope instability. The landfill has some previously observed minor settlement, erosion, ponded water and staining features. This landfill was assessed to have an “Acceptable” overall performance because all observed features were assessed as “Acceptable”. Previously observed sink holes located along the edge of the landfill and a small minor settlement area on the cover surface do not appear to have changed since the last inspection. The sink holes do not appear to be caused by groundwater flow, permafrost thaw or settlement of the subsurface. They appear to be simply caused by sand and gravel washing into voids of the adjacent boulder rockfill, as a result of the gravel cover not being filter compatible with the boulder rockfill. Previously observed erosion channels are self-armouring and are not considered to be a concern. Previously observed ponded water along the edge of the landfill and orange staining may be related to landfill seepage.

Concentrations of metal parameters in soil were highest overall at the shallow MW98-07 sample location, located upgradient of the east side of the landfill. At all three locations, the concentrations of metals were similar to or less than those reported in previous years. No detectable concentrations of cadmium or mercury were noted in any of the samples in 2016.

PHC were detected at upgradient location MW98-07; the modified TPH concentration observed in 2016 exceeded the baseline mean concentration plus 3σ and represents a new historical maximum concentration. PCB were detected at the shallow and deep MW98-08 locations and the shallow MW98-09 location, at concentrations between 0.08 mg/kg and 1.46 mg/kg. The PCB concentration reported at the shallow MW98-08 location exceeded the baseline mean concentration plus 3σ and represents a new historical maximum concentration.

In 2016, groundwater samples could not be collected from any of the three monitoring wells adjacent to the landfill as they were dry or frozen. It is also noted that the casing and monitoring well pipe were filled with bentonite clay and therefore collecting of an accurate sample at these locations should not be possible.

The historical graphs in Appendix C show concentration trends at the Station Area Non-Hazardous Waste Landfill. At downgradient locations MW98-08 and MW98-09, relatively stable trends are noted for most parameters. At upgradient location MW98-07, slight increasing trends are noted for a number of parameters, notably for chromium and modified TPH. The concentrations of all metals at MW98-07 were less than, or similar to, those reported in recent years and the increasing trends observed at MW98-07 are not considered to reflect impact from the landfill. Given the staining in the area of standing water and the presence of elevated PCB at MW98-08 in 2016, impact from the landfill may be occurring, however overall, there is no evident increasing trend in the metals concentrations in this area, with the possible exception of arsenic, up to 2014.

It is recommended that soil samples from closer to the ponded water/staining area be collected during the next monitoring event. It is further recommended, considering the inability to collect groundwater samples from the wells (because they are filled with bentonite clay), that consideration be given to collection of water samples from either the ponded surface water, or a shallow hand dug excavation. In addition, an attempt should be made to flush these wells during the next sampling program.

Pallet Line Landfill

During the 2016 visual inspection there were no observations of erosion, settlement, cracking, exposed waste or indications of instability at the Pallet Line Landfill. The previously observed ponded water was not present during the 2016 visual inspection. A new small hydrocarbon stain was observed in 2016 that was likely caused by a fuel spill and is not related to landfill performance. Based on the visual inspection, the overall stability performance of the landfill was assessed as “Acceptable”.

Concentrations of metals were highest overall at the sample location F4-27 (shallow sample), located downgradient of the east side of the landfill. At F4-26, F4-27, F4-28 and F4-29, the majority of metals concentrations were greater than those reported in 2014. Concentrations of cadmium and PCB at F4-25, F4-26, F4-27 and F4-29 increased from those reported in 2014 (mostly non-detectable) and exceeded their respective baseline mean concentrations plus 3σ. PHC were detected at the F4-26, F4-27 and F4-28 sampling locations; the modified TPH concentrations at F4-26 and F4-28 were greater than the concentrations reported in 2014 and exceeded the baseline mean concentration plus 3σ. No detectable concentrations of mercury were noted in any of the samples in 2016.

Overall, it was noted that whereas metals concentrations for a number of the soil sampling results were greater than in the previous monitoring session, they were not markedly different at upgradient vs downgradient locations. Considering that fewer than seven samples have been collected, confirmation of trends is not possible at this time the data do not suggest that impact from the landfill is occurring.

No modifications to the ongoing monitoring program at this landfill are recommended. Additional data is required to assess if the observed increases in 2016 relate to impact from the landfill or reflect variations in natural conditions or sampling/analytical program influences.

Tanner Bay Landfill

The Tanner Bay Landfill exhibited some isolated minor settlement, cracking, self-armouring erosion and ponded water. The overall stability performance of the landfill was assessed as “Acceptable”.

The concentrations of metals were highest overall at the deep F4-12 sample location, located immediately downgradient of the west side of the landfill. A slight increasing trend of most metals have been observed at this location since 2008. Exceedances of the baseline mean concentration plus 3σ were reported for copper at F4-11 (shallow sample), F4-12 (shallow and deep samples) and F4-13 (deep sample) and for arsenic at F4-12 (deep sample). It is noted that the baseline mean concentrations plus 3σ at the Tanner Bay Landfill are lower in comparison to other FOX-4 landfills. The concentrations of copper and arsenic at all locations were lower than their respective background mean concentrations. No detectable concentrations of mercury, PHC or PCB were noted in any of the samples in 2016.

Overall, it is noted that slight increases in some metal concentrations have been observed at the downgradient locations F4-12 and/or F4-13 including copper, nickel, zinc and chromium. Concentrations of copper appear to be increasing at upgradient location F4-11 as well. These increases are not significant enough to warrant concern, but should continue to be assessed. No modifications to the ongoing monitoring program at this landfill are recommended.

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1.0 INTRODUCTION

Golder Associates Ltd. (Golder) has been contracted by Public Services and Procurement Canada (PSPC), on behalf of the Department of National Defence (DND), to complete the 2015-2018 Distant Early Warning (DEW) Line Sites Landfill Monitoring Program in the Baffin Region of Nunavut (hereafter referred to as the "Project"). The contract number with PSPC is W6837-151002/001/NCS. The DND file number for the Project is QIKIQ15. The contracted scope of work is in accordance with the project Terms of Reference (TOR) dated April 2015, Golder Proposal P1530908 dated June 16, 2015 ("Golder Proposal") and the minutes of the May 12, 2016 meeting attended by Golder and DND.

The five DEW Line sites that were monitored in 2016 as part of the QIKIQ15 contract are FOX-2, FOX-3, FOX-4, FOX-5 and DYE-M. These sites are all now in the Post-Construction Monitoring Phase of their remedial program. Post-Construction Monitoring was carried out in accordance with the TOR and implemented as per Golder's Logistics and Work Plan (LWP) dated July 25, 2016. Monitoring activities included geotechnical visual inspection, thermal monitoring, soil and groundwater sampling.

This monitoring report presents the 2016 post-construction inspection and monitoring results for FOX-4 (the site). The 2016 monitoring was Year 18 for FOX-4; the initial environmental cleanup and demolition of old facilities at the FOX-4 site took place between 1996 and 1999. A second round of environmental cleanup and maintenance was completed between 2011 and 2013 to address certain elements of the Cooperation Agreement that were not addressed during the initial FOX-4 cleanup. FOX-4 was last monitored in 2014.

Appendix A is a summary of the report limitations and forms part of the report.

1.1 Objective of the Study

The objective of the landfill monitoring program is to collect sufficient information to assess the performance, integrity, and stability of the landfills from a geotechnical and environmental perspective for the protection of human health and the environment. The monitoring program is designed to monitor landfill integrity and to determine in the event of any evident deterioration or impacts identified from sampling results, if remedial measures are required.

1.2 Scope of Work

The scope of work for this project includes the following:

1) Project management including liaison with DND, project team coordination, scope management, cost management, schedule management and resource coordination;

2) Preparation of a site-specific Health Safety and Environment Plan (HASEP) and procurement of safety equipment and supplies (e.g., personal protective equipment, first aid kits and satellite phones);

3) Development of a Logistics and Work Plan (LWP) for each field season that outlines the field schedule, travel plans, accommodation, hiring of local Inuit contract workers, all-terrain vehicle (ATV) and charter aircraft rental;

4) Completion of field work consisting of visual inspection, photographic documentation, thermistor data collection and soil and water sample collection;

5) Preparation of a Field Work Progress Report that summarizes field work activities completed each year (submitted under separate cover);

6) Preparation of a Consultant Inuit Participation Plan (CIPP) and Report (CIPR), that contains the Inuit employment and subcontracting content (submitted under separate cover); and,

7) Preparation of draft and final monitoring reports for each site with visual inspection results, photographic log, thermistor data collection, figures of inspection features and photograph locations, soil and groundwater quality monitoring results, Quality Analysis / Quality Control (QA/QC) and data interpretation.

2.0 BACKGROUND

2.1 Site Description

FOX-4 (Cape Hooper) is located on the east coast of Baffin Island, approximately midway between the communities of Qikiqtarjuaq and Clyde River, at 68^o 28’ north latitude and 66^o 50’ west longitude.

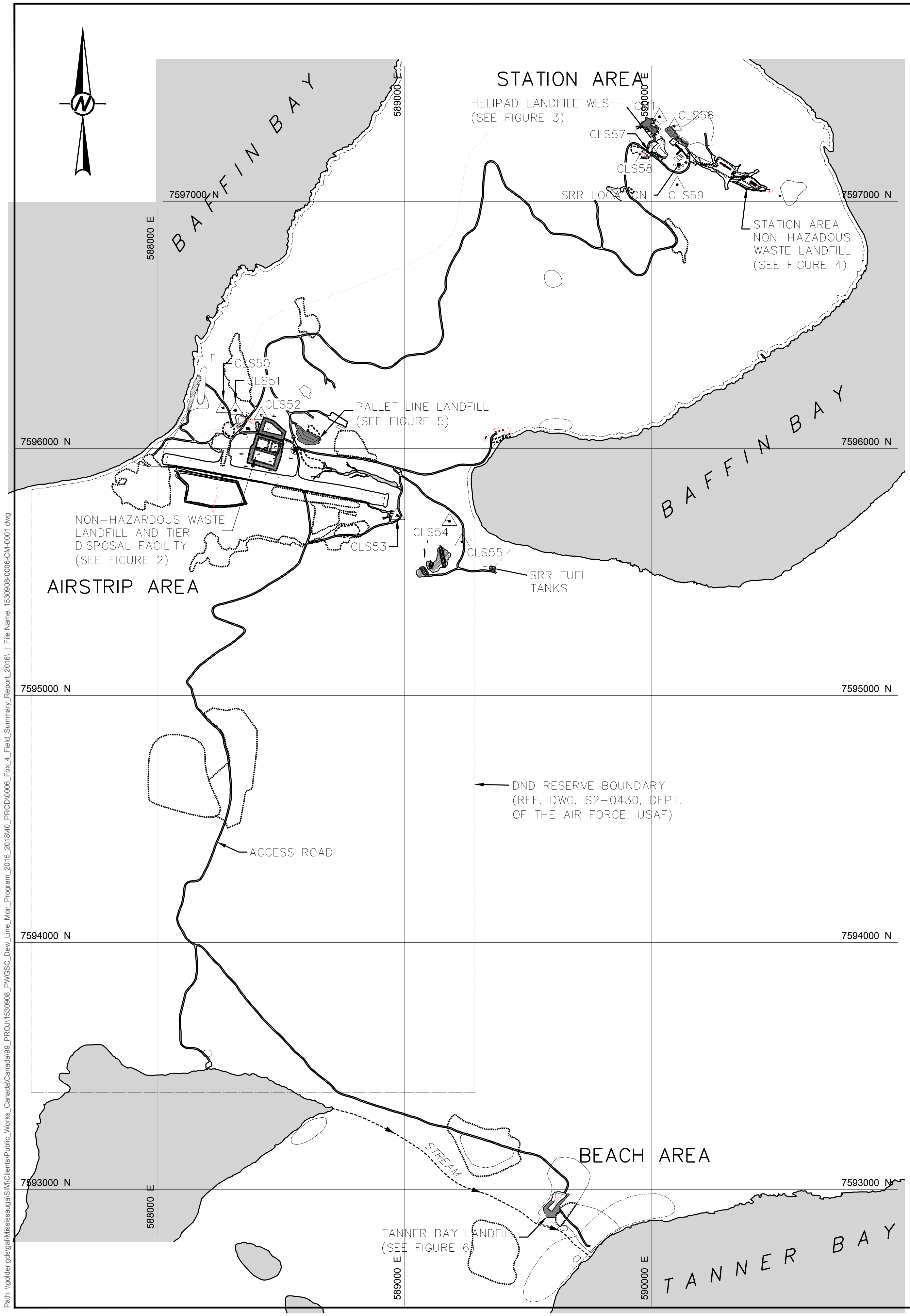
The former DEW Line site comprised facilities at the summit of Cape Hooper, consisting of communications, accommodations, and maintenance facilities, and an airstrip, fuel storage and maintenance facilities near the coast. These areas are referred to as the Upper Site (Station Area) and Lower Site (Airstrip Area), respectively. A North Warning System (NWS) Short Range Radar (SRR) station has been constructed and is operating in the vicinity of the Upper Site. An access road extends south of the Airstrip Area to the Beach Area, located on Tanner Bay, where equipment and supplies were mobilized to the site by water.

The initial environmental cleanup and demolition of old facilities at the FOX-4 site took place between 1996 and 1999, prior to finalization of the Cooperation Agreement between DND and Nunavut Tunngavik Inc. (NTI) that outlined general requirements for DEW Line site cleanup. A second round of environmental cleanup and maintenance was completed between 2011 and 2013 to address certain elements of the Cooperation Agreement that were not addressed during the initial FOX-4 cleanup. This work included excavation and relocation of the Helipad Landfill East, construction of the Non-Hazardous Waste Landfill for disposal of non-hazardous demolition and site wastes, construction of the Tier II Disposal Facility for disposal of Tier II soil excavated at the FOX-4 site (i.e., Helipad Landfill East) and construction of the Pallet Line landfill.

Five landfills remain at the site as a result of these works:

- Non-Hazardous Waste Landfill and Tier II Disposal Facility;
- Helipad West Landfill;
- Station Area Landfill;
- Pallet Line Landfill; and,
- Tanner Bay Landfill.

The above five landfills, shown in plan on Figure FOX-4.1, are part of the FOX-4 long-term monitoring program.



LOCATION OF CAPE HOOPER WITHIN NUNAVUT TERRITORY

SCALE: NTS

LEGEND:

CM1	SURVEY CONTROL MONUMENT
	ARCHAEOLOGICAL FEATURES
	APPROXIMATE LOCATION OF PROPERTY BOUNDARY
	LIMIT OF LANDFILLS
	BODY OF WATER

NOTES:

1. ALL COORDINATES ARE REFERENCED TO NAD83 (CSRS), UTM ZONE 19N.
2. ALL ELEVATIONS REFER TO GEODETIC DATUM.
3. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.

REFERENCE:

PREVIOUS INSPECTION FIGURES FROM SENES CONSULTANTS, PROJECT NO. 350600-515-2, 2014 DEW LINE MONITORING PROGRAM, DATED FEB. 2015

SURVEY CONTROL MONUMENTS

NO.	UTM COORDINATES		ELEV.	DESCRIPTION
	NORTHING	EASTING		
CM1	7 597 342.901	590 033.350	388.309	LEAD PLUG IN ROCK
CLS50	7 596 163.812	588 267.720	12.131	19mm DIA. REBAR AND CAP
CLS51	7 596 154.292	588 317.374	17.038	19mm DIA. REBAR AND CAP
CLS52	7 596 134.413	588 421.327	19.969	19mm DIA. REBAR AND CAP
CLS53	7 595 729.011	588 972.572	5.664	19mm DIA. REBAR AND CAP
CLS54	7 595 705.706	589 183.429	2.043	19mm DIA. REBAR AND CAP
CLS55	7 595 622.365	589 234.457	10.231	19mm DIA. REBAR AND CAP
CLS56	7 597 305.287	590 093.442	379.717	19mm DIA. REBAR AND CAP
CLS57	7 597 199.807	590 001.415	366.177	19mm DIA. REBAR AND CAP
CLS58	7 597 176.541	589 966.724	361.512	19mm DIA. REBAR AND CAP
CLS59	7 597 067.880	590 104.590	372.086	19mm DIA. REBAR AND CAP

CLIENT
DEPARTMENT OF NATIONAL DEFENCE CANADA

PROJECT
2016 FOX-4 MONITORING REPORT

TITLE
OVERALL SITE PLAN

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-11-03
DESIGNED	RM
PREPARED	TDR
REVIEWED	DCJ
APPROVED	DP

PROJECT NO.	PHASE	REV.	FIGURE
1530908	2000	A	FOX-4.1

Path: \\golder.gds\gal\Mississauga\SIM\Clients\Public_Works_Canada\Canada\99_PROJ\1530908_PWGSC_Dew_Line_Mon_Program_2015_2018\40_PROD\0006_Fox_4_Field_Summary_Report_2016\ | File Name: 1530908-0006-CM-0001.dwg

25 mm
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
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2.2 Site Geology, Hydrogeology and Hydrology

FOX-4 Cape Hooper is located within the Canadian Shield, in the Rae Domain of the Churchill Province. Bedrock in the area is composed of Paleoproterozoic granulite-facies paragneiss. The edge of the Laurentide ice sheet was present in this area during the Pleistocene epoch. It is in an area of continuous permafrost with low ground ice content. Local surficial geologic conditions were observed to generally consist of coarse weathered rock and deposits of marine origin.

Groundwater flow is seasonal, occurring mainly in the summer period of maximum active layer thaw. Groundwater is located at shallow depths and is highly affected by local permafrost conditions. Average annual precipitation at Cape Hooper is 278 mm, of which over 80% consists of snow. Surface water in the Station Area and the Airstrip Area drains to Baffin Bay, which surrounds the Station Area. The Beach Area to the south drains through a drainage channel leading from Water Supply Lake to Tanner Bay.

The Station Area, including the Helipad Landfill and the Station Area Landfill is an elevated headland with ground levels reaching 390 metres above sea level (masl). The Airstrip Area ranges from approximately 30 masl at the Pallet Line Landfill, declining to below 17 masl to the west of the Tier II landfill, towards Baffin Bay. At the Beach Area, the Tanner Bay Landfill elevation is also approximately 30 masl, declining to the west and south, towards the drainage channel and Tanner Bay. Based on the local topography, the Non-Hazardous Waste Landfill and Tier II Disposal Facility and the Helipad West generally drain to the west; the Pallet Line Landfill generally drains to the southwest; and Station Area Non-Hazardous Waste Landfill drains to the northwest.

2.3 Land-Use Description

In the 1950s, DEW Line sites were constructed across a number of locations in the northern parts of Alaska, Canada and Greenland, between latitudes 65 and 70 degrees to maintain surveillance of the North American Airspace. In 1963, improvements in surveillance technology led to the closure of most of the DEW Line sites and their replacement with the NWS. Since the 1990s, investigations, decommissioning, and clean-up activities have been undertaken at the DEW Line sites. Clean-up and decommissioning activities involved the demolition of surplus buildings and structures, excavation of contaminated soils, and the regrading of existing landfills. New engineered landfills were also constructed for the disposal of excavated soils and building materials.

Landfills at DEW Line sites can be categorized as follows:

- **Re-graded:** Existing landfills that were re-graded and capped with gravel;
- **Leachate Contained:** Existing landfills that were capped with gravel and provided with an impermeable membrane keyed into the permafrost (either only on the sides or over the entire surface), to contain leachate;
- **New NH:** New non-hazardous waste landfills; and,
- **New Tier II:** New Tier II disposal facilities (used for the disposal of Tier II soils as described by the DEW Line Cleanup Criteria) have impermeable liners below and above the contaminated soil to encapsulate the contents and contain the leachate. Tier II landfills are designed with a saturated granular perimeter berm keyed into the permafrost and sufficient cover of granular material to promote permafrost aggradation into the landfilled materials.

The five landfills in the monitoring program at FOX-4 fall into the following categories:

- Non-Hazardous Waste Landfill and Tier II Disposal Facility (New NH and Tier II);
- Helipad West Landfill (Regraded);
- Station Area Landfill (Regraded);
- Pallet Line Landfill (Regraded); and
- Tanner Bay Landfill (Regraded).

2.4 Field Program Staff and Schedule

Table 2-1 presents a list of field personnel, roles, responsibilities and dates for the FOX-4 2016 monitoring program.

Table 2-1: Field Personnel and Roles

Name (Affiliation)	Role / Responsibility	Site	Date
Darrin Johnson (Golder)	Field Geotechnical Lead / Inspections	FOX-4	August 2-5, 2016
Kevin Rattray (Golder)	Field Environmental Lead / Soil and Water Sampling	FOX-4	August 2-5, 2016
JoAnne Bisson (Golder)	Environmental Field Technician / Soil and Water Sampling	FOX-4	August 2-5, 2016
Jaypootie Moesesie (Inuit Subcontractor)	Wildlife Monitor	FOX-4	August 2-5, 2016
Jeremiah Toomasie (Inuit Subcontractor)	Wildlife Monitor	FOX-4	August 2-5, 2016

2.5 Weather Conditions

Table 2-2 presents a summary of weather conditions on each day of the FOX-4 monitoring program.

Table 2-2: Summary of Weather Conditions

Date	Weather
August 2	Sun and cloud, 10°C to 13°C
August 3	Sun and cloud, 10°C
August 4	Sun and cloud, 10°C to 17°C
August 5	Sun and cloud, 15°C

2.6 Project References

Canadian Council of Ministers of the Environment (CCME, 1993). "*Guidance Manual on Sampling, Analysis and Data Management for Contaminated Sites Guidance Manual on Sampling, Analysis and Data Management for Contaminated Sites – Volumes I and II, Main Report and Analytical Methods*".

Department of National Defence (DND, 2015). "*Terms of Reference, DEW Line Monitoring Program CAM-5, FOX-M, 2, 3, 4, 5, DYE-M*", QIKIQ15 Contract, April 2015.

Golder Associates Ltd. (Golder, 2015), "Solicitation No. W6837-151002/A Baffin Region Dew Line Sites Monitoring Program", Report P1530908, dated June 16, 2015.

"FOX-4, Cape Hooper Nunavut. 2013 Geotechncial Quality Assurance Summary." Prepared by AECOM for Defence Construction Canada, dated November 2013.

Golder Associates Ltd. (Golder, 2016a). "*Baffin Region DEW Line Site Monitoring Health Safety and Environment Plan*", Report 1530908-2000-V2, dated July 25, 2016.

Golder Associates Ltd. (Golder, 2016b), "*2016 Landfill Monitoring Program for QIKIQ15 Contract: Logistics and Work Plan*", Report 1530908-2000-R1-V2, dated July 25, 2016.

Golder Associates Ltd. (Golder, 2016c). "*2016 Baffin Region DEW Line Site Landfill Monitoring Field Work Progress Report*", Report 1530908-2000-R2-V2, dated October 7, 2016.

2.7 Report Structure

This report describes the monitoring program carried out in August 2016 at FOX-4. Results from visual inspection activities, thermal monitoring, soil sampling and groundwater sampling are presented in accordance with the TOR.

Each of the landfills is described in separate sub-sections (Sections 4.1 to 4.5). Each section contains the following 2016 monitoring information:

- Scope deviations summary;
- Visual Inspection Checklist;
- Preliminary Stability Assessment Table;
- Table of visual inspection photographs;
- Landfill plan with photograph locations and observed features;
- Summary of thermal monitoring (if applicable for landfill);
- Summary of soil sampling analytical results;
- Summary of groundwater sampling analytical results (if applicable for landfill); and,
- Discussion of overall landfill performance based on available monitoring data.

Appendix A provides a Limitation of Responsibilities and forms part of the report. Thermal and groundwater monitoring field record sheets are included in Appendix B. Laboratory certificates of analysis, historical landfill monitoring results and QA/QC reports are included in Appendix C. A photographic log is included in Appendix D. An electronic version of the report, tables, figures, full resolution photos and laboratory certificates of analysis are saved on a DVD-ROM, which is appended to the hardcopy of the report.

3.0 APPROACH & METHODOLOGY (GENERAL)

3.1 Summary of Work

3.1.1 Health and Safety

Golder developed a Health, Safety and Environment Plan (Golder, 2016b) for the QIKIQ15 field program, which describes potential hazards, risks and proposed mitigation measures. Unique health and safety risks included the potential for wildlife encounters, travel by air in light planes and on ATVs, long distances to the nearest emergency health care facilities and variable weather conditions. In addition, Golder developed a Logistics and Work Plan (Golder, 2016c) for the field program that contained the detailed schedule and travel plans, contact information, accommodation details, transportation, communications, field equipment and sampling protocols.

3.1.2 Field Program

Table 3-1 provides a summary of the monitoring schedule for the seven DEW Line sites that are part of the QIKIQ15 Project. FOX-4 was monitored in 2016 (Year 18) and will be monitored again in 2018 (Year 20). The field monitoring program consisted of the following activities:

- Visual inspection (of five landfills) including photographic documentation of observed conditions;
- Thermal monitoring (i.e., datalogger downloading at landfills with thermistors);
- Soil sampling; and,
- Groundwater sampling (at landfills with monitoring wells).

Table 3-2 provides a summary of monitoring activities by landfill.

Table 3-1: Summary of QIKIQ15 Project Monitoring Schedule

DEW Line Site	Year			
	2015	2016	2017	2018
CAM-5 Mackar Inlet	Year 5		Year 7	
FOX-M Hall Beach			Year 10	
FOX-2 Longstaff Bluff	Year 4	Year 5		Year 7
FOX-3 Dewar Lakes	Year 4[(a)]	Year 5[(a)]		Year 7
FOX-4 Cape Hooper		Year 18		Year 20
FOX-5 Broughton Island		Year 10		
DYE-M Cape Dyer	Year 2	Year 3	Year 4	Year 5

Legend	
	Phase I Monitoring
	Phase II Monitoring

Note:

a) At FOX-3 in 2015 and 2016 (Years 4 and 5) – Complete a geotechnical inspection of the thermokarst regrade.

Table 3-2: Summary of Monitoring Requirements for Landfills at FOX-4

		Visual Inspection	**Soil Sampling(a)**	**Groundwater Sampling**	**Thermal Monitoring**
Landfill Designation	**Type of Landfill**	**✓ = yes**	**Locations x Samples**	**# of Monitoring Wells**	**# of Thermistors**
FOX-4 Cape Hooper					
Non-Hazardous Waste Landfill and Tier II Disposal Facility	New NH and Tier II	✔	8 X 2	8	10 (see note b)
Helipad West Landfill	Regraded	✔	4 X 2	4	
Station Area Landfill	Regraded	✔	3 X 2	3	
Pallet Line Landfill	Regraded	✔	5 X 2		
Tanner Bay Landfill	Regraded	✔ ▯	3 X 2		
	TOTAL	***5***	***46***	***15***	***10***

Notes:

a) (# x #) Indicates the number of sampling points at each landfill. Samples are collected from two depths at each sampling point; from 0-15 cm and from 40-50 cm (or at refusal).

b) Reorganize dataloggers VT-2 through VT-6 and reinstall dataloggers VT-8 & VT-9 at FOX-4 Tier II Disposal Facility.

3.1.3 Visual Inspection

At each of the FOX-4 landfill locations, a visual inspection was conducted to observe whether there were any visual signs of erosion, cracking, seepage, ponded water, stressed vegetation (potentially caused by the landfill) and for physical stability. Photographic records of the landfills were taken to document the observed conditions and other notable features. Northing and Easting coordinates were recorded for all photograph and feature locations using a Garmin GLO portable GPS receiver (2-5 m accuracy) with Bluetooth connection to a field tablet.

Visual inspection information was used to complete a Preliminary Stability Assessment for each landfill. Each observed feature was assigned a Severity Rating (Acceptable, Marginal, Significant or Unacceptable) and Extent (Isolated, Occasional, Numerous or Extensive) and then the landfill was assigned an overall Performance Rating (Acceptable, Marginal, Significant or Unacceptable). If a type of feature was not observed during the inspection, then the Severity Rating was reported as “Not Observed” in the Preliminary Stability Assessment. Definitions of these terms are as follows:

Feature Severity Rating / Landfill Performance Rating	**Description**
Not Observed	This type of feature was not observed at the landfill during the inspection.
Acceptable	Noted features are of little consequence. The landfill is performing as designed. Minor deviations in environmental or physical performance may be observed, such as isolated areas of erosion, settlement.
Marginal	Physical/environmental performance appears to be deteriorating with time. Observations may include an increase in size or number of features of note, such as differential settlement, erosion or cracking. No significant impact on landfill stability to date, but potential for failure is assessed as low or moderate.

Feature Severity Rating / Landfill Performance Rating	Description
Significant	Significant or potentially significant changes affecting landfill stability, such as significant changes in slope geometry, significant erosion or differential settlement; scarp development. The potential for failure is assessed as imminent.
Unacceptable	Stability of landfill is compromised to the extent that ability to contain waste materials is compromised. Examples may include: ■ Debris exposed in erosion channels or areas of differential settlement. ■ Liner exposed. ■ Slope failure.

Extent	Description
Isolated	Singular feature
Occasional	Features of note occurring at irregular intervals/locations
Numerous	Many features of note, impacting less than 50% of the surface area of the landfill
Extensive	Impacting greater than 50% of the surface area of the landfill

3.1.4 Thermal Monitoring

The landfills that require leachate containment (e.g., Tier II Disposal Facility) and rely on permafrost aggradation incorporate ground temperature monitoring systems with vertical thermistor strings that measure temperature at various depths and automated dataloggers that allow for data collection. The data recorded on the dataloggers was downloaded using a laptop computer and Prolog software from Lakewood Systems Ltd. Thermistor inspection and data downloading details were recorded on field record sheets included in Appendix B.

At the FOX-4 site, thermistors and data loggers were installed only at the Non-Hazardous Waste Landfill and Tier II Disposal Facility.

3.1.5 Soil Sampling

Soil samples were collected in accordance with the TOR, the Golder Proposal, Logistics and Work Plan and Canadian Council of Ministers of the Environment (CCME) Guidance Manual on Sampling, Analysis and Data Management for Contaminated Sites – Volumes I and II, Main Report and Analytical Methods (CCME, 1993). Soil sampling procedures of note are as follows (deviations from the TOR are noted *in italics*):

- Soil samples were collected within 2 to 4 metres of monitoring wells (where applicable). Where there was no corresponding monitoring well soil samples were collected within 2 to 4 metres of previous sample locations. Previous consultants left pins and tags in the ground to indicate where they sampled soil. Golder sampled away from those locations and did not leave pins in the ground.
- Coordinates of the 2016 soil sampling locations were recorded using a field tablet equipped with a Garmin GPS and confirmed to be consistent with previous/required sampling locations prior to sampling.

- Test pits were dug with a shovel that was washed between sample locations. The shovel was decontaminated with soap and water, methyl hydrate and rinsed with distilled water before each use. Soil samples were collected by hand using a single-use disposable nitrile glove and placed into new/clean glass sample jars provided by the laboratory that were labelled with the sample location ID and depth.
- Soil samples were generally collected at 0 to 15 centimetres (cm) depth and at 40 to 50 cm depth at the locations in accordance with the TOR. *At some locations, the sample collection depth was adjusted where soil was frozen or refusal on rock was encountered. Where refusal on a large rock(s) was encountered near surface, the sampling location was moved slightly to avoid the large rock(s). When rocks were encountered prior to reaching the target sampling depth, the test pit was enlarged and the rock(s) were excavated if possible. If the specified sampling depth could not be reached after expending reasonable effort to enlarge the hole in an attempt to remove rock(s), a sample was collected at or near the zone of refusal (in accordance with the TOR). If refusal was encountered after the shallow soil sample depth and even with additional effort it was not possible to remove the rock(s) causing refusal, then only one soil sample was collected at that location (noted as "refusal" in summary tables below).*
- *At locations where the ground was covered with snow and ice, excavation of the snow was attempted but, in general, it was impossible to dig through the ice and frozen ground beneath the snow and soil samples were not collected (noted as "frozen" in summary tables below).*
- Inter-lab field duplicates were collected for approximately 10% of the total soil samples collected. The field duplicates were collected from relatively homogenous soil material *in the test pit*, such that the composition of the samples was the same and to minimize escape of volatile compounds.
- In order to assess the effectiveness of decontamination of the shovel used for soil sampling, an equipment rinsate (equipment blank) sample was completed following a typical decontamination procedure. This was conducted during sampling of the FOX-4 landfill, by pouring distilled water over the decontaminated shovel and capturing it in water sample bottles.

3.1.6 Groundwater Sampling

Groundwater samples were collected in accordance with the TOR, the Golder Proposal, Logistics and Work Plan and CCME (1993). Groundwater sampling procedures of note are as follows (*deviations in italics*):

- Water levels in the wells were measured with an interface probe that was decontaminated with soap and water, methyl hydrate and rinsed with distilled water before each use.
- *At monitoring well locations where there was snow on the ground surrounding the well and no measurable water level or water that could be pumped with the peristaltic pump, water samples were not collected (noted as "frozen" in the summary tables below).*
- *At monitoring well locations that had no measurable water level or water that could be pumped with the peristaltic pump, water samples were not collected (noted as "dry" in summary tables below).*
- *In wells with limited water depth and/or slow recharge, purging was only carried out until the field parameters were observed to stabilize* and then sampling was commenced in the priority order outlined in the TOR. *The number of water sample bottles collected and parameters that could not be analysed are listed in footnotes following the respective summary tables below.*

- Purging and sampling was carried out using a peristaltic pump and a low-flow purge rate of less than 100 mL/min was maintained. Peristaltic pump flexible tubing and nylon tubing extending down the well was single-use and disposed after use at each well (i.e., not reused). Sample tubing was removed from the wells after completion of the sampling event and disposed off-site.
- Groundwater samples were pumped directly from the well into analysis-specific bottles provided by the laboratory that were labelled with the sample location ID. Groundwater samples were not field filtered and were not field-acidified or preserved (in accordance with the TOR).
- Where groundwater was insufficient, sampling was prioritized in the following order:
    - Petroleum hydrocarbons: F1 fraction;
    - Inorganic elements – total concentrations: arsenic, cadmium, chromium, cobalt, copper, lead, nickel, zinc and mercury. Samples were not filtered (which is why low turbidity is so important) or preserved;
    - Petroleum hydrocarbons: F2, F3 and F4 fractions; and
    - PCBs (polychlorinated biphenyls – Total Aroclor analysis).
- Inter-lab duplicates were collected for 10% of the total groundwater samples collected.
- A field blank was filled in the field with distilled water and analyzed for all parameters.
- A travel blank of laboratory prepared water accompanied the sampling containers for the whole duration of the program, and analyzed for the entire suite of parameters.
- In order to assess the effectiveness of decontamination of the groundwater level / interface probe, an equipment rinsate (equipment blank) sample was completed following a typical decontamination procedure. This was conducted during sampling of the FOX-2 landfill, by pouring distilled water over the decontaminated probe and capturing it in water sample bottles.
- No equipment blanks were required for the sample collection tubing as new tubing was used at each sampling location.

3.2 Field Notes and Data

Visual inspection photographs, features, locations and notes were recorded in the field with a tablet computer equipped with a camera and Global Positioning System (GPS). Field data and photographs from the tablet were uploaded to an online Geographic Information System (GIS) database that was used to generate the photograph log and figures presented in this report.

Thermistor inspection and monitoring data were recorded on field record sheets included in Appendix B. Thermistor locations were recorded with either the field tablet or a hand-held GPS.

Soil sampling locations were photographed before test pit excavation, at the maximum depth of the test pit excavation and after backfilling. Soil sampling locations were recorded with either the field tablet or a hand-held GPS.

Groundwater monitoring data was recorded on field record sheets included in Appendix B. Monitoring well locations were recorded with either the field tablet or a hand-held GPS.

3.3 QA/QC

Quality Assurance (QA) is the system of validation checks performed to measure quality in order to determine if the quality objectives have been met. Quality control (QC) is the set of procedures which are incorporated into the project's standard operating procedures to ensure that it achieves its quality objectives.

The QC procedures incorporated into the monitoring program carried out at FOX-4 included:

- Using only ISO 17025 certified environmental labs to perform the soil and groundwater analyses. Golder used Paracel Laboratories Ltd. (Paracel) of Ottawa as the primary lab and AGAT Environmental (AGAT) of Mississauga for the duplicate samples. Both of these laboratories are ISO 17025 certified for the analyses performed. The laboratories also exchanged their "Standard Methods" for the analyses in the program to harmonize their procedures for the duplicate analysis;
- The field sampling for soil and groundwater was completed by a two-person team, which helped to ensure that all of the sampling and field identification procedures were followed in order;
- Duplicate soil samples were collected from relatively homogenous soil material *in the test pit*, such that the composition of the samples was the same and to minimize escape of petroleum hydrocarbon (F1 fraction) compounds;
- Duplicate groundwater samples were prepared by alternately filling bottles for each lab for each parameter type; the yield of the wells in some cases prevented filling the whole suite of sample bottles;
- To minimize the possibility of cross contamination, soil samples were collected directly from the test pits with nitrile gloved hands, at the designated depth intervals, and placed into lab-supplied sample jars leaving no headspace. New gloves were used for each sample. The shovel and trowel used to open the test pits were cleaned manually then rinsed with methyl hydrate and distilled water;
- To minimize the risk of cross-contamination, groundwater samples were pumped from the monitoring wells using dedicated tubing inserted into the well and another dedicated length of tubing between the rollers in the peristaltic pump. Staff holding the sample bottles wore nitrile gloves. Samples were labelled at the monitoring well with identification, time and date;
- Groundwater samples were neither filtered nor preserved in the field. The low-flow sampling technique was employed to minimize the presence of sediment in the water sample;
- Soil samples were not preserved in the field;
- To minimize the time delay from actual sample collection to receipt at the lab, Golder sent coolers from the site to the staging point every time a resupply flight occurred. From the staging point communities, the coolers were sent via First Air to Ottawa Airport where Golder picked them up and took them to Golder's office in Ottawa, where they were checked for breakage, legibility of the labels and accuracy and completeness of the chain of custody. After being checked in Ottawa, the samples were dispatched to the primary and duplicate labs. The maximum allowable hold times for samples were largely met; where they were exceeded, it was due to the logistical limitations of flying in and out of the sites and the long chain of transport from the staging points to the labs.

QA was measured by the duplicate analysis and review of the QA/QC data contained in each laboratory certificate of results. In addition to the duplicate analyses, a field blank (consisting of bottles filled with distilled water in the field) was submitted to Paracel for analysis of all specified parameters. Trip blanks consisted of bottles filled with distilled water and sealed at the laboratory. A trip blank was brought to the field for the overall 2016 program and back, then submitted to Paracel for analysis of all specified parameters.

The soil samples and groundwater samples were collected with only dedicated single-use equipment. The water sampling tubing was single-use from the well to sample bottle, and soil samples were collected from the test pits into sample jars using single-use gloves. This was possible because the texture of the soil samples was generally loose sandy soil. Nevertheless, equipment blanks were prepared for each type of sample. For groundwater sampling, the equipment blank was a sample of water poured over the water level probe, after it had been washed off, and for soil sampling it was a sample of water poured over the trowel after it had been washed between samples.

A discussion of the QA/QC results is provided in Section 5.

4.0 2016 MONITORING PROGRAM RESULTS

Photographs 1 through 196 (in Appendix D) document the observed conditions during the visual inspection including features on the cover/toe of the landfills, the groundwater monitoring wells, soil sample locations before excavation, after excavation and after backfilling as well as the condition of thermistors. The photographs taken at each of the landfill sites to document the observed conditions are organized as follows:

- **Non-Hazardous Waste Landfill and Tier II Disposal Facility –** Photographs 1 through 82;
- **Helipad West Landfill** – Photographs 83 through 122;
- **Station Area Landfill** – Photographs 123 through 152;
- **Pallet Line Landfill** – Photographs 153 through 178; and
- **Tanner Bay Landfill** – Photographs 179 through 196.

A complete log of all photographs is included in Appendix D. Copies of all digital photograph files are included on a DVD attached to this report. Visual inspection photographs are identified by an “ATT number” in the file name which are noted in brackets in the visual inspection photograph log tables.

Many of the acceptable features observed during the inspection do not appear to be related to landfill performance. For example, shallow depressions that appear to be unchanged since construction of the landfill (i.e., as-built condition) or minor hydrocarbon staining from post-construction anthropogenic activities (e.g., ATV use). These acceptable features that do not appear to be related to landfill performance have been reported as “*not a concern*”. Self-armouring erosion, minor water ponding and seepage without staining have also been reported as “*not a concern*” because they are not indicative of deteriorating landfill performance and/or may be weather related. In addition, some minor cracking that appears to be related to thaw creep does not indicate slope instability and is not considered to be a concern at the present time. Significant features that are related to landfill performance have been photographed and described in detail.

The monitoring program results are listed for each landfill in the sections below. In the tables contained within the text and Appendix C, data which exceed the arithmetic mean background data and baseline arithmetic mean data are identified by <u>underlined</u> and **bold** fonts, respectively. The background arithmetic mean limits for each landfill have been previously established using the arithmetic mean concentrations for soil samples collected outside the landfill areas between 1992 and 2011. The baseline arithmetic mean limits were calculated based on the concentrations for soil samples collected at each of the current soil sampling locations adjacent to the landfills, between 1998 and 2013. Soil and groundwater quality data are also compared to the baseline mean concentration plus three standard deviations (3σ); exceedances of this standard are shaded. This limit is based on the “three-sigma rule of thumb”, wherein it is expected that nearly all values not influenced by changes in impact lie within three standard deviations of the arithmetic mean.

A modified total petroleum hydrocarbons (TPH) value, calculated as the sum of the PHC F1, F2 and F3 fractions, is discussed throughout this report to allow for comparison to TPH baseline data.

Historical soil and groundwater results and charts are included in Appendix C. It should be noted that there are discrepancies in the highlighting of baseline and background arithmetic mean exceedances between the 2016 soil and groundwater data summary tables within the body of the report and the historical chemistry tables in Appendix C; exceedances noted in the data tables within the body of the report are considered the correct interpretation of the 2016 results. Discussion of the 2016 data in this report focused on identifying trends, as well as identifying data results for locations where concentrations significantly different (typically greater) than previous years are observed, or locations where concentrations exceeded the baseline concentration plus 3σ.

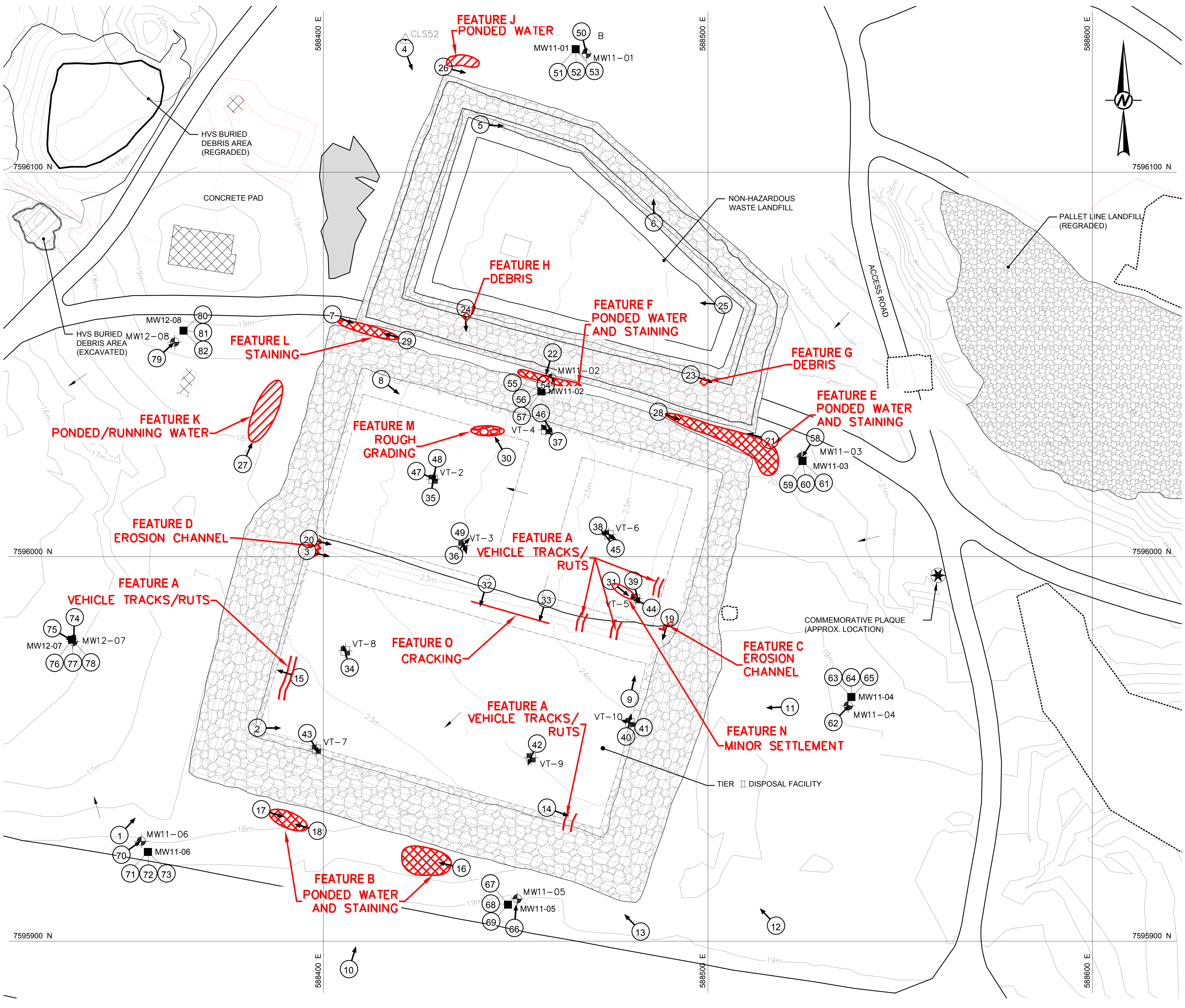
Duplicate soil samples were collected at a total of four locations at FOX-4. This included the deep F4-13 (40-50 cm), shallow F4-28 (0-15 cm), shallow MW11-01 (0-15 cm) and deep MW98-03 (40-50 cm) sample locations. A duplicate groundwater sample was also collected at monitoring well MW11-01. For these duplicate sample locations, the averages of the two concentrations are presented in the tables and used to discuss in the results in Section 4. The reproducibility of the duplicate sample results is discussed in Section 5.

4.1 Non-Hazardous Waste Landfill and Tier II Disposal Facility

4.1.1 Landfill Description

The Non-Hazardous Waste Landfill (NHWL) and Tier II Disposal Facility are located north of the west end of the Cape Hooper airstrip. The Non-Hazardous Waste Landfill and Tier II Disposal Facility have approximate areas of 4,000 m^2 and 10,000 m^2, respectively. The Non-Hazardous Waste Landfill was constructed for disposal of non-hazardous demolition and site wastes between 2011 and 2013, whereas the Tier II Disposal Facility was constructed for disposal of Tier II soil excavated at the FOX-4 site. The original cell of the Tier II Disposal Facility was constructed in 1997; it was expanded to the southwest between 2011 and 2013; the 2016 monitoring event represented the second post-construction monitoring event at these combined landfills.

Seven groundwater monitoring wells, MW11-01 and MW11-03 through MW11-06 and MW12-07 through MW12-08 have been installed around the combined perimeter of the landfills; an eighth well, MW11-02, is located between the two landfills. There are 9 functioning thermistors installed within the Tier II Disposal Facility landfill. The long term monitoring plan for these landfills consists of visual inspection, the collection of soil and groundwater samples, and monitoring of subsurface ground temperatures of the Tier II landfill. The approximate locations for the collection of soil and groundwater samples, and thermistor locations are identified on Figure FOX-4.2.



LEGEND:

═	TIRE TRACKS (NTS)
▨	SEEPAGE / PONDING WATER (NTS)
—	CRACKING
◇	DEBRIS (NTS)
○	SETTLEMENT (NTS)
⩘	EROSION (NTS)
⊗	ROUGH AREA (NTS)
⊠	STAINING (NTS)
■	SOIL SAMPLE LOCATION
← ⑪	PHOTOGRAPH VIEWPOINT
△ CLS50	SURVEY CONTROL MONUMENT
⊕	MONITORING WELL LOCATION
⊞	VERTICAL GROUND TEMPERATURE CABLE LOCATION
▦	TYPE 1 GRANULAR FILL
●	BODY OF WATER
22m	CONTOURS IN 0.5m INTERVALS
←	OVERLAND FLOW DIRECTION

NOTES:

1. ALL COORDINATES ARE REFERENCED TO NAD83 (CSRS), UTM ZONE 19N.
2. ALL ELEVATIONS REFER TO GEODETIC DATUM.
3. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.

REFERENCE:

PREVIOUS INSPECTION FIGURES FROM SENES CONSULTANTS, PROJECT NO. 350600-515-2, 2014 DEW LINE MONITORING PROGRAM, DATED FEB. 2015

0 25 50
1:1,000 METRES

CLIENT
DEPARTMENT OF NATIONAL DEFENCE CANADA

PROJECT
2016 FOX-4 MONITORING REPORT

TITLE
AIRSTRIP AREA
NON HAZARDOUS WASTE LANDFILL
AND TIER II DISPOSAL FACILITY

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-11-03
DESIGNED	RM
PREPARED	TDR
REVIEWED	DCJ
APPROVED	DP

PROJECT NO.	PHASE	REV.	FIGURE
1530908	2000	A	FOX-4.2

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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25 mm

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4.1.2 Visual Inspection

The NHWL and Tier II Disposal Facility exhibits some observed minor settlement, erosion, cracking, ponded/running water and staining. No sloughing, exposed waste or indications of instability were observed. Observed debris, rough grading and tire tracks were documented during the visual inspection but are not considered to be related to landfill performance. Table 4-1 presents a summary of observed visual inspection features and Table 4-2 presents the Preliminary Stability Assessment results. This landfill was assessed to have an “Acceptable” overall performance because was all features were assigned an “Acceptable” severity rating. Table 4-3 is a log of photographs taken during the 2016 visual inspection.

A new crack was observed during the 2016 inspection on the slope between the NHWL and Tier II Disposal Facility crest surfaces (Feature O). It was assigned an “Acceptable” severity rating because there is minimal risk of slope failure and waste exposure. However, it should be identified and monitored during future visual inspections to determine if it is changing with time.

There were several areas along the toe of the landfill with ponded water during the 2016 inspection and some of these areas exhibit orange staining that may be caused by landfill seepage. Two of these are located near sampling locations MW11-02 and MW11-03. Features B, E, F and J were observed during previous inspections and do not appear to changing significantly with time. A new area with orange staining but no ponded water was observed at the west end of the ditch between the landfills (Feature L) that may be related to landfill seepage. There was also a new observation of ponded water along the west toe of the Tier II Disposal Facility (Feature K).

Previously observed minor self-armouring erosion was observed on the Tier II Disposal Facility slopes (Features C and D) but it does not appear to be deteriorating with time. Isolated minor settlement (new Feature N), debris (previously observed Features H and G), tire tracks (previously observed Feature A) and rough grading (new Feature M) on the landfill surface are not considered a concern.

Table 4-1: Visual Inspection Checklist – Non -Hazardous Waste Landfill and Tier II Disposal Facility

SITE NAME: FOX-4
LANDFILL DESIGNATION: Non-Hazardous Waste Landfill and Tier II Disposal Facility
DATE OF INSPECTION: August 2, 2016
DATE OF PREVIOUS INSPECTION: August 26, 2014
INSPECTED BY: Darrin Johnson
REPORT PREPARED BY: Darrin Johnson
MONITORING EVENT NUMBER: 12
The inspector/reporter represents to the best of his/her knowledge that the following statements and observations are true and correct and to the best of the preparer's actual knowledge, no material facts have been suppressed or misstated.

Table 4-1: Visual Inspection Checklist – Non-Hazardous Waste Landfill and Tier II Disposal Facility

Checklist Item	Present (Y/N)	Feature ID (A, B, etc.)	Location Description	Easting	Northing	Length (m)	Width (m)	Depth (m)	Extent of Landfill Area (%)	Description (Severity Rating)	Comparison to Historical Observations	Photos
Settlement	Y	I	NHWL crest surface	588504.0	7596065.5	5	5	0.2	0.18%	As-built undulation (Acceptable)	Previously observed but not considered settlement	25
		N	Tier II DF crest surface	588474.8	7595993.7	10	3	0.3	0.42%	Minor settlement (Acceptable)	New	31
Erosion	Y	C	Slope between crest surfaces	588490.0	7595984.1	5	5	0.1	0.18%	Minor self-armouring erosion (Acceptable)	No change	19
		D	Slope between crest surfaces	588396.9	7596003.1	5	1	0.1	0.04%	Minor self-armouring erosion (Acceptable)	No change	20
Lateral Movement	N											
Frost Action	N											
Sloughing	N											
Cracking	Y	O	Tier II DF bottom of crest surface grade change	588442.5	7595992.9	35	0.05	-	<0.01%	Tension crack (Acceptable)	New	32, 33
Animal Burrows	N											
Vegetation	N											
Staining	Y	L	Valley between landfills	588421.7	7596056.3	30	1.00	-	0.21%	Orange staining (Acceptable)	New	7, 29

Table 4-1: Visual Inspection Checklist – Non-Hazardous Waste Landfill and Tier II Disposal Facility

Checklist Item	Present (Y/N)	Feature ID (A, B, etc.)	Location Description	Easting	Northing	Length (m)	Width (m)	Depth (m)	Extent of Landfill Area (%)	Description (Severity Rating)	Comparison to Historical Observations	Photos
Vegetation Stress	N											
Seepage or Ponded Water	Y	B	South toe	588435.9	7595919.1	20	5	0.2	0.71%	Ponded water with orange staining (Acceptable)	Smaller area compared to previous observation	16, 17, 18
		E	Ditch between landfills	588516.1	7596030.4	35	1	0.1	0.25%	Orange staining and seepage (Acceptable)	Extended in length (~10 m) since previous observation	21, 28
		F	Ditch between landfills	588459.6	7596053.1	20	1	0.1	0.14%	Ponded water near MW with some staining (Acceptable)	Unchanged area since previous observation	22
		J	Northwest toe	588431.2	7596127.4	10	2	0.1	0.14%	Ponded water (Acceptable)	Unchanged since previous observation	26
		K	West toe	588379.0	7596024.1	20	2	0.1	0.29%	Ponded/running water (Acceptable)	New	27
Debris and/or Liner Exposed	Y	G	NHWL east slope	588495.5	7596047.4	-	-	-	-	Small bits of metal and wood (Acceptable)	Unchanged since previous observation	23
		H	NHWL south slope	588437.0	7596064.6	-	-	-	-	Some pieces of metal (Acceptable)	Unchanged since previous observation	24

Table 4-1: Visual Inspection Checklist – Non-Hazardous Waste Landfill and Tier II Disposal Facility

Checklist Item	Present (Y/N)	Feature ID (A, B, etc.)	Location Description	Easting	Northing	Length (m)	Width (m)	Depth (m)	Extent of Landfill Area (%)	Description (Severity Rating)	Comparison to Historical Observations	Photos
Presence / Condition of Monitoring Instruments	Y	-	MW11-01 to -06, MW12-07 to -08, VT-2 to -10	-	-	-	-	-	-	All monitoring wells and thermistors intact Ponded water around MW11-02	-	34-50, 54, 58, 62, 66, 70, 74, 75, 79
Features of Note/Other Observations	Y	A	Southeast crest	588458.1	7595934.7	10	0.5	0.1	0.04%	Tire tracks (Acceptable)	Previously observed, no change	14
			Southwest crest	588393.7	7595968.6	5	0.5	0.1	0.02%			15
		M	Tier II crest surface	588447.6	7596025.9	30	15	-	3.2%	Rough grading that may be as-built (Acceptable)	New	30

Landfill Area = 14,000 m^2

Table 4-2: Preliminary Stability Assessment – Non-Hazardous Waste Landfill and Tier II Disposal Facility

Feature	Severity Rating	Extent
Settlement	Acceptable	Isolated
Erosion	Acceptable	Occasional
Lateral Movement	Not observed	-
Frost Action	Not observed	-
Sloughing	Not observed	-
Cracking	Acceptable	Isolated
Animal Burrows	Not observed	-
Vegetation Establishment	Not observed	-
Staining	Acceptable	Occasional
Vegetation Stress	Not observed	-
Seepage/Ponded Water	Acceptable	Occasional
Debris and/or Liner Exposure	Acceptable	Isolated
Other	Acceptable	Occasional
Overall Landfill Performance	**Acceptable**	

Table 4-3: Summary Table of Photographic Log – Non-Hazardous Waste Landfill and Tier II Disposal Facility

Photo	Description (file name)	Easting	Northing	Date
1	FOX 4 – NHWL/Tier II DF – Southwest toe facing northeast (ATT10_Photo10.jpg)	588347.9	7595926.5	2-Aug-2016
2	FOX 4 – NHWL/Tier II DF – Crest facing east (ATT11_Photo11.jpg)	588382.8	7595955.5	2-Aug-2016
3	FOX 4 – NHWL/Tier II DF – West crest edge where landfill surface changes elevation facing east (ATT12_Photo12.jpg)	588395.7	7596001.5	2-Aug-2016
4	FOX 4 – NHWL/Tier II DF – Northwest toe facing southeast (ATT13_Photo13.jpg)	588421.1	7596132.3	2-Aug-2016
5	FOX 4 – NHWL/Tier II DF – North crest facing east (ATT14_Photo14.jpg)	588440.8	7596112.4	2-Aug-2016
6	FOX 4 – NHWL/Tier II DF – North crest facing north (ATT15_Photo15.jpg)	588485.9	7596086.9	2-Aug-2016
7	FOX 4 – NHWL/Tier II DF – Ditch between landfills facing east – Feature L – Orange staining (Acceptable) (ATT16_Photo16.jpg)	588402.3	7596063.0	2-Aug-2016
8	FOX 4 – NHWL/Tier II DF – Crest surface facing southeast (ATT17_Photo17.jpg)	588415.0	7596046.1	2-Aug-2016

Table 4-3: Summary Table of Photographic Log – Non-Hazardous Waste Landfill and Tier II Disposal Facility

Photo	Description (file name)	Easting	Northing	Date
9	FOX 4 – NHWL/Tier II DF – Crest edge facing north (ATT18_Photo18.jpg)	588479.5	7595960.9	2-Aug-2016
10	FOX 4 – NHWL/Tier II DF – South toe facing north (ATT19_Photo19.jpg)	588541.2	7596023.5	2-Aug-2016
11	FOX 4 – NHWL/Tier II DF – East toe facing west (ATT20_Photo20.jpg)	588521.3	7595960.9	2-Aug-2016
12	FOX 4 – NHWL/Tier II DF – SE corner toe facing northwest (ATT21_Photo21.jpg)	588517.7	7595904.0	2-Aug-2016
13	FOX 4 – NHWL/Tier II DF – SE corner toe facing northwest (ATT46_Photo46.jpg)	588482.5	7595902.5	2 Aug 2016
14	FOX 4 – NHWL/Tier II DF – SE crest facing east – Feature A – Tire tracks (Acceptable) (ATT163_Photo163.jpg)	588458.1	7595934.7	2 Aug 2016
15	FOX 4 – NHWL/Tier II DF – Crest surface facing west – Feature A – Tire tracks (Acceptable) (ATT98_Photo98.jpg)	588393.7	7595968.6	2 Aug 2016
16	FOX 4 – NHWL/Tier II DF – South toe facing west – Feature B – Ponded water (Acceptable) (ATT164_Photo164.jpg)	588435.9	7595919.1	2 Aug 2016
17	FOX 4 – NHWL/Tier II DF – South toe facing east – Feature B – Ponded water with orange staining (Acceptable) (ATT96_Photo96.jpg)	588383.8	7595934.3	2-Aug-2016
18	FOX 4 – NHWL/Tier II DF – South toe facing west – Feature B – Ponded water with some orange staining (Acceptable) (ATT97_Photo97.jpg)	588398.4	7595928.7	2-Aug-2016
19	FOX 4 – NHWL/Tier II DF – Feature C – Minor erosion of internal sloped crest at edge (Acceptable), facing south (ATT116_Photo116.jpg)	588490.0	7595984.1	2-Aug-2016
20	FOX 4 – NHWL/Tier II DF – Slope between crest surfaces facing east – Feature D – Minor erosion (Acceptable) (ATT99_Photo99.jpg)	588396.9	7596003.1	2-Aug-2016
21	FOX 4 – NHWL/Tier II DF – Ditch between landfills facing west – Feature E – Orange staining and seepage (Acceptable) (ATT117_Photo117.jpg)	588516.1	7596030.4	2-Aug-2016
22	FOX 4 – NHWL/Tier II DF – Feature F – Ponded water near MW11-02 (Acceptable), facing south (ATT105_Photo105.jpg)	588459.6	7596053.1	2-Aug-2016
23	FOX 4 – NHWL/Tier II DF – Feature G – Small bits of metal and wood (Acceptable), facing east (ATT104_Photo104.jpg)	588495.5	7596047.4	2-Aug-2016
24	FOX 4 – NHWL/Tier II DF – Feature H – Some pieces of metal (Acceptable), facing south (ATT106_Photo106.jpg)	588437.0	7596064.6	2-Aug-2016

Table 4-3: Summary Table of Photographic Log – Non-Hazardous Waste Landfill and Tier II Disposal Facility

Photo	Description (file name)	Easting	Northing	Date
25	FOX 4 – NHWL/Tier II DF – Crest surface facing west – Previously observed minor settlement (Feature I) considered as built undulations (Acceptable) (ATT102_Photo102.jpg)	588504.0	7596065.5	2-Aug-2016
26	FOX 4 – NHWL/Tier II DF – Northwest toe facing east – Feature J – Ponded water (Acceptable) (ATT101_Photo101.jpg)	588431.2	7596127.4	2-Aug-2016
27	FOX 4 – NHWL/Tier II DF – Feature K – Running water along west toe facing northeast (Acceptable) (ATT100_Photo100.jpg)	588379.0	7596024.1	2-Aug-2016
28	FOX 4 – NHWL/Tier II DF – Feature E – Ponded water in valley between landfills, facing east (Acceptable) (ATT103_Photo103.jpg)	588487.1	7596037.7	2-Aug-2016
29	FOX 4 – NHWL/Tier II DF – Feature L – Orange staining between landfills, facing west (Acceptable) (ATT107_Photo107.jpg)	588421.7	7596056.3	2-Aug-2016
30	FOX 4 – NHWL/Tier II DF – Crest surface facing north – Feature M – Rough grading (Acceptable) (ATT110_Photo110.jpg)	588447.6	7596025.9	2-Aug-2016
31	FOX 4 – NHWL/Tier II DF – Crest surface facing southeast – Feature N – Minor settlement (Acceptable) (ATT114_Photo114.jpg)	588474.8	7595993.7	2-Aug-2016
32	FOX 4 – NHWL/Tier II DF – Feature O – Cracking at bottom of crest surface change (Acceptable), facing south (ATT128_Photo128.jpg)	588442.5	7595992.9	3-Aug-2016
33	FOX 4 – NHWL/Tier II DF – Feature O – East end of cracking at toe of crest surface grade change (Acceptable), facing south (ATT129_Photo129.jpg)	588458.0	7595989.0	3-Aug-2016
34	FOX 4 – NHWL/Tier II DF – Thermistor VT 8 (replaced repaired datalogger) (ATT120_Photo120.jpg)	588406.0	7595975.8	3-Aug-2016
35	FOX-4 – NHWL/Tier II DF – Thermistor VT-2 (ATT108_Photo108.jpg)	588427.6	7596019.9	2-Aug-2016
36	FOX-4 – NHWL/Tier II DF – Thermistor VT-3 (ATT109_Photo109.jpg)	588435.2	7596002.2	2-Aug-2016
37	FOX-4 – NHWL/Tier II DF – Thermistor VT-4 (ATT111_Photo111.jpg)	588459.4	7596033.7	2-Aug-2016
38	FOX-4 – NHWL/Tier II DF – Thermistor VT-6 (ATT112_Photo112.jpg)	588471.4	7596008.0	2-Aug-2016
39	FOX-4 – NHWL/Tier II DF – Thermistor VT-5 (ATT113_Photo113.jpg)	588480.5	7595989.0	2-Aug-2016

Table 4-3: **Summary Table of Photographic Log – Non-Hazardous Waste Landfill and Tier II Disposal Facility**

Photo	Description (file name)	Easting	Northing	Date
40	FOX-4 – NHWL/Tier II DF – Thermistor VT-10 (ATT115_Photo115.jpg)	588480.2	7595956.2	2-Aug-2016
41	FOX-4 – NHWL/Tier II DF – Thermistor VT-10 (datalogger not moved) (ATT118_Photo118.jpg)	588480.4	7595958.6	3-Aug-2016
42	FOX-4 – NHWL/Tier II DF – Thermistor VT-9 (replaced repaired datalogger) (ATT119_Photo119.jpg)	588454.5	7595948.8	3-Aug-2016
43	FOX-4 – NHWL/Tier II DF – Thermistor VT-7 (datalogger not moved) (ATT121_Photo121.jpg)	588398.3	7595950.6	3-Aug-2016
44	FOX-4 – NHWL/Tier II DF – Thermistor VT-5 (datalogger labeled T-2 moved to VT-2, formerly misidentified as VT-5A) (ATT122_Photo122.jpg)	588480.0	7595989.9	3-Aug-2016
45	FOX-4 – NHWL/Tier II DF – Thermistor VT-6 (datalogger labeled T1 not moved) (ATT123_Photo123.jpg)	588474.0	7596007.1	3-Aug-2016
46	FOX-4 – NHWL/Tier II DF – Thermistor VT-4 (datalogger labeled T3 moved to VT-3) (ATT124_Photo124.jpg)	588457.6	7596034.6	3-Aug-2016
47	FOX-4 – NHWL/Tier II DF – Thermistor VT-2 (short datalogger cable) (ATT125_Photo125.jpg)	588428.9	7596021.9	3-Aug-2016
48	FOX-4 – NHWL/Tier II DF – Thermistor VT-2 (datalogger VT-05 moved to VT-5) (ATT126_Photo126.jpg)	588428.9	7596021.9	3-Aug-2016
49	FOX-4 – NHWL/Tier II DF – Thermistor VT-3 (datalogger labeled T4 moved to VT-4) (ATT127_Photo127.jpg)	588436.3	7596003.3	3-Aug-2016
50	FOX-4 – NHWL/Tier II DF – MW11-01 (ATT29_Photo29.jpg)	588465.4	7596132.8	3-Aug-2016
51	FOX-4 – NHWL/Tier II DF – Soil sampling location MW11-01 before excavation (ATT30_Photo30.jpg)	588465.6	7596132.0	3-Aug-2016
52	FOX-4 – NHWL/Tier II DF – Soil sampling location MW11-01 after excavation (ATT31_Photo31.jpg)	588465.6	7596132.0	3-Aug-2016
53	FOX-4 – NHWL/Tier II DF – Soil sampling location MW11-01 after backfilling (ATT33_Photo33.jpg)	588465.6	7596132.0	3-Aug-2016
54	FOX-4 – NHWL/Tier II DF – MW11-02 (ATT40_Photo40.jpg)	588457.8	7596044.8	3-Aug-2016
55	FOX-4 – NHWL/Tier II DF – Soil sampling location MW11-02 before excavation (ATT37_Photo37.jpg)	588456.7	7596043.0	3-Aug-2016
56	FOX-4 – NHWL/Tier II DF – Soil sampling location MW11-02 after excavation (ATT38_Photo38.jpg)	588456.7	7596043.0	3-Aug-2016
57	FOX-4 – NHWL/Tier II DF – Soil sampling location MW11-02 after backfilling (ATT39_Photo39.jpg)	588456.7	7596043.0	3-Aug-2016

Table 4-3: Summary Table of Photographic Log – Non-Hazardous Waste Landfill and Tier II Disposal Facility

Photo	Description (file name)	Easting	Northing	Date
58	FOX-4 – NHWL/Tier II DF – MW11-03 (ATT41_Photo41.jpg)	588526.1	7596027.1	3-Aug-2016
59	FOX-4 – NHWL/Tier II DF – Soil sampling location MW11-03 before excavation (ATT42_Photo42.jpg)	588524.6	7596024.9	3-Aug-2016
60	FOX-4 – NHWL/Tier II DF – Soil sampling location MW11-03 after excavation (ATT43_Photo43.jpg)	588524.6	7596024.9	3-Aug-2016
61	FOX-4 – NHWL/Tier II DF – Soil sampling location MW11-03 after backfilling (ATT44_Photo44.jpg)	588524.6	7596024.9	3-Aug-2016
62	FOX-4 – NHWL/Tier II DF – MW11-04 (ATT45_Photo45.jpg)	588535.0	7595962.8	3-Aug-2016
63	FOX-4 – NHWL/Tier II DF – Soil sampling location MW11-04 before excavation (ATT46_Photo46.jpg)	588537.3	7595963.5	3-Aug-2016
64	FOX-4 – NHWL/Tier II DF – Soil sampling location MW11-04 after excavation (ATT47_Photo47.jpg)	588537.3	7595963.5	3-Aug-2016
65	FOX-4 – NHWL/Tier II DF – Soil sampling location MW11-04 after backfilling (ATT48_Photo48.jpg)	588537.3	7595963.5	3-Aug-2016
66	FOX-4 – NHWL/Tier II DF – MW11-05 (ATT2_Photo2.jpg)	588448.2	7595907.8	2-Aug-2016
67	FOX-4 – NHWL/Tier II DF – Soil sampling location MW11-05 before excavation (ATT3_Photo3.jpg)	588448.0	7595909.5	2-Aug-2016
68	FOX-4 – NHWL/Tier II DF – Soil sampling location MW11-05 after excavation (ATT4_Photo4.jpg)	588448.0	7595909.5	2-Aug-2016
69	FOX-4 – NHWL/Tier II DF – Soil sampling location MW11-05 after backfilling (ATT5_Photo5.jpg)	588448.0	7595909.5	2-Aug-2016
70	FOX-4 – NHWL/Tier II DF – MW11-06 (ATT6_Photo6.jpg)	588350.1	7595925.5	2-Aug-2016
71	FOX-4 – NHWL/Tier II DF – Soil sampling location MW11-06 before excavation (ATT7_Photo7.jpg)	588387.3	7596082.2	2-Aug-2016
72	FOX-4 – NHWL/Tier II DF – Soil sampling location MW11-06 after excavation (ATT8_Photo8.jpg)	588387.3	7596082.2	2-Aug-2016
73	FOX-4 – NHWL/Tier II DF – Soil sampling location MW11-06 after backfilling (ATT9_Photo9.jpg)	588387.3	7596082.2	2-Aug-2016
74	FOX-4 – NHWL/Tier II DF – MW12-07 (ATT10_Photo10.jpg)	588334.5	7595978.6	2-Aug-2016
75	FOX-4 – NHWL/Tier II DF – MW12-07 (ATT11_Photo11.jpg)	588334.5	7595978.6	2-Aug-2016
76	FOX-4 – NHWL/Tier II DF – Soil sampling location at MW12-07 before excavation (ATT12_Photo12.jpg)	588334.6	7595978.4	2-Aug-2016

Table 4-3: Summary Table of Photographic Log – Non-Hazardous Waste Landfill and Tier II Disposal Facility

Photo	Description (file name)	Easting	Northing	Date
77	FOX-4 – NHWL/Tier II DF – Soil sampling location at MW12-07 after excavation (ATT13_Photo13.jpg)	588334.6	7595978.4	2-Aug-2016
78	FOX-4 – NHWL/Tier II DF – Soil sampling location at MW12-07 after backfilling (ATT14_Photo14.jpg)	588334.6	7595978.4	2-Aug-2016
79	FOX-4 – NHWL/Tier II DF – MW12-08 (ATT25_Photo25.jpg)	588362.4	7596058.1	3-Aug-2016
80	FOX-4 – NHWL/Tier II DF – Soil sampling location MW12-08 before excavation (ATT26_Photo26.jpg)	588363.6	7596058.8	3-Aug-2016
81	FOX-4 – NHWL/Tier II DF – Soil sampling location MW12-08 after excavation (ATT27_Photo27.jpg)	588363.6	7596058.8	3-Aug-2016
82	FOX-4 – NHWL/Tier II DF – Soil sampling location MW12-08 after backfilling (ATT28_Photo28.jpg)	588363.6	7596058.8	3-Aug-2016

4.1.3 Thermal Monitoring

The data recorded on the thermistor dataloggers located at the Tier II Disposal Facility (VT-2 through VT-10) was downloaded using a laptop computer and Prolog software from Lakewood Systems Ltd. Thermistor inspection and data downloading details were recorded on field record sheets included in Appendix B.

All thermistor dataloggers were downloaded at their existing locations (i.e., prior to relocating any dataloggers). At VT-7 and VT-10, both ULB1 and ULB15 batteries were replaced in order to download the data. Two repaired dataloggers were replaced/reinstalled at locations VT-8 and VT-9 (and equipped with new ULB1 and ULB15 batteries) at the Tier II Disposal Facility. The location of all dataloggers at this site were reviewed relative to the thermistor string identification and some were relocated to their original/historic locations prior to the 2013/2014 maintenance activities. Dataloggers at VT-3 and VT-4 were switched. Dataloggers at VT-2 (previously misidentified as VT-5A) and VT-5 were switched. The original VT-1 thermistor had been previously decommissioned and, therefore, was not downloaded. A total of 9 thermistor dataloggers are installed and functional at the site, as follows:

Thermistor Location ID	Datalogger ID
VT-1 (decommissioned)	Not applicable
VT-2 (misidentified as VT-5A)	T-2
VT-3	T-3
VT-4	T-4
VT-5	T-5
VT-6	T-1
VT-7	T-7
VT-8	T-8
VT-9	T-9
VT-10	T-10

4.1.4 Summary of Sampling Deviations

The field work was conducted as per the TOR with the following exceptions:

- The deep soil samples at MW11-02 and MW11-04 could not be collected due to refusal on rock; and,
- The groundwater samples at MW11-06 and MW12-08 could not be collected because the wells were dry.

4.1.5 Soil Sampling

Table 4-4 presents a summary of analytical results for soil samples collected at the Non-Hazardous Waste Landfill and Tier II Disposal Facility. MW11-01 represents an upgradient sampling location, whereas MW11-02, MW11-03, MW11-04, MW11-05, MW11-06, MW12-07 and MW12-08 represent downgradient sampling locations, based on topography.

Table 4-4 also lists the arithmetic mean background and baseline values for the landfill, in addition to the baseline mean plus 3σ limits. At the Non-Hazardous Waste Landfill and Tier II Disposal Facility, the background arithmetic means for copper, nickel, cobalt, lead, zinc, chromium and arsenic are greater than the baseline arithmetic means.

MW11-01

Sampling location MW11-01 is located upgradient of the Non-Hazardous Waste Landfill, approximately 16 m north of the toe. The estimated elevation of this sampling point is 21 masl. As shown in Photos 51 and 52, the area consists of sand and gravel with some rock and sparse vegetation. The soils consisted of a dark brown sand with some gravel.

For the shallow sample at MW11-01 (0-15 cm, duplicate location), the concentrations of all metals were greater than those reported in 2014. The average concentrations of nickel, cobalt, cadmium, zinc and chromium exceeded their baseline mean concentrations plus 3σ. No mercury, PHC or PCB were detected at this location in 2016.

The deep sample at MW11-01 (30-40 cm) exhibited metal concentrations greater than those in the shallow sample. The concentrations of cadmium, lead and chromium were greater than those reported in 2014, whereas the concentrations of all other metals were slightly lower. The concentrations of copper, nickel, cobalt, cadmium, zinc and chromium exceeded their baseline mean concentrations plus 3σ; the concentration of arsenic was equal to its baseline mean concentration plus 3σ. No mercury, PHC or PCB were detected at this location in 2016.

MW11-02

Sampling location MW11-02 is located between the Non-Hazardous Waste Landfill and the Tier II Disposal Facility, immediately south of the toe of the NHWL. The estimated elevation of this sampling point is 19.5 masl. As shown in Photo 22, some ponding of water was observed in the ditch that runs between the landfills, in the immediate vicinity of this soil sample location. The area largely consists of sand and gravel and is not vegetated (Photos 55 and 56). The soils consisted of wet brown sand with some gravel and stone. The excavation filled with water soon after the hole was completed. It is noted that there were two samples identified as MW11-1a in the soil sampling field sheets in Appendix B and no samples identified as MW12-2a. Two soil samples (shallow and deep) were submitted for laboratory analysis at the MW-11 location and therefore the second field record for MW11-1 where only a single collected was attributed to the shallow sample at MW-12.

For the shallow sample at MW11-02 (0-15 cm), the concentrations of all metals, with the exception of cadmium, were less than those reported in 2014. The concentration of cadmium (3.8 mg/kg) exceeded the baseline mean concentration plus 3σ (1.7 mg/kg); none of the other parameters exceeded their baseline mean concentrations plus 3σ. No mercury, PHC or PCB were detected at this location in 2016.

MW11-03

Sampling location MW11-03 is located downgradient (cross-gradient) of the Non-Hazardous Waste Landfill, approximately 14 m east of the toe. The estimated elevation of this sampling point is 20.5 masl. As shown in Photo 21, some ponding of water and orange staining was observed in the ditch that runs between the landfills, approximately 6 m west of this soil sample location. The area largely consists of sand and gravel and is not vegetated (Photos 59 and 60). The soils consisted of wet brown sand with some gravel and stone.

For the shallow sample at MW11-03 (0-15 cm), the concentrations of all metals, with the exception of cadmium, lead and arsenic, were less than those reported in 2014. The concentration of lead (288 mg/kg) was much greater than the concentration observed in 2014 (10 mg/kg). The concentrations of cadmium and lead exceeded their baseline mean concentrations plus 3σ); none of the other parameters exceeded their baseline mean concentrations plus 3σ. The concentration of modified TPH (85 mg/kg) was greater than the concentration of 49 mg/kg reported in 2014. The concentration of the PHC F4 fraction in 2016 was 32 mg/kg. No mercury or PCB were detected at this location in 2016.

The deep sample at MW11-03 (30-40 cm) exhibited metal concentrations greater than those in the shallow sample. The concentrations of all metals, with the exception of cobalt, were greater than those reported in 2014. The concentrations of cadmium, lead and zinc exceeded their baseline mean concentrations plus 3σ); none of the other parameters exceeded their baseline mean concentrations plus 3σ. The concentration of modified TPH (77 mg/kg) was greater than the concentration of 23 mg/kg reported in 2014. The concentration of the PHC F4 fraction in 2016 was 30 mg/kg. No mercury or PCB were detected at this location in 2016.

MW11-04

Sampling location MW11-04 is located downgradient of the Tier II Disposal Facility, approximately 34 m east of the toe. The estimated elevation of this sampling point is 19 masl. As shown in Photos 63 and 64, the area consists of sand and gravel with some rock and sparse vegetation. The soils consisted of wet brown sand with some gravel and stone.

For the shallow sample at MW11-04 (0-15 cm), the concentrations of all metals were greater than those reported in 2014. The concentration of cadmium (1.9 mg/kg) slightly exceeded the baseline mean concentration plus 3σ (1.7 mg/kg); none of the other parameters exceeded their baseline mean concentrations plus 3σ. The concentration of modified TPH (44 mg/kg) was below the concentration of 92 mg/kg reported in 2014. The concentration of the PHC F4 fraction in 2016 was 33 mg/kg. No mercury or PCB were detected at this location in 2016.

MW11-05

Sampling location MW11-05 is located downgradient of the Tier II Disposal Facility, approximately 8 m south of the toe. The estimated elevation of this sampling point is 18.5 masl. As shown in Photo 16, some ponding of water was observed along the southern toe of the landfill, in the vicinity of this soil sample location. The area largely consists of sand and gravel is not vegetated (Photos 67 and 68). The soils consisted of wet brown sand with some gravel. The excavation filled with water soon after the hole was completed.

For the shallow sample at MW11-05 (0-15 cm), the concentrations of all metals were greater than those reported in 2014, with the exception of chromium. The concentration of arsenic (83.7 mg/kg) was much greater than the concentration observed in 2014 (10 mg/kg) and exceeded the baseline mean concentration plus 3σ (69 mg/kg); none of the other parameters exceeded their baseline mean concentrations plus 3σ. No mercury, PHC or PCB were detected at this location in 2016.

The deep sample at MW11-05 (40-50 cm) exhibited metals concentrations lower than those in the shallow sample. The concentrations of cadmium, lead and arsenic were greater than those reported in 2014, whereas the concentrations of all other metals were less than in 2014. No mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean concentrations plus 3σ.

MW11-06

Sampling location MW11-06 is located downgradient of the Tier II Disposal Facility, approximately 22 m southwest of the toe. The estimated elevation of this sampling point is 18 masl. As shown in Photos 17 and 18, some ponding of water and orange staining was observed along the southern toe of the landfill, approximately 25 m east of this soil sample location. The area largely consists of sand and gravel is not vegetated (Photos 71 and 72). The soils consisted of brown sand with some gravel and stone.

For the shallow sample at MW11-06 (0-15 cm), the concentrations of cadmium and lead were greater than those reported in 2014, whereas the concentrations of all other metals were lower than in 2014. No mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean concentration plus 3σ.

The deep sample at MW11-06 (30-40 cm) exhibited metals concentrations greater than those in the shallow sample. The concentrations of all metals, with the exception of cadmium, were less than those reported in 2014. The concentration of cadmium (1.8 mg/kg) marginally exceeded the baseline mean concentration plus 3σ (1.7 mg/kg); none of the other parameters exceeded their baseline mean concentrations plus 3σ. No PHC or PCB were detected at this location in 2016.

MW12-07

Sampling location MW12-07 is located downgradient of the Tier II Disposal Facility, approximately 35 m west of the toe. The estimated elevation of this sampling point is 16.5 masl. As shown in Photos 76 and 77, the area largely consists of sand and gravel with some rock and sparse vegetation. The soils consisted of wet grey sand, gravel and stone. The excavation filled with water soon after the hole was completed.

For the shallow sample at MW12-07 (0-15 cm), the concentrations of all metals, with the exception of cadmium, were less than those reported in 2014. The concentration of cadmium (1.8 mg/kg) marginally exceeded the baseline mean concentration plus 3σ (1.7 mg/kg); none of the other parameters exceeded their baseline mean concentrations plus 3σ. No mercury, PHC or PCB were detected at this location in 2016.

The deep sample at MW12-07 (30-40 cm) exhibited metals concentrations greater than those in the shallow sample. The concentrations of all metals were greater than those reported in 2014. The concentration of cadmium (3.6 mg/kg) exceeded the baseline mean concentration plus 3σ (1.7 mg/kg); none of the other parameters exceeded their baseline mean concentrations plus 3σ. No mercury, PHC or PCB were detected at this location in 2016.

MW12-08

Sampling location MW12-08 is located downgradient of the Non-Hazardous Waste Landfill, approximately 35 m west of the toe. A ponded water area (Feature K) is located between the landfill and this sampling location. The estimated elevation of this sampling point is 18.5 masl. As shown in Photos 80 and 81, the area largely consists of sand and gravel and is not vegetated. The soils consisted of brown sand with some gravel and stone.

For the shallow sample at MW12-08 (0-15 cm), the concentrations of all metals, with the exception of cadmium, were less than those reported in 2014. The concentration of cadmium (2.1 mg/kg) slightly exceeded the baseline mean concentration plus 3σ (1.7 mg/kg); none of the other parameters exceeded their baseline mean concentrations plus 3σ. The concentration of modified TPH (434 mg/kg) was greater than the concentration reported in 2014 (67 mg/kg). No mercury or PCB were detected at this location in 2016.

The deep sample at MW12-08 (40-50 cm) exhibited metals concentrations greater than those in the shallow sample. The concentrations of all metals, with the exception of cadmium, were less than those reported in 2014. The concentration of cadmium (3.1 mg/kg) exceeded the baseline mean concentration plus 3σ (1.7 mg/kg). The concentration of modified TPH (491 mg/kg) was greater than the concentration reported in 2014 (374 mg/kg. No mercury or PCB were detected at this location in 2016.

Table 4-4: Soil Chemical Analysis Results – Non-Hazardous Waste Landfill and Tier II Disposal Facility

ID	Depth (cm)	Cu (mg/kg)	Ni (mg/kg)	Co (mg/kg)	Cd (mg/kg)	Pb (mg/kg)	Zn (mg/kg)	Cr (mg/kg)	As (mg/kg)	Hg (mg/kg)	Total PCBs (mg/kg)	F1 (mg/kg)	F2 (mg/kg)	F3 (mg/kg)	F4 (mg/kg)
Background Mean		30.2	24.0	8.8	1.0	10.0	41.5	40.6	28.6	NA	NA	NA	NA	NA	NA
Baseline Mean		**12.8**	**9.9**	**5.0**	**1.0**	**5.6**	**21.9**	**21.5**	**12.2**	**0.100**	**0.050**	**NA**	**NA**	**NA**	**NA**
Baseline + 3σ		83.5	34.5	11.4	1.7	38.3	66.6	67.2	69.2	0.14	0.11	NA	NA	NA	NA
Upgradient															
MW11-01b	0-15	**70.1**	**59**	**14.4**	**5.4**	**10.9**	**88.7**	**84.3**	**49.8**	<0.1	<0.05	<7	<4	<8	<6
MW11-01b dup	0-15	**92**	**66**	**14.4**	<0.5	**11**	**105**	**81**	**57**	<0.10	<0.05	<5	<10	<50	<50
MW11-01b (Dup Avg)	0-15	**81**	**63**	**14.4**	**3.0**	**11**	**96.9**	**83**	**53**	<0.1	<0.05	<6	<7	<29	<28
MW11-01a	30-40	**91.7**	**69.3**	**16.2**	**6.1**	**13.4**	**102**	**88.7**	**69.2**	<0.1	<0.05	<7	<4	<8	<6
Downgradient															
MW11-02a	0-15	**31.5**	**26.3**	**9.6**	**3.8**	**7.9**	**47.3**	**63.9**	**20.8**	<0.1	<0.05	<7	<4	<8	<6
MW11-02 (deep) [1]															
MW11-03b	0-15	**21.3**	**11**	3.4	**2.7**	**288**	**49.8**	**32.5**	**16.8**	<0.1	<0.05	<7	<4	79	32
MW11-03a	30-40	**28.5**	**14**	4.1	**9.4**	**77.5**	**74.2**	**40.5**	**26**	<0.1	<0.05	<7	<4	71	30
MW11-04a	0-15	11.1	**10**	3.3	**1.9**	5	**23.1**	**34.1**	9.4	<0.1	<0.05	<7	<4	38	33
MW11-04 (deep) [1]															
MW11-05b	0-15	11.6	**11.4**	3.6	**1.7**	4.5	19.2	**23.5**	**83.7**	<0.1	<0.05	<7	<4	<8	<6
MW11-05a	40-50	8.6	8.9	3	**1.6**	4.1	17.8	**22.5**	**13.1**	<0.1	<0.05	<7	<4	<8	<6
MW11-06b	0-15	8.9	8.7	2.8	**1.2**	4.3	15.3	19	10.4	<0.1	<0.05	<7	<4	<8	<6
MW11-06a	30-40	12	**10.3**	3.3	**1.8**	4.5	19.9	**24.4**	**19.9**	<0.1	<0.05	<7	<4	<8	<6
MW12-07b	0-15	**16**	**17.7**	4.5	**1.8**	4	**31.1**	**23.4**	10.9	<0.1	<0.05	<7	<4	<8	<6
MW12-07a	30-40	**26.7**	**28**	**7.8**	**3.6**	**7.4**	**50.8**	**48.4**	**25.3**	<0.1	<0.05	<7	<4	<8	<6
MW12-08b	0-15	12.1	**11.6**	3.8	**2.1**	**8.6**	**26**	**33.2**	9.6	<0.1	<0.05	<7	389	41	<6
MW12-08a	40-50	**17.9**	**21**	**7.4**	**3.1**	**8**	**43.6**	**56**	7.3	<0.1	<0.05	<7	464	23	<6

Notes:

NA: Not available; ID: Soil sample location ID.

Underlined values: Results exceed Background arithmetic mean.

Bold Values: Results exceed Baseline arithmetic mean.

Shaded Values: Results exceed the Baseline arithmetic mean plus 3σ.

1: The deep soil samples at MW11-02 and MW11-04 could not be collected due to refusal on rock.

4.1.6 Groundwater Sampling

Groundwater sampling and monitoring well inspection field records are included in Appendix B. Table 4-4 presents a summary of groundwater levels and analytical results for groundwater samples collected at the Non-Hazardous Waste Landfill and Tier II Disposal Facility. It is noted there are two handwritten well sampling sheets for MW11-4 in Appendix B (one where the well was dry). A water sample labelled MW11-4 was submitted for laboratory analysis and therefore the well sampling sheet where the well was dry was attributed to MW11-6.

MW11-01

The depth to groundwater measured at MW11-01 (duplicate location) in 2016 was 1.01 m below grade. The calculated relative percent difference (RPD) values for this duplicate sampled location indicated that the original and duplicate results differ by greater than 30% for nickel, and therefore these results should be interpreted with caution. The average concentrations of all metals in the 2016 groundwater sample were lower than those reported in 2014. No cadmium, lead, chromium, arsenic, mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean concentration plus 3σ.

MW11-02

The depth to groundwater measured at MW11-02 in 2016 was 0.03 m above grade. The concentrations of nickel, cobalt and zinc were greater than those reported in previous years, whereas the concentrations of all other metals were lower. The concentrations of cobalt (0.0357 mg/L) and zinc (19 mg/L) exceeded their baseline mean concentrations plus 3σ (0.034 mg/L and 4.43 mg/L, respectively); none of the other parameters exceeded their baseline mean concentrations plus 3σ. No cadmium, lead, chromium, mercury, PHC or PCB were detected at this location in 2016.

MW11-03

The depth to groundwater measured at MW11-03 in 2016 was 1.11 m below grade. The concentrations of all metals, with the exception of zinc, were lower than those reported in 2014. No chromium, arsenic, mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean concentration plus 3σ.

MW11-04

The depth to groundwater measured at MW11-04 in 2016 was 0.65 m below grade. The concentrations of all metals, with the exception of zinc, were lower than those reported in 2014. No chromium, arsenic, mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean concentration plus 3σ.

MW11-05

The depth to groundwater measured at MW11-05 in 2016 was 0.28 m below grade. The concentrations of all metals, with the exception of zinc, were lower than those reported in 2014. No cadmium, lead, chromium, arsenic, mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean concentration plus 3σ.

MW12-07

The depth to groundwater measured at MW12-07 in 2016 was 0.51 m below grade. The concentrations of all metals, with the exception of zinc, were lower than those reported in 2014. No cadmium, lead, chromium, arsenic, mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean concentration plus 3σ.

Table 4-5: Monitoring Well Groundwater Levels and Groundwater Chemical Analysis Results - Non-Hazardous Waste Landfill and Tier II Disposal Facility

ID	GW Depth BGS (m)	Cu (mg/L)	Ni (mg/L)	Co (mg/L)	Cd (mg/L)	Pb (mg/L)	Zn (mg/L)	Cr (mg/L)	As (mg/L)	Hg (mg/L)	Total PCBs (mg/L)	F1 (mg/L)	F2 (mg/L)	F3 (mg/L)	F4 (mg/L)
Baseline Mean		**0.010**	**0.057**	**0.0087**	**0.0010**	**0.0071**	**0.84**	**0.0306**	**0.0183**	**0.0006**	**0.0001**	**NA**	**NA**	**NA**	**NA**
Baseline + 3σ		0.063	0.301	0.034	0.0043	0.05	4.43	0.2589	0.14	0.0026	0.0007	NA	NA	NA	NA
Upgradient															
MW11-01	1.01	0.001	0.007	0.0011	<0.0001	<0.0001	0.01	<0.001	<0.001	<0.0001	<0.00005	<0.025	<0.100	<0.100	<0.100
MW11-01 dup	1.01	<0.005	0.01	0.0015	<0.0001	<0.0001	<0.005	<0.001	<0.001	<0.0001	<0.00005	<0.025	<0.1	<0.1	<0.1
MW11-01 (Dup Avg)	1.01	0.003	0.01	0.0013	<0.0001	<0.0001	0.01	<0.001	<0.001	<0.0001	<0.00005	<0.025	<0.1	<0.1	<0.1
Downgradient															
MW11-02	-0.03	0.0026	**0.162**	**0.0357**	<0.0001	<0.0001	**19**	<0.001	0.003	<0.0001	<0.00005	<0.025	<0.100	<0.100	<0.100
MW11-03	1.11	0.0031	**0.059**	**0.0236**	0.0002	0.0006	0.527	<0.001	<0.001	<0.0001	<0.00005	<0.025	<0.100	<0.100	<0.100
MW11-04	0.65	0.0047	0.011	0.003	<0.0001	0.0002	0.208	<0.001	<0.001	<0.0001	<0.00005	<0.025	<0.100	<0.100	<0.100
MW11-05	0.28	0.0018	0.012	0.0057	<0.0001	<0.0001	**2.35**	<0.001	<0.001	<0.0001	<0.00005	<0.025	<0.100	<0.100	<0.100
MW11-06 [1]															
MW12-07	0.51	0.001	0.007	0.0033	<0.0001	<0.0001	0.155	<0.001	<0.001	<0.0001	<0.00005	<0.025	<0.100	<0.100	<0.100
MW12-08 [1]															

Notes:

ID: Monitoring well location ID.

GW: Groundwater.

BGS: Below ground surface.

NA: Not available

Bold Values: Results exceed Baseline arithmetic mean.

Shaded Values: Results exceed the Baseline arithmetic mean plus 3σ.

1: The groundwater samples at MW11-06 and MW12-08 could not be collected because the wells were dry.

4.1.7 Conclusions and Overall Performance of the Non-Hazardous Waste Landfill and Tier II Disposal Facility

Based on the visual inspection, there were no indications of instability at the the Non-Hazardous Waste Landfill and Tier II Disposal Facility. No sloughing or exposed waste was observed. A new crack (Feature O) was observed on the slope between the Non-Hazardous Waste Landfill and Tier II Disposal Facility crest surfaces that was assigned an “Acceptable” severity rating. Previously observed occasional minor self-armouring erosion on the landfill slopes does not appear to be deteriorating with time. Isolated locations with minor settlement, debris, tire tracks and rough grading were observed on the landfill surfaces, however these are not considered of concern. Overall, the physical performance of this landfill was assessed as “Acceptable”.

Concentrations of metals in soil were highest overall at the deep sample location MW11-01. At this location, the concentrations of cadmium, lead and chromium were greater than those reported in 2014 and the concentrations of copper, nickel, cobalt, cadmium, zinc and chromium exceeded their baseline mean concentrations plus 3σ; the concentration of arsenic was equal to its baseline mean concentration plus 3σ. Cadmium was the most commonly noted exceedance in 2016, and at all soil sampling locations, cadmium was greater than the concentrations observed in 2014.

Modified TPH concentrations in soil (maximum of 491 mg/kg in the deep sample at MW12-08) were detected at the shallow and deep MW11-03 sample locations, the shallow MW11-04 sample location and the shallow and deep MW12-08 shallow and deep sample locations. The concentrations of modified TPH at the shallow and deep MW12-08 sample locations were greater than the concentrations reported in. No detectable concentrations of mercury or PCB were noted in any of the soil samples in 2016.

The highest concentrations of metals in groundwater were observed at MW11-02. At this location, the concentrations of nickel, cobalt and zinc were greater than those reported in previous years and the concentrations of cobalt and zinc exceeded their baseline mean concentrations plus 3σ. At all other locations, the concentrations of most metals were lower than those reported in 2014. No detectable concentrations of chromium, mercury, PHC or PCB were noted in any of the groundwater samples in 2016.

Comparison of groundwater elevations based on estimated grade elevation and the measured water depth in the wells indicates that groundwater in was highest to the north at MW11-01, and lowest towards the west at MW12-07. The water levels at MW11-02, MW11-03 and MW12-08 indicate there is generally a western gradient in the area of the landfills. This is consistent with local grades.

Overall, it was noted that the soil sampling location with the most exceedances of the baseline mean plus 3σ (entirely metals), MW11-01, was located upgradient of the landfills. The only groundwater sample with exceedances of the baseline mean plus 3σ was MW11-02, located between the landfills and in an area where ponded water and staining are noted. This could potentially reflect impact from the landfills. Metals concentrations for a number of the soil (notably cadmium) and groundwater sampling results were greater than in 2014. Fewer than seven samples have been collected for trend confirmation and therefore additional data are required to confirm an increasing trend.

4.1.8 Recommendations for the Non-Hazardous Waste Landfill and Tier II Disposal Facility

No modifications to the ongoing monitoring program at this landfill are recommended. Additional data is required to assess if the observed increases in 2016 relate to impact from the landfills or reflect variations in natural conditions.

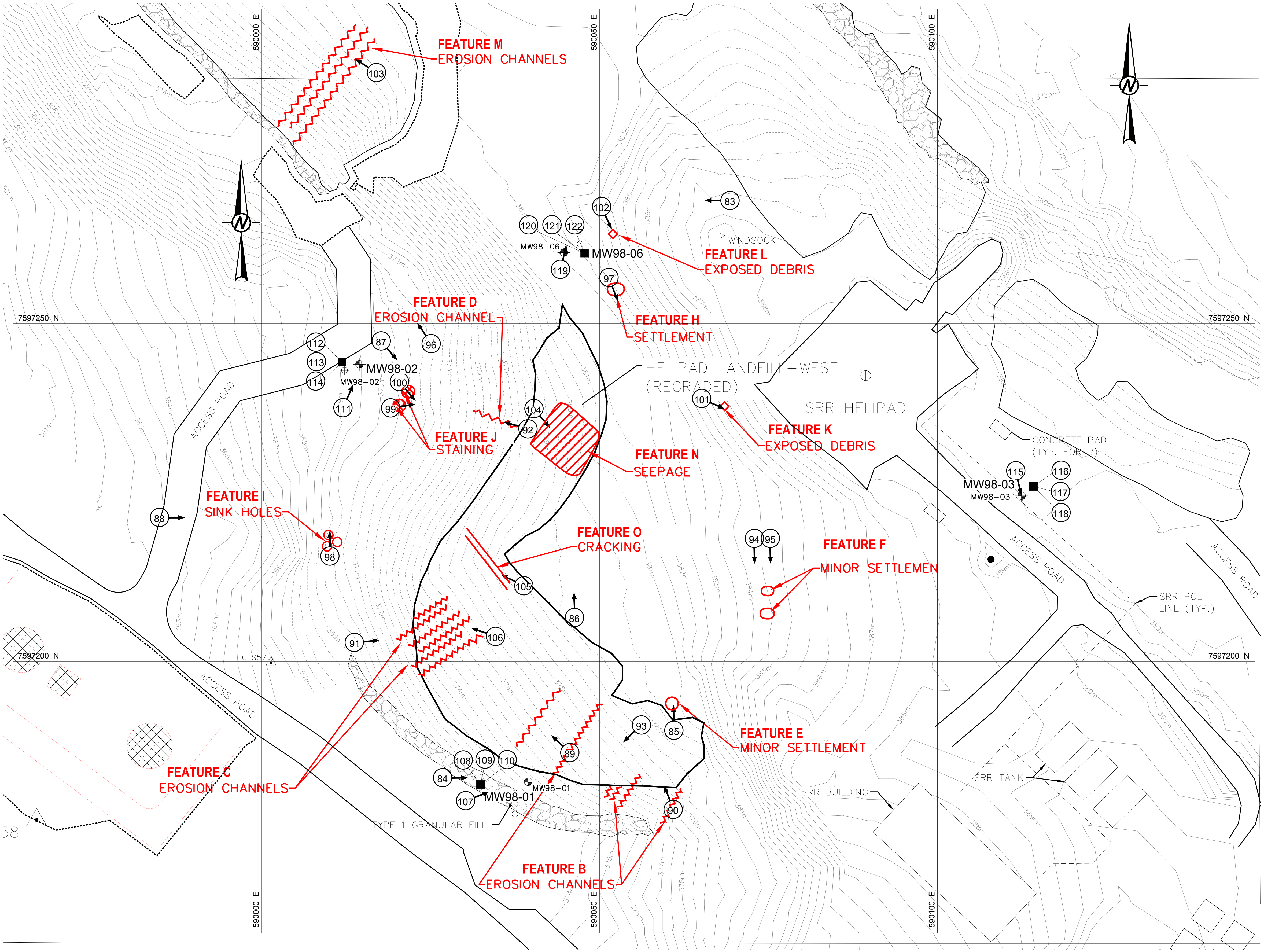
4.2 Helipad West Landfill

4.2.1 Landfill Description

The Helipad West Landfill is located at the Upper Site to the west of the Short Range Radar (SRR) facilities, and has an approximate area of 7,000 m^2. This landfill was initially built during the construction of the SRR site, before the cleanup of the FOX-4 site. It is understood to contain waste materials from the module train, garage, communication dishes, and other miscellaneous wastes. This landfill is classified as a regraded landfill. Four groundwater monitoring wells, MW98-01 through MW98-03 and MW98-06, are installed around the landfill perimeter. Approximate soil and groundwater sampling locations are provided on Figure FOX-4.3.

