PHASE I REMEDIAL INVESTIGATION REPORT

March Point (Whitmarsh) Landfill
Skagit County, Washington

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Whitmarsh Landfill PLP Group

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ACRONYMS AND ABBREVIATIONS

2LAET	Second Lowest Apparent Effects Threshold
ACM	asbestos-containing material
Agreed Order	Agreed Order DE-08TCPHQ-5999
AMEC	AMEC Geomatrix, Inc.
ARI	Analytical Resources, Inc.
bgs	below ground surface
BNSF	Burlington Northern Santa Fe
°C	degrees Celsius
CLARC	Ecology’s Cleanup Levels and Risk Calculations
cm	centimeter
COCs	constituents of concern
COPCs	contaminants of potential concern
DGPS	differential global positioning system
DNR	Washington State Department of Natural Resources
Ecology	Washington State Department of Ecology
EM	electromagnetic
EPA	U.S. Environmental Protection Agency
FS	feasibility study
Herrera	Herrera Environmental Consultants
LAET	Lowest Apparent Effects Threshold
MAG	magnetic survey
MCE	mixed cellulose ester
MDL	method detection limit
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
µm	micrometers
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MLLW	mean lower low water
MSW	municipal solid waste
MTCA	Washington Model Toxics Control Act
NAD83	North American Datum of 1983
NAVD88	North American Vertical Datum of 1988
NGA	Northwest Geophysical Associates, Inc.
OC	organochlorine
PA	preliminary assessment
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PID	photoionization detector
PLPs	potentially liable parties
ppb	parts per billion
ppt	parts per thousand
PQLs	practical quantitation limits
PSI	Puget Sound Initiative
PSLs	preliminary screening levels

ACRONYMS AND ABBREVIATIONS
(Continued)

QAPP	Quality Assurance Project Plan (Appendix B to the RI/FS Work Plan [AMEC, 2008a])
Report	Phase I Remedial Investigation Report
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
RI/FS Work Plan	Remedial Investigation/Feasibility Study Work Plan (AMEC, 2008a)
SAP	Uplands Sampling and Analysis Plan (an appendix to the Draft RI/FS Work Plan [AMEC, 2008a])
Sediment Work Plan	Sediment Investigation Work Plan (AMEC, 2008b)
SHA	site hazard assessment
SI	site inspection
SMS	Washington State Sediment Management Standards
SPCS	Washington State Plane Coordinate System
SQS	Washington Sediment Quality Standard
SVOCs	semivolatile organic compounds
VOCs	volatile organic compounds
TCP	Ecology Toxic Cleanup Program
TEE	terrestrial ecological evaluation
the site	the former March Point (Whitmarsh) Landfill, located on the west side of March Point at 9663 South March Point Road in Anacortes, Washington
TPH	total petroleum hydrocarbons
TPH-D	total petroleum hydrocarbons as diesel
TPH-G	total petroleum hydrocarbons as gasoline
TPH-Oil	total petroleum hydrocarbons in the heavy oil range
WAC	Washington Administrative Code
WQC	water quality criteria

PHASE I REMEDIAL INVESTIGATION REPORT

March Point (Whitmarsh) Landfill
Skagit County, Washington

1.0 INTRODUCTION

On behalf of the participating March Point (Whitmarsh) Landfill Potentially Liable Parties (PLPs; at this time consisting of Shell Oil Company, Skagit County, Texaco, Inc., and the State of Washington, Department of Natural Resources) and in accordance with Agreed Order DE-08TCPHQ-5999 (the Agreed Order), AMEC Geomatrix, Inc. (AMEC), has prepared this Phase I Remedial Investigation Report (Report) for the former March Point (Whitmarsh) Landfill (the site), located on the east side of March Point at 9663 South March Point Road in Anacortes, Washington (Figure 1). The site is listed on the Washington State Department of Ecology (Ecology) Hazardous Sites List as Facility Site ID 2662. This Report presents the Phase I investigational approach, the nature and extent of contamination based on the Phase I investigation, and a current conceptual site model. This Report was prepared for submittal to Ecology in accordance with Section VII.A of the Agreed Order. The former March Point (Whitmarsh) Landfill is one of about eight or nine sites on Padilla Bay and nearby Fidalgo Bay that will be investigated and cleaned up as part of the Puget Sound Initiative (PSI).

1.1 OBJECTIVES AND SCOPE

The goals of the Phase I remedial investigation (RI) were to:

- Evaluate data gaps that remained from previous investigations;
- Collect data required to complete the RI and define the nature and extent of soil, groundwater, surface water, and/or sediment contamination at the site;
- Present data collected during the Phase I investigation and discuss findings; and
- Update the preliminary conceptual model to include elements from the Phase I investigation.

1.2 ORGANIZATION OF THE PHASE I REMEDIAL INVESTIGATION REPORT

This Report is divided into seven sections. The content of each section is described briefly below.

- Section 1 – Describes the objectives of the RI and the organization of this Report.

- Section 2 – Provides background information about the site, including location, historical and current use, site ownership, regulatory and compliance history, and previous environmental investigations conducted at or near the site.

- Section 3 – Describes the components of the Phase I investigation, including geophysical investigation, monitoring well installation, test pit investigation, groundwater/seep/surface water sampling, and sediment sampling.

- Section 4 – Provides information regarding the development of site-specific preliminary screening levels (PSLs).

- Section 5 – Presents and discusses the findings from the Phase I investigation, including a comparison of analytical data to PSLs.

- Section 6 – Presents the current conceptual site model for the site and a summary of the proposed Phase II Scope of Work.

- Section 7 – Provides a list of references for materials cited in this Report.

2.0 SITE DESCRIPTION

This section presents a brief description of the property, site operational history, site regulatory and compliance history, and a brief summary of previous investigations and cleanup actions that have been conducted for the site.

2.1 LOCATION AND ENVIRONMENTAL SETTING

The former landfill is located north of South March Point Road at the base of a bluff in the tidelands area of Padilla Bay (Figure 1). The former landfill is bounded by South March Point Road to the south, the Burlington Northern Santa Fe (BNSF) railroad and Padilla Bay to the north and northeast, and the Swinomish Indian Reservation to the east and southeast. State Highway 20 runs about 800 feet southeast of the site beyond South March Point Road.

The elevation of the former landfill generally ranges from 6 to 25 feet above mean lower low water (MLLW) (North American Vertical Datum of 1988 [NAVD88]). It is relatively flat across the top with higher elevations on the north end. The former landfill slopes down to tidelands on the northeast and east sides and to drainage channels along the north and south sides. The tidelands on the northeast and east sides consist of the inner lagoon and outer lagoon, with an estuarine stream running along the eastern boundary continuing out toward Padilla Bay (Figure 2).

Padilla Bay is part of an ancient delta of the Skagit River that was abandoned by the river and currently has no substantial freshwater stream input. Water depths in Padilla Bay are shallow, with the bottom generally at an elevation of less than 12 feet below MLLW. Tidal fluctuation within Padilla Bay averages 8 feet and can vary from -3 feet to +12 feet MLLW.

2.2 HISTORICAL AND CURRENT USE

This section presents a brief history of landfill operation and ownership. Figures depicting changes in parcel boundary and landfill extent through time are included in the Remedial Investigation/Feasibility Study (RI/FS) Work Plan (RI/FS Work Plan) (AMEC, 2008a).

2.2.1 Ownership

According to the Skagit County Assessor's Office, the former landfill area currently includes five tax parcel numbers (P19676, P19684, P19707, P19713, and P19761). A map showing parcel numbers and boundaries is provided in Figure 3. Ownership of the five parcels is as follows.

- The Snow Mountain Land Company, LLC, owns parcels P19713;

- Based on current information, it appears Parcel P19676 has split ownership. Snow Mountain Land Company, LLC, owns land on this parcel above the 1890 high tide meander line. The State of Washington owns the portion of the parcel below the meander line;

- Charles and Margaret Ellen Moon own parcel P19684;

- The State of Washington owns parcel P19707; and

- Ralph Hillestead owns parcel P19761.

2.2.2 Landfill History

Prior to the 1950s, the property consisted of undeveloped tidelands lying between the main Mount Vernon-Anacortes highway and the Burlington Northern railroad.

Landfilling began in the 1950s when the site was used by the public as a convenient, unregulated dump site. In 1961, Skagit County applied for and received a lease from the state to operate the landfill. The County operated the landfill as a “burn dump” and burned waste regularly until 1969 (Skagit County Health Department, 1990). In 1969 or 1970, the County converted the facility to a “sanitary landfill.” From 1969 through 1973, the Landfill was the primary solid waste disposal facility in Skagit County (Skagit County Health Department, 1990). Skagit County Public Works records of waste accepted from 1970 onward indicate that waste originated from the cities of Anacortes, Burlington, La Conner, Mount Vernon, and Sedro-Woolley; rural Skagit County; Whidbey Island; and the Shell and Texaco refineries, among many others (GeoEngineers, 2007).

Historical documents from the early 1970s indicate that a dike was proposed to be built along the southeastern margin of the landfill apparently to better contain waste within the landfill. Aerial photographs from this same time period show a linear feature extending along the current southeastern margin of the landfill that resembles a dike. These documents indicate that a dike may have been constructed along the current southeastern margin of the landfill.

Limited records are available regarding the composition and quantity of any potentially hazardous substances dumped at the landfill. According to the Skagit County Health Department (Ecology, 1986), powdered vanadium catalysts were dumped at the landfill. Other industrial wastes, including drummed wastes, are also alleged to have been dumped at the landfill. In 1973 Skagit County opened the Inman Landfill and closed the Whitmarsh facility. Closure appears to have consisted of grading the waste and covering it with 2 to 3 feet of soil.

2.2.3 Current Property Use and Site Operations

The northern two-thirds of the former landfill is now occupied by a cedar log mill, which has operated in this location since the late 1980s. The mill area contains buildings, equipment, and stored logs. The southern third of the former landfill is unoccupied and covered with light forest and grass.

2.3 REGULATORY AND COMPLIANCE HISTORY

As stated above, the landfill was operated by Skagit County from 1961 until 1973. It appears that the landfill was closed by covering the waste with soil. In 2003, the Skagit County Health Department published the Site Hazard Assessment (SHA) for the former landfill as required under the Washington Model Toxics Control Act (MTCA), and ranked the site on the state's hazard ranking. On this scale, a ranking of 1 represents the highest relative risk and a ranking of 5 represents the lowest relative risk. The County estimated that the site's hazard ranking, an indication of the potential threat to human health and/or the environment, was a 2. In the SHA, surface water environmental toxicity was evaluated based on bioassay data rather than toxicity data, due to a single sample with a toxicity of 100 percent collected from a location adjacent to the BNSF railway. The SHA noted that this sample may have been impacted by spills from the railway. The SHA also stated that no groundwater contamination was documented on the upland side of the landfill and that groundwater was likely to move into the bay by seeps or tidal movement. The assessment concluded that groundwater contamination was unlikely to travel to any mainland well locations.

2.4 PREVIOUS ENVIRONMENTAL CHARACTERIZATION/SAMPLING INVESTIGATIONS

Previous investigations have included testing surface water and seeps, sometimes as part of studies that included sampling of sediments and/or biota. No soil or groundwater sampling had been conducted at the site prior to the Phase I RI. The approximate locations of samples collected during previous investigations are presented in Figure 2. Results from seep and surface water analyses conducted during those investigations are summarized in the RI/FS Work Plan (AMEC, 2008a). Summary pages from selected historical reports are presented in Appendix A.

2.4.1 Preliminary Assessment (Ecology, 1985)

The landfill was identified as a medium priority site based on a Preliminary Assessment (PA) conducted by Ecology and the U.S. Environmental Protection Agency (EPA) in November 1984. Several potential hazards, both to human health and the environment, were identified. These potential hazards included potentially contaminated groundwater, tidal incursions into the landfill, and groundwater seeps surfacing on the eastern landfill boundary.

The PA recommended sampling and analysis of seeps for priority pollutants and, if necessary, installation and sampling of groundwater monitoring wells. Further recommendations included collection of historical data regarding industrial activities and waste disposal practices for industries operating in the vicinity of March Point. It is unclear if such information was ever collected (GeoEngineers, 2007).

2.4.2 Site Inspection (Ecology, 1986)

Following the PA, Ecology conducted a site inspection (SI) at the landfill in December 1985. Three water samples and one seep sample were collected, consisting of:

- Background water sample from a borrow pit located 40 feet southwest of the landfill (NCT091);
- Estuarial stream sample on the southeast edge of the landfill (NCT092) – The sample map indicates the sample was obtained on the southeast side of the outer lagoon;
- Marine surface water sample collected at high tide on the northeast side of the landfill (NCT094) in the inner lagoon;
- Seep sample collected from water displaying iron staining that was seeping through the dike within the inner lagoon on the northeast side of the landfill (NCT095).

As reported by GeoEngineers (2007), the samples were analyzed for dissolved metals, volatile organic compounds (VOCs), and phenolics. Based on the analytical results Ecology concluded that:

> The sampling data do not show a significant problem at this landfill to warrant further sampling or remedial actions. There is no conclusive indication that hazardous materials are leaching from this landfill into Padilla Bay or its surrounding estuarial area. It is recommended that no further hazardous waste sampling or remedial actions be required at this site. (Ecology, 1986)

2.4.3 Analysis of Groundwater Seeps from Whitmarsh Landfill (1988)

GeoEngineers (2007) reported that in June 1988 Ecology obtained and analyzed a grab sample of groundwater seeping from the northeast corner of the landfill (Ecology, 1989, cited in GeoEngineers, 2007). The sample was analyzed for priority pollutant metals. Ecology (1989) concluded that the results were “an indication of heavy metals problem at the Whitmarsh Landfill which will require further study.” Cadmium, copper, lead, nickel, and zinc were determined to exceed marine water quality criteria.

2.4.4 Skagit County Health Department Sampling (Skagit County, 1996)

Due to the Swinomish Indian Tribal Community's concern regarding potential contaminant releases from the landfill into Padilla Bay, Skagit County collected two groundwater seep samples at the landfill in October 1996. The Skagit County report (1996) reads "sample locations were selected based largely on discolored surface water emanating from the concrete rip-rap wall at points where it discharged to the adjacent mudflats. Two such discharge points were identified."

The samples were obtained from the northeast corner of the landfill within the inner lagoon and were analyzed for priority pollutants. The County concluded, "Based on the sample results from our investigation and Ecology's [1986] investigation, we agree with Ecology's findings and conclude that further investigation using county resources is not warranted at this time."

2.4.5 Ecology Investigation of Chemical Contamination at Whitmarsh Landfill and Padilla Bay Lagoon (Ecology, 1999)

Ecology collected two groundwater seep samples near the northeast corner of the landfill in June 1998. The sample locations appear similar to those sampled by Skagit County in October 1996 (Figure 2). The samples were collected to identify contaminants of potential concern to human health and the environment and to determine if additional sampling in Padilla Bay Lagoon would be necessary. The samples were collected from the two most prominent seeps from the landfill, and they were analyzed for metals, trace elements, cyanide, petroleum hydrocarbons, VOCs, polycyclic aromatic hydrocarbons (PAHs), phenols, chlorinated benzenes, phthalate esters, semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), organotin compounds, pesticides, and herbicides.

Based on the sample results, Ecology concluded:

> The concentrations in seepage were generally low, in most cases, beneath thresholds of toxicity. Iron and the higher concentrations of the insecticide carbaryl (Sevin) were potentially toxic until further diluted. PCB 1242 approached the chronic water quality criterion of 0.03 µg/L [micrograms per liter] for marine waters.
>
> Chemicals analyzed but not detected in the seepage were priority pollutant metals, cyanide, organophosphorus pesticides, organochlorine pesticides, and herbicides. Previous investigations by Skagit County and others have also shown that metals, cyanide, and pesticides are not important contaminants in seepage. (Ecology, 1999)

The report acknowledged that the analyses for this study included a wider range of compounds and lower detection limits than had been done previously (Ecology, 1999). However, some of the detection limits were still greater than the respective cleanup levels; therefore, the presence of these compounds was not precluded.

The tables in the report summarized the analyses conducted and showed that total petroleum hydrocarbons (TPH) in the diesel range (TPH-D) was detected in seep samples at concentrations ranging from 470 µg/L to 850 µg/L. While there were no detections of priority pollutant metals, among the trace elements, manganese was detected at concentrations ranging from 127 µg/L to 234 µg/L, exceeding the human health marine clean water criterion of 100 µg/L.

Ecology (1999) also reported that the Swinomish Indian Tribal Community collected a water sample from the inner lagoon near the landfill in September 1997. Ecology reported that “no organic compounds were detected and metals concentrations were low.”

Ecology (1999) also noted, in reference to the June 1988 Ecology investigation, that “cadmium, copper, lead, nickel and zinc substantially exceeded marine water quality criteria, prompting a recommendation for further study. This finding has not been confirmed by other sampling at Whitmarsh” (Ecology, 1989). The cause of the higher metals concentrations, compared to other sampling events, was not addressed. In our opinion, the cause was likely the presence of particulates in the samples analyzed by the laboratory. Metals are naturally occurring constituents in soil and sediment. If particulates containing metals are present in the analytical sample, then they will be extracted during sample preparation, and the sample results will be artificially high.

2.5 PREVIOUS NEARBY ENVIRONMENTAL INVESTIGATIONS

This section presents information with regards to previous environmental investigations near the site and is presented as a general overview of other environmental investigations in the vicinity of the site. The location and specific information regarding each individual investigation is presented in more detail below.

2.5.1 Burlington Northern Whitmarsh Rail Siding (2004)

The Whitmarsh Rail Siding facility is located approximately 850 feet northwest of the landfill, along the Padilla Bay shoreline north of South March Point Road. Operations at the siding facility over the last 70 years have included loading hazardous materials for shipment to appropriate facilities for treatment, disposal, and/or storage. The siding has been used by various companies, including Northwest Petrochemical, Tecnal Corporation, General Chemical Corporation, and Allied Chemical (Herrera, 2004).

A chemical spill and fire took place at the Burlington Northern Whitmarsh Rail Siding site on July 31, 1991. Following the spill, approximately 23 55-gallon drums of contaminated soil were excavated and removed from the site. No confirmation soil samples were collected during the removal, and the cleanup was limited to the area between the two sets of railroad tracks (Herrera, 2004). Two samples from the drummed soil were analyzed for PAHs. Analytical data from the drum samples indicated high concentrations of several PAHs, phenols, cresols, phenyl mercaptans, and cresyl mercaptans.

Ecology inspected the site in 1992 and found pieces of yellow material between several railroad ties (Ecology, 1992). It remains unclear whether this material has been removed. No samples have been collected in the spill area to confirm that soil concentrations are below MTCA cleanup levels (Herrera, 2004). Most of the site, including the spill area, drains directly into Padilla Bay. Based on information in the Herrera report, the site has been assigned a site status of “Awaiting Remedial Action” by the Ecology Toxics Cleanup Program (TCP) (Herrera, 2004).

2.5.2 KAW Transport Spill

A spill occurred at the intersection of Highway 20 and South March Point Road on September 7, 1989, when 2,500 pounds of hazardous waste solids were released. A Form 2, Notification of Dangerous Waste Activities, was filed with Ecology on September 21, 1989. The Form 2 indicated that the spill included both D-listed (arsenic, lead, and chromium) and WP-listed (halogenated hydrocarbon) wastes. Further, the Form 2 indicated the spill was completely cleaned up on September 8, 1989. KAW Transport, the responsible party for the release, filed a subsequent Form 2 to cancel the site listing on October 24, 1989.

There are no historical records of any confirmation sampling taken (soil or surface water) to ensure that all wastes were properly cleaned up. The spill location is upgradient and to the southeast of the landfill.

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3.0 PHASE I RI ACTIVITIES

During the Phase I RI field work completed in October 2008 through July 2009, numerous field activities were conducted at the site, including a geologic reconnaissance, geophysical survey, monitoring well installation, a sediment investigation, four rounds of water sampling (groundwater, seeps, surface water), test pit excavation, and site surveying. All field work was performed in accordance with the Uplands Sampling and Analysis Plan (SAP) that was included as an appendix to the Draft RI/FS Work Plan (AMEC, 2008a) and in accordance with the Sediment Investigation Work Plan (AMEC, 2008b) (Sediment Work Plan). Sediment sample locations are presented on Figure 4, and uplands sample locations are presented on Figure 5.

The Phase I RI field work scope and methodology are discussed in more detail in this section. Results of the Phase I RI activities are discussed in Section 5.

3.1 GEOLOGIC RECONNAISSANCE

On October 2 and 3, 2008, AMEC staff conducted geologic reconnaissance in the vicinity of the site to verify the geologic conditions presented in previous reports, as discussed in the RI/FS Work Plan (AMEC, 2008a). The geologic reconnaissance included:

- hiking and observing conditions in the wooded areas adjacent to the site where access was allowed;
- observation and assessment from South March Point Road and from along the perimeter of the property lines;
- observation and evaluation from a distance of the exposed hillside on the industrial property to the southwest of the site;
- observations while walking along the shoreline at the north and northwest margin of the site; and
- observation and assessment of the Highway 20 road cut south of the site.

As discussed in Sections 3.1 and 3.2 in the RI/FS Work Plan (AMEC, 2008a), the local geology was generally found to be dominated by (1) sand and gravel deposits laid down during the retreat of the latest glaciation in the region and (2) more recent landslide deposits. Much of the site itself is likely underlain by dense silt and clay consistent with Padilla Bay tidelands.

The exposed hillside southwest of the site appears to consist of alternating layers of glacial deposits, such as sands and gravel. Four different units are visible from the road below the current topsoil layer. It appears that these layers are two thinner, predominantly gravel units, and two thicker, predominantly sand units. The observations from the geological reconnaissance were incorporated into the conceptual site model discussed in Section 6.1.

3.2 GEOPHYSICAL INVESTIGATION

A geophysical investigation was conducted on September 11 through 14, 2008, to attempt to characterize the landfill material and to locate any subsurface magnetic anomalies (e.g., buried drums) within the landfill. The investigation was conducted in accordance with Section 2.2 of the SAP.

Prior to the geophysical survey, the southern part of the site was cleared of any brush by a local brush-clearing contractor utilizing a track-mounted brush cutter. The brush-clearing contractor was unable to clear some areas with trees and very heavy blackberry brambles, and these areas were excluded from the geophysical survey. Only the southern two-thirds of the site was investigated, as the operating lumber mill and abundant surface metallic litter from mill activities (e.g., buildings, crane, metallic pipes and cables, export containers) present in the northern one-third of the site precluded the interpretation of any geophysical data collected in that area for the presence of subsurface magnetic anomalies.

The geophysical investigation included an electromagnetic (EM) survey utilizing the Geonics EM31 terrain conductivity meter and a magnetic (MAG) survey utilizing the Geometrics G858G magnetometer/gradiometer. The EM survey instrument recorded both quadrature-phase (apparent conductivity) and in-phase data at 0.2-second intervals, corresponding to a distance of approximately 1 foot. The MAG survey instrument was run in “continuous” sampling mode, recording the magnetic field at 0.2-second intervals (approximately 1 foot). Two magnetic sensors spaced 0.5 meter apart, one above the other, were used to obtain the vertical magnetic gradient. Both the MAG and EM surveys were conducted on 10-foot line spacing. A 10-foot line spacing is sufficient to detect drums, washers, water tanks, and other metallic objects of similar size.

The geophysical site investigation report is presented in Appendix B.

3.3 MONITORING WELL INSTALLATION AND DEVELOPMENT

From October 7 to October 9, 2008, AMEC staff and Cascade Drilling installed three monitoring wells upgradient and cross-gradient from the site. The monitoring wells were installed in accordance with Section 2.5 of the SAP (AMEC, 2008a). The RI/FS Work Plan had proposed four monitoring wells to be installed, with three wells in the upper aquifer and one well in a lower aquifer. However, only an upper aquifer was encountered during drilling to a total depth of 70 feet below grade. Monitoring well boring locations are presented on Figure 5.

3.3.1 Methodology

Well locations MW-01 through MW-04 were drilled from October 7 to October 9 at locations as shown on Figure 5. MW-01 and MW-02 were drilled in adjacent locations, southwest and upgradient from the site. MW-02 was drilled to a total depth of 20 feet below ground surface (bgs) and screened from 8 to 18 feet bgs. MW-03 was drilled next to the entrance to the lumber mill to a total depth of 20.5 feet bgs and screened from 5 to 15 feet bgs. MW-04 was drilled upgradient and southeast from the site along March Point Road to a total depth of 38.5 feet bgs and screened from 15 to 25 feet bgs. MW-02 and MW-04 were completed as flush-mount wells in the shoulder in the east-bound lane of March Point Road. MW-03 was completed as an aboveground well with three protective bollards to protect the well from forklift operations in the area.

Soil boring samples were collected from the borings at monitoring well locations MW-01, MW-03, and MW-04 during well installation. A well was not installed at MW-01 (drilled to a total depth of 70 feet) because a second deeper aquifer was not encountered; however, soil samples were collected and submitted for analysis. Samples were not submitted from MW-02 as it was co-located with MW-01. Samples were collected at depths of 11.5, 20.5, and 37 feet bgs at MW-01. One sample was collected at MW-03 at a depth of 11.5 feet bgs, and two samples were collected at MW-04 at depths of 8.5 and 19 feet bgs.

AMEC staff returned to the site on October 13, 2008, to develop the wells, assisted by Cascade Drilling. All wells were developed by submersible pumps as outlined in Section 2.5.3 in the SAP. The wells were continuously pumped until water quality parameters had stabilized and the pumped water had no visible turbidity. Results of field water quality parameter measurements are presented in Table 1. Copies of field notes are provided in Appendix C. Approximately 95 gallons of groundwater was removed from MW-02, 115 gallons from MW-03, and 165 gallons from MW-04. Purge water was disposed of in accordance with applicable regulations.

3.3.2 Analyses

Monitoring well soil samples were submitted to Analytical Resources, Inc. (ARI) under chain-of-custody procedures for analysis of metals, TPH as gasoline (TPH-G), VOCs, PCBs, and organochlorine pesticides. Results are discussed in Section 5.3.1.

3.4 SEDIMENT INVESTIGATIONS

Sediment samples were collected by AMEC staff from August 26 to 28, 2008. A total of 13 samples were collected from the inner lagoon area adjacent to the site, and 3 samples were collected in the swale running south of the site. The sediment sampling is discussed in more detail below.

The objectives of the Phase I sediment investigation were to:

- determine if sediments within and adjacent to the inner lagoon adjacent to the former landfill meet Washington State Sediment Management Standards (SMS; Washington Administrative Code [WAC] 173-204) biological criteria; and

- determine if sediments in the drainage swale south of the former landfill have concentrations of constituents of concern (COCs) above the SMS cleanup criteria.

