SCS ENGINEERS







Olympic View Sanitary Landfill (OVSL)
Sampling and Analysis Plan

Presented to:

Waste Management

WM

Presented by:

SCS ENGINEERS
2405 140th Avenue NE, Ste 107
Bellevue, WA 98005
(425) 746-4600

December, 2009
File No. 04204027.08

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REVISION HISTORY

Revision Number	Date	Changes/Additions

1.0 INTRODUCTION

SCS Engineers has prepared this Sampling and Analysis Plan (SAP) for environmental monitoring at the Olympic View Sanitary Landfill (OVSL) on behalf of Olympic View Sanitary Landfill, Inc. The plan presents field sampling, analytical and quality assurance procedures for groundwater, stormwater, leachate and landfill gas monitoring. The purpose of this plan is to provide the direction and guidance necessary to perform consistent, quality-assured environmental monitoring at the site.

The Olympic View Sanitary Landfill is a closed landfill facility on a 400-acre site located in Kitsap County, Washington. The facility address is 10015 SW Barney White Road, Port Orchard, Washington. Former refuse fill areas cover approximately 65 acres of the site.

OVSL accepted municipal solid waste between 1967 and 2003. During January 2001, OVSL entered into Agreed Order No. DE 00SWFAPNR-1729 (Agreed Order) with the Washington Department of Ecology. The Agreed Order defined a phased strategy for a remedial investigation and feasibility study, primarily focused on groundwater contamination associated with past landfill operations. The order also specifically required continued environmental monitoring at the site.

The landfill was closed in accordance with Washington Administrative Code (WAC) 173-351-500, Criteria for Municipal Solid Waste Landfills. Landfill closure included construction of a landfill gas monitoring system, an active landfill gas extraction and treatment system, a leachate collection and treatment system, a surface water drainage control system, and a final cover. The landfill controls were constructed in stages and the closure was completed in 2004.

This sampling and analysis plan (SAP) was developed based on the 2009 revised monitoring plan (Engineering Management Support, Inc., 2009). This document reflects the current post closure monitoring requirements for the landfill and supersedes any previous versions of the SAP established for the facility.

1.1 PURPOSE AND SCOPE

The purpose of this document is to present the field and analytical procedures to be used to perform groundwater, stormwater, leachate and landfill gas migration monitoring at the closed OVSL facility.

This plan formally documents the groundwater, stormwater, leachate and landfill gas migration monitoring required for the closed landfill by the post-closure sections of WAC 173-351, as well as those monitoring requirements related to the Agreed Order in accordance with WAC 173-351-410. The plan presents sampling procedures, analytical methods, and data evaluation techniques designed to ensure that the monitoring results provide an accurate representation of the environmental conditions at the site.

The plan also identifies data quality objectives for the groundwater monitoring program, and presents the data generation, assessment and validation procedures to ensure that the collected data will achieve its planned quality assurance/quality control (QA/QC) performance criteria.

2.0 SITE BACKGROUND

2.1 SITE LOCATION AND DESCRIPTION

The closed OVSL facility is located on an approximately 400 acre site within Sections 3 and 10, Township 23N, Range 1W of the Willamette Meridian, in Kitsap County, Washington. The facility is situated on an upland area approximately 10 miles southwest of the city of Bremerton. The facility address is 10015 SW Barney White Road, Port Orchard, Washington. The former refuse fill area covers approximately 65 acres of the site. A site location map is shown on Figure 1.

The OVSL facility accepted municipal solid waste between 1967 and 2003. Landfill closure was completed in 2004, in accordance with Washington Administrative Code (WAC) 173-351. Landfill closure included final construction of a landfill gas monitoring system, an active landfill gas extraction and treatment system, a leachate collection and treatment system, a surface water drainage control system, and a final cover.

The active landfill gas extraction system consists of a total of 92 well heads (70 vertical wells, 7 horizontal wells, and 15 interconnections to the leachate collection system) connected to a gas treatment flare station. The leachate collection and treatment system consists of subgrade piping, a leachate collection lagoon and an evaporator unit. The surface water drainage control system controls storm water flow and minimizes erosion and offsite migration of sediment-bearing water. Drainage and erosion protection improvements include hydroseeding, a toe underdrain, downchutes, culverts, and drainage ditches.

2.2 TOPOGRAPHY AND CLIMATE

The site is located in the Southern Upland of the Kitsap Peninsula adjacent to the Union River-Gorst Creek trough. The site topography ranges from approximately 150 to 360 feet above mean sea level (msl). The land surface generally slopes towards the west-southwest towards the Union River, which is located approximately a half-mile west of the site.

Kitsap County's climate is characterized as maritime, with long, mild, wet winters and short, cool, dry summers. Climatically, and due to the local relief, there can be significant variations in total annual rainfall and average temperatures over short distances.

2.3 LOCAL AND REGIONAL HYDROGEOLOGY

The regional near-surface geology in the vicinity of OVSL is dominated by glacio-fluvial and glacio-lacustrine deposits associated with the Vashon glaciation. The site conceptual model for OVSL (Parametrix, 2007) identifies the following main stratigraphic units: Organic Soils and Peat (Qw); Alluvium (Qal); Vashon Recessional Outwash (Qvr); Vashon Lacustrine Recessional Outwash (Qvrl); Vashon Till (Qvt), Vashon Advance Outwash (Qva); Vashon Advance Lacustrine Deposits (Qval) and Pre-Vashon Deposits (Qpvu). With the exception of the Vashon Till (which has not been confirmed to be present at the site), all of these units appear to be represented at the landfill.

Geologic investigation (OVSL Remedial Investigation, Parametrix, 2007) indicates that organic soils/peat, alluvium, outwash, glacio-fluvial, glacio-lacustrine and flood plain deposits outcrop along the west-central portions of the OVSL property. Groundwater is present beneath the site at depths ranging between near-surface and 80 feet below ground surface (bgs), or at elevations ranging between 140 and 255 feet above msl. The groundwater flow direction beneath the landfill is towards the west.

3.0 GROUNDWATER MONITORING PROGRAM

Quarterly groundwater monitoring is performed at the OVSL in accordance with the January 2001 Agreed Order and as modified through recent technical discussions with Ecology. The monitoring also meets the requirements of the Criteria for Municipal Solid Waste Landfills (WAC 173-351-430) which are administered through a solid waste permit issued by the Kitsap County Health District (KCHD).

3.1 REGULATORY BACKGROUND

The Agreed Order established a specific monitoring plan which complemented monitoring under WAC 173-351. In 2006, a sampling and analysis plan (SAP) was developed documenting the monitoring to be conducted under the Agreed Order until the remedial investigation, as outlined in the Agreed Order, was completed and a new monitoring plan was proposed and approved by Ecology.

This sampling and analysis plan (SAP) was developed based the 2009 revised monitoring plan (Engineering Management Support, Inc., 2009). This new plan covers the compliance monitoring that will be conducted at the OVSL from 2009 forward. The plan reflects a refined understanding of the site conditions based on the completed remedial investigations, and addresses future monitoring objectives (e.g. corrective action monitoring).

3.2 GROUNDWATER MONITORING NETWORK

The groundwater monitoring network at OVSL includes monitoring wells that are routinely sampled as well as those that are currently only used for water level measurement. The locations of the groundwater monitoring wells in the network are illustrated on Figure 2. Completion details for monitoring wells to be sampled are shown on Table 1. Table 2 provides summary information for those wells used only for water level measurement.

Of the 22 monitoring wells that will be routinely sampled, four are upgradient wells (MW-13A, MW-13B, MW-16 and MW-35), and six are downgradient wells (MW-9, MW-29A, MW-32, MW-33A, MW-33C and MW-36A). Six wells are compliance monitoring wells (MW-15R, MW-34A, MW-34C, MW-39, MW-42 and MW-43). Six are performance monitoring wells (MW-2B1, MW-4, MW-19C, MW-20, MW-23A and MW-24). Each of the wells designated for routine sampling has been outfitted with a dedicated sampling pump (QED Well Wizard) suitable for low-flow purging and sampling. Table 3 summaries the different categories of monitoring wells that will be routinely sampled for water quality.

Well completion depths range from approximately 9 to 260 feet below ground surface. Screen intervals are varied, ranging from between 5 and 20 feet, with most of the well screens being 10 feet in length. Construction data and lithological logs for the groundwater monitoring network wells are presented in the *Report of 2005 Gas Probe and Monitoring Well Installations at OVSL (SCS Engineers, June 2006)* and the *Remedial Investigation Report, OVSL, Kitsap County (*Parametrix, *2007).*

3.3 MONITORING SCHEDULE

Groundwater monitoring will be conducted on a quarterly basis. The quarterly events will be scheduled for each of the spring, summer, fall and winter seasons in a given monitoring year. Specific dates for each quarterly event should not vary significantly between successive monitoring years. It is recommended that sampling be conducted in the months of March, June, September, and December every year. The Kitsap County Health District and Ecology shall be notified seven days in advance of groundwater sampling events.

A summary of the groundwater monitoring program for OVSL, including the well sampling frequency and analytical testing schedule, is provided in Table 3.

3.4 PARAMETERS AND ANALYTICAL METHODS

The analytical parameters to be tested for during quarterly groundwater monitoring at the OVSL facility include the Appendix I and II parameter suite, as follows:

- Field Measurements: temperature, specific conductivity, pH, dissolved oxygen turbidity, and static water level.
- Dissolved Metals: antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, nickel, selenium, silver, thallium, vanadium, and zinc.
- Volatile Organic Compounds: (VOCs) as listed in WAC 173-351 Appendix I.
- Geochemical Indicator Parameters: chloride, sulfate, nitrate, calcium, sodium, bicarbonate, alkalinity, magnesium, potassium, iron, and manganese.
- Leachate Indicator Parameters: ammonia, total organic carbon, and total dissolved solids.

As summarized on Table 3, Appendix I and II groundwater parameters will be analyzed quarterly. In addition, selected groundwater wells will be periodically analyzed for Appendix III parameters, including:

- Semi-Volatile Organic Compounds (SVOCs).
- Polychlorinated Biphenols (PCBs).
- Pesticides.
- Herbicides.

If an Appendix III constituent is detected, it will be added to the monitoring program.

Analytical parameters to be tested for during groundwater monitoring at the OVSL facility, along with the analytical methods recommended for each specific analyte, are provided in Tables 4 through 7. Where an applicable groundwater standard has been developed for an analyte, this information has been included in the tables as a reference. All metals determinations will be for dissolved metals (i.e. filtration will be conducted in the field).

Laboratory methods acceptable for analysis of groundwater samples are to be among those described in EPA publication number SW-846, Test Methods for Evaluating Solid Waste Physical/Chemical Methods. All laboratory analyses must be completed by an accredited laboratory in accordance with WAC 173-50, Accreditation of Environmental Laboratories. Recommended practical quantification limits (PQLs), or reporting limits, are listed in Tables 4 to 7.

3.5 GROUNDWATER MONITORING FIELD PROCEDURES

Field activities will consist of: describing well conditions; obtaining field measurements for water level elevation, pH, specific conductance, temperature, dissolved oxygen and turbidity; collecting groundwater samples for laboratory analysis; and packaging and shipping the samples to the laboratory.

The depth to the static water level (SWL) will be measured in each monitoring well before commencing well purging and groundwater sampling at each location. Depth to water measurements at wells which are not sampled for water quality information will typically be collected over the course of a single day. The remaining depth to water measurements will be recorded over the following two or three day period, based on the groundwater sampling schedule. All quarterly depth to water measurements will be obtained within a five-day period, which given the lack of tidal influence or rapid water table fluctuations at the site, is anticipated to provide a representative snapshot of the seasonal groundwater flow regime.

Specific conductance, pH, dissolved oxygen, turbidity and groundwater temperature measurements will be taken during well purging to ensure the collection of a representative groundwater sample. Field instruments will be calibrated in accordance with manufacturer's guidelines. An accurate record of all sampling activities, field measurements, equipment calibration, and site observations made during each quarterly monitoring event will be maintained in a field log.

The following subsections describe general procedures for the decontamination of field equipment, purging of wells, acquisition of field measurements, groundwater sampling, sample packaging and shipping, and record keeping.

3.5.1 Equipment Decontamination

All non-disposable equipment that is exposed to well water (specifically the water level probe) will be decontaminated between wells with a three-point wash. Decontamination of equipment must be completed before leaving each well head, therefore eliminating cross contamination. The wash will consist of:

- Non-phosphate detergent (such as Alconox) and water wash
- Tap water rinse

- Deionized water rinse

If personnel are exposed to well water (i.e. hands, face), wash with deionized water. Wash with liquid soap and water when possible. Disposable gloves (latex/nitrile) should be discarded after each use and prior to leaving each well head. Gloves can be discarded into regular trash. An equipment list for routine groundwater monitoring at the OVSL is presented on Table 8.

3.5.2 Monitoring Well Purging and Sampling Procedures

All of the groundwater monitoring wells at the OVSL which are designated for sample collection are equipped with dedicated Well Wizard™ bladder (positive displacement-type) pumps manufactured by QED Environmental Systems, Inc. Use of this type of dedicated pumping apparatus helps minimize sampling artifacts as well as the potential for cross contamination between wells, and eliminates the need for decontamination of sampling pumps. Each dedicated bladder pump is positioned with its inlet located within the screened interval of the well.

Purging and sampling of the monitoring wells at the site will be conducted using low-flow/low-volume well sampling techniques. Low-flow/low-volume methods can be used to overcome many of the limitations created by traditional fixed well volume purging (i.e. purge 3 – 5 well volumes). Low-flow sampling can control sample turbidity and minimize sample chemistry alteration by pumping at very low flow rates from the well screen zone, avoiding disturbance to the water column in the well and minimizing stress on the surrounding formation. By pumping water only from the screen zone and not drawing water from the casing above the screen (if present), the volume of water purged to achieve stable water chemistry can be reduced significantly. Samples obtained in this manner will best reflect the groundwater chemistry at each location beneath the site.

Each well's pump has been "set tested" to determine, and document, the specific well's optimum pumping rate (between 100ml/min and 500 ml/min) that would result in achieving a minimal drawdown of the initial static water level (SWL). Steady state drawdown during well purging should not exceed 0.3 feet. Once established, this flow rate will be reproduced for each subsequent sampling event. If a significant change in initial water level occurs between events, it may be necessary to reestablish the optimum flow rate at each sampling event. All water purged from the monitoring wells at the landfill will be collected and discharged to the leachate pond on site.

3.5.3 Monitoring Well Purging and Field Measurements

Prior to the initiation of purging a well, the static water level will be measured and documented. Depth to water measurements at wells which are not sampled for water quality information will typically be collected over the course of a single day, dependant on site conditions. At wells to be sampled for water quality, the well's dedicated pump will be started utilizing its documented control settings and its flow rate will be confirmed by volumetric discharge measurement (using a graduated container and stop watch, or by measuring the total volume discharged per cycle and verifying the number of pump cycles per minute specified by the controller). If necessary, any minor modifications to the control settings to achieve the well's optimum flow rate will be documented on the field log.

When the optimum pump flow rate has been established and at least one pump system volume (bladder volume + discharge tubing volume) has been purged, field measurements for pH, temperature (T), conductivity (Ec), turbidity, and dissolved oxygen (DO) will commence. All water chemistry field measurements will be documented on the field log. A closed, in-line flow-through cell will be used to monitor indicator parameters.