At the time of the initial FOX-4 remediation program in the late 1990s, there were two landfills near the helipad, designated as Helipad Landfill East and Helipad Landfill West. They were both initially assessed to present a low environmental risk; remediation activities consisted of the removal of surface debris and contaminated soil and the placement of a cover of granular material.

During the 2011-2013 FOX-4 maintenance remediation program, the Helipad Landfill East was re-classified as posing a moderate environmental risk because of indications that impacted leachate was being generated. The Helipad Landfill East was consequently excavated completely, and its contents were relocated, because its location and topography were not suitable for installing a leachate containment system. The low risk classification of the Helipad Landfill West remained unchanged and the cover was stabilized by regrading it with additional granular material.



LEGEND:

▨	SEEPAGE / PONDING WATER (NTS)
—	CRACKING
◇	DEBRIS (NTS)
○	SETTLEMENT (NTS)
⩘⩘⩘	EROSION (NTS)
⊗	STAINING (NTS)
■	SOIL SAMPLE LOCATION
⤴ (106)	PHOTOGRAPH VIEWPOINT
△ CLS50	SURVEY CONTROL MONUMENT
✥	MONITORING WELL LOCATION
▢	TYPE 1 GRANULAR FILL
—22m—	CONTOURS IN 0.5m INTERVALS

NOTES:

1. ALL COORDINATES ARE REFERENCED TO NAD83 (CSRS), UTM ZONE 19N.
2. ALL ELEVATIONS REFER TO GEODETIC DATUM.
3. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.

REFERENCE:

PREVIOUS INSPECTION FIGURES FROM SENES CONSULTANTS, PROJECT NO. 350600-515-2, 2014 DEW LINE MONITORING PROGRAM, DATED FEB. 2015

0 10 20
1:600 METRES

CLIENT
DEPARTMENT OF NATIONAL DEFENCE CANADA

PROJECT
2016 FOX-4 MONITORING REPORT

TITLE
STATION AREA
HELIPAD LANDFILL WEST

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-11-03
DESIGNED	RM
PREPARED	TDR
REVIEWED	DCJ
APPROVED	DP

PROJECT NO.	PHASE	REV.	FIGURE
1530908	2000	A	FOX-4.3

Path: \\golder.gds\gal\Mississauga\SIM\Clients\Public_Works_Canada\Canada\99_PROJ\1530908_PWGSC_Dew_Line_Mon_Program_2015_2018\40_PROD\0006_Fox_4_Field_Summary_Report_2016\ | File Name: 1530908-0006-CM-0003.dwg

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25 mm

4.2.2 Visual Inspection

The Helipad West Landfill has some observed settlement, erosion, cracking, seepage and staining. No sloughing, exposed waste or indications of instability were observed. Table 4-6 presents a summary of observed visual inspection features and Table 4-7 presents the Preliminary Stability Assessment results. This landfill was assessed to have a “Marginal” overall performance because a new crack observed in 2016 was assigned a “Marginal” severity rating. Table 4-8 is a log of photographs taken during the 2016 visual inspection.

A new tension crack was observed during the 2016 inspection at the crest of the west slope (Feature O) that was assigned a “Marginal” severity rating because it is at the top of a fairly large slope that was recently regraded. This crack should be identified and monitored during future visual inspections to determine if it is changing with time.

Previously observed orange staining at the toe of the landfill slope (Feature J) was observed again in 2016, however there was no active seepage at the time of the visual inspection. This staining may be caused by landfill seepage. An area of saturated soil was observed on the upper slope that did not have any associated staining and is likely related to thaw seepage (new Feature N).

There were several areas with previously observed minor settlement (Features E and F) and small sink holes (Features H and I), however these they do not appear to have changed since 2014 and are not considered a concern. The sink holes do not appear to be caused by groundwater flow, permafrost thaw or settlement of the subsurface. They appear to be simply caused by sand and gravel washing into voids of the adjacent boulder rockfill, as a result of the gravel cover not being filter compatible with the boulder rockfill. Precipitation runoff from both the landfill granular cover and the adjacent bedrock abutments likely contributed to their formation. They have not resulted in exposed waste to date and do not require any remedial attention at the present time (other than ongoing visual monitoring at the current frequency).

One area with previously observed settlement appears to be uneven ground that may be an as-built condition (Feature G). There are three areas with previously observed erosion channels (Features B, C and D) that are self-armouring and do not appear to be deteriorating with time. Some new self-armouring erosion was observed on a slope north of the landfill (Feature M) but it was stable at the time of the visual inspection and is not considered to be a concern. Two pieces of debris (Features K and L) that were observed previously are not buried landfill waste that has become exposed due to erosion or sloughing.

Previously observed Feature A (vehicle tracks/ruts) were not noted during the 2016 visual inspection.

Table 4-6: Visual Inspection Checklist – Helipad West Landfill

SITE NAME: FOX-4
LANDFILL DESIGNATION: Helipad West Landfill
DATE OF INSPECTION: August 4, 2016
DATE OF PREVIOUS INSPECTION: August 25, 2014
INSPECTED BY: Darrin Johnson
REPORT PREPARED BY: Darrin Johnson
MONITORING EVENT NUMBER: 12
The inspector/reporter represents to the best of his/her knowledge that the following statements and observations are true and correct and to the best of the preparer’s actual knowledge, no material facts have been suppressed or misstated.

Table 4-6: Visual Inspection Checklist – Helipad West Landfill

Checklist Item	Present (Y/N)	Feature ID (A, B, etc.)	Location Description	Easting	Northing	Length (m)	Width (m)	Depth (m)	Extent of Landfill Area (%)	Description (Severity Rating)	Comparison to Historical Observations	Photos
Settlement	Y	E	West slope near station	590056.2	7597190.6	3	5	0.3	0.21%	Minor settlement (Acceptable)	Previously observed, no change	85
		F	Crest surface	590072.9	7597218.2	5	5	0.3	0.36%	Minor settlement (Acceptable)	Previously observed, no change	94, 95
		G	NW toe	590025.1	7597247.0	5	5	0.3	0.36%	As-built uneven ground (Acceptable)	Previously observed but not considered settlement	96
		H	Slope above landfill	590051.4	7597256.8	0.3	0.3	0.5	<0.01%	Small sink holes (Acceptable)	Previously observed, no change	97
		I	Toe of slope at edge of rip-rap	590010.1	7597215.6	1	1	0.3	<0.01%	Small sink holes (Acceptable)	Previously observed, no change	98
Erosion	Y	B	West slope	590045.6	7597186.5	15	25	0.1	5.4%	Self-armouring erosion channels (Acceptable)	Previously observed, no change	89,90
		C	West slope	590013.7	7597202.8	10	10	0.1	1.4%	Self-armouring erosion channels (Acceptable)	Previously observed, no change	91,106
		D	Northwest slope	590039.4	7597234.4	10	3	0.3	0.4%	Self-armouring erosion channel (Acceptable)	Previously observed, no change	92
		M	West slope of graded area north of landfill	590017.0	7597287.1	15	5	0.1	1.1%	Self-armouring erosion channels (Acceptable)	New	103

Table 4-6: Visual Inspection Checklist – Helipad West Landfill

Checklist Item	Present (Y/N)	Feature ID (A, B, etc.)	Location Description	Easting	Northing	Length (m)	Width (m)	Depth (m)	Extent of Landfill Area (%)	Description (Severity Rating)	Comparison to Historical Observations	Photos
Lateral Movement	N											
Frost Action	N											
Sloughing	N											
Cracking	Y	O	West slope	590038.8	7597211.2	10	0.1	0.05	0.01%	Minor weathered tension crack with smaller parallel crack above (Marginal)	New	105
Animal Burrows	N											
Vegetation	N											
Staining	N											
Vegetation Stress	N											
Seepage or Ponded Water	Y	J	Toe	590019.1	7597237.5	5	1	0.01	0.07%	Orange seepage with sheen, soft saturated ground (Acceptable)	Previously observed, no change	99, 100
		N	West slope	590040.3	7597237.4	10	10	-	1.4%	Saturated soil on slope with seepage at toe (Acceptable)	New	104
Debris and/or Liner Exposed	Y	K	Slope above landfill	590065.1	7597238.9	-	-	-	’-	Exposed wires (Acceptable)	Previously observed, no change	101
		L	Slope above landfill	590050.3	7597267.3	-	-	-	’-	Exposed steel pipe (Acceptable)	Previously observed, no change	102

Table 4-6: Visual Inspection Checklist – Helipad West Landfill

Checklist Item	Present (Y/N)	Feature ID (A, B, etc.)	Location Description	Easting	Northing	Length (m)	Width (m)	Depth (m)	Extent of Landfill Area (%)	Description (Severity Rating)	Comparison to Historical Observations	Photos
Presence / Condition of Monitoring Instruments	Y	-	MW98-01, -02, -03, -06	-	-	-	-	-	-	All monitoring wells intact MW98-02 casing full of water and bentonite MW98-06 casing full of bentonite	-	107, 111, 115, 119
Features of Note / Other Observations	N											

Landfill Area = 7,000 m^2.

Table 4-7: Preliminary Stability Assessment – Helipad West Landfill

Feature	Severity Rating	Extent
Settlement	Acceptable	Occasional
Erosion	Acceptable	Occasional
Lateral Movement	Not observed	-
Frost Action	Not observed	-
Sloughing	Not observed	-
Cracking	Marginal	Isolated
Animal Burrows	Not observed	-
Vegetation Establishment	Not observed	-
Staining	Acceptable	Occasional
Vegetation Stress	Not observed	-
Seepage/Ponded Water	Acceptable	Occasional
Debris and/or Liner Exposure	Acceptable	Occasional
Other	Not observed	-
Overall Landfill Performance	**Marginal**	

Table 4-8: Summary Table of Photographic Log – Helipad West Landfill

Photo	Description (file name)	Easting	Northing	Date
83	FOX 4 – Helipad West Landfill - From helipad facing west (ATT26_Photo26.jpg)	590069.3	7597268.2	4-Aug-2016
84	FOX 4 – Helipad West Landfill – From toe facing east towards MW98-01 (ATT27_Photo27.jpg)	590026.8	7597182.8	4-Aug-2016
85	FOX 4 – Helipad West Landfill – Feature E – Minor settlement, facing north (Acceptable) (ATT28_Photo28.jpg)	590061.0	7597189.8	4-Aug-2016
86	FOX 4 – Helipad West Landfill – Crest facing north in area of previously observed vehicle tracks (Feature A not observed in 2016) (ATT29_Photo29.jpg)	590046.3	7597206.5	4-Aug-2016
87	FOX 4 – Helipad West Landfill – NW toe facing southeast upslope – Previously observed settlement (Feature G) is uneven ground at centre and previously observed staining (Feature J) at right (ATT30_Photo30.jpg)	590017.7	7597247.4	4-Aug-2016
88	FOX 4 – Helipad West Landfill – Toe facing east upslope (ATT31_Photo31.jpg)	589984.9	7597221.3	4-Aug-2016
89	FOX 4 – Helipad West Landfill – SW slope facing northwest – Feature B – Minor self armouring erosion channels (Acceptable) (ATT149_Photo149.jpg)	590045.6	7597186.5	4-Aug-2016
90	FOX 4 – Helipad West Landfill – South end of west slope facing north – Feature B – Minor self armouring erosion (Acceptable) (ATT150_Photo150.jpg)	590060.9	7597178.1	4-Aug-2016
91	FOX 4 – Helipad West Landfill – Toe of slope facing east – Feature C – Minor self armouring erosion channels (Acceptable) (ATT153_Photo153.jpg)	590013.7	7597202.8	4-Aug-2016

Table 4-8: Summary Table of Photographic Log – Helipad West Landfill

Photo	Description (file name)	Easting	Northing	Date
92	FOX 4 – Helipad West Landfill – Crest of slope facing northwest – Feature D – Minor self armouring erosion at top of slope (Acceptable) (ATT143_Photo143.jpg)	590039.4	7597234.4	4-Aug-2016
93	FOX 4 – Helipad West Landfill – Previously observed vehicle tracks (Feature A) not considered noteworthy in 2016, facing southwest downslope (ATT148_Photo148.jpg)	590056.2	7597190.6	4-Aug-2016
94	FOX 4 – Helipad West Landfill – Feature F – Minor settlement or uneven ground (Acceptable), facing south (ATT146_Photo146.jpg)	590072.9	7597218.2	4-Aug-2016
95	FOX 4 – Helipad West Landfill – Feature F – Close up of minor settlement areas with cap for scale (Acceptable), facing south (ATT147_Photo147.jpg)	590072.9	7597218.2	4-Aug-2016
96	FOX 4 – Helipad West Landfill – NW toe facing northwest – Previously observed settlement (Feature G) appears to be area of uneven ground and not considered noteworthy in 2016 (ATT157_Photo157.jpg)	590025.1	7597247.0	4-Aug-2016
97	FOX 4 – Helipad West Landfill – Slope above landfill facing south – Feature H – Previously observed settlement area with small sinkholes (Acceptable) (ATT141_Photo141.jpg)	590051.4	7597256.8	4-Aug-2016
98	FOX 4 – Helipad West Landfill – West toe facing north – Feature I – Minor sink holes at edge of coarse rock fill (Acceptable) (ATT154_Photo154.jpg)	590010.1	7597215.6	4-Aug-2016
99	FOX 4 – Helipad West Landfill – Feature J – Orange staining and seepage with sheen, soft saturated ground – West toe facing east (Acceptable) (ATT155_Photo155.jpg)	590019.1	7597237.5	4-Aug-2016
100	FOX 4 – Helipad West Landfill – Feature J – Orange staining with no seepage at time of 2016 inspection – West toe facing southeast (ATT156_Photo156.jpg)	590020.4	7597241.4	4-Aug-2016
101	FOX 4 – Helipad West Landfill – Slope above landfill and below helipad facing west– Feature K – previously observed exposed wires (Acceptable) (ATT145_Photo145.jpg)	590065.1	7597238.9	4-Aug-2016
102	FOX 4 – Helipad West Landfill – Slope east of MW98-06 facing south – Feature L – Exposed steel pipe (Acceptable) (ATT142_Photo142.jpg)	590050.3	7597267.3	4-Aug-2016
103	FOX 4 – Helipad West Landfill – Slope northwest of landfill facing northwest – Feature M – Self armouring erosion (Acceptable) (ATT140_Photo140.jpg)	590017.0	7597287.1	4-Aug-2016
104	FOX 4 – Helipad West Landfill – Feature N – Saturated wet slope with seepage at toe – West slope facing southeast (ATT144_Photo144.jpg)	590040.3	7597237.4	4-Aug-2016
105	FOX 4 – Helipad West Landfill – West slope facing northwest – Feature O – Minor cracking (Marginal), weathered, small parallel crack above (ATT151_Photo151.jpg)	590038.8	7597211.2	4-Aug-2016

Table 4-8: Summary Table of Photographic Log – Helipad West Landfill

Photo	Description (file name)	Easting	Northing	Date
106	FOX 4 – Helipad West Landfill – West slope west – Feature C – Self armouring erosion (Acceptable) (ATT152_Photo152.jpg)	590034.6	7597203.7	4-Aug-2016
107	FOX-4 – Helipad West Landfill – MW98-01 (ATT83_Photo83.jpg)	590030.2	7597179.4	4-Aug-2016
108	FOX-4 – Helipad West Landfill – Soil sampling location MW98-01 before excavation (ATT84_Photo84.jpg)	590032.4	7597181.8	4-Aug-2016
109	FOX-4 – Helipad West Landfill – Soil sampling location MW98-01 after excavation (ATT85_Photo85.jpg)	590032.4	7597181.8	4-Aug-2016
110	FOX-4 – Helipad West Landfill – Soil sampling location MW98-01 after backfilling (ATT86_Photo86.jpg)	590032.4	7597181.8	4-Aug-2016
111	FOX-4 – Helipad West Landfill – MW98-02 monitoring well casing full of water and bentonite (ATT79_Photo79.jpg)	590013.8	7597243.4	4-Aug-2016
112	FOX-4 – Helipad West Landfill – Soil sampling location MW98-02 before excavation (ATT80_Photo80.jpg)	590011.9	7597244.3	4-Aug-2016
113	FOX-4 – Helipad West Landfill – Soil sampling location MW98-02 after excavation (ATT81_Photo81.jpg)	590011.9	7597244.3	4-Aug-2016
114	FOX-4 – Helipad West Landfill – Soil sampling location MW98-02 after backfilling (ATT82_Photo82.jpg)	590011.9	7597244.3	4-Aug-2016
115	FOX-4 – Helipad West Landfill – MW98-03 (ATT87_Photo87.jpg)	590112.4	7597225.7	4-Aug-2016
116	FOX-4 – Helipad West Landfill – Soil sampling location MW98-03 before excavation (ATT88_Photo88.jpg)	590114.2	7597225.9	4-Aug-2016
117	FOX-4 – Helipad West Landfill – Soil sampling location MW98-03 after excavation (ATT89_Photo89.jpg)	590114.2	7597225.9	4-Aug-2016
118	FOX-4 – Helipad West Landfill – Soil sampling location MW98-03 after backfilling (ATT90_Photo90.jpg)	590114.2	7597225.9	4-Aug-2016
119	FOX-4 – Helipad West Landfill – MW98-06 monitoring well casing full of bentonite (ATT75_Photo75.jpg)	590044.2	7597258.0	4-Aug-2016
120	FOX-4 – Helipad West Landfill – Soil sample location MW98-06 before excavation (ATT76_Photo76.jpg)	590047.8	7597260.4	4-Aug-2016
121	FOX-4 – Helipad West Landfill – Soil sample location MW98-6 after excavation (ATT77_Photo77.jpg)	590047.8	7597260.4	4-Aug-2016
122	FOX-4 – Helipad West Landfill – Soil sample location MW98-06 after backfilling (ATT78_Photo78.jpg)	590047.8	7597260.4	4-Aug-2016

4.2.3 Summary of Sampling Deviations

The field work was conducted as per the TOR with the following exception:

- The deep soil samples at MW98-01, MW98-02 and MW98-06 could not be collected due to refusal on rock; and,
- The groundwater samples at MW98-01, MW98-03 and MW98-06 could not be collected because the wells were dry.

4.2.4 Soil Sampling

Table 4-9 presents a summary of analytical results for soil samples collected at the Helipad West Landfill. MW98-03 and MW98-06 represent upgradient sampling locations, whereas MW98-01 and MW98-02 represent downgradient sampling locations.

Table 4-9 also lists the arithmetic mean background and baseline values for the landfill, in addition to the baseline mean plus 3σ limits. At the Helipad West Landfill, the background arithmetic means for copper, nickel, cobalt, zinc and chromium are greater than the baseline arithmetic means. The background arithmetic means for copper and cobalt are also greater than the baseline means plus 3σ.

MW98-03

Sampling location MW98-03 is located upgradient of the landfill, approximately 62 m east of the toe. The estimated elevation of this sampling point is 389 masl. As shown in Photos 116 and 117, the area consists of sand, gravel and rock and is not vegetated. The soils consisted of brown sand, gravel and stone.

For the shallow sample at MW98-03 (0-15 cm), the concentrations of metals were similar to those reported in previous years. The modified TPH concentration observed in 2016 was consistent with concentrations observed in recent years. No cadmium, mercury or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean concentrations plus 3σ.

The deep sample at MW98-03 (40-50 cm, duplicate location) exhibited similar metals concentrations to the shallow sample. The concentrations of metals were similar to those reported in previous years. The average modified TPH concentration observed in 2016 (73 mg/kg) represents a new historical maximum concentration; the previous maximum concentration of 41 mg/kg was observed in 2006. No cadmium, mercury or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean concentration plus 3σ.

MW98-06

Sampling location MW98-06 is located upgradient of the landfill, approximately 8 m north of the toe. The estimated elevation of this sampling point is 382 masl. As shown in Photos 120 and 121, the area largely consists of sand and gravel and is not vegetated. The soils consisted of grey sand with gravel and stone.

For the shallow sample at MW98-06 (0-15 cm), the concentrations of copper, nickel and lead were elevated compared to recent years, whereas the concentrations of other metals were less than or similar to the concentrations reported in previous years. The modified TPH concentration observed in 2016 (170 mg/kg) is greater than the concentration observed in 2015 (28 mg/kg) but was below the baseline mean concentration (222 mg/kg). The concentration of the PHC F4 fraction in 2016 was 28 mg/kg. No cadmium, mercury or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean concentration plus 3σ.

MW98-01

Sampling location MW98-01 is located downgradient of the landfill, approximately 5 m south of the toe. The estimated elevation of this sampling point is 372.5 masl. As shown in Photos 108 and 109, the area is covered with sand and gravel and is not vegetated; a channel containing boulders and stones is present immediately south of the sampling location. The soils consisted of wet brown sand with some gravel.

For the shallow sample at MW98-01 (0-15 cm), the concentrations of most metals observed in 2016 represent new historical maxima. Metals concentrations were relatively stable at this location from 1999 to 2013, but increased in 2014 and 2016. The concentrations of copper, nickel, cobalt, zinc and chromium exceeded their baseline mean concentration plus 3σ; none of the other parameters exceeded their baseline mean concentrations plus 3σ. No cadmium, mercury, PHC or PCB were detected at this location in 2016.

MW98-02

Sampling location MW98-02 is located downgradient of the landfill, approximately 27 m west of the toe. The estimated elevation of this sampling point is 369 masl. As shown in Photos 99 and 100, orange staining was observed approximately 8 m upgradient (east) of the sampling location. The area consists of sand and gravel with some rock and is not vegetated (Photos 112 and 113). The soils consisted of brown sand with some gravel.

For the shallow sample at MW98-02 (0-15 cm), the concentrations of all metals were less than or similar to those reported in previous years. The modified TPH concentration observed in 2016 (3,358 mg/kg) exceeded the baseline mean concentration plus 3σ (1,772 mg/kg) and represents a new historical maximum concentration; the previous maximum concentration of 1,582 mg/kg was observed in 2005. None of the other parameters exceeded their baseline mean concentrations plus 3σ. No cadmium, mercury or PCB were detected at this location in 2016.

Table 4-9: Soil Chemical Analysis Results – Helipad West Landfill

ID	Depth (cm)	Cu (mg/kg)	Ni (mg/kg)	Co (mg/kg)	Cd (mg/kg)	Pb (mg/kg)	Zn (mg/kg)	Cr (mg/kg)	As (mg/kg)	Hg (mg/kg)	Total PCBs (mg/kg)	F1 (mg/kg)	F2 (mg/kg)	F3 (mg/kg)	F4 (mg/kg)
Background Mean		30.2	24.0	8.8	1.0	10.0	41.5	40.6	28.6	NA	NA	NA	NA	NA	NA
Baseline Mean		**15.4**	**15.8**	**5.9**	**1.0**	**24.0**	**35.5**	**34.9**	**33.8**	**NA**	**0.001**	**NA**	**NA**	**NA**	**NA**
Baseline + 3σ		28.7	25.2	8.1	1.1	38.0	51.2	52.6	123.1	NA	0.17	NA	NA	NA	NA
Upgradient															
MW98-03b	0-15	15.2	14.6	5.2	<0.5	5.7	31.9	**44.1**	21	<0.1	<0.05	<7	<4	48	29
MW98-03a	40-50	13.6	12.9	4.3	<0.5	4.3	25.2	31.5	24.2	<0.1	<0.05	<7	<4	82	53
MW98-03a dup	40-50	**19**	**18**	5.1	<0.5	6	**36**	34	22	<0.10	<0.05	<5	<10	<50	<50
MW98-03a (Dup Avg)	40-50	**16**	15	4.7	<0.5	5	31	33	23	<0.1	<0.05	<6	<7	66	52
MW98-06a	0-15	**25.2**	**20.7**	**6.3**	<0.5	8	**37.8**	**47.8**	18.4	<0.1	<0.05	<7	6	160	28
MW98-06 (deep) [1]															
Downgradient															
MW98-01a	0-15	**67.8**	**44.5**	**15.6**	<0.5	5	**71.2**	**139**	**74.7**	<0.1	<0.05	<7	<4	<8	<6
MW98-01 (deep) [1]															
MW98-02a	0-15	**16.1**	**16.5**	5.7	<0.5	4.6	33.3	**42.3**	18.2	<0.1	<0.05	258	2850	250	<6
MW98-02 (deep) [1]															

Notes:

NA: Not available; ID: Soil sample location ID.

Underlined values: Results exceed Background arithmetic mean.

Bold Values: Results exceed Baseline arithmetic mean.

Shaded Values: Results exceed the Baseline arithmetic mean plus 3σ.

1: The deep soil samples at MW98-01, MW98-02 and MW98-06 could not be collected due to refusal on rock.

4.2.5 Groundwater Sampling

Groundwater sampling and monitoring well inspection field records are included in Appendix B. Table 4-10 presents a summary of groundwater levels and analytical results for groundwater samples collected at the Helipad West Landfill. The groundwater samples at MW98-01, MW98-03 and MW98-06 could not be collected because the wells were dry.

MW98-02

The depth to groundwater measured at MW98-02 in 2016 was 0.16 m below grade. The concentrations of all metals were lower in comparison to those reported in recent years. Similarly, the modified TPH concentration observed in 2016 was less than those reported in recent years. No cadmium, chromium, mercury or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean concentration plus 3σ.

Table 4-10: Monitoring Well Groundwater Levels and Groundwater Chemical Analysis Results – Helipad West Landfill

ID	GW Depth BGS (m)	Cu (mg/L)	Ni (mg/L)	Co (mg/L)	Cd (mg/L)	Pb (mg/L)	Zn (mg/L)	Cr (mg/L)	As (mg/L)	Hg (mg/L)	Total PCBs (mg/L)	F1 (mg/L)	F2 (mg/L)	F3 (mg/L)	F4 (mg/L)
Baseline Mean		**0.072**	**1.03**	**0.044**	**0.0018**	**0.016**	**0.14**	**1.27**	**0.015**	**NA**	**0.000026**	**NA**	**NA**	**NA**	**NA**
Baseline + 3σ		0.17	2.8	0.19	0.0031	0.05	0.43	2.79	0.06	NA	0.00012	NA	NA	NA	NA
Upgradient															
MW98-03 [1]															
MW98-06 [1]															
Downgradient															
MW98-01 [1]															
MW98-02	0.16	0.0006	0.006	0.003	<0.0001	0.0001	0.09	<0.001	0.004	<0.0001	<0.00005	0.395	<0.100	<0.100	<0.100

Notes:

ID: Monitoring well location ID.

GW: Groundwater.

BGS: Below ground surface.

NA: Not available

Bold Values: Results exceed Baseline arithmetic mean.

1: The groundwater samples at MW98-01, MW98-03 and MW98-06 could not be collected because the wells were dry.

4.2.6 Conclusions and Overall Performance of the Helipad West Landfill

Based on the visual inspection, there were no indications of instability at the the Helipad West Landfill. No sloughing or exposed waste was observed. A new tension crack (Feature O) was observed at the top of the west slope that was assigned a “Marginal” severity rating. Occasional minor self-armouring erosion observed on the landfill slopes does not appear to be deteriorating with time. Isolated locations with minor settlement, sink holes and debris were observed at the landfill but these are not considered a concern. The overall physical performance of this landfill was assessed as “Marginal” because of the newly observed tension crack near the top of the west slope.

Concentrations of metals in soil were highest overall at the shallow sample location MW98-01, located downgradient of the south side of the landfill. Metals concentrations at this location were relatively stable at this location from 1999 to 2013, but increased in 2014 and 2016. The concentrations of most metals observed in 2016 represent new historical maxima and the concentrations of copper, nickel, cobalt, zinc and chromium exceeded their baseline mean concentration plus 3σ. At MW98-02, MW98-03 and MW98-06, the concentrations of most metals were less than or similar to those reported in previous years.

PHC were detected at the shallow and deep MW98-03 locations, the shallow MW98-02 location and the shallow MW98-06 location at modified TPH concentrations between 54 mg/kg and 3,358 mg/kg; the latter value was reported at MW98-02 and was considerably higher than the concentrations at the other locations. The significantly elevated modified TPH concentration reported at MW98-02 in 2016 exceeded the baseline mean concentration plus 3σ and represents a new historical maximum concentration. No detectable concentrations of cadmium, mercury or PCB were noted in any of the samples in 2016.

In 2016, a groundwater sample could only be collected at MW98-02; the concentrations of all metals and PHC were lower in comparison to those reported in recent years. No cadmium, chromium, mercury or PCB were detected at this location in 2016.

Overall, it was noted that a number of the soil sampling results (e.g., metals at MW98-01 and PHC at MW98-02) were greater than in previous years; this may be reflective of an ongoing impact from the landfill.

4.2.7 Recommendations for the Helipad West Landfill

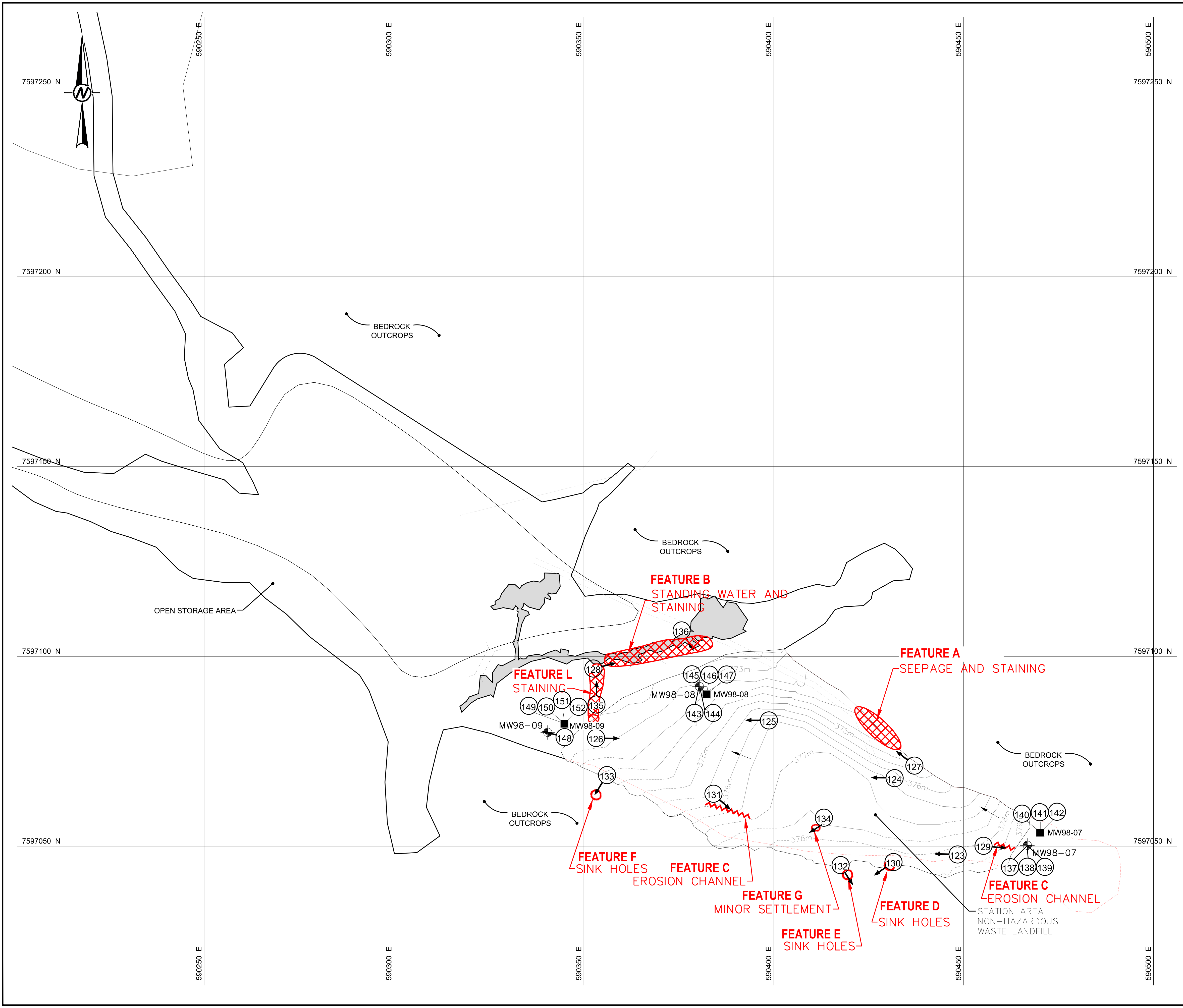
No modifications to the ongoing monitoring program at this landfill are recommended.

4.3 Station Area Landfill

4.3.1 Landfill Description

The Station Area Landfill is a non-hazardous waste landfill located east of the Short Range Radar (SRR) station facilities at the Upper Site, and has an approximate area of 2,000 m^2. This landfill was constructed for disposal of demolition and remediation waste generated during cleanup activities. The design of this landfill included the construction of perimeter berms and placement of granular cover material over the waste materials.

The long term monitoring plan for this landfill consists of visual inspection and the periodic collection of soil and groundwater samples. Three groundwater monitoring wells, MW98-07 through MW98-09, are installed around the landfill perimeter. The approximate locations for the collection of soil and groundwater samples are identified on Figure FOX-4.4.



LEGEND:

◯	SETTLEMENT (NTS)
⩘⩘⩘	EROSION (NTS)
▩	STAINING (NTS)
■	SOIL SAMPLE LOCATION
←(123)	PHOTOGRAPH VIEWPOINT
⊕	MONITORING WELL LOCATION
●	BODY OF WATER
22m	CONTOURS IN 0.5m INTERVALS
←	OVERLAND FLOW DIRECTION

NOTES:

1. ALL COORDINATES ARE REFERENCED TO NAD83 (CSRS), UTM ZONE 19N.
2. ALL ELEVATIONS REFER TO GEODETIC DATUM.
3. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.

REFERENCE:

PREVIOUS INSPECTION FIGURES FROM SENES CONSULTANTS, PROJECT NO. 350600-515-2, 2014 DEW LINE MONITORING PROGRAM, DATED FEB. 2015

0 25 50

1:1,000 METRES

CLIENT
DEPARTMENT OF NATIONAL DEFENCE CANADA

PROJECT
2016 FOX-4 MONITORING REPORT

TITLE
STATION AREA
NON-HAZARDOUS WASTE LANDFILL

CONSULTANT

Golder Associates

YYYY-MM-DD	2016-11-03
DESIGNED	RM
PREPARED	TDR
REVIEWED	DCJ
APPROVED	DP

PROJECT NO.	PHASE	REV.	FIGURE
1530908	2000	A	FOX-4.4

Path: \\golder.gds\gal\Mississauga\SIM\Clients\Public_Works_Canada\Canada\99_PROJ\1530908_PWGSC_Dew_Line_Mon_Program_2015_2018\40_PROD\0006_Fox_4_Field_Summary_Report_2016\ | File Name: 1530908-0006-CM-0004.dwg

4.3.2 Visual Inspection

The Station Area Landfill exhibits some observed minor settlement, erosion, ponded water and staining features. There was no observed cracking, exposed waste or indications of slope instability. Table 4-11 presents a summary of observed visual inspection features and Table 4-12 presents the Preliminary Stability Assessment results. This landfill was assessed to have an “Acceptable” overall performance because all observed features were assessed as “Acceptable.” Table 4-13 is a log of photographs taken during the 2016 visual inspection.

There are some previously observed sink holes located along the edge of the landfill (Features D, E, F) where the cover surface abuts large boulders and bedrock outcrops. The sink holes do not appear to be caused by groundwater flow, permafrost thaw or settlement of the subsurface. They appear to be simply caused by sand and gravel washing into voids of the adjacent boulder rockfill, as a result of the gravel cover not being filter compatible with the boulder rockfill. Precipitation runoff from both the landfill granular cover and the adjacent bedrock abutments likely contributed to their formation. They have not resulted in exposed waste to date and do not require any remedial attention at the present time (other than ongoing visual monitoring at the current frequency).

There was a small minor settlement area on the cover surface (Feature G) that does not appear to have changed since the previous inspection. Previously observed erosion channels (Feature C) appear to be self-armouring and are not a concern.

There were two areas of previously observed ponded water (Features A and B) with orange staining that may be related to landfill seepage. Feature L is an area of orange staining at the west toe of the landfill that may be related to landfill seepage but did not have any associated ponded water.

Previously observed Features H (settlement), I (debris), J (debris) and K (old culvert) were not identified as noteworthy features during the 2016 visual inspection.

Table 4-11: Visual Inspection Checklist – Station Area Landfill

SITE NAME: FOX-4
LANDFILL DESIGNATION: Station Area Non-Hazardous Waste Landfill
DATE OF INSPECTION: August 4, 2016
DATE OF PREVIOUS INSPECTION: August 25, 2014
INSPECTED BY: Darrin Johnson
REPORT PREPARED BY: Darrin Johnson
MONITORING EVENT NUMBER: 12
The inspector/reporter represents to the best of his/her knowledge that the following statements and observations are true and correct and to the best of the preparer’s actual knowledge, no material facts have been suppressed or misstated.

Table 4-11: Visual Inspection Checklist – Station Area Landfill

Checklist Item	Present (Y/N)	Feature ID (A, B, etc.)	Location Description	Easting	Northing	Length (m)	Width (m)	Depth (m)	Extent of Landfill Area (%)	Description	Comparison to Historical Observations	Photos
Settlement	Y	D	South edge of landfill	590431.5	7597045.8	2	1	0.5	0.1%	Sink holes (Acceptable)	Previously observed, no change	130
		E	South edge of landfill	590417.6	7597045.0	2	1	0.5	0.1%	Sink holes (Acceptable)	Previously observed, no change	132
		F	Southwest edge of landfill	590356.1	7597068.7	3	1	0.5	0.15%	Sink holes (Acceptable)	Previously observed, no change	133
		G	Central cover	590413.2	7597057.5	5	2	0.3	0.50%	Minor settlement (Acceptable)	Previously observed, no change	134
Erosion	Y	C	Central and east end of cover surface	590455.2	7597050.1	10	2	0.1	1.0%	Minor self-armouring erosion channels (Acceptable)	Previously observed, no change	129
				590384.1	7597063.8	15	2	0.01	1.5%			131
Lateral Movement	N											
Frost Action	N											
Sloughing	N											
Cracking	N											
Animal Burrows	N											
Vegetation	N											
Staining	Y	L	West toe of landfill	590353.3	7597087.3	15	3	-	2.3%	Orange staining (Acceptable)	Previously observed, no change	135
Vegetation Stress	N											

Table 4-11: Visual Inspection Checklist – Station Area Landfill

Checklist Item	Present (Y/N)	Feature ID (A, B, etc.)	Location Description	Easting	Northing	Length (m)	Width (m)	Depth (m)	Extent of Landfill Area (%)	Description	Comparison to Historical Observations	Photos
Seepage or Ponded Water	Y	A	Lower toe at east end	590437.0	7597071.2	15	3	0.1	2.2%	Minor seepage with some orange staining (Acceptable)	Previously observed, no change	127
		B	Northwest end	590352.5	7597096.8	30	5	0.1	7.5%	Standing water with orange staining (Acceptable)	Previously observed, no change	128, 136
Debris and/or Liner Exposed	N											
Presence / Condition of Monitoring Instruments	Y	MW98-07, -08, -09	-	-	-	-	-	-	-	Monitoring wells intact	Casings filled with bentonite	137, 143, 144, 148
Features of Note / Other Observations	N											

Landfill Area = 2,000 m^2.

Table 4-12: Preliminary Stability Assessment – Station Area Landfill

Feature	Severity Rating	Extent
Settlement	Acceptable	Occasional
Erosion	Acceptable	Isolated
Lateral Movement	Not observed	-
Frost Action	Not observed	-
Sloughing	Not observed	-
Cracking	Not observed	-
Animal Burrows	Not observed	-
Vegetation Establishment	Not observed	-
Staining	Acceptable	Occasional
Vegetation Stress	Not observed	-
Seepage/Ponded Water	Acceptable	Occasional
Debris and/or Liner Exposure	Not observed	-
Other	Not observed	-
Overall Landfill Performance	**Acceptable**	

Table 4-13: Summary Table of Photographic Log – Station Area Landfill

Photo	Description (file name)	Easting	Northing	Date
123	FOX 4 – Station Area Landfill – East end facing west (ATT22_Photo22.jpg)	590448.4	7597047.8	4-Aug-2016
124	FOX 4 – Station Area Landfill – North slope facing west (ATT23_Photo23.jpg)	590431.8	7597067.9	4-Aug-2016
125	FOX 4 – Station Area Landfill – North side facing west and MW98-08 – Feature L (staining) and Feature B (ponded water) in background (Acceptable) (ATT24_Photo24.jpg)	590398.7	7597083.1	4-Aug-2016
126	FOX 4 – Station Area Landfill – West end facing east – Previously observed minor settlement (Feature H) is just rough grading and not considered noteworthy (ATT25_Photo25.jpg)	590353.2	7597078.5	4-Aug-2016
127	FOX 4 – Station Area Landfill – East end toe facing northwest – Previously observed Feature A - Seepage with orange staining (Acceptable) (ATT134_Photo134.jpg)	590437.0	7597071.2	4-Aug-2016
128	FOX 4 – Station Area Landfill – Northwest toe facing east – Feature B – Ponded water with orange staining (Acceptable) (ATT137_Photo137.jpg)	590352.5	7597096.8	4-Aug-2016

Table 4-13: Summary Table of Photographic Log – Station Area Landfill

Photo	Description (file name)	Easting	Northing	Date
129	FOX 4 – Station Area Landfill – East end facing east – Feature C – Minor self armouring erosion with fines washed down slope, soft ground at bottom of slope (Acceptable) (ATT130_Photo130.jpg)	590455.2	7597050.1	4-Aug-2016
130	FOX 4 – Station Area Landfill – Feature D – Sink holes along south edge of landfill facing southwest (Acceptable) (ATT131_Photo131.jpg)	590431.5	7597045.8	4-Aug-2016
131	FOX 4 – Station Area Landfill – Crest surface facing east – Feature C – Minor self armouring erosion (Acceptable) (ATT139_Photo139.jpg)	590384.1	7597063.8	4-Aug-2016
132	FOX 4 – Station Area Landfill – Feature E – Sink holes along south edge of landfill, facing southeast (Acceptable) (ATT132_Photo132.jpg)	590417.6	7597045.0	4-Aug-2016
133	FOX 4 – Station Area Landfill – Feature F – Sink holes along south edge of landfill, facing southwest (Acceptable) (ATT138_Photo138.jpg)	590356.1	7597068.7	4-Aug-2016
134	FOX 4 – Station Area Landfill – Central crest surface facing southwest – Feature G – Previously observed minor settlement (<0.1 m deep) may just be rough grading (Acceptable) (ATT133_Photo133.jpg)	590413.2	7597057.5	4-Aug-2016
135	FOX 4 – Station Area Landfill – West toe facing north – Feature L – Orange staining (Acceptable) (ATT136_Photo136.jpg)	590353.3	7597087.3	4-Aug-2016
136	FOX 4 – Station Area Landfill – Northwest toe facing southeast towards landfill – Feature B – Ponded water with orange staining (Acceptable) (ATT135_Photo135.jpg)	590375.7	7597106.8	4-Aug-2016
137	FOX-4 – Station Area Landfill – MW98-07 monitoring well casing filled with bentonite (ATT69_Photo69.jpg)	590470.2	7597053.6	4-Aug-2016
138	FOX-4 – Station Area Landfill – MW98-07 (ATT70_Photo70.jpg)	590470.2	7597053.6	4-Aug-2016
139	FOX-4 – Station Area Landfill – MW98-07 (ATT71_Photo71.jpg)	590470.2	7597053.6	4-Aug-2016
140	FOX-4 – Station Area Landfill – Soil sampling location MW98-07 before excavation (ATT59_Photo59.jpg)	590462.4	7597054.2	4-Aug-2016
141	FOX-4 – Station Area Landfill – Soil sampling location MW98-07 after excavation (ATT60_Photo60.jpg)	590462.4	7597054.2	4-Aug-2016
142	FOX-4 – Station Area Landfill – Soil sampling location MW98-07 after backfilling (ATT61_Photo61.jpg)	590462.4	7597054.2	4-Aug-2016
143	FOX-4 – Station Area Landfill – MW98-08 (ATT72_Photo72.jpg)	590381.2	7597088.9	4-Aug-2016

Table 4-13: Summary Table of Photographic Log – Station Area Landfill

Photo	Description (file name)	Easting	Northing	Date
144	FOX-4 – Station Area Landfill – MW98-08 monitoring well casing filled with bentonite (ATT73_Photo73.jpg)	590381.2	7597088.9	4-Aug-2016
145	FOX-4 – Station Area Landfill – Soil sampling location MW98-08 before excavation (ATT62_Photo62.jpg)	590382.3	7597090.0	4-Aug-2016
146	FOX-4 – Station Area Landfill – Soil sampling location MW98-08 after excavation (ATT63_Photo63.jpg)	590382.3	7597090.0	4-Aug-2016
147	FOX-4 – Station Area Landfill – Soil sampling location MW98-08 after backfilling (ATT64_Photo64.jpg)	590382.3	7597090.0	4-Aug-2016
148	FOX-4 – Station Area Landfill – MW98-09 with bentonite inside protective casing (ATT74_Photo74.jpg)	590343.0	7597079.8	4-Aug-2016
149	FOX-4 – Station Area Landfill – Soil sampling location MW98-09 before excavation (ATT65_Photo65.jpg)	590344.9	7597082.3	4-Aug-2016
150	FOX-4 – Station Area Landfill – Soil sampling location MW98-09 after excavation (ATT66_Photo66.jpg)	590344.9	7597082.3	4-Aug-2016
151	FOX-4 – Station Area Landfill – Soil sampling location MW98-09 after excavation (ATT67_Photo67.jpg)	590344.9	7597082.3	4-Aug-2016
152	FOX-4 – Station Area Landfill – Soil sampling location MW98-09 after backfilling (ATT68_Photo68.jpg)	590344.9	7597082.3	4-Aug-2016

4.3.3 Summary of Sampling Deviations

The field work was conducted as per the TOR with the following exceptions:

- The deep soil samples at MW98-07 and MW98-09 could not be collected due to refusal on rock;
- The groundwater samples at MW98-07 and MW98-08 could not be collected because the wells were dry; and,
- The groundwater sample at MW98-09 could not be collected because the groundwater in the well was frozen.

4.3.4 Soil Sampling

Table 4-14 presents a summary of analytical results for soil samples collected at the Station Area Landfill. MW98-07 represents an upgradient sampling location, whereas MW98-08 and MW98-09 represent downgradient sampling locations.

Table 4-14 also lists the arithmetic mean background and baseline values for the landfill, in addition to the baseline mean plus 3σ limits. At the Station Area Landfill, the background arithmetic means for copper, nickel, cobalt, cadmium, zinc, chromium and arsenic are greater than the baseline arithmetic means. The background arithmetic means for cobalt, cadmium and arsenic are greater than the baseline means plus 3σ.

MW98-07

Sampling location MW98-07 is located upgradient of the landfill, immediately east of the toe. The estimated elevation of this sampling point is 379.5 masl. As shown in Photos 140 and 141, the area consists of sand and gravel with some rock and is not vegetated. The soils consisted of brown sand with gravel and stone.

For the shallow sample at MW98-07 (0-15 cm), the concentrations of all metals were less than, or similar to, those reported in recent years. The modified TPH and PHC F3 fraction concentrations observed in 2016 (938 mg/kg and 913 mg/kg, respectively) represent new historical maximum concentrations; the previous maximum TPH concentration of 411 mg/kg was observed in 2005. The 2016 modified TPH value of 938 mg/kg exceeded the baseline mean concentration plus 3σ; none of the other parameters exceeded their baseline mean concentrations plus 3σ. No cadmium, mercury or PCB were detected at this location in 2016.

MW98-08

Sampling location MW98-08 is located at the north toe of, and within, the landfill cover. The estimated elevation of this sampling point is 373 masl. As shown in Photos 128 and 136, ponding of water and orange staining is observed along the north toe of the landfill, approximately 15 m north (downgradient) of the sampling location. The area largely consists of sand and gravel with sparse vegetation. The soils consisted of brown sand with some gravel and stone.

For the shallow sample at MW98-08 (0-15 cm), the concentrations of all metals were less than or similar to those reported in previous years. Whereas arsenic had exhibited a slight increasing trend to 2014, the 2016 results indicate a decline. No cadmium, mercury or PHC were detected at this location in 2016. The PCB concentration observed in 2016 (1.46 mg/kg) exceeded the baseline mean concentration plus 3σ (0.6 mg/kg) and represents a new historical maximum concentration; the previous maximum concentration of 0.26 mg/kg was observed in 2014 and 2001. None of the other parameters exceeded their baseline mean concentrations plus 3σ.

For the deep sample at MW98-08 (30-40 cm), metals concentrations were slightly lower than those in the shallow sample. The concentrations of all metals were less than or similar to those reported in previous years. Whereas arsenic had exhibited a slight increasing trend to 2014, the 2016 results indicate a decline. No cadmium, mercury or PHC were detected at this location in 2016. The PCB concentration observed in 2016 (0.19 mg/kg) is similar to the concentrations observed in 2014 and 2015 (0.19 mg/kg and 0.18 mg/kg, respectively). None of the reported values exceeded their respective baseline mean concentration plus 3σ.

MW98-09

Sampling location MW98-09 is located downgradient of the landfill, approximately 5 m west of the toe. The estimated elevation of this sampling point is 372.5 masl. As shown in Photo 135, ponding of water and orange staining is observed along the toe of the landfill, approximately 5 m east of the sampling location. The area largely consists of sand and gravel and is not vegetated (Photo 149). The soils consisted of grey sand with some gravel and stone.

For the shallow sample at MW98-09 (0-15 cm), the concentrations of all metals were similar to those reported in previous years. The concentrations of copper and nickel increased slightly in 2016 and represent new historical maxima. No cadmium, mercury or PHC were detected at this location in 2016. The PCB concentration observed in 2016 (0.08 mg/kg) is similar to the concentrations observed in previous years. None of the reported values exceeded their respective baseline mean concentration plus 3σ.

Table 4-14: Soil Chemical Analysis Results – Station Area Landfill

ID	Depth (cm)	Cu (mg/kg)	Ni (mg/kg)	Co (mg/kg)	Cd (mg/kg)	Pb (mg/kg)	Zn (mg/kg)	Cr (mg/kg)	As (mg/kg)	Hg (mg/kg)	Total PCB (mg/kg)	F1 (mg/kg)	F2 (mg/kg)	F3 (mg/kg)	F4 (mg/kg)
Background Mean		30.2	24.0	8.8	1.0	10.0	41.5	40.6	28.6	NA	NA	NA	NA	NA	NA
Baseline Mean		**16.6**	**19.7**	**5.0**	**0.12**	**25.6**	**35.2**	**27.8**	**13.1**	**NA**	**0.16**	**NA**	**NA**	**NA**	**NA**
Baseline + 3σ		35.2	64.1	7.7	0.3	36.7	53.5	50.4	22.7	NA	0.6	NA	NA	NA	NA
Upgradient															
MW98-07a	0-15	**21.8**	17.2	**5.2**	<0.5	9	35	**40.3**	**17.3**	<0.1	<0.05	<7	21	913	203
MW98-07 (deep) [1]															
Downgradient															
MW98-08b	0-15	11	11.9	3.8	<0.5	3.4	21	23.7	**16.3**	<0.1	**1.46**	<7	<4	<8	<6
MW98-08a	30-40	8.7	9.5	3.2	<0.5	2.5	20.3	21.7	**14.5**	<0.1	**0.19**	<7	<4	<8	<6
MW98-09a	0-15	**18.3**	13.3	4.6	<0.5	6.1	33.3	**29.2**	**13.8**	<0.1	0.08	<7	<4	<8	<6
MW98-09 (deep) [1]															

Notes:

NA: Not available; ID: Soil sample location ID.

Underlined values: Results exceed Background arithmetic mean.

Bold Values: Results exceed Baseline arithmetic mean.

Shaded Values: Results exceed the Baseline arithmetic mean plus 3σ.

1: The deep soil samples at MW98-07 and MW98-09 could not be collected due to refusal on rock.

4.3.5 Groundwater Sampling

Groundwater sampling and monitoring well inspection field records are included in Appendix B. There were no groundwater samples collected at this landfill in 2016.

4.3.6 Conclusions and Overall Performance of the Station Area Landfill

The Station Area Non-Hazardous Waste Landfill had no observed cracking, exposed waste or indications of slope instability. The landfill has some previously observed minor settlement, erosion, ponded water and staining features. This landfill was assessed to have an “Acceptable” overall performance because all observed features were assessed as “Acceptable”. Previously observed sink holes located along the edge of the landfill and a small minor settlement area on the cover surface do not appear to have changed since the last inspection. The sink holes do not appear to be caused by groundwater flow, permafrost thaw or settlement of the subsurface. They appear to be simply caused by sand and gravel washing into voids of the adjacent boulder rockfill, as a result of the gravel cover not being filter compatible with the boulder rockfill. Previously observed erosion channels are self-armouring and are not considered to be a concern. Previously observed ponded water along the edge of the landfill and orange staining may be related to landfill seepage.

Concentrations of metal parameters in soil were highest overall at the shallow MW98-07 sample location, located upgradient of the east side of the landfill. At all three locations, the concentrations of metals were similar to or less than those reported in previous years. No detectable concentrations of cadmium or mercury were noted in any of the samples in 2016.

PHC were detected at upgradient location MW98-07; the modified TPH concentration observed in 2016 exceeded the baseline mean concentration plus 3σ and represents a new historical maximum concentration. PCB were detected at the shallow and deep MW98-08 locations and the shallow MW98-09 location, at concentrations between 0.08 mg/kg and 1.46 mg/kg. The PCB concentration reported at the shallow MW98-08 location exceeded the baseline mean concentration plus 3σ and represents a new historical maximum concentration.In 2016, groundwater samples could not be collected from any of the three monitoring wells adjacent to the landfill as they were dry or frozen. It is also noted that the casing and monitoring well pipe were filled with bentonite clay making collection of an accurate groundwater sample at these locations not be possible.

The historical graphs in Appendix C show concentration trends at the Station Area Non-Hazardous Waste Landfill. At downgradient locations MW98-08 and MW98-09, relatively stable trends are noted for most parameters. At upgradient location MW98-07, slight increasing trends are noted for a number of parameters, notably for chromium and modified TPH. The concentrations of all metals at MW98-07 were less than, or similar to, those reported in recent years and the increasing trends observed at MW98-07 are not considered to reflect impact from the landfill. Given the staining in the area of standing water and the presence of elevated PCB at MW98-08 in 2016, impact from the landfill may be occurring, however overall, there is no evident increasing trend in the metals concentrations in this area, with the possible exception of arsenic, up to 2014.

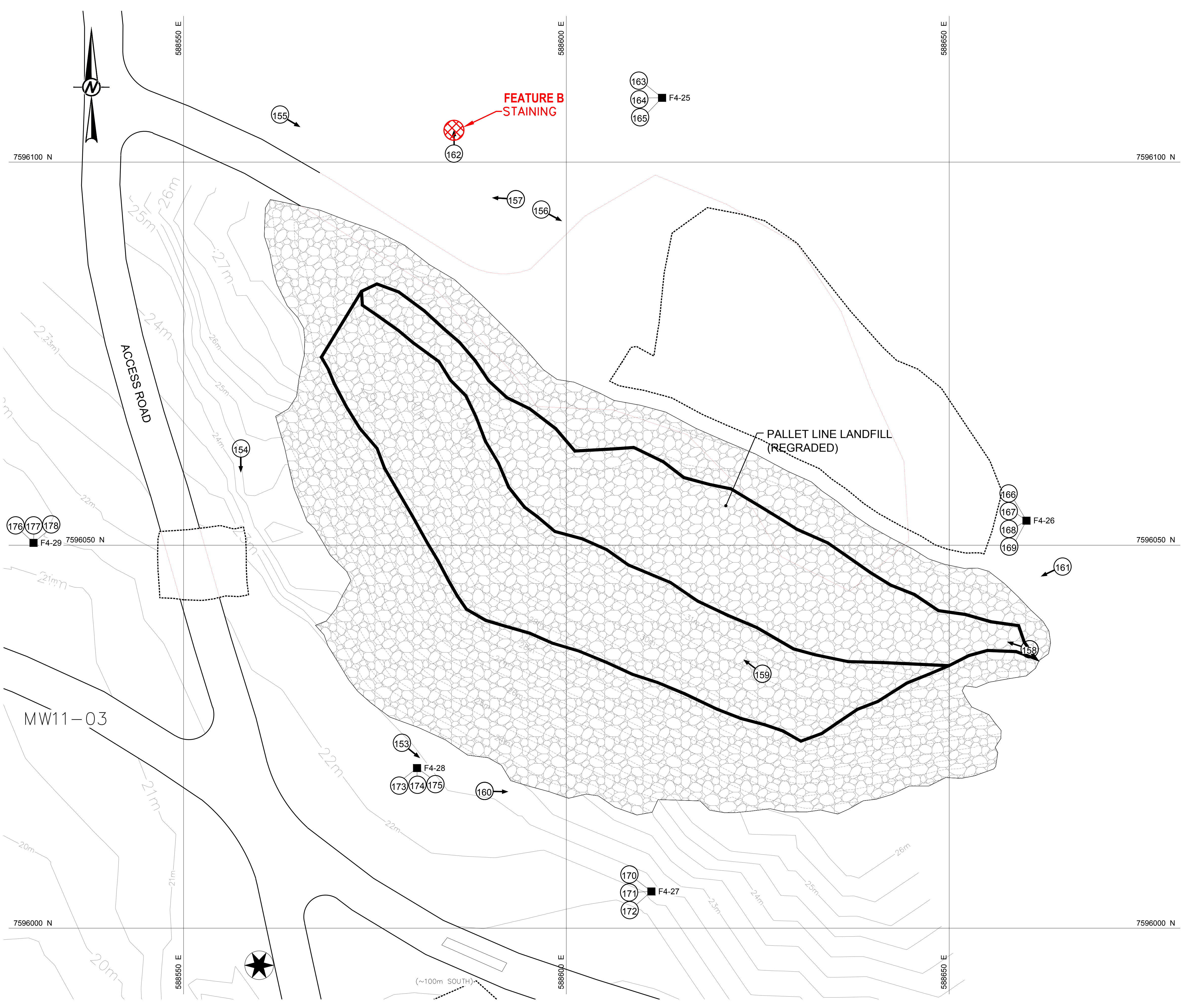
4.3.7 Recommendations for the Station Area Landfill

It is recommended that soil samples from closer to the ponded water/staining area be collected during the next monitoring event. It is further recommended, considering the inability to collect groundwater samples from the wells (because they are filled with bentonite clay), that consideration could be given to collection of water samples from either the ponded surface water, or a shallow hand dug excavation. In addition, an attempt should be made to flush these wells during the next sampling program.

4.4 Pallet Line Landfill

4.4.1 Landfill Description

The Pallet Line Landfill is located at the Lower Site, north of the airstrip and east of the Non-Hazardous Waste Landfill, and has an approximate area of 1,300 m^2. This landfill was in existence prior to the recent cleanup, however, it was upgraded between 2011 and 2013. Landfill remediation consisted of excavation and removal of three areas of Tier II contaminated soil and regrading with 0.4 m of Type 1 granular fill over 0.4 m of Type 2 granular fill. Approximate sampling locations are provided in Figure FOX-4.5. The 2016 monitoring event represented the second monitoring event at this landfill after it was upgraded.



LEGEND:

▨	STAINING (NTS)
■	SOIL SAMPLE LOCATION
(160)→	PHOTOGRAPH VIEWPOINT
22m	CONTOURS IN 0.5m INTERVALS
▨	TYPE 1 GRANULAR A

NOTES:

1. ALL COORDINATES ARE REFERENCED TO NAD83 (CSRS), UTM ZONE 19N.
2. ALL ELEVATIONS REFER TO GEODETIC DATUM.
3. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.

REFERENCE:

PREVIOUS INSPECTION FIGURES FROM SENES CONSULTANTS, PROJECT NO. 350600-515-2, 2014 DEW LINE MONITORING PROGRAM, DATED FEB. 2015

0 10 20

1:500 METRES

CLIENT
DEPARTMENT OF NATIONAL DEFENCE CANADA

PROJECT
2016 FOX-4 MONITORING REPORT

TITLE
AIRSTRIP AREA
PALLET LINE LANDFILL

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-11-03
DESIGNED	RM
PREPARED	TDR
REVIEWED	DCJ
APPROVED	DP

PROJECT NO.	PHASE	REV.	FIGURE
1530908	2000	A	FOX-4.5

Path: \\golder.gds\gal\Mississauga\SIM\Clients\Public_Works_Canada\Canada\99_PROJ\1530908_PWGSC_Dew_Line_Mon_Program_2015_2018\40_PROD\0006_Fox_4_Field_Summary_Report_2016\ | File Name: 1530908-0006-CM-0005.dwg

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25 mm

0

4.4.2 Visual Inspection

The Pallet Line Landfill exhibited no evidence of instability, erosion, settlement or exposed waste. There was a small area (4 m x 4 m) with dark staining (Feature B) on the crest of the Pallet Line Landfill that does not appear to be related to landfill seepage (i.e., it could potentially be from a small surficial hydrocarbon spill). Previously observed ponded water (Feature A) was not observed during the 2016 visual inspection. Table 4-15 presents a summary of observed visual inspection features and Table 4-16 presents the Preliminary Stability Assessment results. This landfill was assessed to have an “Acceptable” overall performance. Table 4-17 is a log of photographs taken during the 2016 visual inspection.

Table 4-15: Visual Inspection Checklist – Pallet Line Landfill

SITE NAME: FOX-4
LANDFILL DESIGNATION: Pallet Line Landfill
DATE OF INSPECTION: August 5, 2016
DATE OF PREVIOUS INSPECTION: August 28, 2014
INSPECTED BY: Darrin Johnson
REPORT PREPARED BY: Darrin Johnson
MONITORING EVENT NUMBER: 12
The inspector/reporter represents to the best of his/her knowledge that the following statements and observations are true and correct and to the best of the preparer's actual knowledge, no material facts have been suppressed or misstated.

Table 4-15: Visual Inspection Checklist – Pallet Line Landfill

Checklist Item	Present (Y/N)	Feature ID (A, B, etc.)	Location Description	Easting	Northing	Length (m)	Width (m)	Depth (m)	Extent of Landfill Area (%)	Description (Severity Rating)	Comparison to Historical Observations	Photos
Settlement	N											
Erosion	N											
Lateral Movement	N											
Frost Action	N											
Sloughing	N											
Cracking	N											
Animal Burrows	N											
Vegetation	N											
Staining	Y	B	Crest surface of landfill	588585.3	7596101.1	2.00	2.00	-	0.31%	Minor dark hydrocarbon stain (Acceptable)	New	162
Vegetation Stress	N											
Seepage or Ponded Water	N	A	East crest	588664.8	7596047.2	-	-	-	-	Previously observed ponded water	Not observed in 2016	161
Debris and/or Liner Exposed	N											
Presence / Condition of Monitoring Instruments	N											
Features of Note / Other Observations	N											

Landfill Area = 1,300 m^2.

Table 4-16: Preliminary Stability Assessment – Pallet Line Landfill

Feature	Severity Rating	Extent
Settlement	Not observed	-
Erosion	Not observed	-
Lateral Movement	Not observed	-
Frost Action	Not observed	-
Sloughing	Not observed	-
Cracking	Not observed	-
Animal Burrows	Not observed	-
Vegetation Establishment	Not observed	-
Staining	Acceptable	Isolated
Vegetation Stress	Not observed	-
Seepage/Ponded Water	Not observed	-
Debris and/or Liner Exposure	Not observed	-
Other	Not observed	-
Overall Landfill Performance	**Acceptable**	

Table 4-17: Summary Table of Photographic Log – Pallet Line Landfill

Photo	Description (file name)	Easting	Northing	Date
153	FOX 4 – Pallet Line Landfill – Southwest slope and toe facing southeast (ATT2_Photo2.jpg)	588578.5	7596024.2	5 Aug 2016
154	FOX 4 – Pallet Line Landfill – West toe facing south (ATT3_Photo3.jpg)	588557.5	7596062.6	5-Aug-2016
155	FOX 4 – Pallet Line Landfill – Northwest corner facing southeast (ATT4_Photo4.jpg)	588562.6	7596106.2	5-Aug-2016
156	FOX 4 – Pallet Line Landfill – Crest of landfill facing southeast (ATT5_Photo5.jpg)	588596.7	7596093.8	5-Aug-2016
157	FOX 4 – Pallet Line Landfill – Crest facing northwest (ATT6_Photo6.jpg)	588946.5	7596283.9	5-Aug-2016
158	FOX 4 – Pallet Line Landfill – South end facing northwest (ATT7_Photo7.jpg)	588660.5	7596036.4	5-Aug-2016
159	FOX 4 – Pallet Line Landfill – South slope facing northwest (ATT8_Photo8.jpg)	588625.6	7596033.2	5-Aug-2016
160	FOX 4 – Pallet Line Landfill – Toe of south slope facing east (ATT9_Photo9.jpg)	588589.3	7596017.9	5-Aug-2016
161	FOX 4 – Pallet Line Landfill – Previously observed ponded water (Feature A) not observed in 2016 – East end facing southwest (ATT95_Photo95.jpg)	588664.8	7596047.2	5-Aug-2016
162	FOX 4 – Pallet Line Landfill – Crest surface of landfill facing north – Feature B – Minor dark (potential hydrocarbon) staining not related to landfill performance (Acceptable) (ATT94_Photo94.jpg)	588585.3	7596101.1	5-Aug-2016

Table 4-17: Summary Table of Photographic Log – Pallet Line Landfill

Photo	Description (file name)	Easting	Northing	Date
163	FOX-4 – Pallet Line Landfill – Soil sample location F4-25 before excavation (ATT49_Photo49.jpg)	588612.5	7596108.4	3-Aug-2016
164	FOX-4 – Pallet Line Landfill – Soil sample location F4-25 after excavation (ATT50_Photo50.jpg)	588612.5	7596108.4	3-Aug-2016
165	FOX-4 – Pallet Line Landfill – Soil sample location F4-25 after backfilling (ATT51_Photo51.jpg)	588612.5	7596108.4	3-Aug-2016
166	FOX-4 – Pallet Line Landfill – Soil sampling location F4-26 before excavation (ATT52_Photo52.jpg)	588660.1	7596053.2	3-Aug-2016
167	FOX-4 – Pallet Line Landfill – Soil sampling location F4-26 after excavation (ATT53_Photo53.jpg)	588660.1	7596053.2	3-Aug-2016
168	FOX-4 – Pallet Line Landfill – Soil sampling location F4-26 after excavation (ATT54_Photo54.jpg)	588660.1	7596053.2	3-Aug-2016
169	FOX-4 – Pallet Line Landfill – Soil sampling location F4-26 after backfilling (ATT55_Photo55.jpg)	588660.1	7596053.2	3-Aug-2016
170	FOX-4 – Pallet Line Landfill – Soil sampling location F4-27 before excavation (ATT56_Photo56.jpg)	588611.1	7596004.8	3-Aug-2016
171	FOX-4 – Pallet Line Landfill – Soil sampling location F4-27 after excavation (ATT57_Photo57.jpg)	588611.1	7596004.8	3-Aug-2016
172	FOX-4 – Pallet Line Landfill – Soil sampling location F4-27 after backfilling (ATT58_Photo58.jpg)	588611.1	7596004.8	3-Aug-2016
173	FOX-4 – Pallet Line Landfill – Soil sampling location F4-28 before excavation (ATT91_Photo91.jpg)	588580.5	7596020.9	5-Aug-2016
174	FOX-4 – Pallet Line Landfill – Soil sampling location F4-28 after excavation (ATT92_Photo92.jpg)	588580.5	7596020.9	5-Aug-2016
175	FOX-4 – Pallet Line Landfill – Soil sampling location F4-28 after backfilling (ATT93_Photo93.jpg)	588580.5	7596020.9	5-Aug-2016
176	FOX-4 – Pallet Line Landfill – Soil sampling location F4-29 before excavation (ATT34_Photo34.jpg)	588530.4	7596050.3	3-Aug-2016
177	FOX-4 – Pallet Line Landfill – Soil sampling location F4-29 after excavation (ATT35_Photo35.jpg)	588530.4	7596050.3	3-Aug-2016
178	FOX-4 – Pallet Line Landfill – Soil sampling location F4-29 after backfilling (ATT36_Photo36.jpg)	588530.4	7596050.3	3-Aug-2016

4.4.3 Summary of Sampling Deviations

The field work was conducted as per the TOR with the following exceptions:

- The deep soil samples at F4-25, F4-26, F4-27, F4-28 and F4-29 could not be collected due to refusal on rock.

4.4.4 Soil Sampling

Table 4-18 presents a summary of analytical results for soil samples collected at the Pallet Line Landfill. F4-25 and F4-26 represent upgradient sampling locations, whereas F4-27, F4-28 and F4-29 represent downgradient sampling locations.

Table 4-18 also lists the arithmetic mean background and baseline values for the site, in addition to the baseline mean plus baseline plus 3σ limits. At the Pallet Line Landfill, the background arithmetic means for copper, nickel, cobalt, zinc and chromium are greater than the baseline arithmetic means.

F4-25

Sampling location F4-25 is located upgradient of the landfill, approximately 35 m north of the toe. The estimated elevation of this sampling point is 32 masl. As shown in Photos 163 and 164, the area consists of sand and gravel with some rock and is not vegetated. The soils consisted of yellow-brown sand, gravel and stone.

For the shallow sample at F4-25 (0-15 cm), the concentrations of most metals were slightly lower than those reported in 2014. The concentration of cadmium (2.8 mg/kg) increased from the non-detectable concentration (less than 0.1 mg/kg) observed in 2014 and exceeded the baseline mean concentration plus 3σ (1.0 mg/kg). No mercury or PHC were detected at this location in 2016. The PCB concentration (0.27 mg/kg) exceeded the baseline mean concentration plus 3σ (0.05 mg/kg); no PCB were detected in 2014. None of the other parameters exceeded their baseline mean concentrations plus 3σ.

F4-26

Sampling location F4-26 is located upgradient of the landfill, approximately 9 m north of the toe. The estimated elevation of this sampling point is 31 masl. As shown in Photos 166 and 167, the area consists of sand with some gravel and rock and is not vegetated. The soils consisted of brown sand with some gravel and stone.

For the shallow sample at F4-26 (0-15 cm), the concentrations of all metals, with the exception of lead, were greater than those reported in 2014. The concentration of cadmium (3.2 mg/kg) increased from the non-detectable concentration (less than 0.1 mg/kg) observed in 2014 and exceeded the baseline mean concentration plus 3σ (1.0 mg/kg). No mercury was detected at this location in 2016. The modified TPH concentration (265 mg/kg) was greater than the concentration reported in 2014 (34 mg/kg) and exceeded the baseline mean concentration plus 3σ (94 mg/kg). The concentration of the PHC F4 fraction in 2016 was 68 mg/kg. The PCB concentration (0.14 mg/kg) exceeded the baseline mean concentration plus 3σ (0.05 mg/kg); a PCB concentration of 0.036 mg/kg was reported in 2014. None of the other parameters exceeded their baseline mean concentrations plus 3σ.

F4-27

Sampling location F4-27 is located downgradient of the landfill, approximately 10 m south of the toe. The estimated elevation of this sampling point is 22 masl. As shown in Photos 170 and 171, the largely area consists of sand with some gravel and is not vegetated. The soils consisted of yellow-brown sand.

For the shallow sample at F4-27 (0-15 cm), the concentrations of all metals were greater than those reported in 2014. The concentration of cadmium (3.5 mg/kg) increased from the non-detectable concentration (less than 0.5 mg/kg) observed in 2014 to a concentration exceeding the baseline mean concentration plus 3σ (1.0 mg/kg). No mercury was detected at this location in 2016. The modified TPH concentration (70 mg/kg) was greater than the concentration of 54 mg/kg reported in 2014. The PCB concentration (0.16 mg/kg) exceeded the baseline mean concentration plus 3σ (0.05 mg/kg); no PCB were detected in 2014. None of the other parameters exceeded their baseline mean concentrations plus 3σ.

F4-28

Sampling location F4-28 is located downgradient of the landfill, approximately 5 m south of the toe. The estimated elevation of this sampling point is 22.5 masl. As shown in Photos 173 and 174, the area consists of sand and gravel and is not vegetated. The soils consisted of yellow-brown sand, gravel and stone.

For the shallow samples at F4-28 (0-15 cm, duplicate location), the calculated RPD values indicated the original and duplicate sample results differ by more than 30% for zinc and this result should therefore be interpreted with caution. The average concentrations of all metals were greater than those reported in 2014. The average modified TPH concentration (96 mg/kg) was greater than the concentration of 44 mg/kg reported in 2014 and marginally exceeded the baseline mean concentration plus 3σ (94 mg/kg). The average concentration of the PHC F4 fraction in 2016 was 48 mg/kg. No cadmium, mercury or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean concentrations plus 3σ.

F4-29

Sampling location F4-29 is located downgradient of the landfill, approximately 33 m west of the toe. The estimated elevation of this sampling point is 21.5 masl. As shown in Photos 176 and 177, the area consists of sand and gravel and is not vegetated. The soils consisted of brown sand, gravel and stone.

For the shallow sample at F4-29 (0-15 cm), the concentrations of most metals were greater than those reported in 2014. The concentration of cadmium (4.9 mg/kg) increased from the non-detectable concentration (less than 0.1 mg/kg) observed in 2014 to a concentration exceeding the baseline mean concentration plus 3σ (1.0 mg/kg). No nickel, mercury or PHC were detected at this location in 2016. The PCB concentration (0.25 mg/kg) exceeded the baseline mean concentration plus 3σ (0.05 mg/kg); no PCB were detected in 2014. None of the other parameters exceeded their baseline mean concentrations plus 3σ.

Table 4-18: Soil Chemical Analysis Results – Pallet Line Landfill

ID	Depth (cm)	Cu (mg/kg)	Ni (mg/kg)	Co (mg/kg)	Cd (mg/kg)	Pb (mg/kg)	Zn (mg/kg)	Cr (mg/kg)	As (mg/kg)	Hg (mg/kg)	Total PCB (mg/kg)	F1 (mg/kg)	F2 (mg/kg)	F3 (mg/kg)	F4 (mg/kg)
Background Mean		30.2	24.0	8.8	0.62	6.4	41.5	40.6	28.6	NA	NA	NA	NA	NA	NA
Baseline Mean		**26.5**	**17.0**	**3.9**	**1.0**	**10.0**	**37.3**	**39.4**	**37.2**	**0.10**	**0.050**	**NA**	**NA**	**NA**	**NA**
Baseline + 3σ		66.6	37.2	10.8	1.0	21.8	97.6	94.3	171.4	0.100	0.05	NA	NA	NA	NA
Upgradient															
F4-25a	0-15	22.7	13.7	**4.6**	**2.8**	8.4	33.3	**50.6**	31.9	<0.1	**0.27**	<7	<4	<8	<6
F4-25 (deep) [1]															
F4-26a	0-15	**31.3**	**27.3**	7.7	**3.2**	**15.8**	41.3	**61.1**	**60.9**	<0.1	**0.14**	<7	<4	259	68
F4-26 (deep) [1]															
Downgradient															
F4-27a	0-15	**53.5**	**25.1**	**6.0**	**3.5**	**15.2**	**44.4**	**49.4**	23	<0.1	**0.16**	<7	<4	64	10
F4-27 (deep) [1]															
F4-28a	0-15	**35.8**	**23**	**7.8**	<0.5	**12.4**	**53.1**	**48.1**	13.4	<0.1	<0.05	<7	<4	127	46
F4-28a dup	0-15	**40**	**31**	**10.2**	<0.5	**16**	**72**	**61**	15	<0.10	<0.05	<5	<10	<50	<50
F4-28a (Dup Avg)	0-15	**38**	**27**	**9.0**	<0.5	**14**	**63**	**55**	14	<0.1	<0.05	<6	<7	89	48
F4-28 (deep) [1]															
F4-29a	0-15	**50.1**	<1.0	**9.8**	**4.9**	9.7	**54.6**	**72.1**	**37.4**	<0.1	**0.25**	<7	<4	<8	<6
F4-29 (deep) [1]															

Notes:

NA: Not available

Underlined values: Results exceed Background arithmetic mean.

Bold Values: Results exceed Baseline arithmetic mean.

Shaded Values: Results exceed the Baseline arithmetic mean plus 3σ.

1: The deep soil samples at F4-25, F4-26, F4-27, F4-28 and F4-29 could not be collected due to refusal.

4.4.5 Conclusions and Overall Performance of the Pallet Line Landfill

During the 2016 visual inspection there were no observations of erosion, settlement, cracking, exposed waste or indications of instability at the Pallet Line Landfill. Previously observed ponded water (Feature A) was not present during the 2016 visual inspection. A new small hydrocarbon stain (Feature B) was observed in 2016 but it does not appear to be related to landfill performance. Based on the visual inspection, the overall stability performance of the landfill was assessed as “Acceptable”.

Concentrations of metals were highest overall at the sample location F4-27 (shallow sample), located downgradient of the east side of the landfill, however, the concentrations observed in 2016 do not represent an overall increase from 2014. At F4-26, F4-27, F4-28 and F4-29, the majority of metals concentrations were greater than those reported in 2014. Concentrations of cadmium and PCB at F4-25, F4-26, F4-27 and F4-29 increased from those reported in 2014 (mostly non-detectable) and exceeded their respective baseline mean concentrations plus 3σ. PHC were detected at the F4-26, F4-27 and F4-28 sampling locations; the modified TPH concentrations at F4-26 and F4-28 were greater than the concentrations reported in 2014 and exceeded the baseline mean concentration plus 3σ. No detectable concentrations of mercury were noted in any of the samples in 2016.

Overall, it was noted that whereas metals concentrations for a number of the soil sampling results were greater than in the previous monitoring session, they were not markedly different at upgradient vs downgradient locations. Considering that fewer than seven samples have been collected, confirmation of trends is not possible at this time; the data do not suggest that impact from the landfill is occurring.

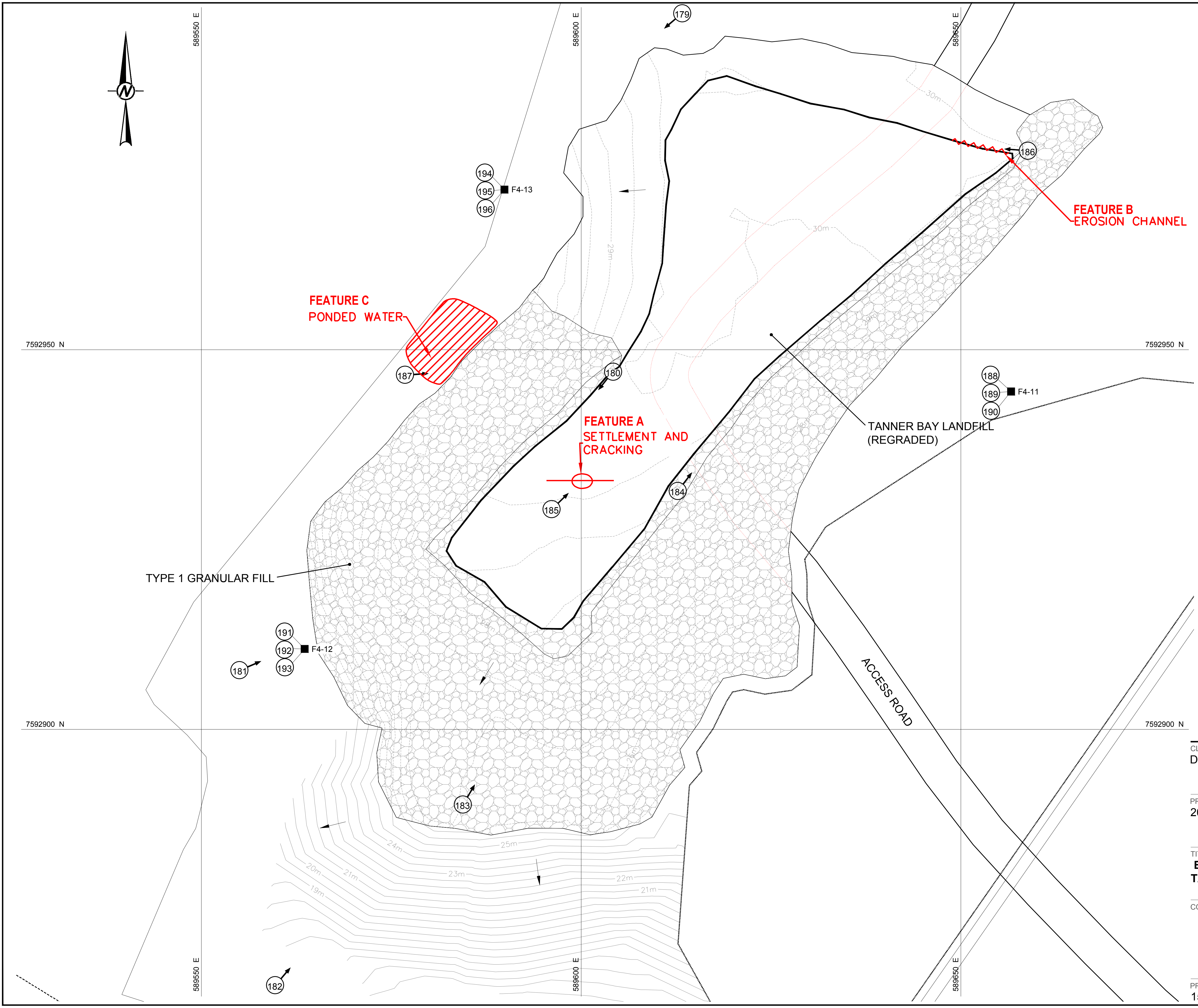
4.4.6 Recommendations for the Pallet Line Landfill

No modifications to the ongoing monitoring program at this landfill are recommended. Additional data is required to assess if the observed increases in 2016 relate to impact from the landfill or reflect variations in natural conditions or sampling/analytical program influences.

4.5 Tanner Bay Landfill

4.5.1 Landfill Description

The Tanner Bay Landfill is located at the original beach landing area for the site along Tanner Bay, and has an approximate area of 2,000 m^2. This landfill existed prior to the recent cleanup. The remediation of the Tanner Bay landfill consisted of removal of exposed debris, the placement of a 1 m compacted granular cover layer and the placement of erosion protection at the toe of the landfill. Approximate sampling locations are provided in Figure FOX-4.6.



LEGEND:

▨ SEEPAGE / PONDING WATER (NTS)

○ SETTLEMENT (NTS)

⩘ EROSION (NTS)

— CRACKING (NTS)

■ SOIL SAMPLE LOCATION

(182) PHOTOGRAPH VIEWPOINT

22m CONTOURS IN 0.5m INTERVALS

← OVERLAND FLOW DIRECTION

TYPE 1 GRANULAR FILL

NOTES:

1. ALL COORDINATES ARE REFERENCED TO NAD83 (CSRS), UTM ZONE 19N.
2. ALL ELEVATIONS REFER TO GEODETIC DATUM.
3. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.

REFERENCE:

PREVIOUS INSPECTION FIGURES FROM SENES CONSULTANTS, PROJECT NO. 350600-515-2, 2014 DEW LINE MONITORING PROGRAM, DATED FEB. 2015

0 10 20
1:500 METRES

CLIENT
DEPARTMENT OF NATIONAL DEFENCE CANADA

PROJECT
2016 FOX-4 MONITORING REPORT

TITLE
BEACH AREA
TANNER BAY LANDFILL

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-11-03
DESIGNED	RM
PREPARED	TDR
REVIEWED	DCJ
APPROVED	DP

PROJECT NO.	PHASE	REV.	FIGURE
1530908	2000	A	FOX-4.6

Path: \\golder.gds\gal\Mississauga\SIM\Clients\Public_Works_Canada\Canada\99_PROJ\1530908_PWGSC_Dew_Line_Mon_Program_2015_2018\40_PROD\0006_Fox_4_Field_Summary_Report_2016\ | File Name: 1530908-0006-CM-0006.dwg

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25 mm
0

4.5.2 Visual Inspection

The Tanner Bay Landfill exhibited isolated locations with observed minor settlement, cracking, self-armouring erosion and ponded water. Table 4-19 presents a summary of observed visual inspection features and Table 4-20 presents the Preliminary Stability Assessment results. This landfill was assessed to have an “Acceptable” overall performance as all observed features were assessed as “Acceptable”. Table 4-21 is a log of photographs taken during the 2016 visual inspection.

An area of previously observed minor settlement (Feature A) does not appear to have changed in size or depth of settlement, however a weathered crack was observed in the same area during the 2016 visual inspection. Previously observed erosion at the northeast end of the landfill (Feature B) appears to be self-armouring and is not considered a concern. There was some new ponded water observed along the west toe of the landfill (Feature C) during the 2016 visual inspection, however there was no associated staining observed.

Table 4-15: Visual Inspection Checklist – Pallet Line Landfill

SITE NAME: FOX-4
LANDFILL DESIGNATION: Tanner Bay Landfill
DATE OF INSPECTION: August 4, 2016
DATE OF PREVIOUS INSPECTION: August 24, 2014
INSPECTED BY: Darrin Johnson
REPORT PREPARED BY: Darrin Johnson
MONITORING EVENT NUMBER: 12
The inspector/reporter represents to the best of his/her knowledge that the following statements and observations are true and correct and to the best of the preparer's actual knowledge, no material facts have been suppressed or misstated.

Table 4-19: Visual Inspection Checklist – Tanner Bay Landfill

Checklist Item	Present (Y/N)	Feature ID (A, B, etc.)	Location Description	Easting	Northing	Length (m)	Width (m)	Depth (m)	Extent of Landfill Area (%)	Description (Severity Rating)	Comparison to Historical Observations	Photos
Settlement	Y	A	Crest surface	589596.1	7592929.0	6	4	0.2	1.2%	Minor settlement and weathered crack (Acceptable)	Settlement observed previously but weathered crack observed in 2016	185
Erosion	Y	B	Southeast corner	589658.8	7592976.2	30	2	0.1	3.0%	Minor self-armouring erosion channel (Acceptable)	Previously observed, no change	186
Lateral Movement	N											
Frost Action	N											
Sloughing	N											
Cracking	Y	A	Crest surface	589596.1	7592929.0	10	0.01	-	0.01%	Minor settlement and weathered crack (Acceptable)	Settlement observed previously but weathered crack observed in 2016	185
Animal Burrows	N											
Vegetation	N											
Staining	N											
Vegetation Stress	N											
Seepage or Ponded Water	Y	C	West toe	589576.8	7592946.7	15	10	0.1	7.5%	Ponded water (Acceptable)	New	187
Debris and/or Liner Exposed	N											

Table 4-19: Visual Inspection Checklist – Tanner Bay Landfill

Checklist Item	Present (Y/N)	Feature ID (A, B, etc.)	Location Description	Easting	Northing	Length (m)	Width (m)	Depth (m)	Extent of Landfill Area (%)	Description (Severity Rating)	Comparison to Historical Observations	Photos
Presence / Condition of Monitoring Instruments	N											
Features of Note / Other Observations	N											

Landfill Area = 2,000 m^2

Table 4-20: Preliminary Stability Assessment – Tanner Bay Landfill

Feature	Severity Rating	Extent
Settlement	Acceptable	Isolated
Erosion	Acceptable	Isolated
Lateral Movement	Not observed	-
Frost Action	Not observed	-
Sloughing	Not observed	-
Cracking	Acceptable	Isolated
Animal Burrows	Not observed	-
Vegetation Establishment	Not observed	-
Staining	Not observed	-
Vegetation Stress	Not observed	-
Seepage/Ponded Water	Acceptable	Isolated
Debris and/or Liner Exposure	Not observed	-
Other	Not observed	-
Overall Landfill Performance	**Acceptable**	

Table 4-21: Summary Table of Photographic Log – Tanner Bay Landfill

Photo	Description (file name)	Easting	Northing	Date
179	FOX 4 – Tanner Bay Landfill – North end facing southwest (ATT32_Photo32.jpg)	589613.3	7592994.3	4-Aug-2016
180	FOX 4 – Tanner Bay Landfill – Crest facing southwest (ATT33_Photo33.jpg)	589604.2	7592947.1	4-Aug-2016
181	FOX 4 – Tanner Bay Landfill – Southwest toe facing northeast (ATT34_Photo34.jpg)	589555.0	7592907.8	4-Aug-2016
182	FOX 4 – Tanner Bay Landfill – South toe near river facing northeast (ATT35_Photo35.jpg)	589559.7	7592866.3	4-Aug-2016
183	FOX 4 – Tanner Bay Landfill – Southwest slope facing northeast (ATT36_Photo36.jpg)	589584.4	7592890.1	4-Aug-2016
184	FOX 4 – Tanner Bay Landfill – Southeast crest edge facing northeast (ATT37_Photo37.jpg)	589612.7	7592931.4	4-Aug-2016
185	FOX 4 – Tanner Bay Landfill – Crest surface facing northeast – Feature A – Minor settlement area with weathered crack (Acceptable) (ATT159_Photo159.jpg)	589596.1	7592929.0	4-Aug-2016
186	FOX 4 – Tanner Bay Landfill – Northeast corner facing west – Feature B – Minor erosion (Acceptable) (ATT160_Photo160.jpg)	589658.8	7592976.2	4-Aug-2016
187	FOX 4 – Tanner Bay Landfill – Feature C – Ponded water at west toe, facing east (Acceptable) (ATT158_Photo158.jpg)	589576.8	7592946.7	4-Aug-2016
188	FOX-4 – Tanner Bay Landfill – Soil sampling location F4-11 before excavation (ATT21_Photo21.jpg)	589656.6	7592944.5	3-Aug-2016
189	FOX-4 – Tanner Bay Landfill – Soil sampling location F4-11 after excavation (ATT22_Photo22.jpg)	589656.6	7592944.5	3-Aug-2016

Table 4-21: Summary Table of Photographic Log – Tanner Bay Landfill

Photo	Description (file name)	Easting	Northing	Date
190	FOX-4 – Tanner Bay Landfill – Soil sampling location F4-11 after backfilling (ATT23_Photo23.jpg)	589656.6	7592944.5	3-Aug-2016
191	FOX-4 – Tanner Bay Landfill – Soil sampling location F4-12 before excavation (ATT18_Photo18.jpg)	589563.6	7592910.6	3-Aug-2016
192	FOX-4 – Tanner Bay Landfill – Soil sampling location F4-12 after excavation (ATT19_Photo19.jpg)	589563.6	7592910.6	3-Aug-2016
193	FOX-4 – Tanner Bay Landfill – Soil sampling location F4-12 after backfilling (ATT20_Photo20.jpg)	589563.6	7592910.6	3-Aug-2016
194	FOX-4 – Tanner Bay Landfill – Soil sampling location F4-13 before excavation (ATT15_Photo15.jpg)	589589.9	7592971.1	3-Aug-2016
195	FOX-4 – Tanner Bay Landfill – Soil sampling location F4-13 after excavation (ATT16_Photo16.jpg)	589589.9	7592971.1	3-Aug-2016
196	FOX-4 – Tanner Bay Landfill – Soil sampling location F4-13 after backfilling (ATT17_Photo17.jpg)	589589.9	7592971.1	3-Aug-2016

4.5.3 Summary of Sampling Deviations

The field work was conducted as per the TOR. There were no notable exceptions to the scope of work.

4.5.4 Soil Sampling

Table 4-22 presents a summary of analytical results for soil samples collected at the Tanner Bay Landfill. F4-11 represents an upgradient sampling location, whereas F4-12 and F4-13 represent downgradient sampling locations.

Table 4-22 also lists the arithmetic mean background and baseline values for the landfill, in addition to the baseline mean plus baseline plus 3σ limits. At the Tanner Bay Landfill, the background arithmetic means for copper, nickel, cobalt, zinc, chromium and arsenic are greater than the baseline arithmetic means. The background arithmetic means for copper, nickel, cobalt and arsenic are also greater than the baseline means plus 3σ.

F4-11

Sampling location F4-11 is located upgradient of the landfill, approximately 15 m east of the toe. The estimated elevation of this sampling point is 30 masl. As shown in Photos 188 and 189, the area consists of sand and gravel with some rock and sparse vegetation. The soils consisted of a brown sand with some gravel and stone.

For the shallow sample at F4-11 (0-15 cm), the concentrations of most metals were similar to those reported in previous years. The concentration of copper (9.9 mg/kg) exceeded the baseline mean concentration plus 3σ (8.0 mg/kg), however, it was less than the concentration observed in 2014 (11.5 mg/kg); none of the other parameters exceeded their baseline mean concentrations plus 3σ. It is noted that cadmium was detected at this location for the first time. No mercury, PHC or PCB were detected at this location in 2016.

For the deep sample at F4-11 (40-50 cm), metals concentrations were similar to those in the shallow sample. The concentrations of most metals were similar to those reported in previous years. Similarly to the shallow sample, cadmium was detected at this location for the first time. No mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean concentration plus 3σ.

F4-12

Sampling location F4-12 is located downgradient of the landfill, immediately southwest of the toe. The estimated elevation of this sampling point is 23 masl. As shown in Photos 191 and 192, the area is largely covered with sand and gravel with some rock and is not vegetated. The soils consisted of brown sand with some gravel. The excavation filled with water soon after the hole was completed.

For the shallow sample at F4-12 (0-15 cm), the concentrations of most metals were similar to those reported in previous years. The concentration of copper (10.5 mg/kg) exceeded the baseline mean concentration plus 3σ (8.0 mg/kg), however, was less than the concentration observed in 2014 (15 mg/kg); none of the other parameters exceeded their baseline mean concentrations plus 3σ. It is noted that cadmium was detected at this location for the first time. No mercury, PHC or PCB were detected at this location in 2016.

For the deep sample at F4-12 (30-40 cm), metals concentrations were greater than those in the shallow sample. The concentrations of most metals were greater than those reported in previous years. The concentrations of copper (10.5 mg/kg) and arsenic (3.6 mg/kg) exceeded their baseline mean concentrations plus 3σ (8.0 mg/kg and 3.1 mg/kg, respectively); none of the other parameters exceeded their baseline mean concentrations plus 3σ. Overall, a slight increasing trend of most metals have been observed at this location since 2008. Similar to the shallow sample, cadmium was detected at this location for the first time. No mercury, PHC or PCB were detected at this location in 2016.

F4-13

Sampling location F4-13 is located downgradient of the landfill, approximately 8 m west of the toe, in the northern part of the landfill. The estimated elevation of this sampling point is 26 masl. As shown in Photos 194 and 195, the area is largely covered with sand and gravel with sparse vegetation. The soils consisted of reddish-brown sand with some gravel.

For the shallow sample at F4-13 (0-15 cm), the concentrations of most metals were less than those reported in recent years. It is noted that cadmium was detected at this location for the first time. No mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean concentration plus 3σ.

For the deep sample at F4-13 (40-50 cm, duplicate location), metals concentrations were greater than those in the shallow sample. It is noted that the calculated RPD values indicated the original and duplicate sample results differ by more than 30% for arsenic and this result should therefore be interpreted with caution. The concentrations of most metals were greater than those reported in previous years. The concentration of copper (10.5 mg/kg) exceeded the baseline mean concentration plus 3σ (8.0 mg/kg); none of the other parameters exceeded their baseline mean concentrations plus 3σ. Similarly to the shallow sample, cadmium was detected at this location for the first time. No mercury, PHC or PCB were detected at this location in 2016.

Table 4-22: Soil Chemical Analysis Results – Tanner Bay Landfill

ID	Depth (cm)	Cu (mg/kg)	Ni (mg/kg)	Co (mg/kg)	Cd (mg/kg)	Pb (mg/kg)	Zn (mg/kg)	Cr (mg/kg)	As (mg/kg)	Hg (mg/kg)	Total PCB (mg/kg)	F1 (mg/kg)	F2 (mg/kg)	F3 (mg/kg)	F4 (mg/kg)
Background Mean		19.1	19.2	7.9	1.0	10.0	34.1	30.6	5.5	NA	0.00035	NA	NA	NA	NA
Baseline Mean		**8.0**	**9.3**	**5.0**	**1.0**	**28.0**	**27.0**	**23.0**	**1.1**	**NA**	**0.050**	**NA**	**NA**	**NA**	**NA**
Baseline + 3σ		8.0	16.7	7.6	4.5	78.7	44.9	44.7	3.1	NA	0.05	NA	NA	NA	NA
Upgradient															
F4-11b	0-15	**9.9**	8.2	2.9	**1.8**	4.8	17.8	18.4	**1.2**	<0.1	<0.05	<7	<4	<8	<6
F4-11a	40-50	6.5	5.9	1.9	**1.4**	3	12.9	15.5	**1.2**	<0.1	<0.05	<7	<4	<8	<6
Downgradient															
F4-12b	0-15	**10.5**	**10.1**	3.4	**2.0**	4.4	21.6	22.8	**1.8**	<0.1	<0.05	<7	<4	<8	<6
F4-12a	30-40	**13.6**	**13**	4.1	**2.5**	6.6	24.8	**26.8**	**3.6**	<0.1	<0.05	<7	<4	<8	<6
F4-13b	0-15	6.5	6.1	2.0	1.0	2.6	11	10.5	**1.4**	<0.1	<0.05	<7	<4	<8	<6
F4-13a	40-50	**10.6**	9.2	3.2	**1.8**	4.7	19	20	**3.1**	<0.1	<0.05	<7	<4	<8	<6
F4-13a dup	40-50	**10**	8	2.7	<0.5	4	19	17	**2**	<0.10	<0.05	<5	<10	<50	<50
F4-13a (Dup Avg)	40-50	**10**	9	3.0	**1.2**	4	19	19	**3**	<0.1	<0.05	<6	<7	<29	<28

Notes:

NA: Not available

Underlined values: Results exceed Background arithmetic mean.

Bold Values: Results exceed Baseline arithmetic mean.

Shaded Values: Results exceed the Baseline arithmetic mean plus 3σ.

4.5.5 Conclusions and Overall Performance of the Tanner Bay Landfill

The Tanner Bay Landfill exhibited some isolated minor settlement, cracking, self-armouring erosion and ponded water. The overall stability performance of the landfill was assessed as “Acceptable”.

The concentrations of metals were highest overall at the deep F4-12 sample location, located immediately downgradient of the west side of the landfill. A slight increasing trend of most metals have been observed at this location since 2008. Exceedances of the baseline mean concentration plus 3σ were reported for copper at F4-11 (shallow sample), F4-12 (shallow and deep samples) and F4-13 (deep sample) and for arsenic at F4-12 (deep sample). It is noted that the baseline mean concentrations plus 3σ at the Tanner Bay Landfill are lower in comparison to other FOX-4 landfills. The concentrations of copper and arsenic at all locations were lower than their respective background mean concentrations. No detectable concentrations of mercury, PHC or PCB were noted in any of the samples in 2016.

The historical graphs in Appendix C show concentration trends at the Tanner Bay Landfill. Overall, it is noted that slight increases in some metal concentrations have been observed at the downgradient locations F4-12 and/or F4-13 including copper, nickel, zinc and chromium. Concentrations of copper appear to be increasing at upgradient location F4-11 as well. At F4-11, an increasing trend is also noted for modified TPH up until 2014, however no PHC were detected at this location in 2016. These increases are not significant enough to warrant concern, but should continue to be assessed.

4.5.6 Recommendations for the Tanner Bay Landfill

No modifications to the ongoing monitoring program at this landfill are recommended.

5.0 QA/QC RESULTS

The results of the QA/QC program described in Section 3.3 are discussed herein. The results are described in terms of accuracy, reliability (blank analysis) and reproducibility (duplicate analysis).

The five DEW Line sites visited in 2016 were executed as a single field program using standard operating procedures which were consistent for all sites in the field program. The QA/QC analysis below contains both program-level (applicable to all five sites) and site-level discussions, which focus on the FOX-4 site. The laboratory reports related to the QA/QC discussion are contained in Appendix C.

5.1 Sample Hold Times

The generally accepted hold times for the parameters analyzed in this program are:

- Metals in soil: 180 days, metals in water: 60 days;
- Mercury in soil and water: 28 days;
- PCB in soil: 365 days, PCB in water: 14 days;
- PHC-F1 in soil: 48 hours (if unpreserved), PHC-F1 in water: 7 days; and,
- PHC F2-F4 in soil: 14 days, PHC F2-F4 in water: 7 days.

At FOX-4, the soil sampling was carried out on August 2-5, 2016. The soil samples collected on August 2 and 3, 2016 were received at Paracel and AGAT on August 9, 2016 and extraction for PHC F1 commenced the following day, which was eight days post sampling for those collected on August 2nd. The soil samples collected on August 4 and 5, 2016 were received at Paracel and AGAT on August 16, 2016 and extraction for PCB commenced the following day, which was thirteen days post sampling for those collected on August 4th.

Maximum hold times were exceeded for PHC-F1 (soil) due to its very short hold time of 48 hours. The very short hold time for unpreserved PHC-F1 in soil is a known issue but it has been decided to not preserve this parameter in order to maintain consistency with earlier years and data in the program. The hold times for PHC F2-F4 were all met for soil.

The groundwater sampling was carried out on August 2-4, 2016. The groundwater samples collected on August 2 and 3, 2016 were received at Paracel and AGAT on August 9, 2016 and analysis commenced that day, which was seven days post sampling for those collected on August 2nd. The maximum hold times were exceeded for PHC-F2-F4 for the two groundwater samples collected on the August 2nd (MW11-5 and MW12-7). The groundwater sample collected on August 4, 2016 (MW98-02) was received at Paracel on August 16, 2016 and analysis commenced that day, which was twleve days post sampling; the maximum hold times were exceeded for PHC-F1-F4 in this sample .