The data from the sediment portion of the Phase I remedial investigation was used to determine if sediments adjacent to the former landfill within the inner lagoon or in the drainage swale at the site pose an adverse risk to human health and the environment.

3.4.1 Methodology

Sediment sampling and analysis were performed as proposed in the Sediment Work Plan (AMEC, 2008b), submitted to and approved by Ecology, with the differences noted below.

- Section 3.4 of the Sediment Work Plan, Sample Compositing, indicates that sediments for pore water extraction for the Microtox® bioassay were to be placed directly from the sampler into the 16-ounce glass sample jar to minimize disturbance and possible volatilization of potential contaminants. Sediments from the first three stations sampled (MP-2, MP-3, and MP-4) were inadvertently homogenized by hand before the sediments for the Microtox bioassay were collected. Homogenization prior to extraction of the pore water could result in minor volatilization of potential contaminants but is unlikely to substantially affect the results of the Microtox biossay. Remaining sediment samples were placed directly into the sample jar, as specified in the Sediment Work Plan.

- Sampling location MP-3 was located in the middle of an approximately 30-foot-wide drainage channel. Soft sediments within the channel would have made collection of the cores very difficult. The station was relocated to an area with similarly soft sediments, but which was accessible from a vegetated area that provided firmer support. The relocated station was moved approximately 16.5 feet from the original proposed station.

The location of the hand cores (top 10 centimeters [cm]) collected during this investigation are shown on Figure 4. Sample locations were determined using a differential global positioning system (DGPS), with coordinates in the Washington State Plane Coordinate System (SPCS), North Zone, referenced to the North American Datum of 1983 (NAD83).

Samples were collected from the inner lagoon using the procedures specified in the Sediment Work Plan. Sampling was conducted during low tides when the sediment surface was exposed. Sampling was conducted in the drainage channels away from areas with vegetation and extensive root mats. Sample locations were adjusted as necessary to allow personnel access and limit disturbance to the softer sediments in the drainage channels. All of the inner lagoon sample locations were within 10 feet of the proposed location, except for sample location MP-3, as noted above.

Hand core samples were also collected from the drainage swale on the south side of the landfill. Samples were collected in areas accessible from the road or the sawmill property. Samples were collected from open areas with limited vegetation that showed signs of waterlogged soils or that had standing water. A syringe type pore water sampler was used to collect a sample of pore water for salinity measurements. Salinity was measured using a temperature-compensated refractometer.

Sample processing followed the approved Sediment Work Plan (AMEC, 2008b) and the health and safety requirements specified in the Site-Specific Health and Safety Plan (Appendix C to the RI/FS Work Plan; AMEC, 2008a), except for the minor differences noted above. The exposed sediment surface at each sampling location was photo-documented prior to sampling. The hand cores were inserted into the sediment to a depth of 10 cm. A stainless steel plate was inserted across the bottom of the sampler, and the sampler, was removed from the substrate. Two hand cores were required at each lagoon sampling location to provide the necessary volume of sediment required for the analyses to be conducted. A single hand core was collected at three locations in the swale.

Sample processing was performed as follows.

- At the field processing area the retention plate was removed from the hand core, and the sediment was extruded into a stainless steel bowl.
- The sample was logged and described in the field log by an experienced field geologist.
- Sediments were collected for Microtox pore water bioassay from one of the cores from stations in the inner lagoon (except as noted above).

- The remaining material was homogenized and bottled for conventional analyses and for amphipod and sediment larval bioassays.
- Additional material was bottled and archived.

Qualitative sample characteristic logs describing the sediment types are provided in Appendix D; and photographs of sediment sampling locations are shown in Appendix E. Sample IDs for each station are also provided in Appendix D.

3.4.2 Analyses

Samples for chemical analysis and bioassay testing were transferred to Columbia Analytical Services, ARI, NewFields, and Nautilus Environmental using chain-of-custody procedures. Samples for bioassay testing and conventional parameters were chilled with “Blue Ice” refrigeration packs and held in the dark until transferred to the respective laboratories. Archived sample material was frozen at -18 degrees Celsius (°C) and stored by the analytical laboratory. Bioassay sediments were held at 4°C and stored in the dark at the bioassay laboratory until used.

Samples for mercury analysis from the inner lagoon and the swale locations were frozen until digested and analyzed within the 28-day holding time. Sediments for conventional analyses (grain size, total organic carbon, total volatile solids, total solids, and bulk ammonia) were refrigerated before being analyzed within the specified holding times.

Archived sediments were analyzed for bulk sulfides at the request of Mr. Peter Adolphson, Ecology project manager for the sediment investigation. The sediments analyzed for bulk sulfides exceeded the recommended holding times and were frozen prior to analysis. The remaining samples from the inner lagoon were archived and are being held pending final results of the biological testing.

The sediments from the swale samples were analyzed for the SMS list of COCs and total organic carbon. Samples for total organic carbon, mercury, and the remaining COCs were analyzed within the specified holding times.

Bioassay testing was conducted within the recommended holding times. Reference sediments were collected by NewFields personnel from Sequim Bay and Carr Inlet. Reference sediments were matched to the test sediments on the basis of the percent fines (particle size less than 63 micrometers [µm]). The amphipod bioassay was conducted using *Ampelisca abdita* after consultation with Ecology. The sediment larval test was conducted using the sand dollar *Dendraster excentricus*. Test sediments were exposed to full spectrum lighting. The bioassay results were compared to the SMS criteria as discussed in Section 5.2.

3.5 LANDFILL TEST PITTING INVESTIGATION

AMEC staff and PSC (excavation subcontractor) mobilized to the site on October 29, 2008, to prepare for test pit excavation within the landfill footprint. A total of 11 test pits (G1 through G11) were excavated from October 30 to November 2, 2008. The test pit locations were selected based on anomalies found during the geophysical investigation and are presented on Figure 5. Test pit logs are presented in Appendix F.

3.5.1 Methodology

Due to the unknown nature of the waste, a rigorous health and safety protocol was prepared and implemented during test pit excavation. These health and safety protocols are discussed in more detail in the Site-Specific Health and Safety Plan (Appendix C of the RI/FS Work Plan [AMEC, 2008a]).

Prior to excavation, an exclusion zone boundary was established, and the excavator was staged upwind from the proposed excavation location. Site personnel, except the excavator operator who was using supplied air, were kept outside the exclusion zone boundary until the exclusion zone had been properly cleared for dangerous environments by the AMEC site health and safety officer. Once the exclusion zone had been cleared, personnel entered the exclusion zone to characterize excavated soils, log the test pit excavation, collect samples, and take photographs. Some of the health and safety monitoring equipment used are listed below.

- Suma Canisters (monitoring VOCs): Suma canisters were deployed inside the cab of the excavator to monitor air breathed by the operator and in the downwind exclusion zone boundary to assess potential migration of VOCs outside of the exclusion zone.

- Mixed cellulose ester (MCE) filters (monitoring metal and asbestos): The MCE filters were attached to standard industrial hygiene sampling pumps and deployed inside the cab of the excavator to monitor air breathed by the operator breathing and in the downwind exclusion zone boundary to assess potential migration of metals and asbestos as fugitive dust outside the exclusion zone.

- Aerosol Monitor (monitoring fugitive dust): The aerosol monitor was continually deployed at the downwind exclusion zone boundary to assess the potential migration of fugitive dust outside the exclusion zone.

- Radiation Meter (monitoring alpha, beta, and gamma radiation): The radiation meter was used to screen excavated soil from each test pit location to assess the presence of radioactive materials and wastes.
- Four-gas meter (monitoring for hydrogen sulfide, carbon monoxide, oxygen, and lower-explosive limit): The four-gas meter, in conjunction with the photoionization meter, was used to clear the exclusion zone during excavation in order for AMEC personnel to be able to examine the excavated soils and to collect samples.
- Photoionization detector (PID) (real-time monitoring for VOCs): The PID was used with the four-gas meter as described above.

A preliminary review of the health and safety monitoring data indicate that no site workers were exposed to hazardous environments during the test pit excavation investigation. The monitoring information will be used going forward to ensure site worker safety if additional site earthwork is deemed necessary.

Per the RI/FS Work Plan, the goal of the soil sampling portion of the test pit investigation was to collect 5 to 10 samples from the soil cap, fill, and native layers in areas identified as anomalies during the geophysical investigation of the southern portion of the landfill where refuse was not reportedly burned. (The northern portion of the landfill will be investigated during the Phase II RI.) Following the criteria described in the RI/FS Work Plan, a total of four samples were collected from the soil cap, eight samples were collected from the fill, and two samples were collected from the native soil layer from test pits G1, G3, G4, G5, G6, G10, and G11.

Samples of the soil cover were collected from test pits G1, G3, G4, and G5 to provide spatial coverage. All samples were collected from a depth of 1 foot bgs.

Eight samples of soil fill material were collected from test pits G1, G3, G4, G5, G6, and G10. Samples were collected from G1, G3, G4, G6, and G10 at depths of 5.5 feet, 8 feet, 5 feet, 6 feet, and 8 feet bgs, respectively. Samples of the fill material were collected from depths of 5 and 9 feet bgs from test pit GP-5. Samples were collected from test pits G1, G3, G4, and G5 to provide spatial coverage of the southern landfill area. Further, a soil sample was collected at test pit G6 due to odor observed during excavation, and a sample was collected at test pit G10 in soil in contact with unearthed, partially crushed drums. A field duplicate sample was also collected from test pit G6 at 6 feet bgs.

According to the RI/FS Work Plan, native soil samples were to be collected from test pits to provide spatial coverage of the southern portion of the landfill in areas where the native soils were not saturated with groundwater or in which the presence of asbestos-containing material (ACM) in the fill did not cause the test pit to be abandoned. Groundwater was encountered before reaching the native layer in test pits G2, G5, G6, G8, G9, and G10, and ACM was encountered in test pit G1. Consequently, native soil samples were not encountered in these test pits and samples were not collected. In addition, a concrete pad and large cobbles were encountered at a depth of 6 feet bgs in test pit G4, which precluded the collection of a native soil sample at this location.

Native soil was encountered in test pits G3, G7, and G11. In test pit G3, a sand layer was encountered at a depth of 9 feet bgs that extended to a depth of approximately 12 feet bgs. Native clay was encountered beneath the sand at a depth of 12 feet bgs and a sample of the native clay was collected. Native clay was encountered at a depth of approximately 11 feet in test pit G11, where a sample was also collected. In addition, native clay was also encountered at a depth of approximately 8 feet bgs in test pit G7; however, it was decided in the field not to collect a sample of native soil from this test pit due to its proximity to test pits G3 and G11. Consequently, samples of the native soil were collected only from test pits G3 and G11 at depths of 12 feet and 11 feet bgs, respectively.

The samples were collected in accordance with methods outlined in Section 2.4.3 of the SAP. Samples were recorded on a chain-of-custody form and kept on ice until delivered to the analytical laboratory.

After the proposed depth had been reached, or if groundwater entered the excavation and obscured visibility, all waste was backfilled into the excavation and the test pit was abandoned. Before leaving each location, the test pit location was staked with a survey marker for subsequent surveying.

3.5.2 Analyses

Samples were sent to ARI and analyzed for the following constituents: metals, TPH, SVOCs, VOCs, PCBs, and organochlorine pesticides. Results are discussed in Section 5.3.2.

3.6 GROUNDWATER/SEEP INVESTIGATIONS

Groundwater and seep water samples were collected at four approximately quarterly intervals during the Phase I field investigation in 2008 and 2009. Results of field water quality parameter measurements are presented in Table 1. Copies of field notes are provided in Appendix C. The first two sampling events were intended to provide a baseline assessment of chemical concentrations in groundwater and seep water during both dry season and wet season regimes. The third sampling event was intended to provide additional quarterly data to assess site conditions during the transition from the wet season to the dry season. The fourth sampling event was intended to collect additional dry season data.

The first round of groundwater, seep, and surface water samples was collected from October 14 to 15, 2008, and the second round of samples was collected from December 17 to 19, 2008. The October samples were collected during dry conditions before the fall and winter rains, and the December samples were collected during the winter rainy period during wet conditions. The third round of sampling was conducted on April 28 and 29, 2009. The fourth round of sampling was conducted on July 23 and 24, 2009. A total of three monitoring well locations (MW-02, MW-03, and MW-04) and three seep locations (SP-1, SP-2, and SP-3) were sampled during each of the four sampling events. The seep sample locations were selected based on field observations on October 14, 2008, during a site walk with Skagit County. All three seep locations are located along the western-most boundary of the site between the inner lagoon and the landfill. No seeps were observed further south or to the east along the inner lagoon/landfill boundary. Sample locations are shown on Figure 5.

3.6.1 Methodology

All three monitoring wells (MW-02, MW-03, and MW-04) were purged and analytical samples collected via low-flow sampling techniques utilizing a peristaltic pump and dedicated, polyethylene disposable tubing in accordance with methods outlined in Section 2.6 of the SAP. Water quality parameters were monitored using a properly calibrated Horiba U-22 water quality monitoring instrument, utilizing a flow-through cell, until water quality parameters had stabilized (per the SAP) indicating that formation water was being extracted from the well and a sample could be collected. In addition, a field duplicate from MW-03 and an equipment blank were collected for quality control purposes during each of the sampling events.

Samples were collected in precleaned, laboratory-supplied bottles and placed on ice immediately after collection. The samples were labeled following procedures outlined in the project-specific Quality Assurance Project Plan (QAPP) (Appendix B to the RI/FS Work Plan [AMEC, 2008a] and recorded on chain-of-custody logs pending delivery to the analytical laboratory.

Seep samples were collected in accordance with methods outlined in Section 2.7 of the SAP, unless noted differently below. During the October sampling event, samples collected at SP-01 and SP-03 were collected by gently submerging a polyethylene tube into the seep. Water was collected using a peristaltic pump due to low flow volumes from the seep. The sample collected at SP-02 was obtained by gently submerging precleaned, laboratory-supplied bottles into the seep water.

During the December sampling event, samples at SP-02 and SP-03 were collected by peristaltic pump due to low flow volumes from the seeps. The sample at SP-01 was collected by gently submerging precleaned, laboratory-supplied bottles into the seep water. During the April and July sampling events, all three seep samples were collected by peristaltic pump due to low flow volumes from the seeps.

Prior to seep sampling, water quality parameters were recorded, and a qualitative description of turbidity was noted on the field sheets per the procedures in the SAP. Samples were recorded on a chain-of-custody form and kept on ice until delivered to the analytical laboratory under standard chain-of-custody procedures.

3.6.2 Analyses

Samples were analyzed by ARI in Tukwila, Washington, in accordance with Table 1 in the SAP except for the analysis of diethyl ether, which was subcontracted to Columbia Analytical Services in Kelso, Washington. Samples were analyzed for metals (total and dissolved), TPH, SVOCs, PAHs, VOCs, organochlorine (OC) pesticides, and PCBs. These results are discussed in Sections 5.4.1 and 5.4.2.

3.7 SURFACE WATER INVESTIGATIONS

Surface water samples were collected concurrently with groundwater and seep samples during the four sampling events in 2008 and 2009. Results of field water quality parameter measurements are presented in Table 1. Copies of field notes are provided in Appendix C.

A total of five surface water locations (SW-01, SW-03, SW-04, SW-05, and SW-06) were sampled during the October 2008 sampling event. All of these locations were also sampled during the December 2008 and April and July 2009 events. An additional surface water location, SW-07, was sampled during the December 2008 and April 2009 events. The location for SW-01 was chosen because it represents stormwater upgradient of the landfill. The locations for SW-02 through SW-04 were chosen because they represent storm water that collects on the southern boundary of the site. The location for SW-05 was chosen because this area collects surface water flowing from the southeast toward the inner lagoon. The location for SW-06 was chosen to represent surface water within the inner lagoon. The location for SW-07 was chosen to represent surface water along the northern boundary of the landfill along the BNSF right-of-way. No surface water was flowing at location SW-07 during the dry season sampling events in October 2008 and July 2009; consequently, samples were not collected at SW-07 during these sampling events. Sample locations are shown on Figure 5.

3.7.1 Methodology

All samples were collected by gently submerging precleaned, laboratory-supplied sample bottles into surface water at each sampling location, except for the sample collected at SW-07 during the December and April sampling events. Those samples were collected by peristaltic pump due to low flow conditions.

After sampling during the October 2008 event, each surface water sampling location was staked using a survey marker for subsequent surveying. Samples collected during the December 2008 and April and July 2009 sampling events were collected at previously staked locations (all stakes were still present). The new location (SW-07) was not staked in December due to deep snow. Instead, the distance of SW-07 from SP-01 along a specified bearing was measured so that the location could be located at a later time if additional sampling is warranted.

3.7.2 Analyses

Samples were analyzed in accordance with Table 1 in the SAP by ARI except for the analysis of diethyl ether, which was subcontracted to Columbia Analytical Services in Kelso, Washington. All samples were analyzed for metals (total and dissolved), SVOCs, PAHs, VOCs, OC pesticides, and PCBs. The results are discussed in Section 5.5.

4.0 IDENTIFICATION OF PRELIMINARY CONTAMINANTS OF POTENTIAL CONCERN AND PRELIMINARY SCREENING LEVELS

This section describes preliminary contaminants of potential concern (COPCs) and preliminary screening levels for soil, groundwater, and surface water, as presented previously and discussed in the RI/FS Work Plan (AMEC, 2008a).

4.1 MTCA CLEANUP LEVELS

Cleanup levels under MTCA are categorized as Methods A, B, or C (WAC 173-340-700). Method A cleanup levels for soil, groundwater, and surface water media are intended to be used for routine site cleanups. Cleanup levels under Method A are available for only about 25 of the chemicals more commonly found in the environment. Tables of the MTCA Method A cleanup levels are available for potable groundwater, soil for unrestricted land use (includes residential), and soil for industrial land use. Method A cleanup levels for these media must be at least as stringent as concentrations established under applicable state and federal laws. In addition, Method A soil cleanup levels must also be protective of terrestrial ecological receptors. Method A groundwater cleanup levels must be protective of surface water beneficial uses (if the pathway for groundwater to surface water is complete). Unlike for groundwater and soil, MTCA regulations do not provide a table of Method A cleanup levels for surface water. Surface water Method A cleanup levels must be at least as stringent as concentrations established under applicable state and federal laws and other requirements (see WAC 173-340-730(2)).

MTCA Method B may be used at any site and is the most common method for setting cleanup levels when sites are contaminated with substances not listed under Method A. Cleanup levels under Method B are established using applicable state and federal laws and the risk assessment equations and other requirements specified in the MTCA Rule for each medium. In addition to accounting for human health impacts, Method B cleanup levels must account for any potential terrestrial or aquatic ecological impacts (unless it can be demonstrated that such impacts are not a concern at the site). Ecology’s Cleanup Levels and Risk Calculations (CLARC) database contains hundreds of precalculated/established levels for hazardous substances in air, groundwater, surface water, and soil media (Ecology, 2008). The Method B cleanup levels in the CLARC database are provided as a service to the public. The CLARC database does not contain cleanup levels for all exposure pathways, such as soil concentrations protective of groundwater and/or surface water.

In contrast to Method B, Method C cleanup levels are intended for industrial sites where exposure to potential contaminants is limited and controllable. As under Method B, potential terrestrial and aquatic ecological impacts must be considered in addition to human health impacts when establishing Method C cleanup levels.

Potential terrestrial impacts are addressed by the completion of a Terrestrial Ecological Evaluation (TEE). A review of the requirements in WAC 173-340-7491(1) indicates that the site will not qualify for an exclusion from conducting a TEE. Upland parcels that make up the site are currently zoned HM- Heavy Manufacturing based on City of Anacortes zoning and are considered “zoned for industrial use” under MTCA (WAC 173-340). Under WAC 173-340-7490(3)(b), industrial properties need to be evaluated for wildlife protection. Therefore, a simplified or site-specific TEE is most appropriate for the site and will be conducted as part of the Phase II RI, and cleanup levels will be established for industrial and public access land uses on or adjacent to the site. Simplified TEE evaluation procedures are described in WAC 173-340-7492. A simplified TEE is intended to identify sites that do not have a substantial potential for posing a threat of significant adverse effects to terrestrial ecological receptors and may be removed from further ecological consideration. The simplified TEE procedures include (1) exposure analysis, (2) pathway analysis, and (3) contaminant analysis.

Site-specific TEE procedures are described in WAC 173-340-7493. The first step is problem formulation, which identifies (1) COPCs, (2) complete potential exposure pathways for plants or animals to COPCs, and (3) current or potential future terrestrial groups reasonably likely to live or feed at the site. Ecological receptors for which complete pathways exist for exposure to COPCs are subsequently evaluated in a toxicological assessment. A variety of approaches are allowed under MTCA cleanup regulations for completing this step to evaluate the potential for adverse effects to ecological receptors (WAC 173-340-7493 (3)). The problem formulation and method selection steps will be completed as part of the Phase II RI in consultation with Ecology.

4.2 CONTAMINANTS OF POTENTIAL CONCERN

The preliminary COPCs for the uplands are listed in Table 2. This table includes chemicals that have been found or are suspected to be present at the site based on historical analytical results for surface water and seep samples. No soils or groundwater data are available, but the presence of elevated levels of toxic metals in water samples indicates the potential for a contaminant source in refuse, site soils, or both.

Certain constituents in the historical analytical data set (such as TPH-G and total petroleum hydrocarbons in the heavy oil range [TPH-Oil], OC pesticides, asbestos, and vanadium) have not necessarily previously been detected in soil or seep samples at the uplands portion of the site, but are included as uplands COPCs because (a) they are typical of industrial and municipal waste streams that may have been landfilled during this time period, or (b) they have been previously detected in some sediments near the landfill.

4.3 PRELIMINARY SCREENING LEVELS

PSLs were developed to provide a mechanism to evaluate analytical data results. In order to encompass a full range of potentially applicable standards, PSLs have been developed using conservative assumptions that may or may not apply to the site. The PSLs in this report are to be used for screening purposes only and are not intended to represent proposed or final cleanup levels. Final cleanup levels will be determined during the feasibility study (FS) process that follows from this RI. Cleanup standards will be developed in the FS in accordance with MTCA.

4.3.1 Preliminary Screening Levels for Soil

Either MTCA Method A or Method B cleanup levels for soil are available for many contaminants. However, some contaminants have both Method A and Method B cleanup levels. Method B cleanup levels are broken down further into levels for individual exposure pathways, such as a Method B cleanup level for protection of direct human contact versus a different Method B cleanup level for protection of groundwater as marine surface water. The lowest of the MTCA Method A or Method B cleanup levels will be used for screening analytical results for soil in the RI, unless regional background levels or available analytical practical quantitation limits (PQLs) are higher.

Concentrations of COPCs in soil protective of groundwater as marine surface water were estimated using the MTCA fixed-parameter three-phase partitioning model in accordance with WAC 174-340-747(4) (Table 3). Because groundwater at the site is not a current or future source of drinking water, and because it likely migrates to marine surface water, concentrations of COPCs in marine surface water protective of human health and aquatic organisms developed in accordance with WAC 174-340-730 were used in the calculations in place of COPC levels in groundwater. Accordingly, the three-phase model provides a conservative estimate of the concentration of a contaminant in soil that is protective of groundwater as marine surface water. Estimated concentrations of COPCs in soil that are protective of groundwater as marine surface water are shown in Table 3.

Soil cleanup levels for metals may be adjusted to no less than natural background concentrations, in accordance with WAC 173-340-740(5)(c). With the exception of chromium, statewide background metals concentrations were obtained from a state background soil metals study conducted by Ecology (1994) for comparison with MTCA Method A and

Method B cleanup levels for the site. According to the Ecology study, background total chromium levels in Northern Skagit and Whatcom Counties are elevated compared to the rest of the state. Because elevated background levels of total chromium are expected, and because the site is located outside of the four main regional areas selected by Ecology for the calculation of soil background concentrations, a site-specific total chromium background concentration for the Anacortes area was calculated.

Data for the calculation were obtained from the Ecology (1994) report for 10 sample locations closest to Anacortes. Ecology's MTCAStat program was used to calculate the 90th percentile concentration and four times the 50th percentile concentration for total chromium. WAC 173-340-709(3)(c) defines background concentration as the lower of the two values for lognormally distributed data sets. The lower value (four times the 50th percentile concentration) was determined to be the appropriate background concentration for the Anacortes area. The background total chromium concentration calculated using this method is117 milligrams per kilogram (mg/kg). The PSL for chromium was adjusted upward to this value to reflect elevated chromium background concentrations present in the area. MTCAStat output for background calculation was provided as Appendix D in the RI/FS Work Plan (AMEC, 2008a).

TEE soil cleanup levels for industrial sites (WAC 173-340-900, Table 749-2) have also been used to develop the PSLs in Table 3.

Candidates for soil PSLs based on values available in the CLARC database for all constituents detected during previous upland analyses are presented in Table 3.

Soil reference levels were identified using the following sources:

- MTCA Method A soil cleanup levels (unrestricted land use);
- MTCA Method B soil cleanup levels (direct contact) (carcinogen and noncarcinogen);
- MTCA Method B soil cleanup level for protection of groundwater as marine surface water;
- MTCA Terrestrial Ecological Evaluation (TEE) soil cleanup level for industrial or commercial sites from WAC 173-340-900 (Table 479-2 of MTCA cleanup regulations); and
- State background soil metals study conducted by Ecology (1994).

The target reporting limits (practical quantitation limits [PQLs]) shown in Table 3 are the lowest soil reference levels for each analyte, when available. For analytes with no soil reference levels, standard laboratory reporting limits are included in Table 3.

Where possible, the analytical methods shown in Table 3 were chosen to provide a method detection limit (MDL) lower by a factor of 5 to 10 than the target reporting limit (i.e., lowest concentration of interest).

4.3.2 Preliminary Screening Levels for Groundwater

Preliminary screening levels for groundwater are based on protection of marine surface water. Analytical results for groundwater presented in Section 5.4 were compared to marine surface water criteria, rather than MTCA Method A or Method B drinking water criteria because groundwater will not be used for drinking water, appears to be discharging to marine surface water, and the marine surface water criteria are more conservative for many COPCs.

Although MTCA Method C (industrial) cleanup levels for groundwater exist, Ecology places severe restrictions on their use for industrial sites. Given the proximity of the site to Padilla Bay, it is unlikely that Method C cleanup levels for groundwater would apply to this site.

Candidates for groundwater PSLs based on values available in the CLARC database are presented in Table 4 for all constituents detected during previous upland analyses.

Groundwater reference levels were identified using the following sources:

- MTCA Method A and Method B (carcinogen and noncarcinogen) cleanup levels;
- Aquatic marine chronic water quality criteria (WQC) published in WAC 173-201A;
- Aquatic marine chronic and human health (fish ingestion) WQC published in Section 304 of the Clean Water Act;
- Aquatic marine chronic and human health (fish ingestion) WQC published in the National Toxics Rule, 40 CFR 131;
- MTCA Method B surface water cleanup levels (carcinogen and noncarcinogen).