Purging will continue until indicator parameters have stabilized. Indicator parameters will be considered stable when three consecutive readings fall within the prescribed ranges (discussed below) for the parameters of interest. Rigid numerical criteria for stabilization (as opposed to evaluating the slope of the graphs of the parameters vs. time) can be problematic as the ability of numerical criteria to identify stability is influenced by the accuracy and repeatability of field instruments, flow rate, and duration between measurements. The frequency of readings will therefore be based on the time required to purge one volume of the flow cell. For example, a 500-ml flow cell purged at a rate of 250 ml/minute will be purged in two minutes, so readings should be at least two minutes apart. If the flow rate is 100 ml/min, the readings should be at least 5 minutes apart, etc.

To account for the accuracy and repeatability of field instruments, indicator parameters and the ranges for stabilized values are as follows:

- Temperature: ± 0.5° C
- pH: ± 0.2 units
- Conductance: ± 5.0 % of reading
- Dissolved oxygen: ± 0.2 mg/L
- Turbidity ± 10% NTU or < 5 NTU

When water quality parameters have stabilized, and there has been no change in the pumping water level (i.e. drawdown has stabilized), sample collection may begin. The final, stabilized indicator parameter values will be reported with the analytical data.

Monitoring Well Groundwater Sampling Procedure

1. Calibrate all field instruments at the start of each day's deployment per the instrument manufacturer's instructions. Record calibration data on the "Field Instruments Calibration Documentation Form."

2. Drive to the first well scheduled to be sampled (typically the least contaminated; this practice will be continually reviewed in light of the analytical results). Make notes in the field log book describing the well condition and activity, if any, in the vicinity of the well. Decontaminate the portable water gauging probe by washing with phosphate-free detergent, rinsing with potable water and rinsing with deionized water.

3. Measure the depth to water from the surveyed reference mark on the wellhead and record the measurement on the groundwater sampling data sheet. Lock the water level meter in place so that the level can be monitored during purging and sampling.

When placing the probe in the well, take precautions to not disturb or agitate the water.

4. Connect the compressed air source's airline to the pump controller's "AIR IN" connection. If utilizing a gas-engine operated compressor, locate the compressor at least 25 feet, downwind from the wellhead.

5. Connect the pump controller "AIR OUT" air-line to the bladder pump's air supply fitting at the wellhead.

6. Connect the pump discharge line to the In-Line flow cell's "IN" fitting.

7. Connect the Flow Cell's "OUT" line and secure to drain the purge water into the purge water collection container.

8. Start the air supply to the pump. Set the pump controller settings to the documented settings for the specific well. Confirm the flow rate is equal to the well's established optimum flow rate. Modify as necessary (documenting any required modifications).

9. Read and record water quality field measurements and static water level (SWL) at appropriate time intervals (see previous section) until all parameters have stabilized within their allowable ranges (documented in the previous section) for at least three consecutive measurements. When stabilization has been achieved, sample collection may begin.

10. Disconnect the flow cell, and it's tubing, from the pump discharge line before collecting samples. Decrease the pump rate to 100 milliliters per minute or less by lowering the controller's air pressure setting prior to collecting samples for volatiles. Utilize the QED Model MP10/MP15 Controller's 'MANUAL SAMPLE' button to ensure minimized sample exposure to the ambient air. Ensure that the volatiles containers do not contain air bubbles. Place the samples in a cooler with enough ice to keep them at 4 degrees Centigrade.

11. Once samples for volatiles have been collected, re-establish pump flow rate to the original purge flow rate by inputting the documented controller settings for the well and collect remaining samples. *Note that the samples for the Appendix I and III metals suite will be field filtered using a 0.45 um disposable filter, as required by WAC 173-351. Filters must be pre-rinsed per manufacturer's instructions prior to filling sample bottles for filtered metals analysis.*

12. When all sample containers have been filled, make a final measurement of the well's SWL and record the measurement on the gauging and sampling sheet.

13. Record total purge volume collected. Purge water is collected and discharged to the leachate pond on site.

14. Remove and decontaminate the water level probe with phosphate-free detergent, rinsing with potable water and rinsing with deionized water.

15. Disconnect the controller air supply to the pump.

16. Secure the pump's discharge line/discharge adapter in the wellhead.

17. Secure the wellhead cover with its lock. Move equipment to next well to be sampled.

18. Clean and decontaminate field meters with phosphate-free detergent, rinsing with potable water and rinsing with deionized water

19. Photocopies of all completed forms should be made and kept in a separate location from the original records.

3.5.4 Sample Preservation and Shipment

Proper sample preservation will ensure that the chemical characteristics of the sample do not change from the time of collection to the time of analysis. The laboratory will provide the appropriate preservative directly in pre-labeled (with the type of preservative) sample containers. Care must be taken when handling acidic or caustic preservatives. Preservatives used during sampling collection include:

- HCL: for VOC analysis.
- HNO_3: for metals analysis.
- H_2SO_4: for TOC, COD, and ammonia analysis.
- NaOH: for cyanide analysis and sulfides.
- $Na_2S_2O_3$: for total coliform analysis.

After properly packing the samples, they should be shipped by an overnight express service, picked up by laboratory currier, or taken immediately to the laboratory to ensure they are received at the designated laboratory without potential impacts to sample integrity.

The following procedures are recommended:

1. Place samples in plastic bag and seal.
2. Put samples in a field cooler with blue ice and/or wet ice. Immediately cooling samples to 4^0C is the best sample preservation technique. Coolers and package coolants should be provided by the laboratory.
3. The samples should be firmly packed with cushioning materials, such as foam blocks or bubble-wrap to minimize the potential for breakage during shipping.
4. Chain of custody forms must be filled out and signed. Place the chain of custody in a plastic zip lock bag and place with the samples. Keep a copy with the field notes.

Secure shipping cooler(s) for shipment with strap tape and custody seals, and coordinate shipment.

Upon receipt of the samples at the laboratory, the date and time of arrival will be noted on the chain of custody forms. The laboratory receiver will verify that the seal is intact and custody has not been broken, and make note of sample bottle condition on the forms. These forms will be retained by the laboratory and returned with the results of the analysis. Any time custody of the samples is relinquished, the chain of custody chronicles must be completed as appropriate on the chain of custody form.

3.5.5 Record Keeping

Sampling procedures, field measurements, and general site observations will be recorded with ink on the field log and/or chain of custody forms.

Field Logs

Field notes shall be kept on Waste Management sample collection forms suitable for a three-ring binder. The following information should be included in the field log for each sampling event:

- Facility site name, sample point identification number, and other pertinent identifiers.
- Equipment calibration and decontamination notes.
- Depth to groundwater.
- Information regarding well purging (e.g. volumes and pumping rates).
- Date and elapsed time from sample start to sample finish.
- Sample location, sample number, and any field duplicates taken.
- Purging data, including time-series measurements of indicator parameters and water levels during purging.
- Type of sample and necessary treatment (e.g. filtering or preservative used).
- Field observations (e.g., weather conditions, well conditions).
- Appearance of sample (i.e., color, turbidity, sediment, odor or sheens).
- Sampler's identity and signature.

A copy of the field log forms to be used for groundwater sampling at the OVSL is provided in Appendix A. A form to document field instrument calibration is provided in Appendix B.

Chain of Custody Forms

Laboratory chain of custody form(s) must be completed for each set of groundwater samples and placed in the shipping cooler for travel with the sample shipment. These forms are provided by the analytical laboratory as a record for tracking samples from the point of collection to the laboratory. Copies of typical chain of custody forms used for OVSL monitoring are provided in Appendix C. Upon transfer of sample possession to subsequent custodians, this form will be signed by the person taking custody of the sample container. As part of the chain of custody procedure, each sample container being delivered will be tracked by the site name, sample number, analytical testing to be performed, and other pertinent information.

Upon receipt of samples at the laboratory, the shipping container seal will be broken and the condition of the samples, including temperature, will be recorded by the receiver. The records will be reviewed in the preparation of the analytical report prepared by the laboratory, and will be considered an integral part of that report.

3.5.6 General Health and Safety

Proper protective chemical-resistant sampling gloves, work gloves and steel-toed boots/shoes and safety glasses are required during groundwater monitoring. When physical protection is necessary, use leather work gloves. If chemical protection is necessary, wear nitrile/latex gloves underneath work gloves or by themselves. Immediately replace gloves that are torn, ripped or otherwise damaged. Use safety glasses when filling sample containers to avoid eye splash of well water or preservatives within sample containers. When lifting, exercise proper lifting techniques (bend at the knees, do not bend or twist the back). Avoid lifting heavy objects. Do not lift any objects that weight over 70 pounds without assistance.

Fill out an incident report for every work place incident. Report the incident to your supervisor immediately or within 24 hours. For minor injuries, apply general first aid. Seek advanced medical attention if necessary.

4.0 STORMWATER MONITORING PROGRAM

Stormwater sampling and analysis is conducted on a quarterly basis at the OVSL facility to monitor the potential for the closed landfill to impact local surface water quality. The stormwater monitoring program is being conducted to comply with the Washington Department of Ecology's stormwater pollution prevention permit # SO3002538C as well as provisions of the Agreed Order.

4.1 REGULATORY BACKGROUND

Stormwater and wastewater discharges from industrial facilities are regulated under the 1972 Clean Water Act through the federal National Pollutant Discharge Elimination System (NPDES). In Washington State, the NPDES program is administered by the Department of Ecology. Industrial activities, identified by Standard Industrial Codes (SIC), that expose potential pollutants to stormwater are required to maintain a stormwater discharge permit and conduct quarterly stormwater monitoring. The OVSL facility currently maintains a NPDES General Industrial Sector stormwater permit.

In a letter dated April 14, 2006, Ecology stated that the stormwater being discharged from the site is considered non-contaminated stormwater by definition in 40 CFR 445.2(g) and not a "wastewater from a landfill unit." Since 40 CFR 445.2(f) specifically excludes non-contaminated stormwater from the definition of wastewater from a landfill unit, OVSL is not subject to the effluent limitation guidelines required by 40 CFR Part 445.

4.2 STORMWATER MONITORING LOCATIONS

Stormwater monitoring is conducted at four outfall locations (Outfalls B, D, F and G). Three of these outfalls (B, D and G) are situated immediately off the western toe of the former fill areas. Outfall F is located further west in a low lying area immediately downgradient of the leachate pond and leachate treatment area. The locations of the stormwater monitoring outfalls are illustrated on Figure 2.

4.3 MONITORING SCHEDULE

Stormwater monitoring, including visual inspections and sampling of outfalls, is conducted quarterly at the OVSL facility. The quarterly events are typically scheduled for each of the spring, summer, fall and winter seasons in a given monitoring year. A more meaningful data set will be accumulated if the specific dates for each quarterly event are not varied significantly between successive monitoring years.

However, the precise time and date for each monitoring event will be dependent on the frequency and intensity of the seasonal precipitation. Ecology guidance recommends that stormwater monitoring be conducted within 30 to 60 minutes of a qualifying rain event (defined as >0.1 inches of precipitation that was preceded by a period of >24 hours of dry conditions). However, due to the remoteness of the OVSL facility and a lack of full-time personnel onsite, stormwater monitoring at the landfill will be conducted as close to a qualifying rain event as practically possible.

4.4 PARAMETERS AND ANALYTICAL METHODS

Stormwater samples collected during routine quarterly monitoring will be analyzed for the permit-specified industrial sector stormwater parameters suite, as listed on Table 9. The analytical methods recommended for each specific analyte, and EPA benchmarks or effluent limitations, are also provided in Table 9.

If the value for total zinc exceeds the EPA benchmark value (117 µg/L) for two consecutive quarters, beginning with the next sampling quarter the facility must include analysis for hardness and total copper and lead. Analysis for these parameters will be required for the remainder of the permit term unless the permittee becomes eligible to suspend monitoring through consistent attainment of benchmark values. Consistent attainment is defined as eight consecutive quarters (any quarter with no stormwater discharge is not counted) where the reported value for a parameter is equal to or less than the benchmark value.

4.5 STORMWATER MONITORING FIELD PROCEDURES

Field activities will consist of visual stormwater inspections, collection of stormwater samples for visual inspection and field and laboratory testing, and packaging and shipping the samples to the laboratory. Similar field methods will be used to collect samples for both visual inspection and laboratory analysis. Stormwater grab samples will be conducted as close to a qualifying rain event as practically possible given the remote location of the Site and the absence of full-time on-site personnel.

4.5.1 Visual Monitoring

Visual monitoring will include observations made at each of the stormwater outfalls being sampled during the quarterly event. When site conditions allow stormwater to be validly sampled, a minimum of one grab sample from each outfall will be collected during each quarterly event. The sample will be collected directly into a clear 1-liter glass bottle, and allowed to sit undisturbed for a minimum of 10 minutes before being visually examined in a well-lighted area.

The examination will document observations of color, odor, clarity, floating solids, settled solids, suspended solids, foam, oil sheen, and other obvious indicators of stormwater pollution. These observations and other pertinent data will be documented on the stormwater visual inspection/sampling form included in Appendix A.

The visual inspections should also include the following:

1. Review of the facility map and stormwater plan to ensure that the map and plan have been modified as necessary to reflect any changes in site conditions.

2. Verification that potential sources of pollutants and areas potentially contributing to pollutant discharge are identified in this plan.

3. Observation of the stormwater management controls identified in the plan to ensure they are operating correctly.

4.5.2 Sample Collection Methods

All stormwater samples will consist of individual grab samples. The following sampling protocol will be used.

All samples must be taken as close to the point of discharge as reasonably practical and can be achieved safely.

Samples will be obtained from mid-depth of flow or from an open fall directly into pre-labeled laboratory containers suitable for chemical parameters being analyzed.

Standing downstream of the sample collection point, submerge the container into the outfall discharge.

Carefully seal each container before proceeding to fill subsequent sample bottle.

Field-measured parameters including temperature, specific conductivity, pH, dissolved oxygen, and turbidity will be measured as described in Standard Methods for the Examination of Water and Wastewater (APHA 1985).

4.5.3 Sample Preservation, Shipment and Recordkeeping

Field information obtained during the visual inspection, such as the date and time of sample collection, the estimated discharge rate of stormwater from outfall, the estimated size and duration of the storm event, or any other pertinent site conditions will be recorded on the stormwater inspection/sampling forms in Appendix A. Sample preservation, shipping and recordkeeping are as previously described for groundwater samples (Sections 3.5.3 and 3.5.4).

5.0 LEACHATE INFLUENT MONITORING PROGRAM

Sampling of leachate influent is conducted quarterly at the OVSL facility. Leachate generated from three separate closed municipal waste storage cells and runoff from the active transfer station is collected and pumped to an arterial force main that discharges to a one-acre leachate pond located on the western end of the site. The force main outfalls on the north end of the leachate lagoon. Accumulated leachate is treated by aeration and consolidated onsite using an evaporator unit.

5.1 REGULATORY BACKGROUND

Leachate monitoring at OVSL is required per WAC 173-351-450(6) because the groundwater monitoring system monitors multiple landfill cells. It is also a specific requirement of the Agreed Order with the Department of Ecology. In addition, leak detection monitoring is performed in the vicinity of the leachate lagoon, per the requirements of WAC 173-350-330.

5.2 LEACHATE MONITORING LOCATIONS

Leachate monitoring is conducted at three locations at the facility, sampling stations L-INF, OBWL-TD, and LP-LCD. Influent leachate sampling station L-INF is located immediately downstream of the force main outfall on the north end of the leachate treatment lagoon. Station L-INF is situated just below the outfall piping, immediately upstream of the edge of the lagoon.