5.2 Accuracy

Accuracy is a measure of how close a measured value is to the true value. The accuracy of the laboratory data is generally evaluated by the laboratory through the use of matrix spikes or surrogate recoveries. For the FOX-4 samples, Paracel performed two spike analyses on water and two on soil. The spike recovery for copper in one of the two soil samples was below the lower end of the acceptable range and the spike recoveries for PHC F2-F3 fractions in one of the two soil samples were above the upper end of the acceptable range; however the majority of parameters met the acceptable data quality objectives, therefore Paracel accepted the batches. The spike recoveries for groundwater were well within the acceptable ranges, with the exception of arsenic in one of the two samples; the majority of parameters met the acceptable data quality objectives, therefore Paracel accepted the batches. AGAT also performed matrix spikes on the batches that included FOX-4 soil and water samples and all of their results were within their own data quality objectives.

Paracel performed two lab blanks for both soil and water, and all were all non-detect. AGAT also performed lab blanks in the batches that included FOX-4 soil and water samples and all of their results were non-detect.

Matrix spike recoveries outside the acceptable range of individual parameters indicate the copper and PHC F2-F3 fractions soil results from Paracel should be interpreted with caution. Matrix spike recoveries outside the acceptable range of individual parameters indicate the arsenic groundwater results from Paracel should be interpreted with caution. All other spike recoveries for the monitoring program are within the acceptable limits and the accuracy of the results is considered acceptable on this basis.

5.3 Reliability

Reliability is a measure of certainty that the concentrations reported by the labs are reliable indicators of field conditions and have not been affected other sources of contamination such as ambient air or cross-contamination from other samples. The analysis of blanks provides a measure of reliability. A set of bottles of deionized water from Paracel accompanied the team on the entire 2016 monitoring program as a Trip Blank. These bottles were not opened at the sites. The analytical reports from Paracel indicate that no parameters were detected in the Trip Blank. One Field Blank was prepared on the 2016 program. Sample bottles were filled with distilled water in the field at FOX-2. No parameters were detected in the Field Blank.

Two Equipment Blanks were prepared: one to test the decontamination of the groundwater probe, and the other to test the decontamination of the soil sample trowel. No parameters were detected in the Shovel Blank. Zinc was the only parameter detected in the Probe Blank, at a concentration (0.006 mg/L) marginally above the MDL of 0.005 mg/L. The Trip Blank, Field Blank and two Equipment Blank sample results are summarized in the table below.

Blank Samples

ID	Cu (mg/L)	Ni (mg/L)	Co (mg/L)	Cd (mg/L)	Pb (mg/L)	Zn (mg/L)	Cr (mg/L)	As (mg/L)	Hg (mg/L)	Total PCB (mg/L)	F1 (mg/L)	F2 (mg/L)	F3 (mg/L)	F4 (mg/L)
Trip Blank	<0.0005	<0.001	<0.0005	<0.0001	<0.0001	<0.005	<0.001	<0.001	<0.0001	<0.00005	<0.025	<0.100	<0.100	<0.100
Field Blank	<0.0005	<0.001	<0.0005	<0.0001	<0.0001	<0.005	<0.001	<0.001	<0.0001	<0.00005	<0.025	NA	NA	NA
Shovel Blank	<0.0005	<0.001	<0.0005	<0.0001	<0.0001	<0.005	<0.001	<0.001	<0.0001	<0.00005	<0.025	<0.100	<0.100	<0.100
Probe Blank	<0.0005	<0.001	<0.0005	<0.0001	<0.0001	0.006	<0.001	<0.001	<0.0001	<0.00005	<0.025	<0.100	<0.100	<0.100

Note: NA – Not analyzed

The Trip Blank, Field Blank and two Equipment Blank sample results indicate that the laboratory results from the 2016 monitoring program were not affected by external influences associated with sampling, storage and transport.

5.4 Reproducibility (Duplicate Analysis)

The reproducibility of lab results was measured through the testing of field duplicate samples. Duplicate soil samples were prepared in the field by mixing up a homogeneous batch of soil in the test pit being sampled, and taking portions of soil and alternately filling the sample jars for the two labs. Duplicate groundwater samples were prepared by alternately filling bottles for each lab for each parameter type.

The labs also performed internal duplicate analysis. Paracel performed two duplicate analyses of soil, which indicated all duplicate pairs met the program's targets, with the exception of the PHC F3-F4 fraction in one of the two internal duplicates, which had RPDs of 66.7% and 50.0%, respectively. Paracel noted that the PHC F3 and F4 sample results were less than ten times the method detection limit (MDL). Paracel also completed two duplicate analyses for groundwater and all duplicate pairs met the program's targets. AGAT performed two duplicate analyses of parameters in soil; a maximum RPD of 10.5% was achieved. AGAT also performed a duplicate analysis of parameters in groundwater, a maximum RPD of 13.9% was achieved, and thus their duplicates met the program requirements.

The total number of original soil samples collected for the 2016 program was 213, for which 21 duplicate soil samples were prepared and analyzed, providing a duplicate ratio of approximately 10%. A total of 41 groundwater samples were collected and six duplicates were analyzed, which is a duplicate ratio of greater than 10% for each site and for the program. The distribution of duplicate soil and groundwater samples over the five sites is provided in the table below.

Four soil duplicates and one groundwater duplicate were prepared at FOX-4.

Soil Samples and Duplicates

	DEW Line Site					Totals
	DYE-M	FOX-2	FOX-3	FOX-4	FOX-5	
Soil Samples Collected	93	31	31	34	24	213
Duplicate Soil Samples	7	4	4	4	2	21
Percent	8%	13%	13%	12%	8%	10%

Groundwater Samples and Duplicates

	DEW Line Site					Totals
	DYE-M	FOX-2	FOX-3	FOX-4	FOX-5	
Monitoring Well Sampled	9	9	7	7	9	41
Duplicate Groundwater Samples	2	1	1	1	1	6
Percent	22%	11%	14%	14%	11%	15%

To determine the reproducibility of the original and duplicate sample results, the RPD was calculated according to the following equation:

$$RPD = \frac{|x_2 - x_1|}{\left(\frac{x_1 + x_2}{2}\right)} \times 100\%$$

Where, x_1 and x_2 are the original and duplicate concentrations of a given parameter in a pair. RPD can only be calculated if concentrations of given parameters are greater than the analytical method detection limits (MDL) in both the duplicate and original samples of the pair. Additionally, the RPD calculation is less meaningful when the reported concentrations are less than five (5) times the MDL. RPD have been calculated wherever the concentrations of a parameter were five (5) times greater than the MDL in both the original and duplicate samples. Sample RPD were calculated by taking the average of the parameter RPD for a given sample-duplicate pair, and a program-level RPD was calculated by taking the average of all sample RPD to arrive at a program-wide indication of repeatability.

The TOR sets a data quality objective (DQO) for the RPD in soil and groundwater between a sample and its blind field duplicate of 30%. A discussion or the RPD for the program and at FOX-4 is provided below.

5.4.1 Soil Samples

Organics and PCB

Program Level Interpretation

The PCB concentrations were below the detection limit for all of the duplicate pairs of soil samples in the program.

PHC F3 was detected in five samples in the program and PHC F2 was detected in one of those five samples. In each case it was the sample analyzed by Paracel, whereas the duplicate sample analyzed by AGAT did not. Paracel's MDL was equal to the program's requirement whereas AGAT's MDL was higher and they showed no exceedance of their MDL. None of the above are at concentrations that are greater than five times the program MDL therefore RPD were not calculated.

Metals

Program Level Interpretation

Mercury and cadmium concentrations were below detection limits for all 21 original and duplicate pairs in the program.

RPD calculations were undertaken for the seven remaining metals (copper, nickel, cobalt, lead, zinc, chromium and arsenic) for the 21 pairs of duplicate soil samples. The program-level average RPD for the soil sample duplicate analysis was 18%, which met the specified data quality objective for field duplicates for inorganics of 30%.

Two of the 21 soil sample pairs in the program had a sample average RPD of over 30%; one of which was collected at FOX-2. Fifteen parameter pairs exhibited an RPD of over 30%; three of them were at FOX-2. Overall, the most frequent metals to have an RPD over 30% were zinc, copper and nickel. The results for the samples analyzed by AGAT exhibited generally higher metals concentrations in 15 cases; Paracel's overall concentrations were higher in four cases, and in two cases it was evenly spilt. There appears to be a bias, in that results from AGAT were generally higher than those of Paracel but this does not impact interpretation of the results.

Site Level Interpretation

From the four soil sample duplicates taken at FOX-4 there were 32 potential parameter pairs for RPD analysis (8 metals for a total of 4 samples). Mercury was not detectable in all samples. As shown in the table below, 23 of the 32 potential metal parameter pairs exhibited concentrations greater than five times the MDL in both the original and duplicate, and therefore 23 individual RPD were calculated. Four RPD exceeded 30% (zinc at F4-28a and copper, nickel and zinc at MW98-3a). The individual RPD ranged from 0% to 35%. Zinc exhibited the highest RPD, from 0% to 35% and chromium was the lowest, from 10% to 13%. The average of the 23 RPD calculations from the four samples was just 17%, which was on the low side of the range of RPD in the program and met the field data quality objective of less than 30%. The table below summarizes the metals results and RPD calculations for FOX-4.

All of the individual RPD at FOX-4 were below 30%, with the exceptions of zinc at F4-28a (30%) and copper, nickel and zinc at MW98-03a (33%, 33% and 35%, respectively) and the site average RPD was 17%. In light of the relatively low average RPD, it can be concluded that the reproducibility of the soil sample results at FOX-4 was acceptable.

Relative Percent Difference Analysis of Soil Data at FOX-4

		Parameter Concentrations (mg/kg)									
Sample ID	**Lab**	**Cu**	**Ni**	**Co**	**Cd**	**Pb**	**Zn**	**Cr**	**As**	**Sample Average RPD**	**Any Over 30%?**
MDL		<1	<1	<1	<0.5	<1	<1	<1	<1		
F4-13a	Paracel	10.6	9.2	**3.2**	**1.8**	**4.7**	19	20	**3.1**	9%	no
F4-13a (duplicate)	AGAT	10	8	**2.7**	**<0.5**	**4**	19	17	**2**		
RPD		6%	14%				0%	16%			
F4-28a	Paracel	35.8	23	7.8	**<0.5**	12.4	53.1	48.1	13.4	23%	1 (Zn)
F4-28a (duplicate)	AGAT	40	31	10.2	**<0.5**	16	72	61	15		
RPD		11%	29.6%	27%		25%	**30.2%**	24%	11%		
MW11-01b	Paracel	70.1	59	14.4	5.4	10.9	88.7	84.3	49.8	10%	no
MW11-01b (duplicate)	AGAT	92	66	14.4	**<0.5**	11	105	81	57		
RPD		27%	11%	0%		1%	17%	4%	13%		
MW98-03a	Paracel	13.6	12.9	**4.3**	**<0.5**	**4.3**	25.2	31.5	24.2	24%	3 (Cu, Ni, Zn)
MW98-03a (duplicate)	AGAT	19	18	5.1	**<0.5**	6	36	34	22		
RPD		**33%**	**33%**				**35%**	8%	10%		
										17%	4

Note: Parameters with concentrations <5 x MDL are **bold and highlighted yellow**.

5.4.2 Groundwater Samples

Organics and PCB

The PHC F1-F4 results for all six of the duplicate pairs of groundwater samples in the program were below the detection limit and all PCB concentrations were below the detection limit. The reliability of these results is therefore considered acceptable.

Metals

Program Level Interpretation

Mercury was not detected in any original-duplicate groundwater pair; the reproducibility of the results is therefore considered acceptable. Six groundwater duplicate samples for a total of eight metals detected at greater than the MDL in one or more samples, resulted in 48 potential parameter pairs for duplicate analysis via RPD calculation. The metals concentrations were very low overall; in fact 33 of the possible 48 pairs exhibited one or both values less than five times the MDL and therefore, in addition to analyzing the QC by RPD analysis it is noted that of the 48 parameter pairs, there were:

- 22 pairs where both labs reported non-detect for the same metals in the parameter pair (good repeatability);
- 10 pairs where one lab reported non-detect and the other lab reported a value less than five times the MDL for the pair (good repeatability);
- 1 pair where both labs reported values that were less than five times the MDL (good repeatability);

- 10 pairs where both labs reported values that were greater than five times the MDL, so an RPD could be calculated. Of those:
  - 6 were under 30% (good repeatability)
  - 4 were over 30% (poor repeatability); and,
- 5 pairs where one lab reported a value less than five times the MDL and the other lab reported a value over five times the MDL and the RPD was over 30% (poor repeatability).

The average of the 10 RPD calculated for analysis of metals in water was 50%, which exceeds the data quality objective of 30%. This however omits the 38 other parameter pairs. A broader representation of program level RPD can be achieved by including all parameter pairs which either had values reported or were non-detect in both parameters. This leaves out only the 10 pairs where one member was non-detect. An RPD of zero has been assigned to pairs for which both members were non-detect. Using this metric, the program level RPD is 26%.

Site Level Interpretation

At FOX-4, the duplicate groundwater sample was collected at MW11-01. Cadmium, lead, chromium, arsenic and mercury were non-detect in both samples collected at this monitoring location, therefore they were excluded from the RPD calculations. As shown in the table below, there was only one groundwater parameter pair for which the concentrations in the original and duplicate were over five times the MDL (nickel); thus, only one RPD was calculated for the groundwater duplicates at FOX-4. The RPD is 35%, which is just over the field data quality objective of 30%. A possible reason for the higher than desired RPD for this sample could be the limited purging due to the small volume of groundwater available in the well.

Relative Percent Difference Analysis of Groundwater Data at FOX-4

		Parameter Concentrations (mg/L)					
Sample ID	**Lab**	**Cu**	**Ni**	**Co**	**Zn**	**Average RPD**	**Any Over 30%?**
MDL		<0.0005	<0.001	<0.001	<0.005		
MW11-01	Paracel	**0.001**	0.007	**0.0011**	**0.01**	35%	1 (Ni)
MW11-01 (Duplicate)	AGAT	**<0.005**	0.01	**0.0015**	**<0.005**		
RPD			**35%**				

Note: Parameters with concentrations <5 x MDL are **bold and highlighted yellow**.

5.4.3 Overall Lab Data Reproducibility

Based on a sample average of the field RPD for soil of 17% and considering that only four individual soil parameter pairs exhibited an RPD slightly over 30%, it is concluded that that the lab data is acceptable. The reproducibility of groundwater data was higher (only RPD calculated was 35%), however, the reported concentrations are low. It is noted that the concentrations of cadmium, lead, chromium, arsenic and mercury were non-detect in both samples at the groundwater duplicate location, which suggests the lab data is acceptable.

5.5 QA/QC Conclusions

The QA/QC analysis has shown that:

- Achieving maximum hold times of PHC is not possible given the logistics of transport from the remote site location unless samples are field preserved;
- With the exception of zinc detected marginally over the MDL in the Probe Blank, the concentrations of parameters in the two Equipment Blanks and one Field Blank were non-detect, as they should be to indicate that no spurious contaminates were biasing the samples while in transit;
- The duplicate analyses for soil met the program field data quality objectives; and,
- The duplicate analyses for water indicated a notable difference in nickel results reported by the two labs, however, the reported concentrations are low.

Report Signature Page

We trust that this Monitoring Report meets the Project requirements of DND. Please direct any questions to the undersigned.

GOLDER ASSOCIATES LTD.

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APPENDIX A

Report Limitations

REPORT LIMITATIONS

This report has been prepared as an assessment of the environmental condition and visual inspection of the subject site. The monitoring program described in this report was conducted in a manner consistent with that level of care and skill normally exercised by other members of the engineering and science professions currently practising under similar conditions, subject to the time limits and financial and physical constraints applicable to the services. The scope of work was carried out in accordance with the agreement between Golder Associates Ltd. and the client.

The assessment of environmental conditions at this Site has been made using the results of chemical analysis of soil and groundwater from a limited number of locations. The Site conditions between sampling locations have been inferred based on conditions observed at sampling locations. Subsurface conditions may vary from those encountered at the sample locations. Additional study, including further subsurface investigation, can reduce the inherent uncertainties associated with this type of study. However, it is never possible, even with exhaustive sampling and testing, to dismiss the possibility that part of a Site may be contaminated and remain undetected. Visual inspection comments are based on observed conditions at the time of the inspection and may change with time.

Any use which a third party makes of this report, or any reliance on, or decisions to be made based on it, are the responsibility of such third parties. Golder Associates Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on the information contained in this report.

The content of this report is based on information collected during our monitoring program, our present understanding of the Site conditions, and our professional judgement in light of such information at the time of writing this report. This report provides a professional opinion and therefore no warranty is expressed, implied, or made as to the conclusions and recommendations offered in this report. This report does not provide a legal opinion regarding compliance with applicable laws. With respect to regulatory compliance issues, it should be noted that regulatory statutes and the interpretation of regulatory statutes are subject to change.

The findings and conclusions of this report are valid only as of the date of this report. If new information is discovered, Golder Associates Ltd. should be requested to re-evaluate the conclusions of this report, and to provide amendments as required.

APPENDIX B

Field Records

Monitoring Well Sampling Logs

Thermistor Inspection Record Sheets

Soil Sampling Record Sheets

Appendix B1

FOX-4 Thermistor Sheets

ANNEX M: Thermistor Inspection Template

Inspector Name:	Kevin Rattray / Darrin Johnson	Inspection Date:	August 3 , 2016
Inspector Signature / Prepared By:			

Thermistor Information (*Some Information can be pre-populated from thermistor logs)

Site Name:	**FOX-4**	Landfill:	Non hazardous / Tier II		
Thermistor Number:	**VT-2**	Inclination:	Vertical		
Datalogger model no:	**RX**	Datalogger cable download model:	**USB**		
*Install Date:		First Date Event		Last Date Event	
*Coordinates and Elevation		N **588428.4**	E **7596019.9**	Elev	
Length of Cable (m)		Cable Lead Above Ground (m)	0.5		
Datalogger Serial #	**67755**	Nodal Points	8		

Thermistor Inspection

	Good	Needs Maintenance	Description
Casing	X	☐	
Cover	X	☐	
Data Logger	X	☐	
Cable	X	☐	
Beads	☐	X	Beads 7 and 8 not functioning
Lock condition	☐	X	Cut and replaced

Battery Installation Date 2012? (ULB5)

Battery Levels Main 11.34 Aux 13.63

Manual Ground Temperature Readings

Bead	V	Degrees C
1	1.42	15.72
2	1.38	14.59
3	1.35	13.43
4	1.32	12.52
5	1.29	11.42
6	1.27	10.72
7	0	-
8	0	-

Bead	ohms	Degrees C

Battery Information

Batteries changed ? Yes ☐ No ☒ Monitoring Year:

Battery model number installed: Existing ULB5 (expires in 2015 according to sticker)

Expected battery life (years): 2015-2017 (3-5 years)

Datalogger Programming (Describe programming completed; beads and frequency)

Observations and Proposed Maintenance

Logger filename VT-02 downloaded at 4:28pm. Logger filename is VT-2, date August 3, 2016, time 15:42 (actually 16:30). Relocated the logger to original T-5 location after downloading. Moved logger T2 (from original T-5 location) to this location. Switched loggers between VT-5 and VT-5A (2014). This is original T-2 location.

ANNEX M: Thermistor Inspection Template

Inspector Name:	Darrin Johnson	Inspection Date:	August 3 , 2016
Inspector Signature / Prepared By:			

Thermistor Information (*Some Information can be pre-populated from thermistor logs)

Site Name:	**FOX-4**	Landfill:	Tier II		
Thermistor Number:	**VT-3**	Inclination:	Vertical		
Datalogger model no:	**R-X**	Datalogger cable download model:	**USB**		
*Install Date:		First Date Event		Last Date Event	
*Coordinates and Elevation	N **588436.2**	E **7596002.9**		Elev	**22.5**
Length of Cable (m)		Cable Lead Above Ground (m)			
Datalogger Serial #	**67703**	Nodal Points	8 (Only 5 beads)		

Thermistor Inspection

	Good	Needs Maintenance	Description
Casing	X	☐	
Cover	X	☐	
Data Logger	X	☐	
Cable	X	☐	Small old style connector
Beads	☐	X	Beads 6-8 not functioning
Lock condition	☐	X	Cut and changed lock
Battery Installation Date	**2012?**		
Battery Levels	Main 11.34	Aux 12.65	

Manual Ground Temperature Readings

Bead	V	Degrees C
1	1.38	14.6
2	1.35	13.4
3	1.31	12.3
4	1.27	11.1
5	1.25	10.3
6	0	381.0
7	0	381.0
8	0	381.0

Bead	ohms	Degrees C

Battery Information

Batteries changed ? Yes ☐ No ☒ Monitoring Year:

Battery model number installed: Existing ULB5 (expires in 2015 according to sticker)

Expected battery life (years): 2015-2017 (3-5 years)

Datalogger Programming (Describe programming completed; beads and frequency)

Observations and Proposed Maintenance

VT-4 download at at 2:32pm on August 3, 2016. Logger for VT-4 (relocated after downloading). Logger date August 3, 2016 and time 11:10am (actually 2:40pm). Logger VT-3/T3 relocated to this location (from VT-4). This is the original T3 location.

ANNEX M: Thermistor Inspection Template

Inspector Name:	Darrin Johnson	Inspection Date:	August 3 2016
Inspector Signature / Prepared By:			

Thermistor Information (*Some Information can be pre-populated from thermistor logs)

Site Name:	**FOX-4**	Landfill:	Tier II
Thermistor Number:	**VT-4**	Inclination:	Vertical
Datalogger model no:	**R-X**	Datalogger cable download model:	**USB**
*Install Date:		First Date Event	Last Date Event
*Coordinates and Elevation	N **588457.8**	E **7596032.9**	Elev **22.7**
Length of Cable (m)		Cable Lead Above Ground (m)	
Datalogger Serial #	**67725**	Nodal Points	8

Thermistor Inspection

	Good	Needs Maintenance	Description
Casing	X	☐	
Cover	X	☐	
Data Logger	X	☐	
Cable	X	☐	Small old plastic plug
Beads	☐	X	Beads 1,2,6,7 appear damaged
Lock condition	☐	X	Cut and changed

Battery Installation Date 2012?

Battery Levels Main 11.34 Aux 13.75

Manual Ground Temperature Readings

Bead	V	Degrees C
1	0	381
2	0.0024	-90.1
3	1.23	9.67
4	1.25	10.40
5	1.26	10.41
6	0.0035	-86.4
7	0	381
8	1.446	16.8

Bead	ohms	Degrees C

Battery Information

Batteries changed ? Yes ☐ No ☒ Monitoring Year: ______

Battery model number installed: Existing ULB5 (expires in 2015 according to sticker)

Expected battery life (years): 2015-2017 (3-5 years)

Datalogger Programming (Describe programming completed; beads and frequency)

Observations and Proposed Maintenance

Downloaded as VT-3 at 3:19pm on August 3, 2016. Logger date August 3, 2016, time 14:36 (actually 3:21pm). After downloading this logger was relocated to VT-3. Logger T4 moved to this location from VT-3. This is original location T-4. Loggers for VT-3 and VT-4 were switched locations.

ANNEX M: Thermistor Inspection Template

Inspector Name:	Darrin Johnson	Inspection Date:	August 3 , 2016
Inspector Signature / Prepared By:			

Thermistor Information (*Some Information can be pre-populated from thermistor logs)

Site Name:	**FOX-4**	Landfill:	Tier II		
Thermistor Number:	**VT-5**	Inclination:	Vertical		
Datalogger model no:	**R-X**	Datalogger cable download model:	**USB**		
*Install Date:		First Date Event		Last Date Event	
*Coordinates and Elevation	N **588481.3**	E **7595989**		Elev	**22.6**
Length of Cable (m)		Cable Lead Above Ground (m)	1.2		
Datalogger Serial #	**806109**	Nodal Points	8		

Thermistor Inspection

	Good	Needs Maintenance	Description
Casing	X	☐	
Cover	X	☐	
Data Logger	X	☐	
Cable	X	☐	Small old plastic plug
Beads	☐	X	Beads 6-8 not functioning
Lock condition	☐	X	Cut and changed

Battery Installation Date 2012 (ULB5)

Battery Levels Main 11.34 Aux 13.75

Manual Ground Temperature Readings

Bead	V	Degrees C
1	1.41	15.5
2	1.37	14.2
3	1.33	12.9
4	1.28	11.1
5	1.30	11.9
6	0	381
7	0	381
8	0	381

Bead	ohms	Degrees C

Battery Information

Batteries changed ? Yes ☐ No ☒ Monitoring Year:

Battery model number installed: Existing ULB5 (expires in 2015 according to sticker)

Expected battery life (years): 2015-2017 (3-5 years)

Datalogger Programming (Describe programming completed; beads and frequency)

Observations and Proposed Maintenance

Logger labeled T2 on outside (filename VT-05 on prolog). Downloaded at 2:53pm on August 3, 2016. Data logger date August 3, 2016, time 14:13 (actually 3:00pm). Logger T2 moved to original T2 location after downloading. Logger T-5 relocated to this location (from original T-2 location). Loggers switched between VT-5 and VT-5A (2016). This is original T-5 location.

ANNEX M: Thermistor Inspection Template

Inspector Name:	Darrin Johnson	Inspection Date:	August 3 , 2016
Inspector Signature / Prepared By:			

Thermistor Information (*Some Information can be pre-populated from thermistor logs)

Site Name:	**FOX-4**	Landfill:	Tier II		
Thermistor Number:	**VT-6**	Inclination:	Vertical		
Datalogger model no:	**R-X**	Datalogger cable download model:	**USB**		
*Install Date:		First Date Event		Last Date Event	
*Coordinates and Elevation	N **588474.1**	E **7596005.8**	Elev	**23.1**	
Length of Cable (m)		Cable Lead Above Ground (m)	Approximately 0.5		
Datalogger Serial #	**705043**	Nodal Points	8		

Thermistor Inspection

	Good	Needs Maintenance	Description
Casing	X	☐	
Cover	X	☐	
Data Logger	X	☐	
Cable	X	☐	Small old plastic plug
Beads	☐	X	Beads 7 and 8 not functioning
Lock condition	☐	X	Cut and changed

Battery Installation Date 2012?

Battery Levels Main 11.34 Aux 13.89

Manual Ground Temperature Readings

Bead	V	Degrees C
1	1.38	14.72
2	1.36	14.02
3	1.33	12.86
4	1.29	11.71
5	1.26	10.58
6	1.24	9.7
7	0	381
8	0	381

Bead	ohms	Degrees C

Battery Information

Batteries changed ? Yes ☐ No ☒ Monitoring Year:

Battery model number installed: Existing ULB5 (expires in 2015 according to sticker)

Expected battery life (years): 2015-2017 (3-5 years)

Datalogger Programming (Describe programming completed; beads and frequency)

Observations and Proposed Maintenance

Downloaded at 4:04pm on August 3, 2016. Logger is VT-1, Date August 3, 2016, Time 15:19 at 4pm. No logger T-6 so did not move this logger (VT-1 was decommissioned).

ANNEX M: Thermistor Inspection Template

Inspector Name:	Darrin Johnson	Inspection Date:	August 3 , 2016
Inspector Signature / Prepared By:			

Thermistor Information (*Some Information can be pre-populated from thermistor logs)

Site Name:	**FOX-4**	Landfill:	Tier II		
Thermistor Number:	**VT-7**	Inclination:	82 degrees		
Datalogger model no:	**R-X**	Datalogger cable download model:	**USB**		
*Install Date:		First Date Event		Last Date Event	
*Coordinates and Elevation	N **588398.3**	E **7595950.2**		Elev	**22.4**
Length of Cable (m)		Cable Lead Above Ground (m)	3.3		
Datalogger Serial #	**07110044**	Nodal Points	16		

Thermistor Inspection

	Good	Needs Maintenance	Description
Casing	X	☐	
Cover	X	☐	
Data Logger	X	☐	
Cable	X	☐	
Beads	☐	X	Beads 13-16 appear damaged
Lock condition	☐	X	Replaced lock

Battery Installation Date 2008? (ULB5) - Probably dead?

Battery Levels Main 0? Aux 0?

Manual Ground Temperature Readings

Bead	V	Degrees C
1	1.42	16.14
2	1.37	14.29
3	1.18	7.91
4	1.06	4.14
5	0.95	0.18
6	0.92	-0.82
7	0.88	-1.90
8	0.85	-3.02

Bead	V	Degrees C
9	0.83	-3.89
10	0.81	-4.56
11	0.80	-4.77
12	0.78	-5.55
13	-	381.0
14	-	381.0
15	-	381.0
16	0.0085	-101.45

Battery Information

Batteries changed ? Yes ☒ No ☐ Monitoring Year: 2016

Battery model number installed: ULB15 and ULB1

Expected battery life (years): 7-8 years (2023-2024)

Datalogger Programming (Describe programming completed; beads and frequency)

Observations and Proposed Maintenance

Unable to download initially (batteries dead?). Swapped out ULB5 for new ULB15 and then downloaded logger on August 3, 2016 at 1:35pm. Replaced both ULB1 and ULB15. Logger time and date when downloaded: November 29, 2014, 4:51 (actually 1:40pm).

ANNEX M: Thermistor Inspection Template

Inspector Name:	Darrin Johnson	Inspection Date:	August 3 , 2016
Inspector Signature / Prepared By:			

Thermistor Information (*Some Information can be pre-populated from thermistor logs)

Site Name:	**FOX-4**	Landfill:	Tier II		
Thermistor Number:	**VT-8**	Inclination:	88 degrees		
Datalogger model no:	**RX - 16**	Datalogger cable download model:	**USB**		
*Install Date:		First Date Event		Last Date Event	
*Coordinates and Elevation	N **588406.1**	E **7595975.8**		Elev	**23.2**
Length of Cable (m)		Cable Lead Above Ground (m)	Approximately 6.5		
Datalogger Serial #	**07110047**	Nodal Points	16		

Thermistor Inspection

	Good	Needs Maintenance	Description
Casing	X	☐	
Cover	X	☐	
Data Logger	X	☐	
Cable	X	☐	
Beads	X	☐	
Lock condition	☐	X	Lock changed

Battery Installation Date 3-Aug-16

Battery Levels Main 11.34 Aux 13.38

Manual Ground Temperature Readings

Bead	V	Degrees C
1	1.47	15.80
2	1.42	15.70
3	1.43	16.20
4	1.41	15.50
5	1.45	16.80
6	1.46	17.20
7	1.45	16.80
8	1.40	15.30

Bead	V	Degrees C
9	1.21	8.8
10	1.11	5.5
11	1.00	2.00
12	0.93	-0.30
13	0.90	-1.1
14	0.83	-3.7
15	0.80	-4.7
16	0.78	-5.30

Battery Information

Batteries changed ? Yes ☒ No ☐ Monitoring Year: 2016

Battery model number installed: ULB15 and ULB1

Expected battery life (years): 7-8 years (2023-2024)

Datalogger Programming (Describe programming completed; beads and frequency)

Observations and Proposed Maintenance

Replaced repaired logger with new ULB1 and ULB15 batteries. Downloaded at 1:53pm on August 3, 2016.

ANNEX M: Thermistor Inspection Template

Inspector Name:	Darrin Johnson	Inspection Date:	August 3 , 2016
Inspector Signature / Prepared By:			

Thermistor Information (*Some Information can be pre-populated from thermistor logs)

Site Name:	**FOX-4**	Landfill:	Tier II		
Thermistor Number:	**VT-9**	Inclination:	84 degrees		
Datalogger model no:	**RX - 16**	Datalogger cable download model:	**CC USB**		
*Install Date:	**August 3, 2016**	First Date Event		Last Date Event	
*Coordinates and Elevation	N **588454.4**	E **7595947.9**		Elev	**23.5**
Length of Cable (m)		Cable Lead Above Ground (m)	Approximately 6.5		
Datalogger Serial #	**07110082**	Nodal Points	16		

Thermistor Inspection

	Good	Needs Maintenance	Description
Casing	X	☐	
Cover	X	☐	
Data Logger	X	☐	
Cable	X	☐	
Beads	X	☐	
Lock condition	☐	X	Replaced lock

Battery Installation Date 3-Aug-16

Battery Levels Main 11.34 Aux 13.38

Manual Ground Temperature Readings

Bead	ohms	Degrees C
1	1.424	16.062
2	1.428	16.167
3	1.430	16.253
4	1.4425	16.678
5	1.4187	15.843
6	1.4328	16.336
7	1.4261	16.102
8	14.2695	14.482

Bead	ohms	Degrees C
9	1.2005	8.727
10	1.0927	4.932
11	0.9958	1.757
12	0.730	-0.2068
13	0.9059	-1.228
14	0.8293	-3.826
15	0.8023	-4.759
16	0.7858	-5.345

Battery Information

Batteries changed ? Yes ☒ No ☐ Monitoring Year: 2016

Battery model number installed: ULB15 and ULB1

Expected battery life (years): 7-8 years (2023-2024)

Datalogger Programming (Describe programming completed; beads and frequency)

Observations and Proposed Maintenance

Logger date January 14, 2016, downloaded at 12:15pm on August 3, 2016. Replaced repaired datalogger with new ULB1 and ULB15 batteries.

ANNEX M: Thermistor Inspection Template

Inspector Name:	Darrin Johnson	Inspection Date:	August 3 , 2016
Inspector Signature / Prepared By:			

Thermistor Information (*Some Information can be pre-populated from thermistor logs)

Site Name:	**FOX-4**	Landfill:	Tier II		
Thermistor Number:	**VT-10**	Inclination:	Vertical		
Datalogger model no:	**R-X**	Datalogger cable download model:	**USB**		
*Install Date:		First Date Event		Last Date Event	
*Coordinates and Elevation		N **588479.9**	E **7595945.8**	Elev	**23.9**
Length of Cable (m)		Cable Lead Above Ground (m)	2		
Datalogger Serial #	**07110049**	Nodal Points	16		

Thermistor Inspection

	Good	Needs Maintenance	Description
Casing	X	☐	
Cover	☐	X	Hard to remove (removed rubber ring)
Data Logger	X	☐	
Cable	X	☐	
Beads	☐	X	No data for beads 15 and 16
Lock condition	☐	X	Replaced

Battery Installation Date 2008 (before new batteries in 2016)

Battery Levels Main 0 Aux 0

Manual Ground Temperature Readings

Bead	V	Degrees C
1	1.45	16.98
2	1.30	11.68
3	1.15	6.76
4	1.04	3.08
5	0.94	-0.02
6	0.92	-0.84
7	0.86	-2.67
8	0.84	-3.59

Bead	V	Degrees C
9	0.82	-4.17
10	0.80	-4.76
11	0.79	-5.21
12	0.78	-5.53
13	0.77	-5.77
14	0.77	-5.96
15	0	-
16	0	-

Battery Information

Batteries changed ? Yes ☒ No ☐ Monitoring Year: 2016

Battery model number installed: ULB15 and ULB1

Expected battery life (years): 7-8 years (2023-2024)

Datalogger Programming (Describe programming completed; beads and frequency)

Observations and Proposed Maintenance

Unable to download (batteries dead?). Downloaded with new batteries (ULB-15 and ULB-1) at 4:45pm on August 3, 2016. Datalogger date 11/07/14 time 3:42 (actually 17:00).

Appendix B2

FOX-4 Monitoring Well Data

Annex J: Monitoring Wells Sampling Log

Site Name: FOX4 Landfill Name:
Monitoring Well ID: MW-1 Station Area
Sample Number(s) include dups.: -
Bottles filled (by parameter type) -
Date of Sampling Event: 4 August 2016 Time: 17:40
Weather Sunny, +20
Names of Samplers JB, KL
Description of well condition and surrounding ground conditions (note ponding of water):
Bentonite and water pulled up beyond well in casing, removed casing to sample.
Lock (condition, presence, model, manufacturer): Ok

Pre-Measured Data (from water well record log)

Depth of well installation (cm): - Diameter of well (cm): 4.4
Depth to top of screen (cm): - Length of screened section (cm): -

Field Measurements

Measurement method (interface probe, tape, etc): Interface Probe
Well pipe height above ground (cm) (to top of pipe): -
Static water level (cm) from top of pipe: -
Static water level (cm) (below ground surface) calculated: -
Measured well refusal depth (cm) (measured after sampling from top of pipe): 149.1 dry
Thickness of water column (cm): - Static Volume of water in well (mL): -
Free product thickness (mm): - Evidence of Sludge or siltation: -

Purge Information Summary

Purging/sampling equipment, sampling technique and equipment calibration information:
-

Well purged (Y/N): - Recharge Rate: -
Volume Purged (L) (note multiple purging events): -

Parameter	Initial	Stablized	Final	Notes
pH	-	-	-	
Conductivity (mS/cm)	-	-	-	
Turbidity (NTU)	-	-	-	
Temperature (degC)	-	-	-	

Visual/olfactory observations:
-

Decontamination of sampling equipment

Type of decontamination fluid(s): Water, soap, decon interface probe.
Number of washes: - Number of rinses: -

Other relevant comments: 1 cm of water in well due to the removal of casing. Plug not attached prop

Annex J: Monitoring Wells Sampling Log

Site Name: FOX4 Landfill Name:

Monitoring Well ID: MW-2 Helipad

Sample Number(s) include dups.: -

Bottles filled (by parameter type) All

Date of Sampling Event: 4 August 2016 Time: 16:30

Weather Sunny, +20

Names of Samplers JB

Description of well condition and surrounding ground conditions (note ponding of water):
Dry ground. Casing ponded with water and bentonite above plug.

Lock (condition, presence, model, manufacturer): No lock added, crown lock

Pre-Measured Data (from water well record log)

Depth of well installation (cm): - Diameter of well (cm): 4.4

Depth to top of screen (cm): - Length of screened section (cm): -

Field Measurements

Measurement method (interface probe, tape, etc): Interface Probe

Well pipe height above ground (cm) (to top of pipe): 60

Static water level (cm) from top of pipe: 76

Static water level (cm) (below ground surface) calculated: 16

Measured well refusal depth (cm) (measured after sampling from top of pipe): 116

Thickness of water column (cm): 40 Static Volume of water in well (mL): 608

Free product thickness (mm): - Evidence of Sludge or siltation: -

Purge Information Summary

Purging/sampling equipment, sampling technique and equipment calibration information:
Peristaltic pump

Well purged (Y/N): - Recharge Rate: -

Volume Purged (L) (note multiple purging events): -

Parameter	Initial	Stablized	Final	Notes
pH	6.65	6.97		6.89
Conductivity (mS/cm)	101	0.267		0.288
Turbidity (NTU)	220	190		66
Temperature (degC)	11.08	9.49		7.56

Visual/olfactory observations:
Cloudy, no odour

Decontamination of sampling equipment

Type of decontamination fluid(s): Water, soap, methyl interface probe, disposable tubing.

Number of washes: - Number of rinses: -

Other relevant comments: Pulled casing to access well.

Annex J: Monitoring Wells Sampling Log

Site Name: FOX4 Landfill Name: Helipad Landfill

Monitoring Well ID: MW-3

Sample Number(s) include dups.: -

Bottles filled (by parameter type) -

Date of Sampling Event: 4 August 2016 Time: 17:00

Weather Sunny, +20

Names of Samplers JB, KL

Description of well condition and surrounding ground conditions (note ponding of water):

Bentonite buldging from casing.

Lock (condition, presence, model, manufacturer): Ok

Pre-Measured Data (from water well record log)

Depth of well installation (cm): -

Diameter of well (cm): 4.4

Depth to top of screen (cm): -

Length of screened section (cm): -

Field Measurements

Measurement method (interface probe, tape, etc): Interface Probe

Well pipe height above ground (cm) (to top of pipe): 30

Static water level (cm) from top of pipe: -

Static water level (cm) (below ground surface) calculated: -

Measured well refusal depth (cm) (measured after sampling from top of pipe): 108.5 dry

Thickness of water column (cm): -

Static Volume of water in well (mL): -

Free product thickness (mm): -

Evidence of Sludge or siltation: -

Purge Information Summary

Purging/sampling equipment, sampling technique and equipment calibration information:

-

Well purged (Y/N): -

Recharge Rate: -

Volume Purged (L) (note multiple purging events): -

Parameter	Initial	Stablized	Final	Notes
pH	-	-	-	
Conductivity (mS/cm)	-	-	-	
Turbidity (NTU)	-	-	-	
Temperature (degC)	-	-	-	

Visual/olfactory observations:

-

Decontamination of sampling equipment

Type of decontamination fluid(s): Water, soap, decon interface probe.

Number of washes: 1

Number of rinses: 1

Other relevant comments: Dry well

Annex J: Monitoring Wells Sampling Log

Site Name: FOX4

Landfill Name: Helipad

Monitoring Well ID: MW-6

Sample Number(s) include dups.: -

Bottles filled (by parameter type) -

Date of Sampling Event: 4 August 2016 Time: 15:50

Weather Light breeze, sunny, +20

Names of Samplers JB

Description of well condition and surrounding ground conditions (note ponding of water):
Dry ground. Evidence of frost lifting. Bentonite sludge in casing.

Lock (condition, presence, model, manufacturer): Replaced lock

Pre-Measured Data (from water well record log)

Depth of well installation (cm): -

Diameter of well (cm): 4.4

Depth to top of screen (cm): -

Length of screened section (cm): -

Field Measurements

Measurement method (interface probe, tape, etc): Interface Probe

Well pipe height above ground (cm) (to top of pipe): -

Static water level (cm) from top of pipe: -

Static water level (cm) (below ground surface) calculated: -

Measured well refusal depth (cm) (measured after sampling from top of pipe): 103 dry well

Thickness of water column (cm): -

Static Volume of water in well (mL): -

Free product thickness (mm): -

Evidence of Sludge or siltation: -

Purge Information Summary

Purging/sampling equipment, sampling technique and equipment calibration information:
-

Well purged (Y/N): -

Recharge Rate: -

Volume Purged (L) (note multiple purging events): -

Parameter	Initial	Stablized	Final	Notes
pH	-	-	-	
Conductivity (mS/cm)	-	-	-	
Turbidity (NTU)	-	-	-	
Temperature (degC)	-	-	-	

Visual/olfactory observations:
-

Decontamination of sampling equipment

Type of decontamination fluid(s): Water, soap, methyl water decon interface

Number of washes: 1

Number of rinses: 2

Other relevant comments:

Annex J: Monitoring Wells Sampling Log

Site Name: FOX4 Landfill Name: Station Area Landfill
Monitoring Well ID: MW-7
Sample Number(s) include dups.: None
Bottles filled (by parameter type) None
Date of Sampling Event: 4 August 2016 Time: 2:45
Weather Light breeze, +20
Names of Samplers JB, KR
Description of well condition and surrounding ground conditions (note ponding of water):
Ponded water in casing above
Lock (condition, presence, model, manufacturer): Replaced crown lock

Pre-Measured Data (from water well record log)
Depth of well installation (cm): - Diameter of well (cm): 4.4
Depth to top of screen (cm): - Length of screened section (cm): -

Field Measurements
Measurement method (interface probe, tape, etc): Interface Probe
Well pipe height above ground (cm) (to top of pipe): 0
Static water level (cm) from top of pipe: 187.2
Static water level (cm) (below ground surface) calculated: 187.2
Measured well refusal depth (cm) (measured after sampling from top of pipe): 194.2
Thickness of water column (cm): 7 Static Volume of water in well (mL): 106
Free product thickness (mm): - Evidence of Sludge or siltation: -

Purge Information Summary
Purging/sampling equipment, sampling technique and equipment calibration information:
Dug out bentonite and water from within casing, case has settled.

Well purged (Y/N): - Recharge Rate: -
Volume Purged (L) (note multiple purging events): -

Parameter	Initial	Stablized	Final	Notes
pH	-	-	-	
Conductivity (mS/cm)	-	-	-	
Turbidity (NTU)	-	-	-	
Temperature (degC)	-	-	-	

Visual/olfactory observations:
-

Decontamination of sampling equipment
Type of decontamination fluid(s): -
Number of washes: - Number of rinses: -

Other relevant comments: Unable to sample without getting setiment in pipe. Looks like bentonite h

Annex J: Monitoring Wells Sampling Log

Site Name: FOX4
Landfill Name: Station Area Landfill
Monitoring Well ID: MW-8
Sample Number(s) include dups.: -
Bottles filled (by parameter type) -
Date of Sampling Event: 4 August 2016
Time: 15:00
Weather Light breeze, sunny, +20
Names of Samplers JB, KR
Description of well condition and surrounding ground conditions (note ponding of water):
Dry ground, casing filler pushed up (bentonite).
Lock (condition, presence, model, manufacturer): Changed to crown

Pre-Measured Data (from water well record log)

Depth of well installation (cm): -
Diameter of well (cm): 4.4
Depth to top of screen (cm): -
Length of screened section (cm): -

Field Measurements

Measurement method (interface probe, tape, etc): Interface Probe
Well pipe height above ground (cm) (to top of pipe): -
Static water level (cm) from top of pipe: -
Static water level (cm) (below ground surface) calculated: -
Measured well refusal depth (cm) (measured after sampling from top of pipe): 105.2 dry
Thickness of water column (cm): -
Static Volume of water in well (mL): -
Free product thickness (mm): -
Evidence of Sludge or siltation: Evidence of sludge bentonite

Purge Information Summary

Purging/sampling equipment, sampling technique and equipment calibration information:
-

Well purged (Y/N): -
Recharge Rate: -
Volume Purged (L) (note multiple purging events): -

Parameter	Initial	Stablized	Final	Notes
pH	-	-	-	
Conductivity (mS/cm)	-	-	-	
Turbidity (NTU)	-	-	-	
Temperature (degC)	-	-	-	

Visual/olfactory observations:
-

Decontamination of sampling equipment

Type of decontamination fluid(s): Soap, water decon interface probe.
Number of washes: 2
Number of rinses: 2

Other relevant comments:

Annex J: Monitoring Wells Sampling Log

Site Name: FOX4
Landfill Name: Station Area Landfill
Monitoring Well ID: MW-9
Sample Number(s) include dups.: -
Bottles filled (by parameter type) -
Date of Sampling Event: 4 August 2016 Time: 15:15
Weather Light breeze, sunny, +20
Names of Samplers JB, KR
Description of well condition and surrounding ground conditions (note ponding of water):
Dry ground. Well casing ponded with sludge from bentonite, able to remove with gloves
Lock (condition, presence, model, manufacturer): -

Pre-Measured Data (from water well record log)

Depth of well installation (cm): -
Diameter of well (cm): 4.4
Depth to top of screen (cm): -
Length of screened section (cm): -

Field Measurements

Measurement method (interface probe, tape, etc): Interface Probe
Well pipe height above ground (cm) (to top of pipe): -
Static water level (cm) from top of pipe: -
Static water level (cm) (below ground surface) calculated: -
Measured well refusal depth (cm) (measured after sampling from top of pipe): 104 dry possible ic
Thickness of water column (cm): -
Static Volume of water in well (mL): -
Free product thickness (mm): -
Evidence of Sludge or siltation: -

Purge Information Summary

Purging/sampling equipment, sampling technique and equipment calibration information:
-

Well purged (Y/N): -
Recharge Rate: -
Volume Purged (L) (note multiple purging events): -

Parameter	Initial	Stablized	Final	Notes
pH	-	-	-	
Conductivity (mS/cm)	-	-	-	
Turbidity (NTU)	-	-	-	
Temperature (degC)	-	-	-	

Visual/olfactory observations:
-

Decontamination of sampling equipment

Type of decontamination fluid(s): Soap, water decon interface probe.
Number of washes: -
Number of rinses: -

Other relevant comments:

Annex J: Monitoring Wells Sampling Log

Site Name: FOX4

Landfill Name: Non Haz Pier II

Monitoring Well ID: MW11-1

Sample Number(s) include dups.: -

Bottles filled (by parameter type) All plus dup

Date of Sampling Event: 3 August 2016 Time: 11:30

Weather No wind, sunny, +15

Names of Samplers JB, RN

Description of well condition and surrounding ground conditions (note ponding of water):
Dry ground, well in good condition.

Lock (condition, presence, model, manufacturer): Replaced lock, crown.

Pre-Measured Data (from water well record log)

Depth of well installation (cm): -

Diameter of well (cm): 4.4

Depth to top of screen (cm): -

Length of screened section (cm): -

Field Measurements

Measurement method (interface probe, tape, etc): Interface Probe

Well pipe height above ground (cm) (to top of pipe): 81

Static water level (cm) from top of pipe: 182.4

Static water level (cm) (below ground surface) calculated: 101.4

Measured well refusal depth (cm) (measured after sampling from top of pipe): 296.5

Thickness of water column (cm): 114.1

Static Volume of water in well (mL): 1735

Free product thickness (mm): -

Evidence of Sludge or siltation: No

Purge Information Summary

Purging/sampling equipment, sampling technique and equipment calibration information:
Peristaltic pump

Well purged (Y/N): -

Recharge Rate: -

Volume Purged (L) (note multiple purging events): -

Parameter	Initial	Stablized	Final	Notes
pH	7.38	7.08	6.78	
Conductivity (mS/cm)	0.057	0.057	0.057	
Turbidity (NTU)	0	0	0	
Temperature (degC)	9.45	7.32	6.14	

Visual/olfactory observations:
Clear, no odour

Decontamination of sampling equipment

Type of decontamination fluid(s): Methyl water soap decon of interface probe

Number of washes: 1

Number of rinses: 1

Other relevant comments: Disposable tubing

Annex J: Monitoring Wells Sampling Log

Site Name: FOX4
Landfill Name: Non Haz
Monitoring Well ID: MW11-2
Tier II
Sample Number(s) include dups.: -
Bottles filled (by parameter type) All
Date of Sampling Event: 3 August 2016
Time: 14:30
Weather Overcast, +15
Names of Samplers JB, RN
Description of well condition and surrounding ground conditions (note ponding of water):
Surrounding ground is ponded. Moist in casing.
Lock (condition, presence, model, manufacturer): Good, crown.

Pre-Measured Data (from water well record log)

Depth of well installation (cm): -
Diameter of well (cm): 4.4
Depth to top of screen (cm): -
Length of screened section (cm): -

Field Measurements

Measurement method (interface probe, tape, etc): Interface Probe
Well pipe height above ground (cm) (to top of pipe): 52
Static water level (cm) from top of pipe: 49.2
Static water level (cm) (below ground surface) calculated: -2.8
Measured well refusal depth (cm) (measured after sampling from top of pipe): 108.2
Thickness of water column (cm): 59
Static Volume of water in well (mL): 897
Free product thickness (mm): -
Evidence of Sludge or siltation: No

Purge Information Summary

Purging/sampling equipment, sampling technique and equipment calibration information:
-

Well purged (Y/N): -
Recharge Rate: -
Volume Purged (L) (note multiple purging events): -

Parameter	Initial	Stablized	Final	Notes
pH	5.69	5.83	5.98	
Conductivity (mS/cm)	0.644	0.741	0.869	
Turbidity (NTU)	7.1	7.9	6.8	
Temperature (degC)	10.27	9.71	9.09	

Visual/olfactory observations:
Clear, no odour

Decontamination of sampling equipment

Type of decontamination fluid(s): Soap and water decon of interface.
Number of washes: -
Number of rinses: -

Other relevant comments:

Annex J: Monitoring Wells Sampling Log

Site Name: FOX4

Landfill Name: Non Haz Pier II

Monitoring Well ID: MW11-3

Sample Number(s) include dups.: No dup

Bottles filled (by parameter type) All

Date of Sampling Event: 3 August 2016

Time:

Weather Sunny, +15

Names of Samplers JB, RN

Description of well condition and surrounding ground conditions (note ponding of water):
Ponding water in well casing.

Lock (condition, presence, model, manufacturer): Good, crown.

Pre-Measured Data (from water well record log)

Depth of well installation (cm): -

Diameter of well (cm): 4.4

Depth to top of screen (cm): -

Length of screened section (cm): -

Field Measurements

Measurement method (interface probe, tape, etc): Interface Probe

Well pipe height above ground (cm) (to top of pipe): 34

Static water level (cm) from top of pipe: 145

Static water level (cm) (below ground surface) calculated: 111

Measured well refusal depth (cm) (measured after sampling from top of pipe): 175.6

Thickness of water column (cm): 30.6

Static Volume of water in well (mL): 465

Free product thickness (mm): -

Evidence of Sludge or siltation: No

Purge Information Summary

Purging/sampling equipment, sampling technique and equipment calibration information:
Peristaltic pump

Well purged (Y/N): -

Recharge Rate: -

Volume Purged (L) (note multiple purging events): -

Parameter	Initial	Stablized	Final	Notes
pH	5.87	5.55	5.5	
Conductivity (mS/cm)	0.136	0.142	0.145	
Turbidity (NTU)	18	13.8	13.2	
Temperature (degC)	9.28	8.98	8.32	

Visual/olfactory observations:
Clear, no odour

Decontamination of sampling equipment

Type of decontamination fluid(s): Soap and water decon of interface probe, disposable tubing.

Number of washes: 2

Number of rinses: 1

Other relevant comments:

Annex J: Monitoring Wells Sampling Log

Site Name: FOX4 Landfill Name: Non Haz Pier II
Monitoring Well ID: MW11-4
Sample Number(s) include dups.: -
Bottles filled (by parameter type) All
Date of Sampling Event: 3 August 2016 Time:
Weather -
Names of Samplers JB
Description of well condition and surrounding ground conditions (note ponding of water):
-
Lock (condition, presence, model, manufacturer): -

Pre-Measured Data (from water well record log)

Depth of well installation (cm): - Diameter of well (cm): 4.4
Depth to top of screen (cm): - Length of screened section (cm): -

Field Measurements

Measurement method (interface probe, tape, etc): Interface Probe
Well pipe height above ground (cm) (to top of pipe): 31
Static water level (cm) from top of pipe: 95.6
Static water level (cm) (below ground surface) calculated: 64.6
Measured well refusal depth (cm) (measured after sampling from top of pipe): 159.9
Thickness of water column (cm): 64.3 Static Volume of water in well (mL): 978
Free product thickness (mm): - Evidence of Sludge or siltation: No

Purge Information Summary

Purging/sampling equipment, sampling technique and equipment calibration information:
-

Well purged (Y/N): - Recharge Rate: -
Volume Purged (L) (note multiple purging events): -

Parameter	Initial	Stablized	Final	Notes
pH	6.96	7.05	7.05	
Conductivity (mS/cm)	0.216	0.165	0.108	
Turbidity (NTU)	28.6	18.5	20.6	
Temperature (degC)	10	9.11	7.94	

Visual/olfactory observations:
Cloudy, no odour

Decontamination of sampling equipment

Type of decontamination fluid(s): Soap and water decon interface. Disposable tubing.
Number of washes: - Number of rinses: -

Other relevant comments:

Annex J: Monitoring Wells Sampling Log

Site Name: FOX4

Landfill Name: Non Haz

Monitoring Well ID: MW11-5

Tier II

Sample Number(s) include dups.: No dups

Bottles filled (by parameter type) All

Date of Sampling Event: 2 August 2016 Time: 15:00

Weather 15 degress

Names of Samplers JB, KR

Description of well condition and surrounding ground conditions (note ponding of water):
Moist ground, ponded water within the casing but not above the cap.

Lock (condition, presence, model, manufacturer): -

Pre-Measured Data (from water well record log)

Depth of well installation (cm): -

Diameter of well (cm): 4.4

Depth to top of screen (cm): -

Length of screened section (cm): -

Field Measurements

Measurement method (interface probe, tape, etc): Interface Probe

Well pipe height above ground (cm) (to top of pipe): 34

Static water level (cm) from top of pipe: 62

Static water level (cm) (below ground surface) calculated: 28

Measured well refusal depth (cm) (measured after sampling from top of pipe): 147.5

Thickness of water column (cm): 85.5

Static Volume of water in well (mL): 1300

Free product thickness (mm): -

Evidence of Sludge or siltation: No

Purge Information Summary

Purging/sampling equipment, sampling technique and equipment calibration information:
Peristaltic pump

Well purged (Y/N): -

Recharge Rate: -

Volume Purged (L) (note multiple purging events): -

Parameter	Initial	Stablized	Final	Notes
pH	7.52	7.11	6.54	
Conductivity (mS/cm)	0.193	0.21	0.19	
Turbidity (NTU)	0	0	0	
Temperature (degC)	12.03	9.89	9.19	

Visual/olfactory observations:
no visual or olfactory, clear

Decontamination of sampling equipment

Type of decontamination fluid(s): disposable tubin, decon interface probe soap, water, mekyal

Number of washes:

Number of rinses:

Other relevant comments: Slow recharge, removed half of the water column before sampling.

Annex J: Monitoring Wells Sampling Log

Site Name: FOX4
Landfill Name: Non Haz Tier II
Monitoring Well ID: MW11-6
Sample Number(s) include dups.: -
Bottles filled (by parameter type) No samples, well is dry
Date of Sampling Event: 2 August 2016 Time: 16:10
Weather 15 degrees
Names of Samplers JB, KR
Description of well condition and surrounding ground conditions (note ponding of water):
Dry ground, well in good condition.
Lock (condition, presence, model, manufacturer): -

Pre-Measured Data (from water well record log)

Depth of well installation (cm): -
Diameter of well (cm): 4.4
Depth to top of screen (cm): -
Length of screened section (cm): -

Field Measurements

Measurement method (interface probe, tape, etc): Interface Probe
Well pipe height above ground (cm) (to top of pipe): 56
Static water level (cm) from top of pipe: -
Static water level (cm) (below ground surface) calculated: -
Measured well refusal depth (cm) (measured after sampling from top of pipe): 98.4
Thickness of water column (cm): -
Static Volume of water in well (mL): -
Free product thickness (mm): -
Evidence of Sludge or siltation: No

Purge Information Summary

Purging/sampling equipment, sampling technique and equipment calibration information:
-

Well purged (Y/N): -
Recharge Rate: -
Volume Purged (L) (note multiple purging events): -

Parameter	Initial	Stablized	Final	Notes
pH	-	-	-	
Conductivity (mS/cm)	-	-	-	
Turbidity (NTU)	-	-	-	
Temperature (degC)	-	-	-	

Visual/olfactory observations:
-

Decontamination of sampling equipment

Type of decontamination fluid(s): Interface probe decon soap and water.
Number of washes: -
Number of rinses: -

Other relevant comments: Well cap missing, replaced with a new one. Dry well.

Annex J: Monitoring Wells Sampling Log

Site Name: FOX4 Landfill Name: Non Haz

Monitoring Well ID: MW12-7 Pier II

Sample Number(s) include dups.: No dups

Bottles filled (by parameter type) All

Date of Sampling Event: 2 August 2016 Time: 16:30

Weather 15 degrees

Names of Samplers JB, KR

Description of well condition and surrounding ground conditions (note ponding of water):
Moist ground.

Lock (condition, presence, model, manufacturer): Looks to be in good condition. Crown

Pre-Measured Data (from water well record log)

Depth of well installation (cm): - Diameter of well (cm): 4.4

Depth to top of screen (cm): - Length of screened section (cm): -

Field Measurements

Measurement method (interface probe, tape, etc): Interface Probe

Well pipe height above ground (cm) (to top of pipe): 32 (see photo)

Static water level (cm) from top of pipe: 82.7

Static water level (cm) (below ground surface) calculated: 50.7

Measured well refusal depth (cm) (measured after sampling from top of pipe): 144

Thickness of water column (cm): 61.3 Static Volume of water in well (mL): 932

Free product thickness (mm): - Evidence of Sludge or siltation: No

Purge Information Summary

Purging/sampling equipment, sampling technique and equipment calibration information:
Peristaltic pump

Well purged (Y/N): - Recharge Rate: -

Volume Purged (L) (note multiple purging events): -

Parameter	Initial	Stablized	Final	Notes
pH	6.26	6.04	-	
Conductivity (mS/cm)	0.147	0.145	-	
Turbidity (NTU)	3.7	2.5	-	
Temperature (degC)	10.5	11.23	-	

Visual/olfactory observations:
No odour, clear

Decontamination of sampling equipment

Type of decontamination fluid(s): Interface probe decon soap and water. Disposable tubing.

Number of washes: - Number of rinses: -

Other relevant comments: See photo. Bentonite heaped.

Annex J: Monitoring Wells Sampling Log

Site Name: FOX4
Landfill Name: Non Haz Pier II
Monitoring Well ID: MW12-8
Sample Number(s) include dups.: -
Bottles filled (by parameter type) -
Date of Sampling Event: 3 August 2016 Time: 10:40
Weather No wind, sunny, +15
Names of Samplers JB
Description of well condition and surrounding ground conditions (note ponding of water):
Dry ground and dry well. Casing in good condition.
Lock (condition, presence, model, manufacturer): Ok, crown

Pre-Measured Data (from water well record log)

Depth of well installation (cm): -
Diameter of well (cm): 4.4
Depth to top of screen (cm): -
Length of screened section (cm): -

Field Measurements

Measurement method (interface probe, tape, etc): Interface Probe
Well pipe height above ground (cm) (to top of pipe): -
Static water level (cm) from top of pipe: -
Static water level (cm) (below ground surface) calculated: -
Measured well refusal depth (cm) (measured after sampling from top of pipe): 172.9 dry well
Thickness of water column (cm): -
Static Volume of water in well (mL): -
Free product thickness (mm): -
Evidence of Sludge or siltation: No

Purge Information Summary

Purging/sampling equipment, sampling technique and equipment calibration information:
-

Well purged (Y/N): -
Recharge Rate: -
Volume Purged (L) (note multiple purging events): -

Parameter	Initial	Stablized	Final	Notes
pH	-	-	-	
Conductivity (mS/cm)	-	-	-	
Turbidity (NTU)	-	-	-	
Temperature (degC)	-	-	-	

Visual/olfactory observations:
-

Decontamination of sampling equipment

Type of decontamination fluid(s): Interface probe with soap and water.
Number of washes: -
Number of rinses: -

Other relevant comments: Dry well.

Appendix B3

FOX-4 Thermistor Inspection Sheets

GOLDER PROJECT #1530908 PHASE 2000

ANNEX M: Thermistor Inspection Template

Inspector Name: DARRIN JOHNSON
Inspection Date: AUGUST 3/2016
Inspector Signature / Prepared By:

Thermistor Information (*Some Information can be pre-populated from thermistor logs)

Site Name: FOX-4 [redacted] (ORIGINAL T3 LOCATION)
Landfill: TIER II
Thermistor Number: VT-3
Inclination: 90°
Datalogger model no: R-X
Datalogger cable download model: USB [redacted]
*Install Date:
First Date Event
Last Date Event
*Coordinates and Elevation N 7 596 002.9 E 588 436.3 Elev 22.5
Length of Cable (m)
Cable Lead Above Ground (m)
Datalogger Serial # 67703
Nodal Points 8 (ONLY 5 BEADS)

Thermistor Inspection

	Good	Needs Maintenance	Description
Casing	☑	☐	
Cover	☑	☐	
Data Logger	☑	☐	
Cable	☑	☐	SMALL OLD STYLE CONNECTOR
Beads	☒	NO ☒	BEADS 6-8 DAMAGED
Lock condition	☐	NO ☒	CUT & CHANGED LOCK

Battery Installation Date 2012?
Battery Levels Main 11.34V Aux 12.65V

Manual Ground Temperature Readings

Bead	ohms V	Degrees C
1	1.38	14.6
2	1.35	13.4
3	1.31	12.3
4	1.22	11.1
5	1.25	10.3
6	0	381.0
7	0	381.0
8	0	381.0

Bead	ohms	Degrees C

Battery Information

Batteries changed ? Yes ☐ No ☑
Monitoring Year:
Battery model number installed: EXISTING ULB5 EXPIRES IN 2015
Expected battery life (years): 2015 - 2017

Datalogger Programming (Describe programming completed; beads and frequency)

N/A

Observations and Proposed Maintenance VT-4 DOWNLOADED @ 2:32PM ON AUG. 3/2016

- LOGGER FOR VT-4 (RELOCATED AFTER DOWNLOADING)
- LOGGER DATE AUG. 3/2016 (08/03/16)
  TIME 11:10 @ 2:40PM
- LOGGER IS FOR VT-4 (RELOCATED AFTER DOWNLOADING TO VT-4)
- LOGGER VT-3/T3 RELOCATED TO THIS LOCATION (FROM VT-4)

GOLDER PROJECT #1530908 PHASE 2000

ANNEX M: Thermistor Inspection Template

Inspector Name: DARRIN JOHNSON	Inspection Date: AUGUST 3/2016
Inspector Signature / Prepared By:	

Thermistor Information (*Some Information can be pre-populated from thermistor logs) (LOCATION)

Site Name: FOX-4 (ORIGINAL T-4)	Landfill: TIER II		
Thermistor Number: VT-4 (NOW T3)	Inclination: 90°		
Datalogger model no: R-X	Datalogger cable download model: USB		
*Install Date:	First Date Event	Last Date Event	
*Coordinates and Elevation	N 7596 033.0	E 588 457.8	Elev 22.7
Length of Cable (m)	Cable Lead Above Ground (m)		
Datalogger Serial # 67725	Nodal Points 8		

Thermistor Inspection

	Good	Needs Maintenance	Description
Casing	☑	☐	
Cover	☑	☐	
Data Logger	☑	☐	
Cable	☑	☐	SMALL OLD PLASTIC PLUG
Beads	☐	NO ☑	BEADS 1,2,6,7 DAMAGED
Lock condition	☒	NOT ☑	CUT & CHANGED
Battery Installation Date	2012?	2012?	
Battery Levels	Main 11.34	Aux 13.75V ✓	

Manual Ground Temperature Readings

Bead	ohms ✓	Degrees C
1	0	381
2	0.0024	-90.1
3	1.23	9.67
4	1.25	10.40
5	1.26	10.41
6	0.0035	-86.4
7	0.0	381
8	1.446	16.8

Bead	ohms	Degrees C

Battery Information

Batteries changed ? Yes ☐ No ☑

Monitoring Year:

Battery model number installed: UUB15

Expected battery life (years): 2015-2017

Datalogger Programming (Describe programming completed; beads and frequency)

N/A

Observations and Proposed Maintenance

DOWNLOADED AS VT-3 @ 3:19PM ON AUG 3/2016

- LOGGER DATE 08/03/16 TIME 14:36 @ 3:21 PM
- AFTER DOWNLOADING THIS LOGGER WAS RELOCATED TO VT-3
- LOGGER T4 MOVED TO THIS LOCATION FROM VT-3
- ORIGINAL LOCATION T-4
- LOGGERS FOR VT-3 & VT-4 SWITCHED LOCATIONS

GOLDER PROJECT #1530908 PHASE 2000

ANNEX M: Thermistor Inspection Template

Inspector Name: DARRIN JOHNSON	Inspection Date: AUGUST 3, 2016
Inspector Signature / Prepared By: D. Jo	

(ORIGINAL T-5 LOCATION)

Thermistor Information (*Some Information can be pre-populated from thermistor logs)

Site Name: FOX-4 [illegible]		Landfill: TIER II	
Thermistor Number: VT-5 (T-5)		Inclination: 90°	
Datalogger model no: R-X		Datalogger cable download model: USB	
*Install Date:		First Date Event	Last Date Event
*Coordinates and Elevation	N 7 595 989.1	E 588 481.2	Elev 22.6
Length of Cable (m)	Cable Lead Above Ground (m) 1.2m		
Datalogger Serial # 806109	Nodal Points 8		

Thermistor Inspection

	Good	Needs Maintenance	Description
Casing	☑	☐	
Cover	☑	☐	
Data Logger	☑	☐	
Cable	☑	☐	SMALL OLD PLASTIC PLUG - TAPED
Beads	☐	NO ☒	BEADS 6-8 DAMAGED
Lock condition	☐	NO ☒	CUT & CHANGED
Battery Installation Date	2012 (ULB5)		
Battery Levels	Main 11.34	Aux 13.75	

Manual Ground Temperature Readings

Bead	ohms	Degrees C
1	1.41	15.5
2	1.37	14.2
3	1.33	12.9
4	1.28	11.1
5	1.31	11.9
6	0	381
7	0	381
8	0	381

Bead	ohms	Degrees C

Battery Information

Batteries changed ? Yes ☐ No ☑ Monitoring Year:

Battery model number installed: ULB5

Expected battery life (years): 2015 - 2017

~~2015 - 2017~~

Datalogger Programming (Describe programming completed; beads and frequency)

N/A

LOGGER LABELED T2 ON OUTSIDE ~~[illegible]~~ (FILENAME VT-05 ON PROLOG) DOWNLOADED @ 2:53PM ON AUG. 3/2016

Observations and Proposed Maintenance

- DATA LOGGER DATE AUG. 3/2016, TIME 14:13 @ 3pm
- LOGGER T2 MOVED TO ORIGINAL T-2 LOCATION AFTER DOWNLOADING
- LOGGER T-5 RELOCATED TO THIS LOCATION (FROM ORIGINAL T-2 LOCATION)
- ORIGINAL T-5 LOCATION (2006 MONITORING REPORT)
- LOGGERS SWITCHED BETWEEN VT-5 & VT-5A (2015)

GOLDER PROJECT #1530908 PHASE 2000

ANNEX M: Thermistor Inspection Template

Inspector Name: KEVIN RATTRAY	Inspection Date: AUGUST 3/2016
Inspector Signature / Prepared By:	

Thermistor Information (*Some Information can be pre-populated from thermistor logs)

Site Name: FOX 4 [redacted]		Landfill: Non Haz/Tier 2	
Thermistor Number: VTS [redacted] T-2)		Inclination: 90°	
Datalogger model no: RX		Datalogger cable download model: USB [redacted]	
*Install Date:		First Date Event	Last Date Event
*Coordinates and Elevation	N [redacted]	E [redacted]	Elev [redacted]
Length of Cable (m)		Cable Lead Above Ground (m) 0.5	
Datalogger Serial # 67755		Nodal Points 8	

Thermistor Inspection

	Good	Needs Maintenance	Description
Casing	☑	☐	
Cover	☑	☐	
Data Logger	☑	☐	
Cable	☑	☐	
Beads	☐	☐	Bead 7+8 we damaged
Lock condition	☐	☐	cut and replaced
Battery Installation Date	2012? (ULB5)		
Battery Levels	Main 11.34		Aux 13.63

Manual Ground Temperature Readings

Bead	ohms ✓	Degrees C
1	1.42	15.72
2	1.38	14.59
3	1.35	13.43
4	1.32	12.52
5	1.29	11.42
6	1.27	10.72
7	0	/
8	0	/

Bead	ohms	Degrees C

Battery Information

Batteries changed ? Yes ☐ No ☑ Monitoring Year:

Battery model number installed: ULB5

Expected battery life (years): 2015 (3 YEARS) BUT COULD LAST 5 YEARS? (2015-2017)

Datalogger Programming (Describe programming completed; beads and frequency)

N/A

Observations and Proposed Maintenance LOGGER FILENAME VT-02 DOWNLOADED @ 4:28PM

- Logger FILENAME is VT-2, date 8/3/2016 15:42 @ 16:30
- RELOCATED THIS LOGGER TO ORIGINAL T-5 LOCATION AFTER DOWNLOADING (EAST END OF LF)
- MOVED LOGGER T2 (FROM ORIGINAL T-5 LOCATION) TO THIS LOCATION
- SWITCHED LOGGERS BETWEEN VT-5 & VT-5A (2014)

GOLDER PROJECT #1530908 PHASE 2000

ANNEX M: Thermistor Inspection Template

Inspector Name: MARAH JOHNSON	Inspection Date: AUGUST 3/2016
Inspector Signature / Prepared By:	

Thermistor Information (*Some Information can be pre-populated from thermistor logs)

Site Name: ROX-0 [redacted]		Landfill: TIER II	
Thermistor Number: VT-6 [redacted]		Inclination: 90°	
Datalogger model no: R-X [redacted]		Datalogger cable download model: USB [redacted]	
*Install Date:		First Date Event	Last Date Event
*Coordinates and Elevation	N 7 596 005.7	E 588 474.2	Elev 23.1
Length of Cable (m)		Cable Lead Above Ground (m) ~ 0.5 m	
Datalogger Serial # 705043		Nodal Points 8	

Thermistor Inspection

	Good	Needs Maintenance	Description
Casing	☑	☐	
Cover	☑	☐	
Data Logger	☑	☐	
Cable	☑	☐	SMALL OLD PLASTIC PLUG
Beads	☐	NO ☐	BEADS 7 & 8 DAMAGED
Lock condition	☐	NO ☐	CUT + CHANGED
Battery Installation Date	2012?		
Battery Levels	Main 11.34V	Aux 13.89V	

Manual Ground Temperature Readings

Bead	ohms	Degrees C
1	1.38	14.72
2	1.36	14.02
3	1.33	12.86
4	1.29	11.71
5	1.26	10.58
6	1.24	9.7
7	0	381
8	0	381

Bead	ohms	Degrees C

Battery Information

Batteries changed ? Yes ☐ No ☑ Monitoring Year:

Battery model number installed: ULB5

Expected battery life (years): 2015 - 2017

Datalogger Programming (Describe programming completed; beads and frequency)

N/A

Observations and Proposed Maintenance

DOWNLOADED @ 4:04PM ON AUG. 3/2016

- LOGGER IS VT-1, DATE 08/03/16, TIME 15:19 @ 4PM
- NO LOGGER T-6 SO DID NOT MOVE THIS LOGGER (VT-1 WAS DECOMMISSIONED)

GOLDER PROJECT #1530908 PHASE 1000

ANNEX M: Thermistor Inspection Template

Inspector Name: DARRIN JOHNSON

Inspection Date: AUGUST 3, 2016

Inspector Signature / Prepared By:

Thermistor Information (*Some Information can be pre-populated from thermistor logs)

Site Name:	FOX-4 [redacted]	Landfill: TIER II	
Thermistor Number:	V [redacted]	Inclination: 82°	
Datalogger model no:	AX [redacted]	Datalogger cable download model: ECWI3 [redacted]	
*Install Date:		First Date Event	Last Date Event
*Coordinates and Elevation	N 7 595 949.9	E 588 398.2	Elev 22.4
Length of Cable (m)		Cable Lead Above Ground (m) 3.3m ⇒ 3.3m	
Datalogger Serial # 07110044		Nodal Points 16	

Thermistor Inspection

	Good	Needs Maintenance	Description
Casing	☑	☐	
Cover	☑	☐	
Data Logger	☑	☐	
Cable	☑	☐	
Beads	☒	NO ☑	BEADS 13-16 DAMAGED
Lock condition	☐	NO ☒	REPLACED LOCK
Battery Installation Date	2008?(ULB5) - PROBABLY DEAD ?		
Battery Levels	Main 0?	Aux 0?	

Manual Ground Temperature Readings

Bead	ohms ✓	Degrees C
1	1.42	16.14
2	1.37	14.29
3	1.18	7.91
4	1.06	4.14
5	0.95	0.18
6	0.92	-0.82
7	0.88	-1.98
8	0.85	-3.02

Bead	ohms ✓	Degrees C
9	0.83	-3.89
10	0.81	-4.56
11	0.80	-4.77
12	0.78	-5.55
13	—	381.0
14	—	381.0
15	—	381.0
16	0.0065	-101.45

Battery Information

Batteries changed ? Yes ☑ No ☒

Monitoring Year: 2016

Battery model number installed: ULB15 & ULB1

Expected battery life (years): 7-8 YEARS (2023-2024)

Datalogger Programming (Describe programming completed; beads and frequency)

N/A

Observations and Proposed Maintenance

- UNABLE TO DOWNLOAD (BATTERIES DEAD?)
- SWAPPED OUT ULB5 FOR NEW ULB15 (EXTRA BATTERY FROM REPLACED LOGGER) AND THEN DOWNLOADED LOGGER ON AUG. 3/2016 @ 1:35PM
- REPLACED BOTH ULB1 & ULB15 ON AUG. 4/2016
- LOGGER TIME & DATE: 11/29/14 4:51 @ 1:40pm

GOLDER PROJECT #1530908 PHASE 2000

ANNEX M: Thermistor Inspection Template

Inspector Name: DARRIN JOHNSON	Inspection Date: AUGUST 3, 2016
Inspector Signature / Prepared By:	

Thermistor Information (*Some Information can be pre-populated from thermistor logs)

Site Name: FOX-4 [redacted]		Landfill: TIER II	
Thermistor Number: VT-[redacted]		Inclination: 88°	
Datalogger model no: RX-16 [redacted]		Datalogger cable download model: USB [redacted]	
*Install Date:		First Date Event	Last Date Event
*Coordinates and Elevation	N 7595 975.5	E 588 705.7	Elev 23.2
Length of Cable (m)		Cable Lead Above Ground (m) ~6.5m	
Datalogger Serial # 07110044		Nodal Points 16	

Thermistor Inspection

	Good	Needs Maintenance	Description
Casing	☑	☐	
Cover	☑	☐	
Data Logger	☑	☐	
Cable	☑	☐	
Beads	☑	☐	
Lock condition	☐	☑	LOCK CHANGED

Battery Installation Date AUG. 3, 2016

Battery Levels Main 11.34 ✓ Aux 13.38V

Manual Ground Temperature Readings

Bead	ohms ✓	Degrees C
1	1.42	15.8
2	1.42	15.7
3	1.43	16.2
4	1.42	15.5
5	1.45	16.8
6	1.46	17.2
7	1.45	16.8
8	1.40	15.3

Bead	ohms ✓	Degrees C
9	1.21	8.8
10	1.11	5.5
11	1.00	2.0
12	0.93	-0.3
13	0.90	-1.1
14	0.83	-3.7
15	0.80	-4.7
16	0.78	-5.3

Battery Information

Batteries changed ? Yes ☑ No ☐ Monitoring Year: 2016

Battery model number installed: ULB15 & ULB1

Expected battery life (years): 7-8 YEARS (2023-2024)

Datalogger Programming (Describe programming completed; beads and frequency)

N/A

Observations and Proposed Maintenance

- REPLACED REPAIRED LOGGER WITH NEW ULB1 & ULB15 BATTERIES
- DOWNLOADED @ 1:53PM ON AUG 3, 2016

GOLDER PROJECT #1530908 PHASE 2000

ANNEX M: Thermistor Inspection Template

Inspector Name: DARRIN JOHNSON	Inspection Date: AUGUST 3, 2016
Inspector Signature / Prepared By:	

Thermistor Information (*Some Information can be pre-populated from thermistor logs)

Site Name: FOX-4 [redacted]		Landfill: TIER II	
Thermistor Number: V[redacted]		Inclination: 84°	
Datalogger model no: Rx[redacted]		Datalogger cable download model: CC USB [redacted]	
*Install Date: AUG. 3/2016		First Date Event	Last Date Event
*Coordinates and Elevation	N 7585947.7	E 588454.0	Elev 23.5
Length of Cable (m)	Cable Lead Above Ground (m) 6.5m		
Datalogger Serial # 07110082	Nodal Points 16		

Thermistor Inspection

	Good	Needs Maintenance	Description
Casing	☑	☐	
Cover	☑	☐	
Data Logger	☑	☐	
Cable	☑	☐	
Beads	☑	☐	
Lock condition	☐	☑	REPLACED LOCK

Battery Installation Date AUG 3, 2016

Battery Levels Main 11.34V Aux 13.38V

Manual Ground Temperature Readings

Bead	ohms	Degrees C
1	1.425	16.062
2	1.428	16.167
3	1.430	16.253
4	1.4425	16.638
5	1.4187	15.843
6	1.4328	16.336
7	1.4261	16.102
8	14.2695	14.482

Bead	ohms	Degrees C
9	1.2085	8.727
10	1.0927	4.932
11	0.9958	1.757
12	0.9305	− 0.2068
13	0.9059	−1.228
14	0.8293	−3.826
15	0.8023	−4.759
16	0.7855	−5.345

Battery Information

Batteries changed ? Yes ☑ No ☐ Monitoring Year: 2016

Battery model number installed: 4LB15 & 4LB3

Expected battery life (years): 7-8 YEARS (2023/2024)

Datalogger Programming (Describe programming completed; beads and frequency)

NONE

Observations and Proposed Maintenance

- LOGGER DATE 01/14/16, DOWNLOADED @ 12:15PM ON AUG.3
- REPLACED REPAIRED DATALOGGER WITH NEW 4LB3 & 4LB15 BATTERIES

GOLDER PROJECT #1530908 PHASE 2000

ANNEX M: Thermistor Inspection Template

Inspector Name: DARRIN JOHNSON	Inspection Date: AUGUST 3/2016
Inspector Signature / Prepared By:	

Thermistor Information (*Some Information can be pre-populated from thermistor logs)

Site Name:	FOX-4	Landfill: TIER II			
Thermistor Number:	VT-10	Inclination: 90° (VERTICAL)			
Datalogger model no:	RX	Datalogger cable download model: USB			
*Install Date:		First Date Event		Last Date Event	
*Coordinates and Elevation		N 7 595 950.9	E 588 479.7	Elev 23.9	
Length of Cable (m)		Cable Lead Above Ground (m) 2(m)			
Datalogger Serial # 07110249		Nodal Points 16			

Thermistor Inspection

	Good	Needs Maintenance	Description
Casing	☑	☐	
Cover	☐	☑	HARD TO REMOVE (REMOVED RUBBER RING)
Data Logger	☑	☐	
Cable	☑	☐	
Beads	☐	☐	
Lock condition	☐	☑	REPLACED
Battery Installation Date	2008 (BEFORE NEW BATTERIES IN 2016)		
Battery Levels	Main 0	Aux 0	

Manual Ground Temperature Readings

Bead	ohms ✓	Degrees C
1	1.45	16.98
2	1,30	11,69
3	1.15	6.76
4	1,04	3.08
5	0.94	-0.02
6	0.92	-0.84
7	0,86	-2,67
8	0.84	-3.59

Bead	ohms ✓	Degrees C
9	0.82	-4,17
10	0.80	-4.76
11	0.79	-5,21
12	0.78	-5,53
13	0.77	-5,77
14	0.77	-5,96
15	0	—
16	0	—

Battery Information

Batteries changed ? Yes ☑ No ☐ Monitoring Year: 2016

Battery model number installed: ULB15 & ULB1

Expected battery life (years): 7-8 YEARS (2023-2024)

Datalogger Programming (Describe programming completed; beads and frequency)

N/A

Observations and Proposed Maintenance

UNABLE TO DOWNLOAD (BATTERIES DEAD?)

Download with new battery (ULB-15 + ULB-1) @ 4:45PM ON Aug 3/16

clock: 11/07/14 time 3:42 @ 17:00

Appendix B4

FOX-4 Thermistors Field Sketch

RED PEN 2014 SENES NOTES

Red labels indicate thermistor ID in the field and on data filenames

ND - data not downloaded.

Aug. 3/2016 FIELD NOTES
DCJ

GENERAL NOTES:

1. ALL COORDINATES ARE REFERENCED TO NAD83 (CSRS), UTM ZONE 19N. ALL ELEVATIONS REFER TO GEODETIC DATUM.
2. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.

LEGEND:

△CLS50	SURVEY CONTROL MONUMENT (1)
⌐510	COORDINATE POINT
⌖	MONITORING WELL LOCATION (8)
⊞	VERTICAL GROUND TEMPERATURE CABLE LOCATION (10)
■	MONITORING SOIL SAMPLE LOCATION (8)
▨	TYPE 1 GRANULAR FILL
●	BODY OF WATER

NON-HAZARDOUS WASTE LANDFILL FINAL GRADING (AS-BUILT)

NO.	UTM COORDINATES		ELEV.
	NORTHING	EASTING	
510	7 596 113.7	588 437.8	22.1
511	7 596 104.2	588 466.2	22.8
512	7 596 064.6	588 509.2	23.9
513	7 596 048.4	588 504.0	23.9
514	7 596 068.8	588 423.5	22.1

NOTE:
COORDINATE POINTS AND ELEVATIONS PROVIDED ARE TO THE FINAL GRADE OF THE TYPE 2 GRANULAR FILL CAP PRIOR TO THE PLACEMENT OF THE TYPE 1 GRANULAR FILL ON THE SIDE SLOPES.

TIER II DISPOSAL FACILITY FINAL GRADING (AS-BUILT)

NO.	UTM COORDINATES		ELEV.
	NORTHING	EASTING	
620	7 596 047.1	588 411.5	21.7
621	7 596 021.5	588 501.6	22.1
622	7 595 983.8	588 491.8	22.1
623	7 595 975.7	588 485.5	24.3
624	7 595 929.1	588 472.2	23.3
625	7 595 954.3	588 383.6	22.3
626	7 596 001.4	588 397.0	23.2

NOTE:
COORDINATE POINTS AND ELEVATIONS PROVIDED ARE TO THE FINAL GRADE OF THE TYPE 2 GRANULAR FILL CAP PRIOR TO THE PLACEMENT OF THE TYPE 1 GRANULAR FILL ON THE SIDE SLOPES.

NON-HAZARDOUS WASTE LANDFILL TIER II DISPOSAL FACILITY MONITORING WELLS (AS-BUILT)

NO.	UTM COORDINATES		ELEV.
	NORTHING	EASTING	
MW11-01	7 596 130.8	588 468.4	21.0
MW11-02	7 596 046.4	588 459.4	19.5
MW11-03	7 596 025.9	588 524.3	20.3
MW11-04	7 595 961.2	588 536.5	19.2
MW11-05	7 595 911.0	588 450.4	18.6
MW11-06	7 595 926.0	588 352.6	18.0
MW12-07	7 595 977.9	588 334.9	16.4
MW12-08	7 596 055.8	588 361.3	18.7

TIER II DISPOSAL FACILITY GROUND TEMPERATURE CABLES (AS-BUILT)

NO.	UTM COORDINATES		ELEV.
	NORTHING	EASTING	
VT-3	7 596 002.9	588 436.3	22.5
VT-4	7 596 033.0	588 457.8	22.7
VT-5	7 595 989.1	588 481.2	22.6
VT-6	7 596 005.7	588 474.2	23.1
VT-7	7 595 949.9	588 398.2	22.4
VT-8	7 595 975.5	588 405.7	23.2
VT-9	7 595 947.7	588 454.0	23.5
VT-10	7 595 956.9	588 479.7	23.9

SURVEY CONTROL MONUMENTS

NO.	UTM COORDINATES		ELEV.	DESCRIPTION
	NORTHING	EASTING		
CLS52	7 596 134.413	588 421.327	19.969	19mm DIA. REBAR AND CAP

0 10 20m

SENES Consultants
AN ARCADIS COMPANY

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

2014 DEW LINE MONITORING PROGRAM

FOX-4 CAPE HOOPER, NUNAVUT
NON-HAZARDOUS WASTE LANDFILL AND TIER II DISPOSAL FACILITY
SAMPLE LOCATION PLAN

Drawn By: P.A.L.	Approved By: C.F.G.	Project No: 350600-515
Date: JULY 2014	Scale: 1:1250	Drawing No: FIGURE 15

Jul 18, 2014 - 11:21am - USER plandry
Z:\350000 Series\350600-515 Baffin DEW Line Monitoring\Landfill Drawings as per DND\FOX-4_4 YEAR 1.dwg

Appendix B5

FOX-4 Monitoring Well Log Sheets

ANNEX J: Monitoring Well Sampling Log (Complete All Fields)

Site Name: Fox 4 Landfill Name: STATION area

Monitoring Well ID: MW-1

Sample Number(s) include dups.: 0

Bottles filled (by parameter type): 0

Date of Sampling Event: Aug 4 Time: 17:40

Weather: +20°c Sunny

Names of Samplers: JB, KL

Description of Well Condition and Surrounding ground conditions (note ponding of water):
Bentonite + water poured up beyond well in casing. removed casing to sample

Lock (condition, presence, model, manufacturer): OK

Pre-Measured Data (From Water Well Record Log)

*Depth of well installation (cm)= ______ Diameter of well (cm)= ______

*Depth to top of screen (cm)= ______ Length screened section (cm)= ______

*note: *depths are from ground surface*

Field Measurements

Measurement method ([✓ interface probe], tape, etc): ______

Well pipe height above ground (cm) (to top of pipe)= ______

Static water level (cm) from top of pipe = ______

Static water level (cm) (below ground surface) calculated = ______

Measured well refusal depth (cm) (measure after sampling)= 149.1 cm dry

Thickness of water column (cm)= ______ Static volume of water in well (mL)= ______

Free product thickness (mm)= ______ Evidence of sludge or siltation: ______

Purging Information Summary*

Purging/sampling equipment, sampling technique and equipment calibration information: ______

Well purged (Y/N): ______ Recharge Rate: ______

Volume Purged (L) (note multiple purging events if applicable): ______

Parameter	Initial	Stabilized	Final	Notes (if not stabilized)
pH				
Conductivity (uS/cm)				
Turbidity (NTU)				
Temperature (degC)				

Visual/olfactory observations (incl. colour, odour, presence of free product/sheen/globules, siltation…): ______

Decontamination of sampling equipment

Type of decontamination fluid (s): SOAP, water decon interface probe

Number washes: ______ Number rinses: ______

Other Relevant Comments: 1 CM of water in well due to the removalE of casing. plug not attached properly

* Complete field notes including full suite of water quality indicator parameters VS time as per EPA low flow sampling procedures should be apended to this summary.

ANNEX J: Monitoring Well Sampling Log (Complete All Fields)

Site Name: Fox4 Landfill Name: heli pad
Monitoring Well ID: MW-2
Sample Number(s) include dups.:
Bottles filled (by parameter type): All
Date of Sampling Event: Aug 4 Time: 16:30
Weather: +20° Sunny,
Names of Samplers: JB
Description of Well Condition and Surrounding ground conditions (note ponding of water):
dry ground, casing ponded w water and bentonite above plug
Lock (condition, presence, model, manufacturer): No Lock added crown Lock

Pre-Measured Data (From Water Well Record Log)

*Depth of well installation (cm)= Diameter of well (cm)=
*Depth to top of screen (cm)= Length screened section (cm)=
*note: *depths are from ground surface*

Field Measurements

Measurement method (interface probe, tape, etc):
Well pipe height above ground (cm) (to top of pipe)= 60 cm
Static water level (cm) from top of pipe = 76 cm
Static water level (cm) (below ground surface) calculated = 1[illegible]6cm
Measured well refusal depth (cm) (measure after sampling)=
Thickness of water column (cm)= Static volume of water in well (mL)=
Free product thickness (mm)= Evidence of sludge or siltation:

Purging Information Summary*

Purging/sampling equipment, sampling technique and equipment calibration information: peristaltic pump
Well purged (Y/N): Recharge Rate:
Volume Purged (L) (note multiple purging events if applicable):

Parameter	Initial	Stabilized	Final	Notes (if not stabilized)
pH	6.65	6.97	6.89	
Conductivity (~~uS~~/cm) mS	101	.267	.288	
Turbidity (NTU)	220	190	66	
Temperature (degC)	11.08	9.49	7.56	

→ other side

Visual/olfactory observations (incl. colour, odour, presence of free product/sheen/globules, siltation…): Cloudy, no odour

Decontamination of sampling equipment

Type of decontamination fluid (s): water/soap, methyl interface probe disposable Tubing
Number washes: Number rinses:
Other Relevant Comments: pulled casing to access well.

* Complete field notes including full suite of water quality indicator parameters VS time as per EPA low flow sampling procedures should be apended to this summary.

ANNEX J: Monitoring Well Sampling Log (Complete All Fields)

Site Name: Fox 4 Landfill Name: Heli PAd Landfill

Monitoring Well ID: MW-3

Sample Number(s) include dups.: 0

Bottles filled (by parameter type): 0

Date of Sampling Event: Aug 4th Time: 17:00

Weather: +20 Sunny

Names of Samplers: JB, KL

Description of Well Condition and Surrounding ground conditions (note ponding of water):

Bentonite buldging from casing

Lock (condition, presence, model, manufacturer): ok

Pre-Measured Data (From Water Well Record Log)

*Depth of well installation (cm)= Diameter of well (cm)=

*Depth to top of screen (cm)= Length screened section (cm)=

*note: *depths are from ground surface*

Field Measurements

Measurement method([✓ interface probe], tape, etc):

Well pipe height above ground (cm) (to top of pipe)= 30cm

Static water level (cm) from top of pipe =

Static water level (cm) (below ground surface) calculated =

Measured well refusal depth (cm) (measure after sampling)= 108.5cm dry

Thickness of water column (cm)= Static volume of water in well (mL)=

Free product thickness (mm)= Evidence of sludge or siltation:

Purging Information Summary*

Purging/sampling equipment, sampling technique and equipment calibration information:

Well purged (Y/N): Recharge Rate:

Volume Purged (L) (note multiple purging events if applicable):

Parameter	Initial	Stabilized	Final	Notes (if not stabilized)
pH				
Conductivity (uS/cm)				
Turbidity (NTU)				
Temperature (degC)				

Visual/olfactory observations (incl. colour, odour, presence of free product/sheen/globules, siltation...):

Decontamination of sampling equipment

Type of decontamination fluid (s): Soap water decon interface probe

Number washes: 1 Number rinses: 1

Other Relevant Comments: dry well

* Complete field notes including full suite of water quality indicator parameters VS time as per EPA low flow sampling procedures should be apended to this summary.

ANNEX J: Monitoring Well Sampling Log (Complete All Fields)

Site Name: Fox 4 Landfill Name: Helicopter landing pad

Monitoring Well ID: MW-6

Sample Number(s) include dups.:

Bottles filled (by parameter type): 0

Date of Sampling Event: Aug 4th Time: 15:50

Weather: +20 sunny, slight breeze

Names of Samplers: JB

Description of Well Condition and Surrounding ground conditions (note ponding of water): dry ground, evidence of frost lifting casing bentonite sludge in casing

Lock (condition, presence, model, manufacturer): replaced Lock

Pre-Measured Data (From Water Well Record Log)

*Depth of well installation (cm)= Diameter of well (cm)=

*Depth to top of screen (cm)= Length screened section (cm)=

*note: *depths are from ground surface*

Field Measurements

Measurement method (interface probe, tape, etc): interface probe

Well pipe height above ground (cm) (to top of pipe)=

Static water level (cm) from top of pipe =

Static water level (cm) (below ground surface) calculated =

Measured well refusal depth (cm) (measure after sampling)= 103cm drywell

Thickness of water column (cm)= Static volume of water in well (mL)=

Free product thickness (mm)= Evidence of sludge or siltation:

Purging Information Summary*

Purging/sampling equipment, sampling technique and equipment calibration information:

Well purged (Y/N): Recharge Rate:

Volume Purged (L) (note multiple purging events if applicable):

Parameter	Initial	Stabilized	Final	Notes (if not stabilized)
pH				
Conductivity (uS/cm)				
Turbidity (NTU)				
Temperature (degC)				

Visual/olfactory observations (incl. colour, odour, presence of free product/sheen/globules, siltation…):

Decontamination of sampling equipment

Type of decontamination fluid (s): water soap methyl water decon interface

Number washes: 1 Number rinses: 2

Other Relevant Comments:

* Complete field notes including full suite of water quality indicator parameters VS time as per EPA low flow sampling procedures should be apended to this summary.

ANNEX J: Monitoring Well Sampling Log (Complete All Fields)

Site Name: Fox 4 Landfill Name: Station Area Landfill

Monitoring Well ID: MW-9

Sample Number(s) include dups.: none.

Bottles filled (by parameter type): none

Date of Sampling Event: August 4th Time: 2:45

Weather: +20 light breeze.

Names of Samplers: JR / KR.

Description of Well Condition and Surrounding ground conditions (note ponding of water): ponded water in casing above

Lock (condition, presence, model, manufacturer): replaced crown lock.

Pre-Measured Data (From Water Well Record Log)

*Depth of well installation (cm)= ______ Diameter of well (cm)= ______

*Depth to top of screen (cm)= ______ Length screened section (cm)= ______

*note: *depths are from ground surface*

Field Measurements

Measurement method ([✓ interface probe], tape, etc): ______

Well pipe height above ground (cm) (to top of pipe)= 0

Static water level (cm) from top of pipe = 187.2

Static water level (cm) (below ground surface) calculated = ~~197.2~~

Measured well refusal depth (cm) (measure after sampling)= 194.2

Thickness of water column (cm)= ______ Static volume of water in well (mL)= ______

Free product thickness (mm)= ______ Evidence of sludge or siltation: ______

Purging Information Summary*

Purging/sampling equipment, sampling technique and equipment calibration information: dug out bentonite and water from within casing cage has settled

Well purged (Y/N): ______ Recharge Rate: ______

Volume Purged (L) (note multiple purging events if applicable): ______

Parameter	Initial	Stabilized	Final	Notes (if not stabilized)
pH				
Conductivity (uS/cm)				
Turbidity (NTU)				
Temperature (degC)				

Visual/olfactory observations (incl. colour, odour, presence of free product/sheen/globules, siltation…): ______

Decontamination of sampling equipment

Type of decontamination fluid (s): ______

Number washes: ______ Number rinses: ______

Other Relevant Comments: unable to sample without getting sediment in pipe. looks like bentonite has fallen in well

* Complete field notes including full suite of water quality indicator parameters VS time as per EPA low flow sampling procedures should be apended to this summary.

ANNEX J: Monitoring Well Sampling Log (Complete All Fields)

Site Name: Fox 4 Landfill Name: Station area Landfill

Monitoring Well ID: MW-8

Sample Number(s) include dups.:

Bottles filled (by parameter type):

Date of Sampling Event: Aug 4 /16 Time: 15:00

Weather: +20°c Sunny, slight breeze

Names of Samplers: JB/KR

Description of Well Condition and Surrounding ground conditions (note ponding of water): ~~ponded~~ ~~water~~ dry ground, casing filler pushed up (bentonite)

Lock (condition, presence, model, manufacturer): Changed to crown

Pre-Measured Data (From Water Well Record Log)

*Depth of well installation (cm)= Diameter of well (cm)=

*Depth to top of screen (cm)= Length screened section (cm)=

*note: *depths are from ground surface*

Field Measurements

Measurement method (interface probe, tape, etc): Interface probe

Well pipe height above ground (cm) (to top of pipe)=

Static water level (cm) from top of pipe =

Static water level (cm) (below ground surface) calculated =

Measured well refusal depth (cm) (measure after sampling)= 105.2cm dry

Thickness of water column (cm)= Static volume of water in well (mL)=

Free product thickness (mm)= Evidence of sludge or siltation:

Evidence of sludge bentonite

Purging Information Summary*

Purging/sampling equipment, sampling technique and equipment calibration information:

Well purged (Y/N): Recharge Rate:

Volume Purged (L) (note multiple purging events if applicable):

Parameter	Initial	Stabilized	Final	Notes (if not stabilized)
pH				
Conductivity (uS/cm)				
Turbidity (NTU)				
Temperature (degC)				

Visual/olfactory observations (incl. colour, odour, presence of free product/sheen/globules, siltation…):

Decontamination of sampling equipment

Type of decontamination fluid (s): Soap, water decon interface prob

Number washes: 2 Number rinses: 1

Other Relevant Comments:

* Complete field notes including full suite of water quality indicator parameters VS time as per EPA low flow sampling procedures should be apended to this summary.

ANNEX J: Monitoring Well Sampling Log (Complete All Fields)

Site Name: Fox 4 Landfill Name: Station area Landfill

Monitoring Well ID: MW-9

Sample Number(s) include dups.:

Bottles filled (by parameter type): 0

Date of Sampling Event: Aug 4th Time: 15:15

Weather: +20°c Sunny slight breeze

Names of Samplers: JB/KR

Description of Well Condition and Surrounding ground conditions (note ponding of water):
dry ground well casing ponded with sludge ~~f~~ from bentonite, able to remove w̄ gloves

Lock (condition, presence, model, manufacturer):

Pre-Measured Data (From Water Well Record Log)

*Depth of well installation (cm)= Diameter of well (cm)=

*Depth to top of screen (cm)= Length screened section (cm)=

*note: *depths are from ground surface*

Field Measurements

Measurement method (interface probe, tape, etc): interface probe

Well pipe height above ground (cm) (to top of pipe)=

Static water level (cm) from top of pipe =

Static water level (cm) (below ground surface) calculated =

Measured well refusal depth (cm) (measure after sampling)= 104cm dry possible ice

Thickness of water column (cm)= Static volume of water in well (mL)=

Free product thickness (mm)= Evidence of sludge or siltation:

Purging Information Summary*

Purging/sampling equipment, sampling technique and equipment calibration information:

Well purged (Y/N): Recharge Rate:

Volume Purged (L) (note multiple purging events if applicable):

Parameter	Initial	Stabilized	Final	Notes (if not stabilized)
pH				
Conductivity (uS/cm)				
Turbidity (NTU)				
Temperature (degC)				

Visual/olfactory observations (incl. colour, odour, presence of free product/sheen/globules, siltation…):

Decontamination of sampling equipment

Type of decontamination fluid (s): Soap, water decon interface probe

Number washes: Number rinses:

Other Relevant Comments:

* Complete field notes including full suite of water quality indicator parameters VS time as per EPA low flow sampling procedures should be apended to this summary.