The target reporting limits (PQLs) in Table 4 are the lowest groundwater reference levels for each analyte, when available. For analytes with no groundwater reference levels, standard laboratory reporting limits are included in Table 4.

Where possible, methods were chosen to provide an MDL lower by a factor of 5 to 10 than the target reporting limit (i.e., lowest concentration of interest).

4.3.3 Preliminary Screening Levels for Surface Water

Preliminary screening levels for surface water based on protection of marine surface water are shown in Table 4. Although MTCA Method C (industrial) cleanup levels for surface water exist, Ecology places severe restrictions on their use for industrial sites. Given the proximity of the site to Padilla Bay, it is unlikely that Method C cleanup levels for surface water would apply to this site.

Candidates for surface water PSLs based on values available in the CLARC database are presented in Table 4 for all constituents detected during previous upland analyses.

Surface water reference levels were identified using the following sources:

- MTCA Method A and Method B (carcinogen and noncarcinogen) cleanup levels;
- Aquatic marine chronic WQC published in WAC 173-201A;
- Aquatic marine chronic and human health (fish ingestion) WQC published in Section 304 of the Clean Water Act;
- Aquatic marine chronic and human health (fish ingestion) WQC published in the National Toxics Rule, 40 CFR 131;
- MTCA Method B surface water cleanup levels (carcinogen and noncarcinogen).

The target reporting limits (PQLs) in Table 4 are the lowest surface water reference levels for each analyte, when available. For analytes with no surface water reference levels, standard laboratory reporting limits are included in Table 4.

Where possible, methods were chosen to provide an MDL lower by a factor of 5 to 10 than the target reporting limit (i.e., the lowest concentration of interest).

5.0 NATURE AND EXTENT OF CONTAMINATION

This section presents the data gathered during Phase I of the RI and discusses the nature and extent of detected levels of contamination. The discussion below is organized by medium sampled or investigated, and then by class of COPCs.

5.1 GEOPHYSICAL INVESTIGATION RESULTS

Field data were post-processed as described in the Geophysical Investigation Report prepared by Northwest Geophysical Associates, Inc. (NGA) (NGA, 2008), and included as Appendix B. The geophysical survey data indicated 11 anomalies of interest (G1 through G11; Figure 2 in Appendix B). Anomalies of interest G1 through G8 were selected from MAG data (primarily from analytical signal data) and represent targets that exhibited a magnetic signature across two or more transect lines. Anomalies exhibiting signatures across two or more transect survey lines are more likely to be concentrations of metallic debris in the subsurface than are single source items. Anomalies of interest G9 through G11 were selected from EM data (primarily from the in-phase data) and represent anomalies that exhibited EM signatures consistent with those of metallic conductive bodies.

Metal debris potentially responsible for the anomalies encountered during the geophysical investigation was encountered at all test pit locations (Figure 6). One partially crushed steel drum was unearthed at test pit location G9. The drum contained fiberglass material and solidified resin. No external markings or labels were present on this drum. Five to six partially crushed steel drums were unearthed at test pit location G10. One of those steel drums contained one plastic drum inside the outer steel drum. Several markings were found on these drums, including “Amoco 543,” “Nalco,” and “UOP Polymerization Catalyst.” Representative photographs of the unearthed drums are included in Appendix E. The other metal debris encountered included old appliances, auto parts, sinks, pressure vessels, and an armored air hose. One clip of old ammunition was unearthed at G5. Excavation at location G1 was terminated prior to reaching the proposed depth and prior to groundwater being encountered due to the presence of suspected asbestos-containing material. This material was sent for asbestos analysis at NVL Labs in Seattle, Washington. Analytical results confirmed that the material contained 23 percent crysotile, a common form of asbestos.

5.2 SEDIMENT RESULTS

Sediments within the inner lagoon were screened for toxicity using a suite of three bioassays: a 10-day amphipod bioassay using *Ampelisca abdita* (Table 5), a 48- to 96-hour sediment larval test using *Dendraster excentricus* (Table 6), and a saline pore water Microtox bioassay (Table 7). A summary of the results is presented in Table 8. The complete bioassay report is provided in Appendix G. None of the results of the amphipod or sediment larval tests exceeded the sediment quality standards (SQS) criteria. Test results for seven locations within the Inner Lagoon exceeded the SQS for the Microtox pore water bioassay only (Table 8; Figure 7).

Based on discussions with Ecology, there may have been factors other than SMS COC chemistry that contributed to the SQS exceedances for the Microtox bioassay. Factors that may have contributed to the negative response of the organisms include (1) holding times, (2) total sulfides/dissolved sulfides, (3) ammonia, and (4) potential impact of sulfur. Consequently, the Microtox bioassay is currently being repeated at the seven locations that exceeded the SQS. The standard 20-day *Neanthes arenaceodentata* growth and survival test is also being run to provide additional information. A supplemental sampling and analysis plan has been submitted to and approved by Ecology that describes the testing procedures that will be used for the bioassay retesting.

A single sediment sample was collected at each of three sample locations in the drainage swale on the south side of the landfill. Pore water extracted from the sediments or from saturated soils along the swale showed a salinity gradient. Salinity ranged from 17 parts per thousand (ppt) near the mouth of the swale, where it discharges into the inner lagoon (MPS-3), to 0 ppt at the upper station (MPS-1) (Table 8). Chemistry results indicate that total organic carbon levels ranged from 11.8 to 16.6 percent. The total organic carbon levels were above values for which carbon normalization is considered appropriate. Consequently, the SMS list of COCs was compared to the SMS dry-weight equivalents (Table 9). The SQS dry-weight equivalent is the Lowest Apparent Effects Threshold (LAET). The Cleanup Screening Level dry-weight equivalent is the Second Lowest Apparent Effects Threshold (2LAET). The comparison of results indicates that a single analyte (phenol at 1,900 parts per billion [ppb]) exceeded the 2LAET value (Figure 8). No other analytes exceeded the SQS or the cleanup screening level dry-weight equivalents in the swale samples.

5.3 SOIL SAMPLE RESULTS

Soil samples were collected during the monitoring well installation and during the landfill test pit investigation. The data from those samples are discussed in more detail below by analyte type. Analytical results for analytes that exceeded PSLs in soil are shown on Figure 9.

5.3.1 Monitoring Well Soil Sample Results

Analytical data for monitoring well soil samples are presented in Table 10. MW-01 and MW-04 were determined to be hydraulically upgradient from the landfill and most likely represent soils unaffected by the landfill. MW-03 was advanced through and screened in fill materials and may be hydraulically connected to landfilled wastes. Monitoring well boring logs are provided in Appendix F.

5.3.1.1 Metals

Metals were detected in all soil samples collected at all depth intervals for MW-01. Copper, molybdenum, nickel, and strontium were detected in at least one sample at concentrations exceeding the PSL. Copper was detected at concentrations ranging from 18.1 mg/kg to 61 mg/kg. Only the sample collected at 37 feet bgs, with a copper concentration of 61 mg/kg, exceeded the PSL and background concentration of 36 mg/kg. Molybdenum was detected at concentrations ranging from 1 to 3 mg/kg, exceeding the PSL of 0.5 mg/kg. Nickel was detected at concentrations ranging from 56 mg/kg to 99 mg/kg, exceeding the PSL of 48 mg/kg. Strontium was detected at concentrations ranging from 19.4 mg/kg to 72 mg/kg, exceeding the PSL of 0.1 mg/kg; no Washington State Background concentration has been established for strontium. Other metals detected in the samples from MW-01 included aluminum, arsenic, barium, beryllium, chromium, iron, lead, manganese, mercury, titanium, vanadium, and zinc. Concentrations of all of these additional metals were less than the PSLs.

Metals were detected in both samples submitted for MW-04, with arsenic, copper, molybdenum, nickel, and strontium detected at concentrations greater than the PSL in at least one sample. In the sample collected from 8.5 feet bgs, arsenic was detected at a concentration of 14 mg/kg, which is greater than the PSL and background concentration of 7 mg/kg. Copper was detected at a concentration of 44.6 mg/kg, which is greater than the PSL of 36 mg/kg. Molybdenum was detected at a concentration of 2.7 mg/kg, which is greater than the PSL of 0.5 mg/kg. Nickel was detected at a concentration of 83 mg/kg, which is greater than the PSL and background concentrations of 48 mg/kg. Strontium was detected at a concentration of 35.9 mg/kg, which is greater than the PSL 0.1 mg/kg. The following metals were detected at concentrations that were less than the PSL: aluminum, barium, beryllium, cadmium, chromium, iron, lead, manganese, mercury, titanium, vanadium, and zinc.

Thirteen of the 17 metals detected in the sample collected at 8.5 feet bgs from MW-04 were also detected in the sample collected at 19 feet bgs. However, only molybdenum, nickel, and strontium were detected at concentrations greater than the PSL. Molybdenum was detected at a concentration of 2.3 mg/kg (PSL of 0.5 mg/kg). Nickel was detected at a concentration of 60 mg/kg (PSL and background concentrations of 48 mg/kg). Strontium was detected at a concentration of 33.2 mg/kg (PSL of 0.1 mg/kg).

In the sample submitted for MW-03, which was drilled through fill material, copper, molybdenum, nickel, strontium, and zinc were detected at concentrations exceeding the PSL. Copper was detected at a concentration of 373 mg/kg (compared to a PSL of 36), molybdenum was detected at a concentration of 4 mg/kg (PSL of 0.5 mg/kg), nickel was detected at a concentration of 80 mg/kg (PSL of 48 mg/kg), strontium was detected at a concentration of 29.3 mg/kg (PSL of 0.1 mg/kg), and zinc was detected at a concentration of 282 mg/kg (PSL of 100.8 mg/kg). These concentrations also exceeded Washington State background concentrations for those metals with established background concentrations. Metals that were detected at concentrations below the PSL include aluminum detected at a concentration of 11,500 mg/kg (less than the PSL of 32,600 mg/kg), arsenic at an estimated concentration of 6.8 mg/kg (less than the PSL of 7 mg/kg), barium at a concentration of 117 mg/kg (less than the PSL of 1,320 mg/kg), cadmium at a concentration of 0.8 mg/kg (less than the PSL of 1.214 mg/kg), chromium at a concentration of 55 mg/kg (less than the PSL of 135 mg/kg), iron at a concentration of 39,900 mg/kg (less than the PSL of 58,700 mg/kg), lead at a concentration of 171 mg/kg (less than the PSL of 220 mg/kg), manganese at a concentration of 400 mg/kg (less than the PSL of 1,200 mg/kg), and vanadium at a concentration of 45.1 mg/kg (less than the PSL of 560 mg/kg).

5.3.1.2 TPH

TPH-G was not detected in any soil sample submitted for sample locations MW-01, MW-03, and MW-04.

5.3.1.3 VOCs

Several VOCs were detected at all depths in the soil samples submitted for MW-01, MW-03, and MW-04; however, no concentrations of VOCs exceeded the associated PSLs. Most notably, acetone (a common laboratory contaminant) was detected in every sample at concentrations ranging from 11 micrograms per kilogram (µg/kg) to an estimated concentration of 95 µg/kg. These detections are lower than the PSL of 8,000,000 µg/kg. Further, carbon disulfide was detected in MW-01 and MW-03; methylene chloride in MW-01, MW-03, and MW-04; and 2-butanone in MW-04. All those detections were below the individual PSLs.

5.3.1.4 Pesticides and PCBs

Pesticides were not detected in any of the soil samples collected from the monitoring well borings. Two PCBs, Aroclor 1248 and Aroclor 1254, were detected in the sample from a depth of 11.5 feet in MW-03 only. Aroclor 1248 was detected at a concentration of 28 µg/kg. No PSL has been established for Aroclor 1248. Aroclor 1254 was detected at a concentration of 27 µg/kg, which is greater than the PSL of 4 µg/kg. Total PCBs were calculated using one-half the reporting limit for non-detected values. The resulting concentration of 66.7 µg/kg is greater than the PSL of 28 µg/kg. No PCBs were detected in the soil samples from borings MW-2 or MW-4.

5.3.1.5 Summary

In summary, all monitoring well soil samples had several total and dissolved metals concentrations above the PSL. In addition, one sample (at MW-03) exceeded the PSL for Aroclor 1254 and total PCBs. Additional PCBs congeners (at MW-03 only) and some VOCs were detected in the other monitoring well soil samples, but none was found exceeding the PSL. No TPH, VOC, or SVOC was detected in any of the borings above its respective PSL.

5.3.2 Test Pit Soil Sample Results

Analytical results for test pit soil samples are discussed in this section and presented in Table 10. Test pit soil samples were collected from soil horizons in the test pits dug in the landfill to characterize metallic objects. In general, the samples were collected from soil adjacent to metallic objects or where there were other indications (staining, etc.) that soil may have been impacted by wastes per the RI/FS Work Plan. During the test pit investigation, an archaeologist was present to screen soils for historical artifacts in or below the refuse. The archaeological summary is provided in Appendix H.

5.3.2.1 Metals

Arsenic was detected at concentrations greater than the PSL and background concentrations of 7 mg/kg in 2 of 14 test pit soil samples. The concentration in the sample from 12 feet bgs from G3 was 8.8 mg/kg, and the concentration in the sample from 11 feet bgs from G11 was 13 mg/kg. Concentrations of arsenic in the remaining samples ranged from 2.3 mg/kg to 5.1 mg/kg.

Cadmium was detected at concentrations greater than the PSL of 1.214 mg/kg and the background concentration of 1 mg/kg in 2 of 14 samples. The concentration in the sample from 5.5 feet bgs from G1 was 2.6 mg/kg, and the concentration in the sample from 5 feet bgs from G4 was 2.7 mg/kg. Detected concentrations of cadmium in the remaining samples ranged from 0.3 to 0.7 mg/kg.

Copper was detected at concentrations greater than the PSL of 36 mg/kg in five samples at concentrations ranging from 36.4 mg/kg in the sample from 9 feet bgs from G5 to 76 mg/kg in the samples from 5.5 feet bgs from G1 and 8 feet bgs from G3. The remaining sample concentrations ranged from 21.6 mg/kg to 33.3 mg/kg.

Lead was detected in all samples, except those from locations G10 and G11. Only one sample contained lead at a concentration greater than the PSL of 220 mg/kg: lead was detected in the sample from 5 feet bgs from G4 at a concentration of 238 mg/kg. The remaining sample concentrations ranged from 2 mg/kg to 112 mg/kg.

Mercury was detected in 7 of the 14 samples at concentrations ranging from 0.07 mg/kg in the sample from a depth of 5 feet bgs from G5 and the field duplicate from 6 feet bgs from G6, to 6.9 mg/kg in the sample from 5.5 feet bgs from G1. Five of these detections are greater than the PSL of 0.07 mg/kg, while the remaining two detections are equal to the PSL.

Molybdenum was detected in all samples at concentrations greater than the PSL of 0.5 mg/kg, with results ranging from 1.6 to 6 mg/kg. No background concentration has been established for molybdenum.

Nickel was detected in all of the samples at concentrations ranging from 34 to 90 mg/kg. Concentrations in 12 of the 14 samples exceed the PSL and background concentrations of 48 mg/kg. The concentrations from samples from 12 feet bgs from G3 and from 11 feet bgs from G11 did not exceed the PSL.

Strontium was detected in all samples at concentrations ranging from 26.7 mg/kg in the sample from 6 feet bgs from G6 to 64.1 mg/kg in the sample from 11 feet bgs from G11, all exceeding the PSL of 0.1 mg/kg. No background concentration has been established for strontium.

Zinc was detected in 8 of the 14 samples at concentrations greater than the PSL of 100.8 mg/kg and the background concentration of 85 mg/kg. Concentrations exceeding the PSL ranged from 174 mg/kg in the sample from 8 feet bgs from G3 to 381 mg/kg in the sample from 5.5 feet bgs from G1.

Metals detected in the test pit samples that were below the associated PSL include aluminum, barium, beryllium, chromium, iron, manganese, titanium (no PSL has been established for titanium), and vanadium.

5.3.2.2 TPH

The test pit samples were analyzed for TPH as diesel (TPH-D), TPH-G, and TPH-Oil. TPH-G was detected in the samples from 5 and 9 feet bgs from G5, at concentrations of 6.5 mg/kg and 310 mg/kg, respectively. The concentrations in the sample from 9 feet bgs exceeds the PSL of 30 mg/kg. TPH-D was detected at low levels in all of the samples except for the samples from 1 feet bgs from G4 and G5 and the sample from G11. Concentrations ranged from 6.1 mg/kg in the sample from 8 feet bgs from G10 to 280 mg/kg in the sample from 9 feet bgs from G5. In addition, TPH-Oil was detected at low levels in all of the samples except for the samples from 1 feet bgs from G5 and the sample from G11. Detected concentrations ranged from 16 mg/kg in the sample from 8 feet bgs from G10 to 670 mg/kg in the sample from 9 feet bgs from G5. Detected concentrations of both TPH-D and TPH-Oil were less than the PSL of 2,000 mg/kg.

5.3.2.3 SVOCs

SVOCs detected in test pit samples were found primarily in the samples from G1 at 5.5 feet bgs and G5 at 9 feet bgs. Bis(2-ethylhexyl) phthalate, naphthalene, and phenanthrene were also detected in samples from other test pits; however, the results were below the associated PSLs. No other SVOCs were detected in samples collected from the test pits.

Twelve SVOCs were detected in the sample collected at a depth of 5.5 feet bgs at G1, with three compounds detected at concentrations greater than the associated PSLs. Benzo(a)anthracene was detected at a concentration of 270 µg/kg (PSL of 129.7 µg/kg); benzo(a)pyrene was detected at a concentration of 240 µg/kg (PSL of 100 µg/kg); and chrysene was detected at a concentration of 320 µg/kg (PSL of 144.1 µg/kg).

Fourteen SVOCs were detected in the sample collected at a depth of 9 feet bgs at G5, with four compounds detected at concentrations greater than the associated PSLs. Benzo(a)anthracene was detected at a concentration of 130 µg/kg (PSL of 129.7 µg/kg); benzo(a)pyrene was detected at a concentration of 120 µg/kg (PSL of 100 µg/kg); bis(2-ethylhexyl) phthalate was detected at a concentration of 6,000 µg/kg (PSL of 4,849 µg/kg); and chrysene was detected at a concentration of 180 µg/kg (PSL of 144.1 µg/kg).

5.3.2.4 VOCs

Several VOC compounds were detected at low levels in all 14 test pit samples, with most of the detections in the samples from 8 and 12 feet bgs from G3, 9 feet bgs from G5, and from G11. None of the compounds detected exceeded the associated PSLs.

5.3.2.5 Pesticides and PCBs

Pesticides were detected in samples submitted from test pit locations G3, G4, G5, and G6. Delta-BHC was detected in the samples collected at 1 and 8 feet bgs from G3 and in the sample collected at 6 feet bgs from G6 at concentrations ranging from 2.8 µg/kg to 120 µg/kg.

These concentrations are greater than the PSL of 1.7 µg/kg. Dieldrin was detected in the sample from 8 feet bgs from G3 and in the sample from 9 feet bgs from G5 at concentrations of 24 µg/kg and 210 µg/kg, respectively, which are greater than the PSL of 3.3 µg/kg. Finally, methoxychlor was detected in the sample from 1 feet bgs from G4 at a concentration of 71 µg/kg, which is greater than the PSL of 48.12 µg/kg. The only other pesticide detected in the samples was aldrin in the sample from 9 feet bgs from G5 at a concentration of 390 µg/kg, which is greater than the PSL of 1.7 µg/kg. No other pesticides were detected in test pit soil samples.

PCBs were detected in samples collected from test pit locations G1 at 5.5 feet bgs, G3 at 8 feet bgs, G4 at 5 feet bgs, G5 at 9 feet bgs, and G6 at 6 feet bgs. Aroclor 1254 was detected at concentrations ranging from 22 µg/kg in the sample from 8 feet bgs at test pit G3 to 240 µg/kg in the sample from 5 feet bgs at test pit G4, all greater than the PSL of 4 µg/kg. Aroclor 1260 was detected in three samples, at concentrations ranging from 9.9 µg/kg in the duplicate sample from 6 feet bgs at test pit G6 to 360 µg/kg in the sample from 5.5 feet bgs at test pit G1. All of the concentrations are less than the PSL of 492.1 µg/kg. Finally, Aroclor 1248 was detected in the sample from 8 feet bgs at G3 at a concentration of 20 µg/kg. No PSL has been established for Aroclor 1248. Total PCBs were calculated by summing the concentrations of individual aroclors. One-half of the reporting limit was assigned for non-detected aroclors. Total PCBs ranged from 50.4 µg/kg in the field duplicate sample from G6 to 690 µg/kg in the sample from 5.5 feet bgs at G1, all of which are greater than the PSL of 28 µg/kg.

5.3.2.6 Summary

In summary, all test pit soil samples had several metals concentrations above the PSL (Figure 9). In addition, one sample (at location G5) exceeded the PSL for TPH-G and two samples (at locations G1 and G5) had a few SVOCs detected above PSLs. PCBs (total and/or individual congeners) exceeded PSLs in six samples located at five different locations G1, G3, G4, G5, and G6. The following pesticides were detected above their respective PSLs in one or more test pit soil samples; aldrin (at location G5), delta-BHC (at location G3 and location G6), dieldrin (at location G3 and location G5), and methoxychlor (at location G4). Other TPH, PCB, SVOC, and VOC analytes were detected in the test pit soil samples, but did not exceed the respective PSL.

5.4 GROUNDWATER/SEEP RESULTS

Analytical data for groundwater and seep samples are presented in Table 11. Analytical results for analytes that exceeded PSLs in groundwater and seep samples are shown on Figure 10.

5.4.1 Groundwater Results

Monitoring well samples collected during the October and December 2008 and April and July 2009 sampling events included samples from monitoring well locations MW-02, MW-03, and MW-04. The samples were analyzed for the analytes noted in Section 3.6.2. Analytical results are discussed below.

5.4.1.1 Metals

Total and dissolved metals were detected in all of the samples collected in October, December, April, and July. In the October sampling event, dissolved arsenic was detected in samples from locations MW-02 through MW-04 at concentrations ranging from 1.9 µg/L to 4.6 µg/L. In the December sampling event, dissolved arsenic was detected in samples from locations MW-02 through MW-04 at concentrations ranging from 0.4 µg/L to 4.4 µg/L. In the April sampling event, dissolved arsenic was detected in samples from MW-02 through MW-04 at concentrations ranging from 0.5 µg/L to 5.5 µg/L. In the July sampling event, dissolved arsenic was detected in samples from MW-02 through MW-04 at concentrations ranging from 2.5 µg/L to 5.9 µg/L. These concentrations were all greater than the PSL of 0.2 µg/L. The total and dissolved arsenic concentrations in MW-02 and MW-04 remained consistent during all four sampling events. The concentrations in samples from location MW-03 decreased during the December and April sampling events.

Total lead was detected in the sample from MW-03 during the October sampling event at a concentration of 16 µg/L, greater than the PSL of 8.1 µg/L. A blind field duplicate was collected at this location, and total lead was detected at a significantly lower concentration of 2 µg/L. Total lead was not detected in the samples from MW-03 during the remaining three sampling events, nor was total or dissolved lead detected in any of the other monitoring wells sampled in October, December, April, or July.

Total and dissolved manganese were detected in samples collected from locations MW-03 and MW-04 during the four sampling events. The concentrations of dissolved manganese in samples from these two wells during all four events ranged from 121 µg/L to 336 µg/L, and the concentration of total manganese ranged from 124 µg/L to 350 µg/L in all four sampling events. All of the concentrations detected in samples from these two wells during the four sampling events were greater than the PSL of 100 µg/L. Total and dissolved manganese were also detected in samples from location MW-02 during all four sampling events at concentrations ranging from 21 µg/L to 45 µg/L for dissolved manganese and 46 µg/L to 64 µg/L for total manganese. All of the detections of total and dissolved manganese in MW-02 were less than the PSL of 100 µg/L.

Total copper was detected in the sample collected from location MW-03 during the October sampling event at a concentration of 3 µg/L, slightly greater than the PSL of 2.4 µg/L. Total zinc was also detected in sample MW-03 during the October sampling event, at a concentration of 30 µg/L, less than the PSL of 81 µg/L. Total copper and zinc were not detected in the samples from MW-03 during the December, April, or July sampling events, nor were they detected in the field duplicate collected at location MW-03 during any of the four sampling events. Total and dissolved copper and zinc were not detected in any of the other samples during the four sampling events.

The only other total and dissolved metal with an associated PSL detected in the monitoring well samples during the October, December, April, and July sampling events is nickel, which was detected at dissolved concentrations ranging from 0.5 µg/L to 4.1 µg/L and total concentrations ranging from 0.5 µg/L to 5.4 µg/L. All of the total and dissolved nickel concentrations detected during the four sampling events were less than the PSL of 8.2 µg/L.

Other total and dissolved metals detected in the monitoring well samples during the October, December, April, and July sampling events that do not have an associated PSL are aluminum, barium, iron, molybdenum, strontium, titanium, and vanadium.

5.4.1.2 Total Petroleum Hydrocarbons

No TPH compounds were detected in any of the samples collected from locations MW-02, MW-03, and MW-04 during the October, December, April, or July sampling events.

5.4.1.3 SVOCs and PAHs

Monitoring well samples were analyzed for SVOCs and PAHs. The select ion monitoring method was used for selected analytes as shown in Table 4 to achieve lower detection limits. No SVOC compounds were detected in the monitoring well samples collected during the October, December, or July sampling events. One compound, bis(2-ethylhexyl) phthalate, was detected in the sample collected from MW-03 during the April sampling event at a concentration of 1.2 µg/L, less than the PSL of 2.2 µg/L.

The only PAH compound consistently detected in groundwater samples was acenaphthene, detected in the sample collected from MW-03 during all four sampling events at concentrations ranging from 0.012 µg/L in the July sampling event to 0.032 µg/L in the October sampling event. All of the detections in the samples from MW-03 and field duplicates from MW-03 are significantly lower than the associated PSL of 640 µg/L.

5.4.1.4 VOCs

Acetone, a known laboratory contaminant, was detected in samples collected from locations MW-02 and MW-03 during the October sampling event at concentrations ranging from 3.1 µg/L to 4.6 µg/L. Acetone was not detected in the samples collected during the remaining three sampling events. No PSL is associated with acetone, and the detections are well below the MTCA Method B cleanup level of 800 µg/L. Chloromethane was detected in the sample from MW-02 during the October sampling event at a concentration of 0.4 µg/L, and in the duplicate sample from MW-03 during the December sampling event at an estimated concentration of 0.5 µg/L. These concentrations are well below the PSL of 130 µg/L. Benzene and toluene were detected in the sample collected from MW-04 during the April sampling event at concentrations of 0.2 µg/L and 0.3 µg/L, respectively. Both of these detections were below the associated PSLs. No other VOC was detected in the monitoring well samples during the four sampling events.