Sampling station OBWL-TD is located at the Old Barney White Landfill Toe Drain collection sump, which is situated immediately next to the leachate evaporator facility. Leachate that collects in this sump is subsequently pumped into the leachate pond.

Sampling station LP-LCD (aka: leachate pond-liner control discharge) is also located near the evaporator unit, on the south end of the leachate pond. Station LP-LCD is situated on a pump discharge line which periodically transfers leakage that accumulates beneath the leachate collection pond back into the main reservoir.

The locations of the leachate monitoring stations are illustrated on Figure 2.

5.3 MONITORING SCHEDULE

As illustrated on Table 3, leachate sampling is generally conducted annually for stations L-INF and OBWL-TD. Station LP-LCD is monitored on a quarterly basis, typically scheduled in parallel with the spring, summer, fall and winter season groundwater monitoring events.

5.4 PARAMETERS AND ANALYTICAL METHODS

The leachate samples will be analyzed for the suite of parameters listed on Table 10. The specified analytical suite for annual monitoring at L-INF and OBWL-TD includes the standard field parameters (pH, specific conductance, temperature, dissolved oxygen and turbidity); the Appendix I inorganic constituents (total recoverable antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, nickel, selenium, silver, thallium, vanadium, zinc, and nitrate); the Appendix I volatile organic compounds (47 compounds); the Appendix II geochemical indicator parameters (chloride, sulfate, iron, manganese, calcium, sodium, bicarbonate, alkalinity, magnesium and potassium); and the Appendix II leachate indicator parameters (ammonia, total organic carbon (TOC) and total dissolved solids (TDS). Appendix IV leachate parameters (nitrite, chemical oxygen demand (COD), biochemical oxygen demand (BOD), total cyanide and total coliform) will also be analyzed annually at influent station L-INF and OBWL-TD.

In addition, Appendix III parameters, including analyses for semi-volatile organic compounds (SVOCs), polychlorinated biphenols (PCBs), pesticides and herbicides will be analyzed every three years at leachate influent station L-INF.

Quarterly monitoring for Appendix II parameters will be conducted at station LP-LCD. Should elevated concentrations of leachate indicator parameters be reported at this location (which may indicate leakage of leachate into the interstitial space), a work plan will be developed for operational modifications or further investigation.

5.5 LEACHATE MONITORING FIELD PROCEDURES

Leachate sampling, preservation, shipping and field documentation procedures are similar to those previously discussed for stormwater monitoring (Sections 4.5.2 and 4.5.3). The leachate samples will consist of discrete grab samples. Since total recoverable metals analysis are required for leachate monitoring under WAC 173-351, field filtering will not be performed for these metals samples.

Field information obtained during leachate sampling will be recorded on the Field Information Form provided in Appendix A.

6.0 LANDFILL GAS MIGRATION MONITORING PROGRAM

The landfill gas migration monitoring program will focus on monitoring for subsurface gas migration around the perimeter of the closed landfill and gas intrusion into onsite structures. The program currently includes monitoring at a total of 17 locations. These locations include 10 subsurface gas monitoring probes (Gas Probes) located around the perimeter of the landfill. In addition, landfill gas monitoring is routinely conducted at existing structures on and immediately adjacent to the landfill (currently a total of 7 locations). The number of building monitoring locations will be modified should any of the existing structures be demolished or if new buildings are constructed in the future.

Select gas probes will be used for monitoring subsurface gas migration as it relates to property boundary compliance (173-351-200 (4)(a)(ii) WAC). Other select gas probes and onsite structures will be monitored as it relates to structures compliance (173-351-200 (4)(a)(i) WAC). The gas probes will be sampled/analyzed for major gas constituents (methane, carbon dioxide and oxygen) and pressure with portable field instruments.

Gas probe sampling will be conducted four times a year (at least once every three months) while results are within regulatory limits or other limits specified in this plan. If parameter limits are exceeded, then sampling frequency will be increased as discussed in section 6.6.4. This monitoring program does not address measures for monitoring related to confined space entry, gas collection systems, flare emissions or surface emission monitoring.

6.1 REGULATORY BACKGROUND

This sampling and analysis plan (SAP) covers the monitoring that will be conducted based on the Agreed Order and the revised landfill monitoring plan. The current monitoring plan reflects a refined understanding of site conditions based on the completed remedial investigations, and addressed future monitoring objectives (e.g. corrective action monitoring).

The Agreed Order and 2004-2006 Solid Waste Landfill Post Closure Permit (Permit), references compliance with WAC 173-351. In addition to this, the Permit specifies monitoring for oxygen and barometric pressure and, whenever possible, monitoring during falling barometric pressure trends. Also, the permit specifies compliance with the Final Closure & Post Closure Maintenance Plan (C/PC Plan) as well as the approved environmental monitoring plan. The C/PC Plan stipulates monitoring for carbon dioxide.

In 2005, Ecology and the KCHD stipulated monitoring subsurface soils around the perimeter of the landfill at 1,000 foot increments as part of the remedial investigation activities. Subsequently, additional gas probes were installed at approximately 1,000 apart around the perimeter of the landfill.

6.2 LANDFILL GAS MONITORING NETWORK

The program includes monitoring landfill gas at the 10 gas probes (GP-7 through GP-16) and 7 onsite structures (which currently include the Maintenance Building, Welding Shop, Main Well House, Old Toll Booth, Scale House, South Slope Well House and Wash Rack Shed) as illustrated on Figure 3 and tabulated on Table 11.

Five of the gas probes (GP-9 through GP-13) have multiple, vertically discrete monitoring zones. Gas probes with dual monitoring zones are designated with an "S" for the shallow zone, and a "D" for the deep zone. Gas probes with triple monitoring zones are designated with an "S" for the shallow zone, "M" for the middle zone, and "D" for the deep zone.

The gas probes for this monitoring program are characterized as follows:

- Perimeter Boundary Gas Probes (2 total).
- Supplemental Interior Gas Probes (8 total).
- Structures (7 total) – currently including the Maintenance Building (three locations), the Welding Shop (three locations), the Main Well House, the Old Toll Booth, the Scale House (three locations), the South Slope Well House, and the Wash Rack Shed.

This distinction is important because the results of landfill gas monitoring are influenced by the proximity of gas probes to refuse, property boundary and onsite structures. Also, regulatory criteria are applicable to perimeter gas probes near the property boundary and monitoring of onsite structures. Details of all the gas probes and boring logs can be found in *Report of 2005 Gas Probe and Monitoring Well Installations at OVSL (SCS Engineers, June, 2006).*

6.3 MONITORING SCHEDULE

Subsurface gas monitoring at the gas probes will be conducted four times a year within the following seasons:

- Once between January 1st and March 31st
- Once between April 1st and June 30th
- Once between July 1st and September 30th
- Once between October 1st and December 31st

The frequencies of sampling may be increased dependant on results.

Whenever possible, in order to obtain results reflective of "worst case" conditions, monitoring should be scheduled when the barometric pressure has steadily declined for a period of 18 hours or more. This typically occurs when a storm front is approaching. Sampling during falling barometric pressure will normally yield higher gas concentrations in soils and buildings, since movement (hence, concentrations) are significantly influenced by barometric pressure.

6.4 PARAMETERS AND FIELD INSTRUMENTATION

Landfill gas parameters to be measured at each location are listed in Table 12. Methane, carbon dioxide, and oxygen will be measured at all locations. Pressure will be measured at all gas probe locations. The deepest monitoring zone at each gas probe location will be evaluated for the possible presence of water using an water level measuring tape.

Methane is the parameter required to be measured to demonstrate compliance with regulations. Measurement of other parameters is performed as required by the Closure Permit and C/PC Plan and on a voluntary basis by OVSL as these data may be useful to assist in evaluating subsurface gas migration and for safety considerations. Measurement of methane alone will indicate immediate conditions for explosion hazards. However, measurement of methane only may not necessarily identify current or future gas migration.

Carbon dioxide, in addition to methane, is useful to monitor since it is the other primary component of landfill gas. Methane is subject to bacterial consumption in soils, and therefore the presence of CO_2 may indicate a migration phenomenon in the absence of significant methane measurement.

Oxygen should also be measured during sampling to identify whether air in the soil is being displaced by other gases. Like CO_2, the depressed O_2 concentrations (e.g. less than 20.3 percent by volume) may indicate a mgration phenomenon in the absence of significant methane measurements. Depending on the type of instrument, it may also be necessary to know oxygen concentration for proper use of instruments in measuring methane.

Relative (static) pressure measurements within the gas probes are also important, as they may be indicative of a driving force behind the methane migration. In general, the presence of higher pressures (on the order of an inch of water column or more) would serve as an indicator of a possible acute migration problem.

Water level measurements are useful at gas probes with deeper sampling zones near the groundwater surface. The measurement of the water level in the segment of perforated pipe can be used to determine whether or not this monitoring zone is partially or completely submerged. This information can be used in the evaluation of gas monitoring results.

The barometric pressure trend (prior to sampling) will provide valuable information when interpreting monitoring results. Barometric changes affect subsurface gas conditions. The three day barometric pressure trend preceding sampling should be noted (i.e. rising, falling, steady, unsteady). The 24 hour barometric pressure trend (immediately) preceding sampling should be recorded at hourly increments.

6.4.1 Instrumentation

The parameters will be measured with portable field instruments (except for barometric pressure). The barometric pressure trend will be recorded using information from the weather station at the nearby Bremerton National Airport (KPWT). The instruments should be capable of measuring the appropriate range of concentrations and accuracy for each parameter shown in Table 13.

6.4.2 Instrument Calibration and Care

The monitoring instruments should be routinely inspected, maintained and calibrated in accordance with manufacturer's recommendations. For all instruments, use, storage, maintenance, and calibration procedures should always be performed in accordance with the instrument manufacturer's recommendations.

The portable gas instruments should be inspected and calibrated each day of use (prior to) for each specific project. If used continuously over several hours, calibration should be checked at least once during the monitoring period. The calibration of the instrument should be documented on the field log provided in Appendix E.

To avoid damage to the instrument when calibrating, gas should be supplied to the instrument at the flow and pressure recommended by the instrument manufacturer.

6.5 LANDFILL GAS MONITORING FIELD PROCEDURES

This section discusses the field procedures for monitoring subsurface landfill gas. It specifically provides procedures for field sampling at the gas probes. This section also provides information on items to address prior to sampling.

6.5.1 Checklist Prior to Monitoring

Prior to conducting landfill gas monitoring, the weather forecast should be evaluated for conditions conducive to monitoring during optimum conditions (as described in section 6.2). The National Weather Service or local meteorologist can give advice on optimum times when this condition will occur. Once the time is established, monitoring activities should be planned accordingly.

The following items should be <u>addressed one day before</u> conducting landfill gas monitoring:

1. Obtain necessary equipment and instrumentation for monitoring activities. These include:
   - portable gas analyzer(s).
   - temperature and pressure gauges.
   - necessary tubing, filters, and fittings.
   - field book and field log.
   - keys to the gas probes.
   - calibration gas.
   - A more comprehensive list of field items is found in Table 14.

2. Make sure the battery for the portable gas analyzer(s) has sufficient charge for the amount of monitoring to be conducted. If not, the battery should be discharged completely before recharging. The battery should then be allowed sufficient time (as recommended by the manufacturer) to fully recharge. This is necessary for nickel-

cadmium batteries to maintain battery charge since nickel-cadmium batteries may develop a “memory” of reduced charge life if not fully discharged and recharged properly.

3. Make sure filters and water traps are clean and dry.
4. Make sure portable gas instrumentation is calibrated and document on Field Instrument Calibration Form (Appendix E).

Prior to beginning sampling, fill out field book with appropriate table headings and weather information. This helps keep monitoring logs consistent and lessens field time spent on recording information.

Note and record weather conditions prior to initiating and after completing sampling. General weather conditions to be recorded include ambient temperature, barometric pressure, wind direction/speed, sky conditions (e.g. clear, cloudy, partially cloudy, high overcast, etc.), and whether it is raining or snowing. If weather conditions change during sampling, these should also be recorded. The three day barometric pressure trend preceding sampling should be noted (i.e., rising, falling, steady, unsteady). The 24 hour barometric pressure trend immediately preceding sampling should be recorded (with hourly measurements recorded).

6.5.2 Precautions

Landfill gas is combustible and may contain toxic compounds. Do not smoke near the landfill gas monitoring probes. Avoid exposure to landfill gas by staying up wind and/or crosswind from gas probes and exhaust port of sampling pumps.

Care should be exercised when opening any vaults and/or removing the cap from the PVC casing. Hazards include insects and rodents that may nest within the monument, and elevated landfill gas concentrations that have accumulated within the casing (or vault).

6.5.3 Sampling and Analysis Procedures

For landfill gas monitoring at the gas probes, sampling and measurements will be conducted in the following sequence:

- After unlocking and removing the lid to the casing (or vault), check to make sure the sampling port valves are closed (¼-inch ball valves). Note: If valves are not closed, representative subsurface pressure readings cannot be obtained.
- Measure depth to water, if present.
- Remove cap from ¼-inch valve head.
- Connect pressure gauge sampling hose to ¼-inch valve.
- Zero pressures on pressure gauge (make sure pump is turned off if the pressure gauge is a component of the gas analyzer), then connect sampling hose to pressure gauge.
- Open ¼-inch valve.
- Record pressure reading (spike and steady values).

- Turn on pump to gas analyzer and observe gas readings (both spike and steady values). Care should be taken not to suck water into the instrument if water is present. Run pump long enough to obtain a steady reading. Generally, two volumes of gas from the probe. This will ensure that the sample is gathered from the surrounding formation. Sample purge times (pump run times) are listed in Table 11.
- Record both spike and steady readings. Record readings in the field book and/or data logger.
- Disconnect sampling hose from valve. Let pump run long enough to purge gases from instrument.
- Close ¼-inch valve.
- Place caps back on valve head; this keeps insects from plugging sampling ports. Make sure all valves are closed air tight.
- Place lid on steel casing and lock down.

The procedure may need to be modified slightly if other instruments are used. The pressure must be measured first before operating the sampling pump or other instruments. If separate instruments are used for each parameter, the valve should remain closed between sampling parameters. Abbreviated instructions for sampling with the GEM-2000 portable multi-gas analyzer are found in Appendix F.

6.5.4 Action Level and Response

For the purposes of monitoring the landfill gas, action levels are defined as those concentrations of gas which exceed the compliance criteria found in Chapter 173-351-200 (4). Specific action is required when:

- combustible gas (methane) in on-site structures exceeds 25 percent of the lower explosive limit of methane (1.25 percent by volume or 25 LEL); or
- combustible gas (methane) in soils at the property boundary exceeds the lower explosive limit of methane (5 percent by volume); or
- combustible gas (methane) in off-site structures exceeds 100 parts per million of methane.

If upon initial sampling, the concentration of methane exceeds any action levels (compliance criteria), then the monitoring technician should verify the measured concentration by immediately re-sampling the monitoring location. If the values still exceed action levels, then the instruments should be immediately checked for calibration. After verifying calibration, the monitoring location should be immediately re-sampled. **If it is verified that the concentration of methane (and/or combustible gas) exceeds action levels, the monitoring personnel should immediately notify the site supervisor** (person with authority and responsibility for site activities acting on behalf of the owner/operator). Also, if concentrations exceed the limits specified, the owner or operator should:

Immediately:

- Take all necessary steps to ensure protection of human health.
- Notify the Health Department.

Within 7 days:

- Record the levels of methane measured and describe the steps taken to protect human health.

Within 60 days:

- Implement a remediation plan for the methane gas releases which describes the nature and extent of the problem and the remedy.
- Place a copy of the plan in the operating record.