ANNEX J: Monitoring Well Sampling Log (Complete All Fields)

Site Name: Fox 4 Landfill Name: Non haz Pier 2

Monitoring Well ID: MW11-1

Sample Number(s) include dups.:

Bottles filled (by parameter type): all + Dup

Date of Sampling Event: Aug 3rd Time: 11:30

Weather: 15°c NO windy Sunny

Names of Samplers: JB, RN

Description of Well Condition and Surrounding ground conditions (note ponding of water):

dry ground Well in good condition

Lock (condition, presence, model, manufacturer): replaced Lock crown

Pre-Measured Data (From Water Well Record Log)

*Depth of well installation (cm)= Diameter of well (cm)=

*Depth to top of screen (cm)= Length screened section (cm)=

*note: *depths are from ground surface*

Field Measurements

Measurement method (interface probe, tape, etc): interface probe

Well pipe height above ground (cm) (to top of pipe)= 81

Static water level (cm) from top of pipe = 182.4

Static water level (cm) (below ground surface) calculated = 296.5

Measured well refusal depth (cm) (measure after sampling)=

Thickness of water column (cm)= Static volume of water in well (mL)=

Free product thickness (mm)= Evidence of sludge or siltation: NO

Purging Information Summary*

Purging/sampling equipment, sampling technique and equipment calibration information: peristaltic pump

Well purged (Y/N): Recharge Rate:

Volume Purged (L) (note multiple purging events if applicable):

Parameter	Initial	Stabilized	Final	Notes (if not stabilized)
pH	7.38	7.08	6.78	
Conductivity (~~uS/cm~~) mScm	.057	.057	.057	
Turbidity (NTU)	0.0	00	00	
Temperature (degC)	9.45	7.32	6.14	

Visual/olfactory observations (incl. colour, odour, presence of free product/sheen/globules, siltation…): clear no odour

Decontamination of sampling equipment

Type of decontamination fluid (s): Methyl water soap decon of interface probe

Number washes: 1 Number rinses: 1

Other Relevant Comments: disposable tubing

* Complete field notes including full suite of water quality indicator parameters VS time as per EPA low flow sampling procedures should be apended to this summary.

ANNEX J: Monitoring Well Sampling Log (Complete All Fields)

Site Name: Fox 4 Landfill Name: NON hazardous Tier 2

Monitoring Well ID: MW11-2

Sample Number(s) include dups.:

Bottles filled (by parameter type): All

Date of Sampling Event: Aug 3 Time: 14:30

Weather: 15°c overcast

Names of Samplers: JB. RN

Description of Well Condition and Surrounding ground conditions (note ponding of water):

Surrounding groudd is ponded. Moist in casing.

Lock (condition, presence, model, manufacturer): good. crown

Pre-Measured Data (From Water Well Record Log)

*Depth of well installation (cm)= Diameter of well (cm)=

*Depth to top of screen (cm)= Length screened section (cm)=

*note: *depths are from ground surface*

Field Measurements

Measurement method (interface probe, tape, etc): interface probe

Well pipe height above ground (cm) (to top of pipe)= 52cm

Static water level (cm) from top of pipe = 49.2cm

Static water level (cm) (below ground surface) calculated = ~~108.2~~ 108.2

Measured well refusal depth (cm) (measure after sampling)=

Thickness of water column (cm)= Static volume of water in well (mL)=

Free product thickness (mm)= Evidence of sludge or siltation: NO

Purging Information Summary*

Purging/sampling equipment, sampling technique and equipment calibration information:

Well purged (Y/N): Recharge Rate:

Volume Purged (L) (note multiple purging events if applicable):

Parameter	Initial	Stabilized	Final	Notes (if not stabilized)
pH	5.69	5.83	5.98	
Conductivity (~~uS~~/cm) mS	.644	.748	.869	
Turbidity (NTU)	7.1	7.9	6.8	
Temperature (degC)	10.27	9.71	9.09	

Visual/olfactory observations (incl. colour, odour, presence of free product/sheen/globules, siltation...): clear no odour

Decontamination of sampling equipment

Type of decontamination fluid (s): SOAP = water decon interface

Number washes: Number rinses:

Other Relevant Comments:

* Complete field notes including full suite of water quality indicator parameters VS time as per EPA low flow sampling procedures should be apended to this summary.

ANNEX J: Monitoring Well Sampling Log (Complete All Fields)

Site Name: Fox 4 Landfill Name: Non haz Pier 2
Monitoring Well ID: MW 11-3
Sample Number(s) include dups.: No dup
Bottles filled (by parameter type): All
Date of Sampling Event: Aug 3 Time:
Weather: 15°C sunny
Names of Samplers: JB RN
Description of Well Condition and Surrounding ground conditions (note ponding of water):
ponding water in well casing.
Lock (condition, presence, model, manufacturer): good crown

Pre-Measured Data (From Water Well Record Log)

*Depth of well installation (cm)= Diameter of well (cm)=
*Depth to top of screen (cm)= Length screened section (cm)=
*note: *depths are from ground surface*

Field Measurements

Measurement method (interface probe, tape, etc): interface probe
Well pipe height above ground (cm) (to top of pipe)= 34
Static water level (cm) from top of pipe = 145.cm
Static water level (cm) (below ground surface) calculated = 175.6cm
Measured well refusal depth (cm) (measure after sampling)=
Thickness of water column (cm)= Static volume of water in well (mL)=
Free product thickness (mm)= Evidence of sludge or siltation: NO

Purging Information Summary*

Purging/sampling equipment, sampling technique and equipment calibration information: peristaltic pump
Well purged (Y/N): Recharge Rate:
Volume Purged (L) (note multiple purging events if applicable):

Parameter	Initial	Stabilized	Final	Notes (if not stabilized)
pH	5.87	5.55	5.50	
Conductivity (~~uS~~/cm) mS	0.136	.142	.145	
Turbidity (NTU)	18.	13.8	13.2	
Temperature (degC)	9.28	8.98	8.32	

Visual/olfactory observations (incl. colour, odour, presence of free product/sheen/globules, siltation…): clear no odour

Decontamination of sampling equipment

Type of decontamination fluid (s): Soap & water decon interface probe, disposable tubing
Number washes: 2 Number rinses: 1
Other Relevant Comments:

* Complete field notes including full suite of water quality indicator parameters VS time as per EPA low flow sampling procedures should be apended to this summary.

ANNEX J: Monitoring Well Sampling Log (Complete All Fields)

Site Name: Fox 4 Landfill Name: Non Haz Pier 2

Monitoring Well ID: MW 11-4

Sample Number(s) include dups.:

Bottles filled (by parameter type): All

Date of Sampling Event: Aug 3 Time:

Weather:

Names of Samplers: JB

Description of Well Condition and Surrounding ground conditions (note ponding of water):

Lock (condition, presence, model, manufacturer):

Pre-Measured Data (From Water Well Record Log)

*Depth of well installation (cm)= Diameter of well (cm)=

*Depth to top of screen (cm)= Length screened section (cm)=

*note: *depths are from ground surface*

Field Measurements

Measurement method (interface probe, tape, etc):

Well pipe height above ground (cm) (to top of pipe)= 31cm

Static water level (cm) from top of pipe = 95.6cm

Static water level (cm) (below ground surface) calculated = 159.9

Measured well refusal depth (cm) (measure after sampling)=

Thickness of water column (cm)= Static volume of water in well (mL)=

Free product thickness (mm)= Evidence of sludge or siltation: NO

Purging Information Summary*

Purging/sampling equipment, sampling technique and equipment calibration information:

Well purged (Y/N): Recharge Rate:

Volume Purged (L) (note multiple purging events if applicable):

Parameter	Initial	Stabilized	Final	Notes (if not stabilized)
pH	6.96	7.05	7.05	
Conductivity (~~uS~~/cm) mS	.216	.165	.108	
Turbidity (NTU)	28.6	18.5	20.6	
Temperature (degC)	10.0	9.11	7.94	

Visual/olfactory observations (incl. colour, odour, presence of free product/sheen/globules, siltation...): Cloudy no odour

Decontamination of sampling equipment

Type of decontamination fluid (s): decon interface w̄ soap + water, disposable tubing

Number washes: Number rinses:

Other Relevant Comments:

* Complete field notes including full suite of water quality indicator parameters VS time as per EPA low flow sampling procedures should be apended to this summary.

ANNEX J: Monitoring Well Sampling Log (Complete All Fields)

Site Name: Fox 4 Landfill Name: Non haz + Tier 2

Monitoring Well ID: MW11-5

Sample Number(s) include dups.: No dup

Bottles filled (by parameter type): All

Date of Sampling Event: Aug 2nd 2016 Time: 15:00

Weather: 15 plus 30KM

Names of Samplers: JB, KR

Description of Well Condition and Surrounding ground conditions (note ponding of water):

Moist ground. ponded water within the casing but not above cap

Lock (condition, presence, model, manufacturer):

Pre-Measured Data (From Water Well Record Log)

*Depth of well installation (cm)= Diameter of well (cm)=

*Depth to top of screen (cm)= Length screened section (cm)=

*note: *depths are from ground surface*

Field Measurements

Measurement method ([✓ interface probe], tape, etc):

Well pipe height above ground (cm) (to top of pipe)= 34cm

Static water level (cm) from top of pipe = 62cm

Static water level (cm) (below ground surface) calculated = 1m 38 cm

Measured well refusal depth (cm) (measure after sampling)= 147.5cm

Thickness of water column (cm)= Static volume of water in well (mL)=

Free product thickness (mm)= Evidence of sludge or siltation: No

Purging Information Summary*

Purging/sampling equipment, sampling technique and equipment calibration information: peristaltic pump

Well purged (Y/N): Recharge Rate:

Volume Purged (L) (note multiple purging events if applicable):

Parameter	Initial	Stabilized	Final	Notes (if not stabilized)
pH	7.52	7.11	6.54	
Conductivity (uS/cm)	0.193 mS/cm	0.210	0.190	
Turbidity (NTU)	0.0	0.0	0.0	
Temperature (degC)	12.03	9.89	9.19	

Visual/olfactory observations (incl. colour, odour, presence of free product/sheen/globules, siltation...): no visual or olfactory, clear

Decontamination of sampling equipment

Type of decontamination fluid (s): disposable tubing, decon interface prob supp, water, methyal

Number washes: Number rinses:

Other Relevant Comments: slow recharge removed half water colum before sampling

* Complete field notes including full suite of water quality indicator parameters VS time as per EPA low flow sampling procedures should be apended to this summary.

ANNEX J: Monitoring Well Sampling Log (Complete All Fields)

Site Name: Fox 4 Landfill Name: NON haz Tier 2
Monitoring Well ID: MW11-4
Sample Number(s) include dups.:
Bottles filled (by parameter type): No samples well dry
Date of Sampling Event: Aug 2 Time: 16:10
Weather: 15°c
Names of Samplers: JB, KR
Description of Well Condition and Surrounding ground conditions (note ponding of water):
dry ground, well in good condition
Lock (condition, presence, model, manufacturer):

Pre-Measured Data (From Water Well Record Log)

*Depth of well installation (cm)= Diameter of well (cm)=
*Depth to top of screen (cm)= Length screened section (cm)=
*note: *depths are from ground surface*

Field Measurements

Measurement method ([✓ interface probe] tape, etc):
Well pipe height above ground (cm) (to top of pipe)= 56cm
Static water level (cm) from top of pipe =
Static water level (cm) (below ground surface) calculated = ?
Measured well refusal depth (cm) (measure after sampling)= 98.4cm
Thickness of water column (cm)= Static volume of water in well (mL)=
Free product thickness (mm)= Evidence of sludge or siltation: NO

Purging Information Summary*

Purging/sampling equipment, sampling technique and equipment calibration information:
Well purged (Y/N): Recharge Rate:
Volume Purged (L) (note multiple purging events if applicable):

Parameter	Initial	Stabilized	Final	Notes (if not stabilized)
pH				
Conductivity (uS/cm)				
Turbidity (NTU)				
Temperature (degC)				

Visual/olfactory observations (incl. colour, odour, presence of free product/sheen/globules, siltation...):

Decontamination of sampling equipment

Type of decontamination fluid (s): interface probe decon soap & water
Number washes: Number rinses:
Other Relevant Comments: Well Cap Missing, replaced w̄ New one
dry well

* Complete field notes including full suite of water quality indicator parameters VS time as per EPA low flow sampling procedures should be apended to this summary.

ANNEX J: Monitoring Well Sampling Log (Complete All Fields)

Site Name: Fox 4 Landfill Name: NON HAZ Pier 2

Monitoring Well ID: MW12-7

Sample Number(s) include dups.: No dup

Bottles filled (by parameter type): ~~JB, KR~~ All

Date of Sampling Event: Aug 2 Time: 16:30

Weather: 15°c

Names of Samplers: JB, KR

Description of Well Condition and Surrounding ground conditions (note ponding of water): Moist ground

Lock (condition, presence, model, manufacturer): Lock in good condition, Crown

Pre-Measured Data (From Water Well Record Log)

*Depth of well installation (cm)= Diameter of well (cm)=

*Depth to top of screen (cm)= Length screened section (cm)=

*note: *depths are from ground surface*

Field Measurements

Measurement method (interface probe, tape, etc):

Well pipe height above ground (cm) (to top of pipe)= 32 cm See photo

Static water level (cm) from top of pipe = 82.7 cm

Static water level (cm) (below ground surface) calculated = 144 cm

Measured well refusal depth (cm) (measure after sampling)=

Thickness of water column (cm)= Static volume of water in well (mL)=

Free product thickness (mm)= Evidence of sludge or siltation: NO

Purging Information Summary*

Purging/sampling equipment, sampling technique and equipment calibration information: peristaltic pump

Well purged (Y/N): Recharge Rate:

Volume Purged (L) (note multiple purging events if applicable):

Parameter	Initial	Stabilized	Final	Notes (if not stabilized)
pH	6.26	6.04		
Conductivity (~~uS/cm~~) mS/cm	0.147	0.145		
Turbidity (NTU)	3.7	2.5		
Temperature (degC)	10.50	11.23		

Visual/olfactory observations (incl. colour, odour, presence of free product/sheen/globules, siltation…): no odour, clear

Decontamination of sampling equipment

Type of decontamination fluid (s): interface probe decon w/ water + soap. disposable Tubing

Number washes: Number rinses:

Other Relevant Comments: see Photo. bentonite heaped

* Complete field notes including full suite of water quality indicator parameters VS time as per EPA low flow sampling procedures should be apended to this summary.

ANNEX J: Monitoring Well Sampling Log (Complete All Fields)

Site Name: Fox 4 Landfill Name: Non haz pier 2

Monitoring Well ID: MW12-8

Sample Number(s) include dups.:

Bottles filled (by parameter type):

Date of Sampling Event: Aug 3 Time: 10:40

Weather: 15°c Nowind sunny

Names of Samplers: JB

Description of Well Condition and Surrounding ground conditions (note ponding of water):

dry ground, dry well. Casing in good Condition

Lock (condition, presence, model, manufacturer): OK crown

Pre-Measured Data (From Water Well Record Log)

*Depth of well installation (cm)= Diameter of well (cm)=

*Depth to top of screen (cm)= Length screened section (cm)=

*note: *depths are from ground surface*

Field Measurements

Measurement method (interface probe, tape, etc):

Well pipe height above ground (cm) (to top of pipe)=

Static water level (cm) from top of pipe =

Static water level (cm) (below ground surface) calculated =

Measured well refusal depth (cm) (measure after sampling)= 172.9cm dry well

Thickness of water column (cm)= Static volume of water in well (mL)=

Free product thickness (mm)= Evidence of sludge or siltation: No

Purging Information Summary*

Purging/sampling equipment, sampling technique and equipment calibration information: ~~peristaltic pump~~

Well purged (Y/N): Recharge Rate:

Volume Purged (L) (note multiple purging events if applicable):

Parameter	Initial	Stabilized	Final	Notes (if not stabilized)
pH				
Conductivity (uS/cm)				
Turbidity (NTU)				
Temperature (degC)				

Visual/olfactory observations (incl. colour, odour, presence of free product/sheen/globules, siltation…):

Decontamination of sampling equipment

Type of decontamination fluid (s): Interface probe w̄ soap water

Number washes: Number rinses:

Other Relevant Comments: dry well

* Complete field notes including full suite of water quality indicator parameters VS time as per EPA low flow sampling procedures should be apended to this summary.

Appendix B6

FOX-4 Soil Sampling Field Notes

SITE NAME: Fox 4

RECORD OF S AMPLING

DAT

SAMPLER NAME:

LANDFILL NAME	SOIL SAMPLE ID	DEPTH (m)	SOIL DESCRIPTION	GPS Northing	GPS Easting	GPS Elevation	Photographs	Backfilled (Y/N)	
Non Haz Tier 2	MW-11-5a	50cm	brown sand with water				3	Y	Aug2 3pm
Non Haz Tier 2	MW-11-5b	30 cm	brown sand				3	Y	
Non Haz Tier 2	MW-11-6a	40cm	refusal (rocky) at 40cm cobbles and sand dry				3	Y	4pm Aug2
Non Haz Tier 2	MW-11-6b	30cm	Brown Sand dry.				3	Y	~~[illegible]~~
"	MW 12-7a	40 cm	Silty sand wet				3	Y	4:25 Aug2
"	MW 12-7b	20cm	silty sand moist.				3	Y	
Tamer Bay	F4-13a	50cm	silty / wet brown Duplicate				3	Y	Aug3
Tamer Bay	F4-13b	30cm	silty sand				3	Y	Aug
"	F4-12a	40cm	Boulder refusal at 40cm Wet loose silty sand				3	Y	
"	F4-12b	30	loose silty sand w/ boulders				3	Y	

ITE NAME:

RECORD OF SOIL SAMPLING

DATE: Aug 3rd
SAMPLER NAME:

LANDFILL NAME	SOIL SAMPLE ID	DEPTH (m)	SOIL DESCRIPTION	GPS Northing	GPS Easting	GPS Elevation	Photographs	Backfilled (Y/N)
Tane Bay	F4-11a	50cm	dark brown silty sand w/ organics				3	Y
Tane Bay	F4-11b	30cm	loose sand and boulders.				3	Y
Non Haz Tier 2	MW 12-8a	50cm	loose sand with rocks				3	Y
Non Haz Tier 2	MW 12-8b	30cm	loose sand	Diesel Smell			3	Y
Non Haz Tier 2	MW 11-1a	40cm	Rocky refusal at 40cm. sand + Rock (cobbles)				3	Y
Non Haz Tier 2	MW11-1b	30cm	sand, some silt organics (small roots)	Duplicate			3	Y
Pallet line landfill	F4-29a	30cm.	sand/cobble hard pack refusal due to hard packed rocks				3	Y
~~Pallet line landfill~~	~~F4~~-29	not sampled; too hard packed to go deeper						
Non haz Tier 2	MW11-1a	30cm	silt and some sand w/ cobble very wet Rocky refusal				3	Y
Non haz Tier 2	MW11-3a	40cm	large rocks/refusal at 40cm sand above rocks.				3	Y

SITE NAME:

RECORD OF SAMPLING

DA

SAMPLER NAME:

LANDFILL NAME	SOIL SAMPLE ID	DEPTH (m)	SOIL DESCRIPTION	GPS Northing	GPS Easting	GPS Elevation	Photographs	Backfilled (Y/N)
non haz Tier 2	MW11-3B	30	sand				3	Y
non haz Tier 2	MW11-4A	30cm	sand w cobble Large rock refusal				3	Y
non haz Tier 2	F25A	30cm	sand w cobble refusal due to hard packed rocks				3	Y
non haz Tier 2	F26A	<30cm	Sand w Cobble refusal due to Rock & Cobble				3	Y
non haz Tier 2	F27A	30cm	Loose sand Refusal at sand and rock				3	Y
~~Area~~ Station area Landfill	MW-7A	<30	gravel, Rock Loose sand refusal at bedrock				3	Y
STAtion area Landfill	MW-8A	<30	gravel, Rock with sand.				3	Y
Station area Landfill	MW-8b	40	sand w small cobble Refusal at Larger cobble				3	Y
Station area Landfill	MW-9a	30	sand w gravel and rock. refusal at compacted rock				3	Y
Landing pad	MW-6a	<30	gravel, rock, compact sand Refusal at compact rock					

Aug 3

Aug

Aug 4

Golder Project #1530908 Phase 1000

GOLDER ASSOCIATES

SITE NAME:

RECORD OF SOIL SAMPLING

DATE: Aug 4

SAMPLER NAME:

LANDFILL NAME	SOIL SAMPLE ID	DEPTH (m)	SOIL DESCRIPTION	GPS Northing	GPS Easting	GPS Elevation	Photographs	Backfilled (Y/N)	
landing pad	MW-2a	30cm	silty sand diesel odour				3	Y	
~~landing pad~~	~~MW-2b~~		rocky refusal wet						
Landing pad	MW-1a	30cm	silty sand and gravel large rock refusal				3	Y	
landing pad	MW-3a dup	30cm	dry sand				3	Y	
landing pad	MW-3b	50cm					3	Y	Aug 4
Pallet line	F4-28a	<30cm	Rocky refusal Brown sand and cobbles.	duplicate.			3	Y	Aug 5
Pallet line	F4-Rinsate.	Equipment Rinsate Sample							Aug 5

APPENDIX C

Laboratory Certificates of Analysis and QA/QC Reports Historical Monitoring Results

Appendix C1

Certificate Of Analysis –
Paracel Laboratories Ltd.,
Aug. 15, 2016; Order #1633139

PARACEL
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300 - 2319 St. Laurent Blvd
Ottawa, ON, K1G 4J8
1-800-749-1947
www.paracellabs.com

Certificate of Analysis

Golder Associates Ltd. (Ottawa)

1931 Robertson Rd.
Ottawa, ON K2H 5B7
Attn: Alyssa Troke

Client PO:
Project: 1530908-2000
Custody: 108715, 108714, 108716

Report Date: 15-Aug-2016
Order Date: 9-Aug-2016

Order #: 1633139

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1633139-01	MW11-1a
1633139-02	MW11-1b
1633139-03	MW11-2a
1633139-04	MW11-3a
1633139-05	MW11-3b
1633139-06	MW11-4a
1633139-07	MW11-5a
1633139-08	MW11-5b
1633139-09	MW11-6a
1633139-10	F4-11a
1633139-11	F4-11b
1633139-12	F4-12a
1633139-13	F4-12b
1633139-14	F4-13a
1633139-15	F4-13b
1633139-16	MW11-6b
1633139-17	MW12-7a
1633139-18	MW12-7b
1633139-19	MW12-8a
1633139-20	MW12-8b
1633139-21	F4-25a
1633139-22	F4-26a
1633139-23	F4-27a
1633139-24	F4-29a

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: Golder Associates Ltd. (Ottawa)
Client PO:

Report Date: 15-Aug-2016
Order Date: 9-Aug-2016
Project Description: 1530908-2000

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
CCME-SQG: Metals by ICP-OES	based on MOE E3470, ICP-OES	11-Aug-16	11-Aug-16
Mercury by CVAA	EPA 7471B - CVAA, digestion	11-Aug-16	11-Aug-16
PCBs, total	SW846 8082A - GC-ECD	11-Aug-16	11-Aug-16
PHC F1	CWS Tier 1 - P&T GC-FID	10-Aug-16	11-Aug-16
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	12-Aug-16	14-Aug-16
Solids, %	Gravimetric, calculation	10-Aug-16	10-Aug-16

Certificate of Analysis

Client: Golder Associates Ltd. (Ottawa)

Client PO:

Report Date: 15-Aug-2016

Order Date: 9-Aug-2016

Project Description: 1530908-2000

Client ID: **Sample Date:** **Sample ID:**	**MDL/Units**	MW11-1a 03-Aug-16 1633139-01 Soil	MW11-1b 03-Aug-16 1633139-02 Soil	MW11-2a 03-Aug-16 1633139-03 Soil	MW11-3a 03-Aug-16 1633139-04 Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	96.4	96.3	89.0	89.7
Metals					
Arsenic	1.0 ug/g dry	69.2	49.8	20.8	26.0
Cadmium	0.5 ug/g dry	6.1	5.4	3.8	9.4
Chromium	1.0 ug/g dry	88.7	84.3	63.9	40.5
Cobalt	1.0 ug/g dry	16.2	14.4	9.6	4.1
Copper	1.0 ug/g dry	91.7	70.1	31.5	28.5
Lead	1.0 ug/g dry	13.4	10.9	7.9	77.5
Mercury	0.1 ug/g dry	<0.1	<0.1	<0.1	<0.1
Nickel	1.0 ug/g dry	69.3	59.0	26.3	14.0
Zinc	1.0 ug/g dry	102	88.7	47.3	74.2
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	<7	<7
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	<4	<4
F3 PHCs (C16-C34)	8 ug/g dry	<8	<8	<8	71
F4 PHCs (C34-C50)	6 ug/g dry	<6	<6	<6	30
PCBs					
PCBs, total	0.05 ug/g dry	<0.05	<0.05	<0.05	<0.05
Decachlorobiphenyl	Surrogate	88.8%	99.8%	92.0%	91.9%

Order #: 1633139

Certificate of Analysis

Client: Golder Associates Ltd. (Ottawa)

Client PO:

Report Date: 15-Aug-2016

Order Date: 9-Aug-2016

Project Description: 1530908-2000

Client ID:		MW11-3b	MW11-4a	MW11-5a	MW11-5b
Sample Date:		03-Aug-16	03-Aug-16	02-Aug-16	02-Aug-16
Sample ID:		1633139-05	1633139-06	1633139-07	1633139-08
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	91.4	90.6	85.4	86.7
Metals					
Arsenic	1.0 ug/g dry	16.8	9.4	13.1	83.7
Cadmium	0.5 ug/g dry	2.7	1.9	1.6	1.7
Chromium	1.0 ug/g dry	32.5	34.1	22.5	23.5
Cobalt	1.0 ug/g dry	3.4	3.3	3.0	3.6
Copper	1.0 ug/g dry	21.3	11.1	8.6	11.6
Lead	1.0 ug/g dry	288	5.0	4.1	4.5
Mercury	0.1 ug/g dry	<0.1	<0.1	<0.1	<0.1
Nickel	1.0 ug/g dry	11.0	10.0	8.9	11.4
Zinc	1.0 ug/g dry	49.8	23.1	17.8	19.2
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	<7	<7
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	<4	<4
F3 PHCs (C16-C34)	8 ug/g dry	79	38	<8	<8
F4 PHCs (C34-C50)	6 ug/g dry	32	33	<6	<6
PCBs					
PCBs, total	0.05 ug/g dry	<0.05	<0.05	<0.05	<0.05
Decachlorobiphenyl	Surrogate	90.1%	92.8%	78.5%	92.8%

Certificate of Analysis
Client: Golder Associates Ltd. (Ottawa)
Client PO:

Report Date: 15-Aug-2016
Order Date: 9-Aug-2016
Project Description: 1530908-2000

Client ID: **Sample Date:** **Sample ID:**	**MDL/Units**	MW11-6a 02-Aug-16 1633139-09 Soil	F4-11a 03-Aug-16 1633139-10 Soil	F4-11b 03-Aug-16 1633139-11 Soil	F4-12a 03-Aug-16 1633139-12 Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	87.1	93.8	97.7	87.5
Metals					
Arsenic	1.0 ug/g dry	19.9	1.2	1.2	3.6
Cadmium	0.5 ug/g dry	1.8	1.4	1.8	2.5
Chromium	1.0 ug/g dry	24.4	15.5	18.4	26.8
Cobalt	1.0 ug/g dry	3.3	1.9	2.9	4.1
Copper	1.0 ug/g dry	12.0	6.5	9.9	13.6
Lead	1.0 ug/g dry	4.5	3.0	4.8	6.6
Mercury	0.1 ug/g dry	<0.1	<0.1	<0.1	<0.1
Nickel	1.0 ug/g dry	10.3	5.9	8.2	13.0
Zinc	1.0 ug/g dry	19.9	12.9	17.8	24.8
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	<7	<7
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	<4	<4
F3 PHCs (C16-C34)	8 ug/g dry	<8	<8	<8	<8
F4 PHCs (C34-C50)	6 ug/g dry	<6	<6	<6	<6
PCBs					
PCBs, total	0.05 ug/g dry	<0.05	<0.05	<0.05	<0.05
Decachlorobiphenyl	Surrogate	95.0%	94.4%	96.6%	96.0%

Certificate of Analysis
Client: Golder Associates Ltd. (Ottawa)
Client PO:

Report Date: 15-Aug-2016
Order Date: 9-Aug-2016
Project Description: 1530908-2000

Client ID: **Sample Date:** **Sample ID:**		F4-12b 03-Aug-16 1633139-13	F4-13a 03-Aug-16 1633139-14	F4-13b 03-Aug-16 1633139-15	MW11-6b 02-Aug-16 1633139-16
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	85.3	84.6	86.8	90.6
Metals					
Arsenic	1.0 ug/g dry	1.8	3.1	1.4	10.4
Cadmium	0.5 ug/g dry	2.0	1.8	1.0	1.2
Chromium	1.0 ug/g dry	22.8	20.0	10.5	19.0
Cobalt	1.0 ug/g dry	3.4	3.2	2.0	2.8
Copper	1.0 ug/g dry	10.5	10.6	6.5	8.9
Lead	1.0 ug/g dry	4.4	4.7	2.6	4.3
Mercury	0.1 ug/g dry	<0.1	<0.1	<0.1	<0.1
Nickel	1.0 ug/g dry	10.1	9.2	6.1	8.7
Zinc	1.0 ug/g dry	21.6	19.0	11.0	15.3
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	<7	<7
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	<4	<4
F3 PHCs (C16-C34)	8 ug/g dry	<8	<8	<8	<8
F4 PHCs (C34-C50)	6 ug/g dry	<6	<6	<6	<6
PCBs					
PCBs, total	0.05 ug/g dry	<0.05	<0.05	<0.05	<0.05
Decachlorobiphenyl	Surrogate	89.1%	95.1%	101%	91.6%

Certificate of Analysis

Client: Golder Associates Ltd. (Ottawa)

Client PO:

Report Date: 15-Aug-2016

Order Date: 9-Aug-2016

Project Description: 1530908-2000

Client ID: **Sample Date:** **Sample ID:**	**MDL/Units**	MW12-7a 02-Aug-16 1633139-17 Soil	MW12-7b 02-Aug-16 1633139-18 Soil	MW12-8a 03-Aug-16 1633139-19 Soil	MW12-8b 03-Aug-16 1633139-20 Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	82.8	84.3	97.0	95.5
Metals					
Arsenic	1.0 ug/g dry	25.3	10.9	7.3	9.6
Cadmium	0.5 ug/g dry	3.6	1.8	3.1	2.1
Chromium	1.0 ug/g dry	48.4	23.4	56.0	33.2
Cobalt	1.0 ug/g dry	7.8	4.5	7.4	3.8
Copper	1.0 ug/g dry	26.7	16.0	17.9	12.1
Lead	1.0 ug/g dry	7.4	4.0	8.0	8.6
Mercury	0.1 ug/g dry	<0.1	<0.1	<0.1	<0.1
Nickel	1.0 ug/g dry	28.0	17.7	21.0	11.6
Zinc	1.0 ug/g dry	50.8	31.1	43.6	26.0
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	<7	<7
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	464	389
F3 PHCs (C16-C34)	8 ug/g dry	<8	<8	23	41
F4 PHCs (C34-C50)	6 ug/g dry	<6	<6	<6	<6
PCBs					
PCBs, total	0.05 ug/g dry	<0.05	<0.05	<0.05	<0.05
Decachlorobiphenyl	Surrogate	93.1%	91.9%	95.6%	97.1%

Certificate of Analysis

Client: Golder Associates Ltd. (Ottawa)

Client PO:

Report Date: 15-Aug-2016

Order Date: 9-Aug-2016

Project Description: 1530908-2000

Client ID: **Sample Date:** **Sample ID:**	**MDL/Units**	F4-25a 03-Aug-16 1633139-21 Soil	F4-26a 03-Aug-16 1633139-22 Soil	F4-27a 02-Aug-16 1633139-23 Soil	F4-29a 02-Aug-16 1633139-24 Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	98.8	95.5	84.1	92.0
Metals					
Arsenic	1.0 ug/g dry	31.9	60.9	23.0	37.4
Cadmium	0.5 ug/g dry	2.8	3.2	3.5	4.9
Chromium	1.0 ug/g dry	50.6	61.1	49.4	72.1
Cobalt	1.0 ug/g dry	4.6	7.7	6.0	9.8
Copper	1.0 ug/g dry	22.7	31.3	53.5	50.1
Lead	1.0 ug/g dry	8.4	15.8	15.2	9.7
Mercury	0.1 ug/g dry	<0.1	<0.1	<0.1	<0.1
Nickel	1.0 ug/g dry	13.7	27.3	25.1	<1.0
Zinc	1.0 ug/g dry	33.3	41.3	44.4	54.6
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	<7	<7
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	<4	<4
F3 PHCs (C16-C34)	8 ug/g dry	<8	259	64	<8
F4 PHCs (C34-C50)	6 ug/g dry	<6	68	10	<6
PCBs					
PCBs, total	0.05 ug/g dry	0.27	0.14	0.16	0.25
Decachlorobiphenyl	Surrogate	87.0%	83.0%	103%	83.4%

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g						
F2 PHCs (C10-C16)	ND	4	ug/g						
F3 PHCs (C16-C34)	ND	8	ug/g						
F4 PHCs (C34-C50)	ND	6	ug/g						
Metals									
Arsenic	ND	1.0	ug/g						
Cadmium	ND	0.5	ug/g						
Chromium	ND	1.0	ug/g						
Cobalt	ND	1.0	ug/g						
Copper	ND	1.0	ug/g						
Lead	ND	1.0	ug/g						
Mercury	ND	0.1	ug/g						
Nickel	ND	1.0	ug/g						
Zinc	ND	1.0	ug/g						
PCBs									
PCBs, total	ND	0.05	ug/g						
Surrogate: Decachlorobiphenyl	*0.0937*		*ug/g*		*93.7*	*60-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g dry	ND				40	
F2 PHCs (C10-C16)	ND	4	ug/g dry	ND				30	
F3 PHCs (C16-C34)	55	8	ug/g dry	27			66.7	30	QR-01
F4 PHCs (C34-C50)	32	6	ug/g dry	19			50.0	30	QR-01
Metals									
Antimony	ND	1.0	ug/g dry	ND			0.0	30	
Arsenic	70.3	1.0	ug/g dry	69.2			1.6	30	
Barium	103	1.0	ug/g dry	107			4.0	30	
Beryllium	ND	1.0	ug/g dry	ND			0.0	30	
Boron	3.53	1.0	ug/g dry	3.50			0.7	30	
Cadmium	6.12	0.5	ug/g dry	6.09			0.5	30	
Chromium	87.8	1.0	ug/g dry	88.7			1.1	30	
Cobalt	16.3	1.0	ug/g dry	16.2			0.4	30	
Copper	94.0	1.0	ug/g dry	91.7			2.5	30	
Lead	14.6	1.0	ug/g dry	13.4			8.7	30	
Mercury	ND	0.1	ug/g dry	ND			0.0	30	
Molybdenum	1.73	1.0	ug/g dry	1.95			11.9	30	
Nickel	68.6	1.0	ug/g dry	69.3			1.0	30	
Selenium	ND	1.0	ug/g dry	ND			0.0	30	
Silver	ND	0.5	ug/g dry	ND			0.0	30	
Thallium	ND	1.0	ug/g dry	ND			0.0	30	
Tin	ND	5.0	ug/g dry	ND			0.0	30	
Uranium	ND	1.0	ug/g dry	ND				30	
Vanadium	83.8	1.0	ug/g dry	83.7			0.1	30	
Zinc	104	1.0	ug/g dry	102			2.1	30	
PCBs									
PCBs, total	ND	0.05	ug/g dry	ND				40	
Surrogate: Decachlorobiphenyl	*0.121*		*ug/g dry*		*95.0*	*60-140*			
Physical Characteristics									
% Solids	91.0	0.1	% by Wt.	91.0			0.0	25	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	162	7	ug/g		80.9	80-120			
F2 PHCs (C10-C16)	81	4	ug/g	ND	80.4	60-140			
F3 PHCs (C16-C34)	219	8	ug/g	ND	105	60-140			
F4 PHCs (C34-C50)	139	6	ug/g	ND	99.8	60-140			
Metals									
Antimony	267		ug/L	ND	107	70-130			
Arsenic	1630		ug/L	1380	98.5	70-130			
Barium	238		ug/L		95.1	70-130			
Beryllium	254		ug/L	9.08	98.0	70-130			
Boron	317		ug/L	70.0	98.9	70-130			
Cadmium	353		ug/L	122	92.6	70-130			
Chromium	1980		ug/L	1770	83.0	70-130			
Cobalt	551		ug/L	325	90.2	70-130			
Copper	2000		ug/L	1830	67.7	70-130			QM-07
Lead	478		ug/L	267	84.2	70-130			
Mercury	1.28	0.1	ug/g	ND	85.3	70-130			
Molybdenum	275		ug/L	39.0	94.4	70-130			
Nickel	1570		ug/L	1390	71.8	70-130			
Selenium	230		ug/L	11.3	87.5	70-130			
Silver	231		ug/L	3.82	91.0	70-130			
Thallium	230		ug/L	11.3	87.5	70-130			
Tin	273		ug/L	85.8	74.9	70-130			
Uranium	246		ug/L	ND	98.5	70-130			
Vanadium	1880		ug/L	1670	80.8	70-130			
Zinc	2220		ug/L	2030	74.8	70-130			
PCBs									
PCBs, total	0.661	0.05	ug/g	ND	130	60-140			
Surrogate: Decachlorobiphenyl	*0.142*		*ug/g*		*111*	*60-140*			

Qualifier Notes:

QC Qualifiers :

QM-07 : The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on other acceptable QC.

QR-01 : Duplicate RPD is high, however, the sample result is less than 10x the MDL.

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.

Soil results are reported on a dry weight basis when the units are denoted with 'dry'.
Where %Solids is reported, moisture loss includes the loss of volatile hydrocarbons.

CCME PHC additional information:

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.
- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.

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e: paracel@paracellabs.com

Chain of Custody
(Lab Use Only)
№ 108715

Page 1 of 4

Client Name: Golder Associates
Contact Name: Alyssa Troke
Address: 1931 Robertson Road, Ottawa, ON K2H5B7
Telephone: 613-592-9600

Project Reference: 1530908-2000
Quote # 16-010
PO #
Email Address: alyssa_troke@golder.com

Turnaround Time:
☐ 1 Day ☐ 3 Day
☐ 2 Day ☑ Regular
Date Required:

Criteria: ☐ O. Reg. 153/04 (As Amended) Table __ ☐ RSC Filing ☐ O. Reg. 558/00 ☐ PWQO ☐ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality: ______ ☐ Other: ______

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Required Analyses

Paracel Order Number:
1633139 - Soil
1633143 - Water

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	See quote						
1	MW 11-1a	S		2	Aug 3									✓	- 60 mL + 250 mL.					
2	MW 11-1B				↓									✓						
3	MW 11-2a													✓						
4	MW 11-3a				Aug 3									✓						
5	MW 11-3B													✓						
6	MW 11-4a	↓			↓									✓						
7	~~MW 11-4B~~																			
8	MW 11-5a	S			Aug 2									✓						
9	MW 11-5B				Aug 2									✓						
10	MW 11-6a	↓		↓	Aug 2.									✓		↓				

Comments: Proceed with F1 regardless of exceedance in hold time Per Alyssa.
Removed loose ice/water from coolers.

Method of Delivery: Drop Box

Relinquished By (Sign): Alyssa Troke
Relinquished By (Print): Alyssa Troke
Date/Time: Aug 8/16 18:00

Received by Driver/Depot:
Date/Time: Aug. 9/16 7:10am
Temperature: 8.6 °C

Received at Lab:
Date/Time: Aug 9/16 @ 11:00
Temperature: 9.1 °C

Verified By:
Date/Time: Aug 9/16 3:52
pH Verified [✓] By: RS

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Chain of Custody
(Lab Use Only)
№ 108714

Page 2 of 4

1530908

Client Name: Golder Associates
Contact Name: Alyssa Troke
Address: 1931 Robertson Road, Ottawa, ON
K2H 5B7
Telephone: 613-592-9600

Project Reference: ~~153908~~ -2000
Quote # 16-010
PO #
Email Address: alyssa_troke@golder.com

Turnaround Time:
☐ 1 Day ☐ 3 Day
☐ 2 Day ☑ Regular
Date Required:

Criteria: ☐ O. Reg. 153/04 (As Amended) Table __ ☐ RSC Filing ☐ O. Reg. 558/00 ☐ PWQO ☐ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality: ________ ☐ Other: ________

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Required Analyses

Paracel Order Number:
1633139 - Soil
1633143 - Water

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	see quote						
1	F4-11a	S		2	Aug3									✓		-60ml+		250ml-		
2	F4-11B	S		2										✓						
3	F4-12a	S		2										✓						
4	F4-12B	S		2										✓						
5	F4-13a	S		2										✓						
6	F4-13B	S		2										✓						
7	MW 11-6B	S		2	Aug 2									✓						
8	MW 12-7a	S		2	Aug 2									✓						
9	MW 12-7B	S		2	Aug 2									✓						
10	MW 12-8a	S		2	Aug 3									✓						

Comments:
Removed loose ice/water from coolers.

Method of Delivery: Drop Box

Relinquished By (Sign): Alyssa Troke
Relinquished By (Print): Alyssa Troke
Date/Time: Aug 5/16 18:00

Received by Driver/Depot:
Date/Time: Aug 9/16 7:10am
Temperature: 8.6 °C

Received at Lab:
Date/Time: Aug 9/16 @ 11:00
Temperature: 9.1 °C

Verified By:
Date/Time: Aug 9/16 3:52
pH Verified [N] By: RS

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Chain of Custody
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№ 108716

Page 3 of 4

Client Name: Golder Associates	Project Reference: 1530908-2000	**Turnaround Time:**	
Contact Name:	Quote # 16-010	☐ 1 Day	☐ 3 Day
Address: see page 1	PO #	☐ 2 Day	☑ Regular
Telephone:	Email Address:	Date Required:	

Criteria: ☐ O. Reg. 153/04 (As Amended) Table __ ☐ RSC Filing ☐ O. Reg. 558/00 ☐ PWQO ☐ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality: ________ ☐ Other: ________

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Required Analyses

Paracel Order Number:
1633139 - Soil
1633143 - water

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	see quote						
1	MW12-8B	S		2	Aug 3									✓		-60mL+250mL				
2	F4-25a													✓						
3	F4-26a													✓						
4	F4-27a													✓						
5	F4-29a	↓		↓	↓									✓			↓			
6	MW11-1	W		6	Aug 3									✓						
7	MW11-2	W		6	Aug 3									✓						
8	MW11-3	W		6	Aug 3									✓						
9	MW11-4	W		6	Aug 3									✓						
10	MW11-5	W		6	Aug 2									✓						

Comments:
Removed loose ice/water from coolers. GB

Method of Delivery: Drop Box

Relinquished By (Sign): Alyssa Trake	Received by Driver/Depot:	Received at Lab:	Verified By:
Relinquished By (Print): Alyssa Troke	Date/Time: Aug. 9/16 7:10am	Date/Time: Aug 9/16 @ 11:00	Date/Time: Aug 9/16 3:52
Date/Time: Aug 8/16 18:00	Temperature: 8.6 °C	Temperature: 9.1 °C	pH Verified [✓] By: RS

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Chain of Custody
(Lab Use Only)
№ 108717

Page 4 of 4

Client Name: Golder Associates

Contact Name: Alyssa Troke

Address: 1931 Robertson Road, Ottawa, ON
K2H 5B7

Telephone: 613-592-9600

Project Reference: 1530908-2000

Quote # 16-010

PO #

Email Address: alyssa_troke@golder.com

Turnaround Time:
☐ 1 Day ☐ 3 Day
☐ 2 Day ☑ Regular
Date Required:

Criteria: ☐ O. Reg. 153/04 (As Amended) Table __ ☐ RSC Filing ☐ O. Reg. 558/00 ☐ PWQO ☐ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality: ________ ☐ Other: ________

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Required Analyses

Paracel Order Number:
1633139 - Soil
1633143 - water

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken		PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	see quote						
					Date	Time														
1	MW 12-7	W		6	Aug 2									✓						
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				

Comments:
Removed loose ice/water from coolers.

Method of Delivery: Drop Box

Relinquished By (Sign): Alyssa Troke
Relinquished By (Print): Alyssa Troke
Date/Time: Aug 8/16 18:00

Received by Driver/Depot:
Date/Time: Aug. 9/16 7:10am
Temperature: 8.6 °C

Received at Lab:
Date/Time: Aug 9/16 @ 11:00
Temperature: 9.1 °C

Verified By:
Date/Time: Aug 9/16 3:52
pH Verified [✓] By: KS

Chain of Custody (Env) - Rev 0.7 Feb. 2016

Appendix C2

Certificate Of Analysis –
Paracel Laboratories Ltd.,
Sept. 2, 2016; Order #1633143

Certificate of Analysis

Golder Associates Ltd. (Ottawa)

1931 Robertson Rd.
Ottawa, ON K2H 5B7
Attn: Alyssa Troke

Client PO:
Project: 1530908-2000
Custody: 108716, 108717

Report Date: 2-Sep-2016
Order Date: 9-Aug-2016

Revised Report **Order #: 1633143**

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1633143-01	MW11-1
1633143-02	MW11-2
1633143-03	MW11-3
1633143-04	MW11-4
1633143-05	MW11-5
1633143-06	MW12-7

Approved By:

Tim McCooeye
Senior Advisor

Certificate of Analysis

Client: Golder Associates Ltd. (Ottawa)

Client PO:

Report Date: 02-Sep-2016

Order Date: 9-Aug-2016

Project Description: 1530908-2000

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Mercury by CVAA	EPA 245.1 - Cold Vapour AA	10-Aug-16	10-Aug-16
Metals, ICP-MS	EPA 200.8 - ICP-MS	10-Aug-16	10-Aug-16
PCBs, total	EPA 608 - GC-ECD	11-Aug-16	11-Aug-16
PHC F1	CWS Tier 1 - P&T GC-FID	9-Aug-16	10-Aug-16
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	10-Aug-16	10-Aug-16

Certificate of Analysis
Client: Golder Associates Ltd. (Ottawa)
Client PO:

Report Date: 02-Sep-2016
Order Date: 9-Aug-2016
Project Description: 1530908-2000

	Client ID: **Sample Date:** **Sample ID:**	MW11-1 03-Aug-16 1633143-01	MW11-2 03-Aug-16 1633143-02	MW11-3 03-Aug-16 1633143-03	MW11-4 03-Aug-16 1633143-04
	MDL/Units	Water	Water	Water	Water
Metals					
Mercury	0.0001 mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	0.001 mg/L	<0.001	0.003	<0.001	<0.001
Cadmium	0.0001 mg/L	<0.0001	<0.0001	0.0002	<0.0001
Chromium	0.001 mg/L	<0.001	<0.001	<0.001	<0.001
Cobalt	0.0005 mg/L	0.0011	0.0357	0.0236	0.0030
Copper	0.0005 mg/L	0.0010	0.0026	0.0031	0.0047
Lead	0.0001 mg/L	<0.0001	<0.0001	0.0006	0.0002
Nickel	0.001 mg/L	0.007	0.162	0.059	0.011
Zinc	0.005 mg/L	0.010	19.0	0.527	0.208
Hydrocarbons					
F1 PHCs (C6-C10)	0.025 mg/L	<0.025	<0.025	<0.025	<0.025
F2 PHCs (C10-C16)	0.100 mg/L	<0.100	<0.100	<0.100	<0.100
F3 PHCs (C16-C34)	0.100 mg/L	<0.100	<0.100	<0.100	<0.100
F4 PHCs (C34-C50)	0.100 mg/L	<0.100	<0.100	<0.100	<0.100
PCBs					
PCBs, total	0.00005 mg/L	<0.00005	<0.00005	<0.00005	<0.00005
Decachlorobiphenyl	Surrogate	88.3%	77.0%	72.5%	86.6%

Certificate of Analysis
Client: Golder Associates Ltd. (Ottawa)
Client PO:

Report Date: 02-Sep-2016
Order Date: 9-Aug-2016
Project Description: 1530908-2000

	Client ID: **Sample Date:** **Sample ID:** **MDL/Units**	MW11-5 02-Aug-16 1633143-05 Water	MW12-7 02-Aug-16 1633143-06 Water	- - - -	- - - -
Metals					
Mercury	0.0001 mg/L	<0.0001	<0.0001	-	-
Arsenic	0.001 mg/L	<0.001	<0.001	-	-
Cadmium	0.0001 mg/L	<0.0001	<0.0001	-	-
Chromium	0.001 mg/L	<0.001	<0.001	-	-
Cobalt	0.0005 mg/L	0.0057	0.0033	-	-
Copper	0.0005 mg/L	0.0018	0.0010	-	-
Lead	0.0001 mg/L	<0.0001	<0.0001	-	-
Nickel	0.001 mg/L	0.012	0.007	-	-
Zinc	0.005 mg/L	2.35	0.155	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	0.025 mg/L	<0.025	<0.025	-	-
F2 PHCs (C10-C16)	0.100 mg/L	<0.100 [1]	<0.100 [1]	-	-
F3 PHCs (C16-C34)	0.100 mg/L	<0.100 [1]	<0.100 [1]	-	-
F4 PHCs (C34-C50)	0.100 mg/L	<0.100 [1]	<0.100 [1]	-	-
PCBs					
PCBs, total	0.00005 mg/L	<0.00005	<0.00005	-	-
Decachlorobiphenyl	Surrogate	83.8%	84.2%	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	0.025	mg/L						
F2 PHCs (C10-C16)	ND	0.100	mg/L						
F3 PHCs (C16-C34)	ND	0.100	mg/L						
F4 PHCs (C34-C50)	ND	0.100	mg/L						
Metals									
Mercury	ND	0.0001	mg/L						
Arsenic	ND	0.001	mg/L						
Cadmium	ND	0.0001	mg/L						
Chromium	ND	0.001	mg/L						
Cobalt	ND	0.0005	mg/L						
Copper	ND	0.0005	mg/L						
Lead	ND	0.0001	mg/L						
Nickel	ND	0.001	mg/L						
Zinc	ND	0.005	mg/L						
PCBs									
PCBs, total	ND	0.00005	mg/L						
Surrogate: Decachlorobiphenyl	*.00018*		*mg/L*		*74.1*	*60-140*			

Certificate of Analysis
Client: Golder Associates Ltd. (Ottawa)
Client PO:

Report Date: 02-Sep-2016
Order Date: 9-Aug-2016
Project Description: 1530908-2000

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	0.025	mg/L	ND				30	
Metals									
Arsenic	ND	0.001	mg/L	ND			0.0	20	
Cadmium	ND	0.0001	mg/L	ND			0.0	20	
Chromium	ND	0.001	mg/L	ND			0.0	20	
Cobalt	0.00108	0.0005	mg/L	0.00111			2.9	20	
Copper	0.00102	0.0005	mg/L	0.00097			5.1	20	
Lead	ND	0.0001	mg/L	ND			0.0	20	
Nickel	0.0072	0.001	mg/L	0.0071			1.1	20	
Zinc	0.011	0.005	mg/L	0.010			4.8	20	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	1.99	0.025	mg/L		99.5	68-117			
F2 PHCs (C10-C16)	1.84	0.100	mg/L		102	60-140			
F3 PHCs (C16-C34)	3.66	0.100	mg/L		98.4	60-140			
F4 PHCs (C34-C50)	2.35	0.100	mg/L		94.6	60-140			
Metals									
Mercury	0.00286	0.0001	mg/L		95.3	80-120			
Arsenic	49.8		ug/L	0.09	99.5	80-120			
Cadmium	48.2		ug/L	0.02	96.4	80-120			
Chromium	47.1		ug/L	0.07	94.1	80-120			
Cobalt	48.6		ug/L	1.11	94.9	80-120			
Copper	46.4		ug/L	0.97	90.9	80-120			
Lead	48.3		ug/L	0.02	96.6	80-120			
Nickel	53.7		ug/L	7.1	93.1	80-120			
Zinc	60		ug/L	10	99.7	80-120			
PCBs									
PCBs, total	0.000978	0.00005	mg/L		97.8	60-140			
Surrogate: Decachlorobiphenyl	*.00017*		*mg/L*		*71.2*	*60-140*			

Qualifier Notes:

Login Qualifiers :

Sample - One or more parameter received past hold time -
Applies to samples: MW11-5, MW12-7

Sample Qualifiers :

1 : Holding time had been exceeded upon receipt of the sample at the laboratory.

Sample Data Revisions

None

Work Order Revisions / Comments:

Revision 1, all results reported in mg/L.

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.

CCME PHC additional information:

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.
- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.

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Chain of Custody
(Lab Use Only)
№ 108716

Page 3 of 4

Client Name: Golder Associates
Contact Name:
Address: see page 1
Telephone:
Project Reference: 1530908-2000
Quote # 16-010
PO #
Email Address:

Turnaround Time:
☐ 1 Day ☐ 3 Day
☐ 2 Day ☑ Regular
Date Required:

Criteria: ☐ O. Reg. 153/04 (As Amended) Table __ ☐ RSC Filing ☐ O. Reg. 558/00 ☐ PWQO ☐ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality: ______ ☐ Other: ______

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Paracel Order Number:
1633139 - Soil
1633143 - water

					Sample Taken		Required Analyses													
	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Date	Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	see quote						
1	MW12-8B	S		2	Aug 3									✓			-60mL+	250mL-		
2	F4-25a													✓						
3	F4-26a													✓						
4	F4-27a													✓						
5	F4-29a	↓		↓	↓									✓				↓		
6	MW11-1	W		6	Aug 3									✓						
7	MW11-2	W		6	Aug 3									✓						
8	MW11-3	W		6	Aug 3									✓						
9	MW11-4	W		6	Aug 3									✓						
10	MW11-5	W		6	Aug 2									✓						

Comments:
Removed loose ice/water from coolers.
PRoceed with analysis regardless of Hold time exceedance on MW11-5 MW12-7

Method of Delivery: Drop Box

Relinquished By (Sign): Alyssa Trake
Relinquished By (Print): Alyssa Troke
Date/Time: Aug 8/16 18:00

Received by Driver/Depot:
Date/Time: Aug. 9/16 7:11am
Temperature: 8.6 °C

Received at Lab:
Date/Time: Aug 9/16 @ 11:0
Temperature: 9.1 °C

Verified By:
Date/Time: Aug 9/16 3:52
pH Verified [✓] By: RS

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e: paracel@paracellabs.com

Chain of Custody
(Lab Use Only)
№ 108717

Page 4 of 4

Client Name: Golder Associates

Contact Name: Alyssa Troke

Address: 1931 Robertson Road, Ottawa, ON
K2H 5B7

Telephone: 613-592-9600

Project Reference: 1530908-2000

Quote #: 16-010

PO #:

Email Address: alyssa_troke@golder.com

Turnaround Time:
☐ 1 Day ☐ 3 Day
☐ 2 Day ☑ Regular
Date Required:

Criteria: ☐ O. Reg. 153/04 (As Amended) Table __ ☐ RSC Filing ☐ O. Reg. 558/00 ☐ PWQO ☐ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality: ☐ Other:

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Paracel Order Number:
1633139 - Soil
1633143 - water

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHC's F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	see quote						
1	MW 12-7	W		6	Aug 2									✓						
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				

Comments:
Removed loose ice/water from coolers. GB

Method of Delivery: Drop Box

Relinquished By (Sign): Alyssa Troke
Relinquished By (Print): Alyssa Troke
Date/Time: Aug 8/16 18:00

Received by Driver/Depot:
Date/Time: Aug. 9/16 7:10am
Temperature: 9.6 °C

Received at Lab:
Date/Time: Aug 9/16 @ 11:00
Temperature: 9.1 °C

Verified By:
Date/Time: Aug 9/16 3:52
pH Verified [✓] By: KS

Appendix C3

Certificate Of Analysis –
Paracel Laboratories Ltd.,
Aug. 22, 2016; Order #1634162

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Certificate of Analysis

Golder Associates Ltd. (Ottawa)

1931 Robertson Rd.
Ottawa, ON K2H 5B7
Attn: Alyssa Troke

Client PO:
Project: 1530908-2000
Custody: 26764

Report Date: 22-Aug-2016
Order Date: 16-Aug-2016

Order #: 1634162

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1634162-01	MW98-1A
1634162-02	MW98-2A
1634162-03	MW98-3A
1634162-04	MW98-3B
1634162-05	MW98-6A
1634162-06	MW98-7A
1634162-07	MW98-8A
1634162-08	MW98-8B
1634162-09	MW98-9A
1634162-10	F4-28A

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis
Client: Golder Associates Ltd. (Ottawa)
Client PO:

Report Date: 22-Aug-2016
Order Date: 16-Aug-2016
Project Description: 1530908-2000

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
CCME-SQG: Metals by ICP-OES	based on MOE E3470, ICP-OES	18-Aug-16	18-Aug-16
Mercury by CVAA	EPA 7471B - CVAA, digestion	19-Aug-16	19-Aug-16
PCBs, total	SW846 8082A - GC-ECD	17-Aug-16	18-Aug-16
PHC F1	CWS Tier 1 - P&T GC-FID	18-Aug-16	19-Aug-16
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	18-Aug-16	18-Aug-16
Solids, %	Gravimetric, calculation	18-Aug-16	18-Aug-16

Certificate of Analysis

Client: Golder Associates Ltd. (Ottawa)

Client PO:

Report Date: 22-Aug-2016

Order Date: 16-Aug-2016

Project Description: 1530908-2000

Client ID:		MW98-1A	MW98-2A	MW98-3A	MW98-3B
Sample Date:		04-Aug-16	04-Aug-16	04-Aug-16	04-Aug-16
Sample ID:		1634162-01	1634162-02	1634162-03	1634162-04
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	89.7	89.4	96.5	96.9
Metals					
Arsenic	1.0 ug/g dry	74.7	18.2	24.2	21.0
Cadmium	0.5 ug/g dry	<0.5	<0.5	<0.5	<0.5
Chromium	1.0 ug/g dry	139	42.3	31.5	44.1
Cobalt	1.0 ug/g dry	15.6	5.7	4.3	5.2
Copper	1.0 ug/g dry	67.8	16.1	13.6	15.2
Lead	1.0 ug/g dry	5.0	4.6	4.3	5.7
Mercury	0.1 ug/g dry	<0.1	<0.1	<0.1	<0.1
Nickel	1.0 ug/g dry	44.5	16.5	12.9	14.6
Zinc	1.0 ug/g dry	71.2	33.3	25.2	31.9
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7 [1]	258 [1]	<7 [1]	<7 [1]
F2 PHCs (C10-C16)	4 ug/g dry	<4	2850	<4	<4
F3 PHCs (C16-C34)	8 ug/g dry	<8	250	82	48
F4 PHCs (C34-C50)	6 ug/g dry	<6	<6	53	29
PCBs					
PCBs, total	0.05 ug/g dry	<0.05	<0.05	<0.05	<0.05
Decachlorobiphenyl	Surrogate	86.7%	88.2%	95.7%	101%

Certificate of Analysis

Client: Golder Associates Ltd. (Ottawa)

Client PO:

Report Date: 22-Aug-2016

Order Date: 16-Aug-2016

Project Description: 1530908-2000

Client ID: **Sample Date:** **Sample ID:**		MW98-6A 04-Aug-16 1634162-05 Soil	MW98-7A 04-Aug-16 1634162-06 Soil	MW98-8A 04-Aug-16 1634162-07 Soil	MW98-8B 04-Aug-16 1634162-08 Soil
	MDL/Units				
Physical Characteristics					
% Solids	0.1 % by Wt.	98.3	96.0	93.9	94.1
Metals					
Arsenic	1.0 ug/g dry	18.4	17.3	14.5	16.3
Cadmium	0.5 ug/g dry	<0.5	<0.5	<0.5	<0.5
Chromium	1.0 ug/g dry	47.8	40.3	21.7	23.7
Cobalt	1.0 ug/g dry	6.3	5.2	3.2	3.8
Copper	1.0 ug/g dry	25.2	21.8	8.7	11.0
Lead	1.0 ug/g dry	8.0	9.0	2.5	3.4
Mercury	0.1 ug/g dry	<0.1	<0.1	<0.1	<0.1
Nickel	1.0 ug/g dry	20.7	17.2	9.5	11.9
Zinc	1.0 ug/g dry	37.8	35.0	20.3	21.0
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7 [1]	<7 [1]	<7 [1]	<7 [1]
F2 PHCs (C10-C16)	4 ug/g dry	6	21	<4	<4
F3 PHCs (C16-C34)	8 ug/g dry	160	913	<8	<8
F4 PHCs (C34-C50)	6 ug/g dry	28	203	<6	<6
PCBs					
PCBs, total	0.05 ug/g dry	<0.05	<0.05	0.19	1.46
Decachlorobiphenyl	Surrogate	86.9%	83.1%	90.9%	96.4%

Certificate of Analysis
Client: Golder Associates Ltd. (Ottawa)
Client PO:

Report Date: 22-Aug-2016
Order Date: 16-Aug-2016
Project Description: 1530908-2000

Client ID:		MW98-9A	F4-28A	-	-
Sample Date:		04-Aug-16	05-Aug-16	-	-
Sample ID:		1634162-09	1634162-10	-	-
	MDL/Units	Soil	Soil	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	93.9	91.9	-	-
Metals					
Arsenic	1.0 ug/g dry	13.8	13.4	-	-
Cadmium	0.5 ug/g dry	<0.5	<0.5	-	-
Chromium	1.0 ug/g dry	29.2	48.1	-	-
Cobalt	1.0 ug/g dry	4.6	7.8	-	-
Copper	1.0 ug/g dry	18.3	35.8	-	-
Lead	1.0 ug/g dry	6.1	12.4	-	-
Mercury	0.1 ug/g dry	<0.1	<0.1	-	-
Nickel	1.0 ug/g dry	13.3	23.0	-	-
Zinc	1.0 ug/g dry	33.3	53.1	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7 [1]	<7 [1]	-	-
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	-	-
F3 PHCs (C16-C34)	8 ug/g dry	<8	127	-	-
F4 PHCs (C34-C50)	6 ug/g dry	<6	46	-	-
PCBs					
PCBs, total	0.05 ug/g dry	0.08	<0.05	-	-
Decachlorobiphenyl	Surrogate	96.5%	86.8%	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g						
F2 PHCs (C10-C16)	ND	4	ug/g						
F3 PHCs (C16-C34)	ND	8	ug/g						
F4 PHCs (C34-C50)	ND	6	ug/g						
Metals									
Arsenic	ND	1.0	ug/g						
Cadmium	ND	0.5	ug/g						
Chromium	ND	1.0	ug/g						
Cobalt	ND	1.0	ug/g						
Copper	ND	1.0	ug/g						
Lead	ND	1.0	ug/g						
Mercury	ND	0.1	ug/g						
Nickel	ND	1.0	ug/g						
Zinc	ND	1.0	ug/g						
PCBs									
PCBs, total	ND	0.05	ug/g						
Surrogate: Decachlorobiphenyl	*0.0792*		*ug/g*		*79.2*	*60-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g dry	ND				40	
F2 PHCs (C10-C16)	ND	4	ug/g dry	ND				30	
F3 PHCs (C16-C34)	177	8	ug/g dry	159			10.6	30	
F4 PHCs (C34-C50)	68	6	ug/g dry	60			13.1	30	
Metals									
Antimony	ND	1.0	ug/g dry	ND				30	
Arsenic	ND	1.0	ug/g dry	ND				30	
Barium	137	1.0	ug/g dry	148			8.1	30	
Beryllium	ND	1.0	ug/g dry	ND			0.0	30	
Boron	ND	1.0	ug/g dry	ND			0.0	30	
Cadmium	ND	0.5	ug/g dry	ND				30	
Chromium	31.9	10.0	ug/g dry	33.2			4.0	30	
Cobalt	6.53	1.0	ug/g dry	6.99			6.8	30	
Copper	16.0	1.0	ug/g dry	17.0			6.1	30	
Lead	4.86	1.0	ug/g dry	5.57			13.5	30	
Mercury	ND	0.1	ug/g dry	ND			0.0	30	
Molybdenum	ND	1.0	ug/g dry	ND			0.0	30	
Nickel	11.8	1.0	ug/g dry	12.4			4.9	30	
Selenium	ND	1.0	ug/g dry	ND			0.0	30	
Silver	ND	0.5	ug/g dry	ND			0.0	30	
Thallium	ND	1.0	ug/g dry	ND			0.0	30	
Tin	ND	5.0	ug/g dry	ND			0.0	30	
Uranium	ND	1.0	ug/g dry	ND				30	
Vanadium	46.8	1.0	ug/g dry	50.9			8.6	30	
Zinc	39.1	1.0	ug/g dry	41.1			5.0	30	
PCBs									
PCBs, total	ND	0.05	ug/g dry	ND				40	
Surrogate: Decachlorobiphenyl	*0.102*		*ug/g dry*		*97.8*	*60-140*			
Physical Characteristics									
% Solids	59.9	0.1	% by Wt.	59.7			0.4	25	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	186	7	ug/g		93.0	80-120			
F2 PHCs (C10-C16)	214	4	ug/g	21	179	60-140			QM-06
F3 PHCs (C16-C34)	393	8	ug/g	46	155	60-140			QM-06
F4 PHCs (C34-C50)	186	6	ug/g	ND	125	60-140			
Metals									
Antimony	246		ug/L	ND	98.3	70-130			
Arsenic	253		ug/L	ND	101	70-130			
Barium	215		ug/L		86.0	70-130			
Beryllium	217		ug/L	ND	86.7	70-130			
Boron	248		ug/L	11.2	94.9	70-130			
Cadmium	297		ug/L	ND	119	70-130			
Chromium	209		ug/L		83.7	70-130			
Cobalt	354		ug/L	140	85.6	70-130			
Copper	555		ug/L	340	86.0	70-130			
Lead	301		ug/L	111	75.8	70-130			
Mercury	1.23	0.1	ug/g	ND	82.0	70-130			
Molybdenum	231		ug/L	18.3	85.2	70-130			
Nickel	449		ug/L	247	80.7	70-130			
Selenium	185		ug/L	ND	74.1	70-130			
Silver	184		ug/L	ND	73.5	70-130			
Thallium	195		ug/L	16.6	71.2	70-130			
Tin	229		ug/L	13.0	86.4	70-130			
Uranium	281		ug/L	ND	112	70-130			
Vanadium	1210		ug/L	1020	77.0	70-130			
Zinc	997		ug/L	821	70.4	70-130			
PCBs									
PCBs, total	0.523	0.05	ug/g	ND	126	60-140			
Surrogate: Decachlorobiphenyl	*0.106*		*ug/g*		*102*	*60-140*			

Qualifier Notes:

Login Qualifiers :

Sample - One or more parameter received past hold time - PHC F1

Applies to samples: MW98-1A, MW98-2A, MW98-3A, MW98-3B, MW98-6A, MW98-7A, MW98-8A, MW98-8B, MW98-9A, F4-28A

Sample Qualifiers :

1 : Holding time had been exceeded upon receipt of the sample at the laboratory.

QC Qualifiers :

QM-06 : Due to noted non-homogeneity of the QC sample matrix, the spike recoveries were out side the accepted range. Batch data accepted based on other QC.

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.

Soil results are reported on a dry weight basis when the units are denoted with 'dry'.
Where %Solids is reported, moisture loss includes the loss of volatile hydrocarbons.

CCME PHC additional information:

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.
- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.

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Page 1 of 2

Client Name: Golder Associates
Contact Name: Alyssa Troke
Address: 1931 Robertson Road, Ottawa
K2H 5B7
Telephone: 613 592 9600

Project Reference: 1530908-2000
Quote # ~~15-304~~ 16-018 Golder Dew Lines Monitoring
PO #
Email Address: alyssa_troke@golder.com
dplenderleith@golder.com

TAT: ☒ Regular ☐ 3 Day ☐ 2 Day ☐ 1 Day
Date Required: ______

Criteria: ☐ O. Reg. 153/04 (As Amended) Table __ ☐ RSC Filing ☐ O. Reg. 558/00 ☐ PWQO ☒ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality: ______ ☐ Other: ______

Matrix Type: [✓ **S** (Soil/Sed.)] [✓ **GW** (Ground Water)] **SW** (Surface Water) **SS** (Storm/Sanitary Sewer) **P** (Paint) **A** (Air) **O** (Other)

Paracel Order Number: 1634163-water
1634162 - Soil

Required Analyses

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	**Sample Taken** Date	Time	See Quote										
1	MW98-1A	S		2	Aug-4		X					-60ml+250ml-					
2	MW98-2A	S		2			X										
3	MW98-3A	S		2			X										
4	MW98-3B	S		2			X										
5	MW98-6A	S		2	↓		X										
6	MW98-7A	S		2	Aug-4		X										
7	MW98-8A	S		2			X										
8	MW98-8B	S		2			X										
9	MW98-9A	S		2	↓		X										
10	F4-28A	S		2	Aug 5		X							↓			

Comments: Proceed regardless of hold time per Alyssa. SC.

Method of Delivery: Walk-in

Relinquished By (Sign):
Relinquished By (Print): Joanne Woodhouse
Date/Time: Aug 16/2016 1030am

Received by Driver/Depot:
Date/Time: 08/16/16 11:13am
Temperature: 8.8 °C

Received at Lab: SUNEEPORN DOKMAI
Date/Time: Aug 16, 2016 03.10
Temperature: 8.8 °C

Verified By: Rachel Subject.
Date/Time: Aug 16/16 4:55
pH Verified ☒ By: N/A

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Chain of Custody
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Nº 26765

Page 2 of 2

Client Name: Golder Associates
Contact Name: see page 1
Address:
Telephone:

Project Reference: 1530908-2000
Quote #: ~~15-304~~ Golder Dew Lines Monitoring
PO #:
Email Address: alyssa_troke@golder.com
dplenderleith@golder.com

TAT: ☒ Regular ☐ 3 Day ☐ 2 Day ☐ 1 Day
Date Required:

Criteria: ☐ O. Reg. 153/04 (As Amended) Table __ ☐ RSC Filing ☐ O. Reg. 558/00 ☐ PWQO ☒ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality: ____ ☐ Other: ____

Matrix Type: [✓ S] (Soil/Sed.) [✓ GW] (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Paracel Order Number: 1634162-Soil
1634163-water

Required Analyses

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	See Quote										
1	MW98-02	W		6	Aug 4	1700	X										
2	Fox 4 - Rinsate	W		6	Aug 5	—	X										
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

Comments:

Method of Delivery:

Relinquished By (Sign): Joanne Woodhouse	Received by Driver/Depot:	Received at Lab: SUNEEPORN DOKMAI	Verified By: Rachel Subject
Relinquished By (Print): Joanne Woodhouse	Date/Time: 08/16/16 11:30am	Date/Time: AUG 16, 2016 03:10	Date/Time: Aug 16/16 5:00
Date/Time: Aug 16/2016 1030am	Temperature: 8.8 °C	Temperature: 8.8 °C	pH Verified [✓] By: RS

Appendix C4

Certificate Of Analysis –
Paracel Laboratories Ltd.,
Sept. 2, 2016; Order #1634163

Certificate of Analysis

Golder Associates Ltd. (Ottawa)
1931 Robertson Rd.
Ottawa, ON K2H 5B7
Attn: Alyssa Troke

Client PO:
Project: 1530908-2000
Custody: 26765

Report Date: 2-Sep-2016
Order Date: 16-Aug-2016

Revised Report **Order #: 1634163**

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	**Client ID**
1634163-01	MW98-02
1634163-02	Fox 4 - Rinsate

Approved By:

Tim McCooeye
Senior Advisor

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Mercury by CVAA	EPA 245.1 - Cold Vapour AA	17-Aug-16	17-Aug-16
Metals, ICP-MS	EPA 200.8 - ICP-MS	18-Aug-16	19-Aug-16
PCBs, total	EPA 608 - GC-ECD	18-Aug-16	18-Aug-16
PHC F1	CWS Tier 1 - P&T GC-FID	16-Aug-16	18-Aug-16
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	19-Aug-16	19-Aug-16

PARACEL LABORATORIES LTD.

Order #: 1634163

Certificate of Analysis
Client: Golder Associates Ltd. (Ottawa)
Client PO:

Report Date: 02-Sep-2016
Order Date: 16-Aug-2016
Project Description: 1530908-2000

	Client ID:	MW98-02	Fox 4 - Rinsate	-	-
	Sample Date:	04-Aug-16	05-Aug-16	-	-
	Sample ID:	1634163-01	1634163-02	-	-
	MDL/Units	Water	Water	-	-
Metals					
Mercury	0.0001 mg/L	<0.0001	<0.0001	-	-
Arsenic	0.001 mg/L	0.004	<0.001	-	-
Cadmium	0.0001 mg/L	<0.0001	<0.0001	-	-
Chromium	0.001 mg/L	<0.001	<0.001	-	-
Cobalt	0.0005 mg/L	0.0030	<0.0005	-	-
Copper	0.0005 mg/L	0.0006	<0.0005	-	-
Lead	0.0001 mg/L	0.0001	<0.0001	-	-
Nickel	0.001 mg/L	0.006	<0.001	-	-
Zinc	0.005 mg/L	0.090	<0.005	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	0.025 mg/L	0.395 [1]	<0.025 [1]	-	-
F2 PHCs (C10-C16)	0.100 mg/L	<0.100 [1]	<0.100 [1]	-	-
F3 PHCs (C16-C34)	0.100 mg/L	<0.100 [1]	<0.100 [1]	-	-
F4 PHCs (C34-C50)	0.100 mg/L	<0.100 [1]	<0.100 [1]	-	-
PCBs					
PCBs, total	0.00005 mg/L	<0.00005	<0.00005	-	-
Decachlorobiphenyl	Surrogate	54.8% [4]	72.4%	-	-

Certificate of Analysis
Client: Golder Associates Ltd. (Ottawa)
Client PO:

Report Date: 02-Sep-2016
Order Date: 16-Aug-2016
Project Description: 1530908-2000

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	0.025	mg/L						
F2 PHCs (C10-C16)	ND	0.100	mg/L						
F3 PHCs (C16-C34)	ND	0.100	mg/L						
F4 PHCs (C34-C50)	ND	0.100	mg/L						
Metals									
Mercury	ND	0.0001	mg/L						
Arsenic	ND	0.001	mg/L						
Cadmium	ND	0.0001	mg/L						
Chromium	ND	0.001	mg/L						
Cobalt	ND	0.0005	mg/L						
Copper	ND	0.0005	mg/L						
Lead	ND	0.0001	mg/L						
Nickel	ND	0.001	mg/L						
Zinc	ND	0.005	mg/L						
PCBs									
PCBs, total	ND	0.00005	mg/L						
Surrogate: Decachlorobiphenyl	*.00020*		*mg/L*		*80.6*	*60-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	0.025	mg/L	ND				30	
Metals									
Mercury	ND	0.0001	mg/L	ND				20	
Arsenic	ND	0.001	mg/L	0.0013			0.0	20	
Cadmium	ND	0.0001	mg/L	ND			0.0	20	
Chromium	ND	0.001	mg/L	ND			0.0	20	
Cobalt	ND	0.0005	mg/L	ND			0.0	20	
Copper	ND	0.0005	mg/L	ND				20	
Lead	ND	0.0001	mg/L	ND			0.0	20	
Nickel	ND	0.001	mg/L	ND				20	
Zinc	ND	0.005	mg/L	ND			0.0	20	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	1.83	0.025	mg/L		91.3	68-117			
F2 PHCs (C10-C16)	1.67	0.100	mg/L		93.0	60-140			
F3 PHCs (C16-C34)	3.16	0.100	mg/L		85.0	60-140			
F4 PHCs (C34-C50)	2.12	0.100	mg/L		85.3	60-140			
Metals									
Mercury	0.00309	0.0001	mg/L	ND	103	70-130			
Arsenic	39.0		ug/L	1.3	75.3	80-120			QM-07
Cadmium	49.2		ug/L	0.01	98.4	80-120			
Chromium	49.9		ug/L	0.1	99.6	80-120			
Cobalt	49.0		ug/L	0.02	98.1	80-120			
Copper	48.0		ug/L	ND	96.0	80-120			
Lead	47.5		ug/L	0.08	94.8	80-120			
Nickel	49.2		ug/L	ND	98.5	80-120			
Zinc	52		ug/L	0.2	103	80-120			
PCBs									
PCBs, total	0.00110	0.00005	mg/L		110	60-140			
Surrogate: Decachlorobiphenyl	*.00021*		*mg/L*		*87.2*	*60-140*			

Qualifier Notes:

Login Qualifiers :

Sample - One or more parameter received past hold time - CCME F1-F4 past hold time

Applies to samples: MW98-02, Fox 4 - Rinsate

Sample Qualifiers :

1 : Holding time had been exceeded upon receipt of the sample at the laboratory.

4 : The surrogate recovery for this sample is outside of established control limits due to a sample matrix effect.

QC Qualifiers :

QM-07 : The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on other acceptable QC.

Sample Data Revisions

None

Work Order Revisions / Comments:

Revision 1, all results reported as mg/L.

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.

CCME PHC additional information:

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.
- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.

PARACEL LABORATORIES LTD. | TRUSTED . RESPONSIVE . RELIABLE .

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Chain of Custody
(Lab Use Only)
№ 26765

Page 2 of 2

Client Name: Golder Associates

Contact Name: see page 1

Address:

Telephone:

Project Reference: 1530908-2000

Quote #: ~~15-304~~ 16-010 Golder Dew Lines Monitoring

PO #:

Email Address: alyssa_troke@golder.com
dplenderleith@golder.com

TAT: ☒ Regular [ ] 3 Day [ ] 2 Day [ ] 1 Day

Date Required:

Criteria: [ ] O. Reg. 153/04 (As Amended) Table __ [ ] RSC Filing [ ] O. Reg. 558/00 [ ] PWQO ☒ CCME [ ] SUB (Storm) [ ] SUB (Sanitary) Municipality: ______ [ ] Other: ______

Matrix Type: [✓ S] (Soil/Sed.) [✓ GW] (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Paracel Order Number: 1634162-Soil
1634163-water

Required Analyses

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	see Quote										
1	MW98-02	GW		6	Aug 4	1700	X										
2	Fox 4 - Rinsate	GW		6	Aug 5	–	X										
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

Comments: Samples not preserved, not field filtered. SC
Proceed regardless of hold time per Alyssa. SC

Method of Delivery:

Relinquished By (Sign): Joanne Woodhouse

Relinquished By (Print): Joanne Woodhouse

Date/Time: Aug 16/2016 1030am

Received by Driver/Depot:

Date/Time: 08/16/16 11:30

Temperature: 8.8 °C

Received at Lab: SUNTEPORN DOKMAI

Date/Time: AUG 16, 2016 03:10

Temperature: 8.8 °C

Verified By: Rachel Subject

Date/Time: Aug 16/16 5:00

pH Verified [✓] By: RS

Chain of Custody (Blank) - Rev 0.3 Oct. 2014

Appendix C5

Certificate Of Analysis –
AGAT Laboratories Ltd.,
Nov. 2, 2016; Order #16Z124588

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GOLDER ASSOCIATES LTD
1931 ROBERTSON ROAD
OTTAWA, ON K2H5B7
(613) 592-9600

ATTENTION TO: Alyssa Troke

PROJECT: 1530908 (2000)

AGAT WORK ORDER: 16Z124588

SOIL ANALYSIS REVIEWED BY: Mike Muneswar, BSc (Chem), Senior Inorganic Analyst

TRACE ORGANICS REVIEWED BY: Oksana Gushyla, Trace Organics Lab Supervisor

WATER ANALYSIS REVIEWED BY: Mike Muneswar, BSc (Chem), Senior Inorganic Analyst

DATE REPORTED: Nov 02, 2016

PAGES (INCLUDING COVER): 9

VERSION*: 2

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

VERSION 2:Revised Report Sent on Nov 2, 2016

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

Certificate of Analysis

AGAT WORK ORDER: 16Z124588
PROJECT: 1530908 (2000)

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GOLDER ASSOCIATES LTD
SAMPLING SITE:DEW Line

ATTENTION TO: Alyssa Troke
SAMPLED BY:

CCME Metals Scan (Soil) (incl. Hg)

DATE RECEIVED: 2016-08-09

DATE REPORTED: 2016-11-02

			SAMPLE DESCRIPTION:	F4-13a	MW11-1B
			SAMPLE TYPE:	Soil	Soil
			DATE SAMPLED:	2016-08-03	2016-08-03
Parameter	Unit	G / S	RDL	7761612	7761613
Arsenic	mg/kg		1	2	57
Cadmium	mg/kg		0.5	<0.5	<0.5
Cobalt	mg/kg		0.5	2.7	14.4
Chromium	mg/kg		1	17	81
Copper	mg/kg		1	10	92
Lead	mg/kg		1	4	11
Mercury	mg/kg		0.10	<0.10	<0.10
Nickel	mg/kg		1	8	66
Zinc	mg/kg		1	19	105

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

7761612 Revised Nov 02, 2016.
Revision: This report replaces the Certificate of Analysis issued on Aug 18, 2016. It has been updated to correct all values previously reported for sample F4-13a (7761612).

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 16Z124588
PROJECT: 1530908 (2000)

CLIENT NAME: GOLDER ASSOCIATES LTD
SAMPLING SITE:DEW Line

ATTENTION TO: Alyssa Troke
SAMPLED BY:

PCBs (Total) - Soil

DATE RECEIVED: 2016-08-09

DATE REPORTED: 2016-11-02

			SAMPLE DESCRIPTION:	F4-13a	MW11-1B
			SAMPLE TYPE:	Soil	Soil
			DATE SAMPLED:	2016-08-03	2016-08-03
Parameter	Unit	G / S	RDL	7761612	7761613
PCBs	mg/kg		0.05	<0.05	<0.05
Moisture Content	%		0.05	13.7	3.5
Surrogate	Unit	Acceptable Limits			
Decachlorobiphenyl	%	60-130		112	108

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

7761612-7761613 Results are based on the dry weight of soil extracted.

Certified By:

Certificate of Analysis

AGAT WORK ORDER: 16Z124588
PROJECT: 1530908 (2000)

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GOLDER ASSOCIATES LTD
SAMPLING SITE:DEW Line

ATTENTION TO: Alyssa Troke
SAMPLED BY:

Petroleum Hydrocarbons F1 - F4 (C6 - C50) in Soil

DATE RECEIVED: 2016-08-09

DATE REPORTED: 2016-11-02

			SAMPLE DESCRIPTION:	F4-13a	MW11-1B
			SAMPLE TYPE:	Soil	Soil
			DATE SAMPLED:	2016-08-03	2016-08-03
Parameter	Unit	G / S	RDL	7761612	7761613
C6 - C10 (F1)	mg/kg		5	<5	<5
C>10 - C16 (F2)	mg/kg		10	<10	<10
C>16 - C34 (F3)	mg/kg		50	<50	<50
C>34 - C50 (F4)	mg/kg		50	<50	<50
Gravimetric Heavy Hydrocarbons	mg/kg		50	NA	NA
Moisture Content	%		0.1	13.7	3.5

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

7761612-7761613 Results are based on sample dry weight.
The C6-C10 fraction is calculated using toluene response factor.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and n-C34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16-C50 and are only determined if the chromatogram of the C34 - C50 hydrocarbons indicates that hydrocarbons >C50 are present.
The chromatogram has returned to baseline by the retention time of nC50.
Total C6 - C50 results are corrected for BTEX contributions.
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC6 and nC10 response factors are within 30% of Toluene response factor.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 + nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.
Fractions 1-4 are quantified with the contribution of PAHs. Under Ontario Regulation 153, results are considered valid without determining the PAH contribution if not requested by the client.
Quality Control Data is available upon request.
The soil sample was prepared in the lab using the Methanol extraction technique. The sample was not field preserved with methanol and an Encore was not provided for analysis.

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
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CANADA L4Z 1Y2
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FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: GOLDER ASSOCIATES LTD
PROJECT: 1530908 (2000)
SAMPLING SITE:DEW Line

AGAT WORK ORDER: 16Z124588
ATTENTION TO: Alyssa Troke
SAMPLED BY:

Soil Analysis

RPT Date: Nov 02, 2016			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
CCME Metals Scan (Soil) (incl. Hg)															
Arsenic	7760820		2	2	NA	< 1	103%	70%	130%	99%	80%	120%	95%	70%	130%
Cadmium	7760820		<0.5	<0.5	NA	< 0.5	109%	70%	130%	104%	80%	120%	97%	70%	130%
Cobalt	7760820		4.5	4.4	2.2%	< 0.5	105%	70%	130%	113%	80%	120%	100%	70%	130%
Chromium	7760820		11	11	0.0%	< 1	92%	70%	130%	112%	80%	120%	110%	70%	130%
Copper	7760820		9	10	10.5%	< 1	95%	70%	130%	109%	80%	120%	97%	70%	130%
Lead	7760820		4	4	NA	< 1	118%	70%	130%	93%	80%	120%	87%	70%	130%
Mercury	7760820		<0.10	<0.10	NA	< 0.10	99%	70%	130%	90%	80%	120%	84%	70%	130%
Nickel	7760820		8	9	4.7%	< 1	105%	70%	130%	110%	80%	120%	98%	70%	130%
Zinc	7760820		22	23	NA	< 1	97%	70%	130%	103%	80%	120%	96%	70%	130%

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By:

Quality Assurance

CLIENT NAME: GOLDER ASSOCIATES LTD
PROJECT: 1530908 (2000)
SAMPLING SITE:DEW Line

AGAT WORK ORDER: 16Z124588
ATTENTION TO: Alyssa Troke
SAMPLED BY:

Trace Organics Analysis

RPT Date: Nov 02, 2016			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Petroleum Hydrocarbons F1 - F4 (C6 - C50) in Soil															
C6 - C10 (F1)	7761612		< 5	< 5	NA	< 5	76%	60%	130%	89%	60%	130%	87%	60%	130%
C>10 - C16 (F2)	7760850		< 10	< 10	NA	< 10	107%	70%	130%	91%	70%	130%	99%	70%	130%
C>16 - C34 (F3)	7760850		< 50	< 50	NA	< 50	104%	70%	130%	94%	70%	130%	96%	70%	130%
C>34 - C50 (F4)	7760850		< 50	< 50	NA	< 50	104%	70%	130%	101%	70%	130%	88%	70%	130%
PCBs (Total) - Water															
PCBs		TW	<0.05	<0.05	0.0%	<0.05	115%	60%	140%	104%	60%	140%	110%	60%	140%
PCBs (Total) - Soil															
PCBs	7762942		< 0.05	< 0.05	0.0%	< 0.05	111%	60%	140%	111%	60%	140%	113%	60%	140%
Petroleum Hydrocarbon F1 - F4 in Water															
C6 - C10 (F1)	7759370		< 25	< 25	NA	< 25	97%	70%	130%	109%	70%	130%	74%	70%	130%
C>10 - C16 (F2)		TW	< 100	< 100	NA	< 100	104%	70%	130%	79%	70%	130%	72%	70%	130%
C>16 - C34 (F3)		TW	< 100	< 100	NA	< 100	102%	70%	130%	83%	70%	130%	93%	70%	130%
C>34 - C50 (F4)		TW	< 100	< 100	NA	< 100	83%	70%	130%	88%	70%	130%	101%	70%	130%

Comments: Tap water analysis has been performed as QC sample testing for duplicate and matrix spike due to insufficient sample volume.
When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

Certified By:

Quality Assurance

CLIENT NAME: GOLDER ASSOCIATES LTD
PROJECT: 1530908 (2000)
SAMPLING SITE:DEW Line

AGAT WORK ORDER: 16Z124588
ATTENTION TO: Alyssa Troke
SAMPLED BY:

Water Analysis

RPT Date: Nov 02, 2016			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
CCME Metals - (Water) - (incl. Hg)															
Arsenic	7761523		< 0.001	< 0.001	NA	< 0.001	97%	90%	110%	97%	90%	110%	104%	70%	130%
Cadmium	7761523		< 0.0001	< 0.0001	NA	< 0.0001	100%	90%	110%	103%	90%	110%	107%	70%	130%
Chromium	7761523		< 0.001	< 0.001	NA	< 0.001	101%	90%	110%	100%	90%	110%	104%	70%	130%
Cobalt	7761523		0.0012	0.0013	NA	< 0.0005	103%	90%	110%	103%	90%	110%	106%	70%	130%
Copper	7761523		0.070	0.073	4.2%	< 0.005	102%	90%	110%	100%	90%	110%	101%	70%	130%
Lead	7761523		0.0293	0.0300	2.4%	< 0.0001	96%	90%	110%	96%	90%	110%	97%	70%	130%
Mercury	7761523		<0.0001	<0.0001	NA	< 0.0001	103%	90%	110%	101%	90%	110%	105%	80%	120%
Nickel	7761523		< 0.001	< 0.001	NA	< 0.001	101%	90%	110%	102%	90%	110%	106%	70%	130%
Zinc	7761523		0.087	0.100	13.9%	< 0.005	100%	90%	110%	101%	90%	110%	106%	70%	130%

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By:

Method Summary

CLIENT NAME: GOLDER ASSOCIATES LTD
PROJECT: 1530908 (2000)
SAMPLING SITE:DEW Line
AGAT WORK ORDER: 16Z124588
ATTENTION TO: Alyssa Troke
SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Arsenic	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cadmium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Copper	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Lead	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Mercury	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Nickel	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Zinc	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Trace Organics Analysis			
PCBs	ORG-91-5113	EPA SW-846 3541 & 8082	GC/ECD
Moisture Content		MOE E3139	BALANCE
Decachlorobiphenyl	ORG-91-5113	EPA SW-846 3541 & 8082	GC/ECD
PCBs	ORG-91-5112	EPA SW-846 3510 & 8082	GC/ECD
Initial Sample Volume			GC/FID
Decachlorobiphenyl	ORG-91-5112	EPA SW-846 3510 & 8082	GC/ECD
C6 - C10 (F1)	VOL-91-5010	MOE PHC-E3421	(P&T)GC/FID
C>10 - C16 (F2)	VOL-91-5010	MOE PHC-E3421	GC/FID
C>16 - C34 (F3)	VOL-91-5010	MOE PHC-E3421	GC/FID
C>34 - C50 (F4)	VOL -91- 5010	MOE PHC-E3421	GC/FID
Gravimetric Heavy Hydrocarbons	VOL-91-5010	MOE PHC-E3421	BALANCE
C6 - C10 (F1)	VOL-91-5009	CCME Tier 1 Method	P & T GC/FID
C>10 - C16 (F2)	VOL-91-5009	CCME Tier 1 Method, EPA SW846 8015	GC / FID
C>16 - C34 (F3)	VOL-91-5009	CCME Tier 1 Method, EPA SW846 8015	GC / FID
C>34 - C50 (F4)	VOL-91-5009	CCME Tier 1 Method, EPA SW846 8015	GC / FID
Gravimetric Heavy Hydrocarbons	VOL - 5012	CCME Tier 1 Method	GRAVIMETRIC ANALYSIS
Moisture Content	VOL-91-5009	CCME Tier 1 Method	Balance
Water Analysis			
Arsenic	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Cadmium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Chromium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Copper	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Lead	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Mercury	MET-93-6100	EPA SW-846 7470 & 245.1	CVAAS
Nickel	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Zinc	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS

AGAT Laboratories

SR 12

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Laboratory Use Only

Work Order #: 16T124588

Cooler Quantity: 1

Arrival Temperatures: 2.6 | 2.7 | 3.1
4.8 | 4.9 | 5.3

Custody Seal Intact: ☐Yes ☐No ☐N/A

Notes: on ice

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water intended for human consumption)

Report Information:

Company: Golder Associates
Contact: Alyssa Troke
Address: 1931 Robertson Road
Ottawa, ON K2H 5B7
Phone: 613 592 9600 Fax:
Reports to be sent to:
1. Email: alyssa_troke@golder.com
2. Email:

Regulatory Requirements:

☐ No Regulatory Requirement

(Please check all applicable boxes)

☐ Regulation 153/04
Table *Indicate One*
☐ Ind/Com
☐ Res/Park
☐ Agriculture
Soil Texture *(Check One)*
☐ Coarse
☐ Fine

☐ Sewer Use
☐ Sanitary
☐ Storm
Region *Indicate One*

☐ Regulation 558
☑ CCME
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
Indicate One

Is this submission for a **Record of Site Condition?**
☐ Yes ☑ No

Report Guideline on *Certificate of Analysis*
☐ Yes ☑ No

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)
☐ 3 Business Days ☐ 2 Business Days ☐ 1 Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

Project Information:

Project: DEW Line 2016
Site Location:
Sampled By:
AGAT Quote #: 69566 PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐

Company:
Contact:
Address:
Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI (Please Circle) Y / N	Metals and Inorganics	Metal Scan	Hydride Forming Metals	Client Custom Metals	(Check Applicable) ORPs: ☐ B-HWS ☐ Cl ☐ CN ☐ Cr⁶⁺ ☐ EC ☐ FOC ☐ NO_3/NO_2 ☐ Total N ☐ Hg ☐ pH ☐ SAR	Nutrients: ☐ TP ☐ NH_3 ☐ TKN ☐ NO_3 ☐ NO_2 ☐ NO_3/NO_2	Volatiles: ☐ VOC ☐ BTEX ☐ THM	CCME Fractions 1 to 4	ABNs	PAHs	Chlorophenols	PCBs	Organochlorine Pesticides	TCLP Metals/Inorganics	Sewer Use	Quote 69566	F1-F4/BTEX	total metals	mercury	total PCBs		
MW 11-1 DUP	Aug 3		5	W		N																✓						
F4-13a	Aug 3		2	S		—																✓						
MW 11-1B	Aug 3		2	S		—																✓						

Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time	
Nicole MacDonald	Aug 8/16	19:00	Berthelet	9 Aug-16	8h10	
Berthelet to Purolator	9 Aug 16	16h45	Simon	16/8/10	9:58	Page 1 of 1
						Nº: T 028854

Pink Copy - Client I Yellow Copy - AGAT I White Copy- AGAT

Appendix C6

Certificate Of Analysis –
AGAT Laboratories Ltd.,
Nov. 2, 2016; Order #16Z124588

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GOLDER ASSOCIATES LTD
1931 ROBERTSON ROAD
OTTAWA, ON K2H5B7
(613) 592-9600

ATTENTION TO: Alyssa Troke

PROJECT: 1530908 (2000)

AGAT WORK ORDER: 16Z124588

SOIL ANALYSIS REVIEWED BY: Mike Muneswar, BSc (Chem), Senior Inorganic Analyst

TRACE ORGANICS REVIEWED BY: Oksana Gushyla, Trace Organics Lab Supervisor

WATER ANALYSIS REVIEWED BY: Mike Muneswar, BSc (Chem), Senior Inorganic Analyst

DATE REPORTED: Nov 02, 2016

PAGES (INCLUDING COVER): 9

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

Certificate of Analysis

AGAT WORK ORDER: 16Z124588

PROJECT: 1530908 (2000)

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GOLDER ASSOCIATES LTD

ATTENTION TO: Alyssa Troke

SAMPLING SITE:DEW Line

SAMPLED BY:

PCBs (Total) - Water

DATE RECEIVED: 2016-08-09

DATE REPORTED: 2016-11-02

			SAMPLE DESCRIPTION:	MW11-1 Dup
			SAMPLE TYPE:	Water
			DATE SAMPLED:	2016-08-03
Parameter	Unit	G / S	RDL	7761611
PCBs	mg/L		0.00005	<0.00005
Initial Sample Volume				0.70
Surrogate	Unit	Acceptable Limits		
Decachlorobiphenyl	%	60-130		78

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

Certificate of Analysis

AGAT WORK ORDER: 16Z124588
PROJECT: 1530908 (2000)

CLIENT NAME: GOLDER ASSOCIATES LTD
SAMPLING SITE:DEW Line

ATTENTION TO: Alyssa Troke
SAMPLED BY:

Petroleum Hydrocarbon F1 - F4 in Water

DATE RECEIVED: 2016-08-09

DATE REPORTED: 2016-11-02

			SAMPLE DESCRIPTION:	MW11-1 Dup
			SAMPLE TYPE:	Water
			DATE SAMPLED:	2016-08-03
Parameter	Unit	G / S	RDL	7761611
C6 - C10 (F1)	mg/L		0.025	<0.025
C>10 - C16 (F2)	mg/L		0.1	<0.1
C>16 - C34 (F3)	mg/L		0.1	<0.1
C>34 - C50 (F4)	mg/L		0.1	<0.1
Gravimetric Heavy Hydrocarbons	mg/L		0.5	NA

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

7761611 The C6-C10 fraction is calculated using Toluene response factor.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and nC34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16 - C50 and are only determined if the chromatogram of the C34 - C50 Hydrocarbons indicated that hydrocarbons >C50 are present.
The chromatogram has returned to baseline by the retention time of nC50.
Total C6-C50 results are corrected for BTEX contributions.
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC6 and nC10 response factors are within 30% of Toluene response factor.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.
Fractions 1-4 are quantified with the contribution of PAHs. Under Ontario Regulation 153/04, results are considered valid without determining the PAH contribution if not requested by the client.
NA = Not Applicable

Certified By:

Certificate of Analysis

AGAT WORK ORDER: 16Z124588
PROJECT: 1530908 (2000)

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GOLDER ASSOCIATES LTD
SAMPLING SITE:DEW Line

ATTENTION TO: Alyssa Troke
SAMPLED BY:

CCME Metals - (Water) - (incl. Hg)

DATE RECEIVED: 2016-08-09

DATE REPORTED: 2016-11-02

			SAMPLE DESCRIPTION:	MW11-1 Dup
			SAMPLE TYPE:	Water
			DATE SAMPLED:	2016-08-03
Parameter	Unit	G / S	RDL	7761611
Arsenic	mg/L		0.001	<0.001
Cadmium	mg/L		0.0001	<0.0001
Chromium	mg/L		0.001	<0.001
Cobalt	mg/L		0.0005	0.0015
Copper	mg/L		0.005	<0.005
Lead	mg/L		0.0001	<0.0001
Mercury	mg/L		0.0001	<0.0001
Nickel	mg/L		0.001	0.010
Zinc	mg/L		0.005	<0.005

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

Quality Assurance

CLIENT NAME: GOLDER ASSOCIATES LTD
PROJECT: 1530908 (2000)
SAMPLING SITE:DEW Line

AGAT WORK ORDER: 16Z124588
ATTENTION TO: Alyssa Troke
SAMPLED BY:

Soil Analysis

RPT Date: Nov 02, 2016			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
CCME Metals Scan (Soil) (incl. Hg)															
Arsenic	7760820		2	2	NA	< 1	103%	70%	130%	99%	80%	120%	95%	70%	130%
Cadmium	7760820		<0.5	<0.5	NA	< 0.5	109%	70%	130%	104%	80%	120%	97%	70%	130%
Cobalt	7760820		4.5	4.4	2.2%	< 0.5	105%	70%	130%	113%	80%	120%	100%	70%	130%
Chromium	7760820		11	11	0.0%	< 1	92%	70%	130%	112%	80%	120%	110%	70%	130%
Copper	7760820		9	10	10.5%	< 1	95%	70%	130%	109%	80%	120%	97%	70%	130%
Lead	7760820		4	4	NA	< 1	118%	70%	130%	93%	80%	120%	87%	70%	130%
Mercury	7760820		<0.10	<0.10	NA	< 0.10	99%	70%	130%	90%	80%	120%	84%	70%	130%
Nickel	7760820		8	9	4.7%	< 1	105%	70%	130%	110%	80%	120%	98%	70%	130%
Zinc	7760820		22	23	NA	< 1	97%	70%	130%	103%	80%	120%	96%	70%	130%

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By:

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: GOLDER ASSOCIATES LTD
PROJECT: 1530908 (2000)
SAMPLING SITE:DEW Line

AGAT WORK ORDER: 16Z124588
ATTENTION TO: Alyssa Troke
SAMPLED BY:

Trace Organics Analysis

RPT Date: Nov 02, 2016			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Petroleum Hydrocarbons F1 - F4 (C6 - C50) in Soil															
C6 - C10 (F1)	7761612		< 5	< 5	NA	< 5	76%	60%	130%	89%	60%	130%	87%	60%	130%
C>10 - C16 (F2)	7760850		< 10	< 10	NA	< 10	107%	70%	130%	91%	70%	130%	99%	70%	130%
C>16 - C34 (F3)	7760850		< 50	< 50	NA	< 50	104%	70%	130%	94%	70%	130%	96%	70%	130%
C>34 - C50 (F4)	7760850		< 50	< 50	NA	< 50	104%	70%	130%	101%	70%	130%	88%	70%	130%
PCBs (Total) - Water															
PCBs		TW	<0.05	<0.05	0.0%	<0.05	115%	60%	140%	104%	60%	140%	110%	60%	140%
PCBs (Total) - Soil															
PCBs	7762942		< 0.05	< 0.05	0.0%	< 0.05	111%	60%	140%	111%	60%	140%	113%	60%	140%
Petroleum Hydrocarbon F1 - F4 in Water															
C6 - C10 (F1)	7759370		< 25	< 25	NA	< 25	97%	70%	130%	109%	70%	130%	74%	70%	130%
C>10 - C16 (F2)		TW	< 100	< 100	NA	< 100	104%	70%	130%	79%	70%	130%	72%	70%	130%
C>16 - C34 (F3)		TW	< 100	< 100	NA	< 100	102%	70%	130%	83%	70%	130%	93%	70%	130%
C>34 - C50 (F4)		TW	< 100	< 100	NA	< 100	83%	70%	130%	88%	70%	130%	101%	70%	130%

Comments: Tap water analysis has been performed as QC sample testing for duplicate and matrix spike due to insufficient sample volume.
When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

Certified By:

Quality Assurance

CLIENT NAME: GOLDER ASSOCIATES LTD
PROJECT: 1530908 (2000)
SAMPLING SITE:DEW Line

AGAT WORK ORDER: 16Z124588
ATTENTION TO: Alyssa Troke
SAMPLED BY:

Water Analysis

RPT Date: Nov 02, 2016			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
CCME Metals - (Water) - (incl. Hg)															
Arsenic	7761523		< 0.001	< 0.001	NA	< 0.001	97%	90%	110%	97%	90%	110%	104%	70%	130%
Cadmium	7761523		< 0.0001	< 0.0001	NA	< 0.0001	100%	90%	110%	103%	90%	110%	107%	70%	130%
Chromium	7761523		< 0.001	< 0.001	NA	< 0.001	101%	90%	110%	100%	90%	110%	104%	70%	130%
Cobalt	7761523		0.0012	0.0013	NA	< 0.0005	103%	90%	110%	103%	90%	110%	106%	70%	130%
Copper	7761523		0.070	0.073	4.2%	< 0.005	102%	90%	110%	100%	90%	110%	101%	70%	130%
Lead	7761523		0.0293	0.0300	2.4%	< 0.0001	96%	90%	110%	96%	90%	110%	97%	70%	130%
Mercury	7761523		<0.0001	<0.0001	NA	< 0.0001	103%	90%	110%	101%	90%	110%	105%	80%	120%
Nickel	7761523		< 0.001	< 0.001	NA	< 0.001	101%	90%	110%	102%	90%	110%	106%	70%	130%
Zinc	7761523		0.087	0.100	13.9%	< 0.005	100%	90%	110%	101%	90%	110%	106%	70%	130%

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By: ____________________

Method Summary

CLIENT NAME: GOLDER ASSOCIATES LTD
PROJECT: 1530908 (2000)
SAMPLING SITE:DEW Line

AGAT WORK ORDER: 16Z124588
ATTENTION TO: Alyssa Troke
SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Arsenic	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cadmium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Copper	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Lead	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Mercury	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Nickel	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Zinc	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Trace Organics Analysis			
PCBs	ORG-91-5113	EPA SW-846 3541 & 8082	GC/ECD
Moisture Content		MOE E3139	BALANCE
Decachlorobiphenyl	ORG-91-5113	EPA SW-846 3541 & 8082	GC/ECD
PCBs	ORG-91-5112	EPA SW-846 3510 & 8082	GC/ECD
Initial Sample Volume			GC/FID
Decachlorobiphenyl	ORG-91-5112	EPA SW-846 3510 & 8082	GC/ECD
C6 - C10 (F1)	VOL-91-5010	MOE PHC-E3421	(P&T)GC/FID
C>10 - C16 (F2)	VOL-91-5010	MOE PHC-E3421	GC/FID
C>16 - C34 (F3)	VOL-91-5010	MOE PHC-E3421	GC/FID
C>34 - C50 (F4)	VOL -91- 5010	MOE PHC-E3421	GC/FID
Gravimetric Heavy Hydrocarbons	VOL-91-5010	MOE PHC-E3421	BALANCE
C6 - C10 (F1)	VOL-91-5009	CCME Tier 1 Method	P & T GC/FID
C>10 - C16 (F2)	VOL-91-5009	CCME Tier 1 Method, EPA SW846 8015	GC / FID
C>16 - C34 (F3)	VOL-91-5009	CCME Tier 1 Method, EPA SW846 8015	GC / FID
C>34 - C50 (F4)	VOL-91-5009	CCME Tier 1 Method, EPA SW846 8015	GC / FID
Gravimetric Heavy Hydrocarbons	VOL - 5012	CCME Tier 1 Method	GRAVIMETRIC ANALYSIS
Moisture Content	VOL-91-5009	CCME Tier 1 Method	Balance
Water Analysis			
Arsenic	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Cadmium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Chromium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Copper	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Lead	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Mercury	MET-93-6100	EPA SW-846 7470 & 245.1	CVAAS
Nickel	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Zinc	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS

AGAT Laboratories

SR 12

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Laboratory Use Only

Work Order #: 16T124588

Cooler Quantity: 1

Arrival Temperatures: 2.6 | 2.7 | 3.1
4.8 | 4.9 | 5.3

Custody Seal Intact: ☐Yes ☐No ☐N/A

Notes: on ice

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water intended for human consumption)

Report Information:

Company: Golder Associates
Contact: Alyssa Troke
Address: 1931 Robertson Road
Ottawa, ON K2H 5B7
Phone: 613 592 9600 Fax:
Reports to be sent to:
1. Email: alyssa_troke@golder.com
2. Email:

Regulatory Requirements:

(Please check all applicable boxes)

☐ No Regulatory Requirement

☐ Regulation 153/04
Table ___ *Indicate One*
☐Ind/Com
☐Res/Park
☐Agriculture
Soil Texture *(Check One)*
☐Coarse
☐Fine

☐ Sewer Use
☐Sanitary
☐Storm
Region ___ *Indicate One*

☐ Regulation 558
☑ CCME
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
___ *Indicate One*

Is this submission for a Record of Site Condition?
☐ Yes ☑ No

Report Guideline on *Certificate of Analysis*
☐ Yes ☑ No

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ 1 Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

Project Information:

Project: DEW Line 2016
Site Location:
Sampled By:
AGAT Quote #: 69566 PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐

Company:
Contact:
Address:
Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI (Please Circle) Y / N	Metals and Inorganics	Metal Scan	Hydride Forming Metals	Client Custom Metals	ORPs: ☐ B-HWS ☐ Cl ☐ CN ☐ Cr⁶⁺ ☐ EC ☐ FOC ☐ NO_3/NO_2 ☐ Total N ☐ Hg ☐ pH ☐ SAR	Nutrients: ☐ TP ☐ NH_3 ☐ TKN ☐ NO_3 ☐ NO_2 ☐ NO_3/NO_2	Volatiles: ☐ VOC ☐ BTEX ☐ THM	CCME Fractions 1 to 4	ABNs	PAHs	Chlorophenols	PCBs	Organochlorine Pesticides	TCLP Metals/Inorganics	Sewer Use	Quote 69566	F1-F4/BTEX	total metals	mercury	total PCBs
MW 11-1 DUP	Aug 3		5	W		N																✓				
F4-13a	Aug 3		2	S		—																✓				
MW 11-1B	Aug 3		2	S		—																✓				

(Check Applicable)

Samples Relinquished By (Print Name and Sign): Nicole MacDonald
Date: Aug 5/16 Time: 19:00
Samples Received By (Print Name and Sign): Berthelet
Date: 9-Aug-16 Time: 8h10

Samples Relinquished By (Print Name and Sign): Berthelet to Purolator
Date: 9 Aug 16 Time: 16h40
Samples Received By (Print Name and Sign): Simon
Date: 16/8/10 Time: 9:58

Samples Relinquished By (Print Name and Sign):
Date: Time:
Samples Received By (Print Name and Sign):
Date: Time:

Page 1 of 1

Nº: T 028854

Pink Copy - Client | Yellow Copy - AGAT | White Copy- AGAT

Appendix C7

Certificate Of Analysis –
AGAT Laboratories Ltd.,
Nov. 2, 2016; Order #16Z126821

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GOLDER ASSOCIATES LTD
1931 ROBERTSON ROAD
OTTAWA, ON K2H5B7
(613) 592-9600

ATTENTION TO: Alyssa Troke

PROJECT: 1530908-2000

AGAT WORK ORDER: 16Z126821

SOIL ANALYSIS REVIEWED BY: Mike Muneswar, BSc (Chem), Senior Inorganic Analyst

TRACE ORGANICS REVIEWED BY: Oksana Gushyla, Trace Organics Lab Supervisor

DATE REPORTED: Nov 02, 2016

PAGES (INCLUDING COVER): 8

VERSION*: 2

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

VERSION 2:Revised Report Sent on Nov 2, 2016

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

Certificate of Analysis

AGAT WORK ORDER: 16Z126821
PROJECT: 1530908-2000

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CLIENT NAME: GOLDER ASSOCIATES LTD
SAMPLING SITE:DEW Line

ATTENTION TO: Alyssa Troke
SAMPLED BY:

CCME Metals Scan (Soil) (incl. Hg)

DATE RECEIVED: 2016-08-16

DATE REPORTED: 2016-11-02

			SAMPLE DESCRIPTION:	F4-28A dup	MW98-3A dup
			SAMPLE TYPE:	Soil	Soil
			DATE SAMPLED:	2016-08-04	2016-08-04
Parameter	Unit	G / S	RDL	7777796	7777801
Arsenic	mg/kg		1	15	22
Cadmium	mg/kg		0.5	<0.5	<0.5
Cobalt	mg/kg		0.5	10.2	5.1
Chromium	mg/kg		1	61	34
Copper	mg/kg		1	40	19
Lead	mg/kg		1	16	6
Mercury	mg/kg		0.10	<0.10	<0.10
Nickel	mg/kg		1	31	18
Zinc	mg/kg		1	72	36

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

7777801 Revised Nov 02, 2016.
Revision: This report replaces the Certificate of Analysis issued on Sep 15, 2016. It has been updated to correct Arsenic value previously reported for sample MW98-3A dup (7777801).