5.4.1.5 Organochlorine Pesticides

Alpha-BHC was detected in the sample from location MW-03 during all four sampling events at concentrations ranging from 0.015 µg/L in October to 0.041 µg/L in April. These levels exceed the PSL of 0.0049 µg/L. In addition, 4,4’-DDD was detected in the sample from location MW-03 during the December, April, and July sampling events at consistent concentrations ranging from an estimated concentration of 0.0056 µg/L in December to 0.0082 µg/L in July. These detections also exceed the PSL of 0.00166 µg/L. Beta-BHC, delta-BHC, and gamma-BHC (Lindane) were also detected in well MW-03 during all four sampling events, but the concentrations were well below their associated PSLs. Pesticides were not detected in either well MW-02 or MW-04.

5.4.1.6 PCBs

Aroclor 1232 was detected in December and April in well MW-03, and Aroclor 1242 was detected in October and December in well MW-03. These aroclor detections did not exceed their respective PSLs. Total PCBs (calculated using one-half the reporting limit) in MW-03 did not exceed PSLs during the April, October, or July sampling events. There were no detections of PCBs in MW-03 during the July sampling event, and PCBs were not detected in MW-02 or MW-04 during any of the four sampling events.

5.4.1.7 Summary

In summary, all groundwater sample locations had several total and dissolved metals concentrations greater than the PSL (Figure 10). PCBs did not exceed PSLs in any of the groundwater samples. SVOCs, PAHs, and VOCs were detected during all four sampling events, but none of the analytes exceeded the applicable PSL. Alpha-BHC was detected in one well (MW-03) during all four sampling events, and 4,4'-DDD was detected in the same well during three of the four sampling events, both at concentrations exceeding the PSLs.

5.4.2 Seep Results

Seep samples collected during the October, December, April, and July sampling events included samples from locations SP-01, SP-02, and SP-03. The samples were analyzed for the analytes listed in Section 3.6.2. Analytical results are discussed below. Analytical results for analytes that exceeded PSLs in seep samples are shown on Figure 10.

5.4.2.1 Total and Dissolved Metals

Total and dissolved metals were detected in all of the samples collected in October, December, April, and July. The dissolved arsenic concentrations detected at location SP-01 in October, April, and July ranged from 0.4 µg/L to 1.2 µg/L. At location SP-02 the dissolved arsenic concentrations ranged from 0.7 µg/L in April to 1.1 µg/L in July. At location SP-03 the dissolved arsenic concentrations from October, April, and July ranged from 0.6 µg/L to 0.8 µg/L. The total arsenic concentrations ranged from a low of 0.8 µg/L detected during the July sampling event at location SP-03 to a high of 2.4 µg/L also detected during the July sampling event at location SP-02. The total and dissolved concentrations detected during all four sampling events are greater than the PSL of 0.2 µg/L.

Total and dissolved manganese were detected in samples collected from locations SP-01, SP-02, and SP-03 during all four sampling events. The concentrations of dissolved manganese at all three locations ranged from 126 µg/L to 545 µg/L, and total concentrations ranged from 85 µg/L to 570 µg/L. All of the concentrations detected in all locations during the four sampling events were greater than the PSL of 100 µg/L, with the exception of the concentration of 85 µg/L detected at location SP-02 during the October sampling event.

Total copper was detected in the sample collected from location SP-02 during the December sampling event at a concentration of 5 µg/L, greater than the PSL of 2.4 µg/L. Total copper was also detected at location SP-02 during the April and July sampling events at a concentration of 2 µg/L. Total and dissolved copper were not detected in any of the other seep locations during the four sampling events.

Total lead was detected in the sample from SP-02 during the December sampling event at a concentration of 1 µg/L, less than the PSL of 8.1 µg/L. Total lead was not detected in the samples from SP-02 during the October, April, or July sampling events, nor was total or dissolved lead detected in any of the other seep locations during the four sampling events.

In the October sampling event, total and dissolved silver were detected in the sample from SP-02 at concentrations of 8 µg/L and 11 µg/L, respectively. Total zinc was detected in the sample from SP-03 at a concentration of 20 µg/L. Neither metal was detected in these locations during the December, April, or July sampling events, and neither was detected in any of the other seep samples collected during the four sampling events. The silver and zinc concentrations detected are less than the associated PSLs of 26,000 µg/L and 81 µg/L, respectively.

The only other total and dissolved metals with an associated PSL detected in the seep samples during the four sampling events are nickel and selenium. Nickel was detected at dissolved concentrations ranging from 0.6 µg/L to 7 µg/L and total concentrations ranging from 0.8 µg/L to 8 µg/L. All of the total and dissolved nickel concentrations detected during the four sampling events are less than the PSL of 8.2 µg/L. Dissolved selenium was detected in SP-03 during the July sampling event at a concentration of 50 µg/L, less than the PSL of 71 µg/L. Total and dissolved selenium were not detected in any other seep samples during the four sampling events.

Other total and dissolved metals detected in the seep samples during the October, December, April, and July sampling events that do not have an associated PSL are aluminum, barium, iron, molybdenum, strontium, titanium, and vanadium.

5.4.2.2 SVOCs and PAHs

Two SVOCs were detected in samples from SP-01: 4-chloro-3-methylphenol detected in the sample collected in December at an estimated concentration of 7.8 µg/L and carbaryl detected in all four sampling events at concentrations ranging from 1.9 µg/L during the October sampling event to 11 µg/L during the July sampling event. There are no associated PSLs for these compounds; however, the concentration of carbaryl is well below the MTCA Method B cleanup level for noncarcinogen in groundwater of 1,600 µg/L.

N-Nitrosodiphenylamine was detected in samples from SP-02 during three sampling events at concentrations of 1.4 µg/L and 1.2 µg/L, which are less than the PSL of 6 µg/L. No other SVOC was detected in SP-02 during the four sampling events.

At SP-03, the SVOCs 1- and 2-methylnaphthalene were detected during the four sampling events at concentrations ranging from 2.9 µg/L to 5.3 µg/L. There is no associated PSL for these compounds. Acenaphthene was detected during all four sampling events at concentrations ranging from 1.0 µg/L in October to 1.3 µg/L in December. The compound 2,4-dimethylphenol was detected during the December, April, and July sampling events at concentrations of 57 µg/L, 13 µg/L, and 1.9 µg/L, respectively. These concentrations were substantially less than the associated PSLs of 640 µg/L for acenapthene and 550 µg/L for 2,4-dimethylphenol. The only other compound detected in location SP-03 was diethyl phthalate during the December sampling event at a concentration of 1.4 µg/L, less than the PSL of 28,000 µg/L.

Several PAH compounds were detected in all three seep locations during the October, December, April, and July sampling events. The concentrations were all at low levels, orders of magnitude below the associated PSLs.

5.4.2.3 Total Petroleum Hydrocarbons

The samples were analyzed for TPH as gasoline (TPH-G) and diesel (TPH-D) as well as hydrocarbon identification. The only detections in the seep samples were low-level diesel detections during the four sampling events. The detections ranged from 0.31 milligrams per liter (mg/L) in SP-02 during the December sampling event to 0.76 mg/L in SP-03 during the July sampling event. There are no PSLs established for TPH compounds; however, the detections of TPH-D in SP-01 and SP-03 during the December, April, and July sampling events ranging from a low of 0.55 mg/L to a high of 0.76 mg/L, and the July detection of 0.51 mg/L in SP-02, all exceeded the MTCA Method A cleanup level of 0.5 mg/L.

5.4.2.4 VOCs

Several VOC compounds were detected at low levels in all three seep locations during the October, December, April, and July sampling events. None of the detected concentrations exceeded the associated PSLs.

5.4.2.5 Organochlorine Pesticides

Pesticides were not detected in seep samples during the October, December, April, or July sampling events.

5.4.2.6 PCBs

Aroclor 1232 was detected in the December and April samples from SP-03, and Aroclors 1232 and 1242 were detected in samples collected in October and December from SP-03. Additionally, Aroclor 1232 was detected in the April sample from SP-02. Concentrations of total PCBs in SP-03 in the December and April samples were calculated as 0.14 µg/L and 0.121 µg/L, respectively, exceeding the PSL of 0.07 µg/L. The concentration of total PCBs in SP-02 in the April sample was calculated at 0.058 µg/L, less than the PSL. PCBs were not detected in SP-01, nor were PCBs detected in any of the seep samples during the July sampling event.

5.4.2.7 Summary

In summary, all seep sample locations had several total and dissolved metals concentrations greater than the PSL. The concentrations of total PCBs exceeded the PSL in the sample collected at SP-03 during December and April. TPH-D and several PAHs, SVOCs, and VOCs were detected in seep samples collected during the four sampling events, but none exceeded the applicable PSL.

5.5 SURFACE WATER RESULTS

Surface water samples collected during the October, December, April, and July sampling events included samples from locations SW-01, SW-03, SW-04, SW-05, and SW-06. A sample was collected from SW-07 only during the December and April sampling events. Proposed location SW-02 was not sampled during any of the sampling events. Location SW-02 was dry during the first sampling event in October 2008. It was decided in the field not to change the sample nomenclature for the subsequent samples collected during the October 2008 event in case surface water samples could be collected at SW-02 during the next monitoring event. No surface water sample has been collected at SW-02 during any of the four monitoring events due to the sampling location being dry. We will continue to observe the conditions at location SW-02 during future monitoring events, and if surface water is present a sample will be collected.

Surface water samples were analyzed for the analytes listed in Section 3.7.2. Analytical results are discussed in this section, and data are presented in Table 11. A summary of analytes that exceed the PSLs is presented in Figure 11.

5.5.1 Total and Dissolved Metals

Total and dissolved metals were detected in all of the surface water samples collected during the four sampling events. Dissolved arsenic was detected in most samples during the four sampling events at concentrations ranging from 0.5 µg/L in SW-07 during the December sampling event to 5.1 µg/L in SW-01 during the July sampling event. Total arsenic was also detected in all but one of the samples collected during the four sampling events at concentrations ranging from 0.8 µg/L in SW-05 in December to 21.3 µg/L in SW-01 in July. All of the detected concentrations of total and dissolved arsenic are greater than the PSL of 0.2 µg/L.

Total and dissolved manganese were detected in all of the surface water samples collected during the four sampling events. The dissolved manganese concentrations exceeded the PSL of 100 µg/L in all samples during all four events, with the exception of the samples collected from SW-01 in October and December, the October and July samples collected from SW-04 and SW-06, and the July sample collected from SW-05. The dissolved manganese concentrations in excess of the PSL ranged from 132 µg/L to 795 µg/L. The total manganese concentrations also exceeded the PSL, with the exception of the October samples collected from location SW-01, the July sample from location SW-05, and the October and July samples from SW-06. The total manganese concentrations in excess of the PSL ranged from 125 µg/L to 782 µg/L.

Total nickel was detected at concentrations that exceeded the PSL of 8.2 µg/L in the December and April samples collected from SW-03 and the December sample collected from SW-04. The total nickel concentrations of 11 µg/L and 10 µg/L, detected in the December and July samples collected from SW-06, also exceeded the PSL. Total nickel was detected in SW-01 during the July sampling event at a concentration of 72.2 µg/L, exceeding the PSL. Dissolved nickel concentrations exceeded the PSL of 8.2 µg/L in the December samples from SW-03 (9 µg/L) and SW-04 (11 µg/L). Total and dissolved nickel were detected in other samples during the four sampling events, but the concentrations were less than the PSL.

Total mercury was detected in surface water samples from only one location, SW-01, during the December and July sampling events at concentrations of 0.0284 µg/L and 0.0649 µg/L, both of which exceed the PSL of 0.025 µg/L. Neither total nor dissolved mercury was not detected in any of the remaining surface water samples during the four sampling event.

Dissolved copper was detected sporadically in SW-03 through SW-06 during the December, April, and July sampling events. Of the 11 detections of dissolved copper in these locations, 9 exceeded the PSL of 2.4 µg/L at concentrations ranging from 3 µg/L to 6 µg/L. Total copper was also detected in the same surface water locations at concentrations ranging from 3 µg/L to 38 µg/L.

Total lead was detected in samples from SW-01 during the December and July sampling events, SW-03 during the April sampling event, and SW-04 during the October sampling event, and SW-07 during the December sampling event. The detected concentration in the sample from SW-01 during the July sampling event exceeded the PSL of 8.1 µg/L at a concentration of 24 µg/L. All other detections were lower than the PSL, with concentrations ranging from 1 µg/L to 3 µg/L.

Total zinc was detected sporadically in samples from SW-01, SW-03, SW-04, SW-05, and SW-07 during the four sampling events. Of the eight detections of total zinc at these locations, only the detection at SW-01 during the July sampling event exceeded the PSL of 81 µg/L at a concentration of 150 µg/L. The remaining detected concentrations ranged from 10 µg/L to 40 µg/L.

The following other total and dissolved metals were detected in one or more surface water samples, but the concentrations did not exceed the PSLs: total and dissolved aluminum, total and dissolved barium, total chromium, total and dissolved iron, total and dissolved molybdenum, total silver, total and dissolved strontium, total and dissolved titanium, total and dissolved vanadium, and dissolved zinc.

5.5.2 TPH

No TPH analytes were detected in any of the surface water samples collected from locations SW-01, SW-03, SW-04, SW-05, SW-06, and SW-07 during the October, December, April, or July sampling events.

5.5.3 SVOCs and PAHs

Surface water samples were analyzed for SVOCs, with PAHs analyzed using select ion monitoring to achieve lower detection limits.

No SVOCs were detected in locations SW-03, SW-04, or SW-06 during the October, December, April, or July sampling events. One compound, bis(2-ethylhexyl) phthalate, was detected in the sample collected at SW-01 during the December sampling event at a concentration of 1.6 µg/L, which is less than the PSL of 2.2 µg/L. The compound bis(2-ethylhexyl) phthalate was not detected in any other samples during the four sampling events. Carbaryl was detected in the samples collected at SW-07 during the December and April sampling events at concentrations of 1.8 µg/L and 1.2 µg/L, respectively. There is no associated PSL for carbaryl, and this compound was not detected in any of the other surface water samples during the four sampling events. Nine SVOCs were detected in the surface water sample collected at SW-05 in October; none of the concentrations exceeded the associated PSL. The most notable detections were benzoic acid at 5,500 µg/L and benzyl alcohol at 600 µg/L. These compounds do not have an associated PSL. No SVOCs were detected in the samples collected at SW-05 in December, April, or July.

No PAH compounds were detected in samples collected during the four sampling events at locations SW-03 and SW-04. However, PAHs were detected at SW-01, SW-05, SW-06, and SW-07. PAH compounds were not detected in sample SW-01 until the July sampling event, during which five PAH compounds were detected. None of the PAHs detected were at a concentration greater than the associated PSL. One PAH compound, acenaphthene, was detected in the sample collected at SW-05 during the October, December, and April sampling events at concentrations ranging from 0.014 µg/L in October to 0.064 µg/L in April. Acenaphthene was also detected in the sample from SW-06 during the April sampling event at a concentration of 0.01 µg/L. These concentrations are several orders of magnitude less than the PSL of 640 µg/L. Acenaphthene was not detected in SW-05 or SW-06 during the July sampling event. Nine PAH compounds were detected in sample SW-07 during the December sampling event, and six PAH compounds were detected during the April sampling event. None of the PAHs was detected at a concentration greater than the associated PSL.

5.5.4 VOCs

During the October sampling event, the only VOC detected was acetone, a known laboratory contaminant; it was detected in a sample from location SW-03 at a concentration of 3.1 µg/L. There is no associated PSL for acetone, and it was not detected in any other samples during the four sampling events. Toluene was detected in samples collected from SW-01, SW-05, and SW-07 in December at concentrations ranging from 0.2 µg/L to 0.8 µg/L. Toluene was detected at SW-04 and SW-07 at concentrations of 0.2 µg/L and 1.4 µg/L, respectively, during the April sampling event, and in SW-01 at 32 µg/L during the July sampling event. These concentrations are all several orders of magnitude less than the PSL of 15,000 µg/L for toluene. During the December sampling event, 1,2,4-trimethylbenzene, benzene, m,p-xylene, and o-xylene were detected in the sample from SW-07. Of these detected VOCs, only benzene has an associated PSL, and the benzene concentration of 2.2 µg/L in SW-07 is less than the PSL of 23 µg/L. During the July sampling event, bromoform was detected at concentrations ranging from 12 µg/L to 17 µg/L, and dibromochloromethane was detected at a concentration of 0.3 µg/L in samples SW-03, SW-04, SW-05, and SW-06. These concentrations are below the PSLs of 140 µg/L for bromoform and 13 µg/L for dibromochloromethane. Carbon disulfide was detected in the samples from SW-03 during the April sampling event and in the samples from SW-01 and SW-04 during the July sampling event at concentrations ranging from 0.2 µg/L to 4.1 µg/L. Carbon disulfide does not have an associated PSL.

5.5.5 Organochlorine Pesticides

The only pesticide detected in any of the surface water samples during the four sampling events was 4,4’-DDD. It was detected in SW-06 in December at an estimated concentration of 0.0019 µg/L, which is slightly greater than the PSL (0.00166 µg/L).

5.5.6 PCBs

PCBs were not detected in any surface water samples.

5.5.7 Summary

In summary, all surface water sample locations had several total and dissolved metals concentrations greater than the PSLs including arsenic, manganese, copper, lead, mercury, nickel, and zinc. In addition, in one sample the concentration of 4,4’-DDD exceeded the PSL during the December sampling event. However, 4,4’-DDD was not detected at the same location during the October, April, or July sampling events. SVOCs, PAHs, and VOCs were detected during the four sampling events, but none of the detected concentrations exceeded the associated PSL.

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6.0 CONCEPTUAL SITE MODEL

This section describes the current conceptual site model developed based on the Phase I remedial investigation.

6.1 CONCEPTUAL SITE MODEL

A preliminary conceptual site model was developed based on the Phase I investigation and historical data. Based on the boring logs and test pits, the local geology is interpreted as follows.

- Silt to Peat Unit: This unit is found at MW-04 only and consists of silt with various amounts of peat. The unit is up to 16 feet thick and is likely a continuation of the Bay Mud discovered in test pits below the landfill.
- Silty Sand Unit (fill): This unit is found at MW-03 and consists of silty sand with a few glass pieces. This fill unit is up to 18.5 feet thick and is likely associated with either rail or road construction or possibly a fill unit associated with the former landfill activity.
- Poorly Graded Sand Unit: This unit is found at MW-02 and MW-04 and consists of poorly graded sand with little or no fines. This unit is up to 31 feet thick (as evident from the boring log for MW-01).
- Padilla Bay Mud Unit: This unit is found in the bottom of three test pits (G-3, G-7, and G-11) below the landfill and consists of silt with various amounts of clay and peat-like material. The thickness of this unit is unknown as it was not encountered in any of the monitoring well borings and the test pits within the landfill footprint were terminated when bay mud was encountered.
- Lean Clay Unit (till): This unit is found in all locations at various elevations. This unit is very stiff, lean clay with occasional trace fine sand laminations and is not fully penetrated in any boring.

Lithologic data from monitoring wells (presented in cross section in Figures 12 and 13) suggest that the landfill material is underlain by native bay mud of unknown thickness. The native bay mud is underlain by deeper native glacial sand units. The native bay mud likely acts as an aquitard, separating shallow groundwater in the landfill material from lower water-bearing zones. This hypothesis is supported by the apparent lack of a deeper water-bearing zone beneath the site. One Phase I boring (MW-01) drilled to a total depth of 70 feet bgs encountered groundwater only in a shallow water-bearing zone from approximately 4 to 31 feet below ground surface. The lack of a deeper water-bearing zone within the upper 70 feet of ground surface suggests that the shallow groundwater zone encountered in the monitoring wells has minimal connectivity to any deeper water-bearing zones that may be present.

Groundwater elevations measured in the three monitoring wells are significantly higher than groundwater observed in landfill excavations during the test pit investigation. This observation suggests that the upgradient shallow groundwater zone between MW-02 and MW-04 may be hydraulically disconnected from the shallow groundwater zone within the landfill footprint. This supposition is supported by observations of flow in the swale southwest of the site along South March Point Road, which would act as a common discharge zone for upgradient groundwater and the groundwater in the waste if there was hydraulic connectivity between these two water-bearing zones. The swale is tidally influenced. At high tide, water in the swale has been observed to extend almost all the way up to monitoring well MW-02, suggesting that groundwater at MW-04 and as far north as MW-02 might be disconnected from groundwater within the landfill.

Location MW-03 is not separated from the landfill by a swale. Fill material was encountered in the MW-03 boring during installation, suggesting that this area may be connected to the groundwater in the landfill. However, the well location is likely downgradient only of the northernmost tip of the landfill. Our interpretation, based on local topography, is that a groundwater divide may occur just north of the sawmill buildings. Groundwater north of this suspected divide may radiate in both north and east directions toward Padilla Bay. Groundwater south of this suspected divide either flows directly east toward seeps SP-01, SP-02, and SP-03, or south toward the swale. As outlined in Figure 14, the middle and southern part of the swale may receive discharge from both upgradient groundwater on the west and southwest side of March Point Road and from groundwater beneath and within the landfill. The swale ultimately flows into the inner lagoon south of the landfill boundary.

No seeps were observed along the southern landfill shoreline or the inner lagoon (Figure 14). This area is the approximate location of a linear dike-like feature observed along the eastern extent of the landfill area in historical aerial photographs from 1971. If present, this dike would act as a hydraulic barrier at the site, diverting groundwater flow to the southern or southwestern edge of the site, and could explain the absence of seeps along this part of the landfill. Seeps observed at the northern end of the landfill enter the inner lagoon and are encountered in approximately the same location as seeps referred to in historical reports (Figures 2 and 14). In addition, surface water observed at location SW-07 was similar in color and odor to seep water encountered at location SP-01 during the December 2008 sampling event. These observations may suggest that a dike does not extend north to this part of the landfill boundary. Aerial photography also indicates that this northern boundary was created as landfill material was being deposited and later armored with large concrete debris (visible today) when landfill operations ended.

This conceptual site model suggests that there are limited areas along the landfill boundary where leachate is seeping, or has the potential to seep, into surface water. These areas are predominantly in the eastern part of the swale south of the site and the northeastern landfill boundary within the inner lagoon. Further, the landfill refuse may extend northwesterly, at least to the location of MW-03, based on fill material (possibly related to the refuse) found in that boring. Soil samples collected from the test pits dug within the landfill footprint indicate elevated levels (above PSLs) for metals, TPH-G, SVOCs, PCBs, and pesticides.

However, of the more than 9,000 individual analyses conducted as part of the Phase I RI, 87.6 percent resulted in analytes not detected at the method detection limits. Furthermore, only results from only 225 analyses (approximately 2.5 percent) consisting of 10 analytes exceeded the PSLs developed for this site, and concentrations of only two analytes (arsenic and copper) exceeded the PSLs by more than a factor of 10. These higher levels of both arsenic and copper were found in water samples from all sampling locations, including upgradient wells and upstream surface water stations.

Metals were found above detection limits and above the PSLs more than any other group of analytes. Metals are naturally occurring elements, and the differences between total and dissolved concentrations often indicate that particulates entrained in the samples may be affecting the results. Concentrations of total metals were usually higher than concentrations of dissolved metals, and in some cases, concentrations of total metals were substantially higher than concentrations of dissolved metals.

Metals concentrations exceeded PSLs for arsenic, copper, lead, manganese, mercury, and nickel. However, the only metals to exceed PSLs in the two upgradient monitoring wells (MW-02 and MW-04) were arsenic and manganese, and manganese was detected greater than the PSL only in MW-04. The upstream surface water samples (SW-01) also exceeded the PSLs for arsenic, copper, lead, manganese, mercury, nickel, and zinc. Mercury only exceeded the PSL in the upstream surface water sample. Nickel, lead, and zinc in that same upstream sample were detected at 72.2 µg/L, 24 µg/L, and 150 µg/L, respectively, all greater than the associated PSL. The PSL for lead was only exceeded in one other sample, in the primary sample at MW-03; however, it was below the PSL in the duplicate sample from the same well.

Both VOCs and SVOCs were rarely detected in the samples, and no analytes in these groups exceeded the PSLs. While PAHs were detected more often than VOCs and SVOCs, no analytes in that group exceeded their respective PSLs either.

There were no TPH compounds detected in either groundwater or surface water. However, TPH-D was consistently detected at low levels (0.31 mg/L to 0.76 mg/L) in all three seep samples. While no PSLs were established for TPH-D in the RI/FS Work Plan, of the 11 detections of TPH-D in seep samples, four were less than the MTCA Method A Groundwater Cleanup Level of 0.5 mg/L (Note: there is no surface water cleanup level for TPH-D).

PCBs were detected at only 3 of 12 locations (MW-03, SP-02 and SP-03), and the concentrations exceeded the PSLs in only one location (SP-03 in December 2008 and April 2009). PCBs were detected in the primary and duplicate sample from MW-03 during the October, December, and April sampling events, but the concentrations of total PCBs, calculated using one-half of the reporting limit for non-detect values, were less than the PSL of 0.07 µg/L. The concentration of total PCBs in the duplicate December 2008 sample from MW-03 was equal to, but did not exceed, the PSL. During April 2009, PCBs were detected at SP-02, but the concentration of total PCBs was less than the PSL, and PCBs were not detected during the remaining three sampling events. At SP-03, the concentration of total PCBs in October was less than the PSL, but concentrations in the December 2008 and April 2009 samples, at 0.14 µg/L and 0.121 µg/L, respectively, exceeded the PSL. PCBs were not detected in any of the samples during the July sampling event.

Likewise, pesticides were detected in only two locations, monitoring well MW-03 and surface water station SW-06. Pesticides including 4,4'-DDD, alpha-BHC, beta-BHC, delta-BHC, and gamma-BHC (Lindane) were detected in well MW-03. However, only concentrations of alpha-BHC (detected during all four sampling events) and 4,4'-DDD (detected in December, April and July) exceeded their respective PSLs. The only pesticide detected in SW-06 was 4,4'-DDD in December, which at a concentration of 0.0019 µg/L was slightly greater than the PSL of 0.00166 µg/L.

In summary, large numbers of drums or other sources of hazardous or dangerous waste were not identified within the landfill. Most of the test pit anomalies were identified as benign waste including a large number of washing machines. Drums were identified in only two of the test pits. Additionally, the Phase I sediment bioassays completed to date do not suggest that discharges from the landfill are impairing the adjacent ecosystem. The conceptual site model also suggests that the landfill is somewhat isolated from groundwater by the tide flat deposits and may not be in a position to affect potable groundwater resources.