6.5.5 Field Documentation

All monitoring results and observations for each sampling event should be recorded on an authorized monitoring report form (Appendix D). At a minimum, the following information should be documented:

- Date
- Name of personnel conducting monitoring
- Time monitoring began and finished
- Instruments used (manufacturer & model number)
- Date instrument was last calibrated
- Weather conditions
- Barometric trends
- Gas probe or other location reference identifications
- Pressure measurements
- Gas concentrations (stabilized measurements and if observed, spike measurements)
- Water level (if applicable)
- Conditions of gas probe or other sampling locations
- Any abnormalities of sampling procedures

Calibration of portable instruments should be documented in the calibration logs. Maintenance of instruments should also be documented on the gas monitoring instrument maintenance log. All field sampling results and calibration logs should be retained for the quarterly reports.

7.0 QUALITY ASSURANCE/QUALITY CONTROL

The following quality assurance/quality control (QA/QC) measures will be performed on all the data obtained during groundwater sampling at the OVSL facility. These measures are necessary because the monitoring program provides for analysis for constituents with standards in the low part per billion concentration range. However, site conditions at the various landfills at the facility are not static. Continuing decomposition of the refuse and the associated settlement reflect processes that result in on-going changes. These conditions can present challenges to developing measurement performance criteria. In order to minimize temporal effects, similar results between consecutive monitoring events will be considered as an indication that measurement performance criteria are being satisfied.

7.1 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

7.1.1 Data Quality Objectives

All data are potentially subject to error during sampling, chemical analysis, and data reduction. Control and recognition of these errors is vital prior to data analysis and final report preparation. The establishment of appropriate levels of control of potential sources of error, and quantifying these errors when possible, will assist in assessing the impact of errors on the findings of the monitoring program.

Data quality objectives, in terms of accuracy, precision, completeness, comparability, and representativeness, have been established for each task that involves the collection of quantifiable data. Definitions of the objectives are discussed below.

Accuracy

Accuracy is a measure of the bias inherent in a system. It is the degree of agreement of a measurement (or an average of the measurements of the same item) with the accepted reference or true value. Because the exact bias of a system cannot be quantified (since the true values are not accessible), inferences are drawn from an examination of blank analyses, field-spiked sample analyses, and laboratory-spiked sample analyses. For example, trip blank analyses provide measures of the bias introduced by shipping and laboratory analyses. Method blanks and laboratory-spiked sample analyses provide measures of biases in laboratory analyses. Finally, field-spiked sample analyses provide measures of biases originating from sample matrices, shipping, and laboratory procedures. Acceptable accuracy measures depend on the sample matrices involved and the types of measurements performed.

Precision

Precision is a measure of the mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. Measurements of precision are made through analyses of replicate samples collected at regular intervals. Because replicate samples are anticipated to contain identical chemical characteristics, any variability in the laboratory analyses of these samples may be due to factors introduced by sampling, handling, or analytical procedures.

Completeness

Completeness is a measure of the quantity of valid data obtained from a measurement system compared to the quantity of data that could be obtained from the system under optimum conditions. Overall completeness consists of field completeness, laboratory completeness, and office completeness. Field completeness is based on the number of planned field samples or tests and the number actually collected. Laboratory completeness is based on the number of samples analyzed by the laboratory and the number of validated analyses produced. Office completeness is the quantity of data received compared to the quantity of chemical data validated. The goal for each is 100 percent.

Comparability

Comparability is an expression of the confidence with which one data set can be compared with another. It can be related to precision and accuracy, as these quantities are measures of data reliability. To assess comparability, field sampling procedures, laboratory sample preparation procedures, analytical procedures, and reporting units must be known. Comparability of analytical data can be enhanced by use of traceable reference materials and by the performance of evaluation programs. Qualitatively, data subjected to rigorous quality assurance or quality control procedures are more comparable than other data because they are more reliable.

Representativeness

Representativeness is the degree to which a set of data accurately represents the characteristics of a population, a process condition, or an environmental condition. Data are usually considered representative if the distribution of the sample results is within statistically defined bounds. The degree to which data represent an intended characteristic will be assessed during the completion of analytical and interpretive procedures.

7.2 DATA GENERATION AND ACQUISITION

7.2.1 Field and Laboratory Control Measures

A Washington Department of Ecology certified laboratory will be used for all the sample analysis. The samples will normally be delivered to the laboratory one to three days after sample collection. The laboratory will perform the analysis within the appropriate holding times.

The laboratory will perform method-specific QC activities, including surrogate recoveries, matrix spike, duplicates, and blanks. The data will be considered valid if percent recoveries fall between method-specific lower and upper control limits.

Equipment Rinse Blanks

Because dedicated sampling pumps have been installed in each of the groundwater monitoring wells at the site, it should not be necessary to collect any equipment rinse blanks from the groundwater sampling equipment.

Duplicate Samples

During each individual sampling event, one field duplicate or one field duplicate for every five percent of the total samples (i.e., 1 duplicate for every 20 samples), whichever is greater will be collected and analyzed for all parameter groups in each sample matrix, except for sample sets of less than five samples.

These samples will be submitted as blind duplicates (i.e. under a separate, unique sample number). The location where the duplicate samples were collected will be recorded in the field logs and documented in the monitoring report. The duplicate samples will be submitted to the same laboratory as the primary samples. The duplicate samples should be collected from wells where constituents of concern have been readily detected above PQLs. The duplicate should rotate among eligible locations between sampling events whenever possible.

Trip Blanks

The trip blank is designed to determine if the VOC vials were decontaminated properly, if the source water was contaminant-free, or if cross contamination may have occurred during storage and transport of samples as a result of VOCs possibly diffusing through the septum lids. The trip blanks will be prepared by the contracted laboratory and sent with the empty VOC sample vials. One set of trip blanks will be included in each cooler containing samples for VOC analysis when 10 or more VOC samples are collected.

7.2.2 Instrument/Equipment Testing, Maintenance and Calibration

Field Instruments

Field instruments will be used to measure the water table elevation, and to monitor groundwater quality parameters during well purging activities. All field instruments shall be calibrated and tested as appropriate before any measurements are collected. Standard equipment inspection and maintenance, consistent with the manufacturer's requirements, shall be performed.

All field instruments used during the monitoring program shall be calibrated according to manufacturers' requirements. The instruments may be calibrated in the office immediately before use, or at the project site. The calibration records (Appendices B and E) shall be placed in the project file.

Laboratory Instruments

Maintenance of the laboratory equipment is the responsibility of the laboratory. Routine performance checks and preventive maintenance will be performed by qualified laboratory personnel or by the instrument manufacturers. Other maintenance or repair functions will be performed by instrument manufacturers' service representatives only.

The laboratory will perform instrument calibration as specified by the analytical methods required for this monitoring program. Otherwise, calibration frequency will conform to the manufacturers' specifications.

7.3 DATA VALIDATION AND USABILITY

7.3.1 Data Review, Validation and Verification Requirements

The data collection process will be reviewed to verify that the data have been collected consistent with the program design and the quality assurance plan. Quality assurance personnel will review the progress of the data collection, starting with the monitoring and sampling and the documentation of field activities. Any deviations from the sampling protocol, the rationale for the deviations, and the expected impact on the program and the collected data will receive particular attention.

The review will follow the sample handling process from collection to delivery at the analytical laboratory. Proper chain-of-custody documentation will be evaluated and confirmed. Sample handling within the laboratory, analytical procedures used, QC activities, and the subsequent data reporting by the laboratory will be reviewed and evaluated.

Field Data Validation

The integrity of the field reportable data must be validated before it can be reported. This involves reviewing all field logs, reviewing and checking raw data entries and calculations, and verifying the custody integrity of all samples collected. Corrective actions will be performed when the precision and accuracy results fall outside of the control limits.

Water level data will be reduced by staff collecting the data and validated with an appropriate checking process performed by another staff member. Resultant reports will bear the initials of the staff member.

Laboratory Data Validation

Laboratory analytical reports shall also be subjected to a data validation review, including confirming the laboratory QA/QC procedures, comparing original and duplicate sample results, and ensuring spike recoveries are within acceptable ranges. Validation will include determining if:

- Sample holding times were met.
- Duplicate sample concentrations were within acceptable limits.
- Trip blanks were analyte-free.
- Detection limits were acceptable.
- Laboratory blanks were analyte free.

- Laboratory matrix spike recoveries were within acceptable limits.
- Any analytical interferences were identified.
- Laboratory precision and accuracy were within acceptable limits.
- Obvious anomalous values were identified and addressed.

Based on these reviews, the data will be classified as valid, useable, or unusable. Data classified as valid will have met all the data quality objectives, the sample custody and field logs will be in order, the results of the analyses of the field and laboratory QC blanks will be acceptable and other laboratory performance criteria will be acceptable. Valid data can be used for all purposes.

Data classified as useable will not have met all the QA/QC criteria described above. Sample custody may have been broken, holding times may have been slightly missed, a QC blank may have been contaminated, or the detection limit may have been elevated. These are a few examples of situations that cause the analytical data to be questionable but still useable, providing that data is used with caution.

Data that has been classified as unusable is invalid and will not be used for any purpose. Unusable data may be the result of gross laboratory error, strong analytical interferences, or other major problems associated with the data.

7.3.2 Reconciliation with Data Quality Objectives

The results of the data verification and validation process will be used to determine the value, application and usefulness of the data for this monitoring project. It is possible that some or all of the data may be qualified. The qualifications, if any, and the impacts on the usefulness of the data, will be discussed in the quarterly monitoring reports.

The data, and any qualifications, will be evaluated with respect to the data quality objectives. Depending on the results, corrective action may be necessary. The corrective action could range from minor adjustments to the monitoring program, to discarding the data and repeating the specific portions of the monitoring for that particular quarter.

8.0 REFERENCES

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Table 1. Groundwater Monitoring Well Data—Wells to Be Sampled

Well ID	Northing	Easting	Reference Elevation (ft)*	Total Depth (ft)	Top of Screen (ft)**	Bottom of Screen (ft)**	Screen Length (ft)
MW-2B1	189232.23	1157544.63	172.94	18	163	153	10
MW-4	188298.52	1156887.57	175.78	34	149	139	10
MW-9	188298.84	1156337.75	160.34	24	140	135	5
MW-13A	188233.33	1159346.53	288.74	155	141	131	10
MW-13B	188223.33	1159346.53	288.66	260	36	26	10
MW-15R	189905.03	1157711.29	180.66	33	157	147	10
MW-16	190804.53	1159350.37	240.01	70	178	168	10
MW-19C	188520.03	1157025.96	196.96	90	111	106	5
MW-20	188850.01	1157062.68	198.41	49	165	150	15
MW-23A	189485.84	1158085.12	182.28	23	172	157	15
MW-24	189795.14	1158383.22	208.24	42	176	161	15
MW-29A	188570.27	1156121.6	160.21	25	140	135	5
MW-32	188908.88	1156388.52	152.36	21	135	130	5
MW-33A	189304.18	1155636.34	147.68	20	140	125	15
MW-33C	189284.18	1155636.34	147.59	65	89	79	10
MW-34A	189391.16	1156929.63	197.95	48	168	148	20
MW-34C	189391.16	1156943.77	199.89	98	114	99	15
MW-35	188917.42	1159762.03	302.69	149	161	151	10
MW-36A	188690.5	1156617.9	187.43	33	159	154	5
MW-39	190362.6	1158325.32	189.92	25	174	164	10
MW-42	188407.6	1156636.6	186.42	30	161	156	5
MW-43	189754.1	1156935.2	192.68	50	147	142	5

* Elevation referenced to MSL
** Below ground surface

Table 2. Groundwater Well Data—Locations for Water Level Measurement-Only

Well ID	Northing	Easting	Reference Elevation (ft)*	Total Depth (ft)	Top of Screen (ft)**	Bottom of Screen **	Screen Length (ft)
MW-1	188267.80	1158593.35	273.63	180	NA	NA	NA
MW-2A1	189242.23	1157544.63	174.22	38	143	133	10
MW-5	188840.50	1156959.90	164.37	14	159.5	149.5	10
MW-10	188737.81	1156265.18	155.12	17.5	142	137	5
MW-11	188424.54	1156062.42	155.04	22	137	132	5
MW-12	187614.62	1158267.67	233.09	70	183	163	20
MW-13	188243.33	1159346.53	288.94	40	256	246	10
MW-14	190169.37	1159300.21	228.22	80	151	146	5
MW-17	187977.80	1158110.35	208.01	54	163	153	10
MW-18	187322.70	1158398.81	258.34	75	199	184	15
MW-19A	188540.03	1157025.96	195.74	45.5	165	150	15
MW-19B	188530.03	1157025.96	195.82	59.5	146	136	10
MW-19D	188510.03	1157025.96	196.83	143	61	51	10
MW-21	188737.81	1156245.18	156.03	15	150	140	10
MW-23B	189475.84	1158085.12	182.42	60	130	120	10
MW-23C	189465.84	1158085.12	182.41	114	76	66	10
MW-26	191159.90	1158911.65	189.73	25.5	178	163	15
MW-27	190934.05	1158891.56	200.65	32.5	182	167	15
MW-28	191379.07	1158948.49	181.05	15	174.5	164.5	10
MW-29B	188580.27	1156121.60	161.69	65	110	95	15
MW-29C	188479.36	1156072.97	156.92	50	111	106	5
MW-30A	188623.5	1155612.45	166.74	35	136	131	5
MW-29B	188580.27	1156121.60	161.69	65	110	95	15
MW-30B	188613.50	1155612.45	166.60	86	84	79	5
MW-31	189001.26	1155843.17	148.28	20	136	126	10
MW-33B	189294.18	1155636.34	147.55	40	114	104	10
MW-34B	189308.15	1156936.77	198.93	208	-1	-11	10
MW-36	189751.87	1156955.77	189.39	100	99	89	10
MW-37	189012.89	1155477.1	145.93	9	139	134	5
MW-38	188892.5	1155905.23	149.93	47	110	101	10
MW-40A	187885.89	1156779.45	180.16	24.4	160	155	5
MW-40B	187882.31	1156784.38	180.24	67	118	113	5
MW-40C	187875.42	1156785.79	181.16	103.7	82	77	5
MW-41A	188106.83	1157522.05	199.43	35.7	168	163	5
MW-41B	188104.34	1157530.68	200.64	79	126	121	5
MW-41C	188101.13	1157541.93	199.67	117	87	82	5
P-1	188680.42	1159357.03	281.66	57.5	232	224	7.5
P-9	191220.13	1159306.83	211.34	36	179	174	5

* Elevation referenced to MSL NA- Not Available

** Below ground surface

Table 3. Summary of Monitoring Well & Leachate Sampling Frequency & Analytical Testing

Well or Leachate Station	Appendix I and II and Appendix III adds*	Appendix III	Appendix IV
Compliance			
39	Quarterly		
15R	Quarterly	5 years	
34A	Quarterly		
34C	Quarterly	5 years	
42	Quarterly	**	
43	Quarterly	**	
Performance			
24	Quarterly	3 years	
23A	Quarterly		
2B1	Quarterly	3 years	
20	Quarterly		
19C	Quarterly	3 years	
4	Quarterly		
Downgradient			
36A	Quarterly		
33A	Semi-annual		
33C	Quarterly		
32	Quarterly	[Initial sampling until new POC wells MW-42 and MW-43 have enough data to select one as a replacement for MW-32]	
29A	Semi-annual		
9	Semi-annual***		
Upgradient			
13A	Quarterly		
13B	Quarterly		
35	Quarterly		
16	Quarterly		
Leachate			
Influent (L-INF)	Annually	3 years	Annually
OBWL-TD	Annually	3 years	Annually
LP-LCD	Quarterly****		

* The routine (quarterly and semi-annual) sampling will also include any additional constituents detected by the Appendix III analyses.