Certified By:

5835 COOPERS AVENUE
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CANADA L4Z 1Y2
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FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GOLDER ASSOCIATES LTD
SAMPLING SITE:DEW Line

ATTENTION TO: Alyssa Troke
SAMPLED BY:

PCBs (Total) - Soil

DATE RECEIVED: 2016-08-16

DATE REPORTED: 2016-11-02

			SAMPLE DESCRIPTION:	F4-28A dup	MW98-3A dup
			SAMPLE TYPE:	Soil	Soil
			DATE SAMPLED:	2016-08-04	2016-08-04
Parameter	Unit	G / S	RDL	7777796	7777801
PCBs	mg/kg		0.05	<0.05	<0.05
Surrogate	Unit	Acceptable Limits			
Decachlorobiphenyl	%	60-130		120	112

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard
7777796-7777801 Results are based on the dry weight of soil extracted.

Certified By:

Certificate of Analysis

AGAT WORK ORDER: 16Z126821
PROJECT: 1530908-2000

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GOLDER ASSOCIATES LTD
SAMPLING SITE:DEW Line

ATTENTION TO: Alyssa Troke
SAMPLED BY:

Petroleum Hydrocarbons F1 - F4 (C6 - C50) in Soil

DATE RECEIVED: 2016-08-16

DATE REPORTED: 2016-11-02

			SAMPLE DESCRIPTION:	F4-28A dup	MW98-3A dup
			SAMPLE TYPE:	Soil	Soil
			DATE SAMPLED:	2016-08-04	2016-08-04
Parameter	Unit	G / S	RDL	7777796	7777801
C6 - C10 (F1)	mg/kg		5	<5	<5
C>10 - C16 (F2)	mg/kg		10	<10	<10
C>16 - C34 (F3)	mg/kg		50	<50	<50
C>34 - C50 (F4)	mg/kg		50	<50	<50
Gravimetric Heavy Hydrocarbons	mg/kg		50	NA	NA
Moisture Content	%		0.1	4.9	2.8

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

7777796-7777801 Results are based on sample dry weight.
The C6-C10 fraction is calculated using toluene response factor.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and n-C34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16-C50 and are only determined if the chromatogram of the C34 - C50 hydrocarbons indicates that hydrocarbons >C50 are present.
The chromatogram has returned to baseline by the retention time of nC50.
Total C6 - C50 results are corrected for BTEX contributions.
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC6 and nC10 response factors are within 30% of Toluene response factor.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 + nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.
Fractions 1-4 are quantified with the contribution of PAHs. Under Ontario Regulation 153, results are considered valid without determining the PAH contribution if not requested by the client.
Quality Control Data is available upon request.
The soil sample was prepared in the lab using the Methanol extraction technique. The sample was not field preserved with methanol and an Encore was not provided for analysis.

Certified By:

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: GOLDER ASSOCIATES LTD
PROJECT: 1530908-2000
SAMPLING SITE:DEW Line

AGAT WORK ORDER: 16Z126821
ATTENTION TO: Alyssa Troke
SAMPLED BY:

Soil Analysis

RPT Date: Nov 02, 2016			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
CCME Metals Scan (Soil) (incl. Hg)															
Arsenic	7785299		5	5	0.0%	< 1	108%	70%	130%	97%	80%	120%	101%	70%	130%
Cadmium	7785299		<0.5	<0.5	NA	< 0.5	100%	70%	130%	109%	80%	120%	105%	70%	130%
Cobalt	7785299		15.1	15.1	0.0%	< 0.5	102%	70%	130%	106%	80%	120%	108%	70%	130%
Chromium	7785299		27	27	1.2%	< 1	88%	70%	130%	102%	80%	120%	107%	70%	130%
Copper	7785299		7	7	2.2%	< 1	97%	70%	130%	105%	80%	120%	104%	70%	130%
Lead	7785299		5	5	NA	< 1	103%	70%	130%	104%	80%	120%	103%	70%	130%
Mercury	7785299		<0.10	<0.10	NA	< 0.10	106%	70%	130%	90%	80%	120%	90%	70%	130%
Nickel	7785299		36	35	3.3%	< 1	101%	70%	130%	106%	80%	120%	106%	70%	130%
Zinc	7785299		67	66	0.6%	< 1	100%	70%	130%	109%	80%	120%	106%	70%	130%

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By: ______________________

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
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Quality Assurance

CLIENT NAME: GOLDER ASSOCIATES LTD

PROJECT: 1530908-2000

SAMPLING SITE:DEW Line

AGAT WORK ORDER: 16Z126821

ATTENTION TO: Alyssa Troke

SAMPLED BY:

Trace Organics Analysis

RPT Date: Nov 02, 2016			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper
PCBs (Total) - Soil															
PCBs	7779859		< 0.1	< 0.1	NA	< 0.1	118%	60%	140%	99%	60%	140%	101%	60%	140%
Petroleum Hydrocarbons F1 - F4 (C6 - C50) in Soil															
C6 - C10 (F1)	7783958		< 5	< 5	NA	< 5	96%	60%	130%	105%	60%	130%	92%	60%	130%
C>10 - C16 (F2)	7785901		< 10	< 10	NA	< 10	102%	70%	130%	96%	70%	130%	70%	70%	130%
C>16 - C34 (F3)	7785901		< 50	< 50	NA	< 50	103%	70%	130%	97%	70%	130%	72%	70%	130%
C>34 - C50 (F4)	7785901		< 50	< 50	NA	< 50	98%	70%	130%	97%	70%	130%	83%	70%	130%

Comments: When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

Certified By:

Method Summary

CLIENT NAME: GOLDER ASSOCIATES LTD

AGAT WORK ORDER: 16Z126821

PROJECT: 1530908-2000

ATTENTION TO: Alyssa Troke

SAMPLING SITE:DEW Line

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Arsenic	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cadmium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Copper	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Lead	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Mercury	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Nickel	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Zinc	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Trace Organics Analysis			
PCBs	ORG-91-5113	EPA SW-846 3541 & 8082	GC/ECD
Decachlorobiphenyl	ORG-91-5113	EPA SW-846 3541 & 8082	GC/ECD
C6 - C10 (F1)	VOL-91-5009	CCME Tier 1 Method	P & T GC/FID
C>10 - C16 (F2)	VOL-91-5009	CCME Tier 1 Method, EPA SW846 8015	GC / FID
C>16 - C34 (F3)	VOL-91-5009	CCME Tier 1 Method, EPA SW846 8015	GC / FID
C>34 - C50 (F4)	VOL-91-5009	CCME Tier 1 Method, EPA SW846 8015	GC / FID
Gravimetric Heavy Hydrocarbons	VOL - 5012	CCME Tier 1 Method	GRAVIMETRIC ANALYSIS
Moisture Content	VOL-91-5009	CCME Tier 1 Method	Balance

AGAT Laboratories 1Lg

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water intended for human consumption)

Laboratory Use Only

Work Order #: 16T126821
Cooler Quantity: 1
Arrival Temperatures: 9.3 | 9.4 | 9.1
8^{6} | 8^{4} | 9
Custody Seal Intact: ☐Yes ☐No ☐N/A
Notes: on ice

Report Information:

Company: Golder Associates
Contact: Alyssa Troke
Address: 1931 Robertson Road
K2H 5B7
Phone: 613 592 9600 Fax:
Reports to be sent to:
1. Email: atroke@golder.com
2. Email: dplenderleith@golder.com

Regulatory Requirements: ☐ No Regulatory Requirement

(Please check all applicable boxes)

☐Regulation 153/04
Table ____ *Indicate One*
☐Ind/Com
☐Res/Park
☐Agriculture
Soil Texture *(Check One)*
☐Coarse
☐Fine

☐Sewer Use
☐Sanitary
☐Storm
Region ____ *Indicate One*

☐Regulation 558
☒CCME
☐Prov. Water Quality Objectives (PWQO)
☐Other
____ *Indicate One*

Is this submission for a **Record of Site Condition?** ☐ Yes ☒ No

Report Guideline on *Certificate of Analysis* ☐ Yes ☒ No

Turnaround Time (TAT) Required:

Regular TAT ☒ 5 to 7 Business Days
Rush TAT (Rush Surcharges Apply)
☐ 3 Business Days ☐ 2 Business Days ☐ 1 Business Day
OR Date Required (Rush Surcharges May Apply): ____
Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

Project Information:

Project: 1530908 - 2000
Site Location:
Sampled By:
AGAT Quote #: 69566 PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☐ No ☐
Company:
Contact:
Address:
Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Metals and Inorganics	Metal Scan	Hydride Forming Metals	Client Custom Metals	(Check Applicable) ORPs: ☐B-HWS ☐Cl⁻ ☐CN ☐Cr⁶⁺ ☐EC ☐FOC ☐NO₃/NO₂ ☐Total N ☐Hg ☐pH ☐SAR	Nutrients: ☐TP ☐NH₃ ☐TKN ☐NO₃ ☐NO₂ ☐NO₃/NO₂	Volatiles: ☐VOC ☐BTEX ☐THM	CCME Fractions 1 to 4	ABNs	PAHs	Chlorophenols	PCBs	Organochlorine Pesticides	TCLP Metals/Inorganics	Sewer Use	Quote
F4-28A dup	Aug 4		2	S																	X
MW98-3A dup	Aug 4		2	S																	X

Samples Relinquished By (Print Name and Sign): Joanne Woodhouse Joanne Woodhouse Date: Aug 16 Time: 1030
Samples Relinquished By (Print Name and Sign): Date: Time:

Samples Received By (Print Name and Sign): L Berthelet Date: 16-Aug-16 Time: 12h50
Samples Received By (Print Name and Sign): Date: 16/8/17 Time: 10 42

Page 1 of 1
Nº: T 018523

Document ID: DIV-78-1511.010
Pink Copy - Client | Yellow Copy - AGAT | White Copy- AGAT
Date Issued: November 2, 2015

Appendix C8

Certificate Of Analysis –
Paracel Laboratories Ltd.,
Sept. 2, 2016; Order #1635445

PARACEL LABORATORIES LTD. | TRUSTED. RESPONSIVE. RELIABLE.

300 - 2319 St. Laurent Blvd
Ottawa, ON, K1G 4J8
1-800-749-1947
www.paracellabs.com

Certificate of Analysis

Golder Associates Ltd. (Ottawa)

1931 Robertson Rd.
Ottawa, ON K2H 5B7
Attn: Alyssa Troke

Client PO:
Project: 1530908-2000
Custody: 20409/102554

Report Date: 2-Sep-2016
Order Date: 26-Aug-2016

Order #: 1635445

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1635445-01	MW-6
1635445-02	MW-16
1635445-03	MW-12
1635445-04	MW-13
1635445-05	MW-15
1635445-06	MW-14
1635445-07	MW-9
1635445-08	MW-10
1635445-09	Probe Blank
1635445-10	MW-7
1635445-11	Field Blank
1635445-12	Trip Blank

Approved By:

Dale Robertson, BSc
Laboratory Director

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Mercury by CVAA	EPA 245.1 - Cold Vapour AA	30-Aug-16	30-Aug-16
Metals, ICP-MS	EPA 200.8 - ICP-MS	1-Sep-16	2-Sep-16
PCBs, total	EPA 608 - GC-ECD	30-Aug-16	30-Aug-16
PHC F1	CWS Tier 1 - P&T GC-FID	26-Aug-16	29-Aug-16
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	29-Aug-16	30-Aug-16

Certificate of Analysis
Client: Golder Associates Ltd. (Ottawa)
Client PO:

Report Date: 02-Sep-2016
Order Date: 26-Aug-2016
Project Description: 1530908-2000

Client ID:		MW-6	MW-16	MW-12	MW-13
Sample Date:		19-Aug-16	20-Aug-16	20-Aug-16	20-Aug-16
Sample ID:		1635445-01	1635445-02	1635445-03	1635445-04
	MDL/Units	Water	Water	Water	Water
Metals					
Mercury	0.0001 mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	0.001 mg/L	<0.001	<0.001	<0.001	<0.001
Cadmium	0.0001 mg/L	<0.0001	<0.0001	0.0003	<0.0001
Chromium	0.001 mg/L	<0.001	<0.001	<0.001	0.001
Cobalt	0.0005 mg/L	0.0045	0.0128	0.0244	0.0120
Copper	0.0005 mg/L	0.0064	0.0031	0.0082	0.0141
Lead	0.0001 mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Nickel	0.001 mg/L	0.053	0.033	0.097	0.069
Zinc	0.005 mg/L	0.008	0.759	0.037	0.012
Hydrocarbons					
F1 PHCs (C6-C10)	0.025 mg/L	<0.025 [2]	<0.025 [2]	<0.025 [2]	<0.025 [2]
F2 PHCs (C10-C16)	0.100 mg/L	<0.100 [2]	<0.216 [1] [2]	<0.100 [2]	-
F3 PHCs (C16-C34)	0.100 mg/L	<0.100 [2]	<0.216 [1] [2]	<0.100 [2]	-
F4 PHCs (C34-C50)	0.100 mg/L	<0.100 [2]	<0.216 [1] [2]	<0.100 [2]	-
PCBs					
PCBs, total	0.00005 mg/L	<0.00005	-	<0.00005	-
Decachlorobiphenyl	Surrogate	85.5%	-	88.8%	-

Client ID: **Sample Date:** **Sample ID:**		MW-15 20-Aug-16 1635445-05	MW-14 20-Aug-16 1635445-06	MW-9 20-Aug-16 1635445-07	MW-10 20-Aug-16 1635445-08
	MDL/Units	Water	Water	Water	Water
Metals					
Mercury	0.0001 mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	0.001 mg/L	<0.001	<0.001	<0.001	<0.001
Cadmium	0.0001 mg/L	0.0003	0.0001	0.0002	0.0007
Chromium	0.001 mg/L	<0.001	<0.001	<0.001	<0.001
Cobalt	0.0005 mg/L	0.0094	0.0133	0.0243	0.0673
Copper	0.0005 mg/L	0.0056	0.0078	0.0079	0.0613
Lead	0.0001 mg/L	<0.0001	<0.0001	<0.0001	0.0003
Nickel	0.001 mg/L	0.036	0.042	0.102	0.256
Zinc	0.005 mg/L	0.024	0.025	0.043	0.119
Hydrocarbons					
F1 PHCs (C6-C10)	0.025 mg/L	<0.025 [2]	<0.025 [2]	<0.025 [2]	<0.025 [2]
F2 PHCs (C10-C16)	0.100 mg/L	<0.100 [2]	<0.100 [2]	<0.100 [2]	<0.100 [2]
F3 PHCs (C16-C34)	0.100 mg/L	<0.100 [2]	<0.100 [2]	<0.100 [2]	<0.100 [2]
F4 PHCs (C34-C50)	0.100 mg/L	<0.100 [2]	<0.100 [2]	<0.100 [2]	<0.100 [2]
PCBs					
PCBs, total	0.00005 mg/L	<0.00005	<0.00005	<0.00005	<0.00005
Decachlorobiphenyl	Surrogate	90.7%	90.2%	97.1%	77.8%

Certificate of Analysis

Client: Golder Associates Ltd. (Ottawa)

Client PO:

Report Date: 02-Sep-2016

Order Date: 26-Aug-2016

Project Description: 1530908-2000

Client ID: **Sample Date:** **Sample ID:**	**MDL/Units**	Probe Blank 19-Aug-16 1635445-09 Water	MW-7 19-Aug-16 1635445-10 Water	Field Blank 19-Aug-16 1635445-11 Water	Trip Blank 08-Aug-16 1635445-12 Water
Metals					
Mercury	0.0001 mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	0.001 mg/L	<0.001	<0.001	<0.001	<0.001
Cadmium	0.0001 mg/L	<0.0001	0.0003	<0.0001	<0.0001
Chromium	0.001 mg/L	<0.001	<0.001	<0.001	<0.001
Cobalt	0.0005 mg/L	<0.0005	0.0308	<0.0005	<0.0005
Copper	0.0005 mg/L	<0.0005	0.0097	<0.0005	<0.0005
Lead	0.0001 mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Nickel	0.001 mg/L	<0.001	0.201	<0.001	<0.001
Zinc	0.005 mg/L	0.006	0.059	<0.005	<0.005
Hydrocarbons					
F1 PHCs (C6-C10)	0.025 mg/L	<0.025 [2]	<0.025 [2]	<0.025 [2]	<0.025 [2]
F2 PHCs (C10-C16)	0.100 mg/L	<0.100 [2]	<0.100 [2]	-	<0.100 [2]
F3 PHCs (C16-C34)	0.100 mg/L	<0.100 [2]	<0.100 [2]	-	<0.100 [2]
F4 PHCs (C34-C50)	0.100 mg/L	<0.100 [2]	<0.100 [2]	-	<0.100 [2]
PCBs					
PCBs, total	0.00005 mg/L	<0.00005	<0.00005	<0.00005	<0.00005 [2]
Decachlorobiphenyl	Surrogate	74.8%	90.5%	93.1%	83.4% [2]

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	0.025	mg/L						
F2 PHCs (C10-C16)	ND	0.100	mg/L						
F3 PHCs (C16-C34)	ND	0.100	mg/L						
F4 PHCs (C34-C50)	ND	0.100	mg/L						
Metals									
Mercury	ND	0.0001	mg/L						
Arsenic	ND	0.001	mg/L						
Cadmium	ND	0.0001	mg/L						
Chromium	ND	0.001	mg/L						
Cobalt	ND	0.0005	mg/L						
Copper	ND	0.0005	mg/L						
Lead	ND	0.0001	mg/L						
Nickel	ND	0.001	mg/L						
Zinc	ND	0.005	mg/L						
PCBs									
PCBs, total	ND	0.00005	mg/L						
Surrogate: Decachlorobiphenyl	*.00019*		*mg/L*		*77.9*	*60-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	0.025	mg/L	ND				30	
Metals									
Mercury	ND	0.0001	mg/L	ND				20	
Arsenic	ND	0.001	mg/L	ND				20	
Cadmium	ND	0.0001	mg/L	ND				20	
Chromium	ND	0.001	mg/L	ND			0.0	20	
Cobalt	0.00083	0.0005	mg/L	0.00083			0.1	20	
Copper	0.00055	0.0005	mg/L	0.00062			12.0	20	
Lead	ND	0.0001	mg/L	ND				20	
Nickel	ND	0.001	mg/L	ND			0.0	20	
Zinc	ND	0.005	mg/L	ND			0.0	20	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	1.93	0.025	mg/L		96.4	68-117			
F2 PHCs (C10-C16)	1.98	0.100	mg/L		110	60-140			
F3 PHCs (C16-C34)	4.07	0.100	mg/L		109	60-140			
F4 PHCs (C34-C50)	2.58	0.100	mg/L		104	60-140			
Metals									
Mercury	0.00292	0.0001	mg/L	ND	97.2	70-130			
Arsenic	44.0		ug/L		88.1	80-120			
Cadmium	47.0		ug/L		93.9	80-120			
Chromium	47.4		ug/L		94.7	80-120			
Cobalt	47.0		ug/L		94.0	80-120			
Copper	47.0		ug/L		94.0	80-120			
Lead	44.7		ug/L		89.4	80-120			
Nickel	46.4		ug/L		92.8	80-120			
Zinc	46		ug/L		91.9	80-120			
PCBs									
PCBs, total	0.00112	0.00005	mg/L		112	60-140			
Surrogate: Decachlorobiphenyl	*.00022*		*mg/L*		*89.3*	*60-140*			

Qualifier Notes:

Login Qualifiers :

Sample - One or more parameter received past hold time -
Applies to samples: MW-6, MW-7, Trip

Sample - Insufficient volume - low volume PHCs - if analysis possible run as per client
Applies to samples: MW-16

Sample Qualifiers :

1 : Elevated Reporting Limits due to limited sample volume.

2 : Holding time had been exceeded upon receipt of the sample at the laboratory.

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.

CCME PHC additional information:

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.
- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.

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Chain of Custody
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№ 20409

Page 4 of ~~4~~5

Client Name: GAL
Contact Name: see pg. 1
Address:
Telephone:

Project Reference: 1530908-2000
Quote # 16-010
PO #
Email Address: see pg. 1

TAT: [✓] Regular [ ] 3 Day
[ ] 2 Day [ ] 1 Day
Date Required:

Criteria: [ ] O. Reg. 153/04 (As Amended) Table __ [ ] RSC Filing [ ] O. Reg. 558/00 [ ] PWQO [X] CCME [ ] SUB (Storm) [ ] SUB (Sanitary) Municipality: ______ [ ] Other: ______

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Paracel Order Number:
1635440-Soil
1635448-water

Required Analyses

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	see quote 16-010	
1	F2-3a	S		2	Aug 21/16		X	60 mL + 250 mL -
2	MW-6	W		6	Aug 19/16	15:45	X	
3	MW-16	W		5	Aug 20/16	11:00	X	no PCBs, analyse PHCs if possible
4	MW-12	W		6	Aug 20/16	16:00	X	
5	MW-13	W		4	Aug 20/16	10:00	X	no PCBs or PHCs
6	MW-15	W		6	Aug 20/16	12:00	X	
7	MW-14	W		6	Aug 20/16	13:00	X	
8	MW-9	W		6	Aug 20/16	17:00	X	
9	MW-10	W		6	Aug 20/16	14:00	X	
10	Probe Blank	W		6	Aug 19/16	17:00	X	

Comments: MW-16: analyse PHCs if possible (low volume)
MW-13: no PCB or PHC

Method of Delivery: Paracel

Relinquished By (Sign): Alyssa Trko
Relinquished By (Print): Alyssa Trko
Date/Time: Aug 26/16 10:00

Received by Driver/Depot: M. Jeouse
Date/Time: 26/08/16 12:00 PM
Temperature: ____ °C

Received at Lab: SUNEETORN DORMAL
Date/Time: AUG 26 2016 01.51
Temperature: 7.3 °C

Verified By: Rachel Subject
Date/Time: Aug 26/16 3:54
pH Verified [✓] By: RS

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Chain of Custody
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№ 102554

Page 5 of 5

Client Name: GAL
Contact Name: see page 1
Address:
Telephone:

Project Reference: 1530908
Quote # 16-010
PO #
Email Address: see page 1

TAT: ☒ Regular ☐ 3 Day ☐ 2 Day ☐ 1 Day
Date Required:

Criteria: ☐ O. Reg. 153/04 (As Amended) Table __ ☐ RSC Filing ☐ O. Reg. 558/00 ☐ PWQO ☒ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality: ______ ☐ Other: ______

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Paracel Order Number:
1635440-Soil
1635445-water.

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	See quote 16-010						
1	MW-7	W		6	Aug 19/16	14:50								X						
2	Field Blank	W		5	Aug 19/16	17:15								X	no PHC analysis					
3	Trip Blank	W		6	Aug 8/16									X						
4																				
5																				
6																				
7																				
8																				
9																				
10																				

Comments:

Method of Delivery: Paracel

Relinquished By (Sign): Alyssa Trake
Relinquished By (Print): Alyssa Trake
Date/Time: Aug 26/16 10:00

Received by Driver/Depot: T. Jouse
Date/Time: 26/08/16 12:00PM
Temperature: ____ °C

Received at Lab: SUNEEPORN DOKMAI
Date/Time: AUG 26, 2016 01.51
Temperature: 12.3 °C

Verified By: Rachel Subject
Date/Time: Aug 26/16 3:54
pH Verified [✓] By: RS

Appendix C9

Certificate Of Analysis –
Paracel Laboratories Ltd.,
Sept. 2, 2016; Order #1634163

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Certificate of Analysis

Golder Associates Ltd. (Ottawa)

1931 Robertson Rd.
Ottawa, ON K2H 5B7
Attn: Alyssa Troke

Client PO:
Project: 1530908-2000
Custody: 26765

Report Date: 2-Sep-2016
Order Date: 16-Aug-2016

Revised Report **Order #: 1634163**

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	**Client ID**
1634163-01	MW98-02
1634163-02	Fox 4 - Rinsate

Approved By:

Tim McCooeye
Senior Advisor

Certificate of Analysis
Client: Golder Associates Ltd. (Ottawa)
Client PO:

Report Date: 02-Sep-2016
Order Date: 16-Aug-2016
Project Description: 1530908-2000

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Mercury by CVAA	EPA 245.1 - Cold Vapour AA	17-Aug-16	17-Aug-16
Metals, ICP-MS	EPA 200.8 - ICP-MS	18-Aug-16	19-Aug-16
PCBs, total	EPA 608 - GC-ECD	18-Aug-16	18-Aug-16
PHC F1	CWS Tier 1 - P&T GC-FID	16-Aug-16	18-Aug-16
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	19-Aug-16	19-Aug-16

Certificate of Analysis
Client: Golder Associates Ltd. (Ottawa)
Client PO:

Report Date: 02-Sep-2016
Order Date: 16-Aug-2016
Project Description: 1530908-2000

	MDL/Units				
Client ID:		MW98-02	Fox 4 - Rinsate	-	-
Sample Date:		04-Aug-16	05-Aug-16	-	-
Sample ID:		1634163-01	1634163-02	-	-
		Water	Water	-	-
Metals					
Mercury	0.0001 mg/L	<0.0001	<0.0001	-	-
Arsenic	0.001 mg/L	0.004	<0.001	-	-
Cadmium	0.0001 mg/L	<0.0001	<0.0001	-	-
Chromium	0.001 mg/L	<0.001	<0.001	-	-
Cobalt	0.0005 mg/L	0.0030	<0.0005	-	-
Copper	0.0005 mg/L	0.0006	<0.0005	-	-
Lead	0.0001 mg/L	0.0001	<0.0001	-	-
Nickel	0.001 mg/L	0.006	<0.001	-	-
Zinc	0.005 mg/L	0.090	<0.005	-	-
Hydrocarbons					
F1 PHCs (C6-C10)	0.025 mg/L	0.395 [1]	<0.025 [1]	-	-
F2 PHCs (C10-C16)	0.100 mg/L	<0.100 [1]	<0.100 [1]	-	-
F3 PHCs (C16-C34)	0.100 mg/L	<0.100 [1]	<0.100 [1]	-	-
F4 PHCs (C34-C50)	0.100 mg/L	<0.100 [1]	<0.100 [1]	-	-
PCBs					
PCBs, total	0.00005 mg/L	<0.00005	<0.00005	-	-
Decachlorobiphenyl	Surrogate	54.8% [4]	72.4%	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	0.025	mg/L						
F2 PHCs (C10-C16)	ND	0.100	mg/L						
F3 PHCs (C16-C34)	ND	0.100	mg/L						
F4 PHCs (C34-C50)	ND	0.100	mg/L						
Metals									
Mercury	ND	0.0001	mg/L						
Arsenic	ND	0.001	mg/L						
Cadmium	ND	0.0001	mg/L						
Chromium	ND	0.001	mg/L						
Cobalt	ND	0.0005	mg/L						
Copper	ND	0.0005	mg/L						
Lead	ND	0.0001	mg/L						
Nickel	ND	0.001	mg/L						
Zinc	ND	0.005	mg/L						
PCBs									
PCBs, total	ND	0.00005	mg/L						
Surrogate: Decachlorobiphenyl	*.00020*		*mg/L*		*80.6*	*60-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	0.025	mg/L	ND				30	
Metals									
Mercury	ND	0.0001	mg/L	ND				20	
Arsenic	ND	0.001	mg/L	0.0013			0.0	20	
Cadmium	ND	0.0001	mg/L	ND			0.0	20	
Chromium	ND	0.001	mg/L	ND			0.0	20	
Cobalt	ND	0.0005	mg/L	ND			0.0	20	
Copper	ND	0.0005	mg/L	ND				20	
Lead	ND	0.0001	mg/L	ND			0.0	20	
Nickel	ND	0.001	mg/L	ND				20	
Zinc	ND	0.005	mg/L	ND			0.0	20	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	1.83	0.025	mg/L		91.3	68-117			
F2 PHCs (C10-C16)	1.67	0.100	mg/L		93.0	60-140			
F3 PHCs (C16-C34)	3.16	0.100	mg/L		85.0	60-140			
F4 PHCs (C34-C50)	2.12	0.100	mg/L		85.3	60-140			
Metals									
Mercury	0.00309	0.0001	mg/L	ND	103	70-130			
Arsenic	39.0		ug/L	1.3	75.3	80-120			QM-07
Cadmium	49.2		ug/L	0.01	98.4	80-120			
Chromium	49.9		ug/L	0.1	99.6	80-120			
Cobalt	49.0		ug/L	0.02	98.1	80-120			
Copper	48.0		ug/L	ND	96.0	80-120			
Lead	47.5		ug/L	0.08	94.8	80-120			
Nickel	49.2		ug/L	ND	98.5	80-120			
Zinc	52		ug/L	0.2	103	80-120			
PCBs									
PCBs, total	0.00110	0.00005	mg/L		110	60-140			
Surrogate: Decachlorobiphenyl	*.00021*		*mg/L*		*87.2*	*60-140*			

Qualifier Notes:

Login Qualifiers :

Sample - One or more parameter received past hold time - CCME F1-F4 past hold time

Applies to samples: MW98-02, Fox 4 - Rinsate

Sample Qualifiers :

1 : Holding time had been exceeded upon receipt of the sample at the laboratory.

4 : The surrogate recovery for this sample is outside of established control limits due to a sample matrix effect.

QC Qualifiers :

QM-07 : The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on other acceptable QC.

Sample Data Revisions

None

Work Order Revisions / Comments:

Revision 1, all results reported as mg/L.

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.

CCME PHC additional information:

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.
- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.

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№ 26765

Page 2 of 2

Client Name: Golder Associates
Contact Name: see page 1
Address:
Telephone:

Project Reference: 1530908-2000
Quote #: 16-010 16-08 ~~15-304~~ Golder Dew Lines Monitoring
PO #:
Email Address: alyssa_troke@golder.com
dplenderleith@golder.com

TAT: ☒ Regular ☐ 3 Day
☐ 2 Day ☐ 1 Day
Date Required:

Criteria: ☐ O. Reg. 153/04 (As Amended) Table ___ ☐ RSC Filing ☐ O. Reg. 558/00 ☐ PWQO ☒ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality: ________ ☐ Other: ________

Matrix Type: [✓ S] (Soil/Sed.) [✓ GW] (Ground Water) SW (Surface Water) SS (Storm Sanitary Sewer) P (Paint) A (Air) O (Other)

Paracel Order Number: 1634162-Soil
1634163-water

Required Analyses

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	see Quote
1	MW98-02	GW		6	Aug 4	1700	X
2	Fox 4 - Rinsate	GW		6	Aug 5	–	X
3							
4							
5							
6							
7							
8							
9							
10							

Comments: Samples not preserved, not field filtered. SC.
Proceed regardless of hold time per Alyssa. SC.

Method of Delivery:

Relinquished By (Sign): Joanne Woodhouse
Relinquished By (Print): Joanne Woodhouse
Date/Time: Aug 16/2016 1030am

Received by Driver/Depot:
Date/Time: 08/16/16 11:30
Temperature: 8.8 °C

Received at Lab: SUNEEPORN DOKMAI
Date/Time: AUG 16, 2016 03:10
Temperature: 8.8 °C

Verified By: Rachel Subject
Date/Time: Aug 16/16 5:00
pH Verified [✓] By: RS

Chain of Custody (Blank) - Rev 0.3 Oct. 2014

Appendix C10

Historical Soil Water Chemistry Data

FOX-4 Cape Hooper - Helipad Landfill West - Summary of Soil Analytical Data**

Sample ID	Location	Year	Monitoring Year	Monitoring Phase	Depth (cm)	Cu [mg/kg]	Ni [mg/kg]	Co [mg/kg]	Cd [mg/kg]	Pb [mg/kg]	Zn [mg/kg]	Cr [mg/kg]	As [mg/kg]	Hg [mg/kg]	Total PCB [mg/kg]	F1 C_6-C_{10} [mg/kg]	F2 C_{10}-C_{16} [mg/kg]	F3 C_{16}-C_{34} [mg/kg]	Modified TPH^ - Total C6-C34 [mg/kg]	TPH Identity	
																				% Fuel Oil	% Lube Oil
Background Data - Average						30	24	8.8	1.0	10	41	41	29								
Baseline Data - Average						**15**	**16**	**5.9**	**1.0**	**24**	**36**	**35**	**34**		**0.001**				**222**	n/a	n/a
Baseline Data - Standard Deviation						4.4	3.2	0.7	0.02	4.7	5	5.9	30		0.056				517		
Baseline average + 3xStandard Deviation						29	25	8	1.1	38	51	53	123		0.17				1772		
Detection Limit						3.0	5.0	5.0	1.0	10	15	20	1.0	0.10	0.001				40		
DEW Line Cleanup Tier I Criteria										*200*					*1*						
DEW Line Cleanup Tier II Criteria & site specific As criteria						*100*	*100*	*50*	*5*	*500*	*500*	*250*	*130*	*2.0*	*5*				*2500*		
Monitoring Data																					
Upgradient- HELIPAD LANDFILL WEST																					
	MW-3 Surface (prior to 2013 excavation)																				
99-3729	MW-3	1999	1	Phase I	0	13	11	<5.0	<1.0	<1.0	26	28	12	<0.10	**0.015**				< 40	n/a	n/a
FO-3-1	MW-3	2000	2	Phase I	0-15	10	10	2.6	<0.10	4.0	18	16	17	<0.050	<0.0030				<100	n/a	n/a
FO-3-1	MW-3	2001	3	Phase I	0-15	9.9	12	3.9	<0.10	3.0	25	23	12	<0.050	<0.010				<20	n/a	n/a
FOM3-1	MW-3	2003	5	Phase I	0-15	13	10	4.0	<1.0	<1.0	23	24	**95**	<0.040	<0.0040	<10	<40	85	110		
MW-3(Soil)0-15cm	MW-3	2006	8	Phase II	0-15	**18**	7.0	2.0	<1.0	<1.0	16	16	8.4	<0.040	<0.10	<12	20	40	66		
MW-3(Soil)0-15cm	MW-3	2007	9	Phase II	0-15	13	10	3.0	0.9	<1.0	25	25	10	<0.040	<0.10	<11	<20	<20	26		
MW-3(Soil)0-15cm	MW-3	2008	10	Phase II	0-15	**21**	**19**	**6.0**	<0.50	7.0	23	**48**	**49**	<0.10	<0.050	<1.0	<1.0	18	19		
10-16957/58	MW-3	2010	12	Phase II	0-10	**26**	**17**	**14**	<1.0	<10	**52**	**43**	13	<0.1	<0.003	<10	4.1	28	37		
not sampled		2013																			
F4-HEL-MW98-03-S	MW-3	2014	16	Phase II	0-15	14	13	4.4	<0.10	4.2	32	32	31	<0.050	<0.010	<10	<10	<10	15		
MW98-03b	MW-3	2016	18	Phase II	0-15	15.2	14.6	5.2	<0.5	5.7	31.9	**44.1**	21	<0.1	<0.05	<7	<4	48	53.5		
		2018	20	Phase II															#N/A		
		2023	25	Phase II															#N/A		
		2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
	MW-3 depth (prior to 2013 excavation)																				
99-3731	MW-3	1999	1	Phase I	30	12	9.1	<5.0	<1.0	<1.0	20	22	11	<0.10	**0.0047**				< 40	n/a	n/a
FO-3-2	MW-3	2000	2	Phase I	40-50	10	11	2.7	<0.10	3.0	21	18	8.0	<0.050	<0.0030				<100	n/a	n/a
FO-3-2	MW-3	2001	3	Phase I	40-50	10	13	3.8	<0.10	4.0	24	23	13	<0.050	<0.010				<20	n/a	n/a
not sampled	MW-3	2003	5	Phase I																	
MW-3(Soil)40-50cm	MW-3	2006	8	Phase II	40-50	11	8.0	3.0	<1.0	<1.0	14	14	11	<0.040	<0.10	<12	<10	30	41		
MW-3(Soil)40-50cm	MW-3	2007	9	Phase II	40-50	11	9.0	3.0	0.9	<1.0	17	15	11	<0.040	<0.10	<10	<20	<20	25		
MW-3(Soil)40-50cm	MW-3	2008	10	Phase II	40-50	**17**	14	<5.0	<0.50	7.0	<2.0	25	17	<0.10	<0.050	<1.0	<1.0	<1.0	1.5		
10-16959/60	MW-3	2010	12	Phase II	30-40	15	13	5.3	<1.0	<10	28	28	14	<0.10	**0.008**	<10	4.5	<9.0	14		
not sampled		2013																	#N/A		
F4-HEL-MW98-03-D	MW-3	2014	16	Phase II	40-50	**19**	**16**	4.7	<0.10	5.5	31	32	30	<0.050	<0.010	<10	<10	<10	15		
MW98-03a	MW-3	2016	18	Phase II	40-50	**16**	15	4.7	<0.5	5	31	33	23	<0.1	<0.05	<6	<7	66	72.5		
		2018	20	Phase II															#N/A		
		2023	25	Phase II															#N/A		
		2028	30	Phase II															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
	MW-4 Surface (prior to 2013 excavation)																				
99-3713	MW-4	1999	1	Phase I	0	**21**	15	5.1	<1.0	11	**46**	**35**	**44**	<0.10	**0.049**				#N/A	100	0
FO-4-1	MW-4	2000	2	Phase I	0-15	11	10	2.7	<0.10	<1.0	25	19	<1.0	<0.050	**0.068**				#N/A	n/a	n/a
FO-4-1	MW-4	2001	3	Phase I	0-15	4.1	7.0	2.5	<0.10	3.0	12	11	11	<0.050	<0.010				#N/A	n/a	n/a
FOM4-1	MW-4	2003	5	Phase I	0-15	10	9.0	4.0	<1.0	<1.0	22	21	9.6	<0.040	<0.005	<10	<40	<40	45		
MW-4	MW-4	2005	7	Phase II	0-12	**21**	6.0	3.0	<1.0	<1.0	19	15	4.5	<0.040	<0.050	<1.0	<40	<40	41		
MW-4(Soil)0-15cm	MW-4	2006	8	Phase II	0-15	**23**	15	4.0	<1.0	15	**51**	33	**37**	0.050	*1.00*	<12	100	210	**316**		
MW-4 (Soil)0-15cm	MW-4	2007	9	Phase II	0-15	13	9.0	3.0	<0.9	<10	35	20	14	<0.04	**0.7**	<11	24	78	108		
MW-4 (Soil)0-15cm	MW-4	2008	10	Phase II	0-15	9.0	8.0	<5	<0.5	3.0	<20	20	5	<0.1	<0.05	<10	<10	<10	15		
		2010	12	Phase II															#N/A		
	MW-4 depth (prior to 2013 excavation)																				
99-3715	MW-4	1999	1	Phase I	30	15	10	<5.0	<1.0	<1.0	26	34	23	<0.10	**0.042**				< 40	n/a	n/a
FO-4-2	MW-4	2000	2	Phase I	40-50	10	10	3.1	<0.10	3.0	23	19	10	<0.050	**0.015**				<100	n/a	n/a
FO-4-2	MW-4	2001	3	Phase I	40-50	4.5	8.0	2.2	<0.10	2.0	15	12	5.0	<0.050	**0.010**				<20	n/a	n/a
FOM4-2	MW-4	2003	5	Phase I	40-50	**21**	15	**6.0**	<1.0	<1.0	29	26	19	<0.040	<0.0010	<1.0	<40	<40	41		
MW-4(Soil)40-50cm	MW-4	2006	8	Phase II	40-50	**26**	15	4.0	<1.0	11	**51**	**35**	18	0.14	**0.90**	<12	220	210	**436**		
MW-4 (Soil)40-50cm	MW-4	2007	9	Phase II	40-50	**21**	13	4.0	<0.9	11	**49**	31	14	<0.04	**0.7**	<11	137	141	**284**		
MW-4 (Soil)40-50cm	MW-4	2008	10	Phase II	40-50	9	8	<5	<0.5	3	<20	18	4.0	<0.1	<0.05	<10	<10	<10	15		
		2010	12	Phase II															#N/A		
	BMW-06 surface (after 2013 excavation)																				
13-27331/13-27357	MW-6	2013	15	Phase II	0-10	**17**	14	<5.0	<1.0	<1.0	35	**39**	**77**	<0.10	<0.050	<1	<4.0	<9.0	7		
F4-HEL-MW98-06-S	MW-6	2014	16	Phase II	0-15	**20**	**20**	**6.7**	0.14	7.1	**77**	**51**	**40**	<0.050	<0.010	<10	<10	18	28		
MW98-06a	MW-6	2016	18	Phase II	0-15	**25.2**	**20.7**	**6.3**	<0.5	8	**37.8**	**47.8**	18.4	<0.1	<0.05	<7	6	160	169.5		
		2018	20	Phase II															#N/A		
		2023	25	Phase II															#N/A		
		2028	30	Phase II															#N/A		
																			#N/A		

FOX-4 Cape Hooper - Helipad Landfill West - Summary of Soil Analytical Data**

Sample ID	Location	Year	Monitoring Year	Monitoring Phase	Depth (cm)	Cu [mg/kg]	Ni [mg/kg]	Co [mg/kg]	Cd [mg/kg]	Pb [mg/kg]	Zn [mg/kg]	Cr [mg/kg]	As [mg/kg]	Hg [mg/kg]	Total PCB [mg/kg]	F1 C_6-C_{10} [mg/kg]	F2 C_{10}-C_{16} [mg/kg]	F3 C_{16}-C_{34} [mg/kg]	Modified TPH^ - Total C6-C34 [mg/kg]	TPH Identity	
																				% Fuel Oil	% Lube Oil
																			#N/A		
																			#N/A		
	BMW-06 depth (after 2013 excavation)																				
13-27332/33	MW-6	2013	15	Phase II	30-40	**17**	14	<5.0	<1.0	<1.0	32	**41**	**39**	<0.10	<0.050	<1.0	4.3	15	19.8		
F4-HEL-MW98-06-D	MW-6	2014	16	Phase II	40-50	**41**	**21**	**6.2**	0.11	6.1	**52**	**40**	**66**	<0.050	<0.010	<10	<10	100	111		
Not sampled - refusal	MW-6	2016	18	Phase II															#N/A		
		2018	20	Phase II															#N/A		
		2023	25	Phase II															#N/A		
		2028	30	Phase II															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
Downgradient- Helipad Landfill West																					
	MW-01 surface																				
99-3725	MW-01	1999	1	Phase I	0	15	15	5.0	<1.0	<1.0	**36**	**47**	**45**	<0.10	<0.0030				< 40	n/a	n/a
FO-1-1	MW-01	2000	2	Phase I	0-15	**17**	**17**	4.9	<0.10	5.0	**36**	34	**58**	<0.050	<0.0030				<100	n/a	n/a
FO-1-1	MW-01	2001	3	Phase I	0-15	11	15	5.5	<0.10	3.0	**66**	24	14	<0.050	<0.010				65	0.0	100
FOM-1-1	MW-01	2003	5	Phase I	0-15	13	11	5.3	<1.0	<1.0	**69**	**47**	13	<0.040	<0.0040	<10	<40	<40	45		
MW-1	MW-01	2006	8	Phase II	0-12	11	11	**6.0**	<1.0	<1.0	29	28	30	<0.040	<0.050	<1.0	< 40	< 40	41		
MW-1(Soil) 0-15cm	MW-01	2006	8	Phase II	0-15	15	13	4.0	<1.0	<1.0	33	26	**81**	<0.040	<0.10	<12	<10	20	31		
MW-1(Soil)0-15cm	MW-01	2007	9	Phase II	0-15	13	13	4	0.9	<1.0	**62**	29	**51**	<0.040	<0.10	<11	<20	32	47.5		
MW-1(Soil)0-15cm	MW-01	2008	10	Phase II	0-15	**20**	**16**	5	<0.50	20	<2.0	31	16	<0.10	<0.050	<1.0	138	85	**224**		
10-16989/90	MW-01	2010	12	Phase II	0-10	15	**16**	**7.0**	<1.0	<1.0	**60**	**40**	17	<0.10	<0.0030	4.4	60	13	77		
13-27334/35	MW-01	2013	15	Phase II	0-10	**18**	15	<5.0	<1.0	<1.0	30	**42**	17	<0.10	<0.050	<1.0	<4.0	<9.0	7		
F4-HEL-MW98-01-S	MW-01	2014	16	Phase II	0-15	**34**	**31**	**9.7**	<0.10	6.1	**47**	**49**	25	<0.050	<0.010	<10	<10	<10	15		
MW98-01a	MW-01	2016	18	Phase II	0-15	**67.8**	**44.5**	**15.6**	<0.5	5	**71.2**	**139**	**74.7**	<0.1	<0.05	<7	<4	<8	9.5		
		2018	20	Phase II															#N/A		
		2023	25	Phase II															#N/A		
		2028	30	Phase II															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
	MW-01 depth																				
99-3727	MW-01	1999	1	Phase I	30	**19**	**18**	**6.9**	<1.0	<1.0	**48**	**57**	25	<0.10	<0.0030				< 40	n/a	n/a
n/s	MW-01	2000	2	Phase I	40-50																
FO-1-2	MW-01	2001	3	Phase I	40-50	12	13	4.3	<0.10	3.0	27	23	15	<0.050	<0.010				<20	n/a	n/a
FOM-1-2	MW-01	2003	5	Phase I	40-50	**16**	15	**7.0**	<1.0	<1.0	**50**	**57**	19	<0.040	<0.0010	<10	<40	<40	45		
MW-1(Soil) 40-50cm	MW-01	2006	8	Phase II	40-50	**20**	**18**	5.0	<1.0	<1.0	30	31	9	<0.040	<0.10	<12	20	50	76		
MW-1(Soil)40-50cm	MW-01	2007	9	Phase II	40-50	10	9	3.0	1	<1.0	32	23	8	<0.040	<0.10	<11	<20	51	67		
MW-1(Soil)40-50cm	MW-01	2008	10	Phase II	40-50	13	13	<5.0	<0.50	6	<2.0	22	14	<0.10	<0.050	<1.0	1800	42	**1843**		
10-16991/92	MW-01	2010	12	Phase II	30-40	**17**	**16**	**6.9**	<1.0	<1.0	**48**	**41**	**75**	<0.10	<0.0030	51	120	10	181		
13-27336/37	MW-01	2013	15	Phase II	30-40	15	13	<5.0	<1.0	<1.0	28	**42**	**38**	<0.10	<0.050	<1.0	<4.0	<9.0	7.0		
F4-HEL-MW98-01-D	MW-01	2014	16	Phase II	40-50	**32**	**31**	**9.3**	<0.10	5.8	**45**	**47**	23	<0.050	<0.010	<10	<10	<10	15		
Not sampled - refusal	MW-01	2016	18	Phase II															#N/A		
		2018	20	Phase II															#N/A		
		2023	25	Phase II															#N/A		
		2028	30	Phase II															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
	MW-02 surface																				
99-3733	MW-02	1999	1	Phase I	0	14	11	<5.0	<1.0	<1.0	32	**43**	**45**	<0.10	<0.0030				< 40	n/a	n/a
FO-2-1	MW-02	2000	2	Phase I	0-15	14	14	4.6	<0.10	3.0	33	31	15	<0.050	<0.0030				<100	n/a	n/a
FO-2-1	MW-02	2001	3	Phase I	0-15	10	12	4.0	<0.10	3.0	25	22	16	<0.050	<0.010				11.0	95	5.0
FOM-2-1	MW-02	2003	5	Phase I	0-15	13	12	**6.0**	<1.0	<1.0	30	**43**	**83**	<0.040	<0.0040	<10	<40	95	120		
MW-2	MW-02	2005	7	Phase II	0-10	**21**	6.0	**9.0**	<1.0	<1.0	**37**	30	14	<0.040	<0.050	<1.0	1100	480	**1581**		
MW-2(Soil)0-15cm	MW-02	2006	8	Phase II	0-15	12	13	4.0	<1.0	<1.0	24	26	13	<0.040	<0.10	<12	90	70	166		
MW-2(Soil)0-15cm	MW-02	2007	9	Phase II	0-15	11	10	3.0	0.9	<1.0	24	25	21	<0.040	<0.10	12	320	20	**352**		
MW-2(Soil)0-15cm	MW-02	2008	10	Phase II	0-15	**31**	**31**	**10**	<0.50	9	33	**46**	8	<0.10	<0.050	16	862	305	**1183**		
10-16977/78	MW-02	2010	12	Phase II	0-10	**16**	**17**	**7.4**	<1.0	<1.0	**41**	**41**	20	<0.10	<0.0030	<4.0	39	11	52		
13-27338/39	MW-02	2013	15	Phase II	0-10	**18**	**16**	<5.0	<1.0	<1.0	**36**	**43**	**50**	<0.10	<0.050	<1.0	<4.0	<9.0	7.0		
F4-HEL-MW98-02-S	MW-02	2014	16	Phase II	0-15	**20.5**	**17.5**	**6.95**	<0.5	5.8	**39.5**	**39.5**	**72**	<0.10	<0.05	<10	23	44.5	72.5		
MW98-02a	MW-02	2016	18	Phase II	0-15	**16.1**	**16.5**	5.7	<0.5	4.6	33.3	**42.3**	18.2	<0.1	<0.05	258	2850	250	*3358*		
		2018	20	Phase II															#N/A		
		2023	25	Phase II															#N/A		
		2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		

FOX-4 Cape Hooper - Helipad Landfill West - Summary of Soil Analytical Data**

Sample ID	Location	Year	Monitoring Year	Monitoring Phase	Depth	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Hg	Total PCB	F1 C_6-C_{10}	F2 C_{10}-C_{16}	F3 C_{16}-C_{34}	Modified TPH^ - Total C6-C34	TPH Identity	
					(cm)	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	% Fuel Oil	% Lube Oil
	MW-02 depth																				
99-3735	MW-02	1999	1	Phase I	30	**16**	13	5.6	<1.0	<1.0	33	**46**	**58**	<0.10	<0.0030				49	100	0
FO-2-2	MW-02	2000	2	Phase I	40-50	14	12	3.9	<0.10	3.0	30	27	**92**	<0.050	<0.0030				<100	n/a	n/a
FO-2-2	MW-02	2001	3	Phase I	40-50	11	15	4.4	<0.10	3.0	28	23	**42**	<0.050	<0.010				<2.0	n.d	n.d
FOM-2-2	MW-02	2003	5	Phase I	40-50	15	13	**6.0**	<1.0	<1.0	33	**46**	21	<0.040	<0.0010	<10	<40	48	73		
MW-2(Soil)40-50cm	MW-02	2006	8	Phase II	40-50	**21**	**21**	**6.0**	<1.0	<1.0	32	33	12	<0.040	<0.10	60	920	60	**1040**		
MW-2(Soil)40-50cm	MW-02	2007	9	Phase II	40-50	13	12	3	0.9	<1.0	24	24	8	<0.040	<0.10	99	3300	87	*3486*		
MW-2(Soil)40-50cm	MW-02	2008	10	Phase II	40-50	**34**	**35**	**10**	<0.50	10	33	**49**	12	<0.10	<0.050	62	6800	764	*7626*		
10-16979/80	MW-02	2010	12	Phase II	30-40	15	14	**6.3**	<1.0	<1.0	32	**37**	21	<0.10	<0.0030	<4.0	17	<8.0	23		
13-27340/41	MW-02	2013	15	Phase II	30-40	**18**	**17**	5.3	<1.0	<1.0	32	**43**	16	<0.10	<0.050	25	970	120	**1115**		
F4-HEL-MW98-02-D	MW-02	2014	16	Phase II	40-50	**34**	**35**	**9.9**	<0.10	10	**55**	**54**	**42**	<0.050	<0.010	100	1100	250	**1450**		
		2016	18	Phase II															#N/A		
		2018	20	Phase II															#N/A		
		2023	25	Phase II															#N/A		
		2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
	F4-17 surface (prior to 2013 excavation)																				
F4-17	F4-17	2005	7	Phase II	0-5														#N/A		
F4-17(Soil) 0-15cm	F4-17	2006	8	Phase II	0-15											<12	10	10	26		
	F4-17 depth																				
F4-17(Soil) 40-45cm	F4-17	2006	8	Phase II	40-45											<12	10	<10	21		
	F4-18 surface																				
S-1-1	MW-1 d/g	2001	3	Phase I	0-15	**22**	**21**	**6.8**	<0.10	15	**44**	**35**	**42**	<0.050	<0.010				#N/A	95	5
F4-18	F4-18	2005	7	Phase II	0-5											<12	1040	2220	*3266*		
F4-18(Soil) 0-15cm	F4-18	2006	8	Phase II	0-15											<12	140	420	**566**		
	F4-18 depth																				
F4-18(Soil) 40-50cm	F4-18	2006	8	Phase II	40-50											97	420	50	**567**		
	F4-19 surface																				
F4-19(Soil)0-15cm	F4-19	2006	8	Phase II	0-15											<12	1670	430	**2106**		
	F4-19 depth																				
F4- 19(Soil)40-45cm	F4-19	2006	8	Phase II	40-45											66	2560	650	*3276*		
	F4-20 surface																				
F4-20	F4-20	2005	7	Phase II	0-6											<12	<40	<40	46		
F4-20(Soil) 0-15cm	F4-20	2006	8	Phase II	0-15											<12	360	390	**756**		
	F4-20 depth																				
F4-20(Soil)30-40cm	F4-20	2006	8	Phase II	30-40											96	6940	420	*7456*		

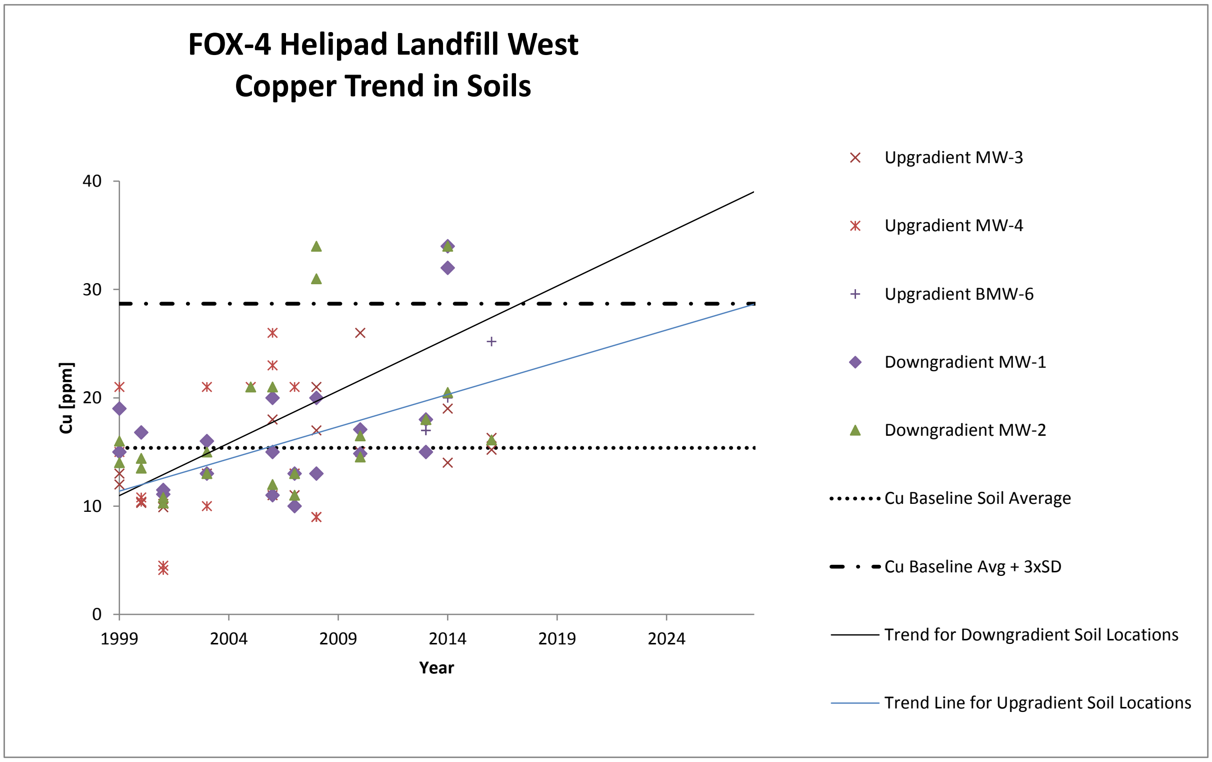
Note: Total Hydrocarbons (C_6-C_{34}) has been calculated by adding results for F1, F2 and F3.

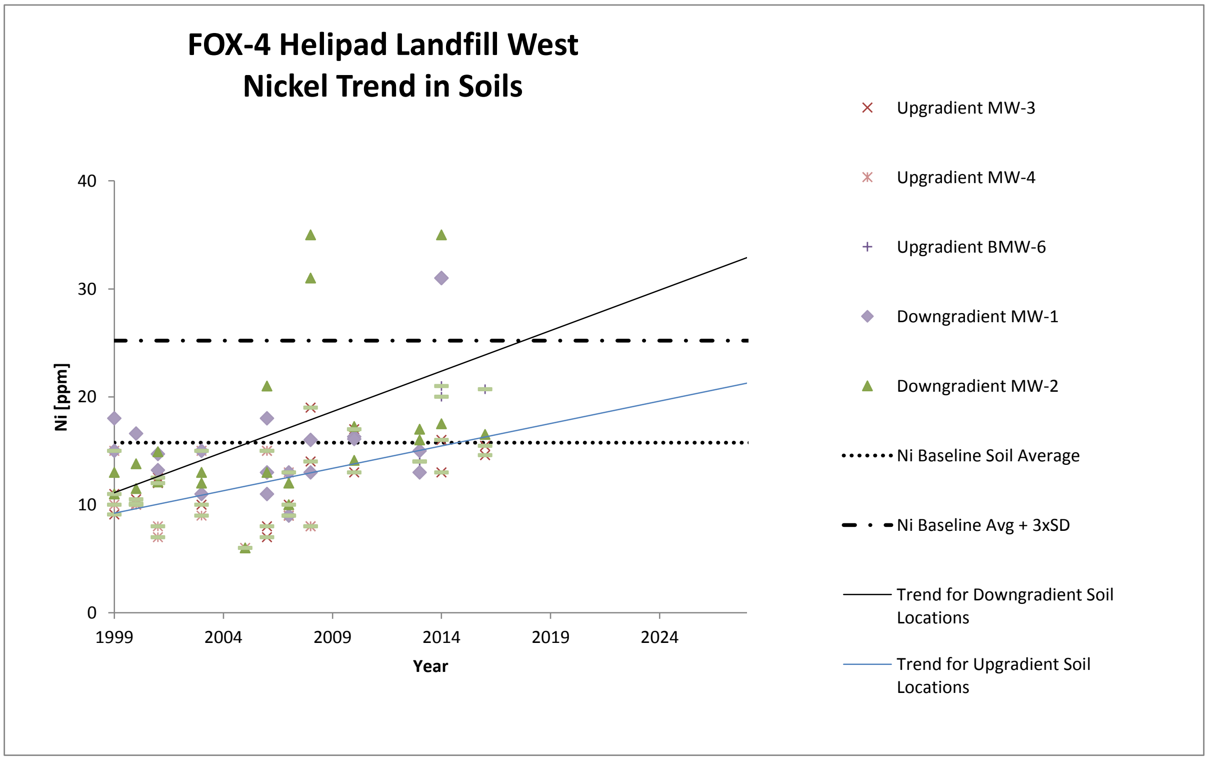
** The Helipad Landfill West underwent additional regrading in 2013.

Legend

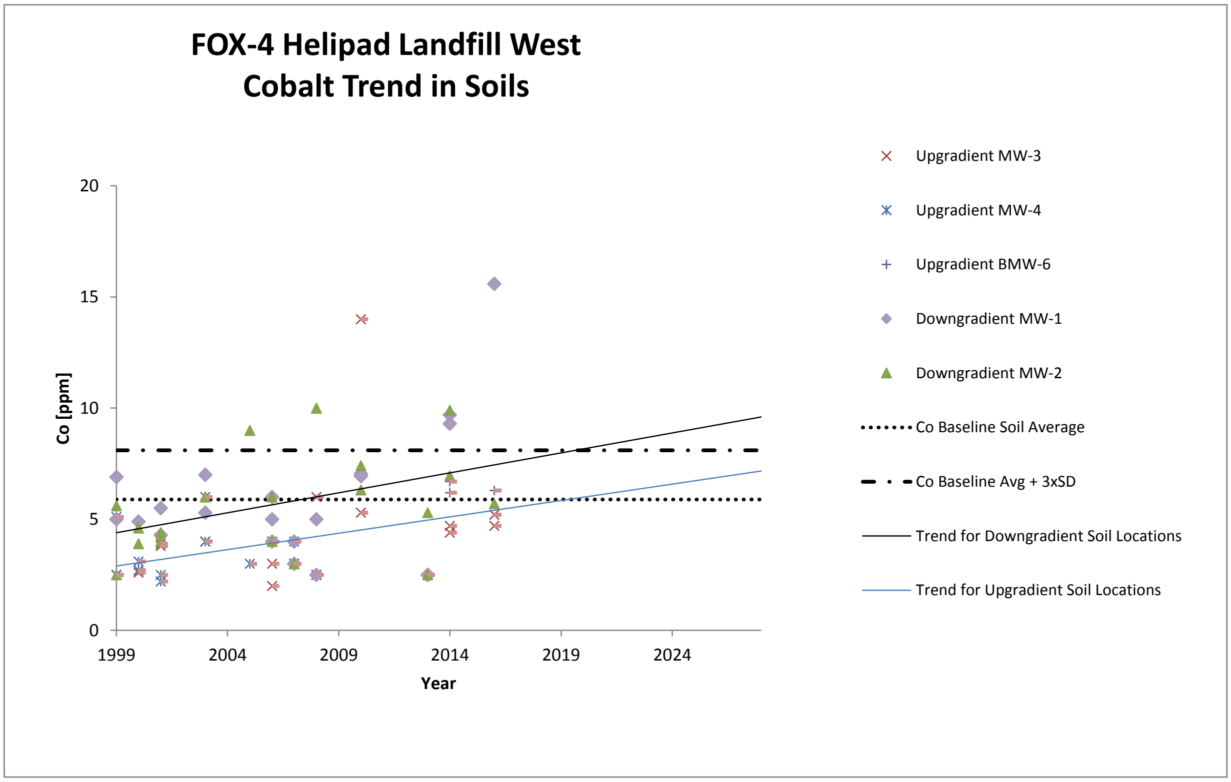
XX	sample exceeds background
XX	**sample exceeds baseline**
XX	*sample exceeds DLCU Tier I criteria*
XX	*sample exceeds DLCU Tier II criteria*

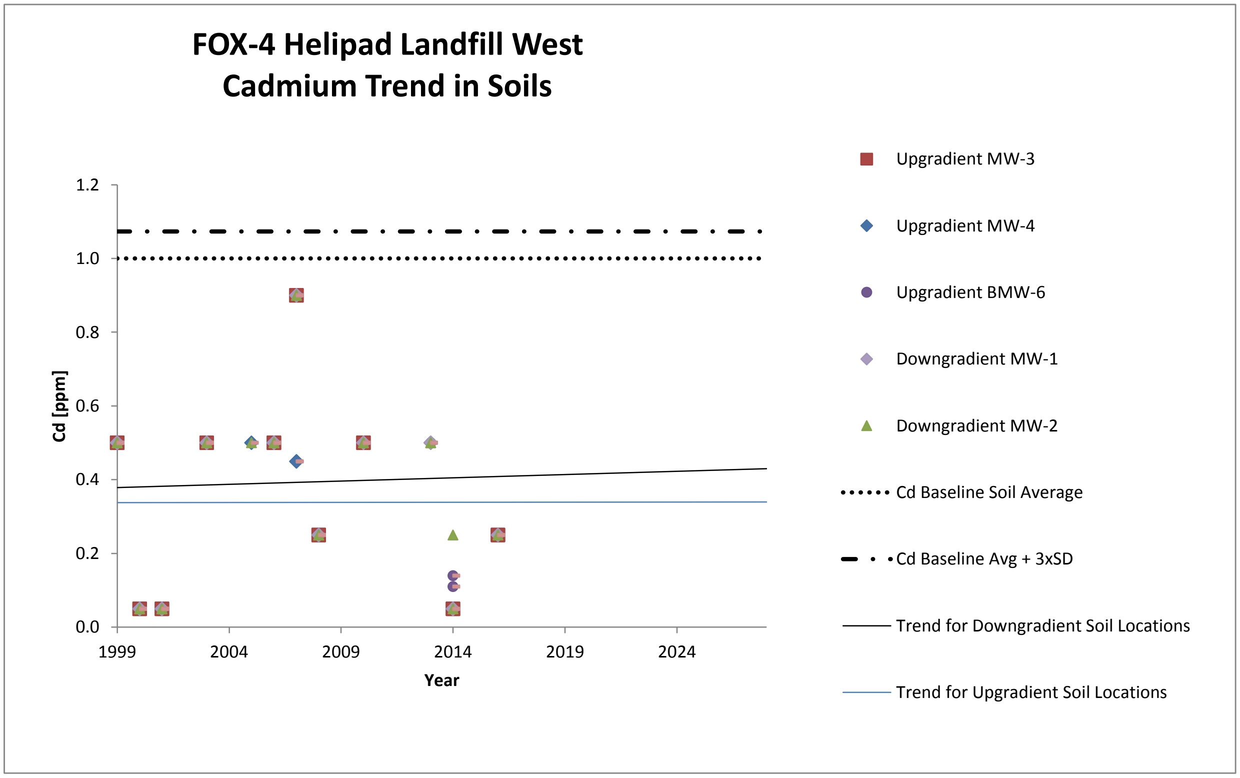
FOX-4 Helipad Landfill West Trends in Soil Inorganics, PCBs and PHCs (modified TPH)
Where results are below detection, half of the detection limit has been used in the charts.
Helipad Landfill West underwent additional regrading in 2013.



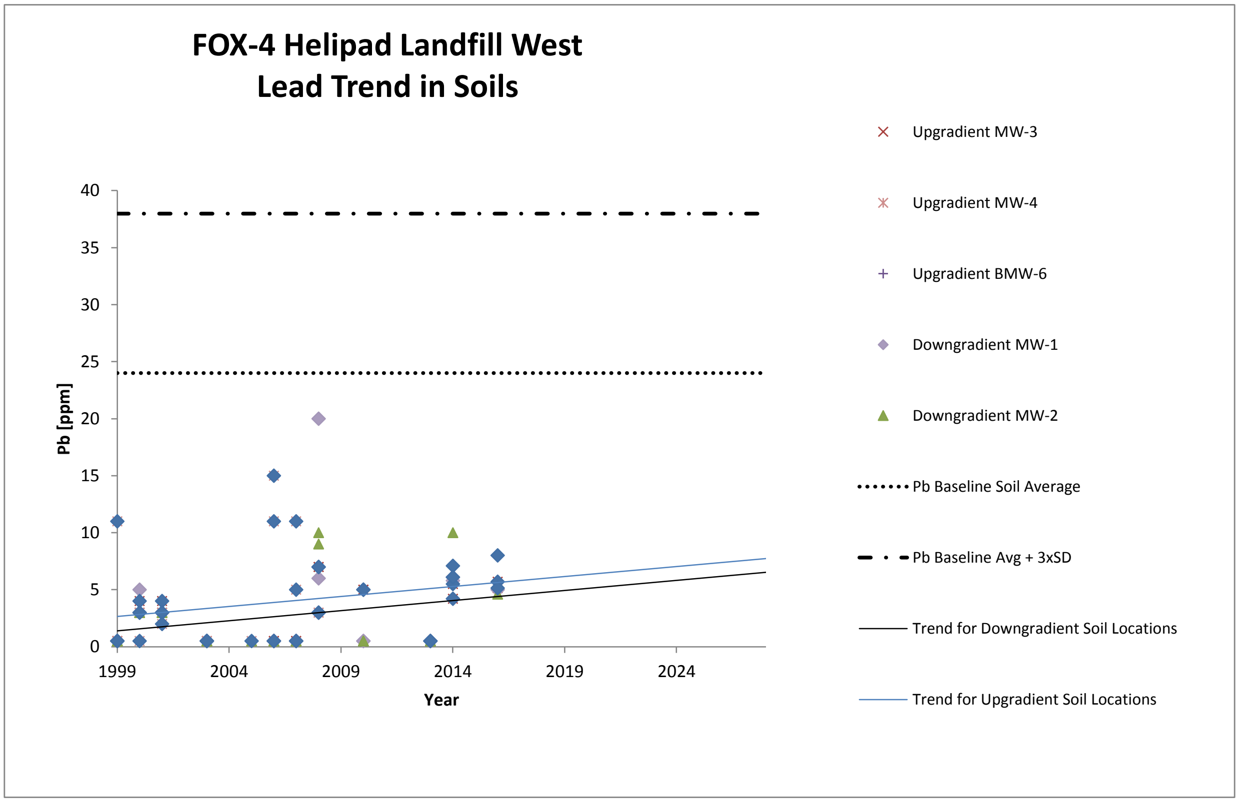


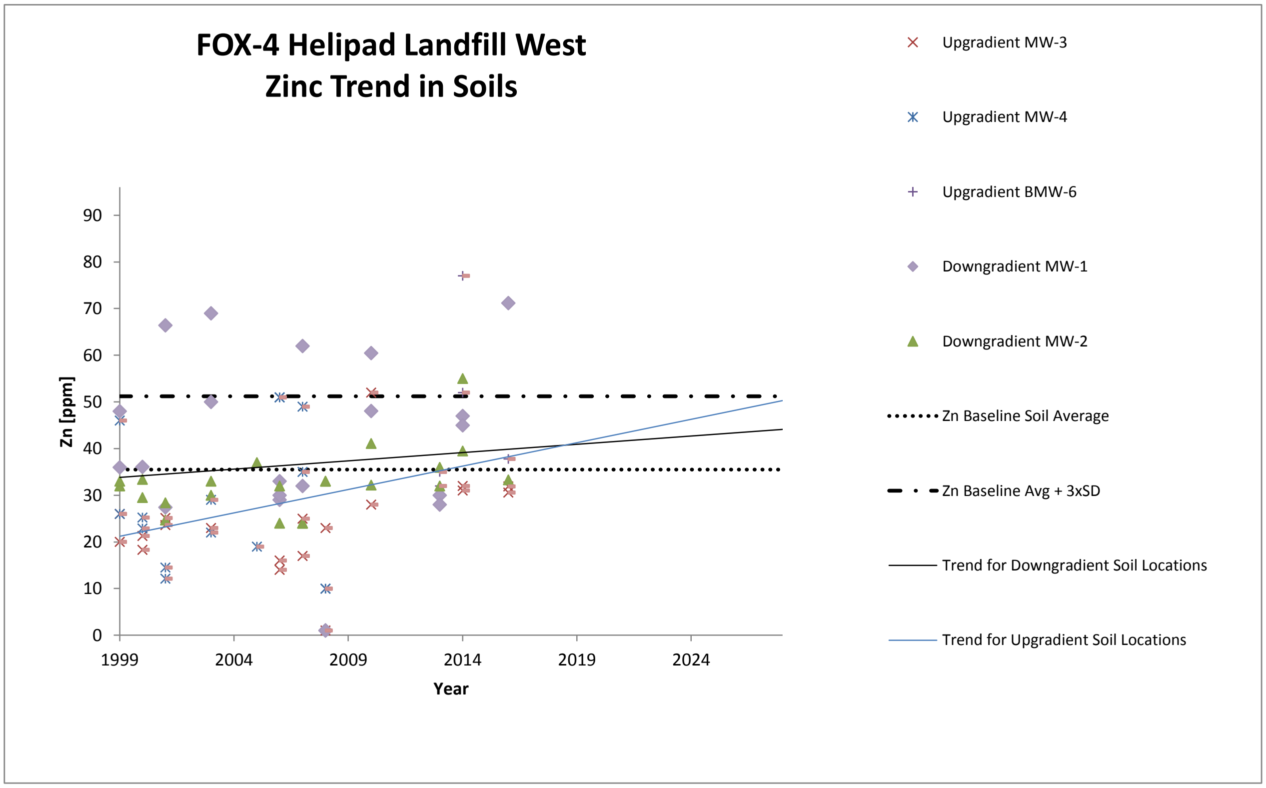
FOX-4 Helipad Landfill West Trends in Soil Inorganics, PCBs and PHCs (modified TPH)



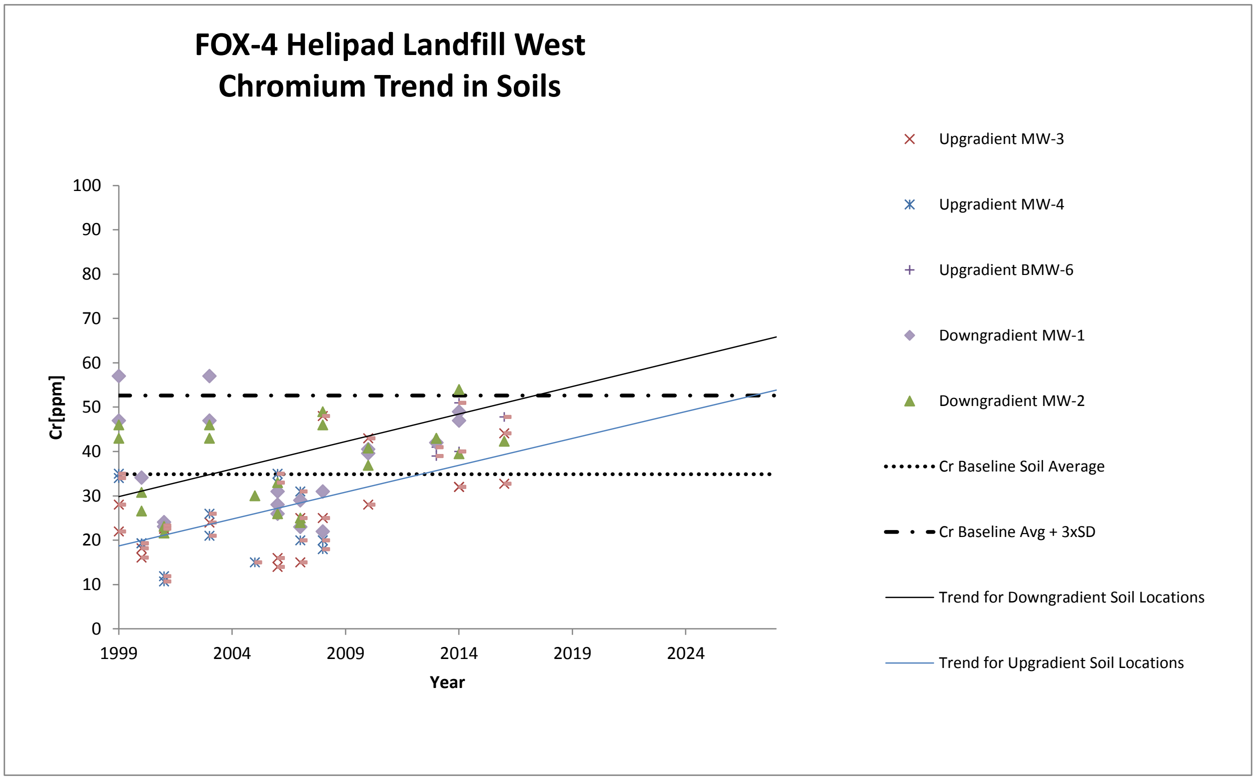


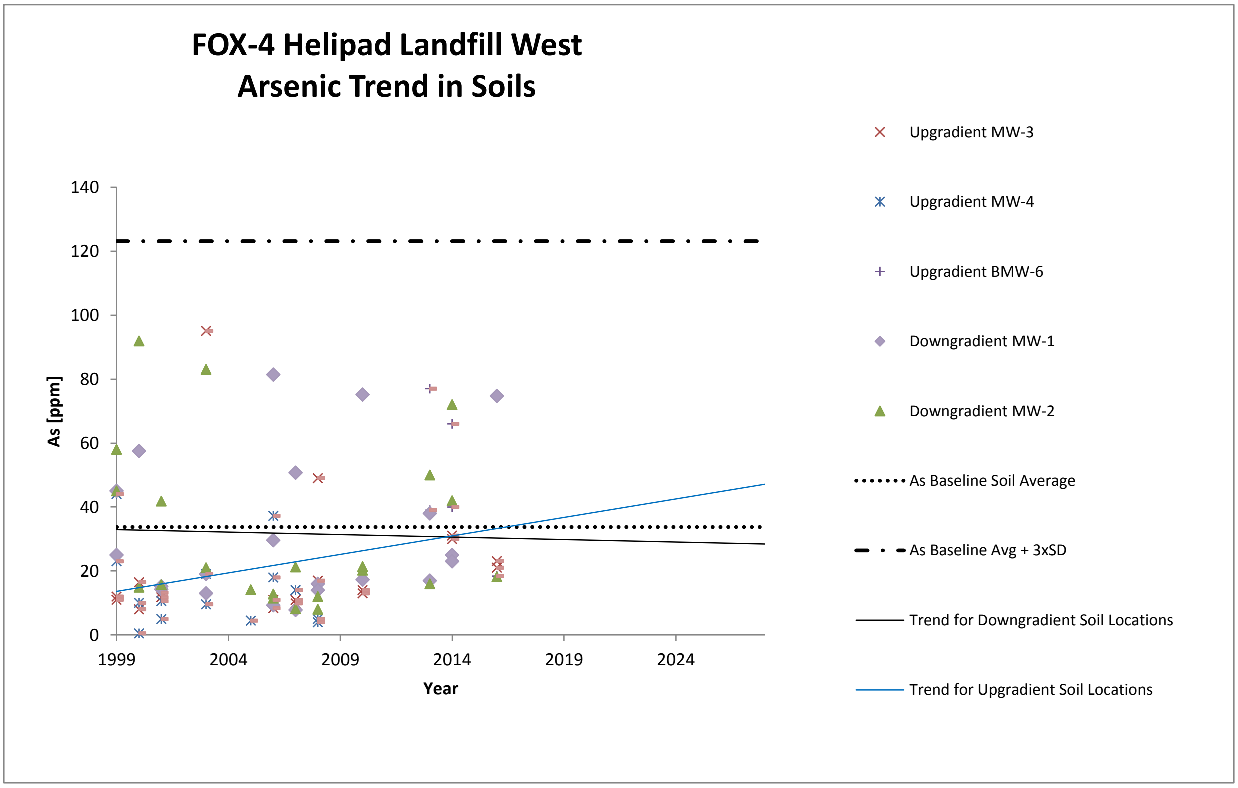
FOX-4 Helipad Landfill West Trends in Soil Inorganics, PCBs and PHCs (modified TPH)



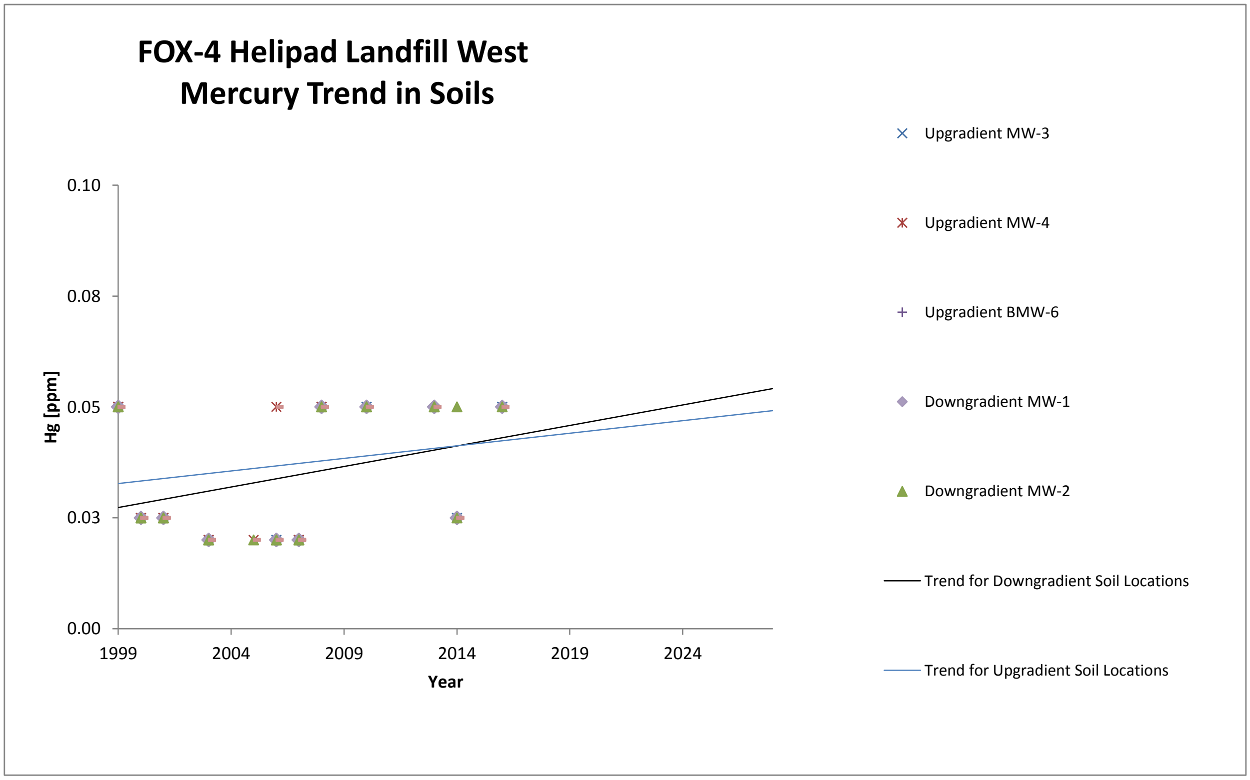


FOX-4 Helipad Landfill West Trends in Soil Inorganics, PCBs and PHCs (modified TPH)

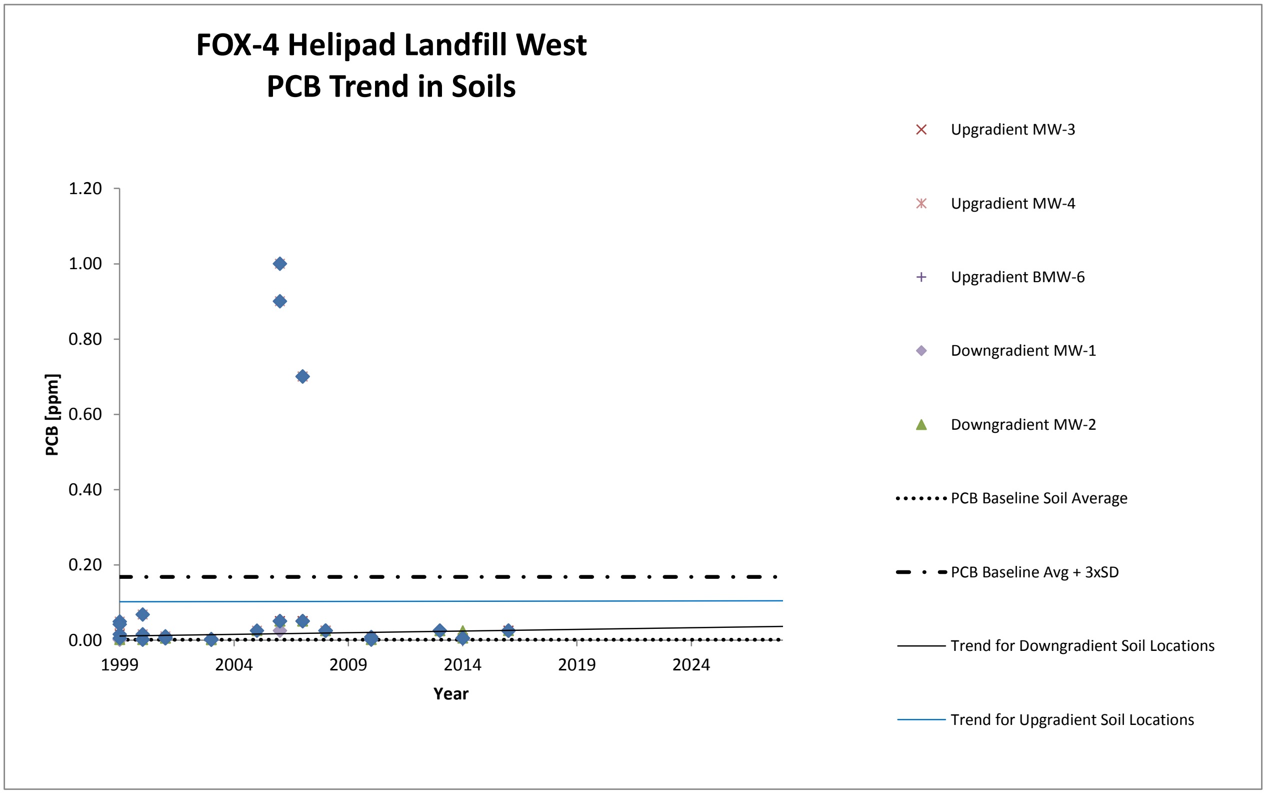




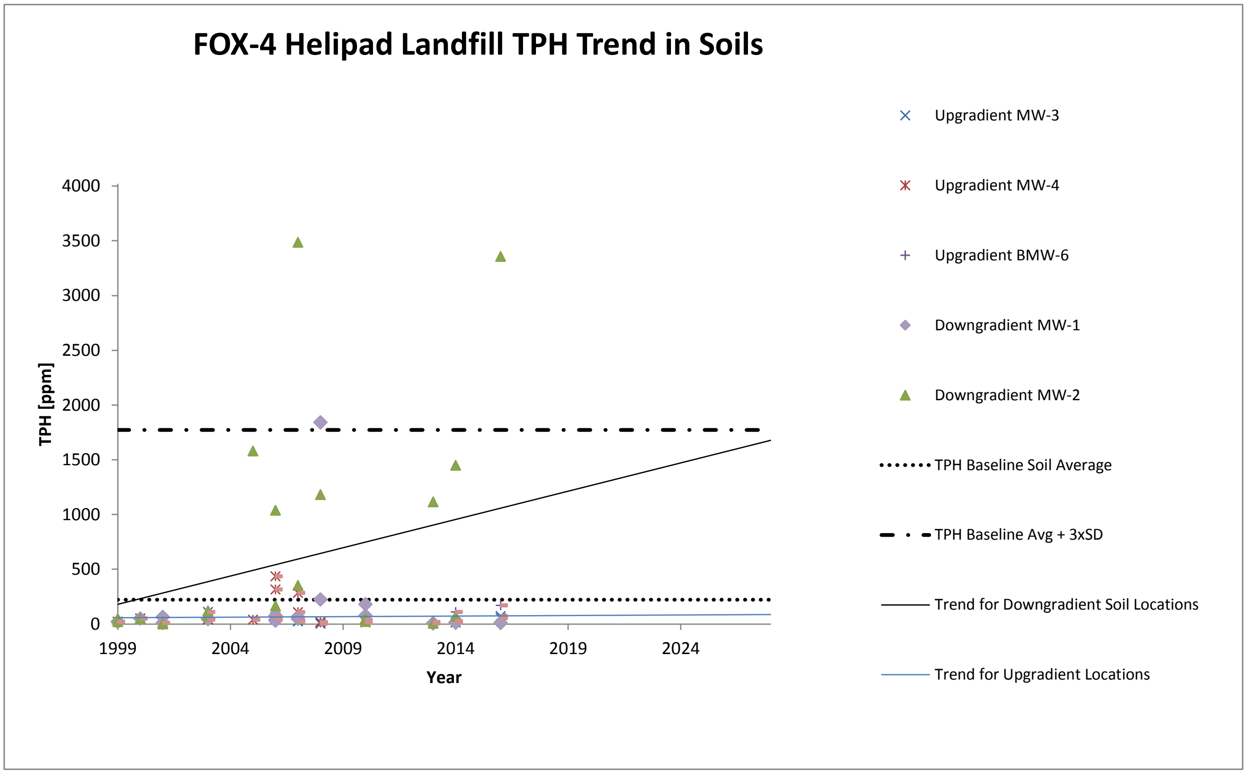
FOX-4 Helipad Landfill West Trends in Soil Inorganics, PCBs and PHCs (modified TPH)



Baseline (1998) and background (1992, 2010 and 2011) did not include mercury analysis for this landfill.