The locations of greatest concern are MW-03, the monitoring well completed in fill directly north of the landfill, and SP-03, the southernmost seep location that discharges to the Padilla Bay Inner Lagoon. Both of these locations have several analytes that exceed project PSLs. However, the upstream surface water location SW-01 is of nearly equal concern because it has the highest concentrations of manganese and mercury found in any of the groundwater, seep, or surface water samples. Surface water at SW-01 flows beneath South March Point Road in a culvert and feeds into the swale directly west of the landfill. This same swale then continues southeast past stations SW-03, SW-04, and SW-05 as it joins the Padilla Bay inner lagoon.

Additional investigations and ongoing monitoring, outlined in Section 6.2, will be completed during the Phase II RI to evaluate whether the conceptual site model and the conclusions based on the conceptual site model are accurate.

6.2 PROPOSED PHASE II SCOPE OF WORK

The Phase II investigation is intended to fill data gaps, confirm the Phase I conceptual site model, and provide sufficient information for the FS to develop and evaluate remedial measures. Based on the conceptual site model developed from the Phase I investigation (Figures 12 through 14), we propose the following additional work to be carried out at the site as part of the Phase II RI. A detailed Phase II RI/FS sampling and analysis plan will be developed for Ecology’s review and approval.

- **Test Pits** — Additional test pit excavations are needed to fully delineate the extent of landfill waste at the landfill edges and further investigate the area around the sawmill. In addition, the southern boundary area along the swale, the area along the northwest boundary adjacent to monitoring well MW-03, and the BNSF right-of-way need further investigation. Soil samples from the test pits associated with suspicious or industrial waste will be collected and analyzed for the same analytical suite used for Phase I soil samples.

- **Geoprobe Borings** — It is anticipated that the test pits will be excavated to groundwater which is expected at approximately 10 feet bgs. If the depth to the original Bay Mud horizon at these locations exceeds this depth, then geoprobe borings will be advanced at the test pit locations to evaluate the presence of and depth to the original Bay Mud horizon. This horizon is believed to be an aquitard unit underlying the entirety of the site, and its depth is important in estimating the costs for containment options to be evaluated in the FS. Selected soil samples from the Bay Mud horizon will be analyzed for the same analytical suite used for Phase I soil samples.

- **Monitoring Wells in Waste** — Five new monitoring wells will be installed within the landfill as part of the Phase II investigation. These new monitoring wells will be sampled over several seasons and analyzed for the same analytical suite used for Phase I water samples. Several of the borings for these monitoring wells will be drilled through the Bay Mud layer so that its thickness can be determined. To minimize cross-contamination, these borings will be advanced inside a large-diameter, conductor casing sealed at the top of the mud. After the bottom of the mud has been reached, the boring will be sealed, the conductor casing will be withdrawn, and the screens installed in the waste above the mud.

Soil samples will be collected from test pits and geoprobe borings for soil classification. Selected soil samples will be submitted to a laboratory for geotechnical testing. Soil gradation, moisture content, hydraulic conductivity and/or triaxial permeability, and Atterberg limits testing are proposed for the Phase II investigation.

- **Piezometer Installation** — Piezometers will be installed in waste at the site. The piezometers and monitoring wells will be used to obtain groundwater level data to evaluate the groundwater flow regime in the landfilled materials. Depending on site conditions, the piezometers will be advanced using a direct-push method and installed with pre-packed screens or through conventional hollow-stem auger drilling and standard well construction methods. Monthly groundwater elevation data will be collected from the piezometers and the several monitoring wells for a period of 1 year.

- **Bay Mud Testing** — Bay Mud samples will be collected from within the inner lagoon in the vicinity of the seep sample locations and/or the monitoring well borings drilled through the mud using a Shelby tube. Several samples will be tested to determine shear strength, triaxial permeability, as well as conventional physical parameters. These data can be used to evaluate the hydraulic properties of the Bay Mud underlying the site, which is presumed to serve as the aquitard beneath the landfill.

- **Soil Sample Archives** — In addition to the soil samples collected and analyzed as discussed above, one soil sample from each soil testing location will be frozen and archived for possible future analytical testing.

- **Dike-like Feature Investigation** — Historical aerial photographs indicate the presence of a dike-like feature along the eastern extent of the landfill area. We believe that this feature was built prior to placement of the waste in the southern half of the landfill. Test pits will be excavated along the feature to evaluate its presence and to collect samples for geotechnical testing: gradation, moisture content, Atterberg Limits, shear strength, and hydraulic conductivity.

- **Native Sand Monitoring Well** — In addition to continued monitoring of groundwater from seeps and monitoring wells in waste, two monitoring wells will be installed along and within the above-mentioned dike structure. This well will be screened in the native sands below the Bay Mud by first installing and sealing a large-diameter conductor casing in the mud, then advancing a smaller diameter boring, and finally installing the well to avoid potential cross-contamination. These new monitoring wells will be sampled several seasons and analyzed for the same analytical suites used for Phase I water samples.

- **Tidal Influence Testing** — Following the investigation of the dike, the piezometer installation, and monitoring well installation, an investigation of tidal effects on groundwater in the waste will be necessary. The scope of this investigation will be determined after these additional data are collected and the results have been evaluated.

- **Sediment Testing** —Sediment samples will be analyzed for bioaccumulative parameters during the Phase II investigation.

- **Sampling of Existing Monitoring Wells** — In addition to the proposed Phase II scope discussed above, and based on quarterly analytical data collected since October 2008, we propose to alter the current groundwater (MW-01, MW-03 and MW-04), seep, and surface water analytical suite by eliminating all classes of analytes where PSLs have not been exceeded during the first year of monitoring. Existing monitoring wells will be sampled at similar intervals as the monitoring wells located within the waste.

- **A Simplified or Site-Specific TEE** — Potential terrestrial impacts will be addressed during the Phase II investigation by completion of a TEE based on the requirements in WAC 173-340-7491(1). The problem formulation and method selection steps will be completed as part of the Phase II RI in consultation with Ecology.

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7.0 REFERENCES

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TABLES

TABLE 1

RESULTS OF FIELD WATER QUALITY PARAMETER MEASUREMENTS

March Point (Whitmarsh) Landfill
Skagit County, Washington

Station	Sampling Event	Sampling Method[1]	Water Quality Parameters					
			pH (unitless)	Conductivity[2,3] (S/cm)	Temperature (°C)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Depth to Water (ft below MP)
MW-02	Oct 2008		7.32	0.22	11.8	10	0	5
	Dec 2008		7.05	0.589	9.9	213	1.01	7.83
	Apr 2009		6.97	0.623	10.43	37	0	7.56
	Jul 2009		6.36	0.0999+	12.2	10.2	0	8.2
MW-03	Oct 2008		7.87	0.156	14.6	7.7	0	9.9
	Dec 2008		10.9	0.418	7.9	4.7	0.18	8.02
	Apr 2009		6.94	0.643	9.4	0.1	0	7.86
	Jul 2009		7.15	0.162	15.7	11.6	8.48	9.4
MW-04	Oct 2008		8.09	0.186	11.1	35	0	3.8
	Dec 2008		9.89	0.464	9.2	0	1.01	3.37
	Apr 2009		7.26	0.513	10.52	0	0	2.95
	Jul 2009		7.33	0.103	12.6	2.8	8.87	3.05
SP-01	Oct 2008	peri	8.08	0.0192	10.9	100	3.68	NA
	Dec 2008	sub	8.66	0.000997	0.5	113	9.42	NA
	Apr 2009	peri	7.31	0.00749	13.61	13.7	5.45	NA
	Jul 2009	peri	7.37	0.00308	16	14	12.9	NA
SP-02	Oct 2008	sub	7.51	0.0344	13.4	43	8.9	NA
	Dec 2008	peri	10.02	0.0000123	0.1	78	6.92	NA
	Apr 2009	peri	6.99	0.132	13.84	9	7.6	NA
	Jul 2009	peri	7.26	0.00152	18	55	11.63	NA
SP-03	Oct 2008	peri	7.75	0.00193	13.2	395	12.15	NA
	Dec 2008	peri	10.15	0.0000043	0.3	363	11.95	NA
	Apr 2009	peri	6.95	0.129	14.31	145	5.48	NA
	Jul 2009	peri	6..86	0.00206	19.3	45	11.65	NA
SW-01	Oct 2008	sub	6.34	0.00234	10.9	12.8	11.85	NA
	Dec 2008	sub	7.45	0.000214	0.9	26.7	8.41	NA
	Apr 2009	sub	6.97	0.046	10.56	4.1	8.76	NA
	Jul 2009	sub	6.81	0.0025	16	0	7.72	NA
SW-03	Oct 2008	sub	9.2	0.0034	6.3	50	11.63	NA
	Dec 2008	sub	6.83	0.0000135	1.9	125	8.99	NA
	Apr 2009	sub	7.82	0.00221	16.34	15	14.09	NA
	Jul 2009	sub	6.79	0.0999+	17.4	20	1.52	NA

TABLE 1

RESULTS OF FIELD WATER QUALITY PARAMETER MEASUREMENTS

March Point (Whitmarsh) Landfill
Skagit County, Washington

Station	Sampling Event	Sampling Method[1]	Water Quality Parameters					
			pH (unitless)	Conductivity[2,3] (S/cm)	Temperature (^{o}C)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Depth to Water (ft below MP)
SW-04	Oct 2008	sub	8	0.00417	4.4	220	11.45	NA
	Dec 2008	sub	6.8	0.00000903	1.8	198	8.99	NA
	Apr 2009	sub	6.74	0.00755	12.49	17.2	7.52	NA
	Jul 2009	sub	8.27	0.0999	22.7	45.7	2.59	NA
SW-05	Oct 2008	sub	8.07	0.0308	5.1	107	9.37	NA
	Dec 2008	sub	6.78	0.00000791	2.2	133	9.03	NA
	Apr 2009	sub	7.54	0.00682	16.47	11	10.55	NA
	Jul 2009	sub	8.66	0.0313	26.4	12.3	4.18	NA
SW-06	Oct 2008	sub	7.93	0.0361	6.7	29	8.68	NA
	Dec 2008	sub	6.51	0.0215	0.9	43	9.1	NA
	Apr 2009	sub	7.41	0.0183	16.81	14	13.85	NA
	Jul 2009	sub	7.62	0.04	23.5	27	3.76	NA
SW-07	Oct 2008		NS	NS	NS	NS	NS	NS
	Dec 2008	peri	8.2	0.000606	3.8	91.3	10.08	NA
	Apr 2009		NS	NS	NS	NS	NS	NS
	Jul 2009		NS	NS	NS	NS	NS	NS

Notes

1. peri = sample collected using peristaltic pump.
   sub = sample collected by submerging precleaned laboratory-supplied sampling bottle.
2. For monitoring wells, values represent stabilized values following purging and recorded immediatedly prior to sampling. Values for suface water and seeps are nonstabilized, instantaneous readings recorded prior to sampling.
3. Plus symbol (+) indicates parameter exceeded calibration range of the instrument.

Abbreviations

°C = degrees celsius
ft = feet
mg/L = milligrams per liter
MP = measuring point

NA = not applicable
NS = not sampled
NTU = nephelometric turbidity units
s/cm = siemens per centimeter

TABLE 2

PRELIMINARY COPCs FOR UPLANDS SITE

March Point (Whitmarsh) Landfill
Skagit County, Washington

Analyte[1]	Previously Detected in Surface Water/Seep Samples	Previously Detected in Sediments
Metals		
Aluminum	X	X
Arsenic	X	X
Barium	X	X
Beryllium	X	X
Cadmium	X	X
Chromium	X	X
Copper	X	X
Lead	X	X
Manganese	X	X
Mercury	X	X
Molybdenum	X	X
Nickel	X	X
Selenium	X	X
Silver	X	X
Strontium	X	X
Thallium	X	
Titanium		X
Vanadium		X
Zinc	X	X
Petroleum Hydrocarbons		
TPH-Diesel range	X	X
TPH-Heavy oil range		X
TPH- Gasoline range		
VOCs		
1,2,4-Trimethylbenzene	X	X
1,2-Dichlorobenzene	X	
1,3,5-Trimethylbenzene	X	X
1,3-Dichlorobenzene	X	
1,4-Dichlorobenzene	X	
2-Butanone		X
4-Methyl-2-pentanone		X
Acetone		X
Benzene	X	X
Carbon disulfide		X
Chlorobenzene	X	
Diethyl ether	X	
Ethylbenzene	X	X
Isopropylbenzene (cumene)	X	X
m,p-Xylenes	X	X
Methylene chloride		X
o-Xylene	X	X
Toluene	X	X

TABLE 2

PRELIMINARY COPCs FOR UPLANDS SITE

March Point (Whitmarsh) Landfill
Skagit County, Washington

Analyte[1]	Previously Detected in Surface Water/Seep Samples	Previously Detected in Sediments
SVOCs		
1-Methylnaphthalene	X	X
2,4-Dimethylphenol	X	X
2-Methylnaphthalene	X	X
2-Methylphenol	X	X
4-Methylphenol (p-cresol)	X	X
Acenaphthene	X	X
Anthracene	X	X
Benzo(a)anthracene	X	X
Benzo(a)pyrene		X
Benzo(b)fluoranthene		X
Benzo(k)fluoranthene		X
Benzoic acid		X
Bis(2-chloroethyl) ether		X
Bis(2-ethylhexyl) phthalate	X	X
Butyl benzyl phthalate		X
Carbazole	X	X
Chrysene	X	X
Dibenzo(a,h)anthracene		X
Dibenzofuran	X	X
Diethyl phthalate	X	X
di-n-Butyl phthalate		X
Fluoranthene	X	X
Fluorene	X	X
Indeno(1,2,3-cd)pyrene		X
Naphthalene	X	X
N-Nitrosodiphenylamine	X	
Phenol	X	X
Pyrene	X	X
Other		
Dioxins and furans (PCDD and PCDF)		X
Carbaryl	X	
Ammonia	X	
Phosphorus	X	

Notes

1. Shaded cells indicate compound not detected (or not analyzed) at the site but suspected at site based on industries that reportedly used landfill.

Abbreviations

COPCs = contaminants of potential concern
PCDD = polychlorinated dibenzo-p-dioxins
PCDF = polychlorinated dibenzofurans
SVOCs = semivolatile organic compounds
VOCs = volatile organic compounds

TABLE 3

SUMMARY OF SOIL SCREENING LEVELS
March Point (Whitmarsh) Landfill
Skagit County, Washington

concentrations in milligrams per kilogram (mg/kg)

Analyte[1,2]	CAS No.	Analytical Method[3]	Target Reporting Limit (PQL)[4]	MTCA Method A, Unrestricted Land Use	MTCA Method B, Carcinogen	MTCA Method B, Noncarcinogen	MTCA Method B Protective of Groundwater as Marine Surface Water[5]	Sites that Qualify for Simplified TEE - Industrial or Commercial Site[6]	Puget Sound Soil Natural Background (Ecology, 1994)[7]	PSL[8]
Metals										
Aluminum	7429-90-5	EPA 6010B	5.0	--[9]	--	--	**N/A[10]**	**--**	32,600.00	**32,600.00**
Antimony	7440-36-0	EPA 6010B	5.0	--	--	32.00	**578.60**	**--**	--	**32.00**
Arsenic	7440-38-2	EPA 7060A	0.10	20.00	0.67	24.00	**0.06**	**20 [11]**	7.00	**7.00**
Barium	7440-39-3	EPA 6010B	0.30	--	--	16,000.00	**N/A**	**1,320.00**	--	**1,320.00**
Beryllium	7440-41-7	EPA 6010B	0.1	--	--	160.00	**4,267.00**	**--**	0.60	**160.00**
Cadmium	7440-43-9	EPA 6010B	0.2	2.00	--	80.00	**1.21**	**36.00**	1.00	**1.21**
Chromium	7440-47-3	EPA 6010B	0.5	2,000.00	--	120,000.00	**960.00**	**135.00**	117***	**135.00**
Copper	7440-50-8	EPA 6010B	0.2	--	--	3,000.00	**1.07**	**550.00**	36.00	**36.00**
Iron	7439-89-6	EPA 6010B	5.0	--	--	--	**N/A**	**--**	58,700.00	**58,700.00**
Lead	7439-92-1	EPA 6010B	2.0	250.00	--	--	**1,620.00**	**220.00**	24.00	**220.00**
Manganese	7439-96-5	EPA 6010B	0.1	--	--	11,000.00	**0.40**	**23,500.00**	1,200.00	**1,200.00**
Mercury	7439-97-6	EPA 7471A	0.05	2.00	--	24.00	**0.03**	**0.7 [12]**	0.07	**0.07**
Molybdenum	7439-98-7	EPA 6010B	0.5	--	--	400.00	**0.02**	**71.00**	--	**0.50**
Nickel	7440-02-0	EPA 6010B	1.0	--	--	1,600.00	**10.69**	**1,850.00**	48.00	**48.00**
Selenium	7782-49-2	EPA 6010B	5.0	--	--	400.00	**7.38**	**0.80**	--	**5.00**
Silver	7440-22-4	EPA 6010B	0.3	--	--	400.00	**4,420.00**	**--**	--	**400.00**
Strontium	7440-24-6	EPA 6010B	0.1	--	--	48,000.00	**0.004**	**--**	--	**0.10**
Thallium	7440-28-0	EPA 6010B	5.0	--	--	5.60	**0.67**	**--**	--	**5.00**
Titanium	7440-32-6	EPA 6010B	0.5	--	--	--	**No CLARC[13]**	**--**	--	**--**
Vanadium	7440-62-2	EPA 6010B	0.3	--	--	560.00	**N/A**	**--**	--	**560.00**
Zinc	7440-66-6	EPA 6010B	1.0	--	--	24,000.00	**100.80**	**570.00**	85.00	**100.80**
TPH										
TPH - Hydrocarbon identification	NA	Ecology NWTPH-HCID	100	--	--	--			--	
TPH - Diesel range	NA	Ecology NWTPH-Dx	5	2,000.00	--	--	**N/A**	**15,000.00**	--	**2,000.00**
TPH - Heavy oil range	NA	Ecology NWTPH-Dx	10	2,000.00	--	--	**N/A**	**--**	--	**2,000.00**
TPH - Gasoline range	NA	Ecology NWTPH-Gx	5	30.00	--	--	**N/A**	**12,000.00**	--	**30.00**
SVOCs										
1-Methylnaphthalene	90-12-0	EPA 8270D	0.067	--	--	24.00	**N/A**	**--**	--	**24.00**
2,4,5-Trichlorophenol	95-95-4	EPA 8270D	0.33	--	--	8,000.00	**129.60**	**--**	--	**129.60**
2,4,6-Trichlorophenol	88-06-2	EPA 8270D	0.33	--	91.00	--	**0.03**	**--**	--	**0.33**
2,4-Dichlorophenol	120-83-2	EPA 8270D	0.33	--	--	240.00	**1.33**	**--**	--	**1.33**
2,4-Dimethylphenol	105-67-9	EPA 8270D	0.067	--	--	1,600.00	**2.20**	**--**	--	**2.20**
2,4-Dinitrophenol	51-28-5	EPA 8270D	0.67	--	--	160.00	**14.00**	**--**	--	**14.00**
2,4-Dinitrotoluene	121-14-2	EPA 8270D	0.33	--	--	160.00	**0.02**	**--**	--	**0.33**
2,6-Dinitrotoluene	606-20-2	EPA 8270D	0.33	--	--	80.00	**N/A**	**--**	--	**80.00**
2-Chloronaphthalene	91-58-7	EPA 8270D	0.067	--	--	--	**4.00**	**--**	--	**4.00**

TABLE 3

SUMMARY OF SOIL SCREENING LEVELS

March Point (Whitmarsh) Landfill
Skagit County, Washington

concentrations in milligrams per kilogram (mg/kg)

Analyte[1,2]	CAS No.	Analytical Method[3]	Target Reporting Limit (PQL)[4]	MTCA Method A, Unrestricted Land Use	MTCA Method B, Carcinogen	MTCA Method B, Noncarcinogen	MTCA Method B Protective of Groundwater as Marine Surface Water[5]	Sites that Qualify for Simplified TEE - Industrial or Commercial Site[6]	Puget Sound Soil Natural Background (Ecology, 1994)[7]	PSL[8]
SVOCs (Continued)										
2-Chlorophenol	95-57-8	EPA 8270D	0.067	--	--	400.00	**38,150.00**	**--**	--	**400.00**
2-Methylnaphthalene	91-57-6	EPA 8270D	0.067	--	--	320.00	**N/A**	**--**	--	**320.00**
2-Methylphenol	95-48-7	EPA 8270D	0.067	--	--	4,000.00	**N/A**	**--**	--	**4,000.00**
2-Nitroaniline	88-74-4	EPA 8270D	0.33	--	--	--	**N/A**	**--**	--	**--**
2-Nitrophenol	88-75-5	EPA 8270D	0.33	--	--	--	**No CLARC**	**--**	--	**--**
3-Nitroaniline	99-09-2	EPA 8270D	0.33	--	--	--	**No CLARC**	**--**	--	**--**
3,3'-Dichlorobenzidine	91-94-1	EPA 8270D	0.33	--	2.20	--	**0.0005152**	**--**	--	**0.33**
4,6-Dinitro-2-methylphenol	534-52-1	EPA 8270D	0.67	--	--	--	**No CLARC**	**--**	--	**--**
4-Bromophenyl phenyl ether	101-55-3	EPA 8270D	0.067	--	--	--	**No CLARC**	**--**	--	**--**
4-Chloro-3-methylphenol	59-50-7	EPA 8270D	0.33	--	--	--	**No CLARC**	**--**	--	**--**
4-Chloroaniline	106-47-8	EPA 8270D	0.33	--	--	320.00	**N/A**	**--**	--	**320.00**
4-Chlorophenyl phenyl ether	7005-72-3	EPA 8270D	0.067	--	--	--	**No CLARC**	**--**	--	**--**
4-Methylphenol (p-cresol)	106-44-5	EPA 8270D	0.067	--	--	400.00	**N/A**	**--**	--	**400.00**
4-Nitroaniline	100-01-6	EPA 8270D	0.33	--	--	--	**No CLARC**	**--**	--	**--**
4-Nitrophenol	100-02-7	EPA 8270D	0.33	--	--	--	**No CLARC**	**--**	--	**--**
Acenaphthene	83-32-9	EPA 8270-SIM	0.067	--	--	4,800.00	**65.29**	**--**	--	**65.29**
Acenaphthylene	208-96-8	EPA 8270-SIM	0.067	--	--	--	**N/A**	**--**	--	**--**
Aniline	62-53-3	EPA 8270D	0.067	--	180.00	--	**N/A**	**--**	--	**180.00**
Anthracene	120-12-7	EPA 8270-SIM	0.067	--	--	24,000.00	**133,700.00**	**--**	--	**24,000.00**
Benzidine	92-87-5	EPA 8270D	0.67	--	0.0043	240.00	**0.0000008**	**--**	--	**0.67**
Benzo(a)anthracene	56-55-3	EPA 8270-SIM	0.067	--	--	--	**0.13**	**--**	--	**0.13**
Benzo(a)pyrene	50-32-8	EPA 8270-SIM	0.067	0.10	0.14	--	**0.35**	**300.00**	--	**0.10**
Benzo(b)fluoranthene	205-99-2	EPA 8270-SIM	0.067	--	--	--	**0.58**	**--**	--	**0.58**
Benzo(ghi)perylene	191-24-2	EPA 8270-SIM	0.067	--	--	--	**N/A**	**--**	--	**--**
Benzo(k)fluoranthene	207-08-9	EPA 8270-SIM	0.067	--	--	--	**0.43**	**--**	--	**0.43**
Benzoic acid	65-85-0	EPA 8270D	0.67	--	--	320,000.00	**N/A**	**--**	--	**320,000.00**
Benzyl alcohol	100-51-6	EPA 8270D	0.33	--	--	24,000.00	**N/A**	**--**	--	**24,000.00**
Bis(2-chloroethoxy)methane	111-91-1	EPA 8270D	0.067	--	--	--	**No CLARC**	**--**	--	**--**
Bis-(2-chloroethyl) ether	111-44-4	EPA 8270D	0.067	--	0.91	--	**0.002926**	**--**	--	**0.07**
Bis(2-chloroisopropyl) ether [2,2'-oxybis(1-chloropropane)]	108-60-1	EPA 8270D	0.067	--	--	3,200.00	**168.00**	**--**	--	**168.00**
Bis(2-ethylhexyl) phthalate	117-81-7	EPA 8270D	0.067	--	71.00	1,600.00	**4.85**	**--**	--	**4.85**
Butyl benzyl phthalate	85-68-7	EPA 8270D	0.067	--	--	16,000.00	**369.20**	**--**	--	**369.20**
Carbaryl	63-25-2	EPA 8270D	0.4	--	--	8,000.00	**N/A**	**--**	--	**8,000.00**
Carbazole	86-74-8	EPA 8270D	0.067	--	50.00	--	**N/A**	**--**	--	**50.00**
Chrysene	218-01-9	EPA 8270-SIM	0.067	--	--	--	**0.14**	**--**	--	**0.14**
Dibenzo(a,h)anthracene	53-70-3	EPA 8270-SIM	0.067	--	--	--	**0.65**	**--**	--	**0.65**
Dibenzofuran	132-64-9	EPA 8270D	0.067	--	--	160.00	**N/A**	**--**	--	**160.00**

TABLE 3

SUMMARY OF SOIL SCREENING LEVELS

March Point (Whitmarsh) Landfill
Skagit County, Washington

concentrations in milligrams per kilogram (mg/kg)