** One of the new wells will be selected for Appendix III testing once enough data are available to select one.

*** Well MW-9 will be sampled until such time as new well MW-43 has been installed and sampled enough times (minimum four) to provide sufficient data to determine if it is a suitable replacement for well MW-9.

**** If the amount of liquid removed from the leak detection system is sufficient to allow for collection of a sample. Sample will initially be analyzed for only Appendix II parameters.

Table 4. Inorganic Parameter Standards & Analytical Methods for Groundwater

Inorganic Constituent (dissolved)	Groundwater Contaminant Levels [1] (ug/L)	Analytical Method	Recommended PQL (ug/L)
Antimony	6	SW-846 6020	1.0
Arsenic	0.05	SW-846 200.8	0.05
Barium	1,000	SW-846 6020	1.0
Beryllium	4	SW-846 6020	1.0
Cadmium	5	SW-846 6020	2.0
Chromium	50	SW-846 6020	3.0
Cobalt	NSE	SW-846 6020	3.0
Copper	1,000	SW-846 6020	2.0
Lead	50	SW-846 6020	1.0
Nickel	100	SW-846 6020	4.0
Selenium	10	SW-846 6020	1.0
Silver	50	SW-846 6020	2.0
Thallium	2	SW-846 6020	1.0
Vanadium	NSE	SW-846 6020	5.0
Zinc	5,000	SW-846 6020	5.0
Nitrate	10,000	EPA 353.2	50

1 Implementation Guidance for the Groundwater Standards, WA Department of Ecology 2005.
NSE: No Standard Established

Table 5. Organic Parameter Standards & Analytical Methods for Groundwater

Appendix I Organic Constituent	Groundwater Contaminant Levels [1] (ug/L)	Analytical Method	Recommended PQL (ug/L)
Acetone	NSE	SW-846 8260	10.0
Acrylonitrile	0.07	SW-846 8260	30.0
Benzene	1	SW-846 8260	1.0
Bromochloromethane	NSE	SW-846 8260	1.0
Bromodichloromethane	0.3	SW-846 8260	1.0
Bromoform	5	SW-846 8260	1.0
Carbon Disulfide	NSE	SW-846 8260	2.0
Carbon Tetrachloride	0.3	SW-846 8260	1.0
Chlorobenzene	100	SW-846 8260	1.0
Chloroethane	NSE	SW-846 8260	2.0
Chloroform	7	SW-846 8260	1.0
Dibromochloromethane	0.5	SW-846 8260	1.0
1,2-Dibromo-3-chloropropane	0.2	SW-846 8260	2.0
1,2-Dibromoethane	0.001	SW-846 8260	1.0
1,2-Dichlorobenzene	600	SW-846 8260	1.0
1,4-Dichlorobenzene	4	SW-846 8260	1.0
trans-1,4-Dichloro-2-butene	NSE	SW-846 8260	3.0
1,1-Dichloroethane	1	SW-846 8260	1.0
1,2-Dichloroethane	0.5	SW-846 8260	1.0
1,1-Dichloroethene	7	SW-846 8260	1.0
cis-1,2-Dichloroethene	70	SW-846 8260	1.0
trans-1,2-Dichloroethene	100	SW-846 8260	1.0
1,2-Dichloropropane	0.6	SW-846 8260	1.0
cis-1,3-Dichloropropene	NSE	SW-846 8260	1.0
trans-1,3-Dichlorpropene	NSE	SW-846 8260	1.0
Ethylbenzene	700	SW-846 8260	1.0
2-Hexanone	NSE	SW-846 8260	5.0
Bromomethane	NSE	SW-846 8260	2.0
Chloromethane	NSE	SW-846 8260	2.0
Dibromomethane	NSE	SW-846 8260	1.0
Methylene Chloride	5	SW-846 8260	5.0
2-Butanone	NSE	SW-846 8260	5.0
Methyl iodide	NSE	SW-846 8260	5.0
4-Methyle-2-Pentanone	NSE	SW-846 8260	1.0
Styrene	100	SW-846 8260	1.0
1,1,1,2-Tetrachloroethane	NSE	SW-846 8260	1.0
1,1,2,2-Tetrachloroethane	NSE	SW-846 8260	1.0
Tetrachloroethene	0.8	SW-846 8260	1.0
Toluene	1,000	SW-846 8260	1.0
1,1,1-Trichloroethane	200	SW-846 8260	1.0
1,1,2-Trichloroethane	NSE	SW-846 8260	1.0
Trichloroethene	3	SW-846 8260	1.0
Trichlorofluoromethane	NSE	SW-846 8260	2.0
1,2,3-Trichloropropane	NSE	SW-846 8260	2.5
Vinyl Acetate	NSE	SW-846 8260	3.0
Vinyl Chloride	0.02	SW-846 8260 SIM	0.02
Xylenes, Total	10,000	SW-846 8260	2.0

1 Implementation Guidance for the Groundwater Standards, WA Department of Ecology 2005.
NSE: No Standard Established

Table 6. Supplemental Parameter Standards & Analytical Methods for Groundwater

Constituent	Groundwater Contaminant Levels [1]	Analytical Method	Recommended PQL (mg/L)[1]
Field Parameters			
pH	6.5-8.5	Field Instrument	N.A.
Specific conductance	700 unhos/cm	Field Instrument	N.A.
Temperature	NSE	Field Instrument	N.A.
Dissolved Oxygen	NSE	Field Instrument	0.2
Turbidity	NSE	Field Instrument	0.2 NTU
Static water level	N.A.	Field Instrument	0.01 feet
Geochemical Indicator Parameters			
Alkalinity (as $CaCO_3$)	NSE	EPA 310.1	5
Calcium (Ca)	NSE	SW-846 6010	0.04
Chloride (Cl)	250	SW-846 9251	1
Iron (Fe)	0.3	SW-846 6010	0.06
Magnesium (Mg)	NSE	SW-846 6010	0.001
Manganese (Mn)	0.05	SW-846 6010	0.05
Potassium (K)	NSE	SW-846 6010	1
Sodium (Na)	20	SW-846 6010	1
Sulfate (SO_4)	250	EPA 300.0	1
Leachate Indicators			
Ammonia (NH_3, N)	10	EPA 350.1	0.03
Total Organic Carbon (TOC)	NSE	EPA 415.2	1
Total Dissolved Solids (TDS)	500	EPA 160.1	5

1 Implementation Guidance for the Groundwater Standards, WA Department of Ecology 2005.
NSE: No Standard Established

Table 7. Appendix III Parameter Standards & Analytical Methods for Groundwater

Appendix III Constituent	Groundwater Contaminant Levels [1] (ug/L)	Analytical Method	Recommended PQL (ug/L)
Base/Neutrals and Acids			
Acenaphthene	NSE	SW-846 8270C	4.0
Acenaphthylene	NSE	SW-846 8270C	4.0
Acetophenone	NSE	SW-846 8270C	10.0
2-Acetylaminofluorene	NSE	SW-846 8270C	100.0
4-Aminobiphenyl	NSE	SW-846 8270C	50.0
Anthracene	0.01	SW-846 8270C	4.0
Benzo(a)anthracene	0.01	SW-846 8270C	4.0
Benzo(b)fluoranthene	0.01	SW-846 8270C	4.0
Benzo(k)fluoranthene	0.01	SW-846 8270C	4.0
Benzo(ghi)perylene	0.01	SW-846 8270C	4.0
Benzo(a)pyrene	0.008	SW-846 8270C	4.0
Benzyl alcohol	NSE	SW-846 8270C	10.0
bis(2-Chloroethoxy)methane	NSE	SW-846 8270C	10.0
bis(2-Chloroethyl) ether	0.07	SW-846 8270C	10.0
bis(2-Chloroisopropyl) ether	NSE	SW-846 8270C	10.0
bis(2-Ethylhexyl) phthalate	6	SW-846 8270C	10.0
4-Bromophenyl phenyl ether	NSE	SW-846 8270C	10.0
Butyl benzyl phthalate	NSE	SW-846 8270C	4.0
4-Chloroaniline	NSE	SW-846 8270C	10.0
4-Chloro-3-methylphenol	NSE	SW-846 8270C	10.0
2-Chloronaphthalene	NSE	SW-846 8270C	4.0
2-Chlorophenol	NSE	SW-846 8270C	10.0
4-Chlorophenyl phenyl ether	NSE	SW-846 8270C	10.0
Chrysene	0.01	SW-846 8270C	4.0
Diallate	1	SW-846 8270C	20.0
Dibenz(a,h)anthracene	0.01	SW-846 8270C	4.0
Dibenzofuran	NSE	SW-846 8270C	4.0
Di-n-butyl phthalate	NSE	SW-846 8270C	4.0
3,3'-Dichlorobenzidine	0.2	SW-846 8270C	50.0
2,4-Dichlorophenol	NSE	SW-846 8270C	10.0
2,6-Dichlorophenol	NSE	SW-846 8270C	10.0
Diethyl phthalate	NSE	SW-846 8270C	4.0
p-Dimethylaminoazobenzene	NSE	SW-846 8270C	20.0
7,12-Dimethylbenz(a)anthracene	NSE	SW-846 8270C	20.0

1 Implementation Guidance for the Groundwater Standards, WA Department of Ecology 2005.
NSE: No Standard Established

Table 7. Appendix III Parameter Standards & Analytical Methods for Groundwater (continued)

Appendix III Constituent	Groundwater Contaminant Levels [1] (ug/L)	Analytical Method	Recommended PQL (ug/L)
2,4-Dimethylphenol	NSE	SW-846 8270C	10.0
Dimethyl phthalate	NSE	SW-846 8270C	4.0
Di-n-octyl phthalate	NSE	SW-846 8270C	4.0
1,3-Dinitrobenzene	NSE	SW-846 8270C	10.0
4,6-Dinitro-2-methylphenol	NSE	SW-846 8270C	50.0
2,4-Dinitrophenol	NSE	SW-846 8270C	30.0
2,4-Dinitrotoluene	0.1	SW-846 8270C	10.0
2,6-Dinitrotoluene	0.1	SW-846 8270C	10.0
Diphenylamine	NSE	SW-846 8270C	10.0
Ethyl methanesulfonate	NSE	SW-846 8270C	10.0
Famphur	NSE	SW-846 8270C	100.0
Fluoranthene	0.01	SW-846 8270C	4.0
Fluorene	0.01	SW-846 8270C	4.0
Hexachlorobenzene	0.05	SW-846 8270C	10.0
Hexachlorobutadiene	NSE	SW-846 8270C	10.0
Hexachlorocyclopentadiene	50	SW-846 8270C	50.0
Hexachloroethane	NSE	SW-846 8270C	10.0
Hexachloropropene	NSE	SW-846 8270C	100.0
Indeno(1,2,3-cd)pyrene	0.01	SW-846 8270C	4.0
Isodrin	NSE	SW-846 8270C	10.0
Isophorone	NSE	SW-846 8270C	10.0
Isosafrole	NSE	SW-846 8270C	20.0
Methapyrilene	NSE	SW-846 8270C	50.0
o-Toluidine	0.2	SW-846 8270C	10.0
3-Methylcholanthrene	NSE	SW-846 8270C	20.0
Methyl methanesulfonate	NSE	SW-846 8270C	10.0
2-Methylnaphthalene	NSE	SW-846 8270C	4.0
Methyl parathion	NSE	SW-846 8270C	50.0
2-Methylphenol	NSE	SW-846 8270C	10.0
1,4-Naphthoquinone	NSE	SW-846 8270C	50.0
1-Naphthylamine	NSE	SW-846 8270C	10.0
2-Naphthylamine	NSE	SW-846 8270C	10.0
2-Nitroaniline	NSE	SW-846 8270C	10.0
3-Nitroaniline	NSE	SW-846 8270C	10.0
4-Nitroaniline	NSE	SW-846 8270C	10.0
Nitrobenzene	NSE	SW-846 8270C	10.0

1 Implementation Guidance for the Groundwater Standards, WA Department of Ecology 2005.
NSE: No Standard Established

Table 7. Appendix III Parameter Standards & Analytical Methods for Groundwater (continued)

Appendix III Constituent	Groundwater Contaminant Levels [1] (ug/L)	Analytical Method	Recommended PQL (ug/L)
2-Nitrophenol	NSE	SW-846 8270C	10.0
4-Nitrophenol	NSE	SW-846 8270C	10.0
N-Nitrosodi-n-butylamine	0.02	SW-846 8270C	10.0
N-Nitrosodiethylamine	0.0005	SW-846 8270C	10.0
N-Nitrosodimethylamine	0.002	SW-846 8270C	10.0
N-Nitrosodi-n-propylamine	0.01	SW-846 8270C	10.0
N-Nitrosodiphenylamine	17	SW-846 8270C	10.0
N-Nitrosomethylethylamine	0.004	SW-846 8270C	10.0
N-Nitrosopiperidine	NSE	SW-846 8270C	10.0
N-Nitrosopyrrolidine	0.04	SW-846 8270C	20.0
5-Nitro-o-toluidine	NSE	SW-846 8270C	50.0
Parathion	NSE	SW-846 8270C	10.0
Pentachlorobenzene	NSE	SW-846 8270C	50.0
Pentachloronitrobenzene	NSE	SW-846 8270C	50.0
Pentachlorophenol	NSE	SW-846 8270C	20.0
Phenacetin	NSE	SW-846 8270C	4.0
Phenanthrene	NSE	SW-846 8270C	10.0
Phenol	NSE	SW-846 8270C	100.0
p-Phenylene diamine	NSE	SW-846 8270C	20.0
Pronamide	NSE	SW-846 8270C	10.0
Pyrene	0.01	SW-846 8270C	20.0
Safrole	NSE	SW-846 8270C	10.0
1,2,4,5-Tetrachlorobenzene	NSE	SW-846 8270C	50.0
2,3,4,6-Tetrachlorophenol	NSE	SW-846 8270C	10.0
2,4,5-Trichlorophenol	NSE	SW-846 8270C	10.0
2,4,6-Trichlorophenol	4	SW-846 8270C	50.0
O,O,O-Triethyl phosphorothioate	NSE	SW-846 8270C	50.0
1,3,5-Trinitrobenzene	NSE	SW-846 8270C	10.0
Chlorobenzilate	NSE	SW-846 8270C	10.0
3-Methylphenol & 4-Methylphenol	NSE	SW-846 8270C	10.0
Pesticides			
Aldrin	0.005	SW-846 8081A	0.05
alpha-BHC	NSE	SW-846 8081A	0.05
beta-BHC	NSE	SW-846 8081A	0.05
delta-BHC	NSE	SW-846 8081A	0.05
gamma-BHC (Lindane)	0.06	SW-846 8081A	0.05

1 Implementation Guidance for the Groundwater Standards, WA Department of Ecology 2005.
NSE: No Standard Established

Table 7. Appendix III Parameter Standards & Analytical Methods for Groundwater (continued)