FOX-4 Helipad Landfill West Trends in Soil Inorganics, PCBs and PHCs (modified TPH)



FOX-4 Cape Hooper - Helipad Landfill West - Summary of Groundwater Analytical Data**

Sample #	Location	Date	Monitoring Year	Monitoring Phase	Cu [mg/L]	Ni [mg/L]	Co [mg/L]	Cd [mg/L]	Pb [mg/L]	Zn [mg/L]	Cr [mg/L]	As [mg/L]	Hg [mg/L]	Total PCB [mg/L]	F1 C_6-C_{10} (mg/L)	F2 C_{10}-C_{16} (mg/L)	F3 C_{16}-C_{34} (mg/L)	Modified TPH^ - Total C6-C34 [mg/L]	TPH Identity	
																			% Fuel Oil	% Lube Oil
Baseline Data																				
Upgradient- Helipad West																				
WF4-MW3_98	MW-3	1998			0.026	0.98	0.03	0.0015	0.0076	0.14	0.7	0.0028		<0.00001				4.0		
WF4-MW4_98	MW-4	1998			0.048	0.42	0.01	0.0012	0.0130	0.05	0.8	0.0079		0.00008				17		
WF4-MW6_98	MW-6	1998			0.096	2.00	0.13	0.0024	0.0095	0.30	1.9	0.0048		<0.00001				4.0		
Downgradient																				
WF4-MW1-98	MW-1	1998			0.083	0.97	0.028	0.0018	0.034	0.12	1.5	0.037		0.00003				2.0		
WF4-MW2-98	MW-2	1998			0.11	0.80	0.022	0.0018	0.016	0.078	1.4	0.022		0.00001				9.0		
		N value			5	5	5	5	5	5	5	5	0	5				5		
		Baseline Average			**0.072**	**1.03**	**0.044**	**0.0018**	**0.016**	**0.14**	**1.27**	**0.015**		**0.000026**				**7.2**		
		Standard Deviation			0.034	0.587	0.047	0.000	0.011	0.098	0.505	0.014		0.000032				6.1		
	Average + 3xStandard Deviation				0.17	2.8	0.19	0.00	0.05	0.43	2.79	0.06		0.00012				25.4		
		Detection Limit			0.005	0.010	0.005	0.001	0.010	0.005	0.005	0.050	0.001	0.00001				5.0		
Monitoring Data																				
Upgradient - MW-3																				
PO-3-1	MW-3	2000	2	Phase I	<0.003	0.03	<0.005	0.0003	<0.002	0.13	0.007	<0.002	<0.001	<0.000025				<0.1		
MW-3	MW-3	2006	8	Phase II	0.013	0.04	0.002	<0.001	**0.020**	**0.99**	0.028	0.001	<0.0002	<0.0001	<0.025	<0.1	<0.1	0.113		
no sample taken	MW-3	2013																		
F4-HEL-MW98-03	MW-3	2014	16	Phase II	0.0063	0.048	0.0021	0.000086	0.0021	**0.16**	0.048	0.0025	<0.00001	<0.05	<0.025	<0.100	<0.100	0.1125		
Not sampled - dry	MW-3	2016	18	Phase II														#N/A		
		2018	20	Phase II														#N/A		
		2023	25	Phase II														#N/A		
		2028	30	Phase II														#N/A		
				Phase III														#N/A		
																		#N/A		
																		#N/A		
Upgradient - MW-4																				
PO-4-1	MW-4	2000	2	Phase I	0.012	0.33	<0.005	0.0005	0.005	0.047	0.053	<0.002	<0.001	<0.000021						
PO-4-1	MW-4	2001	3	Phase I	0.015	0.022	<0.005	**0.004**	0.003	**0.63**	0.095	0.009	<0.0001	<0.00005				<0.1		
MW-4	MW-4	2006	8	Phase II																
Upgradient - MW-6																				
PO-6-1	MW-6	2001	3	Phase I	0.037	0.12	0.042	**0.004**	**0.04**	**7.8**	0.087	**0.02**	<0.00010	<0.000050				<1.0		
MW-6	MW-6	2006	8	Phase II														#N/A		
no sample taken - well dry	MW-6	2013	15	Phase II														#N/A		
no sample taken - well dry	MW-6	2014	16	Phase II														#N/A		
Not sampled - dry	MW-6	2016	18	Phase II														#N/A		
		2018	20	Phase II														#N/A		
		2023	25	Phase II														#N/A		
		2028	30	Phase II														#N/A		
				Phase III														#N/A		
																		#N/A		
																		#N/A		
Downgradient - MW-1																				
99-3813	MW-1	1999	1	Phase I	0.006	0.074	0.015	0.001	<1.0	**0.17**	0.014	<0.05	<0.001	<0.00002				< 5		
PO-1-1	MW-1	2000	2	Phase I	0.036	0.35	0.015	**0.01**	**0.132**	**3.54**	0.036	**0.019**	<0.0010	<0.000021				<0.10		
PO-1-1	MW-1	2001	3	Phase I	0.025	**1.4**	0.035	**0.004**	**0.07**	**4.8**	0.027	**0.03**	<0.00010	<0.00005				<0.1		
PO-1-1	MW-1	2003	5	Phase I	<0.010	0.06	0.01	<0.010	<0.010	**0.28**	0.01	<0.010	<0.00020					0.43		
MW-1	MW-1	2005	7	Phase II	0.04	0.27	0.02	0.001	**0.09**	**0.42**	0.47	**0.02**	<0.00020					<5.0		
MW-1	MW-1	2006	8	Phase II	0.009	0.03	0.007	<0.0010	0.01	**0.47**	0.009	0.002	<0.00020	<0.0001				<0.10		
MW-1	MW-1	2007	9	Phase II	0.002	0.036	0.01	<0.0010	0.003	**0.39**	0.005	0.002	<0.00010							
MW-1	MW-1	2008	10	Phase II	<0.0010			<0.0010	<0.0010	<0.020	<0.050	<0.010	<0.00010	<0.000050				<0.20		
13-27355	MW-1	2013	15	Phase II	0.062	0.072	0.0092	<0.0010	<0.0010	**0.28**	0.079	0.0044	<0.00040	<0.0030				<0.050		
F4-HEL-MW98-01	MW-1	2014	16	Phase II	**0.17**	0.097	0.0098	0.00048	0.0018	**0.38**	0.066	0.0016	<0.00001	<0.05	0.041	<0.100	<0.100	0.141		
Not sampled - dry	MW-1	2016	18	Phase II														#N/A		
		2018	20	Phase II														#N/A		
		2023	25	Phase II														#N/A		
		2028	30	Phase II														#N/A		
				Phase III														#N/A		
																		#N/A		
																		#N/A		
Downgradient - MW-2																				
99-3814	MW-2	1999	1	Phase I	0.014	0.064	0.008	0.001	<0.010	0.053	0.012	<0.050	<0.0010	<0.000050				<5.0		
PO-2-1	MW-2	2000	2	Phase I	0.01	0.25	0.024	0.0003	0.01	0.129	0.028	0.004	<0.0010	<0.000021				0.65		
PO-2-1	MW-2	2001	3	Phase I	0.016	0.15	<0.005	**0.002**	**0.1**	**0.47**	0.02	**0.02**	<0.00010	<0.000050				0.81		
PO-2-1	MW-2	2003	5	Phase I	0.01	0.04	0.01	<0.010	<0.010	0.1	0.01	0.01	<0.00020					2.6		
MW-2	MW-2	2005	7	Phase II	0.02	0.08	0.01	0.001	0.01	**0.39**	0.07	**0.03**	<0.00020							
MW-2	MW-2	2006	8	Phase II	**0.098**	0.01	0.01	<0.001	0.01	**0.58**	0.009	0.014	<0.00020	<0.0001				0.96		
MW-2	MW-2	2007	9	Phase II	0.009	0.009	0.017	<0.0010	0.001	0.08	0.005	**0.018**	<0.00010					0.732		
MW-2	MW-2	2008	10	Phase II	<0.0010			<0.0010	<0.0010	0.0214	<0.050	<0.010	<0.00010	<0.000050				0.869		
13-27356	MW 02	2013	15	Phase II	0.027	0.27	0.014	<0.0010	<0.0010	**0.14**	0.45	**0.065**	<0.00040	<0.0030				1.08		

FOX-4 Cape Hooper - Helipad Landfill West - Summary of Groundwater Analytical Data**

Sample #	Location	Date	Monitoring Year	Monitoring Phase	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Hg	Total	F1 C_6-C_{10}	F2 C_{10}-C_{16}	F3 C_{16}-C_{34}	Modified TPH^ - Total C6-C34	TPH Identity	
					[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	PCB [mg/L]	(mg/L)	(mg/L)	(mg/L)	[mg/L]	% Fuel Oil	% Lube Oil
F4-HEL-MW98-02	MW-2	2014	16	Phase II	0.0057	0.043	0.018	0.000042	0.0013	0.034	0.067	**0.027**	<0.00001	<0.05	0.4	0.94	<0.100	1.39		
MW98-02	MW-2	2016	18	Phase II	0.0006	0.006	0.003	<0.0001	0.0001	0.09	<0.001	0.004	<0.0001	<0.00005	*0.395*	*<0.100*	*<0.100*	0.495		
		2018	20	Phase II														#N/A		
		2023	25	Phase II														#N/A		
		2028	30	Phase II														#N/A		
				Phase III														#N/A		
																		#N/A		
																		#N/A		

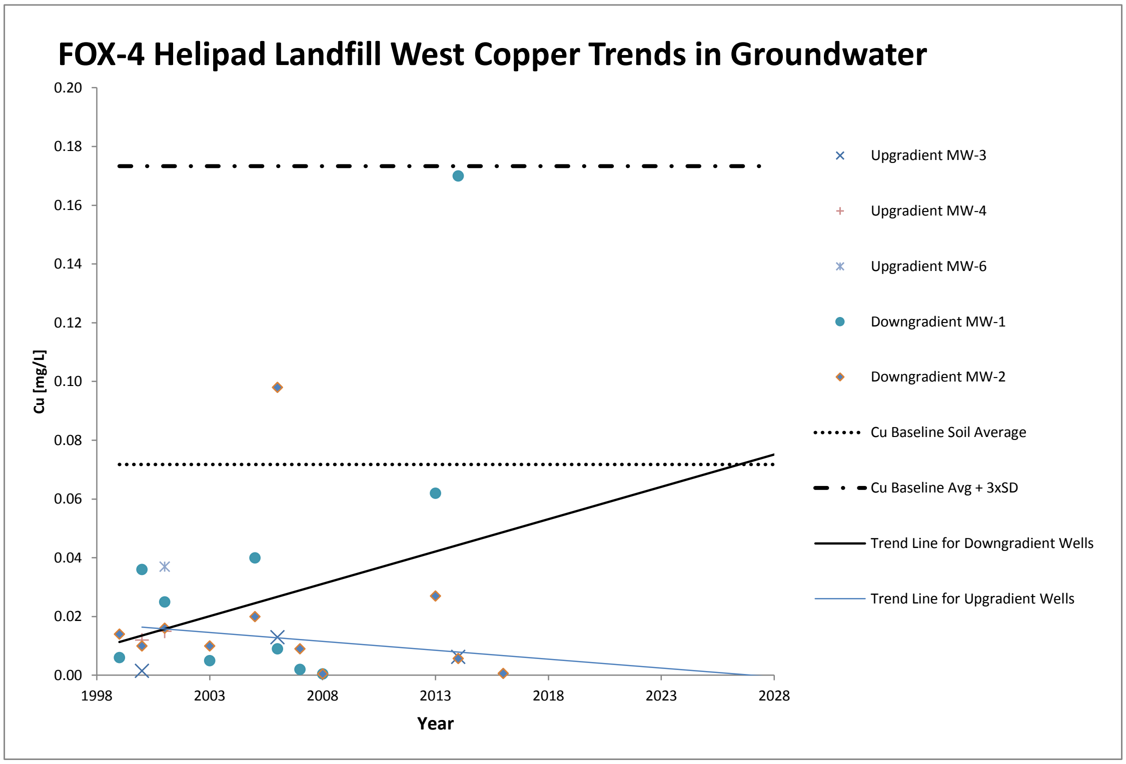
Note: Total Hydrocarbons (C_6-C_{34}) has been calculated by adding results for F1, F2 and F3.

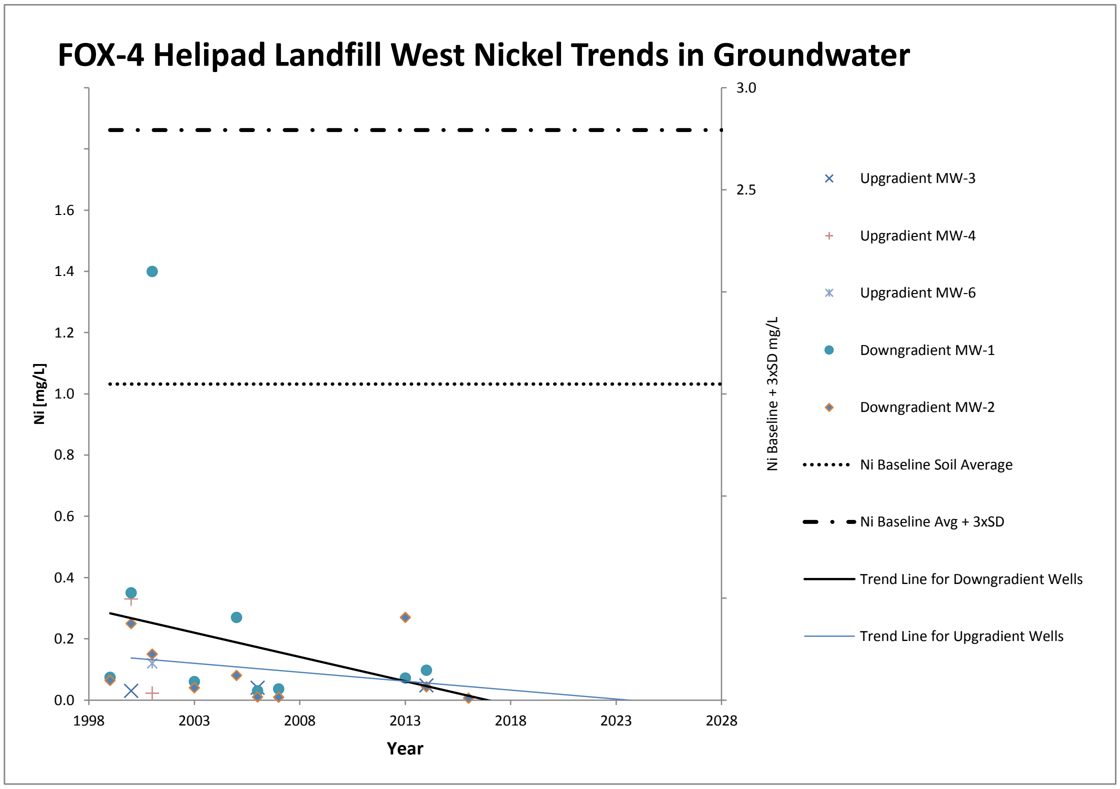
** The Helipad Landfill West underwent additional regrading in 2013.

Legend	**XX**	Sample exceeds Baseline Average

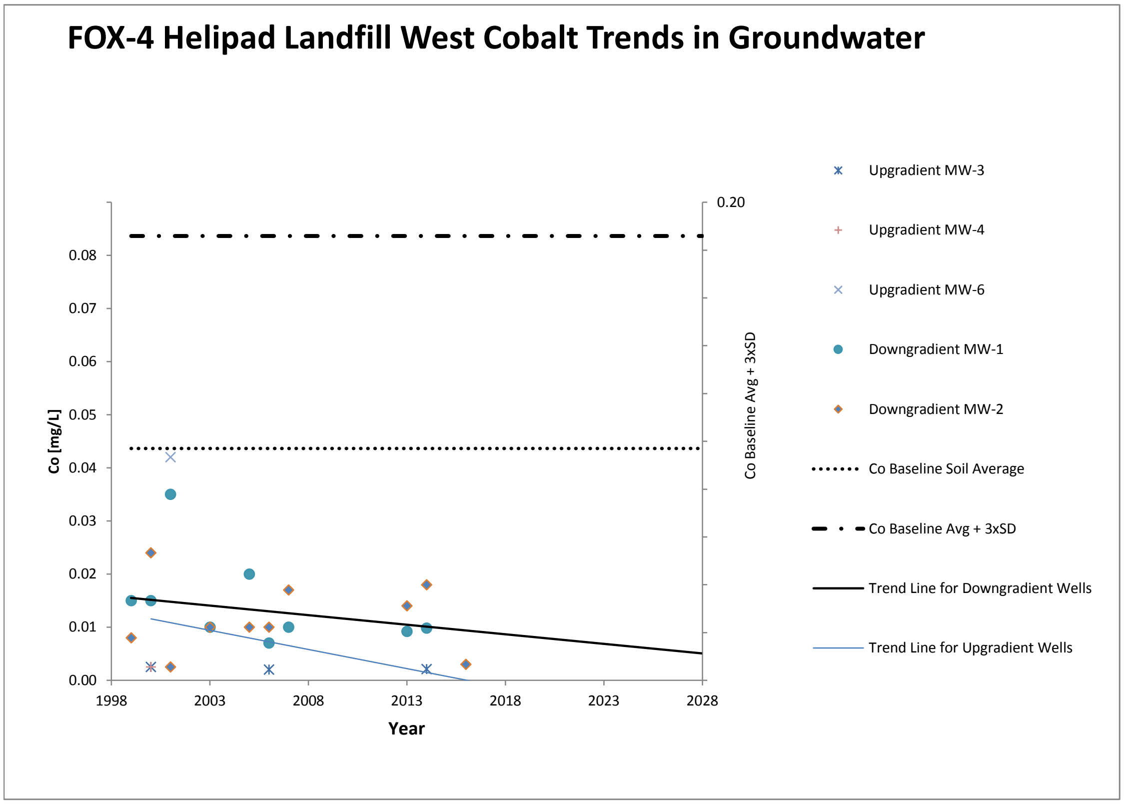
FOX-4 Helipad Landfill West Graphs of Trends for Inorganic Elements, PCBs and TPH in Groundwater Samples

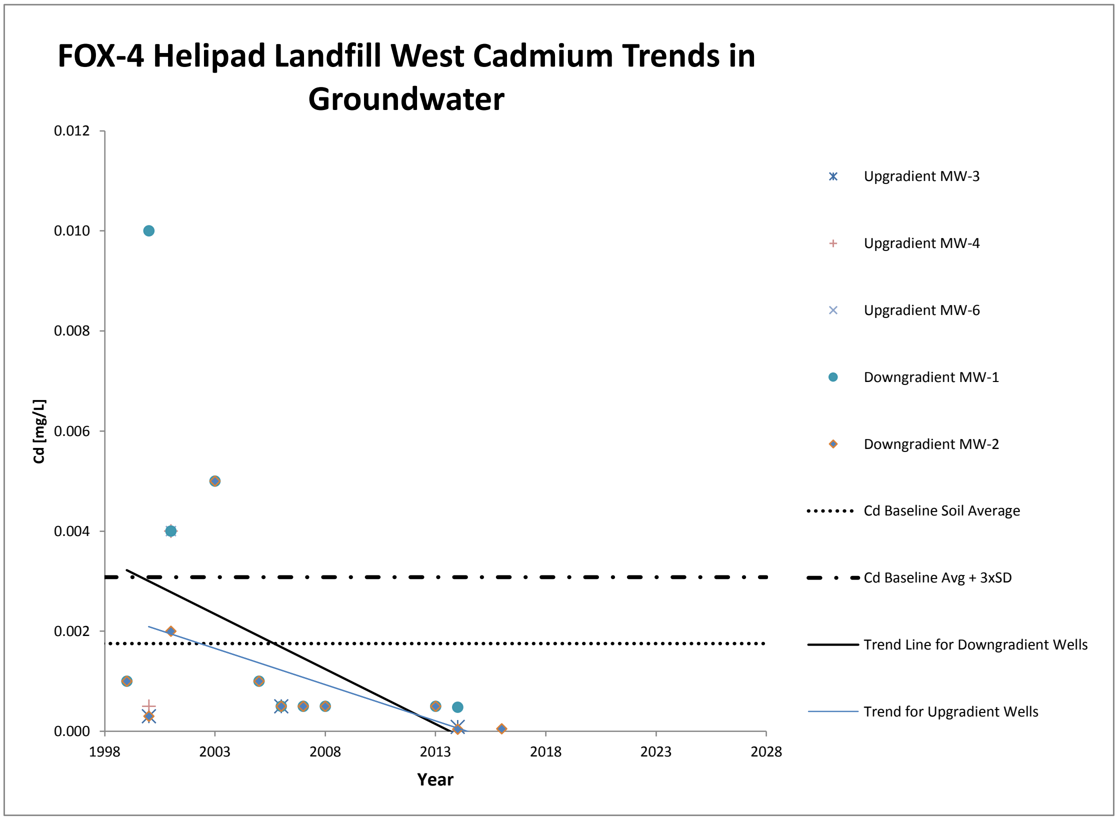
Where results are below detection, half of the detection limit has been used in the charts.



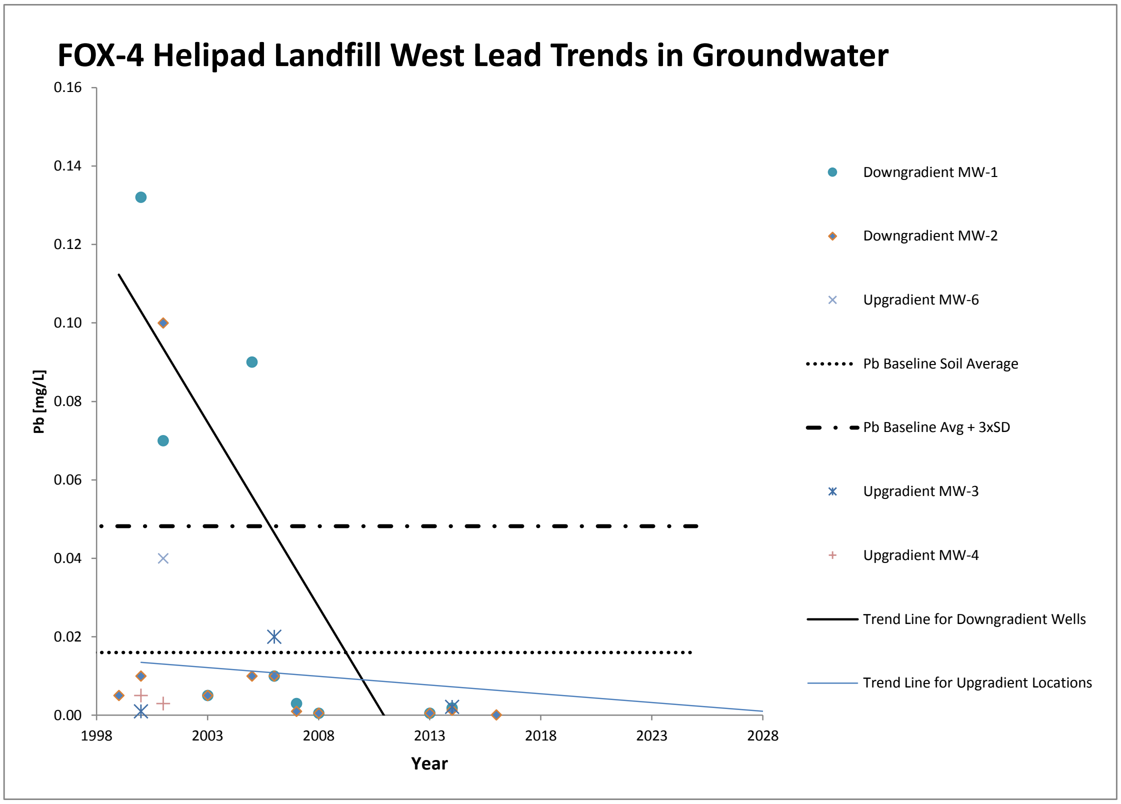


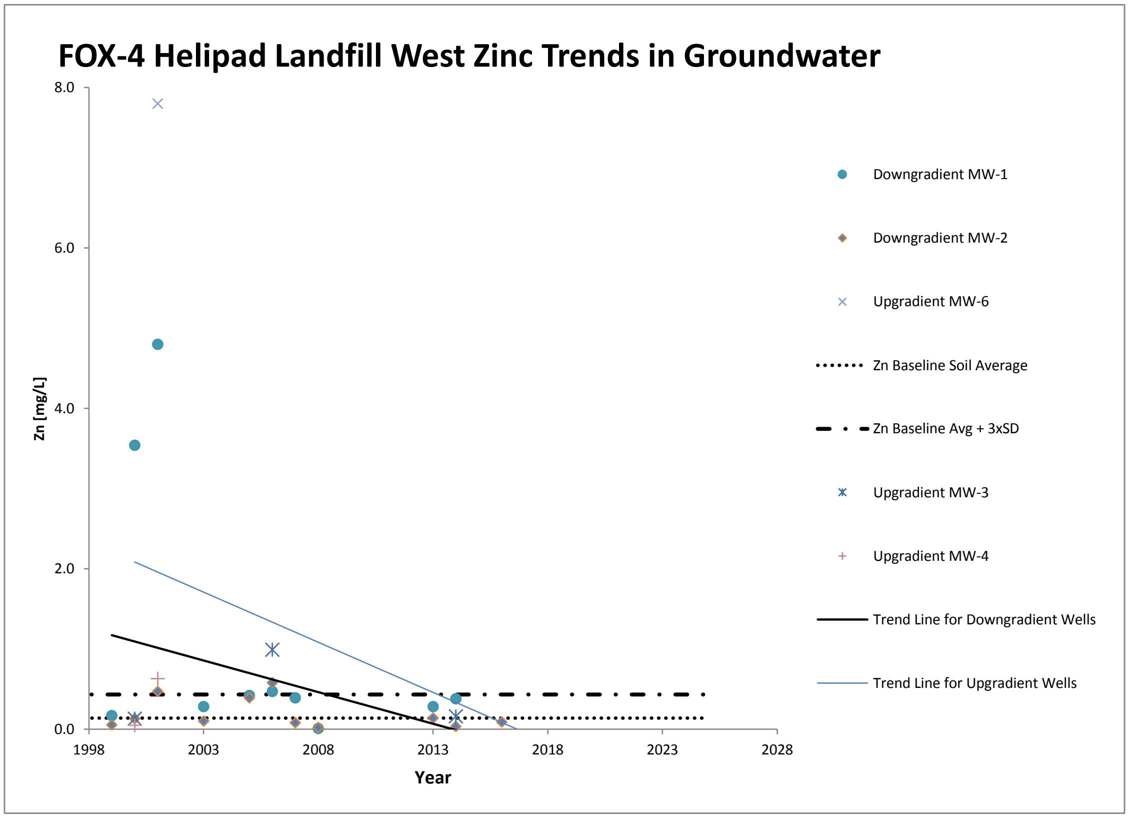
FOX-4 Helipad Landfill West Graphs of Trends for Inorganic Elements, PCBs and TPH in Groundwater Samples



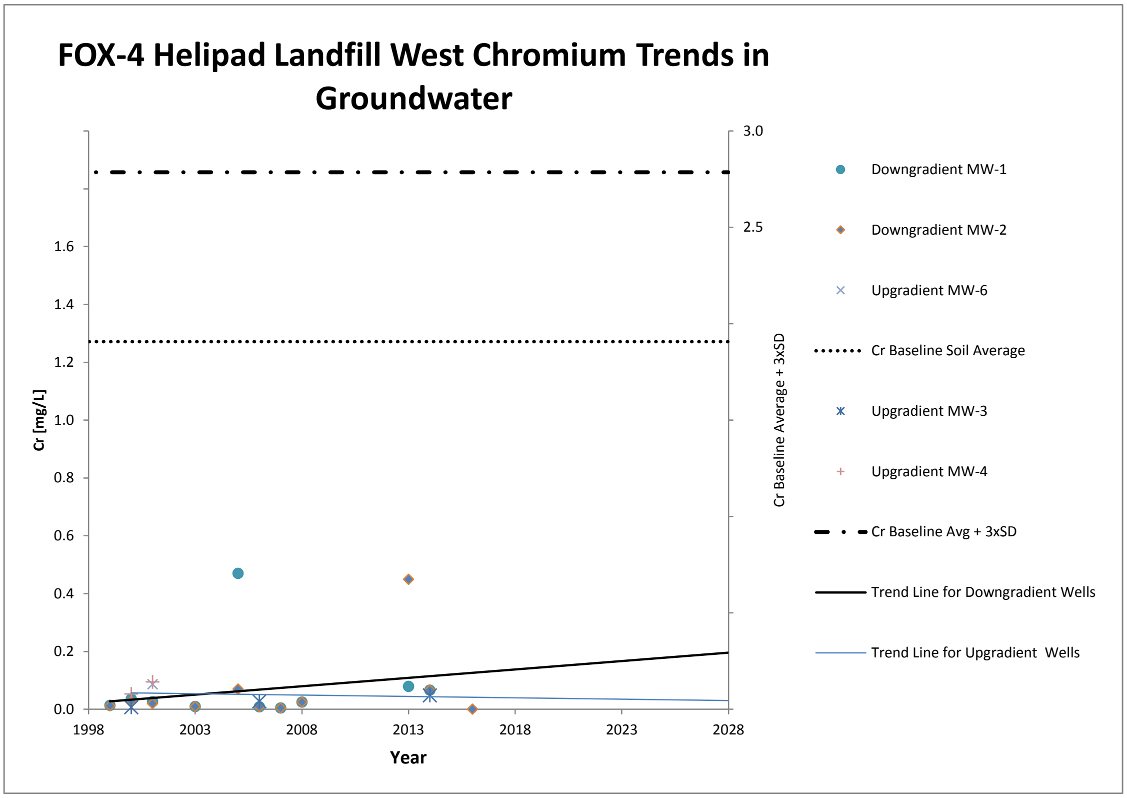


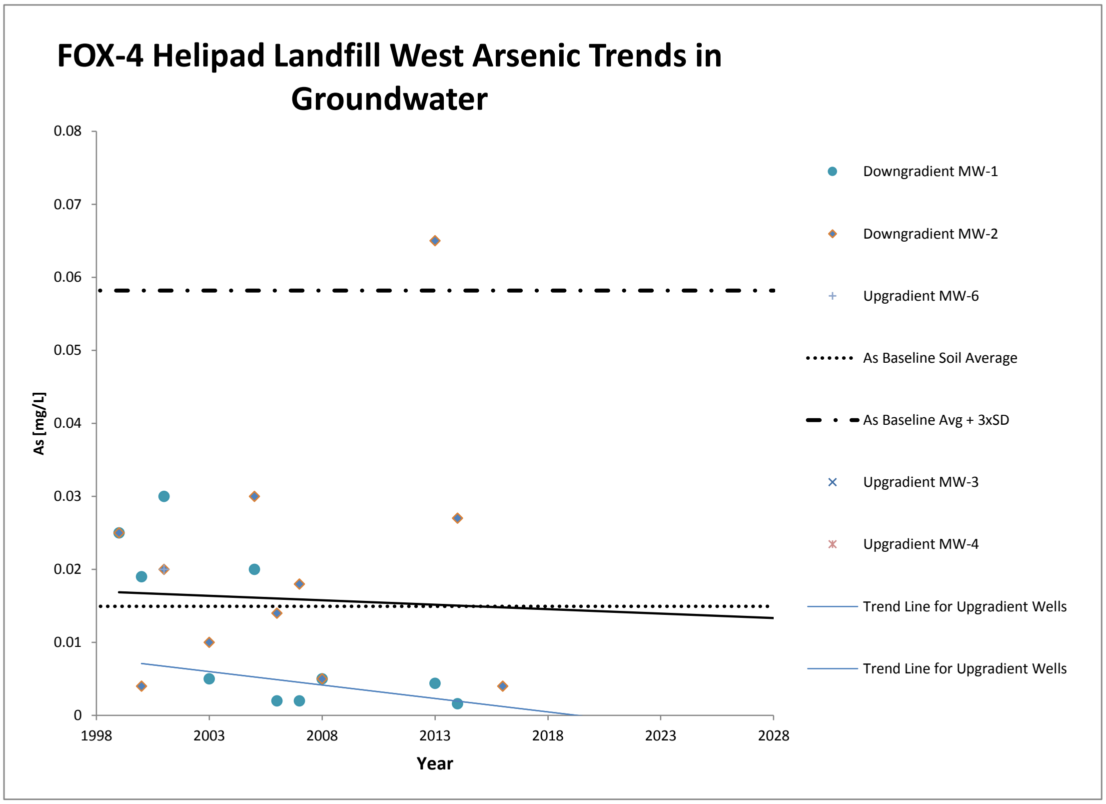
FOX-4 Helipad Landfill West Graphs of Trends for Inorganic Elements, PCBs and TPH in Groundwater Samples



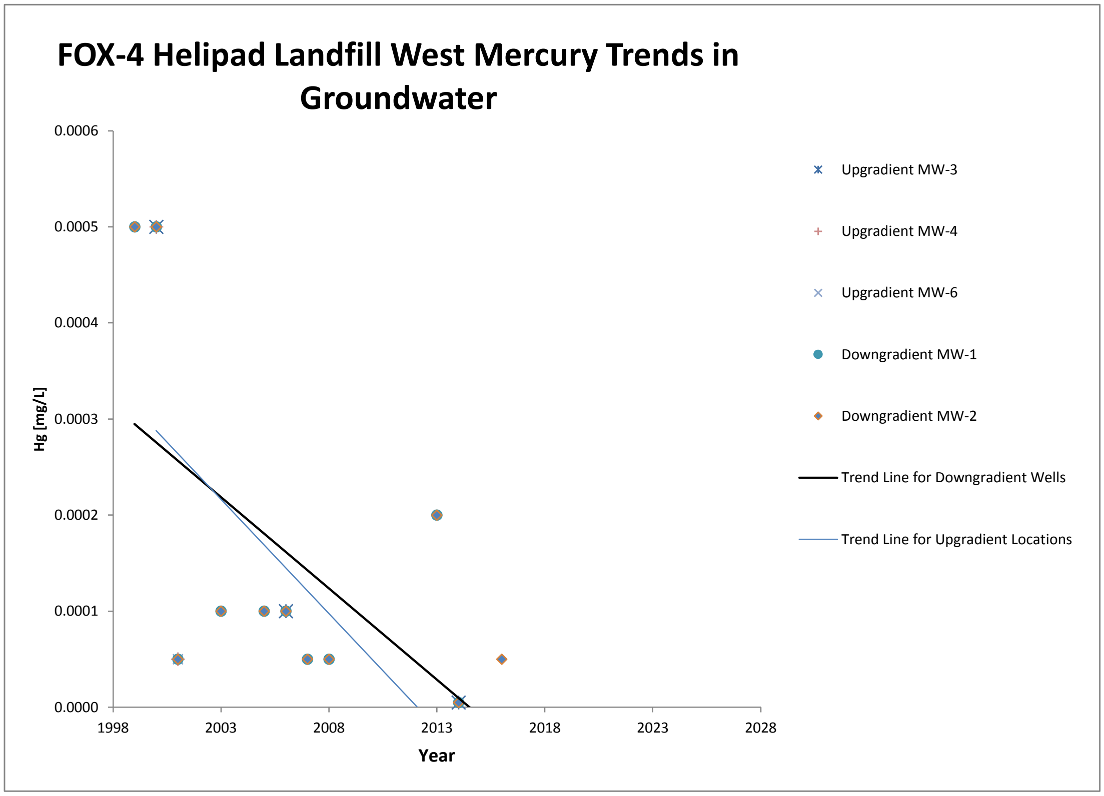


FOX-4 Helipad Landfill West Graphs of Trends for Inorganic Elements, PCBs and TPH in Groundwater Samples

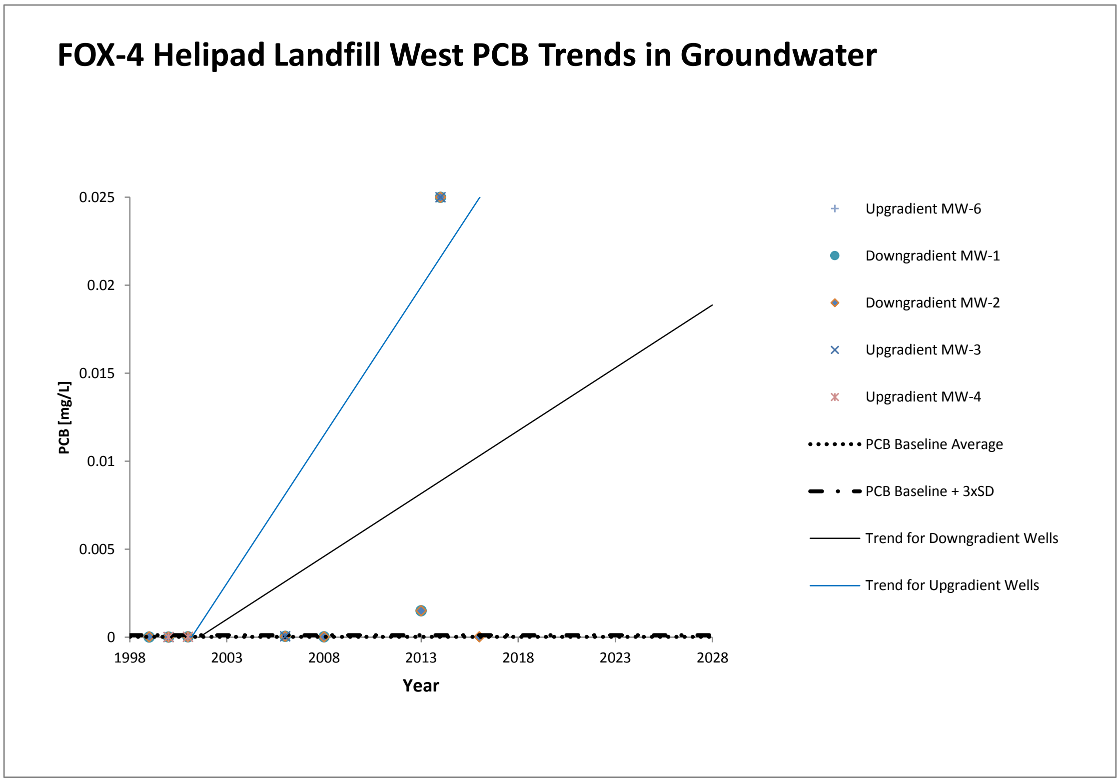




FOX-4 Helipad Landfill West Graphs of Trends for Inorganic Elements, PCBs and TPH in Groundwater Samples

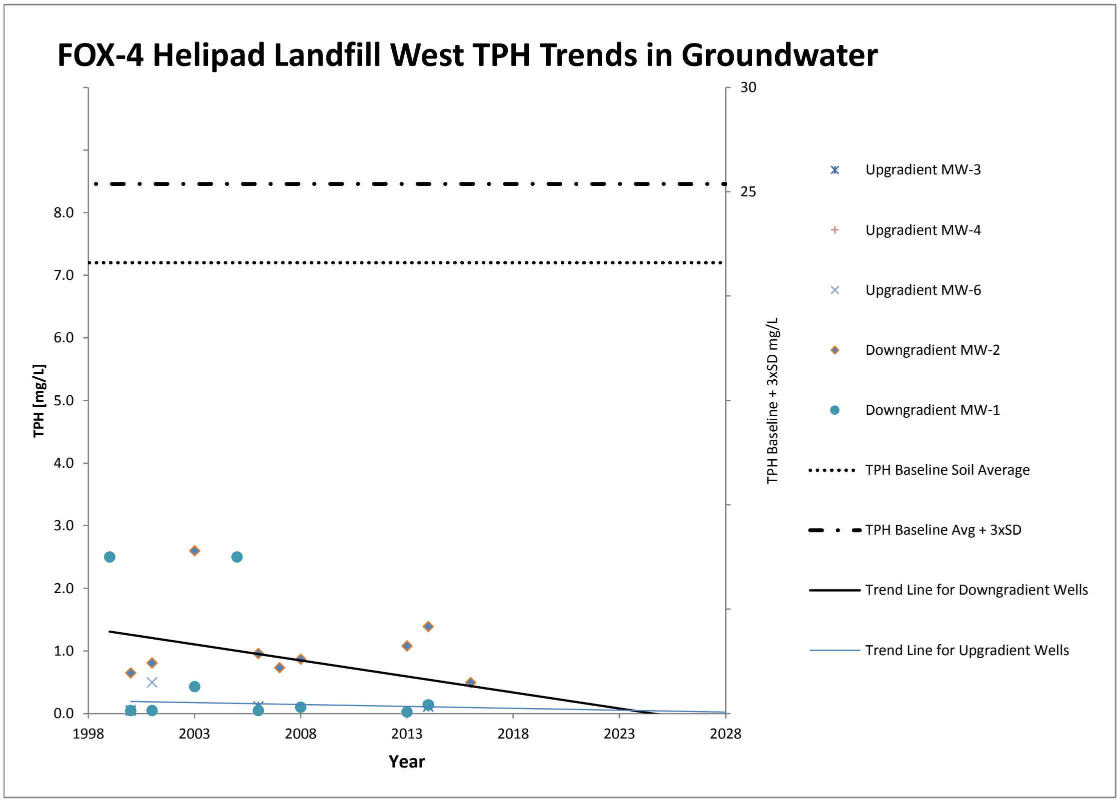


Mercury was not analyzed in 1998 Baseline samples.
Mercury results were below detection in monitoring groundwater samples up to 2014. Trendlines reflect changes in detection limits



PCB results in groundwater have been below detection. Trendlines reflect changes in detection limits.

FOX-4 Helipad Landfill West Graphs of Trends for Inorganic Elements, PCBs and TPH in Groundwater Samples



FOX-4 Cape Hooper - Station Area Landfill - Summary of 1999-2028 Soil Analytical Data**

Sample #	Location	Year	Monitoring Year	Monitoring Phase	Depth (cm)	Cu [mg/kg]	Ni [mg/kg]	Co [mg/kg]	Cd [mg/kg]	Pb [mg/kg]	Zn [mg/kg]	Cr [mg/kg]	As [mg/kg]	Hg [mg/kg]	Total PCB [mg/kg]	F1 C_6-C_{10} [mg/kg]	F2 C_{10}-C_{16} [mg/kg]	F3 C_{16}-C_{34} [mg/kg]	Modified TPH^ - Total C6-C34 [mg/kg]	TPH Identity	
																				% Fuel Oil	% Lube Oil
Background Data - Average						30	24	8.8	1.00	10.0	41	41	28.6								
Baseline Data - Average						**17**	**20**	**5**	**0.12**	**26**	**35**	**28**	**13**		**0.16**				**53**	n/a	n/a
Baseline Data - Standard Deviation						6	14.8	0.9	0.05	4	6	8	3		0.14				30		
Baseline average + 3xStandard Deviation						35	64	7.7	0.3	37	53	50	23		0.6				144		
Detection Limit						3.0	5.0	5.0	1.0	10	15	20	0.20	0.10	0.050				40		
DEW Line Cleanup Tier I Criteria										*200*					*1*						
DEW Line Cleanup Tier II Criteria & site specific As criteria						*100*	*100*	*50*	*5*	*500*	*500*	*250*	*130*	*2.0*	*5*				*2500*		
Monitoring Data																					
Upgradient																					
	MW-7 surface																				
99-3737	MW-7	1999	1	Phase I	0	**69**	15	<5.0	<1.0	**64**	**71**	**50**	9.7	<0.10	0.13				< 40	n/a	n/a
FO-7-1	MW-7	2000	2	Phase I	0-15	**54**	**32**	**6.3**	**1.0**	**27**	**80**	**41**	**17**	<0.050	0.12				<100	n/a	n/a
FO-7-1	MW-7	2001	3	Phase I	0-15	**17**	11	3.4	<0.10	12	28	21	12	<0.050	*6.2*				11	95	5
FOM-7-1	MW-7	2003	5	Phase I	0-15	11	10	4.0	<0.10	<1.0	22	19	**19**	<0.040	0.021	<1.0	<40	44	**65**		
MW-7	MW-7	2005	7	Phase II	0-8	**50**	17	**7.0**	<1.0	**43**	**59**	**37**	**17**	<0.040	0.10	<1.0	<40	390	**411**		
MW-7 (Soil) 0-15 cm	MW-7	2006	8	Phase II	0-15	11	10	3.0	<1.0	<1.0	20	20	11	<0.040	<0.10	<1.0	<1.0	30	31		
MW-7(Soil)0-15cm	MW-7	2008	10	Phase II	0-15	**47**	**21**	**6.0**	**0.60**	**40**	**48**	**41**	**20**	<0.10	0.050	<1.0	<1.0	170	**171**		
10-16953/54	MW-7	2010	12	Phase II	0-10	**45**	15	**5.6**	<1.0	**39**	**52**	**31**	11	<0.10	0.05	<1.0	4.3	20	25		
13-27321/22	MW-7	2013	15	Phase II	0-10	**32**	**22**	**5.5**	<1.0	13	**49**	**43**	**26**	<0.10	0.04	<10	5.3	12	22		
F4-STA-MW98-07-S	MW-7	2014	16	Phase II	0-15	**50**	**30**	**7.8**	0.11	23	**57**	**61**	**33**	<0.050	0.032	<10	<10	28	38		
MW98-07a	MW-7	2016	18	Phase II	0-15	**21.8**	17.2	**5.2**	<0.5	9	35	**40.3**	**17.3**	<0.1	<0.05	<7	21	913	**938**		
		2018	20	Phase II															#N/A		
		2023	25	Phase II															#N/A		
		2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
	MW-7 depth																				
99-3739	MW-7	1999	1	Phase I	30	*410*	**24**	**6.5**	<1.0	11	**49**	**61**	**20**	<0.10	0.019				< 40	n/a	n/a
n/s	MW-7	2000	2	Phase I	40-50																
FO-7-2	MW-7	2001	3	Phase I	40-50	14	15	3.7	<0.10	4.0	25	23	**22**		**0.19**				**54**	95	5.0
FOM-7-2	MW-7	2003	5	Phase I	40-50	**32**	**23**	**8.0**	<0.10	<1.0	**39**	**49**	**23**	<0.040	<0.0010	<1.0	<40	<40	41		
MW- 7 (Soil) 40-50 cm	MW-7	2006	8	Phase II	40-50	**18**	14	4.0	<1.0	<1.0	24	**28**	**13**	<0.040	<0.10	<1.0	<1.0	230	**231**		
MW-7(Soil)40-50cm	MW-7	2008	10	Phase II	40-50	**53**	**32**	**8.0**	<0.050	24	**46**	**61**	**24**	<0.10	<0.050	<1.0	<1.0	180	**181**		
10-16955/56	MW-7	2010	12	Phase II	30-40	**35**	**21**	**7.4**	<1.0	17	**50**	**45**	**16**	<0.10	0.017	<1.0	7.1	39	47		
13-27319/20	MW-7	2013	15	Phase II	30-40	**32**	**22**	<5.0	<1.0	13	**48**	**31**	**14**	<0.10	<0.050	<10	4.8	14	24		
F4-STA-MW98-07-D	MW-7	2014	16	Phase II	40-50	**64**	**43**	**10.8**	<0.5	5.85	**57**	**67.5**	**45.5**	<0.10	<0.05	<10	<10	<50	35		
Not sampled - refusal	MW-7	2016	18	Phase II															#N/A		
		2018	20	Phase II															#N/A		
		2023	25	Phase II															#N/A		
		2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
Downgradient																					
	MW-8 surface																				
99-3741	MW-8	1999	1	Phase I	0	14	11	<5.0	<1.0	<1.0	34	**28**	10	<0.10	0.080				< 40	n/a	n/a
FO-8-1	MW-8	2000	2	Phase I	0-15	16	12	4.3	<0.10	5.0	**39**	25	**14**	<0.050	0.12				<100	n/a	n/a
FO-8-1	MW-8	2001	3	Phase I	0-15	12	12	3.7	<0.10	4.0	33	20	12	<0.050	**0.26**				<20	n/a	n/a
FOM-8-1	MW-8	2003	5	Phase I	0-15	13	11	4.0	<0.10	<1.0	22	21	12	<0.040	<0.0010	<1.0	<40	<40	41		
MW-8	MW-8	2005	7	Phase II	0-10	11	9.0	4.0	<1.0	<1.0	29	20	6.6	<0.040	<0.050	<1.0	< 40	< 40	41		
MW-8 (Soil) 0-15 cm	MW-8	2006	8	Phase II	0-15	13	10	3.0	<1.0	<1.0	20	19	10	<0.040	<0.10	<1.0	10	150	**161**		
MW-8(Soil)0-15cm	MW-8	2008	10	Phase II	0-15	**19**		<5.0	<0.050	8.0	21	**29**	**17**	<0.10	<0.050	<1.0	<1.0	37	38		
10-16945/46	MW-8	2010	12	Phase II	0-10	12	10	<5.0	<1.0	<1.0	**40**	23	7.5	<0.10	0.0060	<1.0	5.5	15	21		
13-27325/26	MW-8	2013	15	Phase II	0-10	10	11	<5.0	<1.0	<10	23	25	**21**	<0.10	<0.05	<10	3.4	9.5	18		
F4-STA-MW98-08-S	MW-8	2014	16	Phase II	0-15	16	14	4.0	<0.10	5	30	**28**	**21**	<0.050	**0.26**	<10	10	<10	20		
MW98-08b	MW-8	2016	18	Phase II	0-15	11	11.9	3.8	<0.5	3.4	21	23.7	**16.3**	<0.1	*1.46*	<7	<4	<8	10		
		2018	20	Phase II															#N/A		
		2023	25	Phase II															#N/A		
		2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
	MW-8 depth																				
99-3743	MW-8	1999	1	Phase I	30	**17**	16	<5.0	<1.0	<1.0	**42**	**36**	**19**	<0.10	0.019				**150**	100	0
FO-8-2	MW-8	2000	2	Phase I	40-50	**17**	12	3.5	<0.10	4.0	27	25	11	<0.050	0.053				<100	n/a	n/a
FO-8-2	MW-8	2001	3	Phase I	40-50	11	14	4.3	<0.10	3.0	30	24	**37**	<0.050	0.060				25	95	5.0
FOM-8-2	MW-8	2003	5	Phase I	40-50	15	14	**5**	<0.10	**70**	27	24	12	<0.040	<0.0010	<1.0	<40	<40	41		
MW-8 (Soil) 40-50 cm	MW-8	2006	8	Phase II	40-50	15	12	3.0	<1.0	<1.0	20	21	11	<0.040	<0.10	<1.0	<1.0	30	31		
MW-8(Soil)40-50cm	MW-8	2008	10	Phase II	40-50	**17**		<5.0	<0.050	7.0	<2.0	26	11	<0.10	<0.050	<1.0	<1.0	42	43		
10-16947/48	MW-8	2010	12	Phase II	30-40	16	9.2	<5.0	<1.0	<1.0	27	24	8.3	<0.10	0.019	<1.0	4.4	37	42		
13-27323/24	MW-8	2013	15	Phase II	30-40	15	13	<5.0	<1.0	<10	**38**	**28**	**16**	<0.10	**0.19**	<10	4.9	5.5	15		
F4-STA-MW98-08-D	MW-8	2014	16	Phase II	40-50	12	14	4.0	<0.10	4	32	**32**	**20**	<0.050	**0.18**	<10	<10	<10	15		
MW98-08a	MW-8	2016	18	Phase II	30-40	8.7	9.5	3.2	<0.5	2.5	20.3	21.7	**14.5**	<0.1	**0.19**	<7	<4	<8	10		
		2018	20	Phase II															#N/A		
		2023	25	Phase II															#N/A		
		2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		

Sample #	Location	Year	Monitoring Year	Monitoring Phase	Depth	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Hg	Total PCB	F1 C_6-C_{10}	F2 C_{10}-C_{16}	F3 C_{16}-C_{34}	Modified TPH^ - Total C6-C34	TPH Identity	
					(cm)	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	% Fuel Oil	% Lube Oil
	MW-9 surface																				
99-3745	MW-9	1999	1	Phase I	0	15	11	<5.0	<1.0	<1.0	29	**32**	**36**	<0.10	**0.20**				**68**	100	0
FO-9-1	MW-9	2000	2	Phase I	0-15	14	13	4.1	<0.10	5.0	29	21	**46**	<0.050	**0.35**				<100	n/a	n/a
FO-9-1	MW-9	2001	3	Phase I	0-15	11	13	4.3	<0.10	4.0	**53**	20	**19**	<0.050	0.080				<20	n/a	n/a
FOM-9-1	MW-9	2003	5	Phase I	0-15	15	13	**6.0**	<0.10	<1.0	**40**	**29**	**15**	<0.040	0.12	<1.0	<40	<40	41		
MW-9	MW-9	2005	7	Phase II	0-11	11	9.0	4.0	<1.0	<1.0	25	21	6.7	<0.040	*2.9*	<1.0	< 40	< 40	41		
MW-9 (Soil) 0-15 cm	MW-9	2006	8	Phase II	0-15	11	10	3.0	<1.0	<1.0	20	22	**61**	<0.040	<0.10	<1.0	10	<1.0	11		
MW-9(Soil)0-15cm	MW-9	2008	10	Phase II	0-15	**17**	12	<5.0	<0.050	7.0	<2.0	**30**	**18**	<0.10	**0.17**	<1.0	36	56	**93**		
10-16949/50	MW-9	2010	12	Phase II	0-10	**18**	8.6	**5.83**	<1.0	<1.0	**39**	**32**	**14**	<0.10	0.053	<1.0	6.1	13	20		
13-27327/28	MW-9	2013	15	Phase II	0-10	15	12	<5.0	<1.0	<10	**41**	**28**	10	<0.10	0.07	<10	4.1	6.9	16		
F4-STA-MW98-09-S	MW-9	2014	16	Phase II	0-15	16	12	3.7	<0.10	8	35	25	**14**	<0.050	0.1	<10	<10	<10	15		
MW98-09a	MW-9	2016	18	Phase II	0-15	**18.3**	13.3	4.6	<0.5	6.1	33.3	**29.2**	**13.8**	<0.1	0.08	<7	<4	<8	10		
		2018	20	Phase II															#N/A		
		2023	25	Phase II															#N/A		
		2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
	MW-9 depth																				
99-3747	MW-9	1999	1	Phase I	30	15	11	<5.0	<1.0	<1.0	22	25	**38**	<0.10	**0.33**				**75**	100	0
FO-9-2	MW-9	2000	2	Phase I	40-50	14	13	4.8	<0.10	4.0	34	25	**15**	<0.050	0.13				<100	n/a	n/a
FO-9-2	MW-9	2001	3	Phase I	40-50	9	11	3.5	<0.10	4.0	26	21	11	<0.050	**0.21**				<20	n/a	n/a
FOM-9-2	MW-9	2003	5	Phase I	40-50	12	11	**5.0**	<0.10	<1.0	31	**32**	*170*	<0.040	0.10	<1.0	<40	<40	41		
MW-9 (Soil) 40-45 cm	MW-9	2006	8	Phase II	40-45	10	10	3.0	<1.0	<1.0	18	22	**25**	<0.040	<0.10	<1.0	<1.0	<1.0	2		
MW-9(Soil)40-50cm	MW-9	2008	10	Phase II	40-50	**30**	8.7	**7.0**	<0.050	6.0	**37**	**65**	**15**	<0.10	0.050	<1.0	<1.0	29	30		
10-16951/52	MW-9	2010	12	Phase II	30-40	**17**	6.6	**7.82**	<1.0	<1.0	**51**	**47**	**26**	<0.10	0.056	<1.0	17	30	48		
13-27329/30	MW-9	2013	15	Phase II	40-50	**17**	13	<5.0	<1.0	<10	32	**33**	11	<0.040	0.07	<10	6.4	145	**156**		
F4-STA-MW98-09-D	MW-9	2014	16	Phase II	40-50	16	13	3.9	<0.10	6	28	26	**66**	<0.050	0.15	<10	<10	<10	15		
Not sampled - refusal	MW-9	2016	18	Phase II															#N/A		
		2018	20	Phase II															#N/A		
		2023	25	Phase II															#N/A		
		2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		

Note: Total Hydrocarbons (C_6-C_{34}) has been calculated by adding results for F1, F2 and F3.

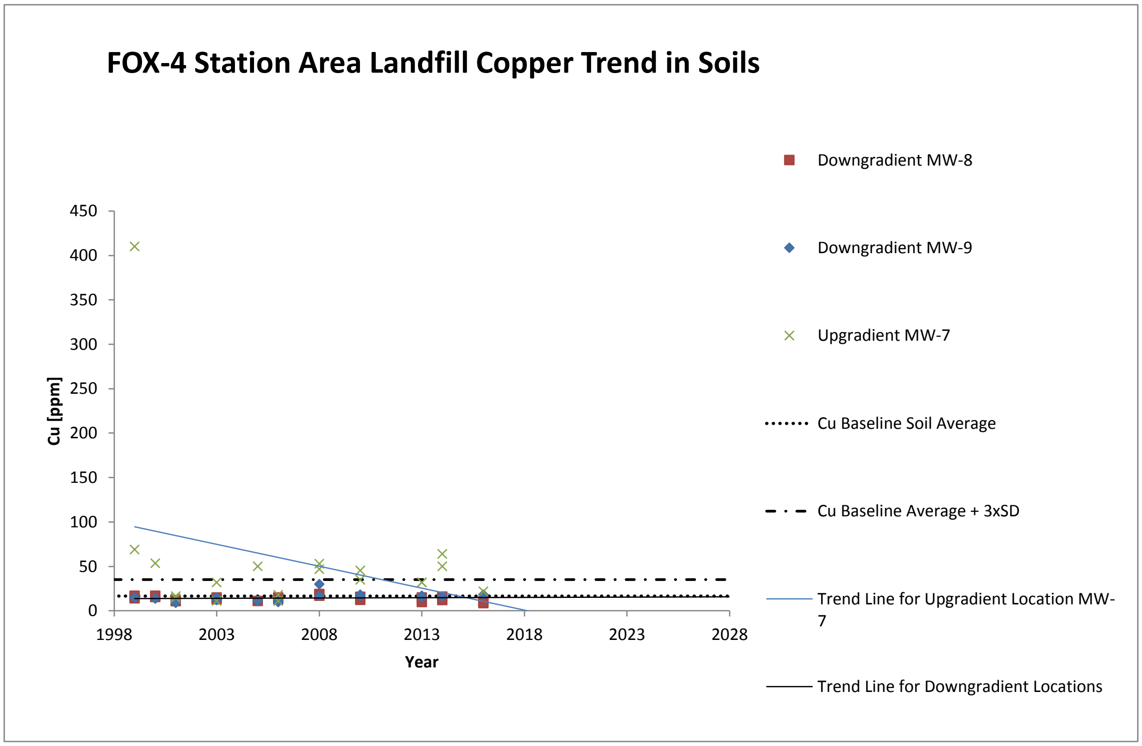
** Additional regrading of the Station Landfill occurred in 2013.

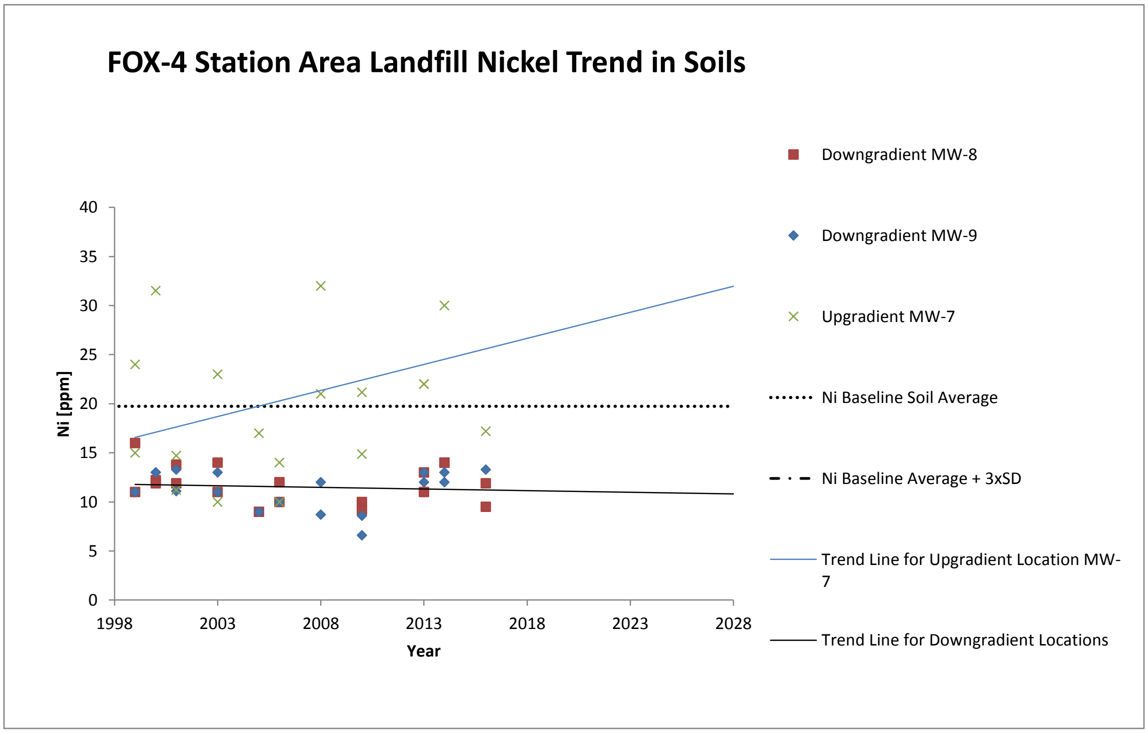
Legend

XX	sample exceeds background
XX	**sample exceeds baseline**
XX	*sample exceeds DLCU Tier I criteria*
XX	*sample exceeds DLCU Tier II criteria*

FOX-4 Station Area Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)

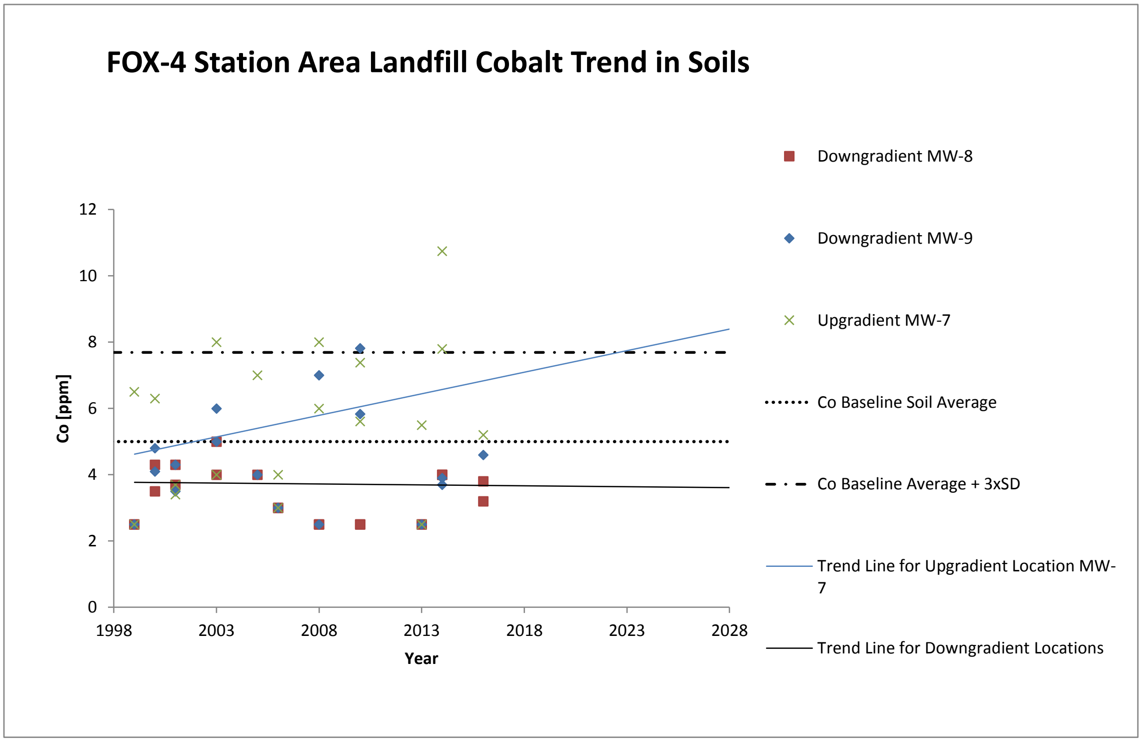
Where results are below detection, half of the detection limit has been used in the charts.

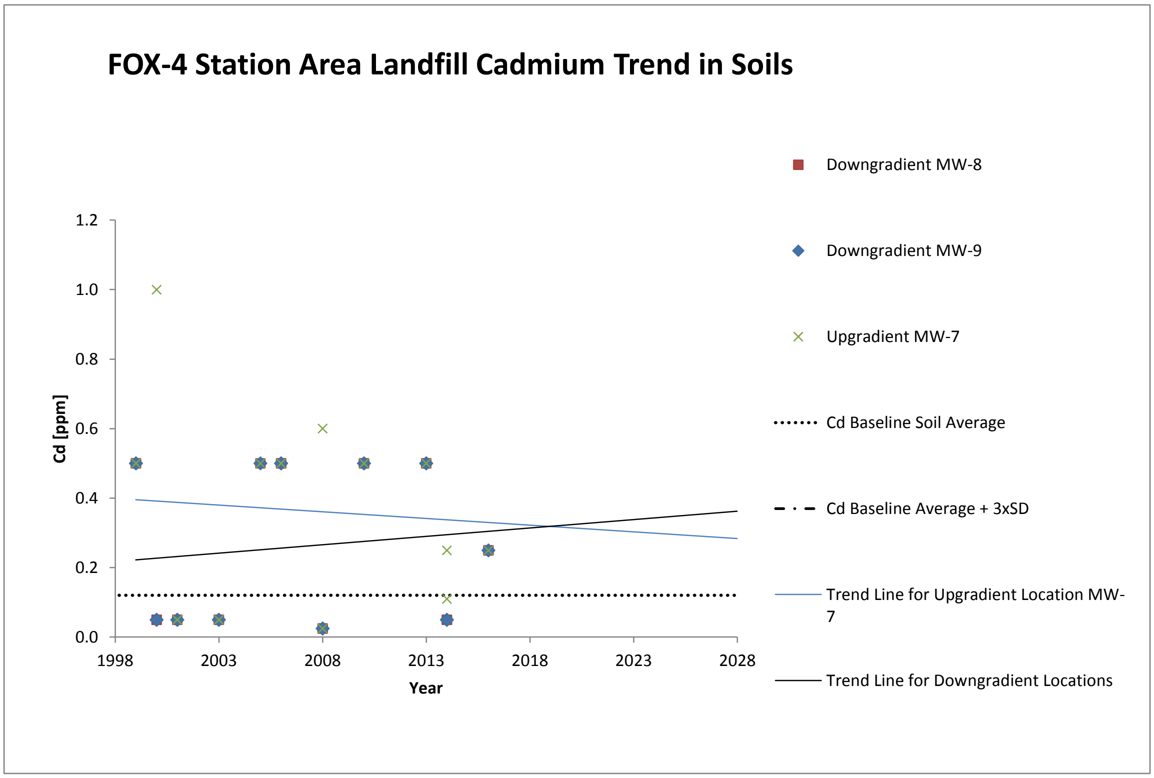




FOX-4 Station Area Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)

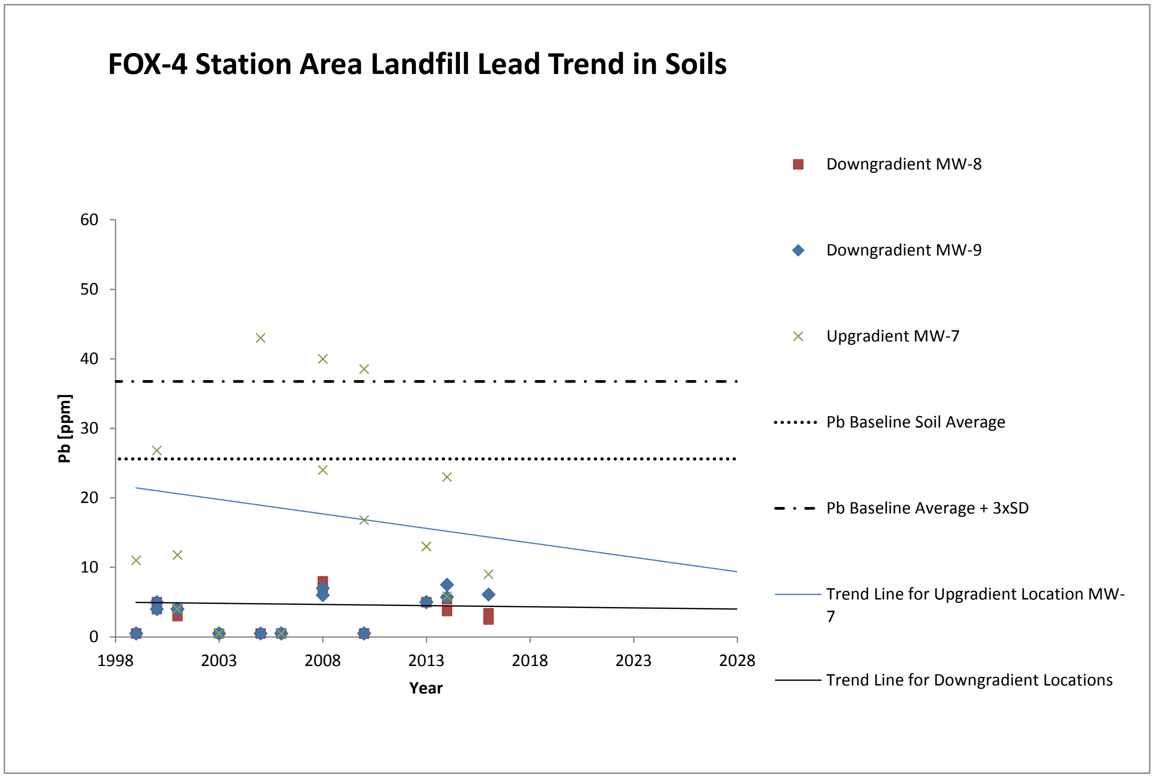
Where results are below detection, half of the detection limit has been used in the charts.

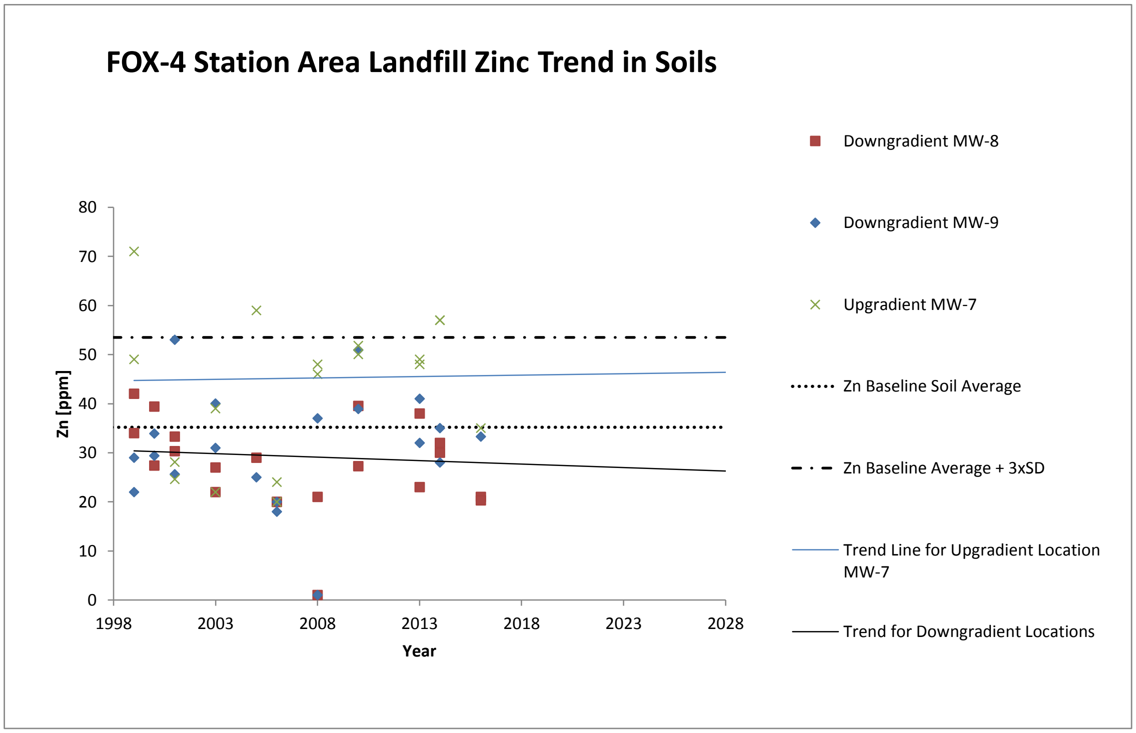




FOX-4 Station Area Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)

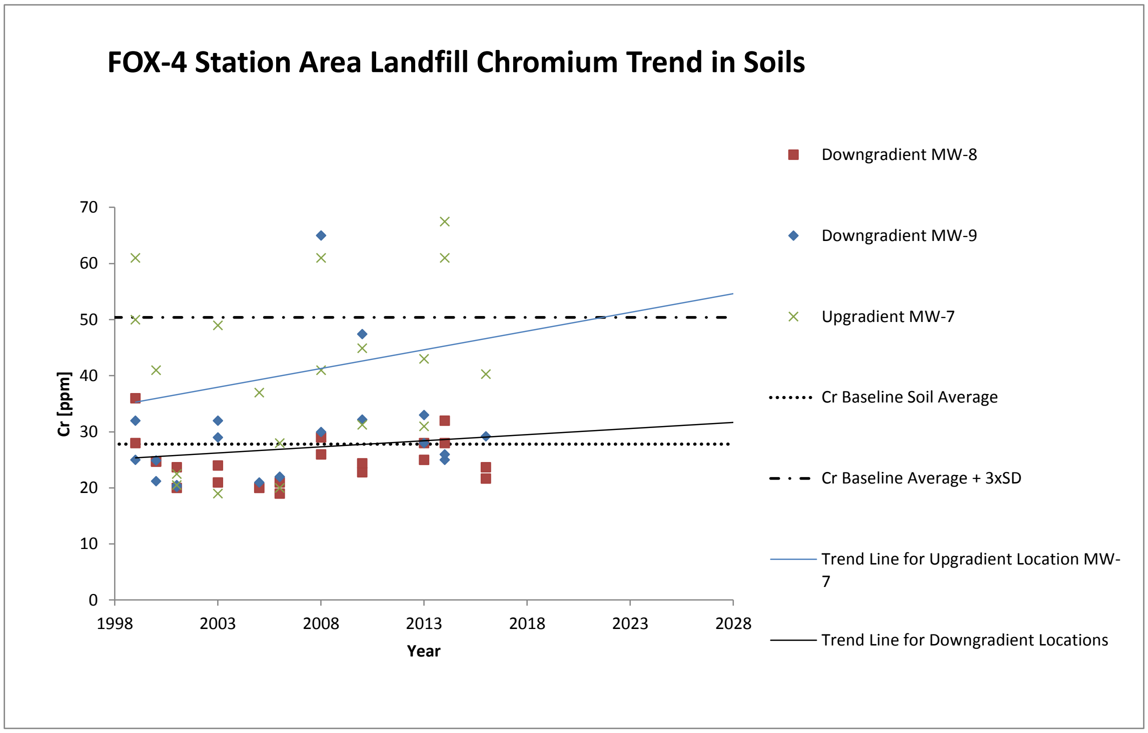
Where results are below detection, half of the detection limit has been used in the charts.

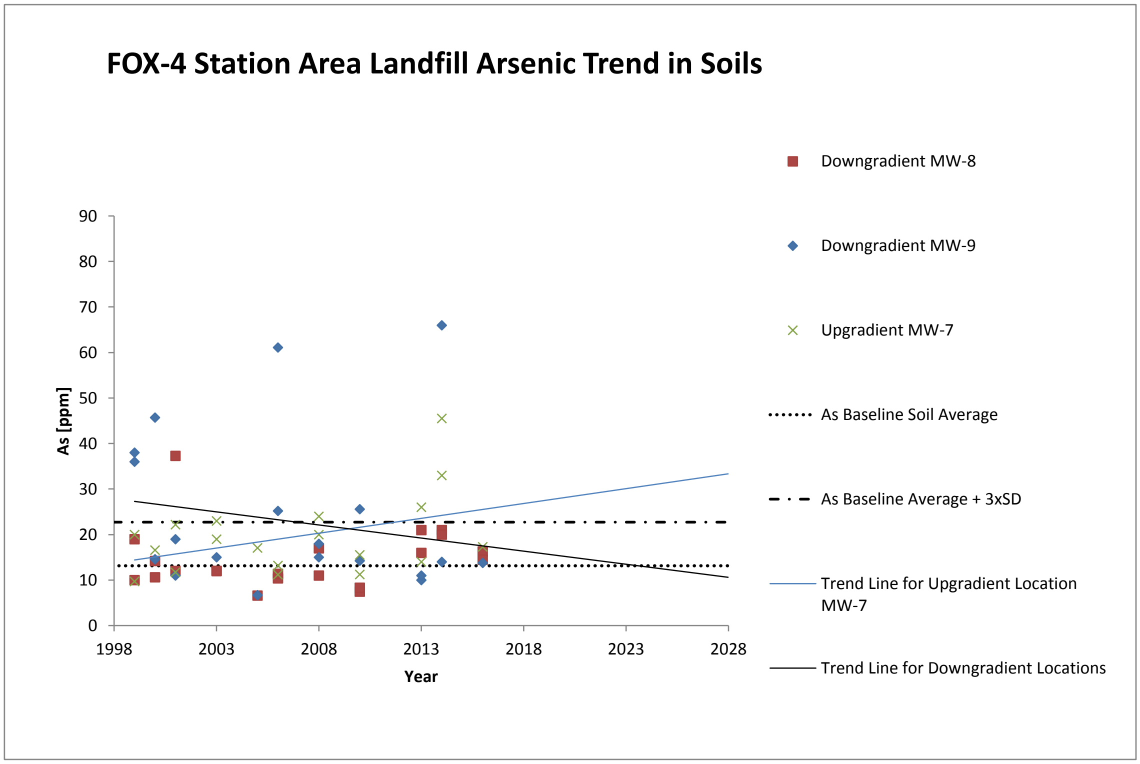




FOX-4 Station Area Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)

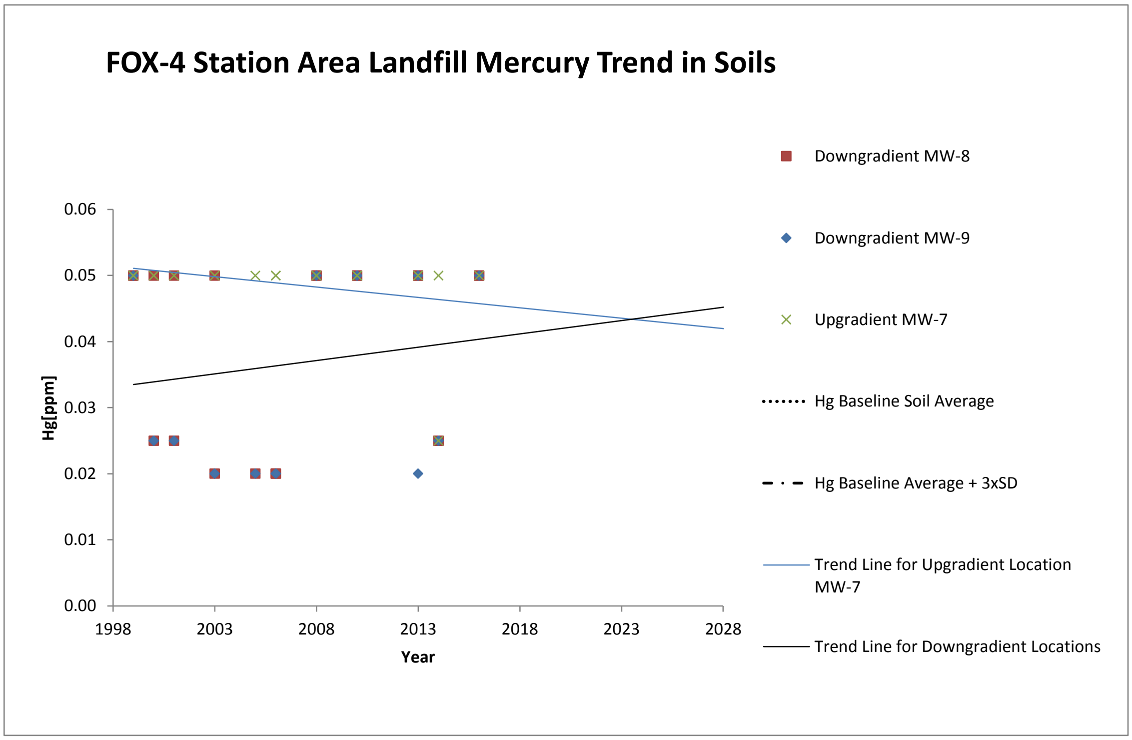
Where results are below detection, half of the detection limit has been used in the charts.

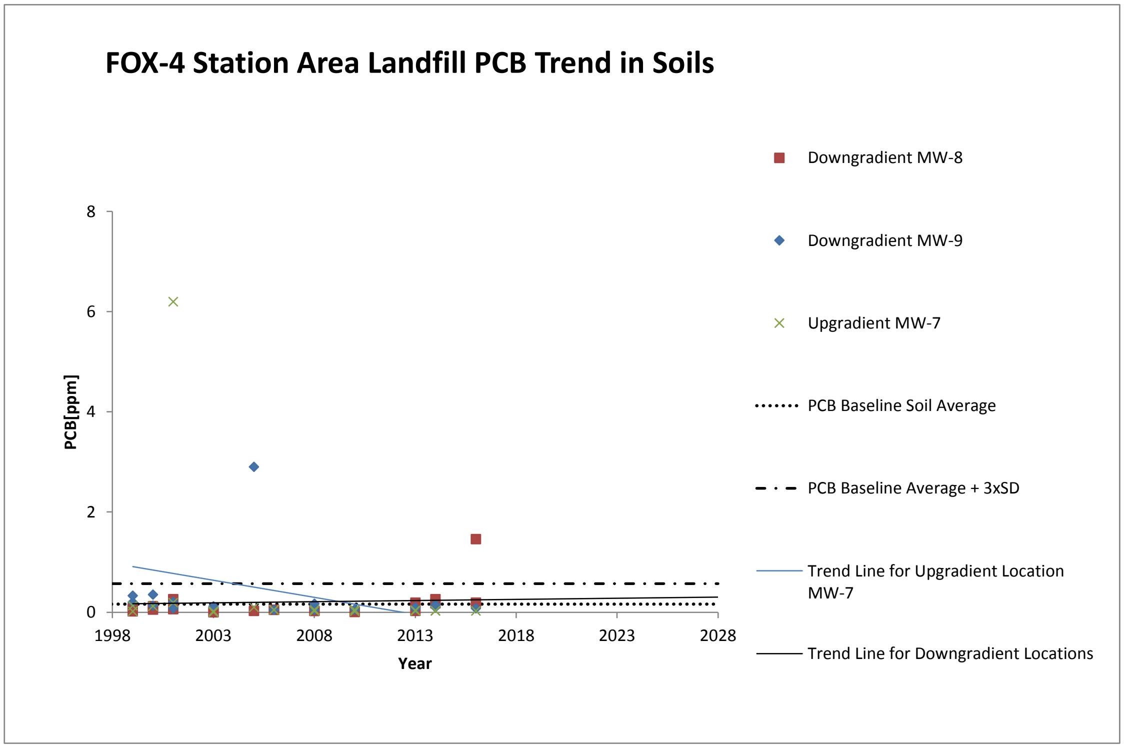




FOX-4 Station Area Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)

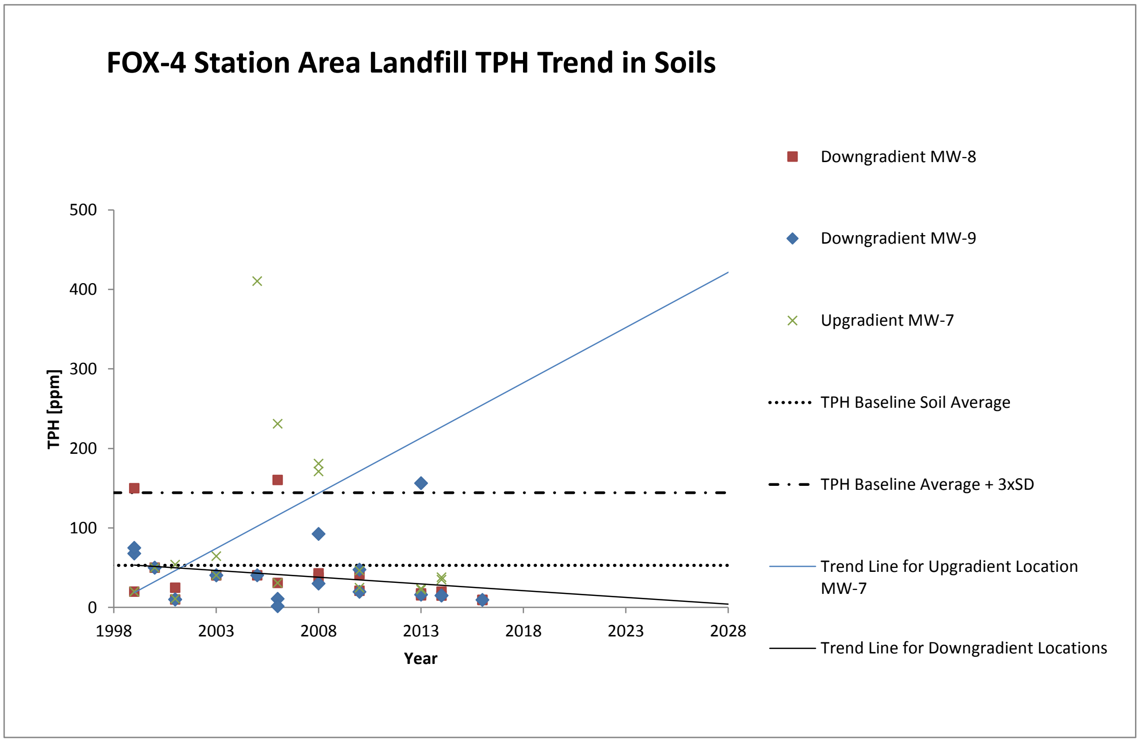
Where results are below detection, half of the detection limit has been used in the charts.





FOX-4 Station Area Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)

Where results are below detection, half of the detection limit has been used in the charts.



FOX-4 Cape Hooper - Station Landfill - Summary of Groundwater Analytical Data**

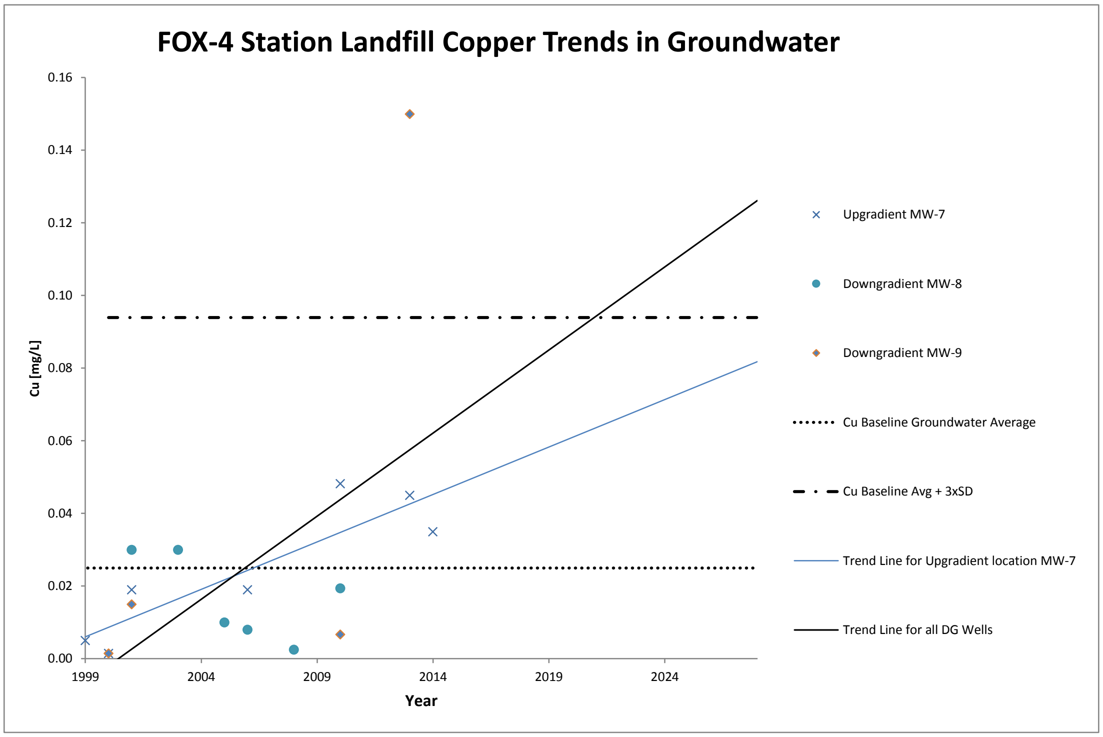
Sample #	Location	Year	Monitoring Year	Monitoring Phase	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Hg	Total PCB	F1 C_6-C_{10}	F2 C_{10}-C_{16}	F3 C_{16}-C_{34}	Modified TPH^ - Total C6-C34	TPH Identity	
					[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	% Fuel Oil	% Lube Oil
Baseline Data																				
Upgradient:																				
WF4-MW-7-98	BMW 07	1998			0.020	0.19	0.0078	0.0021	0.027	0.10	0.31	0.0020		0.000021				2.0		
WF4-MW7-98	BMW 07	1999			0.0050	0.25	0.0090	0.0020	<0.010	0.32	0.015	<0.050	<0.0010	<0.000020				<5.0		
Downgradient:																				
WF4-MW9-98	MW-9	1998			0.050	1.5	0.049	0.00066	0.015	0.12	1.4	0.014		0.000038						
		N value			3	3	3	3	3	3	3	3	1	3				2		
		Average			**0.025**	**0.65**	**0.022**	**0.0016**	**0.016**	**0.2**	**0.56**	**0.050**	**0.001**	**0.00002**				**5.0**		
	Standard Deviation				0.023	0.75	0.024	0.001	0.0110	0.1	0.71	0.012		0.000				0		
	Average + 3xStandard Deviation				0.09	2.9	0.093	0.004	0.049	0.5	2.7	0.08		0.000				6.1		
	Detection Limit				0.0050	0.010	0.0050	0.0010	0.010	0.0050	0.0050	0.050	0.0010	0.0030				1.0		
Monitoring Data																				
Upgradient - MW-7															**Total TPH will appear when F1, F2, F3 fractions are entered**					
99-3815	BMW 07	1999	1	Phase I	0.005	0.25	0.009	**0.002**	<0.01	**0.32**	0.015	<0.005	<0.001	<0.00002				< 5		
PO-7-1	BMW 07	2000	2	Phase I	<0.003	0.05	0.006	0.0008	0.005	0.15	0.02	<0.002	<0.001	<0.000025				<0.1		
PO-7-1	BMW 07	2001	3	Phase I	0.019	0.11	0.007	0.001	0.010	**0.99**	0.041	0.01	<0.0001	<0.00005				<0.1		
n/s	BMW 07	2003	5	Phase I																
MW-7	BMW 07	2006	8	Phase II	0.019	0.100	**0.022**	0.001	**0.02**	**1.1**	0.014	0.002	<0.0002	<0.0001				<0.1		
	BMW 07	2008	10	Phase II																
10-18408	BMW 07	2010	12	Phase II	**0.048**	0.27	**0.023**	<0.0010	<0.010	**0.45**	0.36	<0.0030	<0.0040	<0.000020				<1.0		
13-27353	BMW 07	2013	15	Phase II	**0.045**	0.44	**0.037**	0.0011	<0.0010	0.15	**0.60**	<0.0010	<0.0040	<0.0030	<0.05	<0.5	<1.0	0.775		
F4-STA-MW98-07	BMW 07	2014	16	Phase II	**0.04**	0.19	0.02	0.0005	0.0037	0.10	0.22	0.0015	<0.00001	<0.00005	<0.025	<0.100	<0.100	0.113		
Not sampled - dry	BMW 07	2016	18	Phase II														#N/A		
		2018	20	Phase II														#N/A		
		2023	25	Phase II														#N/A		
		2028	30	Phase II														#N/A		
				Phase III														#N/A		
																		#N/A		
																		#N/A		
Downgradient - MW-8																				
PO-8-1	MW-8	2001	3	Phase I	**0.03**	**0.74**	**0.036**	**0.004**	0.01	**5.4**	0.082	0.01	<0.0001	<0.00005				0.24		
PO-8	MW-8	2003	5	Phase I	**0.03**	0.47	**0.03**	**0.010**	**0.03**	**10**	0.14	**0.2**	0.0002	<0.0030				0.95		
MW-8	MW-8	2005	7	Phase II	0.01	0.06	0.02	0.001	0.008	**2.4**	0.062	0.006	<0.0002					<0.05		
MW-8	MW-8	2006	8	Phase II	0.008	0.030	0.009	0.001	0.010	**2.5**	0.015	0.003	<0.0002	<0.0001				<0.1		
MW-8	MW-8	2008	10	Phase II	<0.005		<0.005	<0.0010	<0.0010	**1.8**	<0.050	<0.010	<0.00010	<0.000050				0.22		
10-18407	MW-8	2010	12	Phase II	0.019	0.19	0.012	<0.0010	<0.010	**2.4**	0.24	<0.0030	<0.0040	<0.000020				<1.0		
not sampled		2013	15	Phase II														#N/A		
No sample collected - well was dry		2014	16	Phase II														#N/A		
Not sampled - dry	MW-8	2016	18	Phase II														#N/A		
		2018	20	Phase II														#N/A		
		2023	25	Phase II														#N/A		
		2028	30	Phase II														#N/A		
				Phase III														#N/A		
																		#N/A		
																		#N/A		
Downgradient - MW-9																				
PO-8-1	MW 09	2000	2	Phase I	<0.003	0.09	0.015	0.0009	0.0070	**0.23**	0.0080	0.0080	<0.001	<0.00003				<0.1		
PO-9-1	MW 09	2001	3	Phase I	0.015	0.08	0.02	**0.0020**	0.0040	**0.7**	0.011	0.02	<0.0001	<0.00005				<0.1		
n/s	MW 09	2003	5	Phase I																
MW-9	MW 09	2006	8	Phase II																
	MW 09	2008	10	Phase II																
10-18406	MW 09	2010	12	Phase II	0.0067	0.12	0.0091	0.0013	<0.010	**1.5**	0.20	<0.0030	<0.0040	<0.000020				<1.0		
13-27354	MW 09	2013	15	Phase II	**0.15**	0.27	**0.047**	**0.0031**	<0.0010	**1.2**	0.470	0.0018	<0.0040	<0.0030	<0.05	<0.5	<1.0	0.775		
No sample collected - well was dry		2014	16	Phase II														#N/A		
Not sampled - frozen	MW 09	2016	18	Phase II														#N/A		
		2018	20	Phase II														#N/A		
		2023	25	Phase II														#N/A		
		2028	30	Phase II														#N/A		
				Phase III														#N/A		
																		#N/A		
																		#N/A		

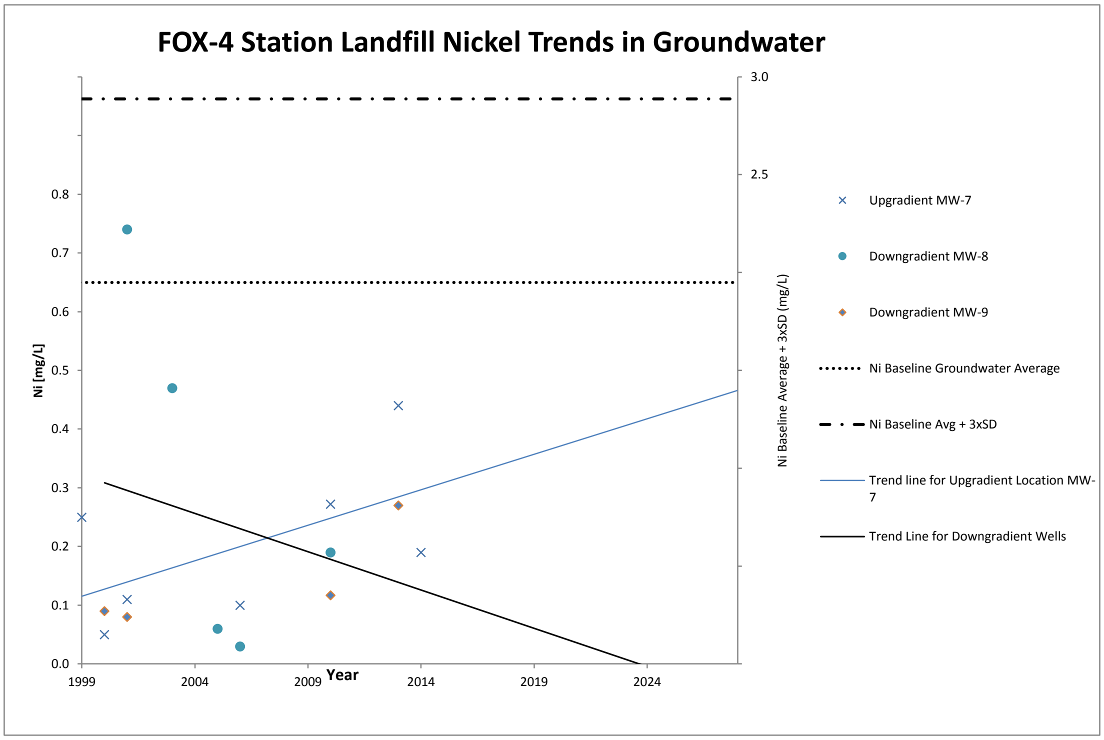
Note: Total Hydrocarbons (C_6-C_{34}) has been calculated by adding results for F1, F2 and F3.

** Additional regrading of the Station Landfill occurred in 2013.

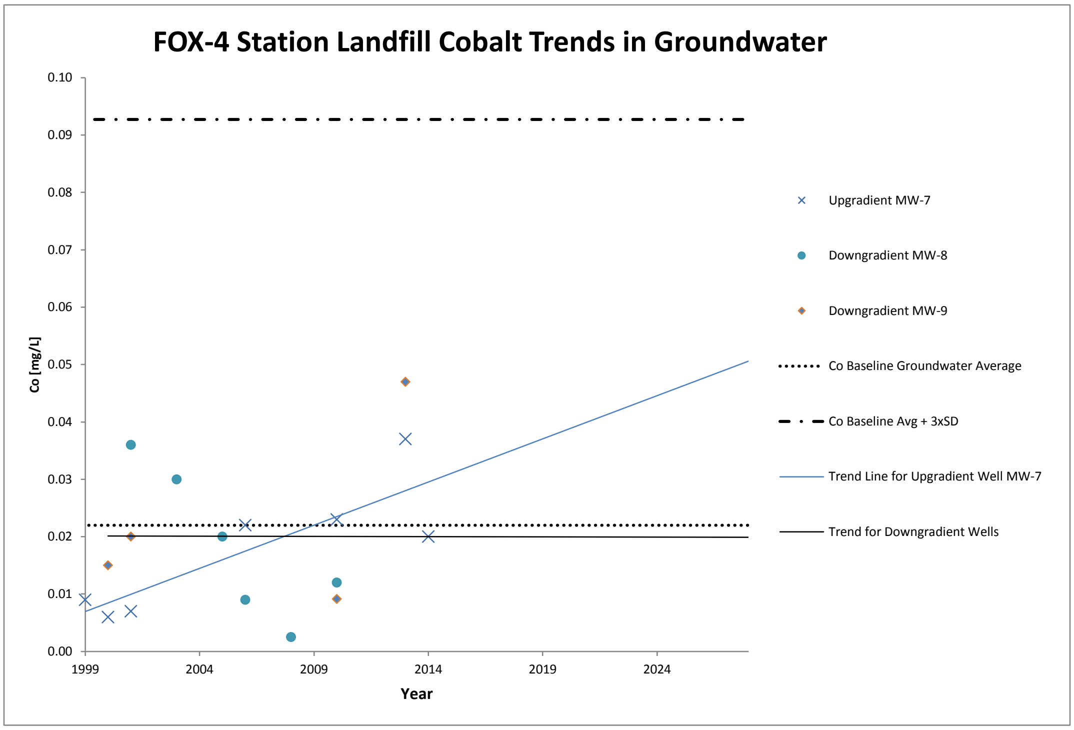
FOX-4 Station Landfill Graphs of Trends for Inorganic Elements, PCBs and TPH in Groundwater Samples

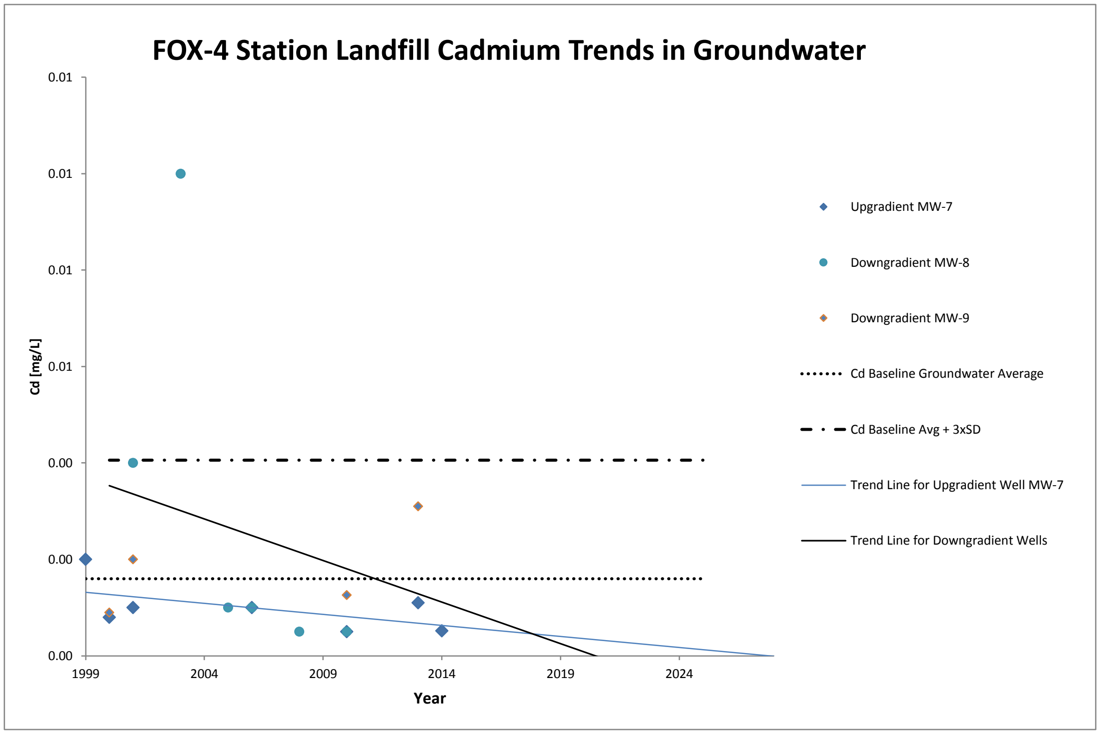
Where results are below detection, half of the detection limit has been used in the charts.