Analyte[1,2]	CAS No.	Analytical Method[3]	Target Reporting Limit (PQL)[4]	MTCA Method A, Unrestricted Land Use	MTCA Method B, Carcinogen	MTCA Method B, Noncarcinogen	MTCA Method B Protective of Groundwater as Marine Surface Water[5]	Sites that Qualify for Simplified TEE - Industrial or Commercial Site[6]	Puget Sound Soil Natural Background (Ecology, 1994)[7]	PSL[8]
SVOCs (Continued)										
Diethyl phthalate	84-66-2	EPA 8270D	0.067	--	--	64,000.00	**157.90**	**--**	--	**157.90**
Dimethyl phthalate	131-11-3	EPA 8270D	0.067	--	--	80,000.00	**288.00**	**--**	--	**288.00**
Di-n-butyl phthalate	84-74-2	EPA 8270D	0.067	--	--	8,000.00	**104.40**	**--**	--	**104.40**
Di-n-octyl phthalate	117-84-0	EPA 8270D	0.067	--	--	1,600.00	**N/A**	**--**	--	**1,600.00**
Fluoranthene	206-44-0	EPA 8270-SIM	0.067	--	--	3,200.00	**88.56**	**--**	--	**88.56**
Fluorene	86-73-7	EPA 8270-SIM	0.067	--	--	3,200.00	**553.00**	**--**	--	**553.00**
Hexachlorobenzene	118-74-1	EPA 8270D	0.067	--	0.63	64.00	**0.0004652**	**31.00**	--	**0.07**
Hexachlorobutadiene	87-58-3	EPA 8270D	0.067	--	13.00	16.00	**No CLARC**	**--**	--	**13.00**
Hexachlorocyclopentadiene	77-47-4	EPA 8270D	0.33	--	--	480.00	**4,406.00**	**--**	--	**480.00**
Hexachloroethane	67-72-1	EPA 8270D	0.067	--	71.00	80.00	**0.13**	**--**	--	**0.13**
Indeno(1,2,3-cd)pyrene	193-39-5	EPA 8270-SIM	0.067	--	--	--	**1.26**	**--**	--	**1.26**
Isophorone	78-59-1	EPA 8270D	0.067	--	1,100.00	16,000.00	**2.41**	**--**	--	**2.41**
Naphthalene	91-20-3	EPA 8270-SIM	0.067	5.00	--	1,600.00	**137.40**	**--**	--	**5.00**
Nitrobenzene	98-95-3	EPA 8270D	0.067	--	--	40.00	**2.88**	**--**	--	**2.88**
N-Nitrosodimethylamine	62-75-9	EPA 8270D	0.33	--	--	--	**0.01**	**--**	--	**0.33**
N-Nitrosodi-n-propylamine	621-64-7	EPA 8270D	0.330	--	0.14	--	**0.002285**	**--**	--	**0.33**
N-Nitrosodiphenylamine	86-30-6	EPA 8270D	0.33	--	200.00	--	**0.18**	**--**	--	**0.33**
Pentachlorophenol	87-86-5	EPA 8270D	0.33	--	8.30	2,400.00	**0.05**	**11.00**	--	**0.33**
Phenanthrene	85-01-8	EPA 8270-SIM	0.067	--	--	--	**N/A**	**--**	--	**--**
Phenol	108-95-2	EPA 8270D	0.067	--	--	48,000.00	**5,038.00**	**--**	--	**5,038.00**
Pyrene	129-00-0	EPA 8270-SIM	0.067	--	--	2,400.00	**3,546.00**	**--**	--	**2,400.00**
Pyridine	110-86-1	EPA 8270D	0.33	--	--	80.00	**N/A**	**--**	--	**80.00**
VOCs										
1,1,1,2-Tetrachloroethane	630-20-6	EPA 8260B	0.001	--	38.00	2,400.00	**0.02**	**--**	--	**0.02**
1,1,1-Trichloroethane	71-55-6	EPA 8260B	0.001	2.00	--	72,000.00	**148,500.00**	**--**	--	**2.00**
1,1,2,2-Tetrachloroethane	79-34-5	EPA 8260B	0.001	--	5.00	--	**0.02**	**--**	--	**0.02**
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	EPA 8260B	0.002	--	--	2,400,000.00	**N/A**	**--**	--	**2,400,000.00**
1,1,2-Trichloroethane	79-00-5	EPA 8260B	0.001	--	18.00	320.00	**0.09**	**--**	--	**0.09**
1,1-Dichloroethane	75-34-3	EPA 8260B	0.001	--	--	8,000.00	**0.02**	**--**	--	**0.02**
1,1-Dichloroethene	75-35-4	EPA 8260B	0.001	--	--	4,000.00	**N/A**	**--**	--	**4,000.00**
1,2,3-Trichlorobenzene	87-61-6	EPA 8260B	0.005	--	--	--	**No CLARC**	**--**	--	**--**
1,2,3-Trichloropropane	96-18-4	EPA 8260B	0.002	--	0.14	480.00	**N/A**	**--**	--	**0.14**
1,2,4-Trichlorobenzene	120-82-1	EPA 8260B	0.005	--	--	800.00	**2.67**	**--**	--	**2.67**
1,2,4-Trimethylbenzene	95-63-6	EPA 8260B	0.001	--	--	4,000.00	**N/A**	**--**	--	**4,000.00**
1,2-Dibromo-3-chloropropane	96-12-8	EPA 8260B	0.005	--	0.71	--	**N/A**	**--**	--	**0.71**
1,2-Dibromoethane	106-93-4	EPA 8260B	0.001	0.01	0.01	--	**N/A**	**--**	--	**0.01**
1,2-Dichlorobenzene	95-50-1	EPA 8260B	0.001	--	--	7,200.00	**15.26**	**--**	--	**15.26**

TABLE 3

SUMMARY OF SOIL SCREENING LEVELS
March Point (Whitmarsh) Landfill
Skagit County, Washington

concentrations in milligrams per kilogram (mg/kg)

Analyte[1,2]	CAS No.	Analytical Method[3]	Target Reporting Limit (PQL)[4]	MTCA Method A, Unrestricted Land Use	MTCA Method B, Carcinogen	MTCA Method B, Noncarcinogen	MTCA Method B Protective of Groundwater as Marine Surface Water[5]	Sites that Qualify for Simplified TEE - Industrial or Commercial Site[6]	Puget Sound Soil Natural Background (Ecology, 1994)[7]	PSL[8]
VOCs (Continued)										
1,2-Dichloroethane	107-06-2	EPA 8260B	0.001	--	11.00	1,600.00	**0.18**	**--**	--	**0.18**
1,2-Dichloropropane	78-87-5	EPA 8260B	0.001	--	15.00	--	**0.08**	**--**	--	**0.08**
1,3,5-Trimethylbenzene	108-67-8	EPA 8260B	0.001	--	--	4,000.00	**N/A**	**--**	--	**4,000.00**
1,3-Dichlorobenzene	541-73-1	EPA 8260B	0.001	--	--	--	**3.85**	**--**	--	**3.85**
1,4-Dichlorobenzene	106-46-7	EPA 8260B	0.001	--	42.00	--	**0.08**	**--**	--	**0.08**
2-Butanone	78-93-3	EPA 8260B	0.005	--	--	48,000.00	**N/A**	**--**	--	**48,000.00**
2-Chloroethyl vinyl ether	110-75-8	EPA 8260B	0.005	--	--	--	**No CLARC**	**--**	--	**--**
2-Hexanone	591-78-6	EPA 8260B	0.005	--	--	--	**No CLARC**	**--**	--	**--**
4-Chlorotoluene	106-43-4	EPA 8260B	0.001	--	--	--	**No CLARC**	**--**	--	**--**
4-Methyl-2-pentanone	108-10-1	EPA 8260B	0.005	--	--	6,400.00	**N/A**	**--**	--	**6,400.00**
Acetone	67-64-1	EPA 8260B	0.005	--	--	8,000.00	**N/A**	**--**	--	**8,000.00**
Acrylonitrile	107-13-1	EPA 8260B	0.005	--	1.90	80.00	**0.001**	**--**	--	**0.01**
Benzene	71-43-2	EPA 8260B	0.001	0.03	18.00	320.00	**0.13**	**--**	--	**0.03**
Bromobenzene	108-86-1	EPA 8260B	0.001	--	--	--	**No CLARC**	**--**	--	**--**
Bromodichloromethane	75-27-4	EPA 8260B	0.001	--	16.00	1,600.00	**0.09**	**--**	--	**0.09**
Bromoform	75-25-2	EPA 8260B	0.001	--	130.00	1,600.00	**0.93**	**--**	--	**0.93**
Bromomethane	74-83-9	EPA 8260B	0.001	--	--	110.00	**4.49**	**--**	--	**4.49**
Carbon disulfide	75-15-0	EPA 8260B	0.001	--	--	8,000.00	**N/A**	**--**	--	**8,000.00**
Carbon tetrachloride	56-23-5	EPA 8260B	0.001	--	7.70	56.00	**0.01**	**--**	--	**0.01**
Chlorobenzene	108-90-7	EPA 8260B	0.001	--	--	1,600.00	**13.86**	**--**	--	**13.86**
Chloroethane	75-00-3	EPA 8260B	0.001	--	350.00	32,000.00	**N/A**	**--**	--	**350.00**
Chloroform	67-66-3	EPA 8260B	0.001	--	160.00	800.00	**1.49**	**--**	--	**1.49**
Chloromethane	74-87-3	EPA 8260B	0.001	--	77.00	--	**0.54**	**--**	--	**0.54**
cis-1,2-Dichloroethene	156-59-2	EPA 8260B	0.001	--	--	800.00	**N/A**	**--**	--	**800.00**
cis-1,3-Dichloropropene	10061-01-5	EPA 8260B	0.001	--	--	--	**No CLARC**	**--**	--	**--**
Dibromochloromethane	124-48-1	EPA 8260B	0.001	--	12.00	1,600.00	**0.07**	**--**	--	**0.07**
Dichlorodifluoromethane	75-71-8	EPA 8260B	0.001	--	--	16,000.00	**N/A**	**--**	--	**16,000.00**
Diethyl ether	60-29-7	--	--	--	--	--	**--**	**--**	--	**--**
Ethylbenzene	100-41-4	EPA 8260B	0.001	6.00	--	8,000.00	**17.96**	**--**	--	**6.00**
Hexachlorobutadiene	87-68-3	EPA 8260B	0.005	--	13.00	16.00	**19.52**	**--**	--	**13.00**
Isopropylbenzene (cumene)	98-82-8	EPA 8260B	0.001	--	--	8,000.00	**N/A**	**--**	--	**8,000.00**
m,p-Xylenes	1330-20-7	EPA 8260B	0.001	9.00	--	16,000.00	**N/A**	**--**	--	**9.00**
Methyl tert-butyl ether	1634-04-4	EPA 8260B	0.001	0.10	560.00	69,000.00	**N/A**	**--**	--	**0.10**
Methylene chloride	75-09-2	EPA 8260B	0.002	0.02	130.00	4,800.00	**2.57**	**--**	--	**0.02**
n-Butylbenzene	104-51-8	EPA 8260B	0.001	--	--	--	**N/A**	**--**	--	**--**
n-Propylbenzene	103-65-1	EPA 8260B	0.001	--	--	--	**N/A**	**--**	--	**--**
o-Chlorotoluene	95-49-8	EPA 8260B	0.001	--	--	1,600.00	**N/A**	**--**	--	**1,600.00**
o-Xylene	95-47-6	EPA 8260B	0.001	--	--	160,000.00	**N/A**	**--**	--	**160,000.00**

TABLE 3

SUMMARY OF SOIL SCREENING LEVELS

March Point (Whitmarsh) Landfill
Skagit County, Washington

concentrations in milligrams per kilogram (mg/kg)

Analyte[1,2]	CAS No.	Analytical Method[3]	Target Reporting Limit (PQL)[4]	MTCA Method A, Unrestricted Land Use	MTCA Method B, Carcinogen	MTCA Method B, Noncarcinogen	MTCA Method B Protective of Groundwater as Marine Surface Water[5]	Sites that Qualify for Simplified TEE - Industrial or Commercial Site[6]	Puget Sound Soil Natural Background (Ecology, 1994)[7]	PSL[8]
VOCs (Continued)										
p-Isopropyltoluene	99-87-6	EPA 8260B	0.001	--	--	--	**No CLARC**	**--**	--	**--**
sec-Butylbenzene	135-98-8	EPA 8260B	0.001	--	--	--	**N/A**	**--**	--	**--**
Styrene	100-42-5	EPA 8260B	0.001	--	33.00	16,000.00	**N/A**	**--**	--	**33.00**
tert-Butylbenzene	98-06-6	EPA 8260B	0.001	--	--	--	**N/A**	**--**	--	**--**
Tetrachloroethene	127-18-4	EPA 8260B	0.001	0.05	1.90	800.00	**0.004173**	**--**	--	**0.004173**
Toluene	108-88-3	EPA 8260B	0.001	7.00	--	6,400.00	**190.00**	**--**	--	**7.00**
trans-1,2-Dichloroethene	156-60-5	EPA 8260B	0.001	--	--	1,600.00	**54.36**	**--**	--	**54.36**
trans-1,3-Dichloropropene	10061-02-6	EPA 8260B	0.001	--	--	--	**No CLARC**	**--**	--	**--**
Trichloroethene	79-01-6	EPA 8260B	0.001	0.03	2.50	24.00	**0.01**	**--**	--	**0.01**
Trichlorofluoromethane	75-69-4	EPA 8260B	0.001	--	--	24,000.00	**N/A**	**--**	--	**24,000.00**
Vinyl chloride	75-01-4	EPA 8260B	0.001	--	0.67	240.00	**0.02**	**--**	--	**0.02**
PCBs										
Aroclor 1016	12674-11-2	EPA 8082 low level	0.004	--	--	5.60	**0.01**		--	**0.01**
Aroclor 1221	11104-28-2	EPA 8082 low level	0.004	--	--	--	**No CLARC**		--	**--**
Aroclor 1232	11141-16-5	EPA 8082 low level	0.004	--	--	--	**No CLARC**		--	**--**
Aroclor 1242	53469-21-9	EPA 8082 low level	0.004	--	--	--	**No CLARC**		--	**--**
Aroclor 1248	12672-29-6	EPA 8082 low level	0.004	--	--	--	**No CLARC**		--	**--**
Aroclor 1254	11097-69-1	EPA 8082 low level	0.004	--	--	1.60	**0.0000068**		--	**0.0040**
Aroclor 1260	11096-82-5	EPA 8082 low level	0.004	--	--	--	**0.49**		--	**0.49**
Total polychlorinated biphenyls	1336-36-3	EPA 8082 low level	0.028	1.00	0.50	--	**0.000397**	**2.00**	--	**0.03**
Pesticides (Organochlorine)										
Aldrin	309-00-2	EPA 8081	0.0017	--	0.06	2.40	**0.0000492**	**0.17**	--	**0.0017**
Chlordane	57-74-9	EPA 8081	0.0017	--	2.90	40.00	**0.0006042**	**7.00**	--	**0.0017**
4,4'-DDD	72-54-8	EPA 8081	0.0033	--	4.20	--	**0.0002864**	**1.00**	--	**0.0033**
4,4'-DDE	72-55-9	EPA 8081	0.0033	--	2.90	--	**0.0003793**	**1.00**	--	**0.0033**
4,4'-DDT	50-29-3	EPA 8081	0.0033	3.00	2.90	40.00	**0.0029930**	**1.00**	--	**0.0033**
Dieldrin	60-57-1	EPA 8081	0.0033	--	0.06	4.00	**0.0000283**	**0.17**	--	**0.0033**
Endosulfan I	959-98-8	EPA 8081	0.0017	--	--	--	**No CLARC**	**--**	--	**--**
Endosulfan II	33213-65-9	EPA 8081	0.0033	--	--	--	**No CLARC**	**--**	--	**--**
Endosulfan sulfate	1031-07-8	EPA 8081	0.0033	--	--	--	**No CLARC**	**--**	--	**--**
Endrin	72-20-8	EPA 8081	0.0033	--	--	24.00	**0.0005152**	**0.40**	--	**0.0033**
Endrin aldehyde	7421-93-4	EPA 8081	0.0033	--	--	--	**No CLARC**	**--**	--	**--**
Endrin ketone	53494-70-5	EPA 8081	0.0033	--	--	--	**No CLARC**	**--**	--	**--**
Heptachlor	76-44-8	EPA 8081	0.0017	--	0.22	40.00	**0.0000153**	**--**	--	**0.0017**
Heptachlor epoxide	1024-57-3	EPA 8081	0.0017	--	0.11	1.00	**0.0027010**	**0.60**	--	**0.0027**
a-Hexachlorocyclohexane	319-84-6	EPA 8081	0.0017	--	0.16	--	**0.0001960**	**--**	--	**0.0017**
b-Hexachlorocyclohexane	319-85-7	EPA 8081	0.0017	--	0.56	--	**0.0007820**	**--**	--	**0.0017**
c-Hexachlorocyclohexane	319-86-8	EPA 8081	0.0017	--	--	--	**0.0001640**	**--**	--	**0.0017**

TABLE 3

SUMMARY OF SOIL SCREENING LEVELS
March Point (Whitmarsh) Landfill
Skagit County, Washington

concentrations in milligrams per kilogram (mg/kg)

Analyte[1,2]	CAS No.	Analytical Method[3]	Target Reporting Limit (PQL)[4]	MTCA Method A, Unrestricted Land Use	MTCA Method B, Carcinogen	MTCA Method B, Noncarcinogen	MTCA Method B Protective of Groundwater as Marine Surface Water[5]	Sites that Qualify for Simplified TEE - Industrial or Commercial Site[6]	Puget Sound Soil Natural Background (Ecology, 1994)[7]	PSL[8]
Pesticides (Organochlorine) (Continued)										
Lindane	58-89-9	EPA 8081	0.0017	0.01	0.77	24.00	**0.0012160**	**10.00**	--	**0.0017**
Methoxylchlor	72-43-5	EPA 8081	0.017	--	--	400.00	**0.0481200**	**--**	--	**0.05**
Toxaphene	8001-35-2	EPA 8081	0.17	--	0.91	--	**0.0003848**	**--**	--	**0.17**
Other										
Ammonia	7664-41-7	SM 4500-NH3 D-97	0.1	--	--	--	**0.14**	**--**	--	**0.14**
Phosphorus	7723-14-0	EPA 365.2/ SM 4500-PB	0.4	--	--	1.60	**0.0004**	**--**	--	**0.40**

Notes
1. Shaded analytes have been previously detected at/around the site.
2. Analytes that have been detected at the site that are not listed in this table include chloride, sulfate, ferrous iron, DOC, total organic carbon, total suspended solids, total dissolved solids, calcium, magnesium, potassium, sodium, tellurium, and dibenzothiophene.
3. Method numbers refer to EPA SW-846 Analytical Methods, Washington State Department of Ecology (Ecology) recommended analytical methods, or Standard Methods (SM) for the Examination of Water and Wastewater.
4. Reporting limits based on wet weight and will be slightly higher on a dry weight basis, including matrix interference.
5. Calculated using fixed-parameter three-phase partitioning model, WAC 173-340-747(4).
6. TEE values are from Table 479-2 of the MTCA regulations (WAC 173-340-900).
7. *** Background level for chromium is level calculated for the Custom Plywood site.
8. PSL was chosen as the lower of the MTCA Method A cleanup levels, MTCA Method B cleanup levels, and TEE cleanup level for industrial and commercial sites, unless natural background concentration and/or available laboratory PQL values were higher. In those cases, PSL was set to the natural background concentration or the PQL. The PSL shown is the screening level used in Table 10.
9. -- = No value available.
10. N/A = No surface water screening levels in CLARC database (Ecology, 2008); no soil screening level calculated.
11. TEE values are for speciated arsenic; the lower value for arsenic (III) is used. The arsenic (V) value is 95 mg/kg.
12. TEE value is for organic mercury; inorganic mercury value is 9 mg/kg.
13. No CLARC = Analyte not listed in CLARC database.

Abbreviations
CAS = Chemical Abstracts Service
CLARC = Cleanup Levels and Risk Calculations
DOC = dissolved organic carbon
EPA = U.S. Environmental Protection Agency
MTCA = Model Toxics Control Act
PCBs = polychlorinated biphenyls
PQL = practical quantitation limit.
PSL = preliminary screening level
SIM = selective ion monitoring
SVOCs = semivolatile organic compounds
TEE = terrestrial ecological evaluation
TPH = total petroleum hydrocarbons
VOCs = volatile organic compounds
WAC = Washington Administrative Code

TABLE 4

SUMMARY OF GROUNDWATER AND SURFACE WATER SCREENING LEVELS
March Point (Whitmarsh) Landfill
Skagit County, Washington

Concentrations in micrograms per liter (µg/L)

Analyte[1,2]	CAS No.	Analytical Method[3]	Target Reporting Limit (PQL)	Groundwater MTCA Method A	Groundwater MTCA Method B, Carcinogen	Groundwater MTCA Method B, Non-Carcinogen	Aquatic Life - Marine/Chronic - Ch.173-201A WAC	Aquatic Life - Marine/Chronic - Clean Water Act 304	Aquatic Life - Marine/Chronic - National Toxics Rule 40 CFR 131	Human Health - Marine - Clean Water Act 304	Human Health - Marine - National Toxics Rule, 40 CFR 131	Surface Water MTCA Method B, Carcinogen	Surface Water MTCA Method B, Non-Carcinogen	PSL[4]
Dissolved Metals														
Aluminum	7429-90-5	EPA 6010B	50	--[5]	--	--	--	--	--	--	--	--	--	--
Antimony	7440-36-0	EPA 6010B	50	--	--	6.40	--	--	--	640.00	4,300.00	--	1,000.00	**640.00**
Arsenic	7440-38-2	EPA 6020	0.2	5	0.06	4.80	36.00	36.00	36.00	0.14	0.14	0.10	18.00	0.20
Barium	7440-39-3	EPA 6010B	3.0	--	--	3,200.00	--	--	--		--	--	--	--
Beryllium	7440-41-7	EPA 6010B	1.0	--	--	32.00	--	--	--	--	--	--	270.00	**270.00**
Cadmium	7440-43-9	EPA 6010B	2.0	5	--	8.00	9.30	8.80	9.30	--	--	--	20.00	**8.80**
Chromium	7440-47-3	EPA 6010B	5.0	50	--	24,000.00	--	--	--	--	--	--	240,000.00	**240,000.00**
Copper	7440-50-8	EPA 6010B	2.0	--	--	590.00	3.10	3.10	2.40	--	--	--	2,700.00	**2.40**
Iron	7439-89-6	EPA 6010B	50	--	--	--	--	--	--	--	--	--	--	--
Lead	7439-92-1	EPA 7421	1.0	15	--	--	8.10	8.10	8.10	--	--	--	--	**8.10**
Manganese	7439-96-5	EPA 6010B	1.0	--	--	2,200.00	--	--	--	100.00	--	--	--	**100.00**
Mercury	7439-97-6	EPA 7470A - Low level	0.02	2	--	4.80	0.03	0.94	0.03	0.30	0.15	--	--	**0.03**
Molybdenum	7439-98-7	EPA 6010B	5	--	--	80.00	--	--	--	--	--	--	--	--
Nickel	7440-02-0	EPA 6020	0.5	--	--	320.00	8.20	8.20	8.20	4,600.00	4,600.00	--	1,100.00	**8.20**
Selenium	7782-49-2	EPA 6010B	50	--	--	80.00	71.00	71.00	71.00	4,200.00	--	--	2,700.00	**71.00**
Silver	7440-22-4	EPA 6010B	3.0	--	--	80.00	--	--	--	--	--	--	26,000.00	**26,000.00**
Strontium	7440-24-6	EPA 6010B	1.0	--	--	9,600.00	--	--	--	--	--	--	--	--
Thallium	7440-28-0	EPA 7841	0.2	--	--	1.10	--	--	--	0.47	6.30	--	1.60	**0.47**
Titanium	7440-32-6	EA 6010B	5.0	--	--	--	--	--	--	--	--	--	--	--
Vanadium	7440-62-2	EPA 6010B	3.0	--	--	110.00	--	--	--	--	--	--	--	--
Zinc	7440-66-6	EPA 6010B	10	--	--	4,800.00	81.00	81.00	81.00	26,000.00	--	--	17,000.00	**81.00**
TPH														
TPH - Hydrocarbon Identification	NA	Ecology NWTPH-HCID	630	--	--	--	--	--	--	--	--	--	--	--
TPH - Diesel range	NA	Ecology NWTPH-Dx	250	500	--	--	--	--	--	--	--	--	--	--
TPH - Heavy oil range	NA	Ecology NWTPH-Dx	500	500	--	--	--	--	--	--	--	--	--	--
TPH - Gasoline	NA	Ecology NWTPH-Gx	250	800	--	--	--	--	--	--	--	--	--	--
SVOCs														
1-Methylnaphthalene	90-12-0	EPA 8270D	1.0	--	--	2.40	--	--	--	--	--	--	--	--
2,4,5-Trichlorophenol	95-95-4	EPA 8270D	5.0	--	--	800.00	--	--	--	3,600.00	--	--	--	**3,600.00**
2,4,6-Trichlorophenol	88-06-2	EPA 8270D	5.0	--	4.00	--	--	--	--	2.40	6.50	3.90	--	**5.00**
2,4-Dichlorophenol	120-83-2	EPA 8270D	5.0	--	--	24.00	--	--	--	290.00	790.00	--	190.00	**190.00**
2,4-Dimethylphenol	105-67-9	EPA 8270D	1.0	--	--	160.00	--	--	--	850.00	--	--	550.00	**550.00**
2,4-Dinitrophenol	51-28-5	EPA 8270D	10.0	--	--	32.00	--	--	--	5,300.00	14,000.00	--	3,500.00	**3,500.00**
2,4-Dinitrotoluene	121-14-2	EPA 8270D	5.0	--	--	32.00	--	--	--	3.40	9.10	--	1,400.00	**5.00**
2,6-Dinitrotoluene	606-20-2	EPA 8270D	5.0	--	--	16.00	--	--	--	--	--	--	--	--
2-Chloronaphthalene	91-58-7	EPA 8270D	1.0	--	--	640.00	--	--	--	1,600.00	--	--	1,000.00	**1,000.00**
2-Chlorophenol	95-57-8	EPA 8270D	1.0	--	--	40.00	--	--	--	--	--	--	97.00	**97.00**
2-Methylnaphthalene	91-57-6	EPA 8270D	1.0	--	--	32.00	--	--	--	--	--	--	--	--
2-Methylphenol	95-48-7	EPA 8270D	1.0	--	--	400.00	--	--	--	--	--	--	--	--
2-Nitroaniline	88-74-4	EPA 8270D	5.0	--	--	--	--	--	--	--	--	--	--	--
2-Nitrophenol	88-75-5	EPA 8270D	5.0	--	--	--	--	--	--	--	--	--	--	--
3-Nitroaniline	99-09-2	EPA 8270D	5.0	--	--	--	--	--	--	--	--	--	--	--
3,3'-Dichlorobenzidine	91-94-1	EPA 8270D	5.0	--	0.19	--	--	--	--	0.03	0.08	0.05	--	**5.00**
4,6-Dinitro-2-methylphenol	534-52-1	EPA 8270D	10.0	--	--	--	--	--	--	--	--	--	--	--
4-Bromophenyl phenyl ether	101-55-3	EPA 8270D	1.0	--	--	--	--	--	--	--	--	--	--	--
4-Chloro-3-methylphenol	59-50-7	EPA 8270D	5.0	--	--	--	--	--	--	--	--	--	--	--
4-Chloroaniline	106-47-8	EPA 8270D	5.0	--	--	32.00	--	--	--	--	--	--	--	--
4-Chlorophenyl phenyl ether	7005-72-3	EPA 8270D	1.0	--	--	--	--	--	--	--	--	--	--	--

TABLE 4

SUMMARY OF GROUNDWATER AND SURFACE WATER SCREENING LEVELS

March Point (Whitmarsh) Landfill
Skagit County, Washington

Concentrations in micrograms per liter (µg/L)