Appendix III Constituent	Groundwater Contaminant Levels [1] (ug/L)	Analytical Method	Recommended PQL (ug/L)
Chlordane (technical)	0.06	SW-846 8081A	0.50
alpha-Chlordane	NSE	SW-846 8081A	0.05
gamma-Chlordane	NSE	SW-846 8081A	0.05
4,4'-DDD	0.3	SW-846 8081A	0.05
4,4'-DDE	0.3	SW-846 8081A	0.05
4,4'-DDT	0.3	SW-846 8081A	0.05
Dieldrin	0.005	SW-846 8081A	0.05
Endosulfan I	NSE	SW-846 8081A	0.05
Endosulfan II	NSE	SW-846 8081A	0.05
Endosulfan sulfate	NSE	SW-846 8081A	0.05
Endrin	0.2	SW-846 8081A	0.05
Endrin aldehyde	NSE	SW-846 8081A	0.05
Heptachlor	0.02	SW-846 8081A	0.05
Heptachlor epoxide	0.009	SW-846 8081A	0.05
Kepone	NSE	SW-846 8081A	1.0
Methoxychlor	0.1	SW-846 8081A	0.1
Toxaphene	0.08	SW-846 8081A	2.50
Herbicides (8151A)			
2,4-D	70	SW-846 8151A	4.0
Dinoseb	7	SW-846 8151A	1.0
2,4,5-TP (Silvex)	10	SW-846 8151A	1.0
2,4,5-T	NSE	SW-846 8151A	1.0
Organophosphorus Compounds			
Thionazin	NSE	SW-846 8141A	1.0
Dimethoate	NSE	SW-846 8141A	1.5
Disulfoton	NSE	SW-846 8141A	1.0
Phorate	NSE	SW-846 8141A	1.2
PCBs			
Aroclor 1016	0.1	SW-846 8082	1.0
Aroclor 1221	0.1	SW-846 8082	1.0
Aroclor 1232	0.1	SW-846 8082	1.0
Aroclor 1242	0.1	SW-846 8082	1.0
Aroclor 1248	0.1	SW-846 8082	1.0
Aroclor 1254	0.1	SW-846 8082	1.0
Aroclor 1260	0.1	SW-846 8082	1.0

1 Implementation Guidance for the Groundwater Standards, WA Department of Ecology 2005.
NSE: No Standard Established

Table 7. Appendix III Parameter Standards & Analytical Methods for Groundwater (continued)

Appendix III Constituent	Groundwater Contaminant Levels [1] (ug/L)	Analytical Method	Recommended PQL (ug/L)
Additional Metals			
Mercury, Dissolved	2	SW-7470/7471	1.0
Tin, Dissolved	NSE	SW-846-6020	10.0
Additional VOCs			
Acetonitrile	NSE	SW-846 8260	30.0
Acrolien	NSE	SW-846 8260	2.0
Allyl Chloride	NSE	SW-846 8260	2.0
Chloroprene	NSE	SW-846 8260	1.0
1,3-Dichlorobenzene	NSE	SW-846 8260	1.0
Dichlorodifluromethane	NSE	SW-846 8260	2.0
2,2-Dichloropropane	NSE	SW-846 8260	5.0
1,1-Dichloropropene	NSE	SW-846 8260	1.0
Ethyl methacrylate	NSE	SW-846 8260	3.0
Isobutyl alcohol	NSE	SW-846 8260	110.0
Methacrylonitrile	NSE	SW-846 8260	10.0
Methyl methacrylate	NSE	SW-846 8260	4.0
Naphthalene	NSE	SW-846 8260	1.0
Propionitrile	NSE	SW-846 8260	20.0
1,2,4-Trichlorobenzene	70	SW-846 8260	1.0

1 Implementation Guidance for the Groundwater Standards, WA Department of Ecology 2005.
NSE: No Standard Established

Table 8. List of Groundwater Monitoring Equipment

General Equipment & Tools	
☐ Well/Gate Keys ☐ Site Location Map ☐ Site Map ☐ Water Level Meter (at least one small diameter probe) ☐ Flow Cell ☐ Pneumatic Controller ☐ Graduated Cylinder ☐ Stop Watch ☐ Turbidity Meter ☐ Clipboard	☐ Knife ☐ Health and Safety Plan ☐ Nitrogen Regulator ☐ Tool Box including: 11/16 socket bolt cutters set of wrenches ☐ Manhole Hook ☐ Machete and Pruning Shears ☐ Purge Bucket ☐ Cell Phone
Safety Equipment ☐ First Aid Kit ☐ Fire Extinguisher ☐ Hat ☐ Leather Gloves	☐ Raingear ☐ Carhartts ☐ Steel-Toed Leather or Rubber Boots ☐ Whistle ☐ Orange Safety Vest
Decon Equipment ☐ Buckets	
Supplies	
☐ Nitrogen and CO2 ☐ Spare Swage Fittings for Bladder Pump Connections ☐ 0.45 Micron Filters ☐ Hose Clamps ☐ ¼" OD Poly Tubing ☐ Masterflex Tubing ☐ Batteries ☐ Surveyor's Tape	☐ Calibration Supplies (pH buffers, conductivity stds.) ☐ Sample Coolers, Bottles, Ice ☐ Packing Material (bubble wrap, tape, custody seals, stickers, labels, etc.) ☐ Ziplock Bags ☐ Business Cards ☐ Insect Repellent ☐ Kleenex ☐ Permanent Markers
Safety Supplies ☐ Thick Nitrile Gloves ☐ Thin Nitrile Gloves	Decon Supplies ☐ Alconox Detergent ☐ Garbage Bags ☐ Paper Towels ☐ DI Water (decon and FB) ☐ Tap Water
FORMS, ETC.	
☐ STL FedEx Forms (enough for one per day) and Blank FedEx Forms ☐ Field Information Forms (blank and from previous event) ☐ Chain of Custody Forms	☐ Sample Container Forms ☐ Calibration Forms ☐ Unified Monitoring Field Report ☐ Water Level Measurement Form ☐ Project Contact List

Table 9. Stormwater Parameter Standards and Analytical Methods

Constituent	Benchmark or Effluent Limit	Analytical Method	Recommended PQL (mg/L)
Field Parameters			
Dissolved oxygen	NSE	Field Instrument	0.2
pH	6-9 units	Field Instrument	N.A.
Specific conductance	NSE	Field Instrument	N.A.
Temperature	NSE	Field Instrument	N.A.
Turbidity	25 ntu	Field Instrument	0.2 ntu
Stormwater Parameters			
Oil & Grease	15 mg/L	EPA-1664(A)	5 mg/L
Total Zinc	0.117 mg/L	EPA-200.7	0.02 mg/L
Fecal Coliform	200 mpn/100	SW-846 9221E	2 mpn/100
Iron (Fe-dissolved)	1 mg/L	SW-846 6020	0.06
Manganese (Mn-dissolved)	1 mg/L	SW-846 6020	0.001
Magnesium (Mg-dissolved)	0.0636	SW-846 6020	0.05
Alkalinity (as $CaCO_3$)	NSE	EPA-310.1	5

NSE: No Standard Established
N.A.: Not Applicable

If the value for total zinc exceeds the EPA benchmark value (0.117 mg/L) for two consecutive quarters, beginning with the next sampling quarter the facility must include analysis for hardness and total copper and lead. Analysis for these parameters will be required for the remainder of the permit term unless the permittee becomes eligible to suspend monitoring through consistent attainment of benchmark values. Consistent attainment is defined as eight consecutive quarters (any quarter with no stormwater discharge is not counted) where the reported value for a parameter is equal to or less than the benchmark value.

Table 10. Leachate Analytical Methods

Constituent	Analytical Method	Recommended PQL (mg/L)
Field Parameters		
pH, specific conductance, temperature.	Same analytical methods presented in Table 6.	Same PQLs presented in Table 6.
Inorganic Parameters		
antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, nickel, selenium, silver, thallium, vanadium and zinc.	Total recoverable metals using analytical methods presented in Table 4.	Same PQLs presented in Table 4.
Volatile Organic Compounds		
Same VOC analyte list presented in Table 5.	Same analytical methods presented in Table 5.	Same PQLs presented in Table 5.
Geochemical Indicator Parameters		
alkalinity, calcium, chloride, iron, manganese, magnesium, potassium, sodium and sulfate. (total)	Same analytical methods presented in Table 6.	Same PQLs presented in Table 6.
Leachate Indicator Parameters		
ammonia, total organic carbon and total dissolved solids.	Same analytical methods presented in Table 6.	Same PQLs presented in Table 6.
Supplemental Inorganic Parameters		
Nitrate	EPA-353.2	0.05
Nitrite	EPA-353.2	0.05
Chemical oxygen demand (COD)	EPA-410.1	10
Biochemical oxygen demand (BOD)	EPA-405.1	2
Total Coliform	SW-846 9921E	2

Table 11. Gas Probe Locations, Characteristics & Sample Purge Times

Reference Designation Loc.	Zone	Description	Comment	Dist. from Refuse (ft)	Type of Well Head	Depth of Perfor. (ft)	Total Length of Pipe (ft)	Nominal Diameter of Pipe [A] (in)	Volume of Pipe (ft^3)	Smpl Time (sec) for 1 Purge Vol. at Rate of 0.95 (ft^3/hr)
GP-1		Perimeter	Abandon	1550	Flush	??	20	0.5	0.060	226
GP-2		Interior	Not In Monitoring Program	100	Flush	??	20	0.5	0.060	226
GP-3		Interior	Abandon	600	Flush	??	20	0.5	0.060	226
GP-4	S	Perimeter	Not In Monitoring Program	620	Elevated	??	32.5	0.75	0.132	498
"	M	"	"	"	"	??	57.2	0.75	0.231	877
"	D	"	"	"	"	60.6 to 75.6	77.1	0.75	0.312	1182
GP-5	S	Perimeter	Not In Monitoring Program	350	Elevated	??	30	0.75	0.121	460
"	D	"	"	"	"	55.1 to 65.1	66.5	0.75	0.269	1020
GP-6		Perimeter	Abandon	1500	Flush	??	20	0.75	0.081	307
GP-7		Interior	W. of OBW Area	980	Elevated	7.1 to 12.1	15.6	0.75	0.063	239
GP-8		Interior	WSW. of OBW Area	200	Elevated	12.8 to 17.8	17.8	0.75	0.072	273
GP-9	S	Interior	S. of OBW Area	400	Elevated	9.2 to 14.2	16.5	0.5	0.042	160
"	D	"	"	"	"	23.7 to 28.7	31.3	0.75	0.127	480
GP-10	S	Interior	S. of Phase 1	500	Elevated	10.1 to 15.1	18.0	0.5	0.046	174
"	D	"	"	"		21.0 to 26.0	29.1	0.75	0.118	446
GP-11	S	Perimeter	SE. Boundary of Phase 1	120	Elevated	7.8 to 12.8	15.3	0.75	0.062	235
"	D	"	"	"	"	22.3 to 27.3	30.3	0.75	0.123	465
GP-12	S	Perimeter	E. Boundary of Phase 1 & 2	70	Elevated	10.0 to 15.0	16.4	0.5	0.042	159
"	M	"	"	"	"	30.2 to 35.2	36.6	0.5	0.094	355
"	D	"	"	"	"	43.3 to 48.3	50.4	0.75	0.204	773
GP-13	S	Interior	NE. Boundary of Phase 2	60	Elevated	10.1 to 15.1	17.1	0.5	0.044	166
"	M	"	"	"	"	31.5 to 36.5	38.5	0.5	0.098	373
"	D	"	"	"	"	42.8 to 52.8	55.2	0.75	0.223	847
GP-14		Interior	NNW of Phase 2	440	Elevated	7.9 to 12.9	15.4	0.75	0.062	236
GP-15		Interior	W of Phase 2	80	Elevated	7.1 to 12.1	15.4	0.75	0.062	236
GP-16		Interior	WNW. of OBW Area	80	Elevated	7.4 to 12.4	15.2	0.75	0.062	233
MB-Of		Building	Slab on Grade	400						180
MB-Ba		Building	" " "	"						60
MB-Sh		Building	" " "	"						120
WS-R1		Building	Slab on Grade	400						180
WS-Of		Building	" " "	"						120
WS-R2		Building	" " "	"						60
OldTB		Building	Slab on Grade	200						120
MN-WH		Building	Slab on Grade	100						120
SH-SS		Building	Slab on Grade	300						60
SH-NS		Building	" " "	"						60
SH-Of		Building	" " "	"						120
SS-WH		Building	On Landfill	0						120
WR-Sh		Building	Slab on Grade	550						

GP = Gas Probe
S = Shallow Monitoring Zone
M = Middle Monitoring Zone
D = Deep Monitoring Zone

MB-Of = Maintenance Building - Office
MB-Ba = Maintenance Building - Bathroom
MB-Sh = Maintenance Building - Shed
WS-R1 = Welding Shop - Storage Room 1
WS-Of = Welding Shop - Office
WS-R2 = Welding Shop - Storage Room 2

MN-WH = Main Well House
OldTB = Old Toll Booth
SH-SS = Scale House - South Side Exterior
SH-NS = Scale House - North Side Exterior
SH-Of = Scale House - Office Interior
SS-WH = South Slope Well House
WR-Sh = Wash Rack Shed

Table 12. Parameters for Monitoring Landfill Gas

Location	Specific Parameter
Perimeter Boundary Gas Probes: GP-11 & GP-12	Pressure Methane (CH_4), Carbon Dioxide (CO_2), Oxygen (O_2)
Supplemental Interior Gas Probes: GP-7, 8, 9, 10, 13, 14, 15, & 16	Water Level *
Buildings: Maintenance Building(office, bathroom, shed), Welding Shop (office, storage rooms 1 & 2), Main Well House, Old Toll Booth, Scale House (office, south and north exteriors), South Slope Well House, Wash Rack Shed	Methane (CH_4), Carbon Dioxide (CO_2), Oxygen (O_2)
Site Atmospheric Conditions	Barometric Pressure (preceding 48 hour trend)
* The deepest monitoring zone for each gas probe will be measured for water level during the periods of higher groundwater conditions (i.e., winter and spring).	

Table 13. Portable Monitoring Instrument Detection Methods, Range and Accuracy

Parameter	Detection Method (1)	Response Time (sec)	Units	Range	Accuracy	Resolution	Detection Limit
Methane (CH_4)	Catalytic Oxidation (2) or infrared	< 20	% Vol.	0 – 5	+ 0.5 %	+ 0.1	+ 0.1
	Thermal Conductivity or infrared	< 20	% Vol.	0 – 100	+ 3.0 %	+ 0.1	+ 0.1
Carbon Dioxide (CO_2)	Chemical Absorption or infrared	< 20	% Vol.	0 – 5	+ 0.5 %	+ 0.1	+ 0.1
	Chemical Absorption or infrared	< 20	% Vol.	0 – 60	+ 3.0 %	+ 0.1	+ 0.1
Oxygen (O_2)	Chemical absorption or electro-chemical cell or galvanic cell	< 20	% Vol.	0 – 5	+ 1.0 %	+ 0.1	+ 0.1
	Chemical absorption or galvanic cell	< 20	% Vol.	0 – 25	+ 1.0 %	+ 0.1	+ 0.1
Relative (Static) Pressure	Magnetic Linkage or Transducer		in. of W.C.	+ 250 mbar	+ 1.0 %	+ 0.01	+ 0.01

Equivalent methods may be used, but must be documented on the field log and in the monitoring report.
Catalytic Oxidation must have at least 10 percent oxygen to function accurately.