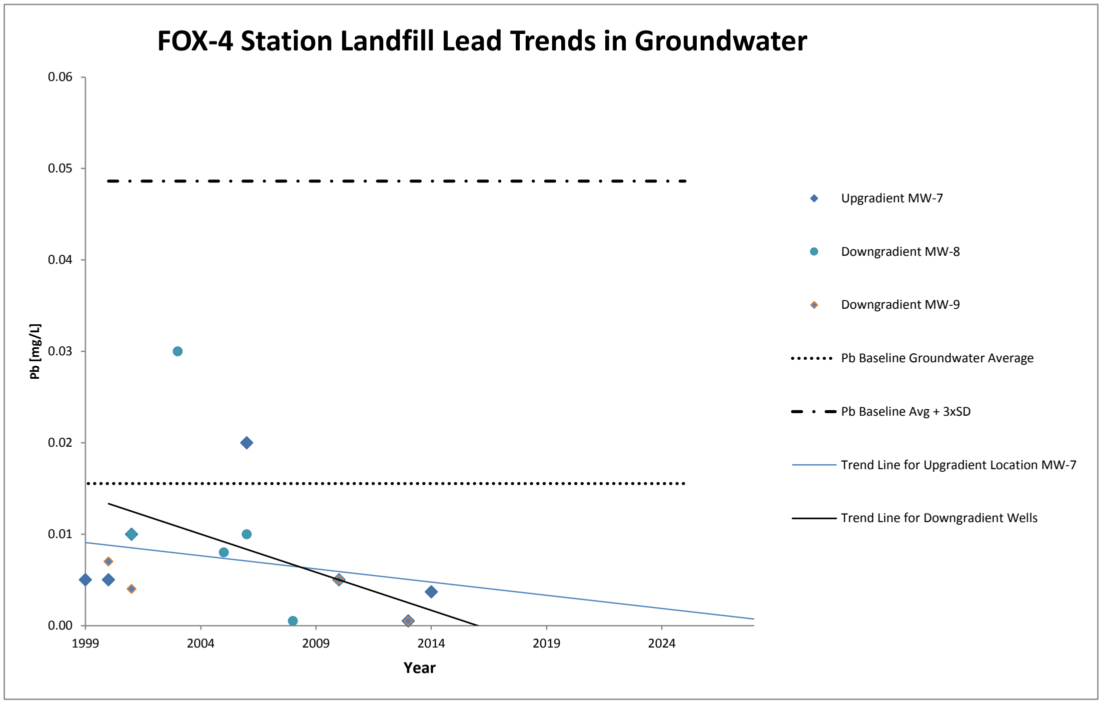


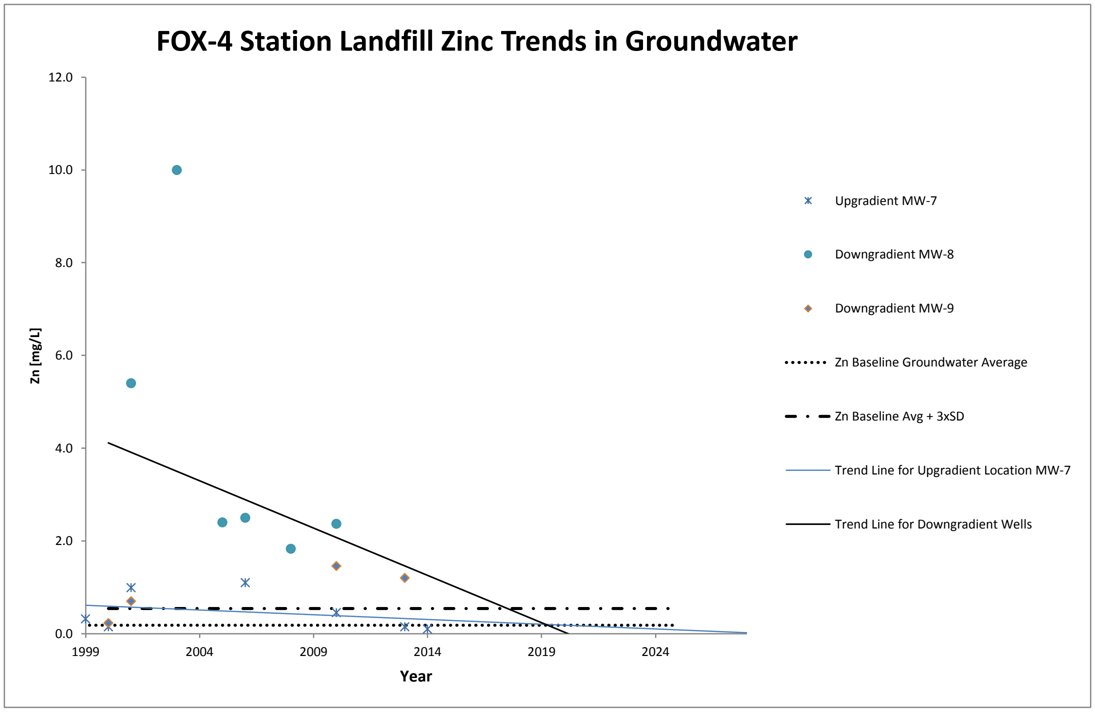
FOX-4 Station Landfill Graphs of Trends for Inorganic Elements, PCBs and TPH in Groundwater Samples



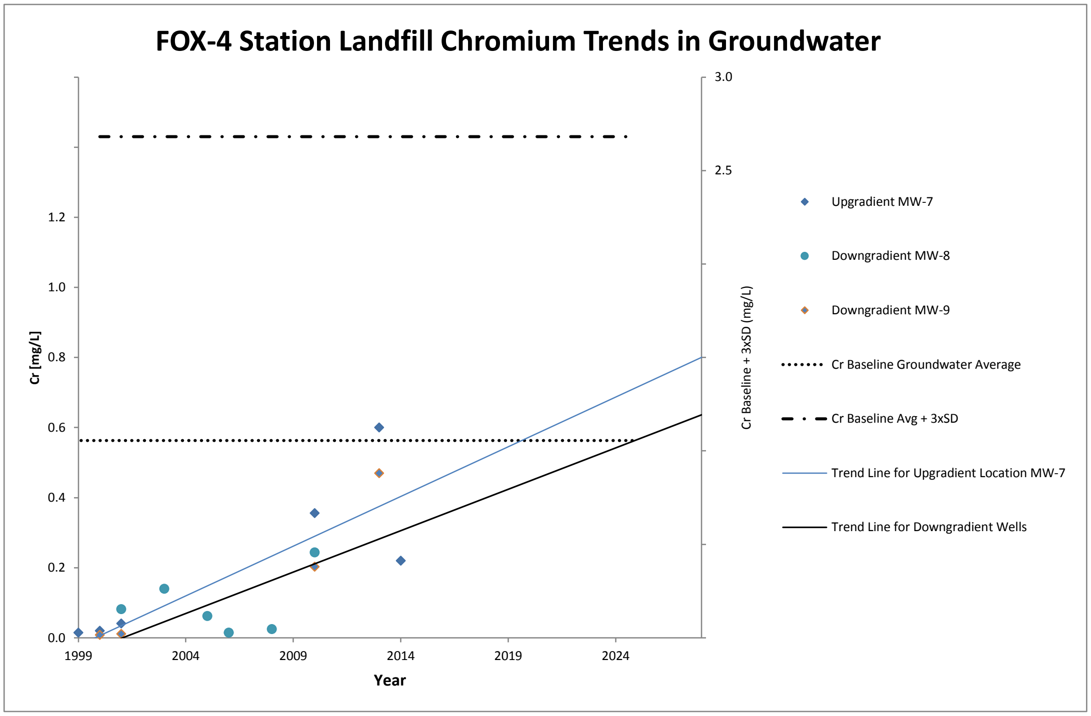


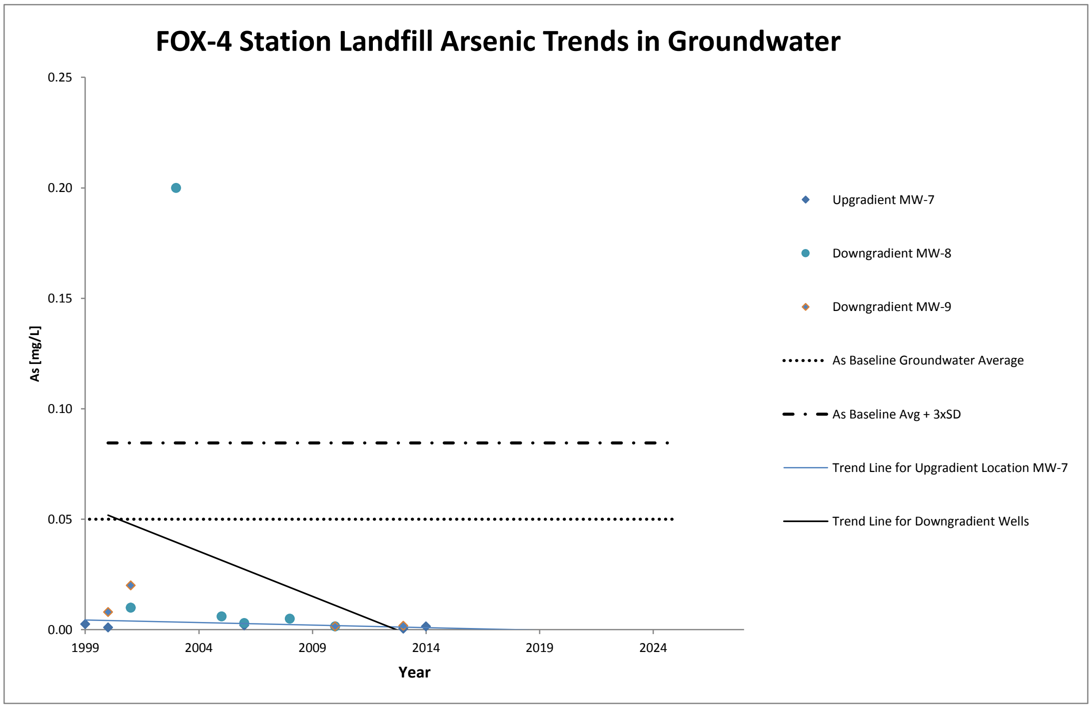
FOX-4 Station Landfill Graphs of Trends for Inorganic Elements, PCBs and TPH in Groundwater Samples



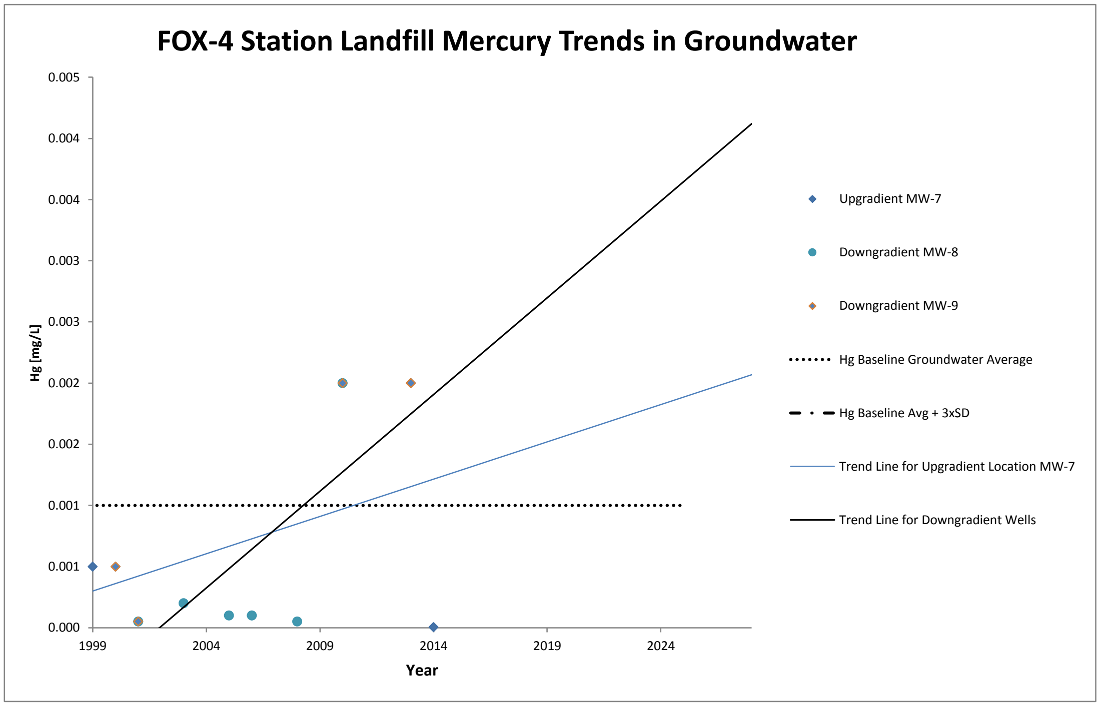


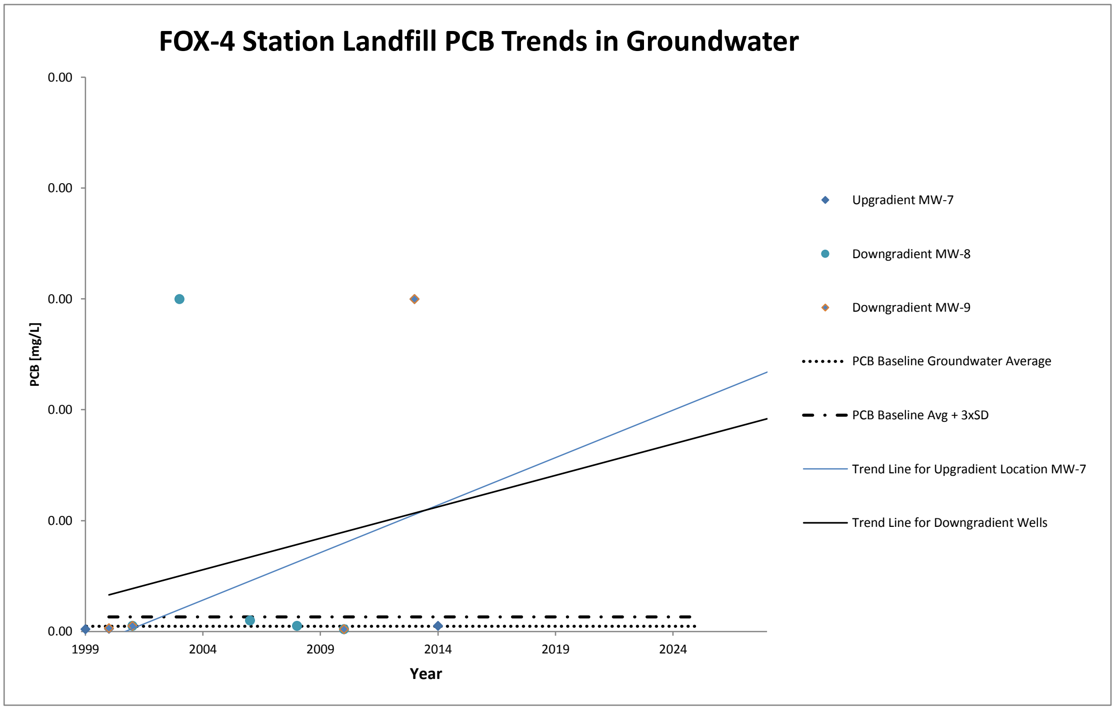
FOX-4 Station Landfill Graphs of Trends for Inorganic Elements, PCBs and TPH in Groundwater Samples



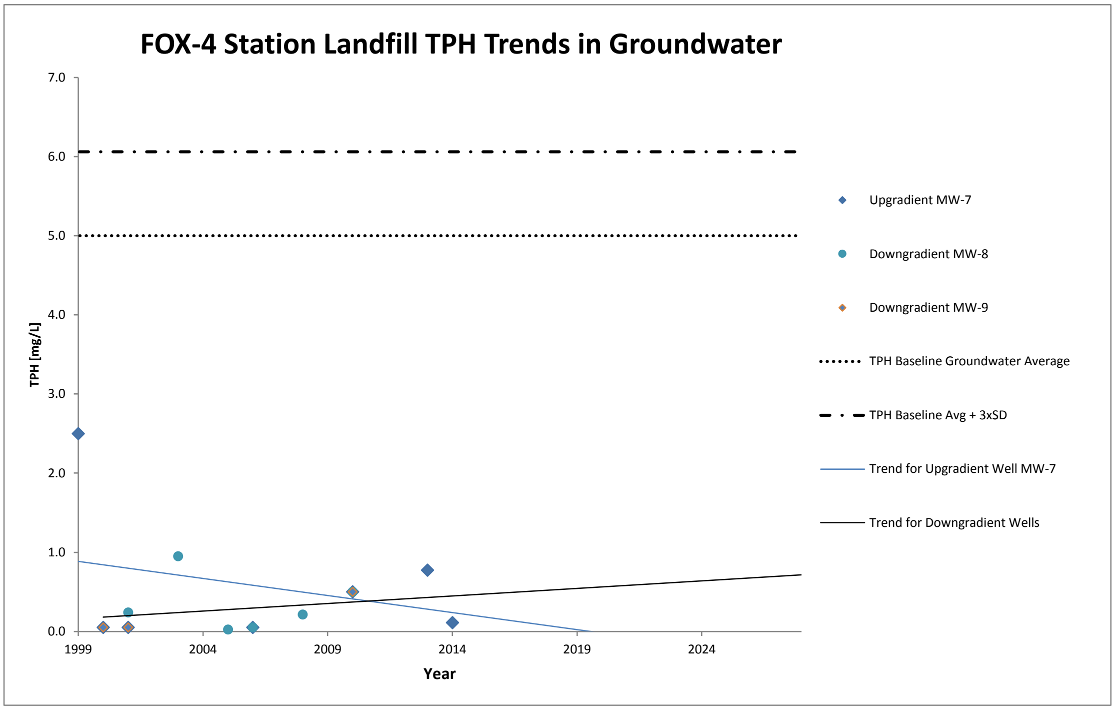


FOX-4 Station Landfill Graphs of Trends for Inorganic Elements, PCBs and TPH in Groundwater Samples





FOX-4 Station Landfill Graphs of Trends for Inorganic Elements, PCBs and TPH in Groundwater Samples



New Tier II and NHWL Facility Monitoring. Summary of 2013 and Ongoing Soil Analytical Data**

FOX-4 Cape Hooper - NHWL & Tier II Disposal Facilities - Summary of 2013-2028 Soil Analytical Data

Sample ID	Location	Year	Monitoring Year	Monitoring Phase	Depth (cm)	Cu [mg/kg]	Ni [mg/kg]	Co [mg/kg]	Cd [mg/kg]	Pb [mg/kg]	Zn [mg/kg]	Cr [mg/kg]	As [mg/kg]	Hg [mg/kg]	Total PCB [mg/kg]	F1 C_6-C_{10} [mg/kg]	F2 C_{10}-C_{16} [mg/kg]	F3 C_{16}-C_{34} [mg/kg]	Modified TPH^ - Total C6-C34 [mg/kg]	TPH Identity	
																				% Fuel Oil	% Lube Oil
Background Average						30	24	9	1.0	10	41	41	29								
Baseline Data - Average						**13**	**10**	**5.0**	**1.0**	**5.6**	**22**	**21**	**12**	**0.100**	**0.050**				**41**		
Baseline Data - Standard Deviation						24	8	2.1	0.23	11	15	15	19	0.014	0.0188				70		
Baseline Average + 3xStandard Deviation						83	34	11	1.7	38	67	67	69	0.14	0.11				251		
Detection Limit						<3.0	<5.0	<5.0	<1.0	<10	<15	<20	<0.2	<0.1	<0.05				<40		
DEW Line Cleanup Tier I Criteria										*200*					*1*						
DEW Line Cleanup Tier II Criteria & DLCU Hydrocarbon Action Level & site specific As criteria						*100*	*100*	*50*	*5*	*500*	*500*	*250*	*130*	*2.0*	*5*				*2500*		
Monitoring Data																					
Upgradient																					
	BMW 11-01 surface																				
F4-NH-MW11-01-S	BMW 11-01	2014	16	Phase II	0-15	**52**	**40**	**11**	<0.10	**9.9**	**86**	**73**	**48**	<0.050	<0.010	<10	<10	<10	15		
MW11-1b (Dup Avg)	BMW 11-01	2016	18	Phase II	0-15	**81**	**63**	**14.4**	**3.0**	**11**	**96.9**	**83**	**53**	<0.1	<0.05	<6	<7	<29	21		
	BMW 11-01	2018	20	Phase II															#N/A		
	BMW 11-01	2023	25	Phase II															#N/A		
	BMW 11-01	2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
	BMW 11-01 depth																				
F4-NH-MW11-01-D	BMW 11-01	2014	16	Phase II	40-50	**98**	**73**	**17**	<0.10	**13**	**110**	**83**	*170*	<0.050	<0.010	<10	<10	<10	15		
MW11-1a	BMW 11-01	2016	18	Phase II	30-40	**91.7**	**69.3**	**16.2**	*6.1*	**13.4**	**102**	**88.7**	**69.2**	<0.1	<0.05	<7	<4	<8	10		
	BMW 11-01	2018	20	Phase II															#N/A		
	BMW 11-01	2023	25	Phase II															#N/A		
	BMW 11-01	2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
Downgradient																					
	MW 11-02 surface																				
F4-NH-MW11-02-S	MW 11-02	2014	16	Phase II	0-15	**49**	**41**	**14**	<0.10	**11**	**70**	**80**	**31**	<0.050	<0.010	<10	<10	<10	15		
MW11-02a	MW 11-02	2016	18	Phase II	0-15	**31.5**	**26.3**	**9.6**	**3.8**	**7.9**	**47.3**	**63.9**	**20.8**	<0.1	<0.05	<7	<4	<8	10		
	MW 11-02	2018	20	Phase II															#N/A		
	MW 11-02	2023	25	Phase II															#N/A		
	MW 11-02	2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
	MW 11-02 depth																				
F4-NH-MW11-02-D	MW 11-02	2014	16	Phase II	40-50	**52**	**42**	**14**	<0.10	**12**	**74**	**82**	**34**	<0.050	0.012	<10	<10	21	31		
Not sampled - refusal	MW 11-02	2016	18	Phase II															#N/A		
	MW 11-02	2018	20	Phase II															#N/A		
	MW 11-02	2023	25	Phase II															#N/A		
	MW 11-02	2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
	MW 11-03 surface																				
F4-NH-MW11-03-S	MW 11-03	2014	16	Phase II	0-15	**22**	**14**	4.8	**2.3**	**10**	**50**	**39**	12	<0.050	**0.083**	<10	<10	39	**49**		
MW11-3b	MW 11-03	2016	18	Phase II	0-15	**21.3**	**11**	3.4	**2.7**	*288*	**49.8**	**32.5**	**16.8**	<0.1	<0.05	<7	<4	79	**85**		
	MW 11-03	2018	20	Phase II															#N/A		
	MW 11-03	2023	25	Phase II															#N/A		
	MW 11-03	2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
	MW 11-03 depth																				
F4-NH-MW11-03-D	MW 11-03	2014	16	Phase II	40-50	**18**	**12**	4.3	0.9	**8.8**	**37**	**36**	**21**	<0.050	0.048	<10	<10	13	23		
MW11-3a	MW 11-03	2016	18	Phase II	30-40	**28.5**	**14**	4.1	*9.4*	**77.5**	**74.2**	**40.5**	**26**	<0.1	<0.05	<7	<4	71	**77**		
	MW 11-03	2018	20	Phase II															#N/A		
	MW 11-03	2023	25	Phase II															#N/A		
	MW 11-03	2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		

FOX-4 Cape Hooper - NHWL & Tier II Disposal Facilities - Summary of 2013-2028 Soil Analytical Data

Sample ID	Location	Year	Monitoring Year	Monitoring Phase	Depth (cm)	Cu [mg/kg]	Ni [mg/kg]	Co [mg/kg]	Cd [mg/kg]	Pb [mg/kg]	Zn [mg/kg]	Cr [mg/kg]	As [mg/kg]	Hg [mg/kg]	Total PCB [mg/kg]	F1 C_6-C_{10} [mg/kg]	F2 C_{10}-C_{16} [mg/kg]	F3 C_{16}-C_{34} [mg/kg]	Modified TPH^ - Total C6-C34 [mg/kg]	TPH Identity	
																				% Fuel Oil	% Lube Oil
	MW 11-04 surface																				
F4-NH-MW11-04-S	MW 11-04	2014	16	Phase II	0-15	7.4	7.1	2.1	<0.10	2.5	16	21	7.4	<0.050	<0.010	<10	<10	82	**92**		
MW11-4a	MW 11-04	2016	18	Phase II	0-15	11.1	**10**	3.3	**1.9**	5	**23.1**	**34.1**	9.4	<0.1	<0.05	<7	<4	38	**44**		
	MW 11-04	2018	20	Phase II															#N/A		
	MW 11-04	2023	25	Phase II															#N/A		
	MW 11-04	2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
	MW 11-04 depth																				
F4-NH-MW11-04-D	MW 11-04	2014	16	Phase II	40-50	**13**	**14**	3.7	<0.10	3.1	**27**	**31**	11	<0.050	<0.010	<10	<10	<10	15		
Not sampled - refusal	MW 11-04	2016	18	Phase II															#N/A		
	MW 11-04	2018	20	Phase II															#N/A		
	MW 11-04	2023	25	Phase II															#N/A		
	MW 11-04	2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
	MW 11-05 surface																				
F4-NH-MW11-05-S	MW 11-05	2014	16	Phase II	0-15	11	9	2.7	<0.10	2.5	18	**24**	10	<0.050	<0.010	<10	<10	43	**53**		
MW11-5b	MW 11-05	2016	18	Phase II	0-15	11.6	**11.4**	3.6	**1.7**	4.5	19.2	**23.5**	**83.7**	<0.1	<0.05	<7	<4	<8	10		
	MW 11-05	2018	20	Phase II															#N/A		
	MW 11-05	2023	25	Phase II															#N/A		
	MW 11-05	2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
	MW 11-05 depth																				
F4-NH-MW11-05-D	MW 11-05	2014	16	Phase II	40-50	**14**	**11**	3.4	<0.10	3.1	**22**	**28**	12	<0.050	<0.010	<10	<10	17	27		
MW11-5a	MW 11-05	2016	18	Phase II	40-50	8.6	8.9	3	**1.6**	4.1	17.8	**22.5**	**13.1**	<0.1	<0.05	<7	<4	<8	10		
	MW 11-05	2018	20	Phase II															#N/A		
	MW 11-05	2023	25	Phase II															#N/A		
	MW 11-06	2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
	MW 11-06 surface																				
F4-NH-MW11-06-S	MW 11-06	2014	16	Phase II	0-15	**13**	**11**	3.5	<0.10	3.9	21	**24**	**22**	<0.050	<0.010	<10	<10	17	27		
MW11-6b	MW 11-06	2016	18	Phase II	0-15	8.9	8.7	2.8	**1.2**	4.3	15.3	19	10.4	<0.1	<0.05	<7	<4	<8	10		
	MW 11-06	2018	20	Phase II															#N/A		
	MW 11-06	2023	25	Phase II															#N/A		
	MW 11-06	2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
	MW 11-06 depth																				
F4-NH-MW11-06-D	MW 11-06	2014	16	Phase II	40-50	**14**	**14**	3.8	<0.10	5.4	**26**	**29**	**45**	<0.050	<0.010	<10	<10	22	32		
MW11-6a	MW 11-06	2016	18	Phase II	30-40	12	**10.3**	3.3	**1.8**	4.5	19.9	**24.4**	**19.9**	<0.1	<0.05	<7	<4	<8	10		
	MW 11-06	2018	20	Phase II															#N/A		
	MW 11-06	2023	25	Phase II															#N/A		
	MW 11-06	2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
	MW 12-07 surface																				
F4-NH-MW11-07-S	MW 12-07	2014	16	Phase II	0-15	**36**	**36**	**9.9**	0.13	**13**	**74**	**41**	**30**	<0.050	<0.010	<10	<10	56	**66**		
MW12-7b	MW 12-07	2016	18	Phase II	0-15	**16**	**17.7**	4.5	**1.8**	4	**31.1**	**23.4**	10.9	<0.1	<0.05	<7	<4	<8	10		
	MW 12-07	2018	20	Phase II															#N/A		
	MW 12-07	2023	25	Phase II															#N/A		
	MW 12-07	2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		

FOX-4 Cape Hooper - NHWL & Tier II Disposal Facilities - Summary of 2013-2028 Soil Analytical Data

Sample ID	Location	Year	Monitoring Year	Monitoring Phase	Depth (cm)	Cu [mg/kg]	Ni [mg/kg]	Co [mg/kg]	Cd [mg/kg]	Pb [mg/kg]	Zn [mg/kg]	Cr [mg/kg]	As [mg/kg]	Hg [mg/kg]	Total PCB [mg/kg]	F1 C_6-C_{10} [mg/kg]	F2 C_{10}-C_{16} [mg/kg]	F3 C_{16}-C_{34} [mg/kg]	Modified TPH^ - Total C6-C34 [mg/kg]	TPH Identity	
																				% Fuel Oil	% Lube Oil
	MW 12-07 depth																				
F4-NH-MW11-07-D	MW 12-07	2014	16	Phase II	40-50	**17**	**20**	**5.1**	<0.10	4.5	**31**	**24**	**16**	<0.050	<0.010	<10	<10	<10	15		
MW12-07a	MW 12-07	2016	18	Phase II	30-40	**26.7**	**28**	**7.8**	**3.6**	**7.4**	**50.8**	**48.4**	**25.3**	<0.1	<0.05	<7	<4	<8	10		
	MW 12-07	2018	20	Phase II															#N/A		
	MW 12-07	2023	25	Phase II															#N/A		
	MW 12-07	2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
	MW 12-08 surface																				
F4-NH-MW11-08-S	MW 12-08	2014	16	Phase II	0-15	**20**	**14**	**5.65**	<0.5	**10**	**39**	**42**	**37**	<0.10	<0.05	<10	41	21	**67**		
MW12-8b	MW 12-08	2016	18	Phase II	0-15	12.1	**11.6**	3.8	**2.1**	**8.6**	**26**	**33.2**	9.6	<0.1	<0.05	<7	389	41	**434**		
	MW 12-08	2018	20	Phase II															#N/A		
	MW 12-08	2023	25	Phase II															#N/A		
	MW 12-08	2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
	MW 12-08 depth																				
F4-NH-MW11-08-D	MW 12-08	2014	16	Phase II	40-50	**30**	**22**	**7.8**	<0.10	**18**	**56**	**64**	**16**	<0.050	<0.010	<10	320	49	**374**		
MW12-8a	MW 12-08	2016	18	Phase II	40-50	**17.9**	**21**	**7.4**	**3.1**	**8**	**43.6**	**56**	7.3	<0.1	<0.05	<7	464	23	**491**		
	MW 12-08	2018	20	Phase II															#N/A		
	MW 12-08	2023	25	Phase II															#N/A		
	MW 12-08	2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		

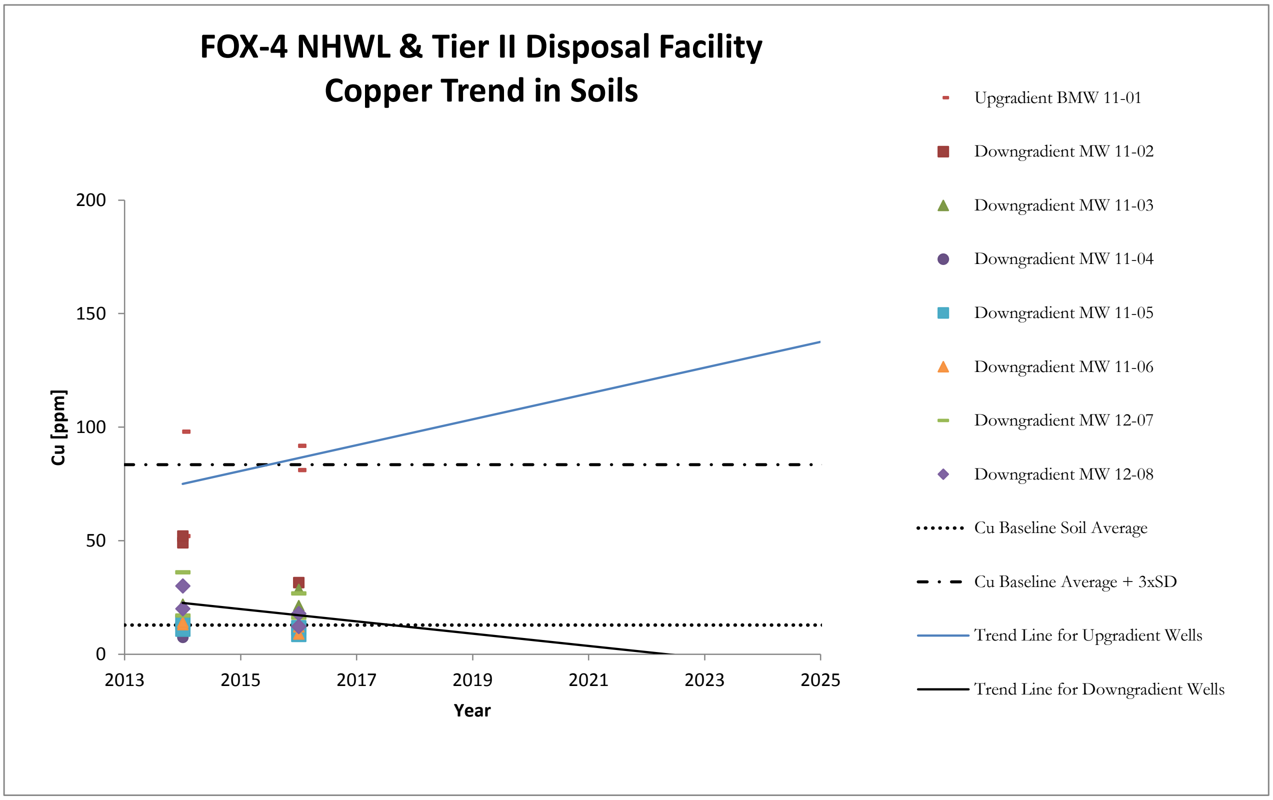
Legend

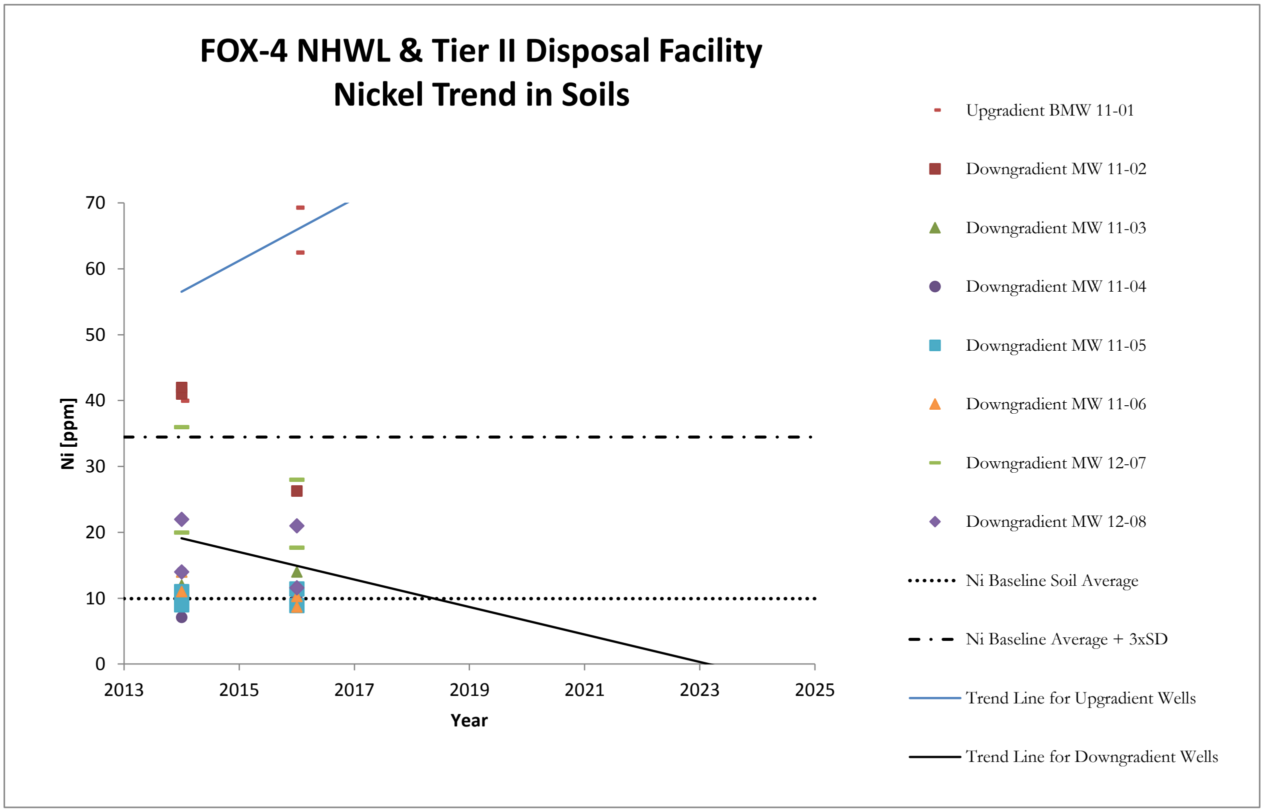
XX	sample exceeds background
XX	**sample exceeds baseline**
XX	*sample exceeds DLCU Tier I criteria*
XX	*sample exceeds DLCU Tier II criteria*

Note: Total Hydrocarbons (C_6-C_{34}) has been calculated by adding results for F1, F2 and F3.
** The New Tier II and NHWL Facility was constucted in 2012 during additional remediation at FOX-4.
The facilities received Tier II and Non-Hazardous material and were both closed in 2013.
Monitoring wells were established around the facilities in 2013.

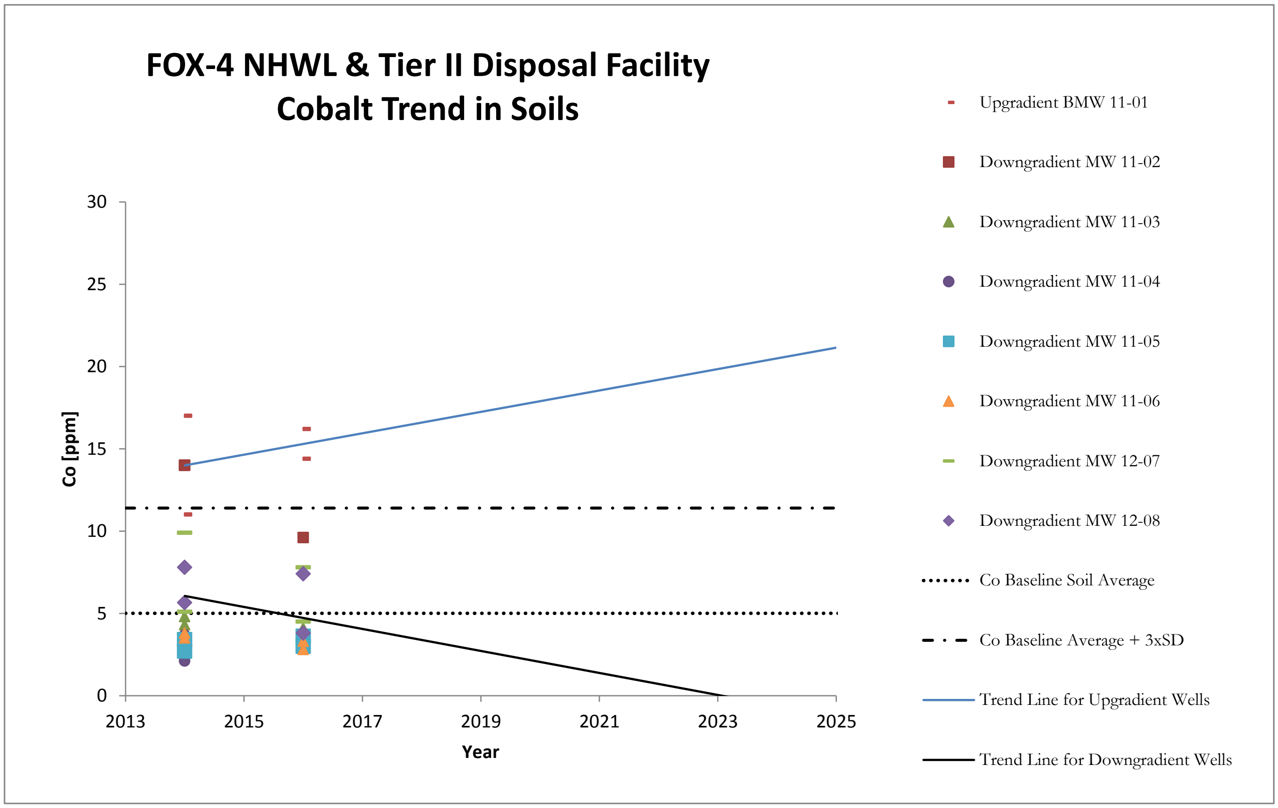
FOX-4 NHWL & Tier II Disposal Facility Trends in Soil Inorganics, PCBs and PHCs (modified TPH)
Where results are below detection, half of the detection limit has been used in the charts.

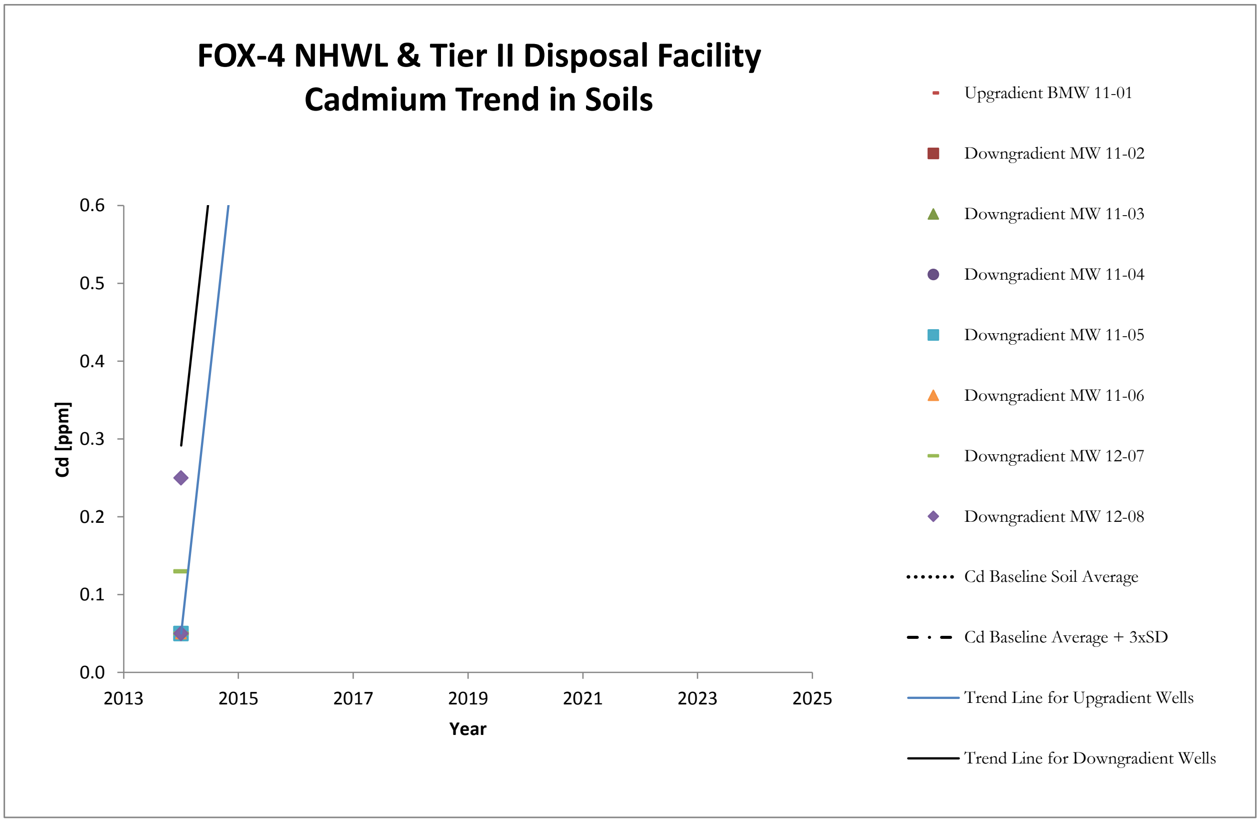
New monitoring locations were established in 2013 around the Tier II and NHWL facilities at FOX-4 and will be monitored as part of the landfill monito
program at FOX-4.



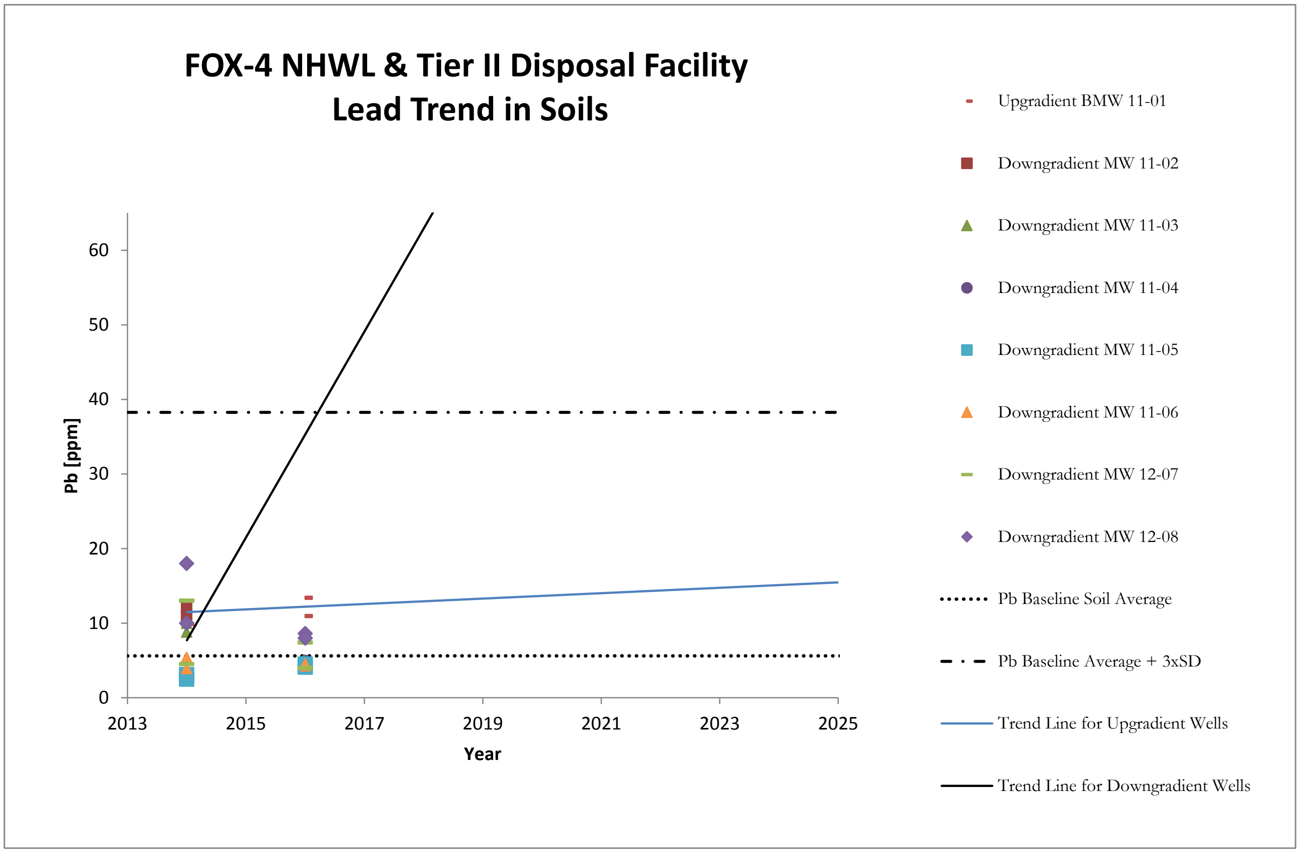


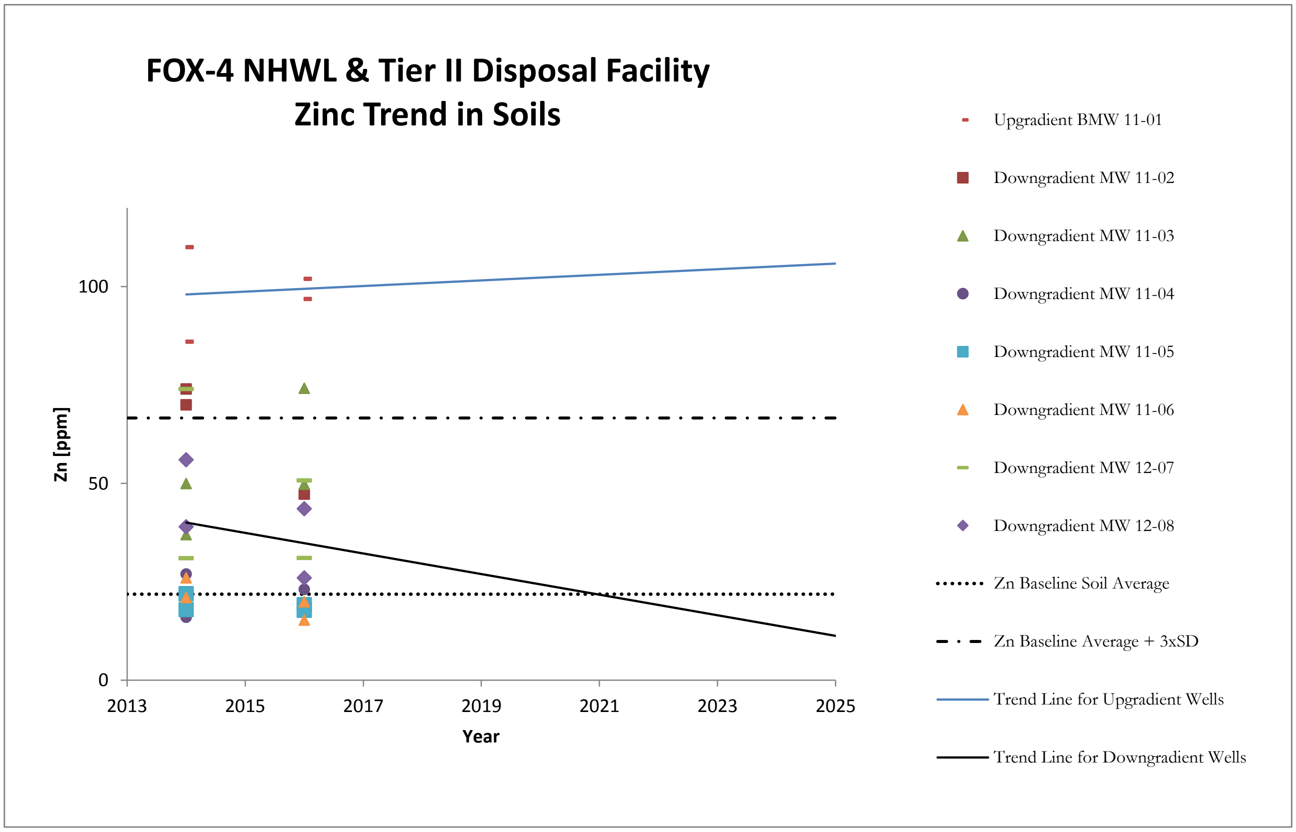
FOX-4 NHWL & Tier II Disposal Facility Trends in Soil Inorganics, PCBs and PHCs (modified TPH)



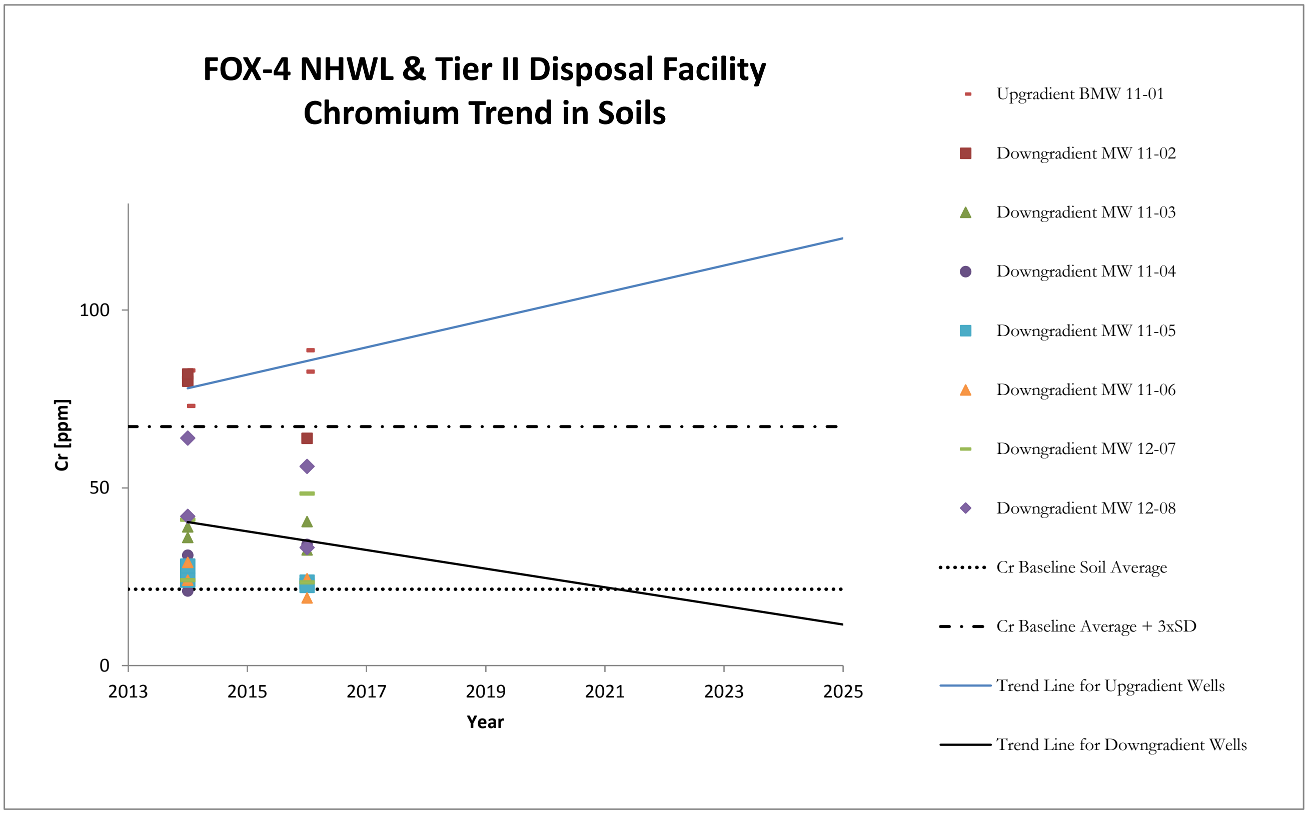


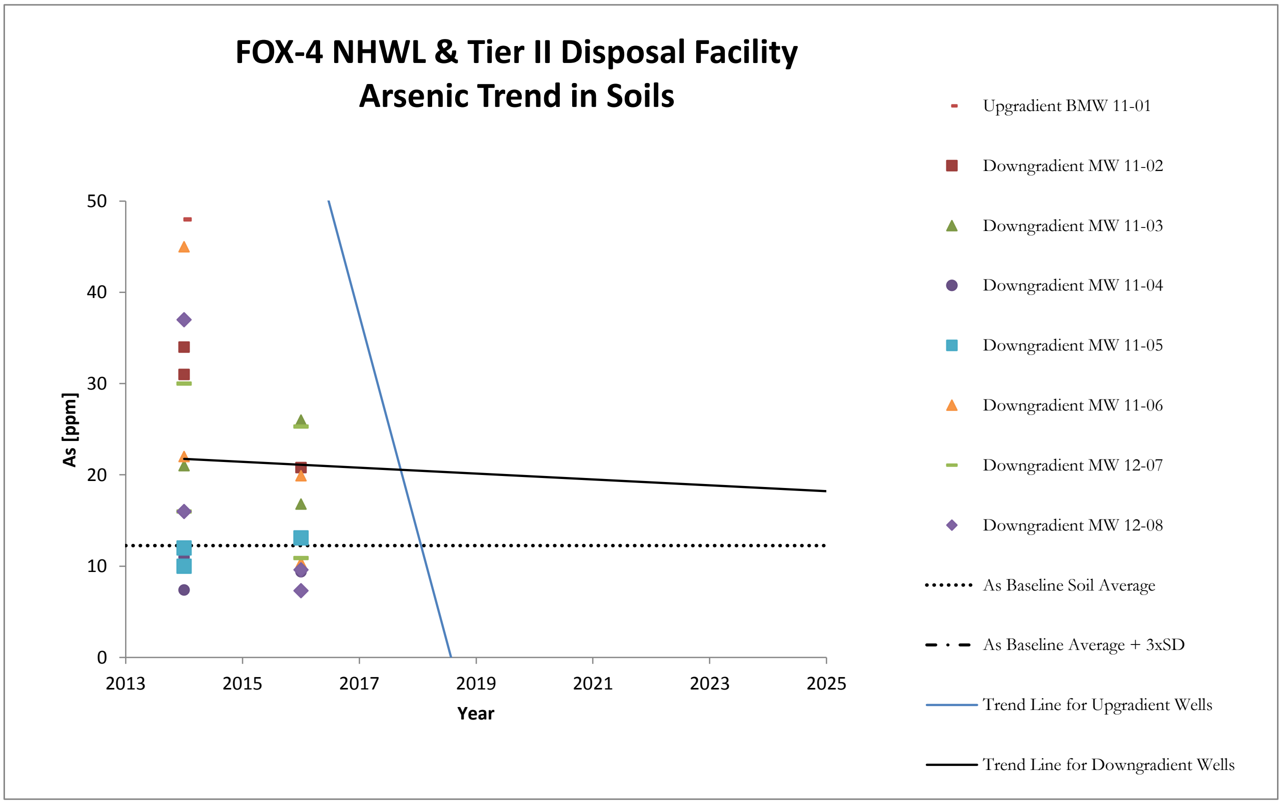
FOX-4 NHWL & Tier II Disposal Facility Trends in Soil Inorganics, PCBs and PHCs (modified TPH)



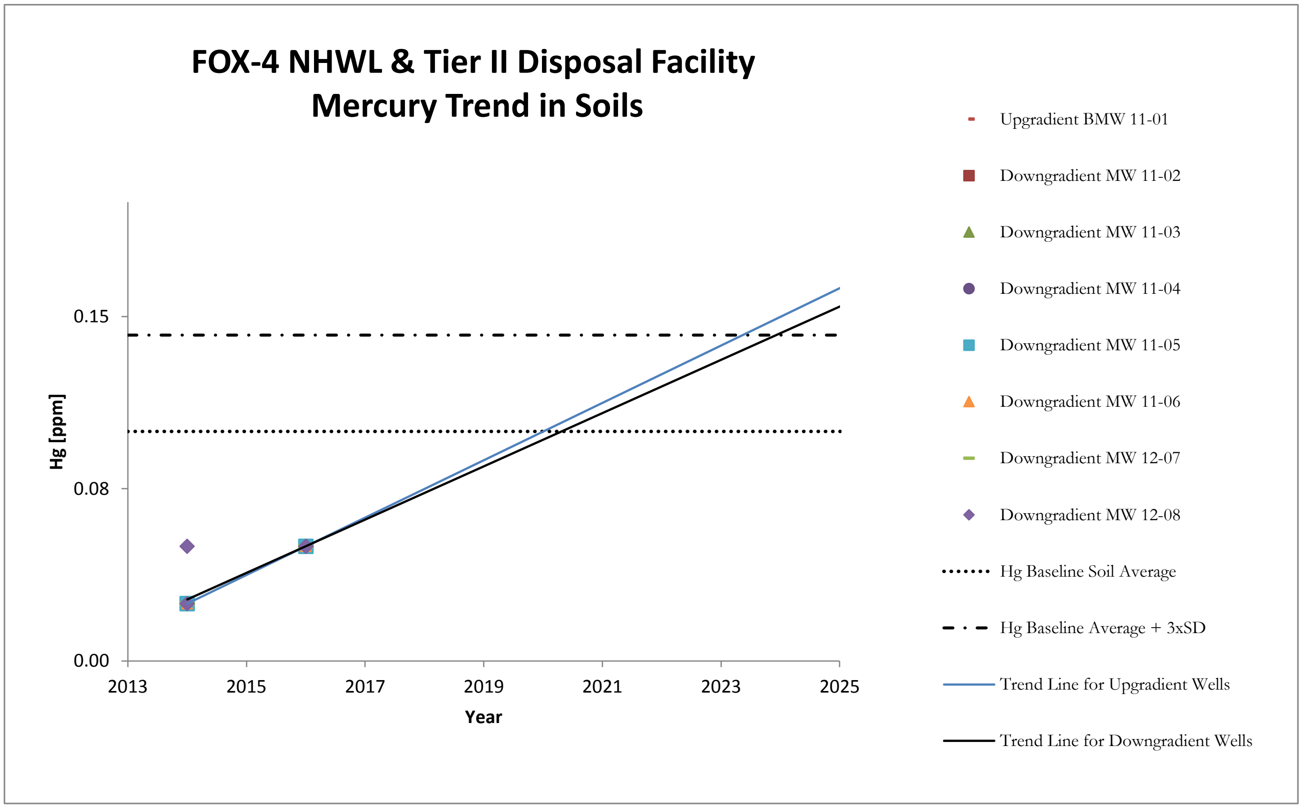


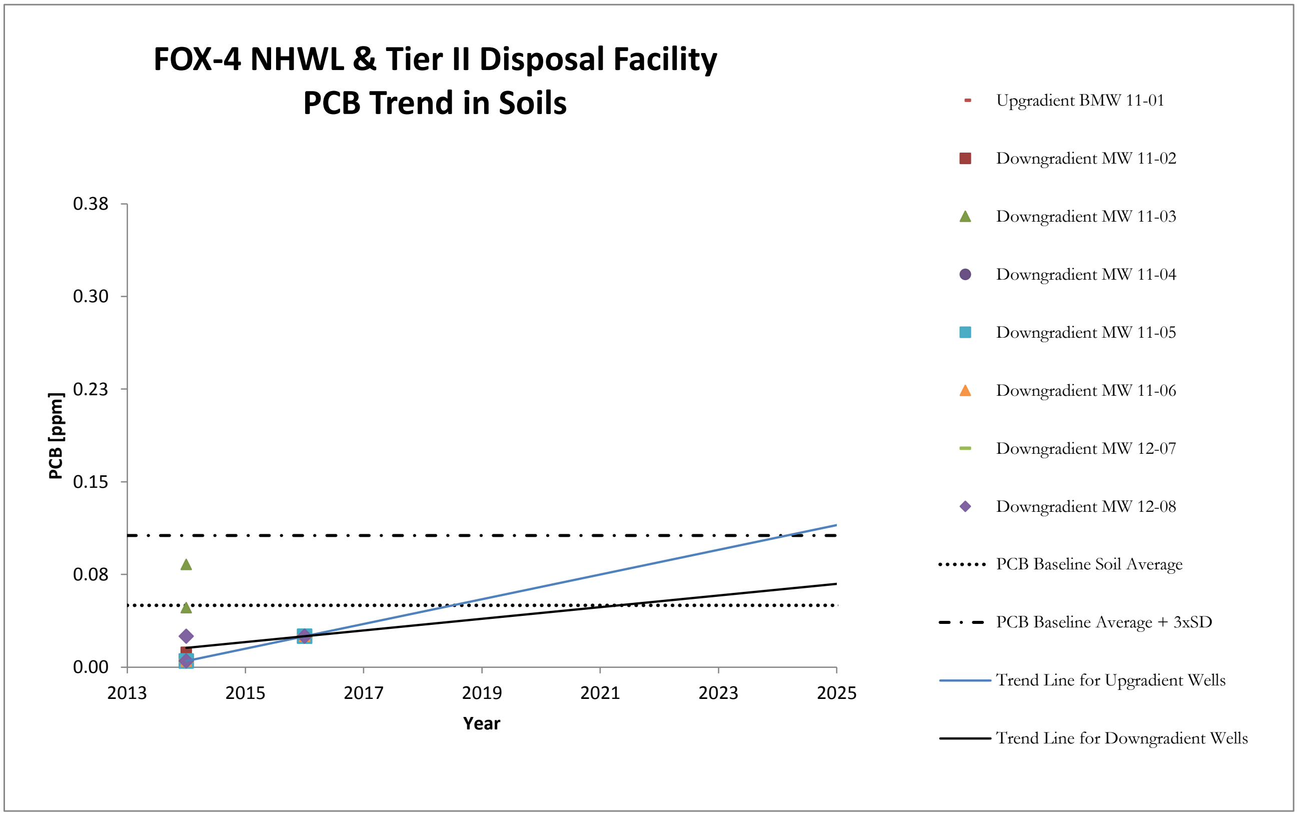
FOX-4 NHWL & Tier II Disposal Facility Trends in Soil Inorganics, PCBs and PHCs (modified TPH)



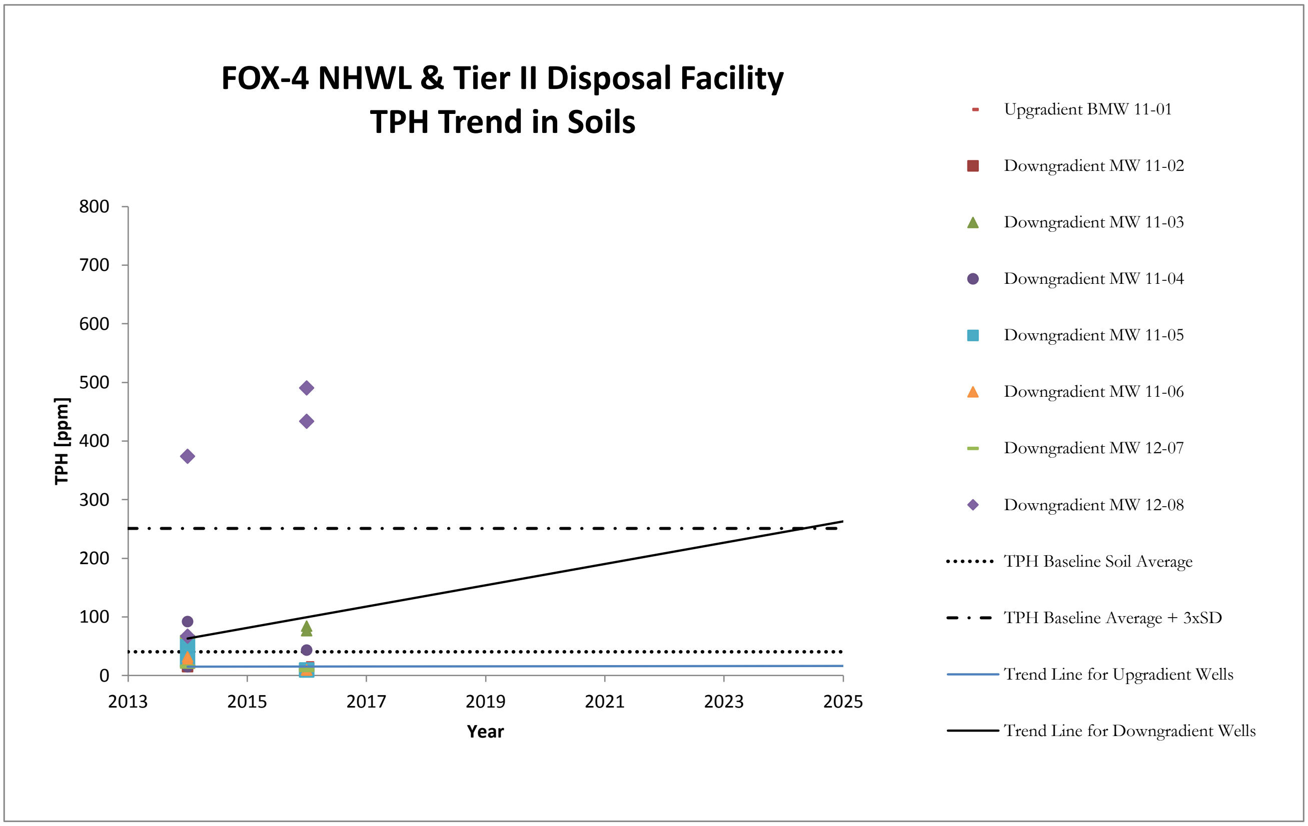


FOX-4 NHWL & Tier II Disposal Facility Trends in Soil Inorganics, PCBs and PHCs (modified TPH)





FOX-4 NHWL & Tier II Disposal Facility Trends in Soil Inorganics, PCBs and PHCs (modified TPH)



New Tier II and NHWL Facility Monitoring. Summary of 2013 and Ongoing Groundwater Analytical Data**

FOX-4 Cape Hooper - NWHL & Tier II Disposal Facility - Summary of 1999-2006 Groundwater Analytical Data

Sample ID	Location	Year	Monitoring Year	Monitoring Phase	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Hg	Total PCB	F1 C_6-C_{10}	F2 C_{10}-C_{16}	F3 C_{16}-C_{34}	Modified TPH^ - Total C6-C34	TPH Identity	
					[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	% Fuel Oil	Oil
	Baseline Average				**0.010**	**0.057**	**0.0087**	**0.0010**	**0.0071**	**0.84**	**0.0306**	**0.0183**	**0.0006**	**0.0001**				**0.65**		
	Standard Deviation				0.018	0.081	0.008	0.001	0.015	1.20	0.076	0.042	0.001	0.0002				0.97		
Baseline Average + 3xStandard Deviation					0.063	0.301	0.034	0.0043	0.05	4.43	0.2589	0.14	0.0026	0.0007				3.55		
	Detection Limit				0.0050	0.0050	0.005	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050				1.0		
Monitoring Data																				
Upgradient BMW 11-01																				
F4-NH-MW11-01	BMW 11-01	2014	16	Phase II	**0.0805**	**0.284**	**0.0335**	0.00059	**0.019**	0.1005	**1.015**	**0.021**	<0.0001	<0.0001	<0.025	<0.100	<0.100	0.11		
MW11-1	BMW 11-01	2016	18	Phase II	0.003	0.01	0.0013	<0.0001	<0.0001	0.01	<0.001	<0.001	<0.0001	<0.00005	<0.025	<0.1	<0.1	0.11		
	BMW 11-01	2018	20	Phase II														#N/A		
	BMW 11-01	2023	25	Phase II														#N/A		
		2028	30	Phase II														#N/A		
				Phase III														#N/A		
																		#N/A		
																		#N/A		
																		#N/A		
																		#N/A		
																		#N/A		
Downgradient - MW 11-02																				
F4-NH-MW11-02	MW 11-02	2014	16	Phase II	**0.022**	0.037	0.0073	0.000043	0.0039	**17**	0.027	**0.11**	<0.00010	<0.00005	0.072	0.12	<0.100	0.24		
MW11-2	MW 11-02	2016	18	Phase II	0.0026	**0.162**	**0.0357**	<0.0001	<0.0001	**19**	<0.001	0.003	<0.0001	<0.00005	<0.025	<0.100	<0.100	0.11		
	MW 11-02	2018	20	Phase II														#N/A		
	MW 11-02	2023	25	Phase II														#N/A		
		2028	30	Phase II														#N/A		
				Phase III														#N/A		
																		#N/A		
																		#N/A		
																		#N/A		
																		#N/A		
																		#N/A		
Downgradient- MW 11-03																				
F4-NH-MW11-03	MW 11-03	2014	16	Phase II	**0.13**	**0.33**	**0.095**	**0.0011**	**0.26**	0.33	**0.54**	**0.053**	<0.00010	<0.00005	0.028	<0.100	<0.100	0.13		
MW11-3	MW 11-03	2016	18	Phase II	0.0031	**0.059**	**0.0236**	0.0002	0.0006	0.527	<0.001	<0.001	<0.0001	<0.00005	<0.025	<0.100	<0.100	0.11		
	MW 11-03	2018	20	Phase II														#N/A		
	MW 11-03	2023	25	Phase II														#N/A		
		2028	30	Phase II														#N/A		
				Phase III														#N/A		
																		#N/A		
																		#N/A		
																		#N/A		
																		#N/A		
																		#N/A		
Downgradient- MW 11-04																				
F4-NH-MW11-04	MW 11-04	2014	16	Phase II	**0.069**	**0.13**	**0.018**	0.00012	**0.016**	0.18	**0.2**	**0.024**	<0.00010	<0.00005	0.031	<0.100	<0.100	0.13		
MW11-4	MW 11-04	2016	18	Phase II	0.0047	0.011	0.003	<0.0001	0.0002	0.208	<0.001	<0.001	<0.0001	<0.00005	<0.025	<0.100	<0.100	0.11		
	MW 11-04	2018	20	Phase II														#N/A		
	MW 11-04	2023	25	Phase II														#N/A		
		2028	30	Phase II														#N/A		
				Phase III														#N/A		
																		#N/A		
																		#N/A		
																		#N/A		
																		#N/A		
																		#N/A		

New Tier II and NHWL Facility Monitoring. Summary of 2013 and Ongoing Groundwater Analytical Data**

FOX-4 Cape Hooper - NWHL & Tier II Disposal Facility - Summary of 1999-2006 Groundwater Analytical Data

Sample ID	Location	Year	Monitoring Year	Monitoring Phase	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Hg	Total PCB	F1 C_6-C_{10}	F2 C_{10}-C_{16}	F3 C_{16}-C_{34}	Modified TPH^ - Total C6-C34	TPH Identity	
					[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	[mg/L]	% Fuel Oil	Oil
Downgradient- MW 11-05																				
F4-NH-MW11-05	MW 11-05	2014	16	Phase II	**0.056**	0.055	**0.014**	0.000083	**0.014**	0.65	**0.068**	**0.031**	<0.00010	<0.00005	0.033	<0.100	<0.100	0.13		
MW11-5	MW 11-05	2016	18	Phase II	0.0018	0.012	0.0057	<0.0001	<0.0001	**2.35**	<0.001	<0.001	<0.0001	<0.00005	<0.025	<0.100	<0.100	0.11		
	MW 11-05	2018	20	Phase II														#N/A		
	MW 11-05	2023	25	Phase II														#N/A		
		2028	30	Phase II														#N/A		
				Phase III														#N/A		
																		#N/A		
																		#N/A		
																		#N/A		
																		#N/A		
																		#N/A		
Downgradient- MW 11-06																				
No sample collected - well was dry	MW 11-04	2014	16	Phase II														#N/A		
Not sampled - dry	MW 11-04	2016	18	Phase II														#N/A		
	MW 11-04	2018	20	Phase II														#N/A		
	MW 11-04	2023	25	Phase II														#N/A		
		2028	30	Phase II														#N/A		
				Phase III														#N/A		
																		#N/A		
																		#N/A		
																		#N/A		
																		#N/A		
																		#N/A		
Downgradient- MW 12-07																				
F4-NH-MW12-07	MW 12-07	2014	16	Phase II	**0.082**	**0.092**	**0.026**	0.00025	**0.021**	0.13	**0.14**	**0.04**	<0.00010	<0.00005	<0.025	<0.100	<0.100	0.11		
MW12-7	MW 12-07	2016	18	Phase II	0.001	0.007	0.0033	<0.0001	<0.0001	0.155	<0.001	<0.001	<0.0001	<0.00005	<0.025	<0.100	<0.100	0.11		
	MW 12-07	2018	20	Phase II														#N/A		
	MW 12-07	2023	25	Phase II														#N/A		
		2028	30	Phase II														#N/A		
				Phase III														#N/A		
																		#N/A		
																		#N/A		
																		#N/A		
																		#N/A		
Downgradient- MW 12-08																				
No sample collected - well was dry	MW 12-08	2014	16	Phase II														#N/A		
Not sampled - dry	MW 12-08	2016	18	Phase II														#N/A		
	MW 12-08	2018	20	Phase II														#N/A		
	MW 12-08	2023	25	Phase II														#N/A		
		2028	30	Phase II														#N/A		
				Phase III														#N/A		
																		#N/A		
																		#N/A		
																		#N/A		
																		#N/A		

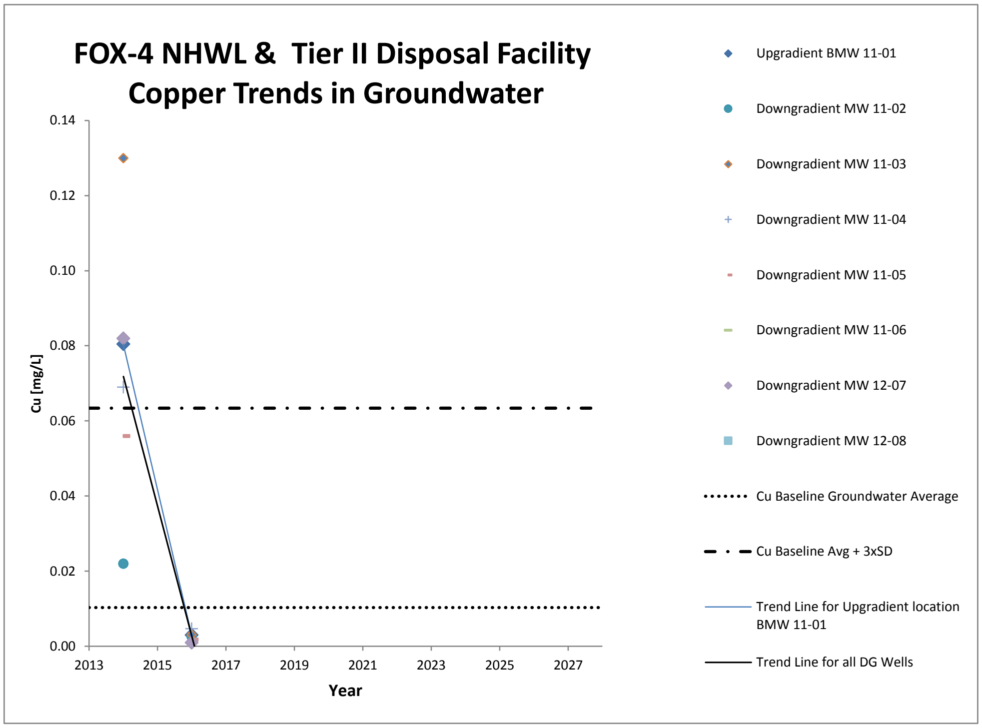
Note: Total Hydrocarbons (C6-C34) has been calculated by adding results for F1, F2 a<1.0 F3.

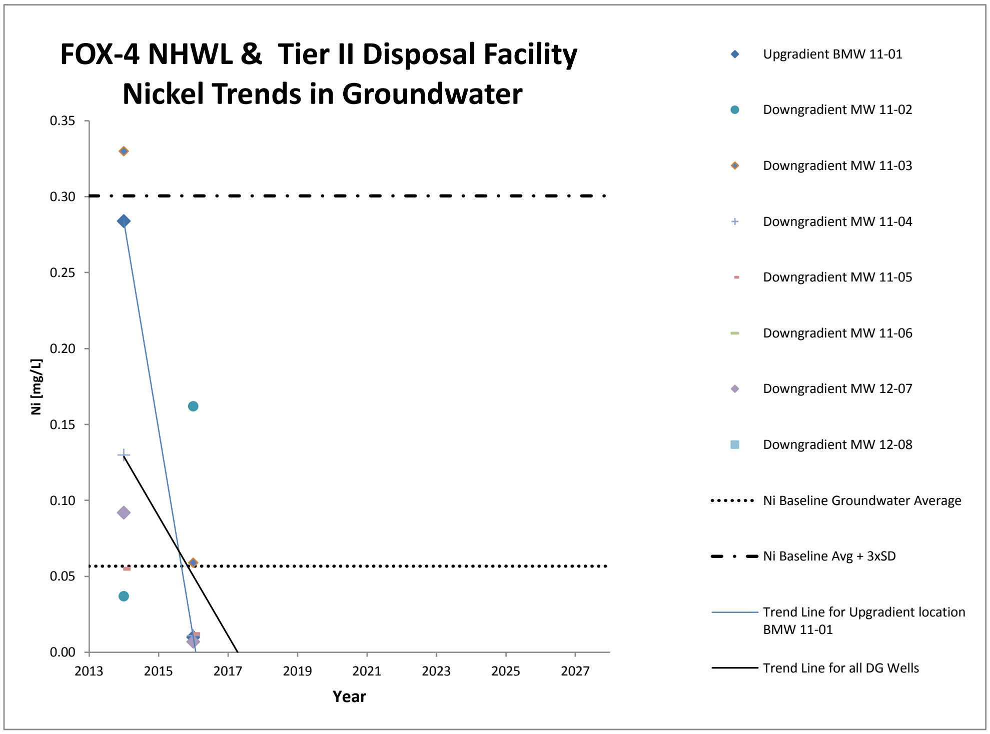
** Further remediation occurred at the NHWL and Tier II Disposal Facility in 2011, 2012 and 2013. Because of this work, baseline data includes monitoring results in Monitoring Years 1-15 prior to the additional remediaton. This data can be found at the top of this sheet and on the sheet labelled Previous FOX-4 NHWL & Tier II GW Sum

FOX-4 NHWL & Tier II Disposal Facility Graphs of Trends for Inorganic Elements, PCBs and TPH in Groundwater Samples

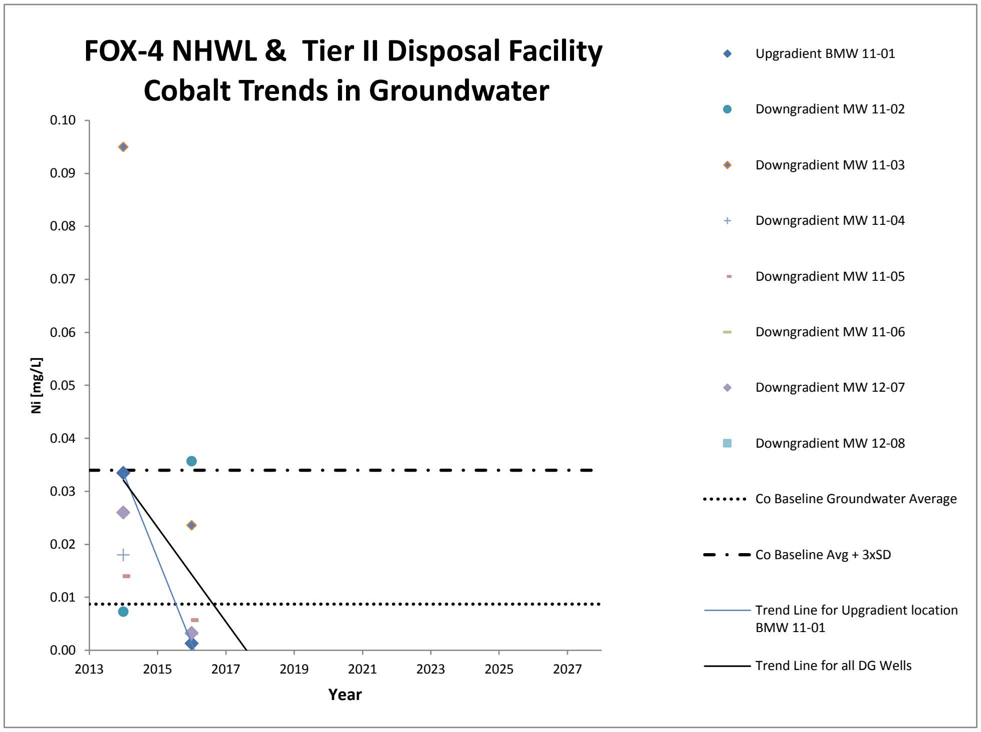
Where results are below detection, half of the detection limit has been used in the charts.

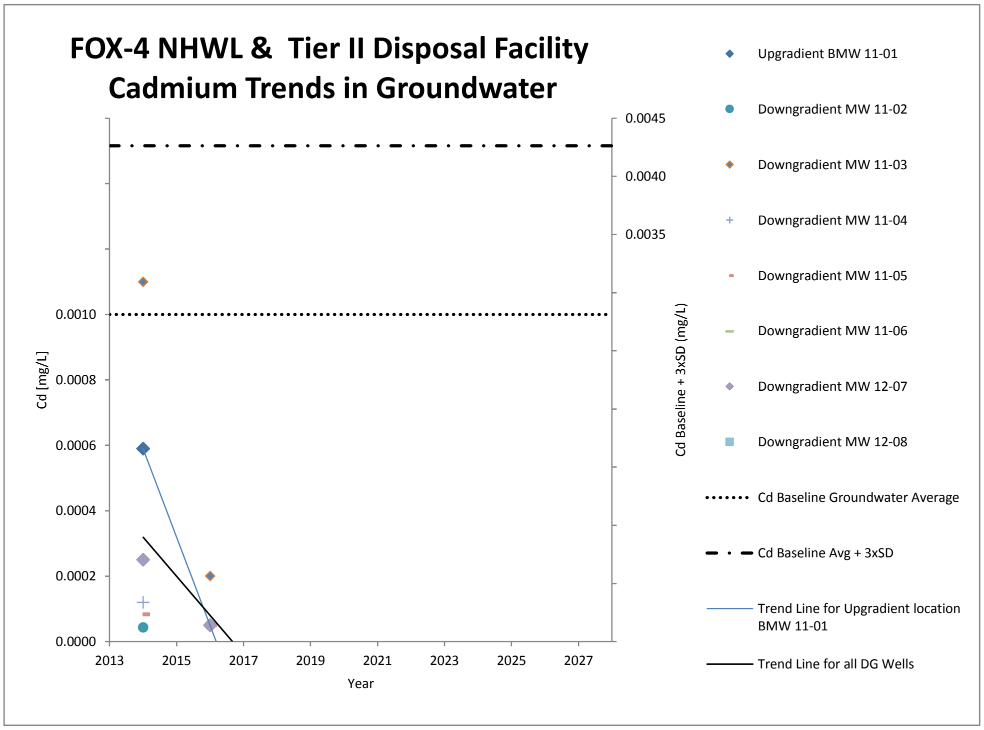
New monitoring locations were established in 2013 around the Tier II and NHWL facilities at FOX-4 and will be monitored as part of the landfill monitoring program.



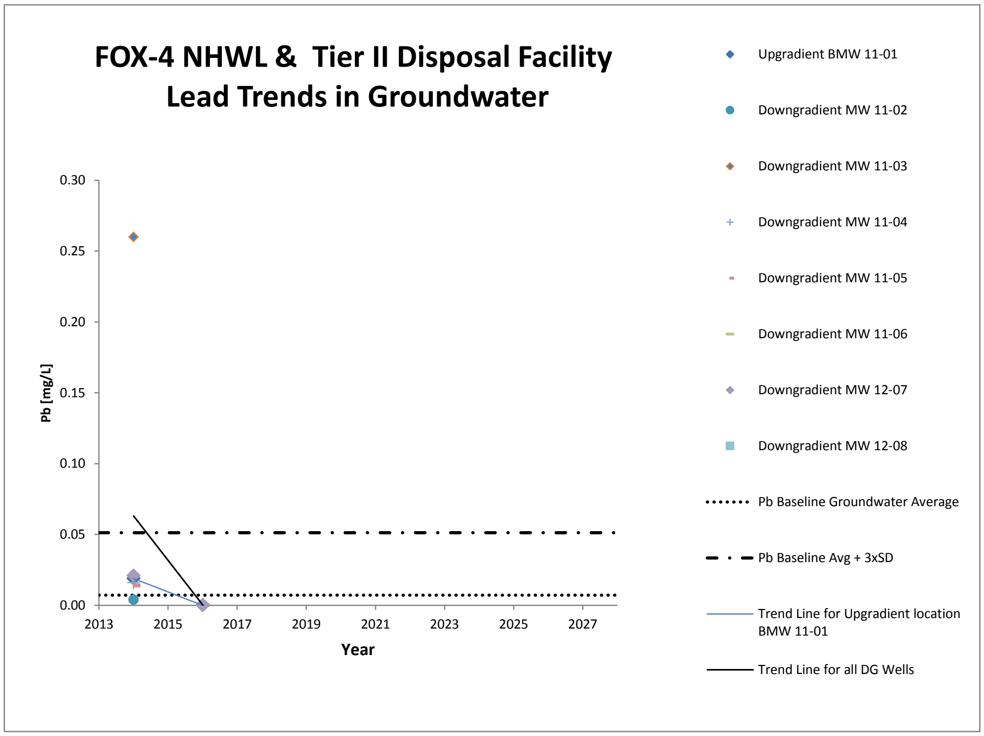


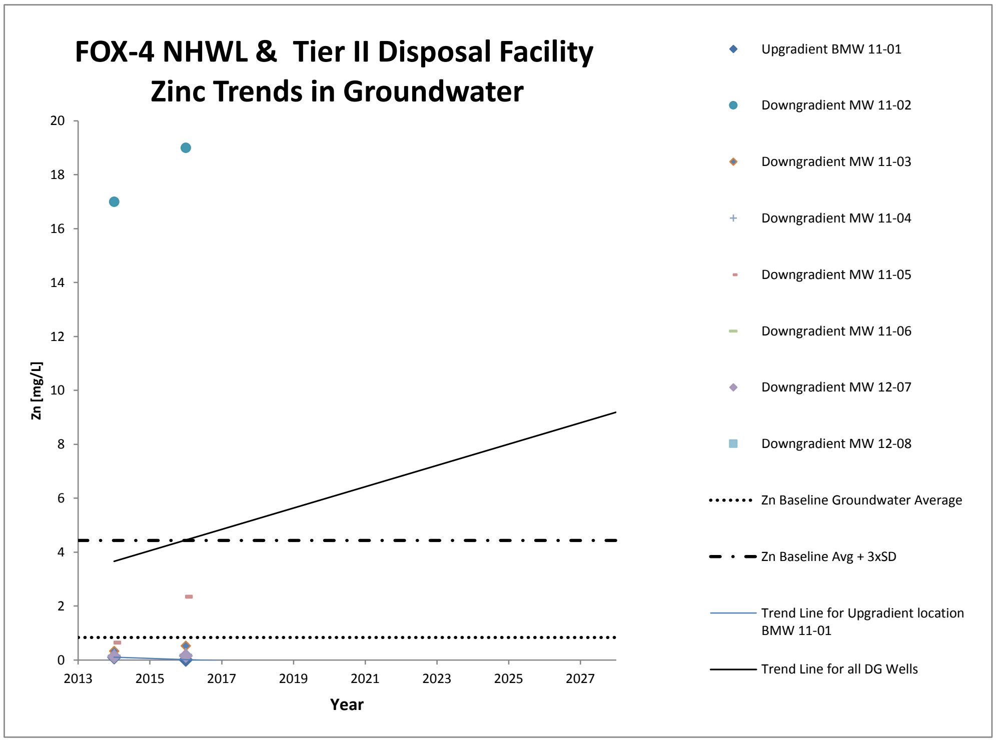
FOX-4 NHWL & Tier II Disposal Facility Graphs of Trends for Inorganic Elements, PCBs and TPH in Groundwater Samples



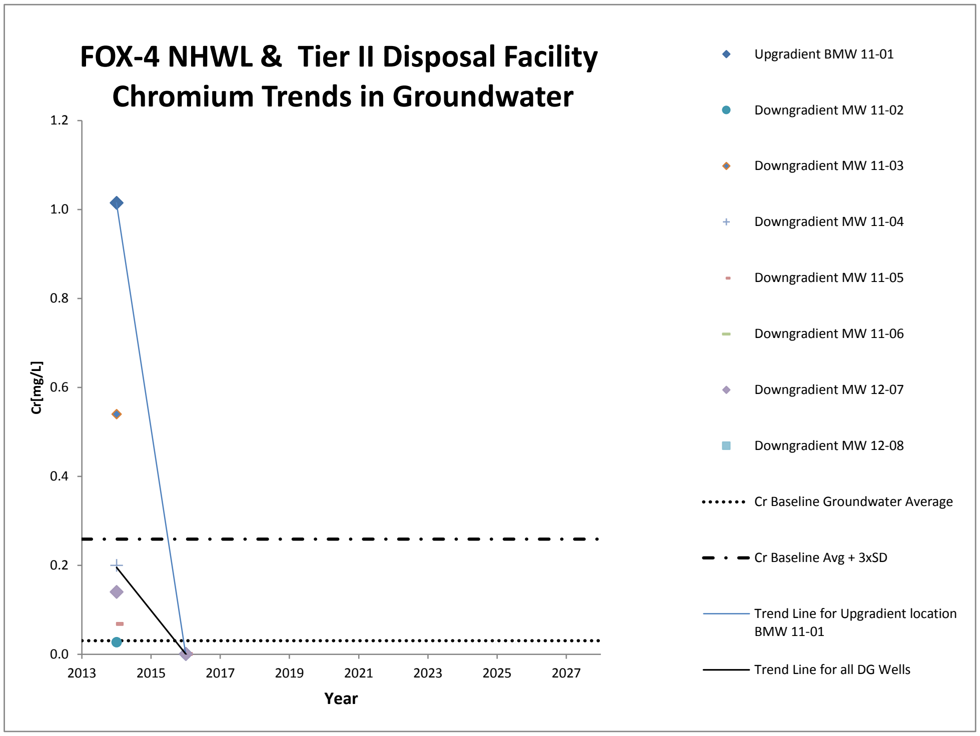


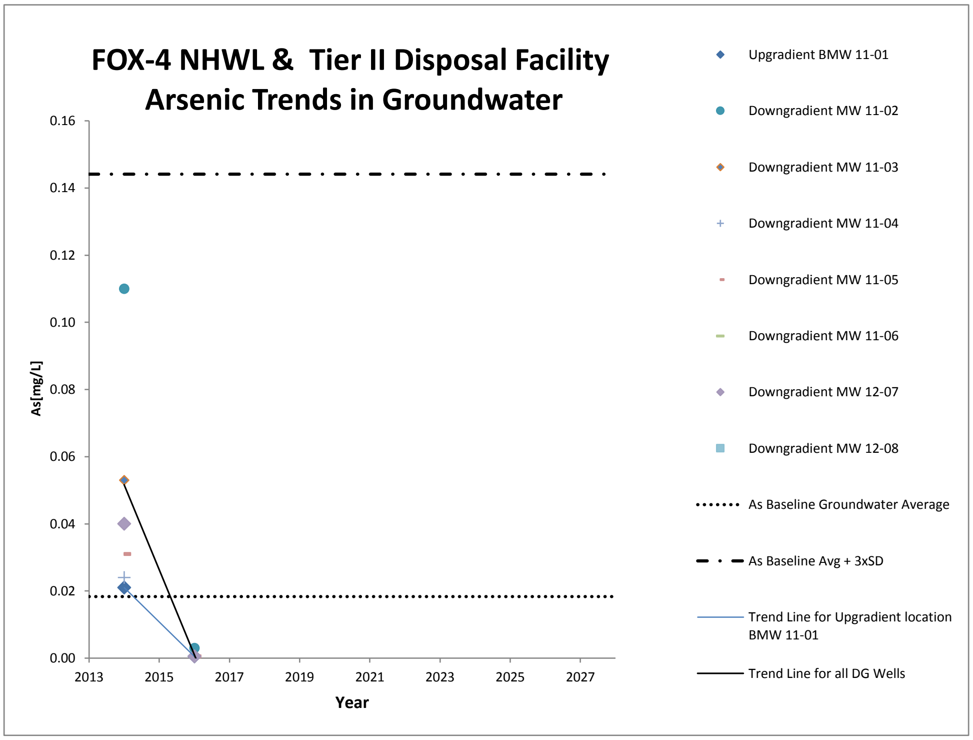
FOX-4 NHWL & Tier II Disposal Facility Graphs of Trends for Inorganic Elements, PCBs and TPH in Groundwater Samples



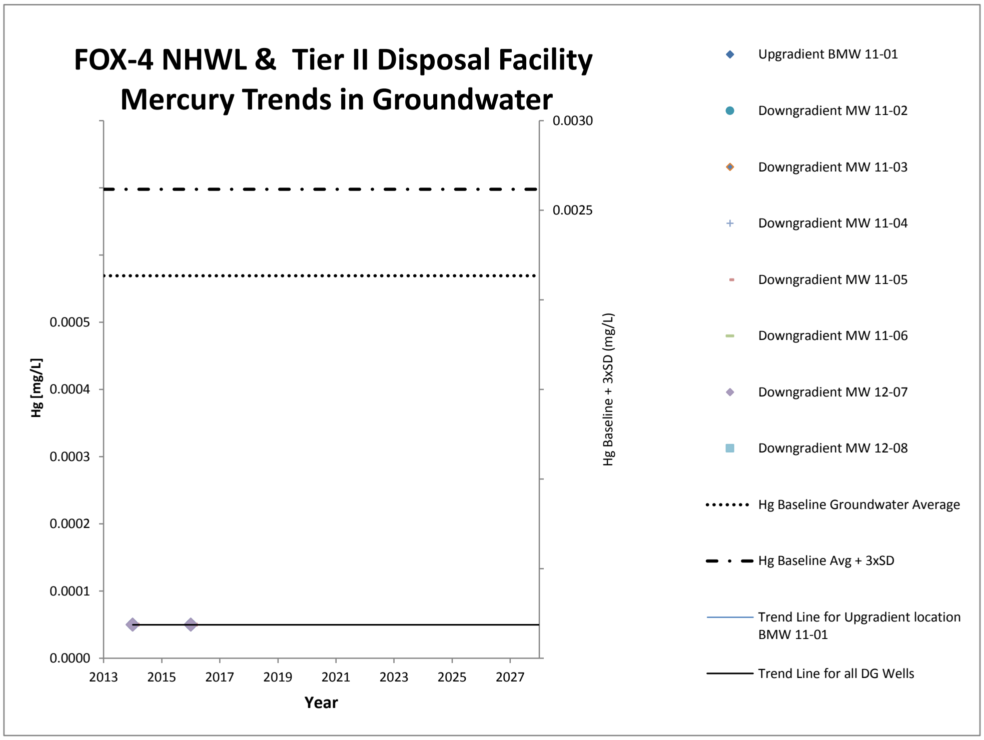


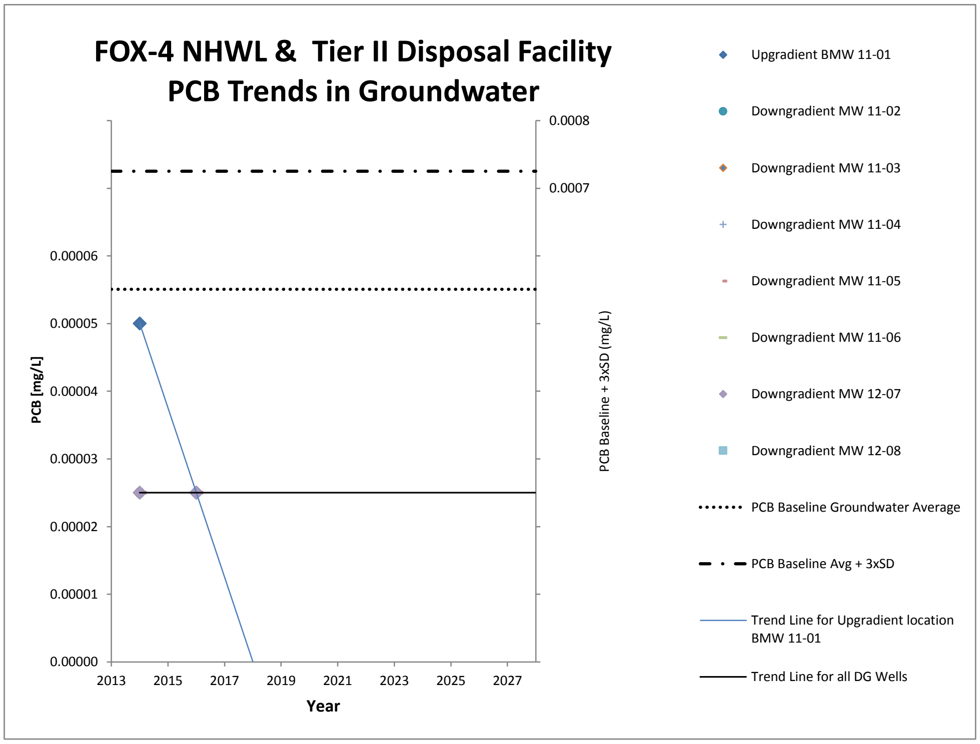
FOX-4 NHWL & Tier II Disposal Facility Graphs of Trends for Inorganic Elements, PCBs and TPH in Groundwater Samples



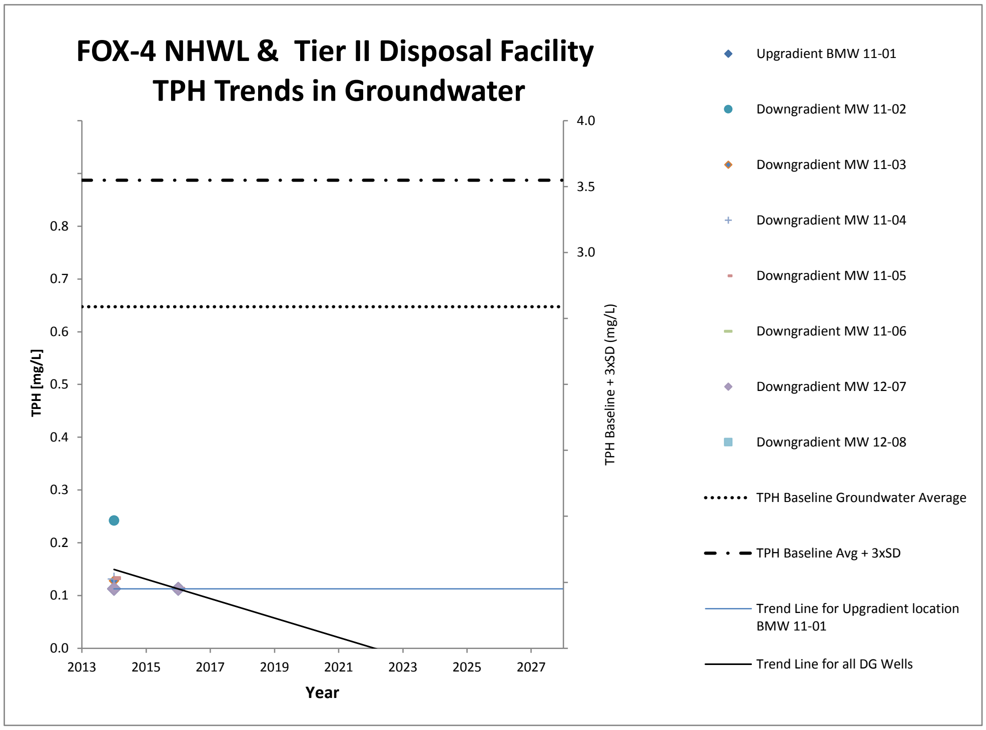


FOX-4 NHWL & Tier II Disposal Facility Graphs of Trends for Inorganic Elements, PCBs and TPH in Groundwater Samples