Analyte[1,2]	CAS No.	Analytical Method[3]	Target Reporting Limit (PQL)	Groundwater MTCA Method A	Groundwater MTCA Method B, Carcinogen	Groundwater MTCA Method B, Non-Carcinogen	Aquatic Life - Marine/Chronic - Ch.173-201A WAC	Aquatic Life - Marine/Chronic - Clean Water Act 304	Aquatic Life - Marine/Chronic - National Toxics Rule 40 CFR 131	Human Health - Marine - Clean Water Act 304	Human Health - Marine - National Toxics Rule, 40 CFR 131	Surface Water MTCA Method B, Carcinogen	Surface Water MTCA Method B, Non-Carcinogen	PSL[4]
SVOCs (Continued)														
4-Methylphenol (p-cresol)	106-44-5	EPA 8270D	1.0	--	--	40.00	--	--	--	--	--	--	--	--
4-Nitroaniline	100-01-6	EPA 8270D	5.0	--	--	--	--	--	--	--	--	--	--	--
4-Nitrophenol	100-02-7	EPA 8270D	5.0	--	--	--	--	--	--	--	--	--	--	--
Acenaphthene	83-32-9	EPA 8270-SIM	0.01	--	--	960.00	--	--	--	990.00	--	--	640.00	**640.00**
Acenaphthylene	208-96-8	EPA 8270-SIM	0.01	--	--	--	--	--	--	--	--	--	--	--
Aniline	62-53-3	EPA 8270D	1.0	--	7.70	--	--	--	--	--	--	--	--	--
Anthracene	120-12-7	EPA 8270-SIM	0.01	--	--	4,800.00	--	--	--	40,000.00	110,000.00	--	26,000.00	**26,000.00**
Benzidine	92-87-5	EPA 8270D	10.0	--	0.00	48.00	--	--	--	0.00	0.00	0.00	89.00	**10.00**
Benzo(a)anthracene	56-55-3	EPA 8270-SIM	0.01	--	--	--	--	--	--	0.02	0.03	--	--	**0.02**
Benzo(a)pyrene	50-32-8	EPA 8270-SIM	0.01	0.1	0.01	--	--	--	--	0.02	0.03	0.03		**0.02**
Benzo(b)fluoranthene	205-99-2	EPA 8270-SIM	0.01	--	--	--	--	--	--	0.02	0.03	--	--	**0.02**
Benzo(ghi)perylene	191-24-2	EPA 8270-SIM	0.01	--	--	--	--	--	--	--	--	--	--	--
Benzo(k)fluoranthene	207-08-9	EPA 8270-SIM	0.01	--	--	--	--	--	--	0.02	0.03	--	--	**0.02**
Benzoic acid	65-85-0	EPA 8270D	10.0	--	--	64,000.00	--	--	--	--	--	--	--	--
Benzyl alcohol	100-51-6	EPA 8270D	5.0	--	--	2,400.00	--	--	--	--	--	--	--	--
Bis(2-chloroethoxy)methane	111-91-1	EPA 8270D	1.0	--	--	--	--	--	--	--	--	--	--	--
Bis(2-chloroethyl) ether	111-44-4	EPA 8270D	1.0	--	0.04	--	--	--	--	0.53	1.40	0.85	--	**1.00**
Bis(2-chloroisopropyl) ether [2,2'-oxybis(1-chloropropane)]	108-60-1	EPA 8270D	1.0	--	--	320.00	--	--	--	65,000.00	170,000.00	--	42,000.00	**42,000.00**
Bis(2-ethylhexyl) phthalate	117-81-7	EPA 8270D	1.0	--	6.30	320.00	--	--	--	2.20	5.90	3.60	400.00	**2.20**
Butyl benzyl phthalate	85-68-7	EPA 8270D	1.0	--	--	3,200.00	--	--	--	1,900.00	--	--	1,300.00	**1,300.00**
Carbaryl	63-25-2	EPA 8270D	20	--	--	1,600.00	--	--	--	--	--	--	--	--
Carbazole	86-74-8	EPA 8270D	1.0	--	4.40	--	--	--	--	--	--	--	--	--
Chrysene	218-01-9	EPA 8270-SIM	0.01	--	--	--	--	--	--	0.02	0.03	--	--	**0.02**
Dibenzo(a,h)anthracene	53-70-3	EPA 8270-SIM	0.01	--	--	--	--	--	--	0.02	0.03	--	--	**0.02**
Dibenzofuran	132-64-9	EPA 8270D	1.0	--	--	32.00	--	--	--	--	--	--	--	--
Diethyl phthalate	84-66-2	EPA 8270D	1.0	--	--	13,000.00	--	--	--	44,000.00	120,000.00	--	28,000.00	**28,000.00**
Dimethyl phthalate	131-11-3	EPA 8270D	1.0	--	--	16,000.00	--	--	--	1,100,000.00	2,900,000.00	--	72,000.00	**72,000.00**
Di-n-butyl phthalate	84-74-2	EPA 8270D	1.0	--	--	1,600.00	--	--	--	4,500.00	12,000.00	--	2,900.00	**2,900.00**
Di-n-octyl phthalate	117-84-0	EPA 8270D	1.0	--	--	320.00	--	--	--	--	--	--	--	--
Fluoranthene	206-44-0	EPA 8270-SIM	0.01	--	--	640.00	--	--	--	140.00	370.00	--	90.00	**90.00**
Fluorene	86-73-7	EPA 8270-SIM	0.01	--	--	640.00	--	--	--	5,300.00	14,000.00	--	3,500.00	**3,500.00**
Hexachlorobenzene	118-74-1	EPA 8270D	1.0	--	0.06	13.00	--	--	--	0.00	0.00	0.00	0.24	**1.00**
Hexachlorobutadiene	87-58-3	EPA 8270D	1.0	--	--	--	--	--	--	18.00	50.00	30.00	190.00	**18.00**
Hexachlorocyclopentadiene	77-47-4	EPA 8270D	5.0	--	--	48.00	--	--	--	1,100.00	17,000.00	--	3,600.00	**1,100.00**
Hexachloroethane	67-72-1	EPA 8270D	1.0	--	3.10	8.00	--	--	--	3.30	8.90	5.30	30.00	**3.30**
Indeno(1,2,3-cd)pyrene	193-39-5	EPA 8270-SIM	0.01	--	--	--	--	--	--	0.02	0.03	--	--	**0.02**
Isophorone	78-59-1	EPA 8270D	1.0	--	46.00	1,600.00	--	--	--	960.00	600.00	1,600.00	120,000.00	**600.00**
Naphthalene	91-20-3	EPA 8270-SIM	0.01	160	--	160.00	--	--	--	--	--	--	4,900.00	**4,900.00**
Nitrobenzene	98-95-3	EPA 8270D	1.0	--	--	4.00	--	--	--	690.00	1,900.00	--	450.00	**450.00**
N-Nitrosodimethylamine	62-75-9	EPA 8270D	5.0	--	0.00	--	--	--	--	3.00	8.10	4.90	--	**5.00**
N-Nitrosodi-n-propylamine	621-64-7	EPA 8270D	5.0	--	--	--	--	--	--	0.51		0.82	--	**5.00**
N-Nitrosodiphenylamine	86-30-6	EPA 8270D	1.0	--	--	--	--	--	--	6.00	16.00	9.70	--	**6.00**
Pentachlorophenol	87-86-5	EPA 8270D	5.0	--	0.73	480.00	7.90	7.90	7.90	3.00	8.20	4.90	7,100.00	**5.00**
Phenanthrene	85-01-8	EPA 8270-SIM	0.01	--	--	--	--	--	--	--	--	--	--	--
Phenol	108-95-2	EPA 8270D	1.0	--	--	4,800.00	--	--	--	1,700,000.00	4,600,000.00	--	1,100,000.00	**1,100,000.00**
Pyrene	129-00-0	EPA 8270-SIM	0.01	--	--	480.00	--	--	--	4,000.00	11,000.00	--	2,600.00	**2,600.00**
Pyridine	110-86-1	EPA 8270D	5.0	--	--	8.00	--	--	--	--	--	--	--	--

TABLE 4

SUMMARY OF GROUNDWATER AND SURFACE WATER SCREENING LEVELS

March Point (Whitmarsh) Landfill
Skagit County, Washington

Concentrations in micrograms per liter (µg/L)

Analyte[1,2]	CAS No.	Analytical Method[3]	Target Reporting Limit (PQL)	Groundwater MTCA Method A	Groundwater MTCA Method B, Carcinogen	Groundwater MTCA Method B, Non-Carcinogen	Aquatic Life - Marine/Chronic - Ch.173-201A WAC	Aquatic Life - Marine/Chronic - Clean Water Act 304	Aquatic Life - Marine/Chronic - National Toxics Rule 40 CFR 131	Human Health - Marine - Clean Water Act 304	Human Health - Marine - National Toxics Rule, 40 CFR 131	Surface Water MTCA Method B, Carcinogen	Surface Water MTCA Method B, Non-Carcinogen	PSL[4]
VOCs														
1,1,1,2-Tetrachloroethane	630-20-6	EPA 8260B 10 mL purge	0.2	--	1.70	240.00	--	--	--	4.00	11.00	6.50	--	**4.00**
1,1,1-Trichloroethane	71-55-6	EPA 8260B 10 mL purge	0.2	200	--	7,200.00	--	--	--	--	--	--	420,000.00	**420,000.00**
1,1,2,2-Tetrachloroethane	79-34-5	EPA 8260B 10 mL purge	0.2	--	0.22	--	--	--	--	4.00	11.00	6.50	--	**4.00**
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	EPA 8260B 10 mL purge	0.2	--	--	240,000.00	--	--	--	--	--	--	--	**--**
1,1,2-Trichloroethane	79-00-5	EPA 8260B 10 mL purge	0.2	--	0.77	32.00	--	--	--	16.00	42.00	25.00	2,300.00	**16.00**
1,1-Dichloroethane	75-34-3	EPA 8260B 10 mL purge	0.2	--	--	800.00	--	--	--	7,100.00	3.20	--	23,000.00	**3.20**
1,1-Dichloroethene	75-35-4	EPA 8260B 10 mL purge	0.2	--	--	400.00	--	--	--	--	--	--	--	**--**
1,2,3-Trichlorobenzene	87-61-6	EPA 8260B 10 mL purge	0.5	--	--	--	--	--	--	--	--	--	--	**--**
1,2,3-Trichloropropane	96-18-4	EPA 8260B 10 mL purge	0.5	--	0.01	48.00	--	--	--	--	--	--	--	**--**
1,2,4-Trichlorobenzene	120-82-1	EPA 8260B 10 mL purge	0.5	--	--	80.00	--	--	--	70.00	--	--	230.00	**70.00**
1,2,4-Trimethylbenzene	95-63-6	EPA 8260B 10 mL purge	0.2	--	--	400.00	--	--	--	--	--	--	--	**--**
1,2-Dibromo-3-chloropropane	96-12-8	EPA 8260B 10 mL purge	0.5	--	0.03	--	--	--	--	--	--	--	--	**--**
1,2-Dibromoethane	106-93-4	EPA 8260B 10 mL purge	0.2	0.01	0.00	--	--	--	--	--	--	--	--	**--**
1,2-Dichlorobenzene	95-50-1	EPA 8260B 10 mL purge	0.2	--	--	720.00	--	--	--	1,300.00	17,000.00	--	4,200.00	**1,300.00**
1,2-Dichloroethane	107-06-2	EPA 8260B 10 mL purge	0.2	5	0.48	160.00	--	--	--	37.00	99.00	59.00	43,000.00	**37.00**
1,2-Dichloropropane	78-87-5	EPA 8260B 10 mL purge	0.2	--	0.64	--	--	--	--	15.00	--	23.00	--	**15.00**
1,3,5-Trimethylbenzene	108-67-8	EPA 8260B 10 mL purge	0.2	--	--	400.00	--	--	--	--	--	--	--	**--**
1,3-Dichlorobenzene	541-73-1	EPA 8260B 10 mL purge	0.2	--	--	--	--	--	--	960.00	2,600.00	--	--	**960.00**
1,4-Dichlorobenzene	106-46-7	EPA 8260B 10 mL purge	0.2	--	1.80	--	--	--	--	190.00	2,600.00	4.90	--	**4.90**
2-Butanone	78-93-3	EPA 8260B 10 mL purge	2.5	--	--	4,800.00	--	--	--	--	--	--	--	**--**
2-Chloroethyl vinyl ether	110-75-8	EPA 8260B 10 mL purge	1.0	--	--	--	--	--	--	--	--	--	--	**--**
2-Hexanone	591-78-6	EPA 8260B 10 mL purge	2.5	--	--	--	--	--	--	--	--	--	--	**--**
4-Chlorotoluene	106-43-4	EPA 8260B 10 mL purge	0.2	--	--	--	--	--	--	--	--	--	--	**--**
4-Methyl-2-pentanone	108-10-1	EPA 8260B 10 mL purge	2.5	--	--	640.00	--	--	--	--	--	--	--	**--**
Acetone	67-64-1	EPA 8260B 10 mL purge	2.5	--	--	800.00	--	--	--	--	--	--	--	**--**
Acrylonitrile	107-13-1	EPA 8260B 10 mL purge	1.0	--	0.08	8.00	--	--	--	0.25	0.66	0.40	86.00	**1.00**
Benzene	71-43-2	EPA 8260B 10 mL purge	0.2	5	0.80	32.00	--	--	--	51.00	71.00	23.00	2,000.00	**23.00**
Bromobenzene	108-86-1	EPA 8260B 10 mL purge	0.2	--	--	--	--	--	--	--	--	--	--	**--**
Bromodichloromethane	75-27-4	EPA 8260B 10 mL purge	0.2	--	0.71	160.00	--	--	--	17.00	22.00	28.00	14,000.00	**17.00**
Bromoform	75-25-2	EPA 8260B 10 mL purge	0.2	--	5.50	160.00	--	--	--	140.00	360.00	220.00	14,000.00	**140.00**
Bromomethane	74-83-9	EPA 8260B 10 mL purge	0.5	--	--	11.00	--	--	--	1,500.00	4,000.00	--	970.00	**970.00**
Carbon disulfide	75-15-0	EPA 8260B 10 mL purge	0.2	--	--	800.00	--	--	--	--	--	--	--	**--**
Carbon tetrachloride	56-23-5	EPA 8260B 10 mL purge	0.2	--	0.34	5.60	--	--	--	1.60	4.40	2.70	97.00	**1.60**
Chlorobenzene	108-90-7	EPA 8260B 10 mL purge	0.2	--	--	160.00	--	--	--	1,600.00	21,000.00	--	5,000.00	**1,600.00**
Chloroethane	75-00-3	EPA 8260B 10 mL purge	0.2	--	15.00	3,200.00	--	--	--	--	--	--	--	**--**
Chloroform	67-66-3	EPA 8260B 10 mL purge	0.2	--	7.20	80.00	--	--	--	470.00	470.00	280.00	6,900.00	**280.00**
Chloromethane	74-87-3	EPA 8260B 10 mL purge	0.2	--	3.40	--	--	--	--	--	--	130.00	--	**130.00**
cis-1,2-Dichloroethene	156-59-2	EPA 8260B 10 mL purge	0.2	--	--	80.00	--	--	--	--	--	--	--	**--**
cis-1,3-Dichloropropene	10061-01-5	EPA 8260B 10 mL purge	0.2	--	--	--	--	--	--	--	--	--	--	**--**
Dibromochloromethane	124-48-1	EPA 8260B 10 mL purge	0.2	--	0.52	160.00	--	--	--	13.00	34.00	21.00	14,000.00	**13.00**
Dichlorodifluoromethane	75-71-8	EPA 8260B 10 mL purge	0.2	--	--	1,600.00	--	--	--	--	--	--	--	**--**
Diethyl ether	60-29-7			--	--	1,600.00	--	--	--	--	--	--	--	**--**
Ethylbenzene	100-41-4	EPA 8260B 10 mL purge	0.2	700	--	800.00	--	--	--	2,100.00	29,000.00	--	6,900.00	**2,100.00**

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SUMMARY OF GROUNDWATER AND SURFACE WATER SCREENING LEVELS

March Point (Whitmarsh) Landfill
Skagit County, Washington

Concentrations in micrograms per liter (µg/L)

Analyte[1,2]	CAS No.	Analytical Method[3]	Target Reporting Limit (PQL)	Groundwater MTCA Method A	Groundwater MTCA Method B, Carcinogen	Groundwater MTCA Method B, Non-Carcinogen	Aquatic Life - Marine/Chronic - Ch.173-201A WAC	Aquatic Life - Marine/Chronic - Clean Water Act 304	Aquatic Life - Marine/Chronic - National Toxics Rule 40 CFR 131	Human Health - Marine - Clean Water Act 304	Human Health - Marine - National Toxics Rule, 40 CFR 131	Surface Water MTCA Method B, Carcinogen	Surface Water MTCA Method B, Non-Carcinogen	PSL[4]
VOCs (Continued)														
Hexachlorobutadiene	87-68-3	EPA 8260B 10 mL purge	0.5	--	0.56	1.60	--	--	--	18.00	50.00	30.00	190.00	**18.00**
Isopropylbenzene (cumene)	98-82-8	EPA 8260B 10 mL purge	0.2	--	--	800.00	--	--	--	--	--	--	--	**--**
m,p-Xylenes	1330-20-7	EPA 8260B 10 mL purge	0.4	1,000	--	1,600.00	--	--	--	--	--	--	--	**--**
Methyl tert-butyl ether	1634-04-4	EPA 8260B 10 mL purge	0.5	20	24.00	6,900.00	--	--	--	--	--	--	--	**--**
Methylene chloride	75-09-2	EPA 8260B 10 mL purge	0.5	5	5.80	480.00	--	--	--	590.00	1,600.00	960.00	170,000.00	**590.00**
n-Butylbenzene	104-51-8	EPA 8260B 10 mL purge	0.2	--	--	--	--	--	--	--	--	--	--	**--**
n-Propylbenzene	103-65-1	EPA 8260B 10 mL purge	0.2	--	--	--	--	--	--	--	--	--	--	**--**
o-Chlorotoluene	95-49-8	EPA 8260B 10 mL purge	0.2	--	--	160.00	--	--	--	--	--	--	--	**--**
o-Xylene	95-47-6	EPA 8260B 10 mL purge	0.2	--	--	16,000.00	--	--	--	--	--	--	--	**--**
p-Isopropyltoluene	99-87-6	EPA 8260B 10 mL purge	0.2	--	--	--	--	--	--	--	--	--	--	**--**
sec-Butylbenzene	135-98-8	EPA 8260B 10 mL purge	0.2	--	--	--	--	--	--	--	--	--	--	**--**
Styrene	100-42-5	EPA 8260B 10 mL purge	0.2	--	1.50	1,600.00	--	--	--	--	--	--	--	**--**
tert-Butylbenzene	98-06-6	EPA 8260B 10 mL purge	0.2	--	--	--	--	--	--	--	--	--	--	**--**
Tetrachloroethene	127-18-4	EPA 8260B 10 mL purge	0.2	5	0.08	80.00	--	--	--	3.30	8.90	0.39	840.00	**0.39**
Toluene	108-88-3	EPA 8260B 10 mL purge	0.2	1,000	--	640.00	--	--	--	15,000.00	200,000.00	--	19,000.00	**15,000.00**
trans-1,2-Dichloroethene	156-60-5	EPA 8260B 10 mL purge	0.2	--	--	160.00	--	--	--	10,000.00	--	--	33,000.00	**10,000.00**
trans-1,3-Dichloropropene	10061-02-6	EPA 8260B 10 mL purge	0.2	--	--	--	--	--	--	--	--	--	--	**--**
Trichloroethene	79-01-6	EPA 8260B 10 mL purge	0.2	5	0.11	2.40	--	--	--	30.00	81.00	1.50	71.00	**1.50**
Trichlorofluoromethane	75-69-4	EPA 8260B 10 mL purge	0.2	--	--	2,400.00	--	--	--	--	--	--	--	**--**
Vinyl chloride	75-01-4	EPA 8260B 10 mL purge	0.2	0.2	0.03	24.00	--	--	--	2.40	530.00	3.70	6,600.00	**2.40**
PCBs														
Aroclor 1016	12674-11-2	EPA 8082 low level	0.01	--	--	1.10	--	--	0.03	--	--	--	0.01	**0.01**
Aroclor 1221	11104-28-2	EPA 8082 low level	0.01	--	--	--	--	--	--	--	--	--	--	**--**
Aroclor 1232	11141-16-5	EPA 8082 low level	0.01	--	--	--	--	--	--	--	--	--	--	**--**
Aroclor 1242	53469-21-9	EPA 8082 low level	0.01	--	--	--	--	--	--	--	--	--	--	**--**
Aroclor 1248	12672-29-6	EPA 8082 low level	0.01	--	--	--	--	--	--	--	--	--	--	**--**
Aroclor 1254	11097-69-1	EPA 8082 low level	0.01	--	--	0.32	--	--	0.03	--	--	--	0.00	**0.01**
Aroclor 1260	11096-82-5	EPA 8082 low level	0.01	--	--	--	--	--	0.03	--	--	--	--	**0.03**
Total polychlorinated biphenyls (PCBs)	1336-36-3	EPA 8082 low level	0.07	0.1	0.04	--	0.03	0.03	0.03	0.00	0.00	0.00	--	**0.07**
Pesticides (Organochlorine)														
Aldrin	309-00-2	EPA 8081 - Manchester	0.00083	--	0.00	0.24	0.00	--	--	0.00	0.00	0.00	0.02	**0.00**
Chlordane	57-74-9	EPA 8081 - Manchester	0.00083	--	0.25	8.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	**0.00**
4,4'-DDD	72-54-8	EPA 8081 - Manchester	0.00166	--	0.36	--	0.00	--	--	0.00	0.00	0.00	--	**0.00**
4,4'-DDE	72-55-9	EPA 8081 - Manchester	0.00166	--	0.26	--	0.00	--	--	0.00	0.00	0.00	--	**0.00**
4,4'-DDT	50-29-3	EPA 8081 - Manchester	0.00166	0.3	0.26	8.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	**0.00**
Dieldrin	60-57-1	EPA 8081 - Manchester	0.00166	--	0.01	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.03	**0.00**
Endosulfan I	959-98-8	EPA 8081 - Manchester	0.00083	--	--	--	--	--	--	--	--	--	--	**--**
Endosulfan II	33213-65-9	EPA 8081 - Manchester	0.00166	--	--	--	--	--	--	--	--	--	--	**--**
Endosulfan sulfate	1031-07-8	EPA 8081 - Manchester	0.00166	--	--	--	--	--	--	--	--	--	--	**--**
Endrin	72-20-8	EPA 8081 - Manchester	0.00166	--	--	4.80	0.00	0.00	0.00	0.06	0.81	--	0.20	**0.00**
Endrin aldehyde	7421-93-4	EPA 8081 - Manchester	0.00166	--	--	--	--	--	--	--	--	--	--	**--**
Endrin ketone	53494-70-5	EPA 8081 - Manchester	0.00166	--	--	--	--	--	--	--	--	--	--	**--**
Heptachlor	76-44-8	EPA 8081 - Manchester	0.00083	--	0.02	8.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	**0.00**
Heptachlor epoxide	1024-57-3	EPA 8081 - Manchester	0.00083	--	0.00	0.10	--	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
a-Hexachlorocyclohexane	319-84-6	EPA 8081 - Manchester	0.00083	--	0.01	--	--	--	--	0.00	0.01	0.01	--	**0.00**
b-Hexachlorocyclohexane	319-85-7	EPA 8081 - Manchester	0.00083	--	0.05	--	--	--	--	0.02	0.05	0.03	--	**0.02**
c-Hexachlorocyclohexane	319-86-8	EPA 8081 - Manchester	0.00083	--	--	--	--	--	--	0.04	--	--	--	**0.04**
Lindane	58-89-9	EPA 8081 - Manchester	0.00083	0.2	0.07	4.80	--	--	--	1.80	0.06	0.04	6.00	**0.04**
Methoxylchlor	72-43-5	EPA 8081 - Manchester	0.00833	--	--	80.00	--	0.03	--	--	--	--	8.40	**0.03**
Toxaphene	8001-35-2	EPA 8081	5.00	--	0.08	--	0.00	0.00	0.00	0.00	0.00	0.00	--	**5.00**

TABLE 4

SUMMARY OF GROUNDWATER AND SURFACE WATER SCREENING LEVELS
March Point (Whitmarsh) Landfill
Skagit County, Washington

Concentrations in micrograms per liter (µg/L)

Analyte[1,2]	CAS No.	Analytical Method[3]	Target Reporting Limit (PQL)	Groundwater MTCA Method A	Groundwater MTCA Method B, Carcinogen	Groundwater MTCA Method B, Non-Carcinogen	Aquatic Life - Marine/Chronic - Ch.173-201A WAC	Aquatic Life - Marine/Chronic - Clean Water Act 304	Aquatic Life - Marine/Chronic - National Toxics Rule 40 CFR 131	Human Health - Marine - Clean Water Act 304	Human Health - Marine - National Toxics Rule, 40 CFR 131	Surface Water MTCA Method B, Carcinogen	Surface Water MTCA Method B, Non-Carcinogen	PSL[4]
Other														
Ammonia	7664-41-7	SM 4500-NH3 D-97	10	--	--	--	35.00	--	--	--	--	--	--	**35.00**
Phosphorus	7723-14-0	EPA 365.2/SM 4500-PB	16	--	--	0.16	--	0.10	--	--	--	--	--	**16.00**

Notes
1. Shaded analytes have been previously detected at/around the site.
2. Analytes that have been detected at the site that are not listed in this table include chloride, sulfate, ferrous iron, DOC, total organic carbon, total suspended solids, total dissolved solids, calcium, magnesium, potassium, sodium, tellurium, and dibenzothiophene.
3. Method numbers refer to EPA SW-846 Analytical Methods, Washington State Department of Ecology (Ecology) recommended analytical methods, or Standard Methods (SM) for the Examination of Water and Wastewater.
4. PSL was chosen as the lower of the aquatic marine chronic WQC published in WAC 173-201A, aquatic marine chronic and human health (fish ingestion) WQC published in Section 304 of the Clean Water Act, aquatic marine chronic and human health (fish ingestion) WQC published in the National Toxics Rule (40 CFR 131), and MTCA Method B surface water cleanup levels (carcinogen and noncarcinogen). The PSL is the screening level used in Table 11.
5. -- = No value available.