Table 14. List of Field Items for Landfill Gas Monitoring

Documents

Landfill Gas Monitoring Plan (including map and gas probe information)
Site Safety Plan
Instrument Calibration Log
Field Book or Form*

Instruments

Portable Gas Analyzer (GEM 2000)
Camera *
Measuring Tape *

Equipment

Battery Charger

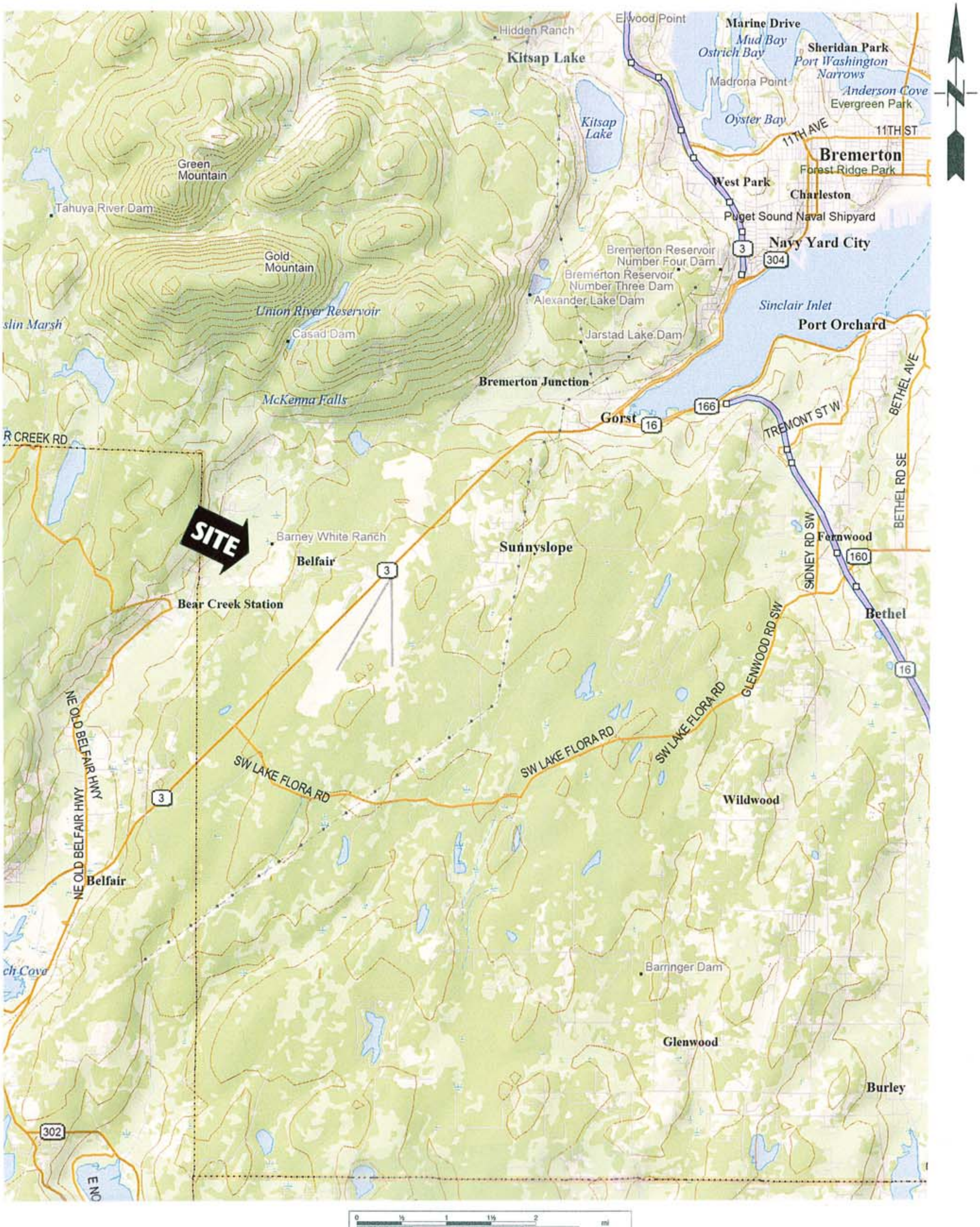
Tools

Keys to: Gates, Casing / Vault Lids, Scale House and Animal Shelter
Tool to open lids to Vaults / Manholes
Socket Wrench with Sockets for Vault Lids
Stick (to remove insect/spider webs)
Pencil / Pen *
Black Permanent Marker *
Screw Driver (Flat Head and Phillips) *
Hammer *
Bolt Cutters *
Channel Lock Pliers *
Crescent Wrench *
Pipe Cutter *
Scissors or Knife *
Flash Light *

Supplies

Calibration Gas Kit
Particle Filter
Hydrophobic Filter
Hose & Fittings
Compressed Air
Silicon or WD-40 Lubricant Spray
Insect Spray *
Batteries*
Electrical Tape *
Teflon Tape *

* Not required, but may be needed for unanticipated conditions.



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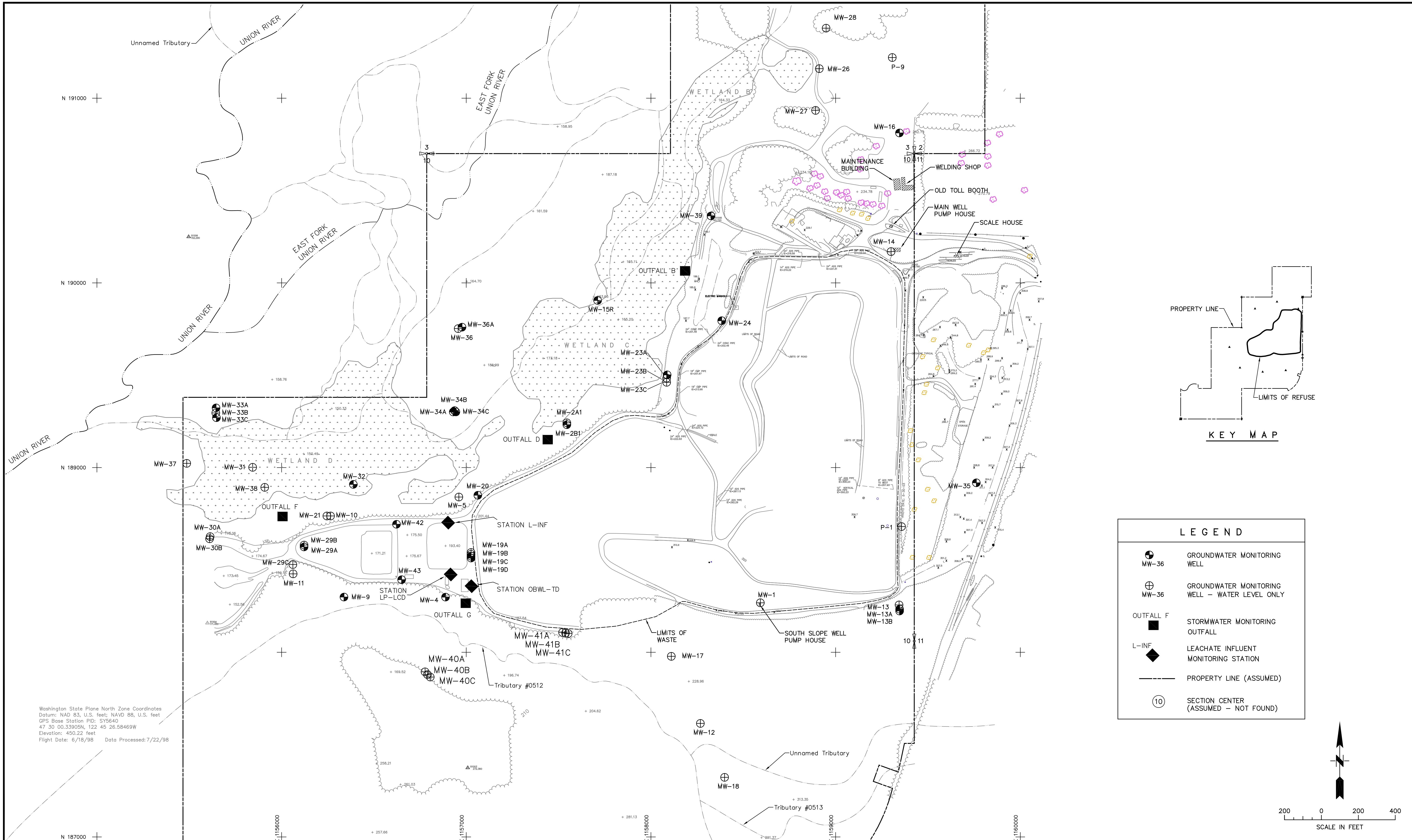
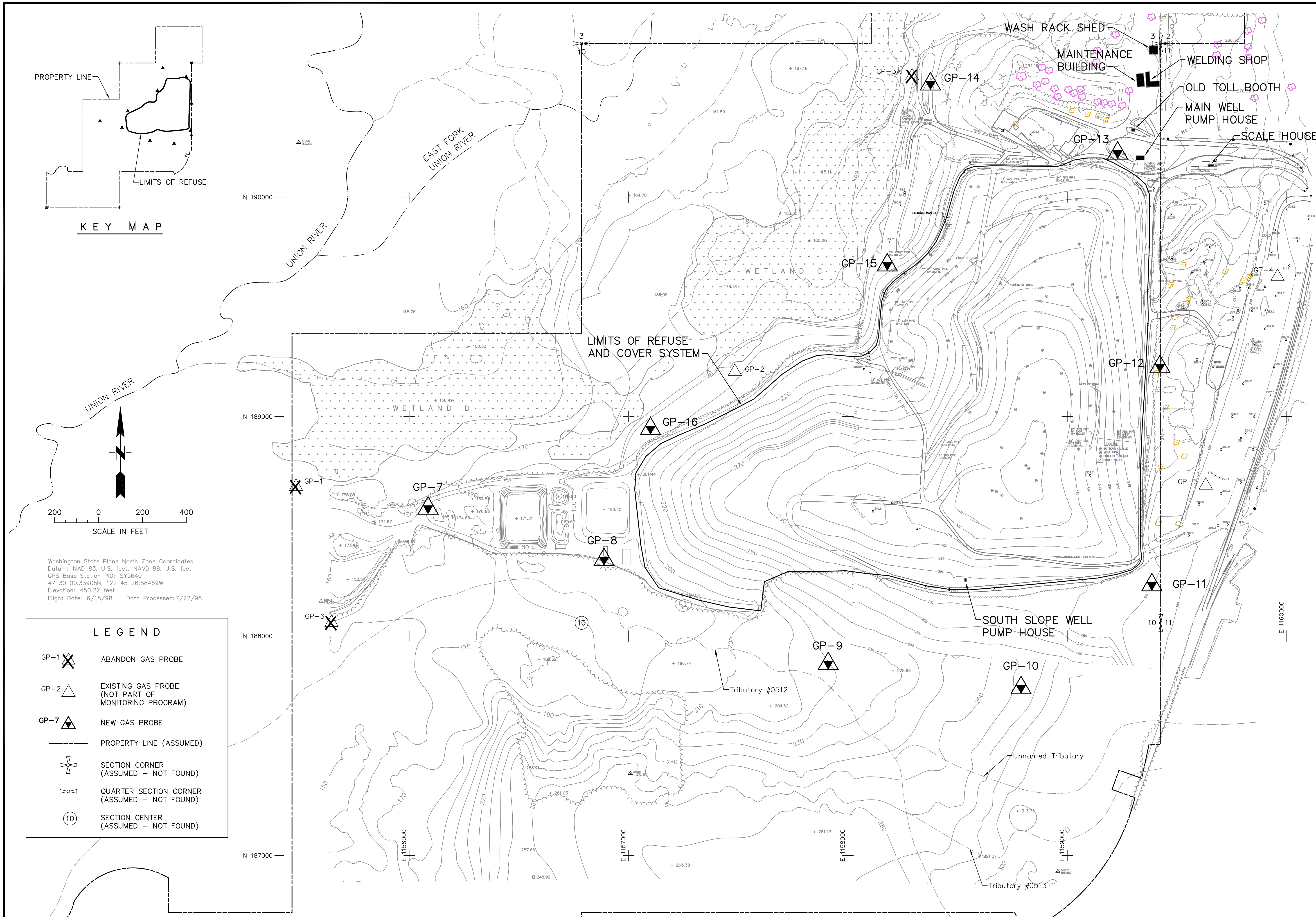
SCS ENGINEERS STEARNS, CONRAD AND SCHMIDT CONSULTING ENGINEERS, INC. 2405 140TH AVE NE, SUITE 107, BELLEVUE, WA 98005 (425) 746-4600	PROJECT NO. 04204027.00 SCALE 1:100,000 CAD FILE FIG-FRM1	DES BY E.D. CHK BY E.D. APP BY M.V.	SITE LOCATION MAP Olympic View Sanitary Landfill Port Orchard, Washington	DATE July 2005 FIGURE 1



SCS ENGINEERS STEARNS, CONRAD AND SCHMIDT CONSULTING ENGINEERS 2405 140TH AVE NE, SUITE 107, BELLEVUE, WA 98005 (425) 746-4600	PROJECT NO. 04204027.00 SCALE AS SHOWN CAD FILE FIGURE 1	DES BY D.V. CHK BY M.V. APP BY M.V.	GROUNDWATER MONITORING WELL, STORMWATER OUTFALL & LEACHATE MONITORING LOCATIONS OLYMPIC VIEW SANITARY LANDFILL PORT ORCHARD, WASHINGTON	DATE FEBRUARY 2009 FIGURE 2



NO.	REVISION	DATE

SHEET TITLE: LOCATION OF SUBSURFACE GAS MIGRATION MONITORING PROBES AND BUILDING MONITORING LOCATIONS

PROJECT TITLE: SAMPLING AND ANALYSIS PLAN OLYMPIC VIEW SANITARY LANDFILL

G:\04204027.03\Drawings\wastemanagement.jpg

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT CONSULTING ENGINEERS, INC.

PROJ. NO. 04204027.00 | DSN. BY: TAM | DWN. BY: LEL | CHK. BY: TAM | APP. BY: MV | ACAD FILE: FIGURE 3

DATE: SEPT 2006

SCALE: AS SHOWN

DRAWING NO. 3

Appendix A
Example Groundwater, Stormwater and Leachate Monitoring
Field Data Collection Forms

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FIELD INFORMATION FORM

WM WASTE MANAGEMENT

Site Name: ______

Site No.: ______ Sample Point: ______ Sample ID

This Waste Management Field Information Form is Required
This form is to be completed, in addition to any State Forms. The Field Form is submitted along with the Chain of Custody Forms that accompany the sample containers (i.e. with the cooler that is returned to the laboratory).

Laboratory Use Only/Lab ID: ______

PURGE INFO

PURGE DATE (MM DD YY)	PURGE TIME (2400 Hr Clock)	ELAPSED HRS (hrs:min)	WATER VOL IN CASING (Gallons)	ACTUAL VOL PURGED (Gallons)	WELL VOLs PURGED

Note: For Passive Sampling, replace "Water Vol in Casing" and "Well Vols Purged" w/ Water Vol in Tubing/Flow Cell and Tubing/Flow Cell Vols Purged. Mark changes, record field data, below.