FOX-4 NHWL & Tier II Disposal Facility Graphs of Trends for Inorganic Elements, PCBs and TPH in Groundwater Samples



FOX-4 Cape Hooper - Tanner Bay Landfill - Summary of Soil Analytical Data**

Sample #	Location	Date	Monitoring Year	Monitoring Phase	Depth	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	Hg	Total PCB	F1 C_6-C_{10}	F2 C_{10}-C_{16}	F3 C_{16}-C_{34}	Modified TPH^ - Total C6-C34	TPH Identity	
					(cm)	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	% Fuel Oil	% Lube Oil
Background Average						19	19	7.9	1.0	10	34	31	5.5		0.00035						
Baseline Data - Average						**8.0**	**9.3**	**5.0**	**1.0**	**28**	**27**	**23**	**1.1**		**0.050**				**128**		
Baseline Data - Standard Deviation						0.0	2.5	0.85	1.16	17	6.0	7.2	0.7		0.00				265		
Baseline Average + 3xStandard Deviation						8.0	17	7.6	4.5	79	45	45	3.1		0.05				924		
Detection Limit						3.0	5.0	5.0	1.0	10	15	20	0.20	0.10	0.050				40		
DEW Line Cleanup Tier I Criteria										*200*					*1*						
DEW Line Cleanup Tier II Criteria						*100*	*100*	*50*	*5*	*500*	*500*	*250*	*30*	*2.0*	*5*				2500		
Monitoring Data																					
Upgradient																					
	F4-11 Surface																				
99-3763	ML #1/F4-11	1999	1	Phase I	30	4.9	5.6	<5.0	<1.0	<10	<15	<20	0.83	<0.10	<0.050				<40	n/a	n/a
FO-51-1	F4-11	2001	3	Phase I	0-15	1.4	<5.0	<5.0	<1.0	<10	<15	<20	**2.0**	<0.10	<0.050				<40	n/a	n/a
FO-9-1	F4-9/F4-11	2003	5	Phase I	0-15	7.0	7.0	<5.0	<1.0	<10	17	<20	**1.2**	<0.10	<0.050	<10	<40	<40	<40		
F4-11	F4-11	2005	7	Phase II	0-11	4.0	5.0	<5.0	<1.0	<10	<15	<20	<0.70	<0.10	<0.10	<10	<40	<40	<40		
F4-11(Soil)0-15cm	F4-11	2006	8	Phase II	0-15	**10**	**10**	<5.0	<1.0	<10	17	<20	1.1	<0.10	<0.10	<12	10	<10	21		
F4-11(Soil)0-15cm	F4-11	2007	9	Phase II	0-15	5.0	5.0	<5.0	<1.0	<10	<15	<20	1.1	<0.1	<0.10	<12	657	778	**1441**		
F4-11(Soil)0-15cm	F4-11	2008	10	Phase II	0-15	3.0	7.0	<5.0	<1.0	<10	<15	<20	<1.0	<0.10	<0.050	<1.0	1100	590	**1691**		
10-18023*/24	F-11	2010	12	Phase II	0-10	4.7	5.4	<5.0	<1.0	<10	<15	<20	**1.4**	<0.10	<0.050	<10	440	180	**625**		
13-27258/59	F4-11	2013	15	Phase II	0-10	7.4	6.1	<5.0	<1.0	<10	16.0	<20	**1.2**	<0.1	<0.05	<10	270	380	**655**		
F4-TAN-11-S	F4-11	2014	16	Phase II	0-15	**11.5**	4.8	2.6	<0.5	4.05	13.5	16.5	**5.8**	<0.10	<0.05	<10	<10	<50	35		
F4-11b	F4-11	2016	18	Phase II	0-15	**9.9**	8.2	2.9	**1.8**	4.8	17.8	18.4	**1.2**	<0.1	<0.05	<7	<4	<8	10		
		2018	20	Phase II															#N/A		
		2023	25	Phase II															#N/A		
		2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
	F4-11 depth																				
FO-51-2	F4-11	2001	3	Phase I	40-50	**8.5**	**11**	<5.0	<1.0	<10	17	<20	**2.0**	<0.10	<0.050				<40		
FO-9-2	F4-9/F4-11	2003	5	Phase I	40-50	6.0	7.0	<5.0	<1.0	<10	16	<20	1.0	<0.10	<0.050	<1.0	<40	<1.0	<40		
F4-11(Soil)40-50cm	F4-11	2006	8	Phase II	40-50	**9.0**	8.0	<5.0	<1.0	<10	<15	<20	0.70	<0.10	<0.10	<12	<10	<10	16		
F4-11(Soil)40-50cm	F4-11	2007	9	Phase II	40-50	7.0	5.0	<5.0	<1.0	<10	<15	<20	0.80	<0.1	<0.1	<11	<20	23	39		
F4-11(Soil)40-50cm	F4-11	2008	10	Phase II	40-50	3.0	7.0	<5.0	<1.0	<10	<15	<20	<1.0	<0.10	<0.050	<1.0	270	110	**381**		
10-18025*/26	F-11	2010	12	Phase II	30-40	<3.0	<5.0	<5.0	<1.0	<10	<15	<20	**1.2**	<0.10	<0.050	<10	780	75	**860**		
13-27260/61	F4-11	2013	15	Phase II	30-40	6.5	5.1	<5.0	<1.0	<10	<15	<20	**2.3**	<0.1	<0.05	<10	4.4	33	42		
F4-TAN-11-D	F4-11	2014	16	Phase II	40-50	6.6	5.2	1.7	<0.10	3.2	11.0	15	1.10	<0.050	<0.010	<10	<10	<10	15		
F4-11a	F4-11	2016	18	Phase II	40-50	6.5	5.9	1.9	**1.4**	3	12.9	15.5	**1.2**	<0.1	<0.05	<7	<4	<8	10		
		2018	20	Phase II															#N/A		
		2023	25	Phase II															#N/A		
		2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
Downgradient																					
	F4-12 Surface																				
99-3769	ML #3/F4-12	1999	1	Phase I	0	6.5	7.4	<5.0	<1.0	<10	19	21	0.81	<0.10	<0.050				41	100	0
FO-52-1	F4-12	2001	3	Phase I	0-15	1.7	5.0	<5.0	<0.10	<10	<15	<20	**2.0**	<0.10	<0.050				43	0.0	100
FO-11-1	F4-11/F4-12	2003	5	Phase I	0-15	**12**	**11**	<5.0	<0.10	<10	23	**25**	*70*	<0.10	<0.050	<10	<40	<40	<40		
F4-12	F4-12	2005	7	Phase II	0-11	6.0	7.0	<5.0	<1.0	<10	16	<20	<0.70	<0.10	<0.10	<10	40	47	<40		
F4-12(Soil)0-15cm	F4-12	2006	8	Phase II	0-15	3.0	5.0	<5.0	<1.0	<10	<15	<20	0.70	<0.10	<0.10	<12	<10	130	**141**		
F4-12(Soil)0-15cm	F4-12	2007	9	Phase II	0-15	4.0	5.0	<5.0	<1.0	<10	<15	<20	<0.7	<0.1	<0.10	<10	<10	11	21		
F4-12(Soil)0-15cm	F4-12	2008	10	Phase II	0-15	3.0	8.0	<5.0	<1.0	<10	<15	<20	<1.0	<0.10	<0.050	<1.0	<1.0	11	<40		
10-18019/20	F4-12	2010	12	Phase II	0-10	4.4	<5.0	<5.0	<1.0	<10	<15	<20	**1.8**	<0.10	<0.050	<10	5.6	<9.0	<40		
13-27262/63	F4-12	2013	15	Phase II	0-10	6.7	<5.0	<5.0	<1.0	<1.0	<1.1	<2.0	**1.6**	<0.10	<0.050	<10	< 4.0	< 9.0	12		
F4-TAN-12-S	F4-12	2014	16	Phase II	0-15	**15**	**11**	3.6	<0.10	4.1	23.0	21	**1.6**	<0.050	<0.010	<10	<10	<10	15		
F4-12b	F4-12	2016	18	Phase II	0-15	**10.5**	**10.1**	3.4	**2**	4.4	21.6	22.8	**1.8**	<0.1	<0.05	<7	<4	<8	10		
		2018	20	Phase II															#N/A		
		2023	25	Phase II															#N/A		
		2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
	F4-12 depth																				
99-3771	ML #3/F4-12	1999	1	Phase I	30	4.3	<5.0	<5.0	<1.0	<10	<15	<20	0.57	<0.10	<0.050				**500**	100.0	0
FO-52-2	F4-12	2001	3	Phase I	40-50	5.5	6.0	<5.0	<1.0	<10	11	<20	**3.0**	<0.10	<0.050				84	1.0	99
FO-11-2	F4-11/F4-12	2003	5	Phase I	40-50	5.0	5.0	<5.0	<1.0	<10	<15	<20	**1.5**	<0.10	<0.050	35	1100	190	**1325**		
F4-12(Soil)40-50cm	F4-12	2006	8	Phase II	40-50	**14**	9.0	<5.0	<1.0	<10	<15	<20	0.90	<0.10	<0.10	<12	20	<10	31		
F4-12(Soil)40-50cm	F4-12	2007	9	Phase II	40-50	<5	8.0	<5.0	<1.0	<10	<20	<20	<1.0	<0.1	<0.1	<11	<20	<20	26		
F4-12(Soil)40-50cm	F4-12	2008	10	Phase II	40-50	3.0	8.0	<5.0	<1.0	<10	<15	<20	<1.0	<0.10	<2.0	<1.0	<1.0	<1.0	2		
10-18021*/22	F4-12	2010	12	Phase II	30-40	6.4	7.1	<5.0	<1.0	<10	15	<20	**1.7**	<0.10	<0.050	<10	5.7	13	24		
13-27264/65	F4-12	2013	15	Phase II	30-40	**11**	9.2	<5.0	<1.0	<10	19	**28**	**2.4**	<0.10	<0.050	<10	< 4.0	< 9.0	12		
F4-TAN-12-D	F4-12	2014	16	Phase II	40-50	**13**	**10**	3.3	<0.10	3.9	19	21	**1.9**	<0.050	<0.010	<10	<10	<10	15		
F4-12a	F4-12	2016	18	Phase II	30-40	**13.6**	**13**	4.1	**2.5**	6.6	24.8	**26.8**	**3.6**	<0.1	<0.05	<7	<4	<8	10		
		2018	20	Phase II															#N/A		
		2023	25	Phase II															#N/A		
		2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		

FOX-4 Cape Hooper - Tanner Bay Landfill - Summary of Soil Analytical Data**

Sample #	Location	Date	Monitoring Year	Monitoring Phase	Depth (cm)	Cu [mg/kg]	Ni [mg/kg]	Co [mg/kg]	Cd [mg/kg]	Pb [mg/kg]	Zn [mg/kg]	Cr [mg/kg]	As [mg/kg]	Hg [mg/kg]	Total PCB [mg/kg]	F1 C_6-C_{10} [mg/kg]	F2 C_{10}-C_{16} [mg/kg]	F3 C_{16}-C_{34} [mg/kg]	Modified TPH^ - Total C6-C34 [mg/kg]	TPH Identity % Fuel Oil	TPH Identity % Lube Oil
	F4-13 Surface																				
99-3765	ML #2/F4-13	1999	1	Phase I	0	7.1	8.6	<5.0	<1.0	<10	17	<20	**1.3**	<0.10	<0.050				< 40	n/a	n/a
FO-53-1	F4-13	2001	3	Phase I	0-15	5.7	9.0	<5.0	<1.0	<10	<15	<20	**3.0**	<0.10	<0.050				<40	0.0	100
FO-10-1	F4-10/F4-13	2003	5	Phase I	0-15	5.0	6.0	<5.0	<1.0	<10	<15	<20	1.0	<0.10	<0.050	<10	<40	<40	<40		
F4-13	F4-13	2005	7	Phase II	0-11	5.0	5.0	<5.0	<1.0	<10	<15	<20	<0.70	<0.10	<0.10	<10	<40	<40	<40		
F4-13(Soil)0-15cm	F4-13	2006	8	Phase II	0-15	7.0	5.0	<5.0	<1.0	<10	<15	<20	0.90	<0.10	<0.10	<12	10	130	**146**		
F4-13(Soil)0-15cm	F4-13	2007	9	Phase II	0-15	6.0	7.0	<5.0	<1.0	<10	17	<20	0.70	<0.10	<0.1	<12	<20	<20	26		
F4-13(Soil)0-15cm	F4-13	2008	10	Phase II	0-15	3.0	**10**	<5.0	<1.0	<10	<15	<20	<1.0	<0.10	<0.050	<1.0	<1.0	<1.0	<40		
10-18015*/16*	F4-13	2010	12	Phase II	0-10	6.8	7.2	<5.0	<1.0	<10	19	<20	<1.0	<0.10	<0.050	<10	4.5	9	<40		
13-27266/67	F4-13	2013	15	Phase II	0-10	**8.1**	8.0	<5.0	<1.0	<10	16	<20	**1.2**	<0.10	<0.050	<10	< 4.0	< 9.0	12		
F4-TAN-13-S	F4-13	2014	16	Phase II	0-15	**9.9**	8.0	2.3	<0.10	3.8	17.0	18	**2.1**	<0.050	<0.010	<10	<10	<10	15		
F4-13b	F4-13	2016	18	Phase II	0-15	6.5	6.1	2	**1**	2.6	11	10.5	**1.4**	<0.1	<0.05	<7	<4	<8	10		
		2018	20	Phase II															#N/A		
		2023	25	Phase II															#N/A		
		2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
	F4-13 depth																				
99-3767	ML #2/F4-13	1999	1	Phase I	30	5.5	<5.0	<5.0	<1.0	<10	<15	<20	0.62	<0.10	<0.050				<40	n/a	n/a
FO-53-2	F4-13	2001	3	Phase I	40-50	2.9	5.0	<5.0	<1.0	<10	<15	<20	**3.0**	<0.10	<0.010				71	0.0	100
FO-10-2	F4-10/F4-13	2003	5	Phase I	40-50	5.0	5.0	<5.0	<1.0	<10	<15	<20	1.1	<0.10	<0.050	<10	<40	<40	<40		
F4-13(Soil)40-50cm	F4-13	2006	8	Phase II	40-50	5.0	5.0	<5.0	<1.0	<10	<15	<20	0.80	<0.10	<0.10	<12	20	<10	31		
F4-13(Soil)40-50cm	F4-13	2007	9	Phase II	40-50	5.0	<5.0	<5.0	<1.0	<10	<15	<20	0.80	<0.1	<0.1	<12	20	<10	2		
F4-13(Soil)40-50cm	F4-13	2008	10	Phase II	40-50	3.0	8.0	<5.0	<1.0	<10	<15	<20	<1.0	<0.10	<0.050	<1.0	<1.0	<1.0	<1.0		
10-18017*/18	F4-13	2010	12	Phase II	30-40	5.7	5.6	<5.0	<1.0	<10	<15	<20	**2.1**	<0.10	<0.050	<10	5.4	12	22		
13-27268/69	F4-13	2013			30-40	7.5	5.3	<5.0	<1.0	<10	<15	<20	**1.7**	<0.10	<0.050	<10	< 4.0	< 9.0	12		
F4-TAN-13-D	F4-13	2014	16	Phase II	40-50	8.0	7.2	2.3	<0.10	2.7	16.0	17	**1.9**	<0.050	<0.010	<10	<10	<10	15		
F4-13a (Dup Avg)	F4-13	2016	18	Phase II	40-50	**10**	9	3.0	**1.2**	4	19	19	**3**	<0.1	<0.05	<6	<7	<29	21		
		2018	20	Phase II															#N/A		
		2023	25	Phase II															#N/A		
		2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		

Note: Total Hydrocarbons (C_6-C_{34}) has been calculated by adding results for F1, F2 and F3.

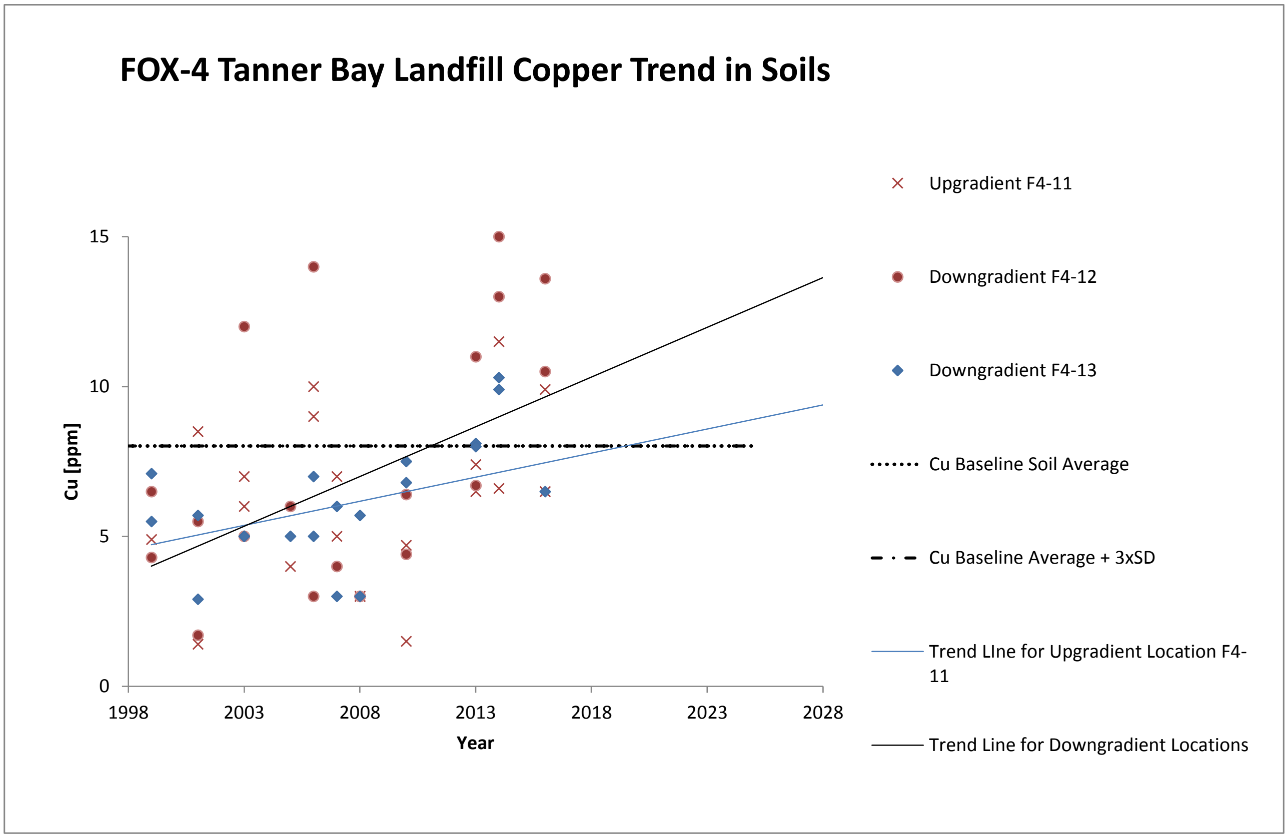
** Tanner Bay Landfill is located in the South Zone. First year monitoring occurred in 1999. The landfill was regraded in 2013.

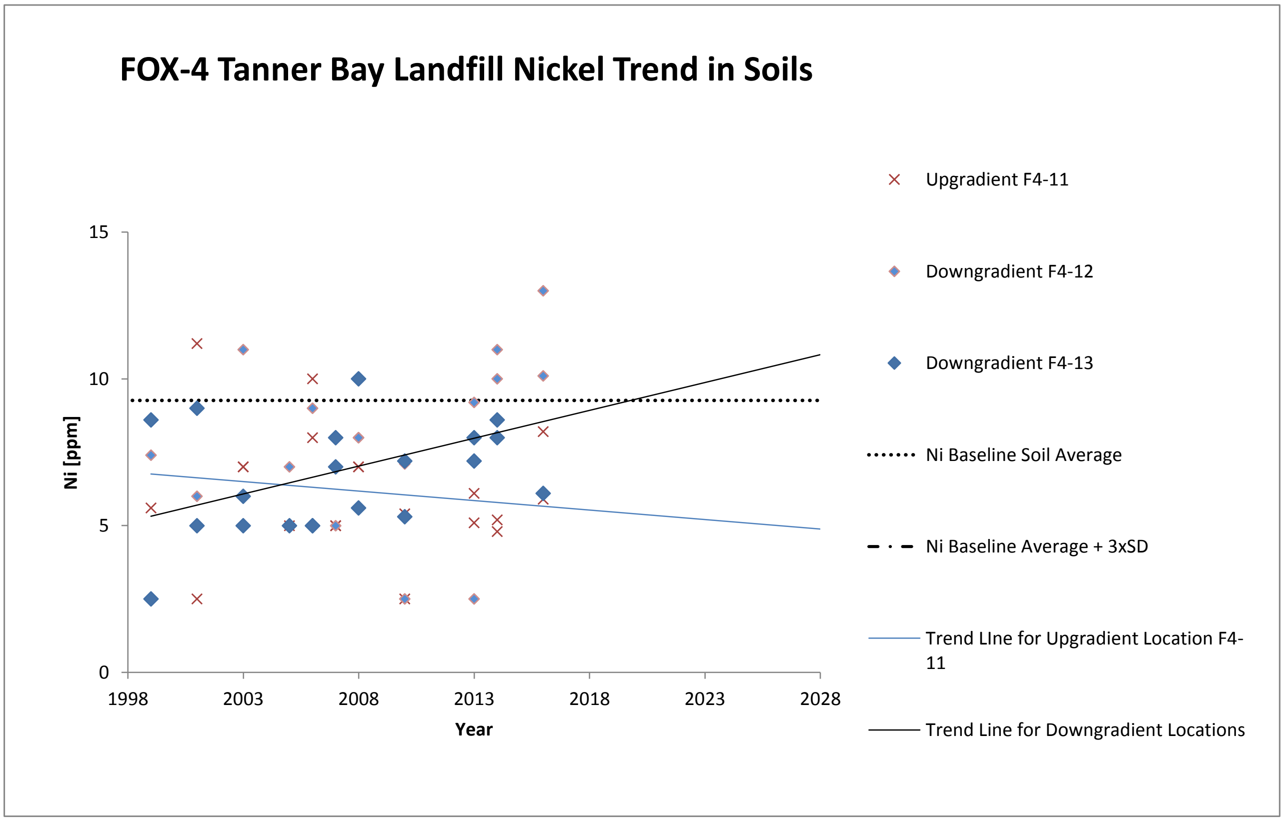
Legend

XX	sample exceeds background
XX	**sample exceeds baseline**
XX	sample exceeds DLCU Tier I criteria
🟧 *XX*	sample exceeds DLCU Tier II criteria

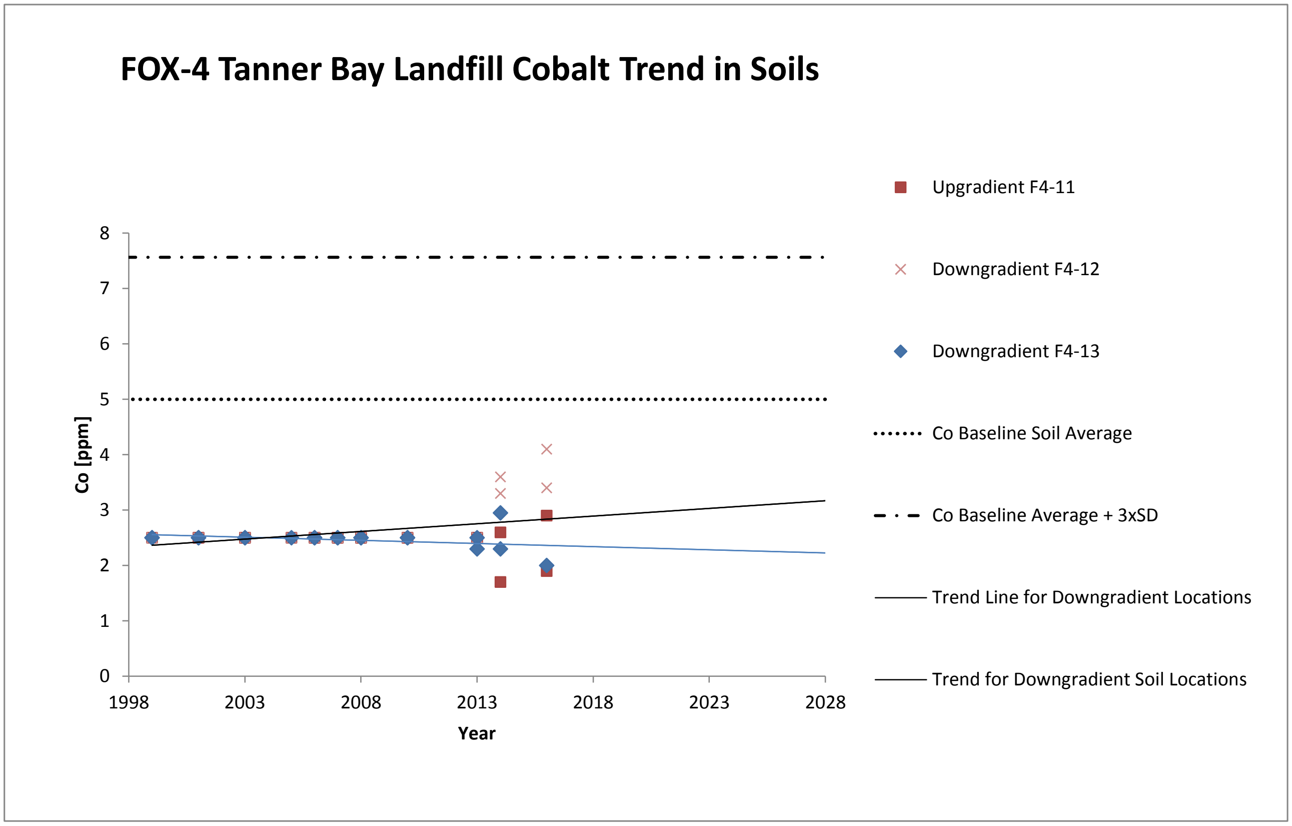
FOX-4 Tanner Bay Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)

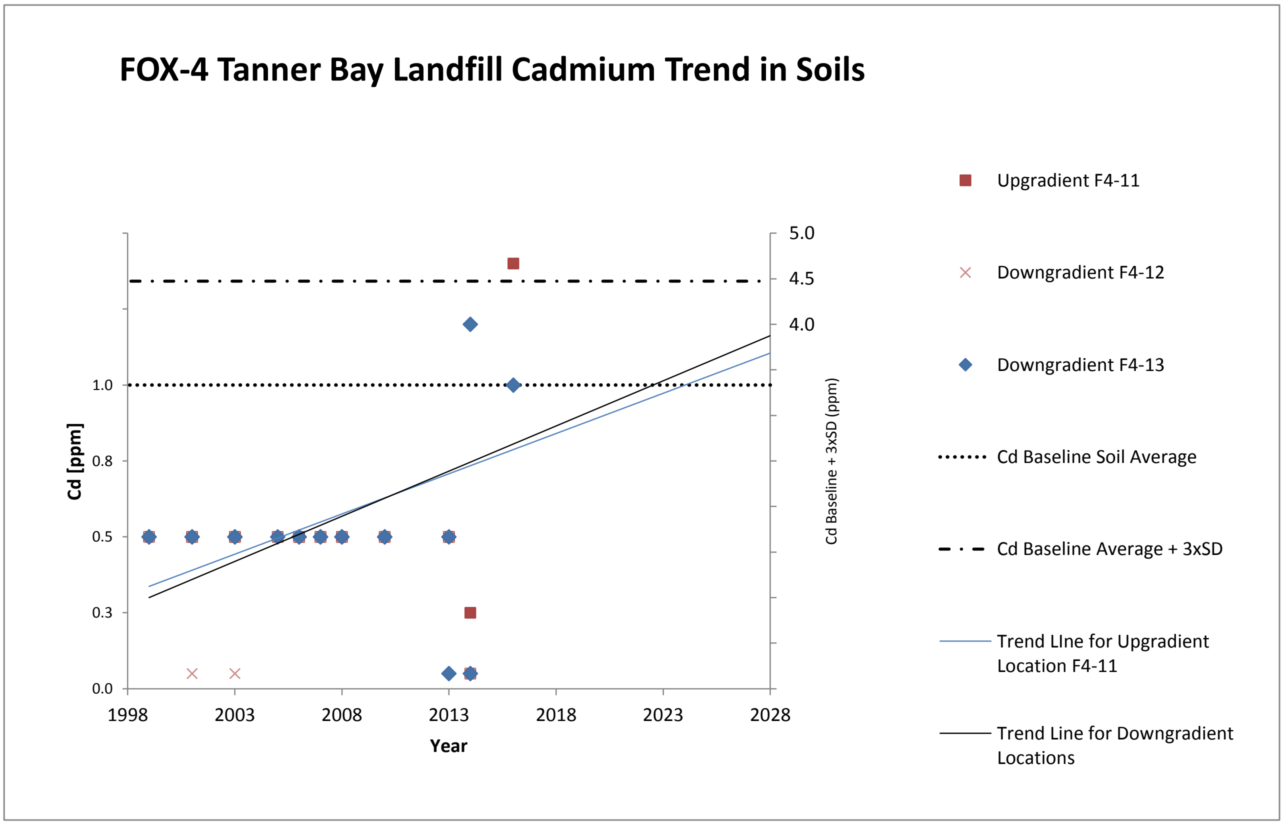
Where results are below detection, half of the detection limit has been used in the charts.



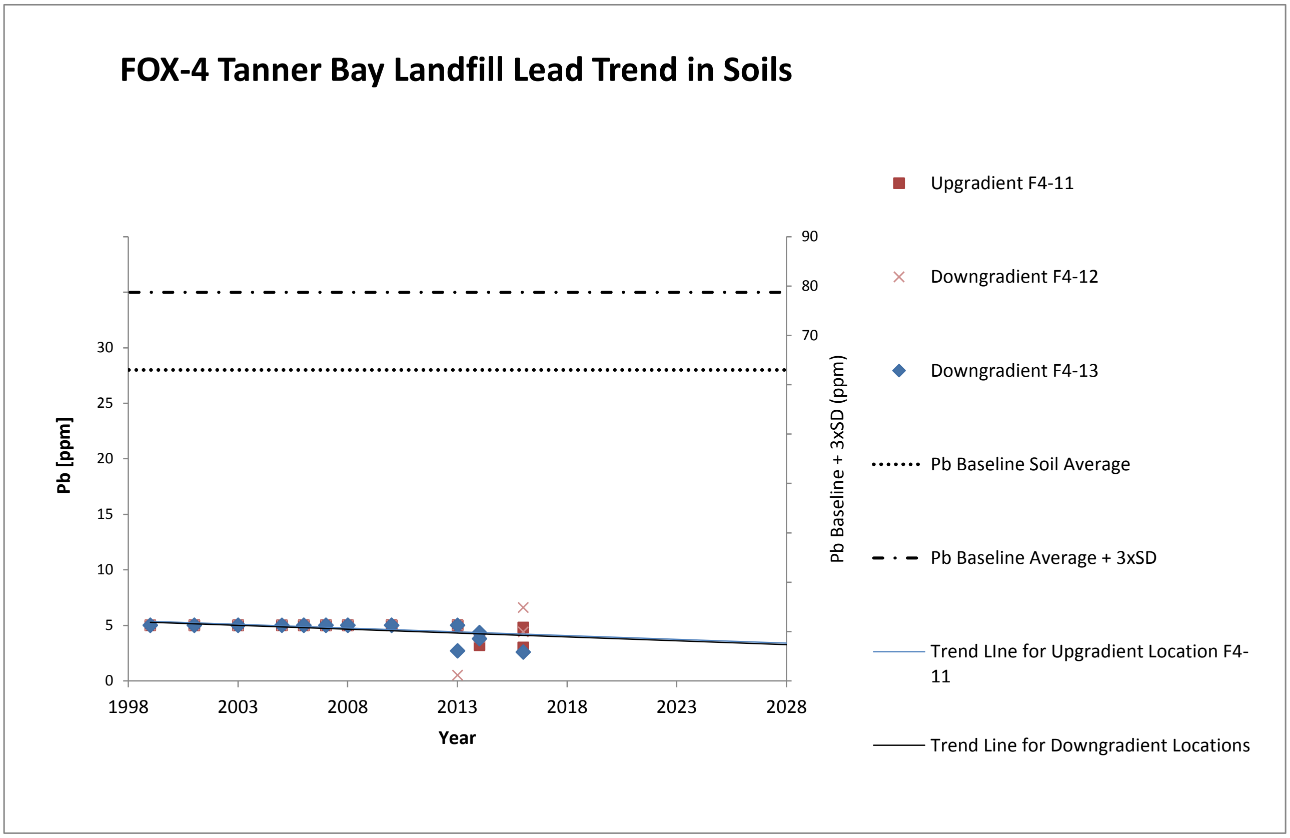


FOX-4 Tanner Bay Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)

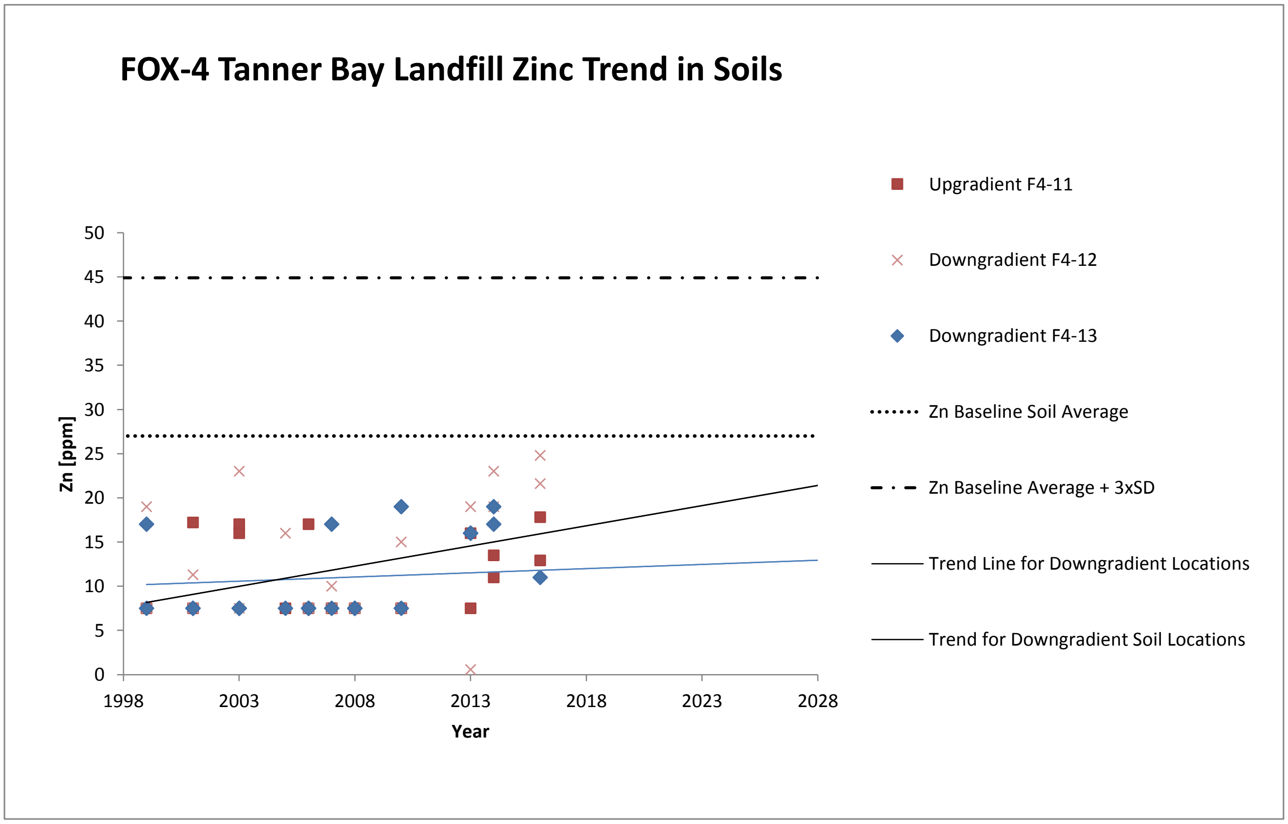




FOX-4 Tanner Bay Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)

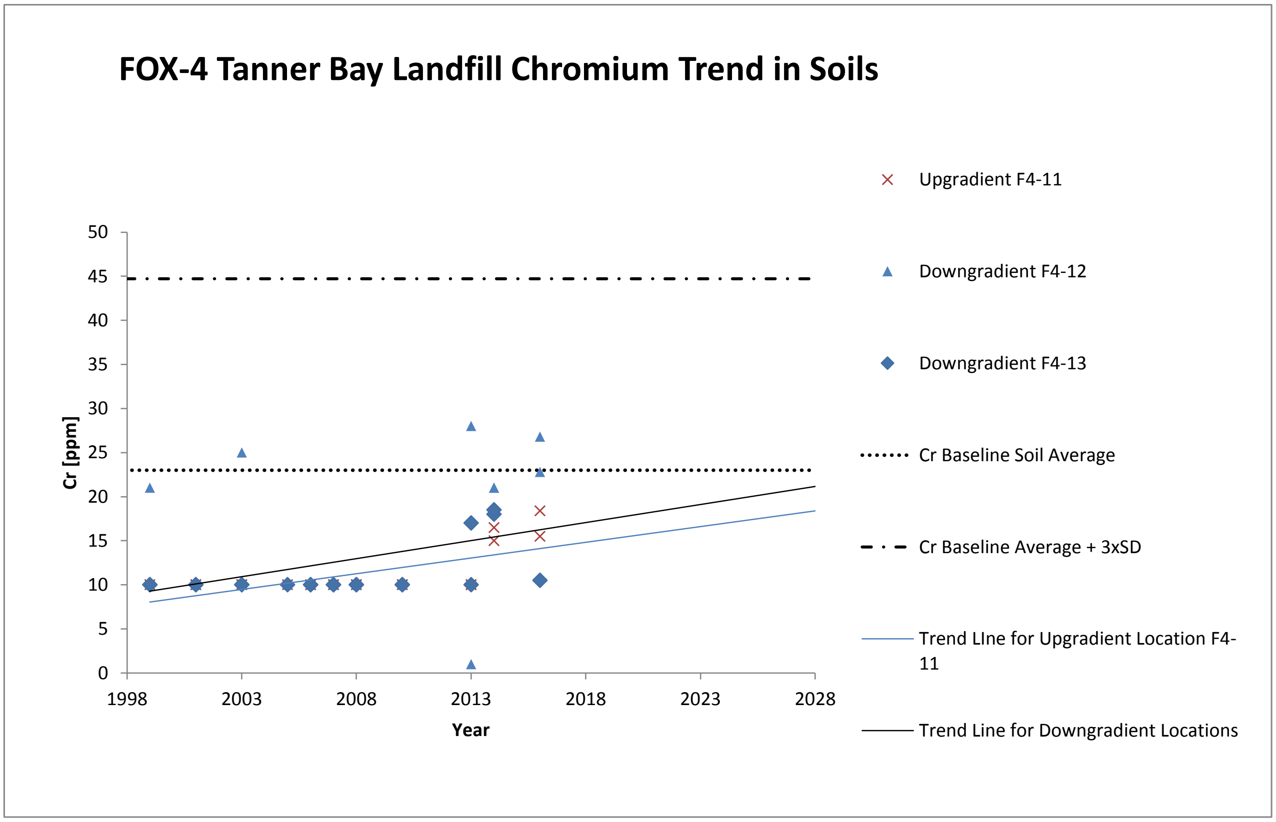


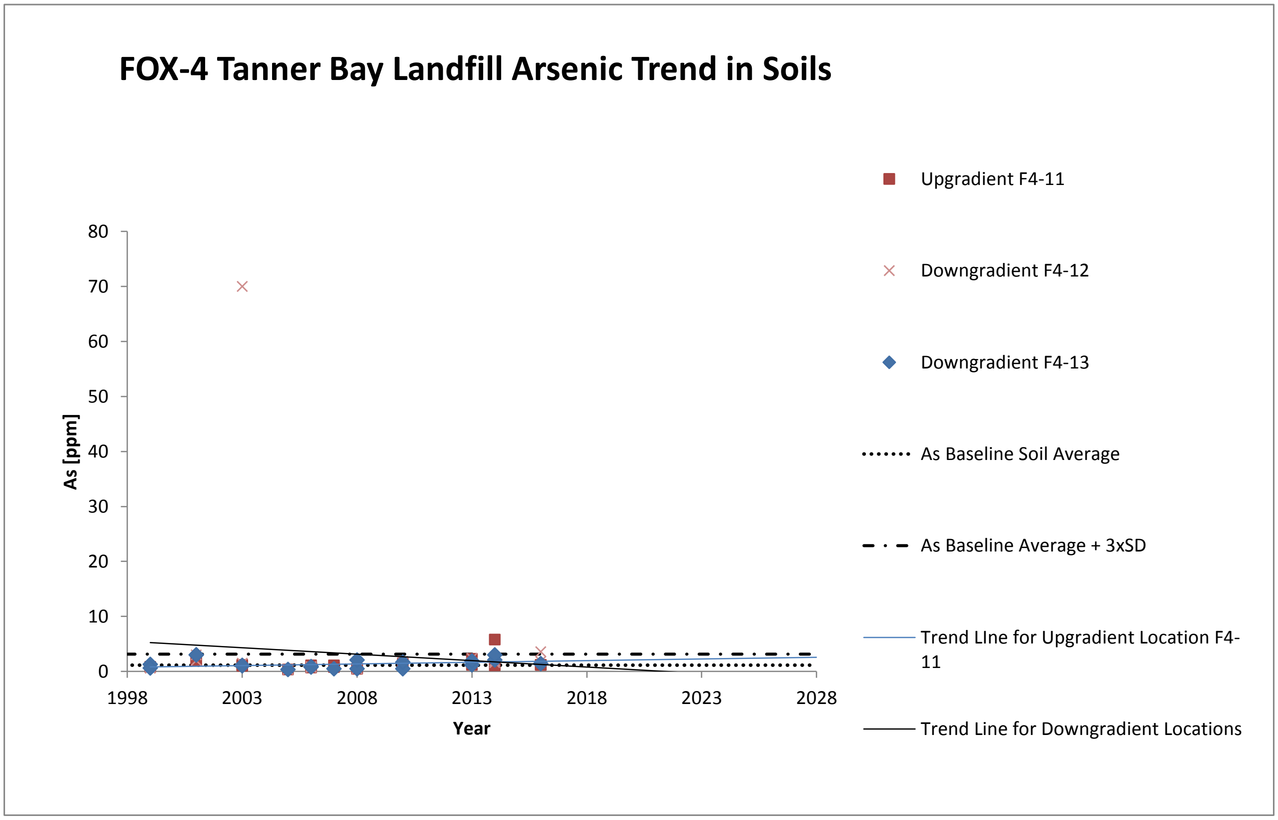
FOX-4 Tanner Bay Landfill Lead Trend in Soils



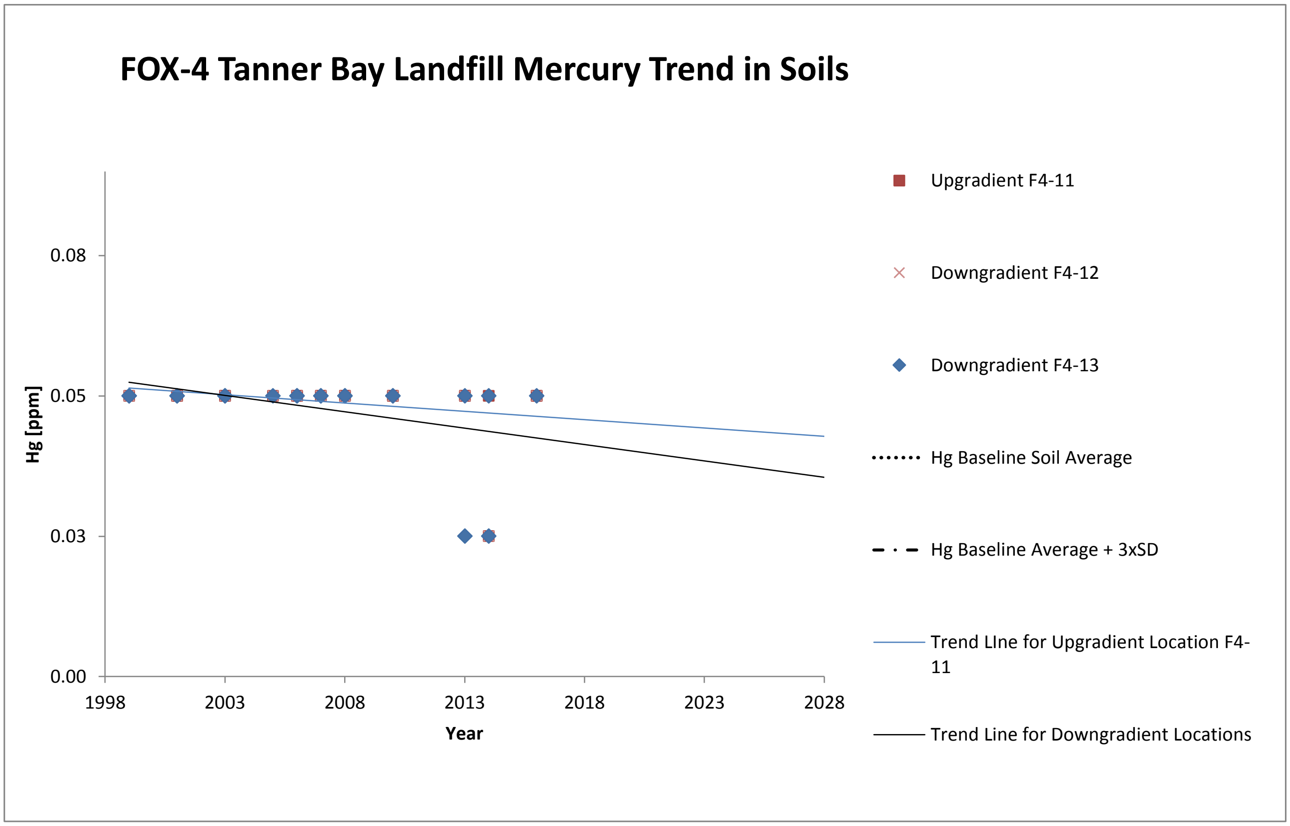
FOX-4 Tanner Bay Landfill Zinc Trend in Soils

FOX-4 Tanner Bay Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)

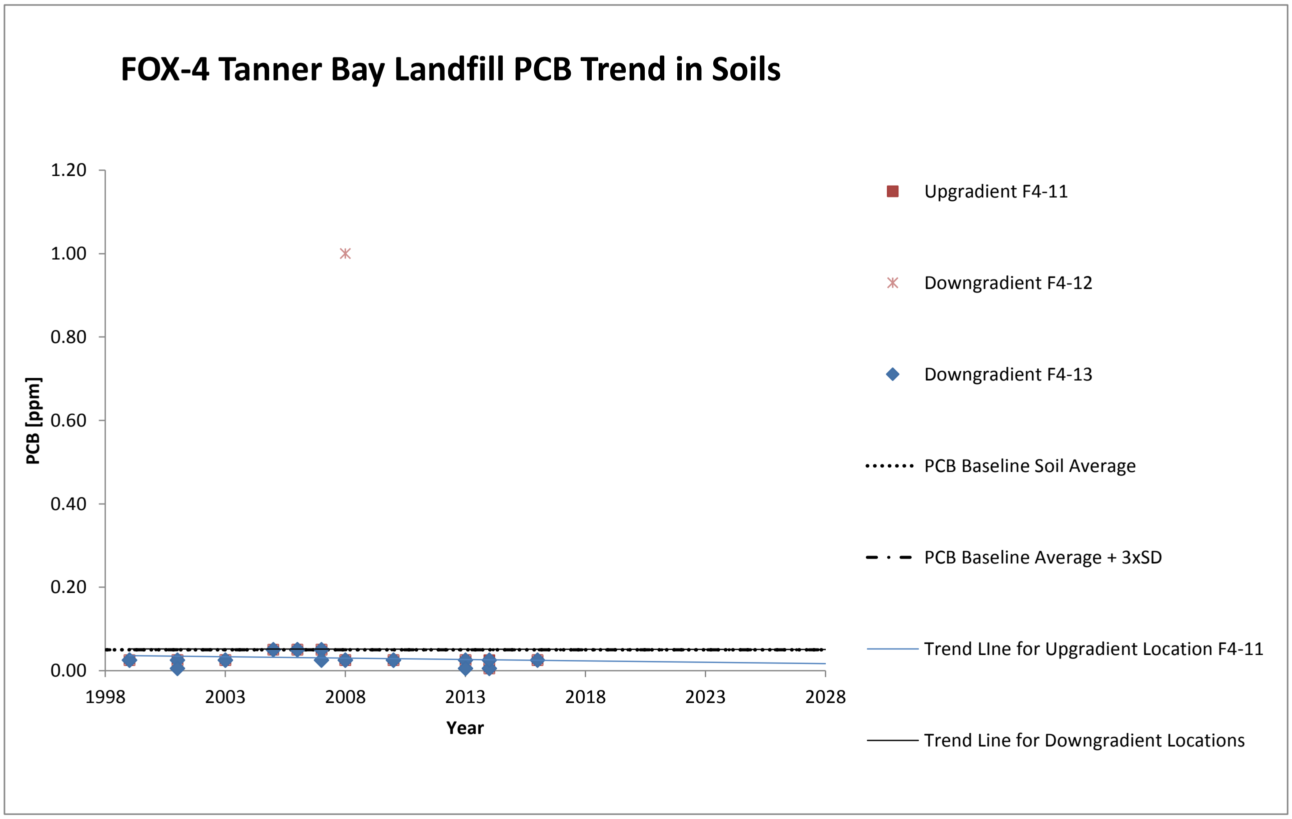




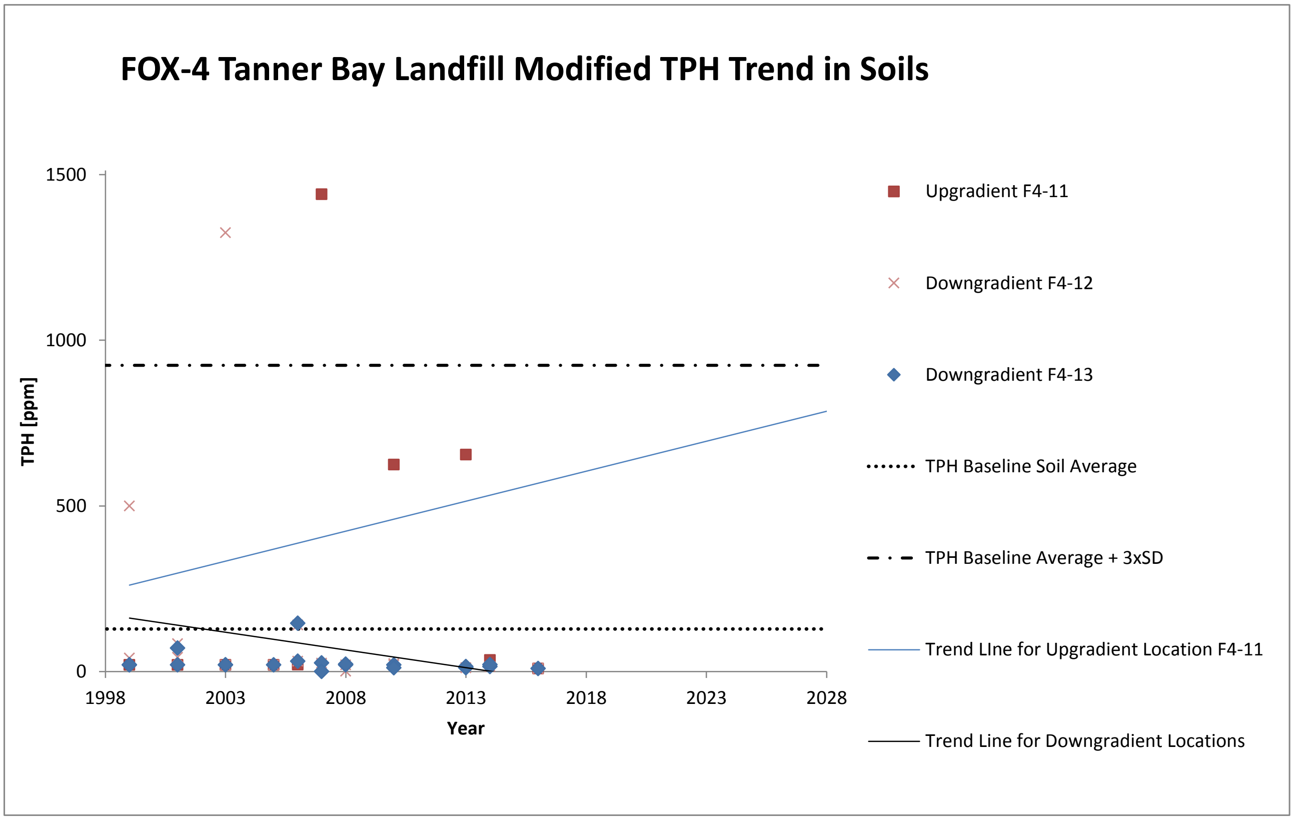
FOX-4 Tanner Bay Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)



Baseline samples were not analyzed for mercury at this location.



FOX-4 Tanner Bay Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)



FOX-4 Cape Hooper - Pallet Line Landfill - New Landfill Monitoring starting in 2014**

Sample ID	Location	Year	Monitoring Year	Monitoring Phase	Depth (cm)	Cu [mg/kg]	Ni [mg/kg]	Co [mg/kg]	Cd [mg/kg]	Pb [mg/kg]	Zn [mg/kg]	Cr [mg/kg]	As [mg/kg]	Hg [mg/kg]	Total PCB [mg/kg]	F1 C_6-C_{10} [mg/kg]	F2 C_{10}-C_{16} [mg/kg]	F3 C_{16}-C_{34} [mg/kg]	Modified TPH^ - Total C6-C34 [mg/kg]	TPH Identity	
																				% Fuel Oil	% Lube Oil
Background Average						30	24	9	0.62	6	41	41	29								
Baseline Data - Average						**27**	**17**	**3.9**	**1.0**	**10**	**37**	**39**	**37**	**0.10**	**0.050**				**26**		
Baseline Data - Standard Deviation						13.4	6.7	2.31	0.00	4	20.1	18.3	44.7	0.000	0.00				23		
Baseline Average + 3xStandard Deviation						67	37	10.8	1.0	22	98	94	171	0.100	0.05				94		
Detection Limit						3.0	5.0	5.0	1.0	10	15	20	0.20	0.10	0.050				10		
DEW Line Cleanup Tier I Criteria										*200*					*1*						
DEW Line Cleanup Tier II Criteria & site specific As criteria						*100*	*100*	*50*	*5*	*500*	*500*	*250*	*130*	*2.0*	*5*				*2500*		
Monitoring Data																					
Upgradient																					
	F4-25 Surface																				
F4-PAL-25-S	F4-25	2014	16	Phase II	0-15	23	14	**4.6**	<0.10	**10**	**38**	**50**	**38**	<0.050	<0.010	<10	<10	<10	15		
F4-25a	F4-25	2016	18	Phase II	0-15	22.7	13.7	**4.6**	**2.8**	8.4	33.3	**50.6**	31.9	<0.1	**0.27**	<7	<4	<8	9.5		
		2018	20	Phase II															#N/A		
		2023	25	Phase II															#N/A		
		2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
	F4-25 Depth																				
F4-PAL-25-D	F4-25	2014	16	Phase II	40-50	**33**	**23**	**7.4**	<0.10	6.8	**46**	**58**	**110**	<0.050	<0.010	<10	<10	<10	15		
Not sampled - refus	F4-25	2016	18	Phase II															#N/A		
		2018	20	Phase II															#N/A		
		2023	25	Phase II															#N/A		
		2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
	F4-26 Surface																				
F4-PAL-26-S	F4-26	2014	16	Phase II	0-15	18.0	12.0	3.2	<0.10	**33**	28	27	21	<0.050	0.036	<10	<10	24	**34**		
F4-26a		2016	18	Phase II	0-15	**31.3**	**27.3**	**7.7**	**3.2**	**15.8**	**41.3**	**61.1**	**60.9**	<0.1	**0.14**	<7	<4	259	**264.5**		
		2018	20	Phase II															#N/A		
		2023	25	Phase II															#N/A		
		2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
	F4-26 Depth																				
F4-PAL-26-D	F4-26	2014	16	Phase II	40-50	**61**	**43**	**12**	<0.10	7	**61**	**78**	*140*	<0.050	<0.010	<10	<10	<10	15		
Not sampled - refus	F4-26	2016	18	Phase II															#N/A		
		2018	20	Phase II															#N/A		
		2023	25	Phase II															#N/A		
		2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
Downgradient																					
	F4-27 Surface																				
F4-PAL-27-S	F4-27	2014	16	Phase II	0-15	11.5	5.7	2.85	<0.5	**10.5**	19	20	11.5	<0.10	<0.05	<10	16	32.5	**53.5**		
F4-27a	F4-27	2016	18	Phase II	0-15	**53.5**	**25.1**	**6**	**3.5**	**15.2**	**44.4**	**49.4**	23	<0.1	**0.16**	<7	<4	64	**69.5**		
		2018	20	Phase II															#N/A		
		2023	25	Phase II															#N/A		
		2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			0		
	F4-27 Depth																				
F4-PAL-27-D	F4-27	2014	16	Phase II	40-50	19	16	**4**	<0.10	**41**	28	30	11	<0.050	<0.010	190	2700	380	*3270*		
Not sampled - refus	F4-27	2016	18	Phase II															#N/A		
		2018	20	Phase II															#N/A		
		2023	25	Phase II															#N/A		
		2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		

FOX-4 Cape Hooper - Pallet Line Landfill - New Landfill Monitoring starting in 2014**

Sample ID	Location	Year	Monitoring Year	Monitoring Phase	Depth (cm)	Cu [mg/kg]	Ni [mg/kg]	Co [mg/kg]	Cd [mg/kg]	Pb [mg/kg]	Zn [mg/kg]	Cr [mg/kg]	As [mg/kg]	Hg [mg/kg]	Total PCB [mg/kg]	F1 C_6-C_{10} [mg/kg]	F2 C_{10}-C_{16} [mg/kg]	F3 C_{16}-C_{34} [mg/kg]	Modified TPH^ - Total C6-C34 [mg/kg]	TPH Identity	
																				% Fuel Oil	% Lube Oil
	F4-28 Surface																				
F4-PAL-28-S	F4-28	2014	16	Phase II	0-15	18	17.0	**6.1**	<0.10	5.9	31	31	7	<0.050	<0.010	<10	<10	34	**44**		
F4-28a (Dup Avg)	F4-28	2016	18	Phase II	0-15	**38**	**27**	**9.0**	<0.5	**14**	**63**	**55**	14	<0.1	<0.05	<6	<7	89	**95.5**		
		2018	20	Phase II															#N/A		
		2023	25	Phase II															#N/A		
		2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
	F4-28 Depth																				
F4-PAL-28-D	F4-28	2014	16	Phase II	40-50	**43**	**41**	**12**	0.11	9.3	**67**	**61**	14	<0.050	<0.010	<10	<10	10	20		
Not sampled - refus	F4-28	2016	18	Phase II															#N/A		
		2018	20	Phase II															#N/A		
		2023	25	Phase II															#N/A		
		2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
	F4-29 Surface																				
F4-PAL-29-S	F4-29	2014	16	Phase II	0-15	**46**	16.0	**5.6**	<0.10	**12**	**43**	**72**	17	<0.050	<0.010	<10	<10	130	**140**		
F4-29a	F4-29	2016	18	Phase II	0-15	**50.1**	<1.0	**9.8**	**4.9**	9.7	**54.6**	**72.1**	**37.4**	<0.1	**0.25**	<7	<4	<8	9.5		
		2018	20	Phase II															#N/A		
		2023	25	Phase II															#N/A		
		2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		
	F4-29 Depth																				
F4-PAL-29-D	F4-29	2014	16	Phase II	40-50	20	**37**	**9.6**	0.14	8.2	**61**	**84**	14	<0.050	<0.010	<10	<10	120	**130**		
Not sampled - refus	F4-29	2016	18	Phase II															#N/A		
		2018	20	Phase II															#N/A		
		2023	25	Phase II															#N/A		
		2028	30	Phase II															#N/A		
				Phase III															#N/A		
																			#N/A		
																			#N/A		
																			#N/A		

Note: Total Hydrocarbons (C_6-C_{34}) has been calculated by adding results for F1, F2 and F3.

** The Pallet Line Landfill originated from DEW Line operation activities. It was not part of the original monitoring which began in 1999.

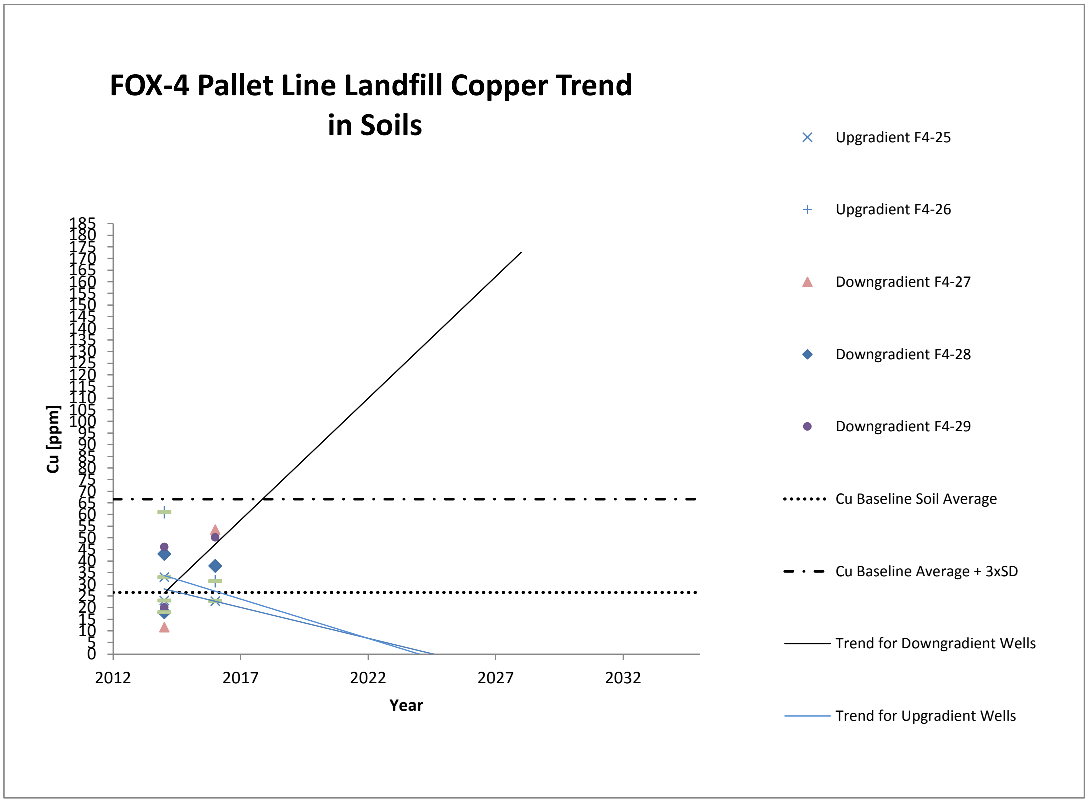
Additional regrading was performed in 2013 and monitoring locations were established for ongoing landfill monitoring.

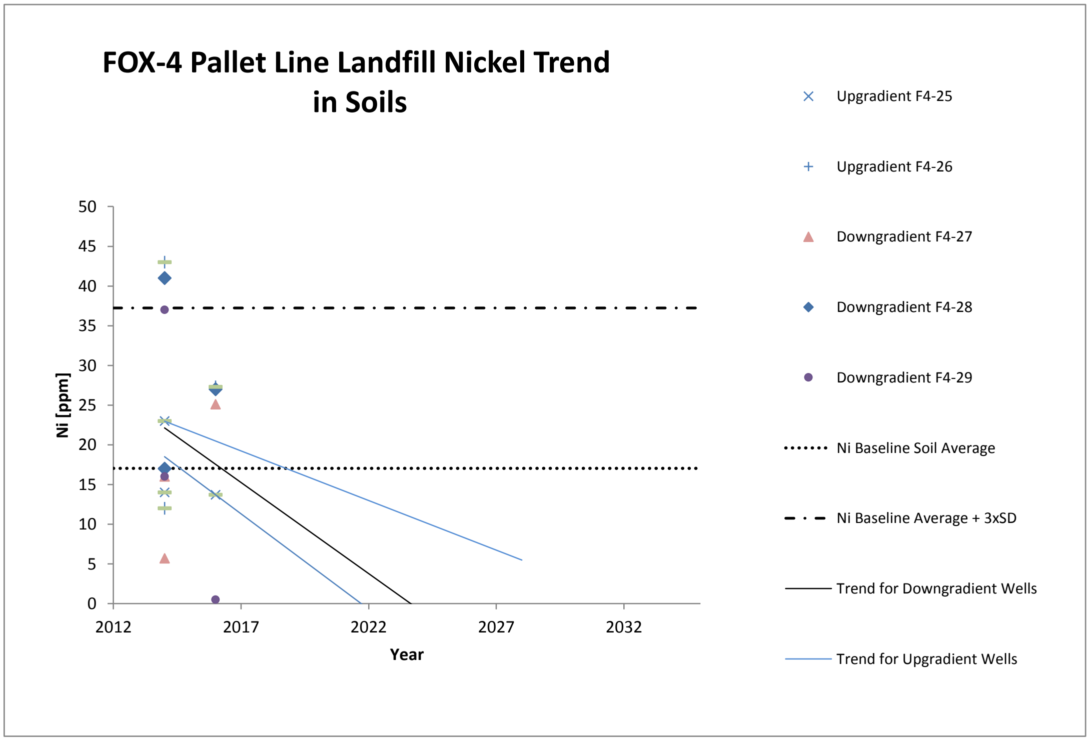
Legend	XX	sample exceeds background
	XX	**sample exceeds baseline**
	XX	*sample exceeds DLCU Tier I criteria*
	XX	*sample exceeds DLCU Tier II criteria*

FOX-4 Pallet Line Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)

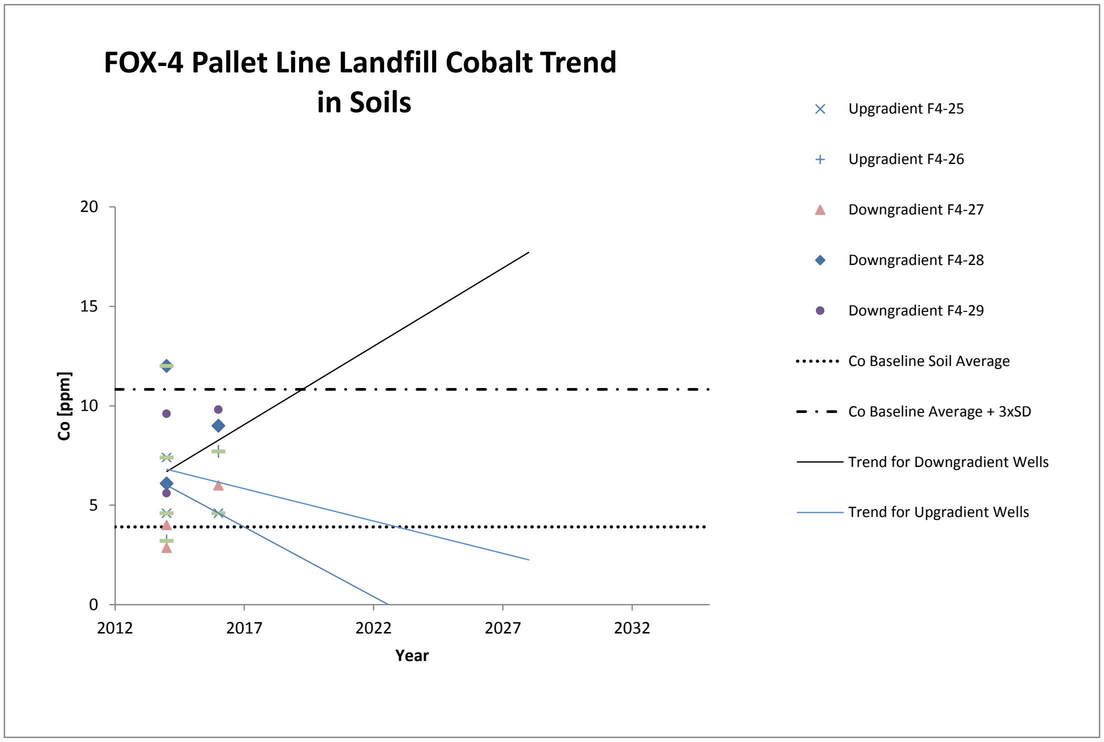
Where results are below detection, half of the detection limit has been used in the charts.

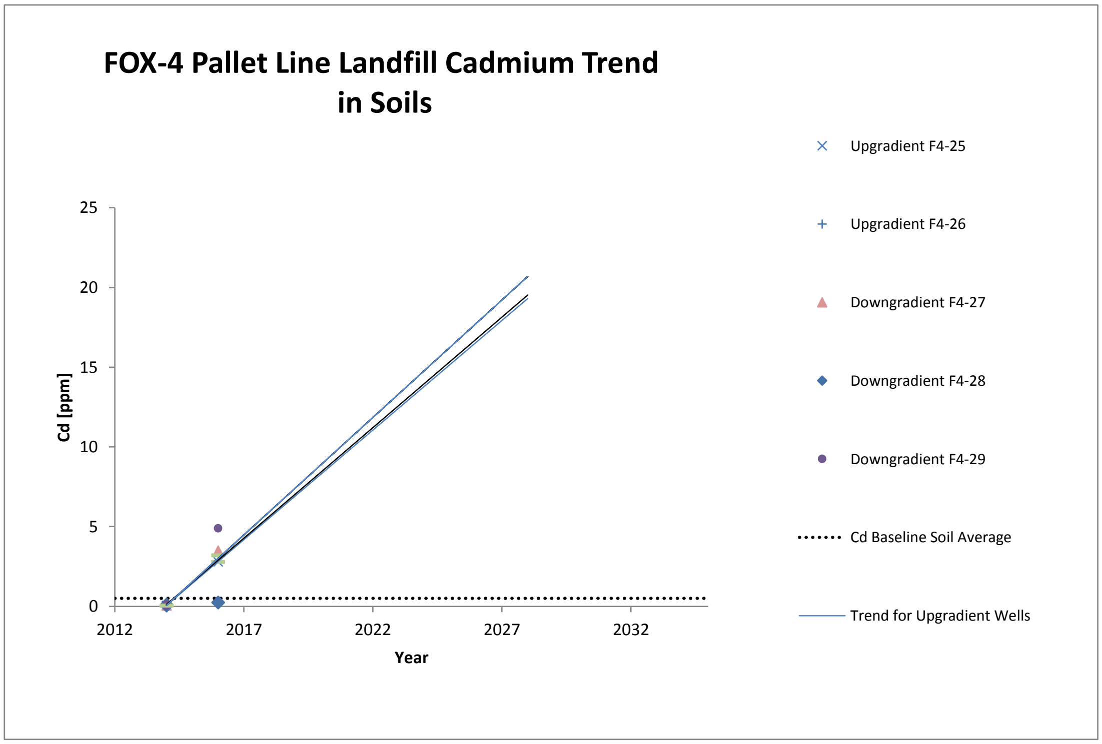
New monitoring locations were established in 2013 around the Pallet Line Landfill at FOX-4 and will be monitored as part of the landfill monitoring program.





FOX-4 Pallet Line Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)





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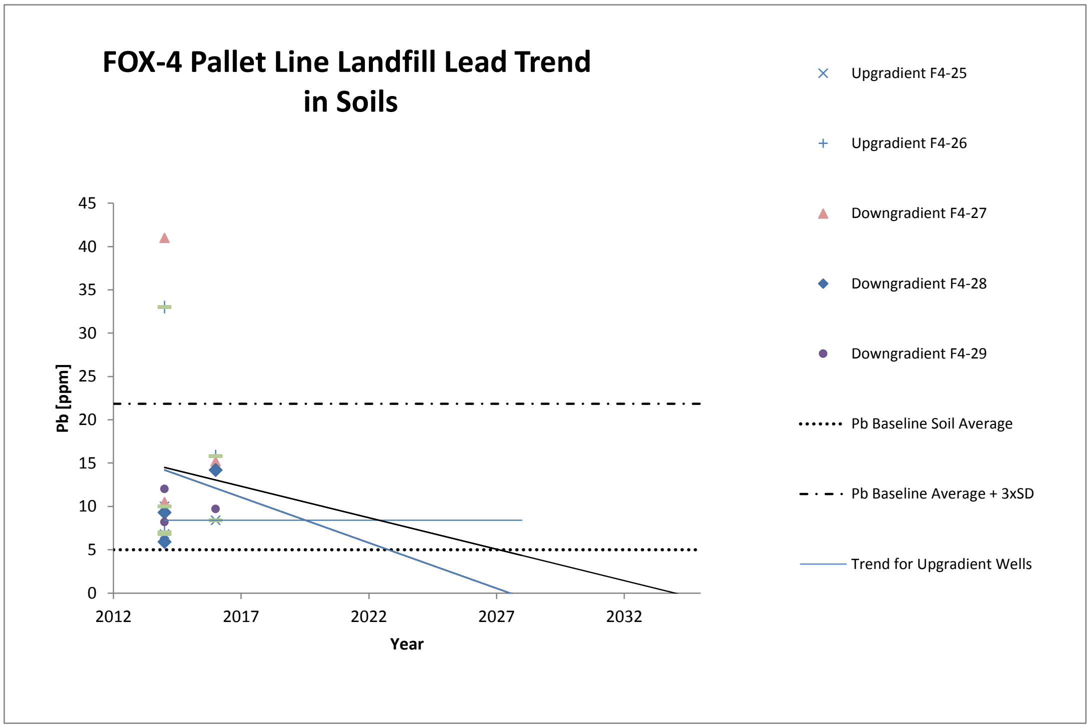
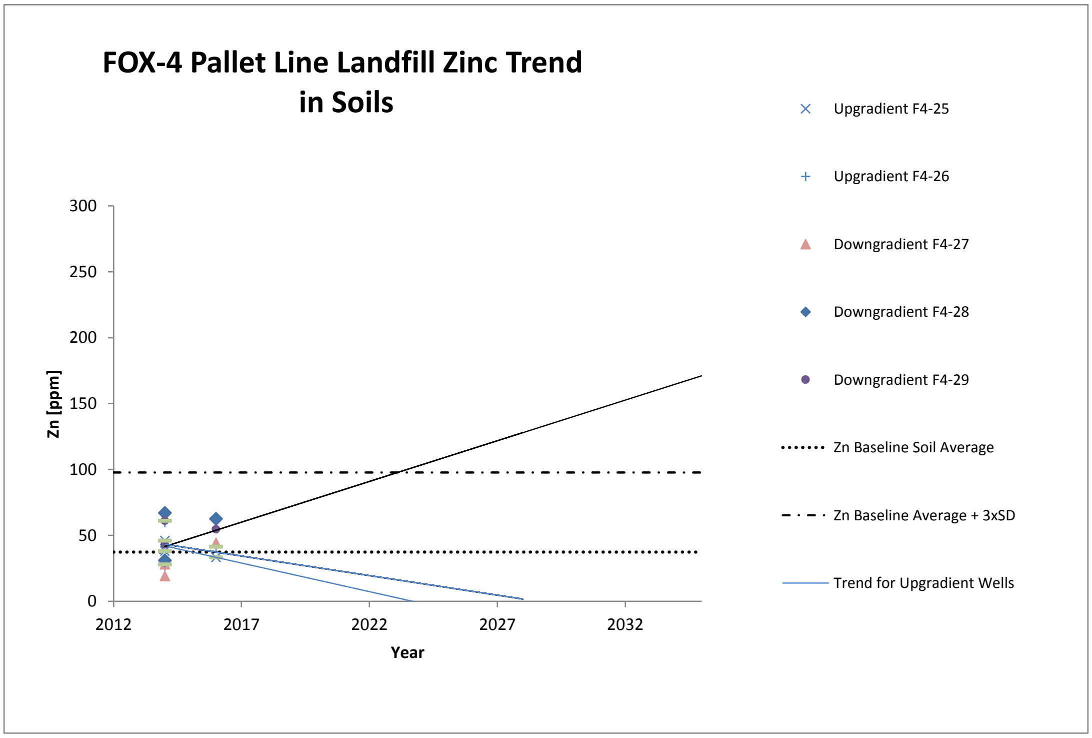
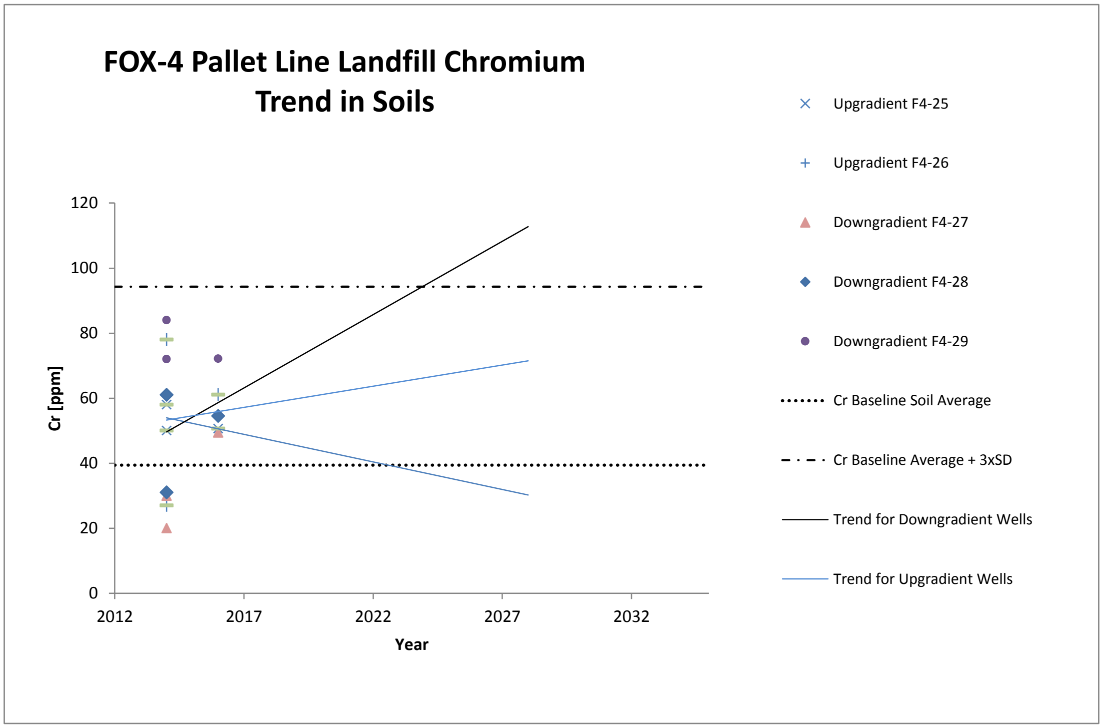
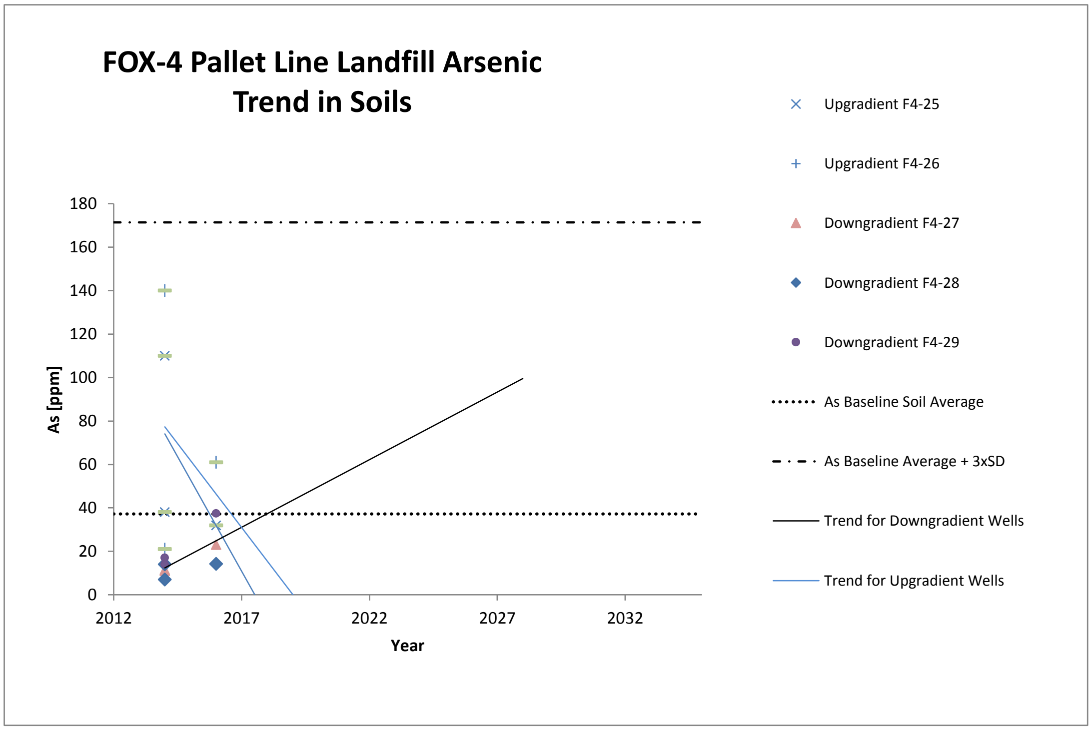
FOX-4 Pallet Line Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)



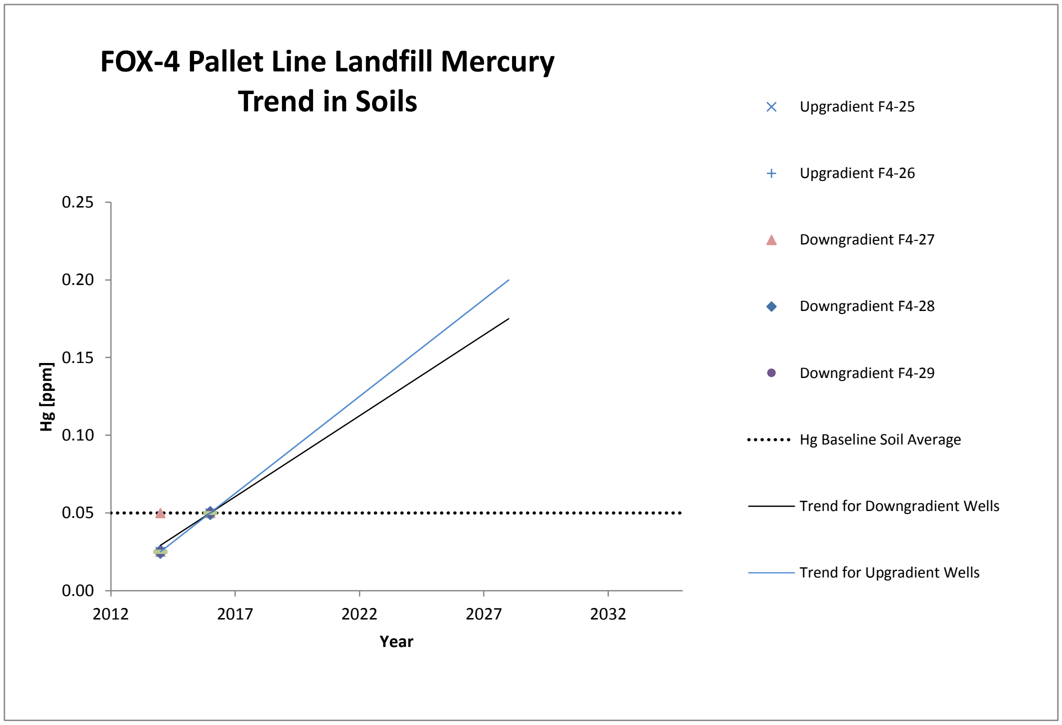


FOX-4 Pallet Line Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)





FOX-4 Pallet Line Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)



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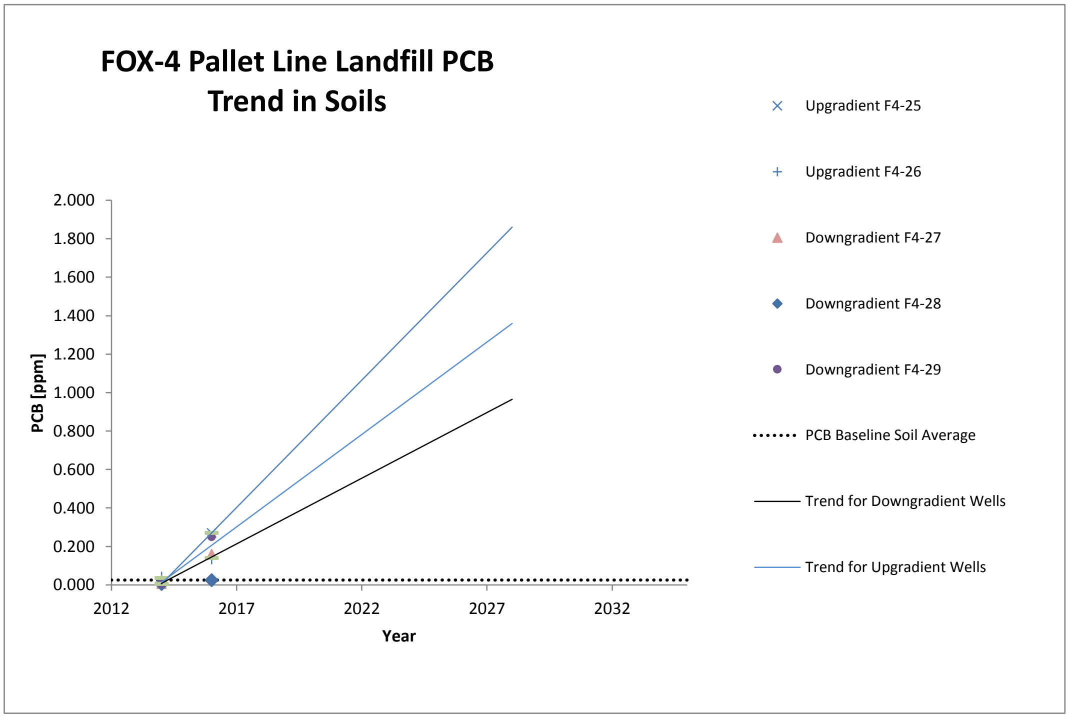
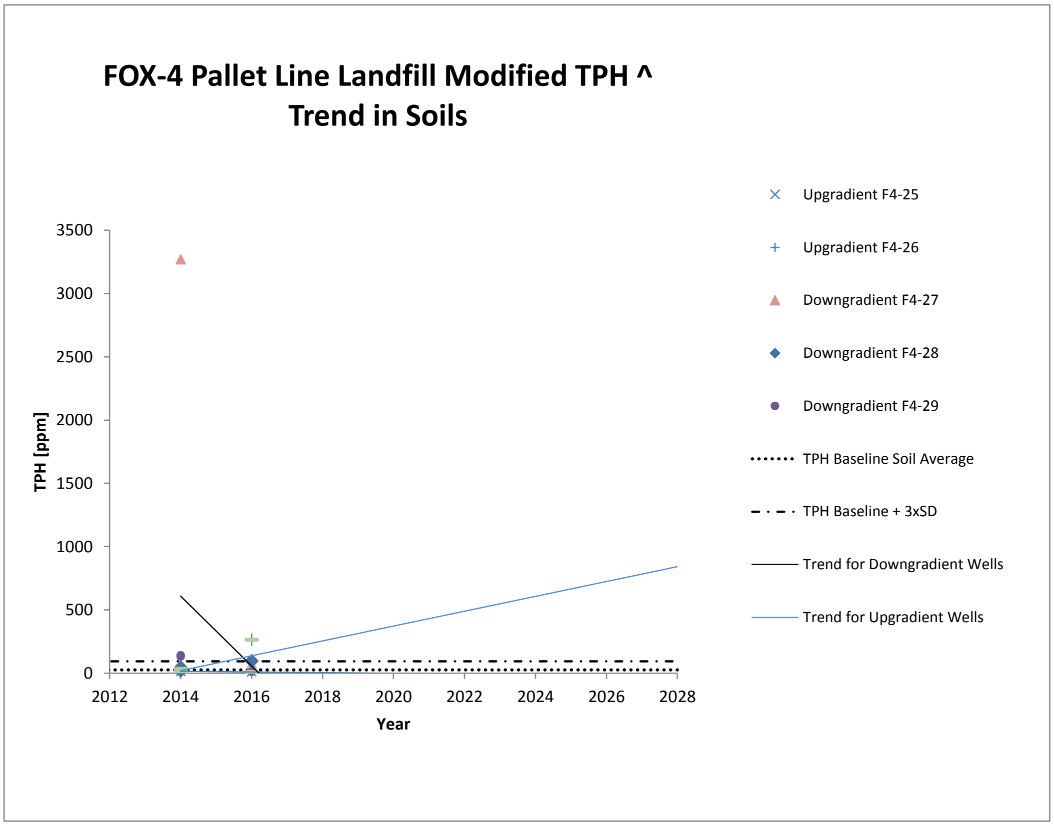


FOX-4 Pallet Line Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)



^ Total Hydrocarbons (C_6-C_{34}) has been calculated by adding results for F1, F2 and F3.

APPENDIX D

Photograph Log

Visual Inspection Photographs

Thermistor Photographs

Monitoring Well Photographs

Soil Sampling Photographs

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Photo 2: FOX-4 – NHWL/Tier II DF – Crest facing east (ATT11_Photo11.jpg)

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Photo 3: FOX-4 – NHWL/Tier II DF – West crest edge where landfill surface changes elevation facing east (ATT12_Photo12.jpg)

Photo 4: FOX-4 – NHWL/Tier II DF – Northwest toe facing southeast (ATT13_Photo13.jpg)

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Photo 5: FOX-4 – NHWL/Tier II DF – North crest facing east (ATT14_Photo14.jpg)

Photo 6: FOX-4 – NHWL/Tier II DF – North crest facing north (ATT15_Photo15.jpg)

Photo 7: FOX-4 – NHWL/Tier II DF – Ditch between landfills facing east – Feature L – Orange staining (Acceptable) (ATT16_Photo16.jpg)

Photo 8: FOX-4 – NHWL/Tier II DF – Crest surface facing southeast (ATT17_Photo17.jpg)

Photo 9: FOX-4 – NHWL/Tier II DF – Crest edge facing north (ATT18_Photo18.jpg)

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Photo 11: FOX-4 – NHWL/Tier II DF – East toe facing west (ATT20_Photo20.jpg)

Photo 12: FOX-4 – NHWL/Tier II DF – SE corner toe facing northwest (ATT21_Photo21.jpg)

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Photo 38: FOX-4 – NHWL/Tier II DF – Thermistor VT-6 (ATT112_Photo112.jpg)

Photo 39: FOX-4 – NHWL/Tier II DF – Thermistor VT-5 (ATT113_Photo113.jpg)

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Photo 44: *FOX-4 – NHWL/Tier II DF – Thermistor VT-5 (datalogger labeled T-2 moved to VT-2, formerly misidentified as VT-5A) (ATT122_Photo122.jpg)*

Photo 45: FOX-4 – NHWL/Tier II DF – Thermistor VT-6 (datalogger labeled T1 not moved) (ATT123_Photo123.jpg)

Photo 46: FOX-4 – NHWL/Tier II DF – Thermistor VT-4 (datalogger labeled T3 moved to VT-3) (ATT124_Photo124.jpg)

Photo 47: FOX-4 – NHWL/Tier II DF – Thermistor VT-2 (short datalogger cable) (ATT125_Photo125.jpg)

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Photo 52: FOX-4 – NHWL/Tier II DF – Soil sampling location MW11-01 after excavation (ATT31_Photo31.jpg)

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Photo 58: FOX-4 – NHWL/Tier II DF – MW11-03 (ATT41_Photo41.jpg)

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Photo 67: FOX-4 – NHWL/Tier II DF – Soil sampling location MW11-05 before excavation (ATT3_Photo3.jpg)

Photo 68: FOX-4 – NHWL/Tier II DF – Soil sampling location MW11-05 after excavation (ATT4_Photo4.jpg)

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Photo 70: FOX-4 – NHWL/Tier II DF – MW11-06 (ATT6_Photo6.jpg)

Photo 71: FOX-4 – NHWL/Tier II DF – Soil sampling location MW11-06 before excavation (ATT7_Photo7.jpg)

Photo 72: FOX-4 – NHWL/Tier II DF – Soil sampling location MW11-06 after excavation (ATT8_Photo8.jpg)

Photo 73: FOX-4 – NHWL/Tier II DF – Soil sampling location MW11-06 after backfilling (ATT9_Photo9.jpg)

Photo 74: FOX-4 – NHWL/Tier II DF – MW12-07 (ATT10_Photo10.jpg)

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Photo 79: FOX-4 – NHWL/Tier II DF – MW12-08 (ATT25_Photo25.jpg)

Photo 80: FOX-4 – NHWL/Tier II DF – Soil sampling location MW12-08 before excavation (ATT26_Photo26.jpg)

Photo 81: FOX-4 – NHWL/Tier II DF – Soil sampling location MW12-08 after excavation (ATT27_Photo27.jpg)

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Photo 83: FOX-4 – Helipad West Landfill - From helipad facing west (ATT26_Photo26.jpg)

Photo 84: FOX-4 – Helipad West Landfill – From toe facing east towards MW98-01 (ATT27_Photo27.jpg)

Photo 85: FOX-4 – Helipad West Landfill – Feature E – Minor settlement, facing north (Acceptable) (ATT28_Photo28.jpg)

Photo 86: FOX-4 – Helipad West Landfill – Crest facing north in area of previously observed vehicle tracks (Feature A not observed in 2016) (ATT29_Photo29.jpg)

Photo 87: *FOX-4 – Helipad West Landfill – NW toe facing southeast upslope – Previously observed settlement (Feature G) is uneven ground at centre and previously observed staining (Feature J) at right (ATT30_Photo30.jpg)*

Photo 88: *FOX-4 – Helipad West Landfill – Toe facing east upslope (ATT31_Photo31.jpg)*

Photo 89: FOX-4 – Helipad West Landfill – SW slope facing northwest – Feature B – Minor self armouring erosion channels (Acceptable) (ATT149_Photo149.jpg)

Photo 90: FOX-4 – Helipad West Landfill – South end of west slope facing north – Feature B – Minor self armouring erosion (Acceptable) (ATT150_Photo150.jpg)

Photo 91: FOX-4 – Helipad West Landfill – Toe of slope facing east – Feature C – Minor self armouring erosion channels (Acceptable) (ATT153_Photo153.jpg)

Photo 92: FOX-4 – Helipad West Landfill – Crest of slope facing northwest – Feature D – Minor self armouring erosion at top of slope (Acceptable) (ATT143_Photo143.jpg)

Photo 93: FOX-4 – Helipad West Landfill – Previously observed vehicle tracks (Feature A) not considered noteworthy in 2016, facing southwest downslope (ATT148_Photo148.jpg)

Photo 94: FOX-4 – Helipad West Landfill – Feature F – Minor settlement or uneven ground (Acceptable), facing south (ATT146_Photo146.jpg)

Photo 95: FOX-4 – Helipad West Landfill – Feature F – Close up of minor settlement areas with cap for scale (Acceptable), facing south (ATT147_Photo147.jpg)

Photo 96: FOX-4 – Helipad West Landfill – NW toe facing northwest – Previously observed settlement (Feature G) appears to be area of uneven ground and not considered noteworthy in 2016 (ATT157_Photo157.jpg)

Photo 97: FOX-4 – Helipad West Landfill – Slope above landfill facing south – Feature H – Previously observed settlement area with small sinkholes (Acceptable) (ATT141_Photo141.jpg)

Photo 98: FOX-4 – Helipad West Landfill – West toe facing north – Feature I – Minor sink holes at edge of coarse rock fill (Acceptable) (ATT154_Photo154.jpg)

Photo 99: FOX-4 – Helipad West Landfill – Feature J – Orange staining and seepage with sheen, soft saturated ground – West toe facing east (Acceptable) (ATT155_Photo155.jpg)

Photo 100: FOX-4 – Helipad West Landfill – Feature J – Orange staining with no seepage at time of 2016 inspection – West toe facing southeast (ATT156_Photo156.jpg)

Photo 101: FOX-4 – Helipad West Landfill – Slope above landfill and below helipad facing west– Feature K – previously observed exposed wires (Acceptable) (ATT145_Photo145.jpg)

Photo 102: FOX-4 – Helipad West Landfill – Slope east of MW98-06 facing south – Feature L – Exposed steel pipe (Acceptable) (ATT142_Photo142.jpg)

Photo 103: FOX-4 – Helipad West Landfill – Slope northwest of landfill facing northwest – Feature M – Self-armouring erosion (Acceptable) (ATT140_Photo140.jpg)

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Photo 106: FOX-4 – Helipad West Landfill – West slope west – Feature C – Self-armouring erosion (Acceptable) (ATT152_Photo152.jpg)

Photo 107: FOX-4 – Helipad West Landfill – MW98-01 (ATT83_Photo83.jpg)

Photo 108: FOX-4 – Helipad West Landfill – Soil sampling location MW98-01 before excavation (ATT84_Photo84.jpg)

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Photo 110: FOX-4 – Helipad West Landfill – Soil sampling location MW98-01 after backfilling (ATT86_Photo86.jpg)

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Photo 111: FOX-4 – Helipad West Landfill – MW98-02 monitoring well casing full of water and bentonite (ATT79_Photo79.jpg)

Photo 112: FOX-4 – Helipad West Landfill – Soil sampling location MW98-02 before excavation (ATT80_Photo80.jpg)

Photo 113: FOX-4 – Helipad West Landfill – Soil sampling location MW98-02 after excavation (ATT81_Photo81.jpg)

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Photo 115: FOX-4 – Helipad West Landfill – MW98-03 (ATT87_Photo87.jpg)

Photo 116: FOX-4 – Helipad West Landfill – Soil sampling location MW98-03 before excavation (ATT88_Photo88.jpg)

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Photo 125: FOX-4 – Station Area Landfill – North side facing west and MW98-08 – Feature L (staining) and Feature B (ponded water) in background (Acceptable) (ATT24_Photo24.jpg)

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Photo 131: FOX-4 – Station Area Landfill – Crest surface facing east – Feature C – Minor self-armouring erosion (Acceptable) (ATT139_Photo139.jpg)

Photo 132: FOX-4 – Station Area Landfill – Feature E – Sink holes along south edge of landfill, facing southeast (Acceptable) (ATT132_Photo132.jpg)

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Photo 133: FOX-4 – Station Area Landfill – Feature F – Sink holes along south edge of landfill, facing southwest (Acceptable) (ATT138_Photo138.jpg)

Photo 134: FOX-4 – Station Area Landfill – Central crest surface facing southwest – Feature G – Previously observed minor settlement (<0.1 m deep) may just be rough grading (Acceptable) (ATT133_Photo133.jpg)

Photo 135: FOX-4 – Station Area Landfill – West toe facing north – Feature L – Orange staining (Acceptable) (ATT136_Photo136.jpg)

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Photo 148: FOX-4 – Station Area Landfill – MW98-09 with bentonite inside protective casing (ATT74_Photo74.jpg)

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Photo 153: FOX-4 – Pallet Line Landfill – Southwest slope and toe facing southeast (ATT2_Photo2.jpg)

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Photo 155: FOX-4 – Pallet Line Landfill – Northwest corner facing southeast (ATT4_Photo4.jpg)

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Photo 161: FOX-4 – Pallet Line Landfill – Previously observed ponded water (Feature A) not observed in 2016 – East end facing southwest (ATT95_Photo95.jpg)

Photo 162: FOX-4 – Pallet Line Landfill – Crest surface of landfill facing north – Feature B – Minor dark (potential hydrocarbon) staining not related to landfill performance (Acceptable) (ATT94_Photo94.jpg)

Photo 163: FOX-4 – Pallet Line Landfill – Soil sample location F4-25 before excavation (ATT49_Photo49.jpg)

Photo 164: FOX-4 – Pallet Line Landfill – Soil sample location F4-25 after excavation (ATT50_Photo50.jpg)

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Photo 166: FOX-4 – Pallet Line Landfill – Soil sampling location F4-26 before excavation (ATT52_Photo52.jpg)

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Photo 176: FOX-4 – Pallet Line Landfill – Soil sampling location F4-29 before excavation (ATT34_Photo34.jpg)

Photo 177: FOX-4 – Pallet Line Landfill – Soil sampling location F4-29 after excavation (ATT35_Photo35.jpg)

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Photo 183: FOX-4 – Tanner Bay Landfill – Southwest slope facing northeast (ATT36_Photo36.jpg)

Photo 184: FOX-4 – Tanner Bay Landfill – Southeast crest edge facing northeast (ATT37_Photo37.jpg)

Photo 185: FOX-4 – Tanner Bay Landfill – Crest surface facing northeast – Feature A – Minor settlement area with weathered crack (Acceptable) (ATT159_Photo159.jpg)

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