PURGE/SAMPLE EQUIPMENT

Purging and Sampling Equipment ... Dedicated: Y or N

Filter Device: Y or N   0.45 µ or ______ µ (circle or fill in)

Purging Device ______   A- Submersible Pump   D-Bailer
Sampling Device ______   B-Peristaltic Pump   E-Piston Pump
C-QED Bladder Pump   F-Dipper/Bottle
X-Other: ______

Filter Type: ______   A-In-line Disposable   C-Vacuum   B-Pressure   X-Other ______

Sample Tube Type: ______   A-Teflon   C-PVC   X-Other: ______   B-Stainless Steel   D-Polypropylene

WELL DATA

Well Elevation (at TOC) ______ (ft/msl)   **Depth to Water (DTW) (from TOC)** ______ (ft)   **Groundwater Elevation (site datum, from TOC)** ______ (ft/msl)

Total Well Depth (from TOC) ______ (ft)   Stick Up (from ground elevation) ______ (ft)   Casing ID ______ (in)   Casing Material ______

Note: Total Well Depth, Stick Up, Casing Id, etc. are optional and can be from historical data, unless required by Site/Permit. Well Elevation, DTW, and Groundwater Elevation must be current.

STABILIZATION DATA (Optional)

Sample Time (2400 Hr Clock)	Rate/Unit		pH (std)		Conductance (SC/EC) (µmhos/cm @ 25 °C)	Temp. (°C)	Turbidity (ntu)	D.O. (mg/L - ppm)	eH/ORP (mV)	DTW (ft)
		1st		1st						
		2nd		2nd						
		3rd		3rd						
		4th		4th						
Suggested range for 3 consec. readings or note Permit/State requirements:			+/- 0.2		+/- 3%	--	--	+/- 10%	+/- 25 mV	Stabilize

__Stabilization Data Fields are Optional__ *(i.e. complete stabilization readings for parameters required by WM, Site, or State). These fields can be used where four (4) field measurements are required by State/Permit/Site. If a Data Logger or other Electronic format is used, fill in final readings below and submit electronic data separately to Site. __If more fields above are needed, use separate sheet or form.__*

FIELD DATA

SAMPLE DATE (MM DD YY)	pH (std)	CONDUCTANCE (umhos/cm @ 25°C)	TEMP. (°C)	TURBIDITY (ntu)	DO (mg/L-ppm)	eH/ORP (mV)	Other: ______ Units ______

__Final Field Readings are required__ *(i.e. record field measurements, final stabilized readings, passive sample readings before sampling for all field parameters required by State/Permit/Site.*

FIELD COMMENTS

Sample Appearance: ______   Odor: ______   Color: ______   Other: ______

Weather Conditions (required daily, or as conditions change):   Direction/Speed: ______   Outlook: ______   Precipitation: Y or N

Specific Comments (including purge/well volume calculations if required): ______

______

______

______

______

______

I certify that sampling procedures were in accordance with applicable EPA, State, and WM protocols (if more than one sampler, all should sign):

Date	Name	Signature	Company
__/__/__			
__/__/__			

DISTRIBUTION: WHITE/ORIGINAL - Stays with Sample, YELLOW - Returned to Client, PINK - Field Copy

STORMWATER VISUAL INSPECTION/SAMPLING FORM

Use this form to document all quarterly monitoring events and stormwater visual inspections and all stormwater sampling in support of the permit. Conduct the visual inspection/sampling within one hour of a rainfall event that is heavy enough to create runoff at the facility outfalls.

Use a separate form for each outfall inspected. Conduct the visual inspection at the same time as the quarterly monitoring. Be sure to conduct a visual inspection of each outfall, including the ones that are not sampled, at least once per year. **Maintain copies of all inspection/sampling forms with the SWPPP.**

FACILITY NAME: ______________________________

OUTFALL ID: ____________________ DATE COLLECTED: __________

COLLECTED BY: ____________________ QUARTER: 1 2 3 4 YEAR: ____

STORM EVENT INFORMATION	
Approx. Time discharge from site began:	Type of runoff: Rainfall / Snowmelt
Time sample was collected:	Has it been over 24 hrs since last discharge from site occurred at this outfall? How can you tell? Rain Gauge/Website/Observation/Other__________
Duration of the storm event (hours):	Estimate of storm intensity: (How many inches of rain over what period of time)

VISUAL INSPECTION AND SAMPLE INFORMATION

PARAMETER	OBSERVATION (1 to 5 Scale)	COMMENTS/DESCRIPTION/POTENTIAL SOURCE
Color	1 2 3 4 5 CLEAR DARK	
Odor	1 2 3 4 5 NONE PUNGENT	
Clarity	1 2 3 4 5 CLEAR OPAQUE	
Floating Solids	1 2 3 4 5 NONE COVERED	
Foam	1 2 3 4 5 NONE SIGNIFICANT	
Oil Sheen	1 2 3 4 5 NONE FREE PRODUCT	
Other Settled solids?	1 2 3 4 5	

DRY WEATHER INSPECTION
(July 1 - September 30)

The purpose of the dry weather inspection is to ensure that no unpermitted non-stormwater discharges are mixing with the stormwater discharge. Conduct the inspection during a period of extended dry weather (i.e. 7 days without measurable precipitation), and look for evidence of runoff from sources other than rain that might be mixing with the discharge.

Maintain copies of all inspections.

I. GENERAL DATA:

Site Name: ______________________________

Today's Date: ______________________________

Inspector(s): ______________________________

Weather: ______________________________

Days since last rainfall: ______________ Quantity Estimate: High-Med-Low

II. SWPPP REVIEW

Review the SWPPP. Are BMPs recommended in the plan fully implemented? Are the site maps accurate and up to date? Have there been any changes in the rules which should be reflected in the SWPPP? ______________________________

III. NON-STORMWATER DISCHARGE

Is there any unpermitted non-stormwater discharge entering the discharge point(s)? (flow from fire-fighting activities; foundation or footing drain runoff; springs or groundwater seepage; and landscaping irrigation return flows is permitted. All other discharges must be composed entirely of stormwater.)

(Stop here if no discharge is observed. If a discharge is observed, contact the District Manager immediately, and have them review the reporting requirements associated with non-stormwater discharges.

IV. EVALUATION OF DISCHARGE

	OBSERVATION	RESPONSE
1	Conduct a visual inspection of the non-stormwater discharge. Note color, odor, temperature (hot, cold), oil sheen, or other indicators which describe the discharge, and can help identify its source.	
2	Conduct one of the tests described in the SWPPP. Note which test was conducted, and the results.	
3	What is the suspected source of the discharge? Can it be eliminated within 30 days?	

SCS ENGINEERS

RECORD OF WATER LEVEL READINGS
Olympic View Sanitary Landfill
04204027.00

Well ID	Date	Time	DTW	Measured by (initials)	Equipment Used	Comments	Last Quarter DTW
MW-1							78.53
MW-2A1							10.24
MW-5							5.10
MW-10							9.07
MW-11							17.87
MW-12							53.07
MW-14							52.45
MW-16							Pump @ 61.90
MW-17							37.29
MW-18							68.84
MW-19A							35.83
MW-19B							36.66
MW-21							7.19
MW-26							Pump @ 15.13
MW-27							Pump @ 25.14
MW-28							Pump @ 9.97
MW-29B							19.39
MW-30B							25.96
MW-31							3.24
SG-UR						downstream side of bridge on Lyle Harvey's property	
MW-33B							3.46
MW-33C							3.36
SG-512						downstream side of bridge that leads to the MW-40s	
P-1							47.97
P-9							32.20

Appendix B

Example Groundwater, Stormwater and Leachate Monitoring
Field Equipment Calibration Forms

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SCS ENGINEERS

GROUNDWATER SAMPLING INSTRUMENT CALIBRATION DOCUMENTATION FORM

	Conductivity	pH 7	pH 4	DO	Turbidity	Comments/Exceptions
Date						
Time						
Weather (sky or precip, temp)						
Barometric Pressure (*)						
Type of Calibration						
Standard Value						
Pre-Cal Reading						
Post Cal Reading						
Descrepancy						
Calib. Successful?						
Calibration by						
Instrument Type, ID						
Calibration Location						

* If Direct Reading is Unavailable, Assume pressure = 760 mm - 2.5 (altitude in ft/100)

Appendix C
Example Chain of Custody Forms

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Chain of Custody Record

SEVERN TRENT **STL**
Severn Trent Laboratories, Inc.

STL Denver
4955 Yarrow Street
Arvada, CO 80002

STL-4124 (0901)

Client	Project Manager	Date	Chain of Custody Number 312102
Address	Telephone Number (Area Code)/Fax Number	Lab Number	Page ______ of ______

City	State	Zip Code	Site Contact	Lab Contact

Project Name and Location (State)	Carrier/Waybill Number

Contract/Purchase Order/Quote No.

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Matrix: Aqueous	Matrix: Sed.	Matrix: Soil	Matrix:	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH		Analysis (Attach list if more space is needed)												Special Instructions/ Conditions of Receipt

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal
☐ Return To Client ☐ Disposal By Lab ☐ Archive For ______ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required
☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other______

QC Requirements (Specify)

1. Relinquished By	Date	Time	1. Received By	Date	Time
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number:	Turn-around Requested:	Page:	of
ARI Client Company:	Phone:	Date:	Ice Present?
Client Contact:		No. of Coolers:	Cooler Temps:
Client Project Name:			
Client Project #:	Samplers:		

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

Sample ID	Date	Time	Matrix	No. Containers	Analysis Requested								Notes/Comments

Comments/Special Instructions	Relinquished by: (Signature)	Received by: (Signature)	Relinquished by: (Signature)	Received by: (Signature)
	Printed Name:	Printed Name:	Printed Name:	Printed Name:
	Company:	Company:	Company:	Company:
	Date & Time:	Date & Time:	Date & Time:	Date & Time:

Limits of Liability: *ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.*

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

Appendix D

Example Landfill Gas Monitoring Field Data Collection Forms

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Results of Landfill Gas Monitoring

SCS Engineers

Landfill Gas Monitoring Network
Olympic View Landfill
Waste Management, Incorporated

4204027.00

Date:
Monitored by:
Instruments:
Calibration Date:

Weather Conditions
Sky Cover:
Wind / Rain / Snow:
Temperature:
Preceding 24 hr Baro. Trend:
(i.e., rising / falling / steady / unsteady)

Location ID	Time	Baro. Pressure (in. Hg)	Relative Pressure (in. H_2O)	Pump Run Time (sec.)	CH_4 (% vol.)	CO_2 (% vol.)	O_2 (% vol.)	Comments
GP-7								
GP-8								
GP-9s								
GP-9d								
GP-10s								
GP-10d								
GP-11s								
GP-11d								
GP-12s								
GP-12m								
GP-12d								
GP-13s								
GP-13m								
GP-13d								
GP-14								
GP-15								
GP-16								
Maint. Bldg. - Office								
Maint. Bldg. - Bathroom								
Maint. Bldg. - Shed								
Weld Shop - Storage Room 1								
Weld Shop - Office								
Weld Shop - Storage Room 2								
Old Toll Booth								
Main Well House								
Scale House - S. Side								
Scale House - N. Side								
Scale House - Interior								
S. Slope Well House								

Notes:

Appendix E
Example Landfill Gas Monitoring Field Instrument Calibration and Maintenance Forms

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Calibration Log for Portable Landfill Gas Instruments

							Tank # 1 (or ambient air)			Tank # 2									Ambient Air		
							Methane Low End Concentration (% vol)			Methane High End Concentration (% vol)			Carbon Dioxide High End Concentration (% vol)			Oxygen Low End Concentration (% vol)			Oxygen High End Concentration (% vol)		
Date	Instrument mfr & model #	Calibrated by	Date filter replaced	Date battery dischar ed / recharged	Pump vacuum (in. H_2O)	Pump flow (scfh)	Initial	Final [A]	Cal. Gas	Initial	Final [A]	Cal. Gas	Initial	Final [A]	Cal. Gas	Initial	Final [A]	Cal. Gas	Initial	Final [A]	Cal. Gas
15-Dec-05	Landtec GEM-2000	LEL			>100, <6sec	0.8	0.1	-	0.0	50.9	-	50.0	35.6	-	35.0	<<<	<<<	0.0	20.7	-	20.9
"	"	"			"	"										3.9	-	4.0			

[A] If no adjustment is made, then indicate with " - " symbol.

	Gas	0 to 5 %vol	@ 5	5 to 15 %vol	@ 15	15 to FS %vol	@ TR		@ TR		@ FS	
Instrument accuracy for GEM 2000	CH_4	+/- 0.5%	0.03	+/- 1%	0.15	+/- 3%	1.5	50	1.8	60	3	100
TR = typical range	CO_2	+/- 0.5%	0.03	+/- 1%	0.15	+/- 3%	1.05	35	1.2	40	1.8	60
FS = full scale	O_2	+/- 1%	0.05	+/- 1%	0.15	+/- 1%	0.6	21	0.6	21	0.8	25

Maintenance Log for Landfill Gas Instruments

Date	Instrument Manufacturer & Model #	Description	Serviced By	Amount

Appendix F

Sampling and Analysis Procedures for Gas Probes Using GEM 2000

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Sampling and Analysis Procedures
for Gas Probes using the "GA" mode of the
GEM-2000 portable multi-gas analyzer

For landfill gas monitoring at the gas probes, sampling and measurements will be conducted in the following sequence:

1. Depress the red "on" button to turn on the gas analyzer.

   Wait for self test and purge cycle (pump running) to stop < 20 seconds.

   Wait for "gas read" menu to be displayed.

2. Connect sampling hoses to instrument. If temperature is being measured connect temperature probe to instrument and sampling hose pipe.

3. Depress the "[1]" button for Menu.

   Scroll to select "Mode of Operation", then depress the "enter" button.

   Scroll to select "Landfill Gas Analyzer", then depress the "enter" button.

   The "gas read" menu will be displayed.

4. Depress the "[3]" button for Next ID.

   Scroll to select the "ID Number ####", then depress the "enter" button.

   The "clean air purge" menu will be displayed.

   Depress the "enter" button to start purge cycle.

   After the purge cycle has ended (<30 seconds), a note will be displayed stating: "Please connect hoses to device."

   Depress the "[1]" button to continue.

   The "gas read" menu will be displayed.

5. Make sure the relative pressure has stabilized to zero (+/- 0.01) before connecting hose to sampling port.

   Note: The pressure must be measured first before operating the sampling pump or other instruments. If separate instruments are used for each parameter, the valve should remain closed between sampling parameters.

   If the pressure does not stabilize to zero, then zero the transducer. Press "[1]" and scroll to select "zero transducer(s)", then press "enter". The "zero relative pressure transducer" menu will be displayed. Press "enter" to zero transducer. The transducer will be zeroed and the "gas read" menu will be displayed.

6. Unlock and remove the lid to the casing (or vault) and check to make sure the sampling port valves are closed (¼-inch ball valves).

   Note: If valves are not closed, representative subsurface pressure readings can not be obtained (Skip step 10).

7. Remove cap from ¼-inch valve head.

   Note: If there is moisture present in the barbed connection of the ¼-inch valves, then blow out moisture with compressed air.

8. Connect sampling hose to ¼-inch valve.

9. Open ¼-inch valve.

10. Make sure relative pressure has stabilized, then depress the "pump on" button.

    This will automatically record the pressure reading at the moment the pump is turned on.

11. Observe the display (gas read menu) for gas concentrations and temperature as the pump is running and note any spike readings.

    Care should be taken not to suck water into the instrument (if water is present).

    Run the pump for the prescribed time interval (a minimum of one volume of gas from the probe).

    This will ensure that the sample is gathered from the surrounding formation.

12. Depress the "enter" button to record measurements.

    This will automatically record the gas concentrations and temperature (if temperature probe is connected to analyzer).

13. Disconnect sampling hose from valve.

14. Close ¼-inch valve.

15. Place caps back on valve head.

    Note: This keeps insects from plugging sampling ports. Make sure all valves are closed air tight.

16. Place lid on steel casing (or vault) and lock down.

Go to step 4 and repeat process for next gas probe.