Abbreviations
CAS = Chemical Abstracts Service
CFR = Code of Federal Regulations
DOC = dissolved organic carbon
EPA = U.S. Environmental Protection Agency
mL = milliliters
MTCA = Model Toxics Control Act
NA = not applicable
PCBs = polychlorinated biphenyls
PQL = practical quantitation limit
PSL = preliminary screening level
SIM = selective ion monitoring
SVOCs = semivolatile organic compounds
TPH = total petroleum hydrocarbons
VOCs = volatile organic compounds
WAC = Washington Administrative Code
WQC = water quality criteria

TABLE 5

TEST RESULTS FOR THE 10-DAY ACUTE TOXICITY TEST WITH *AMPELISCA ABDITA*

March Point (Whitmarsh) Landfill
Skagit County, Washington

Treatment	Percent Fines (% ≤ 63 μ)[1]	Replicate	Number Initiated	Number Surviving	Number Missing or Dead	Percentage Survival	Mean Percentage Survival[2]
Control		1	20	18	2	90	
		2	20	18	2	90	
		3	20	17	3	85	
		4	20	18	2	90	
		5	20	20	0	100	91 ± 5.5
CR-1	60%	1	20	17	3	85	
		2	20	15	5	75	
		3	20	20	0	100	
		4	20	17	3	85	
		5	20	16	4	80	85 ± 9.4
MP-3	67%	1	20	14	6	70	
		2	20	14	6	70	
		3	20	15	5	75	
		4	20	18	2	90	
		5	20	15	5	75	76 ± 8.2
MP-5	66%	1	20	14	6	70	
		2	20	15	5	75	
		3	20	14	6	70	
		4	20	14	6	70	
		5	20	14	6	70	71 ± 2.2
MP-6	61%	1	20	17	3	85	
		2	20	20	0	100	
		3	20	18	2	90	
		4	20	18	2	90	
		5	20	15	5	75	88 ± 9.1
MP-8	60%	1	20	18	2	90	
		2	20	18	2	90	
		3	20	17	3	85	
		4	20	18	2	90	
		5	20	17	3	85	88 ± 2.7
SBREF-80	80%	1	20	12	8	60	
		2	20	13	7	65	
		3	20	19	1	95	
		4	20	17	3	85	
		5	20	20	0	100	81 ± 17.8

TABLE 5

TEST RESULTS FOR THE 10-DAY ACUTE TOXICITY TEST WITH *AMPELISCA ABDITA*

March Point (Whitmarsh) Landfill
Skagit County, Washington

Treatment	Percent Fines (% ≤ 63 µ)[1]	Replicate	Number Initiated	Number Surviving	Number Missing or Dead	Percentage Survival	Mean Percentage Survival[2]
MP-1	83%	1	20	18	2	90	
		2	20	18	2	90	
		3	20	14	6	70	
		4	20	16	4	80	
		5	20	16	4	80	82 ± 8.4
MP-2	81%	1	20	17	3	85	
		2	20	19	1	95	
		3	20	19	1	95	
		4	20	17	3	85	
		5	20	18	2	90	90 ± 5.0
MP-4	77%	1	20	14	6	70	
		2	20	15	5	75	
		3	20	15	5	75	
		4	20	15	5	75	
		5	20	14	6	70	73 ± 2.7
MP-7	70%	1	20	15	5	75	
		2	20	10	10	50	
		3	20	15	5	75	
		4	20	16	4	80	
		5	20	18	2	90	74 ± 14.7
MP-9	78%	1	20	18	2	90	
		2	20	16	4	80	
		3	20	18	2	90	
		4	20	16	4	80	
		5	20	7	13	35	75 ± 22.9
MP-10	74%	1	20	20	0	100	
		2	20	16	4	80	
		3	20	15	5	75	
		4	20	16	4	80	
		5	20	17	3	85	84 ± 9.6
MP-11	84%	1	20	20	0	100	
		2	20	18	2	90	
		3	20	18	2	90	
		4	20	16	4	80	
		5	20	11	9	55	83 ± 17.2

TABLE 5

TEST RESULTS FOR THE 10-DAY ACUTE TOXICITY TEST WITH *AMPELISCA ABDITA*

March Point (Whitmarsh) Landfill
Skagit County, Washington

Treatment	Percent Fines (% ≤ 63 μ)[1]	Replicate	Number Initiated	Number Surviving	Number Missing or Dead	Percentage Survival	Mean Percentage Survival[2]
MP-12	80%	1	20	18	2	90	
		2	20	11	9	55	
		3	20	15	5	75	
		4	20	17	3	85	
		5	20	16	4	80	77 ± 13.5
MP-13	76%	1	20	15	5	75	
		2	20	9	11	45	
		3	20	14	6	70	
		4	20	16	4	80	
		5	20	18	2	90	72 ± 16.8

Notes

1. Percentage of sediment grains with diameter less than 63 µm.
2. Test results were evaluated relative to Washington SMS, based on criteria presented in the Sediment Investigation Work Plan (AMEC, 2008b).

Abbreviations

µm = micrometers
SMS = Sediment Management Standards

TABLE 6

TEST RESULTS FOR THE LARVAL TEST WITH *DENDRASTER EXCENTRICUS*

March Point (Whitmarsh) Landfill
Skagit County, Washington

Treatment	Percent Fines (% ≤ 63 μ)[1]	Replicate	Normal	Abnormal	Total	Mean Normal Survival (%)[2]
Initial Stocking Density		1			218	
		2			213	
		3			255	
		4			280	
		5			247	
Seawater Control		1	194	7	201	
		2	211	4	215	
		3	230	4	234	
		4	232	3	235	
		5	213	4	217	89 ± 6.4
Sediment Control		1	233	2	235	
		2	213	4	217	
		3	237	1	238	
		4	216	4	220	
		5	197	0	197	N/A
CR-1	60%	1	191	7	198	
		2	204	5	209	
		3	191	5	196	
		4	237	5	242	
		5	141	4	145	87.3 ± 13.2
MP-3	67%	1	207	6	213	
		2	175	2	177	
		3	205	3	208	
		4	204	3	207	
		5	213	13	226	93 ± 6.9
MP-5	66%	1	197	5	202	
		2	219	1	220	
		3	153	6	159	
		4	190	10	200	
		5	187	10	197	87.3 ± 10.6
MP-6	61%	1	210	6	216	
		2	245	2	247	
		3	227	4	231	
		4	252	6	258	
		5	248	2	250	99.4 ± 1.2
MP-8	60%	1	216	8	224	
		2	199	7	206	
		3	185	3	188	
		4	212	4	216	
		5	205	2	207	94.2 ± 5.6

TABLE 6

TEST RESULTS FOR THE LARVAL TEST WITH *DENDRASTER EXCENTRICUS*

March Point (Whitmarsh) Landfill
Skagit County, Washington

Treatment	Percent Fines (% ≤ 63 µ)[1]	Replicate	Normal	Abnormal	Total	Mean Normal Survival (%)[2]
SBREF80	80%	1	233	5	238	
		2	202	1	203	
		3	214	7	221	
		4	204	7	211	
		5	178	11	189	93.9 ± 7.0
MP-1	83%	1	208	4	212	
		2	201	7	208	
		3	233	7	240	
		4	227	5	232	
		5	221	5	226	97.9 ± 3.1
MP-2	81%	1	236	6	242	
		2	198	0	198	
		3	215	5	220	
		4	196	5	201	
		5	233	7	240	96.4 ± 4.7
MP-4	77%	1	225	3	228	
		2	208	2	210	
		3	199	3	202	
		4	189	9	198	
		5	176	12	188	91.5 ± 7.3
MP-7	70%	1	205	5	210	
		2	218	5	223	
		3	211	4	215	
		4	209	7	216	
		5	219	2	221	97.9 ± 2.2
MP-9	78%	1	235	1	236	
		2	228	4	232	
		3	213	6	219	
		4	212	2	214	
		5	183	2	185	96.3 ± 6.5
MP-10	74%	1	206	8	214	
		2	192	1	193	
		3	220	5	225	
		4	202	4	206	
		5	213	9	222	95.3 ± 4.4
MP-11	84%	1	233	4	237	
		2	234	1	235	
		3	195	4	199	
		4	265	5	270	
		5	222	6	228	98.1 ± 4.3

TABLE 6

TEST RESULTS FOR THE LARVAL TEST WITH *DENDRASTER EXCENTRICUS*

March Point (Whitmarsh) Landfill
Skagit County, Washington

Treatment	Percent Fines (% ≤ 63 μ)[1]	Replicate	Normal	Abnormal	Total	Mean Normal Survival (%)[2]
MP-12	80%	1	194	3	197	
		2	220	6	226	
		3	220	5	225	
		4	192	5	197	
		5	217	5	222	95.7 ± 5.8
MP-13	76%	1	230	4	234	
		2	221	5	226	
		3	204	2	206	
		4	200	7	207	
		5	195	4	199	95.5 ± 4.4

Notes

1. Percentage of sediment grains with diameter less than 63 µm.
2. Test results were evaluated relative to Washington SMS, based on criteria presented in the Sediment Investigation Work Plan (AMEC, 2008b).

Abbreviations

µm = micrometers
N/A = not applicable
SMS = Sediment Management Standards

TABLE 7

TEST RESULTS FOR THE MICROTOX BIOASSAY

March Point (Whitmarsh) Landfill
Skagit County, Washington

Change in Light Reading From $I_{(0)}$ to $I_{(15)}$						
Test	**Replicate 1**	**Replicate 2**	**Replicate 3**	**Replicate 4**	**Replicate 5**	**Mean % Output**[1]
Test 1[2]						
Control	0.82	0.81	0.83	0.83	0.86	83 ± 2
SBREF80	0.68	0.65	0.68	0.68	0.69	67 ± 2
MP-1	0.65	0.70	0.72	0.72	0.74	70 ± 3
MP-2	0.95	1.04	0.97	0.99	0.96	98 ± 3
MP-4	0.65	0.61	0.60	0.62	0.61	62 ± 2
MP-7	0.63	0.74	0.72	0.74	0.66	70 ± 5
Test 2[2]						
Control	0.86	0.94	0.96	0.92	0.96	93 ± 4
SBREF80	0.67	0.62	0.73	0.70	0.66	68 ± 4
MP-9	0.84	0.68	0.69	0.62	0.73	71 ± 8
MP-10	0.73	0.73	0.73	0.71	0.69	72 ± 2
MP-11	0.63	0.67	0.66	0.57	0.65	63 ± 4
MP-12	1.15	1.20	1.18	1.28	1.25	121 ± 5
Test 3[2]						
Control	0.99	0.93	1.05	1.02	0.94	99 ± 5
SBREF80	0.91	0.81	0.71	0.75	0.73	76 ± 4
MP-13	0.45	0.47	0.46	0.49	0.47	46 ± 2
Test 4						
Control	0.86	0.82	0.83	0.79	0.73	81 ± 5
CR-1	0.94	0.94	0.87	0.89	0.93	91 ± 3
MP-3	0.97	0.95	0.95	0.90	0.95	94 ± 3
MP-5	0.78	0.70	0.77	0.68	0.69	72 ± 4
MP-6	0.89	0.91	0.88	0.97	0.84	90 ± 5
MP-8	0.77	0.70	0.60	0.62	0.66	67 ± 7

Notes

1. Test results were evaluated relative to Washington SMS, based on criteria presented in the Sediment Investigation Work Plan (AMEC, 2008b).
2. Poor performance of reference sediment SBREF80. Test sediments were instead compared to control sediment.

Abbreviations

$I_{(0)}$ = Initial light reading

$I_{(15)}$ = Light reading after 15 minutes.

SMS = Sediment Management Standards

TABLE 8

SUMMARY OF PRELIMINARY BIOASSAY TEST RESULTS FOR SEDIMENT SAMPLES

March Point (Whitmarsh) Landfill
Skagit County, Washington

Station	Date	Time	Proposed Sample Location (SPCS WA N [4601] NAD83 Survey Feet)		Actual Sample Location (SPCS WA N [4601] NAD83 Survey Feet)		TVS	TS	Ammonia	Sulfides	TOC	Fines (< 63 µm)	Salinity	Microtox^1	Amphipod^1		Sediment Larval^1	
			Northing	Easting	Northing	Easting	(%)	(%)	(mg/kg)	(mg/kg)	(%)	(%)	(ppt)	SQS	SQS	CSL	SQS	CSL
Inner Lagoon Samples																		
MP-1	8/28/2008	0809	537990	1229338	537993	1229337	6.2	44.4	55.1	309	2.05	83%		Pass	Pass	Pass	Pass	Pass
MP-2	8/26/2008	1145	538146	1229108	538148	1229111	6.18	47.2	12.7	513	2.02	81%		Pass	Pass	Pass	Pass	Pass
MP-2D^2	8/26/2008	1205	538146	1229108	538148	1229111												
MP-3	8/26/2008	1100	538316	1228883	538328	1228894	9.61	35.2	19.8	8180	3.26	67%		Pass	Pass	Pass	Pass	Pass
MP-4	8/27/2008	0800	538517	1228856	538518	1228857	10.6	33.7	18.5	4160	3.06	77%		Fail	Pass	Pass	Pass	Pass
MP-4D^2	8/27/2008	0810	538517	1228856	538518	1228857												
MP-5	8/27/2008	0836	538415	1229185	538415	1229185	8.49	40.8	9.3	370	2.85	66%		Fail	Pass	Pass	Pass	Pass
MP-6	8/28/2008	0823	538192	1229437	538196	1229438	9.21	49.7	1.5	916	2.93	61%		Pass	Pass	Pass	Pass	Pass
MP-6D^2	8/28/2008	0827	538192	1229437	538196	1229438												
MP-7	8/27/2008	1311	538004	1229645	538004	1229643	7.81	38.5	14.6	239	2.44	70%		Pass	Pass	Pass	Pass	Pass
MP-8	8/27/2008	1242	537906	1229900	537905	1229900	8.24	46.5	4.6	31.6	4.61	60%		Fail	Pass	Pass	Pass	Pass
MP-9	8/27/2008	1048	537731	1229997	537728	1229997	7.68	46.1	5	52.7	2.82	78%		Fail	Pass	Pass	Pass	Pass
MP-9D^2	8/27/2008	1048	537731	1229997	537728	1229997												
MP-10	8/27/2008	1009	537525	1230054	537525	1230055	6.58	42.3	5.4	157	2.03	74%		Fail	Pass	Pass	Pass	Pass
MP-11	8/27/2008	1128	537291	1229984	537293	1229979	7.46	40.3	5.1	102	2.39	84%		Fail	Pass	Pass	Pass	Pass
MP-12	8/27/2008	0912	538436	1229011	538441	1229010	6.4	41.8	13.1	210	1.94	80%		Pass	Pass	Pass	Pass	Pass
MP-13	8/27/2008	1348	538248	1229262	538248	1229261	7.58	43.3	14	276	2.29	76%		Fail	Pass	Pass	Pass	Pass
Swale Samples																		
MPS-1	8/28/2008	1122			538006	1228723					16.6		0					
MPS-2	8/28/2008	1000			537849	1228833					13.9		7					
MPS-3	8/28/2008	1020			537533	1229226					11.8		17					

Notes

1. Test results were evaluated relative to Washington SMS, based on criteria presented in the Sediment Investigation Work Plan (AMEC, 2008b).
2. D indicates duplicate sample.

Abbreviations

µm = micrometers
CSL = cleanup screening levels
mg/kg = milligrams per kilogram
NAD83 = North American Datum of 1983
ppt = parts per thousand
SMS = Sediment Management Standards
SPCS = State Plane Coordinate System
SQS = Sediment Quality Standards
TOC = total organic carbon
TS = total solids
TVS = total volatile solids

TABLE 9

ANALYTICAL TEST RESULTS FOR SWALE SEDIMENT SAMPLES [1, 2]

March Point (Whitmarsh) Landfill
Skagit County, Washington

		SMS		SMS Dry Weight Equivalents [3]		Analytical Results		
Parameter	**CAS Number**	**SQS**	**CSL**	**Dry Weight "SQS" [4]**	**Dry Weight "CSL" [5]**	**MPS-1**	**MPS-2**	**MPS-3**
Conventionals								
Total Organic Carbon (%)						16.6	14	11.8
Metals		**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**
Arsenic	7440-38-2	57	93	57	93	30	20 U	20 U
Cadmium	7440-43-9	5.1	6.7	5.1	6.7	0.9	0.9	0.9
Chromium	7440-47-3	260	270	260	270	63	52	58
Copper	7440-50-8	390	390	390	390	67.2	51	54.3
Lead	7439-92-1	450	530	450	530	37	19	21
Mercury	7439-97-6	0.41	0.59	0.41	0.59	0.2 U	0.2 U	0.1 U
Silver	7440-22-4	6.1	6.1	6.1	6.1	1 U	1 U	1 U
Zinc	7440-66-6	410	960	410	960	199	131	194
Organics								
LPAHs		**ppm-OC**	**ppm-OC**	**ppb**	**ppb**	**ppb**	**ppb**	**ppb**
Naphthalene	91-20-3	99	170	2,100	2,100	20 U	20 U	20 U
Acenaphthylene	208-96-8	66	66	1,300	1,300	20 U	20 U	20 U
Acenaphthene	83-32-9	16	57	500	500	20 U	20 U	20 U
Fluorene	86-73-7	23	79	540	540	20 U	20 U	20 U
Phenanthrene	85-01-8	100	480	1,500	1,500	20 U	20 U	20 U
Anthracene	120-12-7	220	1,200	960	960	20 U	20 U	20 U
2-Methylnaphthalene	91-57-6	38	64	670	670	20 U	20 U	20 U
Total LPAH		370	780	5,200	5,200	20 U	20 U	20 U
HPAHs		**ppm-OC**	**ppm-OC**	**ppb**	**ppb**	**ppb**	**ppb**	**ppb**
Fluoranthene	206-44-0	160	1,200	1,700	2,500	20 U	20 U	20 U
Pyrene	129-00-0	1,000	1,400	2,600	3,300	20 U	20 U	20 U
Benzo(a)anthracene	56-55-3	110	270	1,300	1,600	20 U	20 U	20 U
Chrysene	218-01-9	110	460	1,400	2,800	20 U	20 U	20 U
Total Benzofluoranthenes		230	450	3,200	3,600	20 U	20 U	20 U
Benzo(b)fluoranthene	205-99-2					20 U	20 U	20 U
Benzo(k)fluoranthene	207-08-9					20 U	20 U	20 U
Benzo(a)pyrene	50-32-8	99	210	1,600	1,600	20 U	20 U	20 U
Indeno(1,2,3-cd)pyrene	193-39-5	34	88	600	690	20 U	20 U	20 U
Dibenz(a,h)anthracene	53-70-3	12	33	230	230	20 U	20 U	20 U
Benzo(g,h,i)perylene	191-24-2	31	78	670	720	20 U	20 U	20 U
Total HPAH		960	5,300	12,000	17,000	20 U	20 U	20 U
Chlorinated Benzenes		**ppm-OC**	**ppm-OC**	**ppb**	**ppb**	**ppb**	**ppb**	**ppb**
1,4-Dichlorobenzene	106-46-7	3.1	9	110	110	4.6 U	4.1 U	4.2 U
1,2-Dichlorobenzene	95-50-1	2.3	2.3	35	50	20 U	20 U	20 U
1,2,4-Trichlorobenzene	120-82-1	0.81	1.8	31	51	20 U	20 U	20 U
Hexachlorobenzene	118-74-1	0.38	2.3	22	70	0.99 U	1.8	1 U
Phthalates		**ppm-OC**	**ppm-OC**	**ppb**	**ppb**	**ppb**	**ppb**	**ppb**
Dimethyl phthalate	131-11-3	53	53	71	160	20 U	20 U	20 U
Diethyl phthalate	84-66-2	61	110	200	1,200	20 U	20 U	20 U
Di-n-Butyl phthalate	84-74-2	220	1,700	1,400	5,100	20 U	20 U	20 U
Butyl benzyl phthalate	85-68-7	4.9	64	63	900	20 U	31 UY	26 UY
bis(2-Ethylhexyl) phthalate	117-81-7	47	78	1,300	3,100	20 U	20 U	33
Di-n-Octyl phthalate	117-84-0	58	4,500	6,200	6,200	20 U	20 U	20 U
Miscellaneous Extractables		**ppm-OC**	**ppm-OC**	**ppb**	**ppb**	**ppb**	**ppb**	**ppb**
Hexachlorobutadiene	87-68-3	3.9	6.2	11	120	0.99 U	1 U	1 U
N-Nitrosodiphenylamine	86-30-6	11	11	28	40	20 UJ	20 UJ	20 UJ
Dibenzofuran	132-64-9	15	58	540	540	20 U	20 U	20 U
PCBs		**ppm-OC**	**ppm-OC**	**ppb**	**ppb**	**ppb**	**ppb**	**ppb**
Aroclor 1016	12674-11-2	--	--	--	--	20 U	20 U	20 U
Aroclor 1221	11104-28-2	--	--	--	--	20 U	20 U	20 U
Aroclor 1232	11141-16-5	--	--	--	--	20 U	20 U	20 U
Aroclor 1242	53469-21-9	--	--	--	--	20 U	20 U	20 U
Aroclor 1248	12672-29-6	--	--	--	--	20 U	20 U	20 U
Aroclor 1254	11097-69-1	--	--	--	--	20 U	20 U	20 U
Aroclor 1260	11096-82-5	--	--	--	--	20 U	20 U	20 U
Total PCB		12	65	130	1000	20 U	20 U	20 U

TABLE 9

ANALYTICAL TEST RESULTS FOR SWALE SEDIMENT SAMPLES [1, 2]

March Point (Whitmarsh) Landfill
Skagit County, Washington

Parameter	CAS Number	SMS		SMS Dry Weight Equivalents [3]		Analytical Results		
		SQS	CSL	Dry Weight "SQS" [4]	Dry Weight "CSL" [5]	MPS-1	MPS-2	MPS-3
Organics (Continued)								
Phenols		**ppb**	**ppb**	**ppb**	**ppb**	**ppb**	**ppb**	**ppb**
Phenol	108-95-2	420	1200	420	1,200	23	46	1,900
2-Methylphenol	95-48-7	63	63	63	63	20 U	20 U	20 U
4-Methylphenol	106-44-5	670	670	670	670	20 U	20 U	20 U
2,4-Dimethylphenol	105-67-9	29	29	29	29	20 U	20 U	20 U
Pentachlorophenol	87-86-5	360	690	360	690	99 U	100 U	100 U
Miscellaneous Extractables		**ppb**	**ppb**	**ppb**	**ppb**	**ppb**	**ppb**	**ppb**
Benzyl Alcohol	100-51-6	57	73	57	73	20 U	20 U	20 U
Benzoic Acid	65-85-0	650	650	650	650	200 U	200 U	200 U

Notes
1. Shaded cells indicate sample results above the SMS CSL.
2. Data qualifiers are as follows:
   U = Undetected at the reporting limit
   UY = Analyte is not detected at the raised reporting limit
   UJ = Analyte is not detected. The associated reporting limit is an estimate and may be inaccurate or imprecise.
3. The Sediment Management Standards for most nonionizable organic compounds are expressed as a carbon-normalized value. But the nonionizable organic compounds values are usually not carbon-normalized in sediments with TOC values above 4%. The dry weight equivalent values are used instead following consultation with Ecology. The nonionizable organic compounds in the table are the ones for which the SQS and CSL criteria are expressed in units of ppm-OC.
4. Dry Weight "SQS": Lowest Apparent Effects Threshold, dry weight equivalent of the SMS "SQS."
5. Dry Weight "CSL": Second Lowest Apparent Effects Threshold (2LAET), dry weight equivalent of the SMS "CSL."
   Not all the CSL dry weight equivalents are the same as the 2LAET. Some of the chemicals have the CSL dry weight equivalents set to the HAET or the LAET. A majority of the chemicals are set at the 2LAET but there are exceptions.

Abbreviations
CAS = Chemical Abstracts Service
CSL = cleanup screening levels
HAET = highest apparent effects threshold
HPAH = high-molecular weight polycyclic aromatic hydrocarbons
LAET = lowest apparent effects threshold
2LAET = second lowest apparent effects threshold
LPAH = low-molecular weight polycyclic aromatic hydrocarbons
PCBs = polychlorinated biphenyls
ppb = parts per billion
ppm = parts per million
ppm-OC = parts per million of organic carbon
SMS = Sediment Management Standards
SQS = Sediment Quality Standards
TOC = total organic carbon

TABLE 10

SUMMARY OF DETECTED ANALYTES FOR MONITORING WELL AND TEST PIT SOIL SAMPLES
OCTOBER AND NOVEMBER 2008[1,2,3]

March Point (Whitmarsh) Landfill
Skagit County, Washington

	Sample ID	**MW-01**			**MW-03**	**MW-04**		**G1[6]**		**G3[6]**			**G4[6]**		**G5[6]**			**G6[6]**		**G10[6]**	**G11[6]**
	Depth (ft bgs)	**11.5**	**20.5**	**37**	**11.5**	**8.5**	**19**	**1**	**5.5**	**1**	**8**	**12**	**1**	**5**	**1**	**5**	**9**	**6**	**field dup.**	**8**	**11**
	Sample Date	**10/7/2008**			**10/9/2008**	**10/8/2009**		**11/1/2008**		**10/31/2008**			**10/31/2008**		**11/2/2008**			**11/1/2008**		**11/1/2008**	**10/31/2008**
	PSL[4,5]																				
Metals (mg/kg)																					
Aluminum	32,600	11,900	12,300	29,900	11,500	17,100	11,200	18,600	18,800	16,800	15,200	20,200	17,200	17,700	16,200	16,000	18,500	13,400	14,200	14,300	21,500
Antimony	32	--	--	--	--	--	--	--	--	--	5 J	--	--	--	--	--	--	--	11 J	--	--
Arsenic	7	1.4 J	5.1 J	2.7 J	6.8 J	**14 J**	4.9 J	3.2	4.3	2.3	3	**8.8**	2.6	4.7	2.4	2.9	4.7	5.1	4.6	4.1	**13**
Barium	1,320	40.3	40.1	239	117	82.6	47	95.4	115	77.2	74.1	47.3	78.3	259	73.3	85.5	93.8	60.2	69.9	65.0	43
Beryllium	160	0.1	0.2	0.4	--	0.2	--	0.3	0.4	0.3	0.2	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	--
Cadmium	1.214	--	--	--	0.8	0.5	--	0.5	**2.6**	0.3	0.5	0.5	0.4	**2.7**	0.4	0.7	0.7	0.5	0.6	0.3	--
Chromium	135	32.4	28.4	53	55	57.7	33.1	41.2	67	34.6	32.8	54.8	45.8	47.2	35.9	38.6	33.3	39.4	39.3	30.1	58
Copper	36	18.1	21.4	**61.0**	**373**	**44.6**	15.8	23.6	**76**	23.2	**76.0**	33.3	26.7	**49.3**	21.6	29.5	**36.4**	**50.0**	**70.8**	21.8	23.4
Iron	58,700	19,100	21,900	42,600	39,900	27,100	16,700	23,700	34,400	21,900	24,800	30,300	23,800	26,500	22,300	26,800	29,800	28,300	23,200	18,200	38,500
Lead	220	2	--	7	171	6	--	13	112	4	33	6	3	**238**	2	31	58	18	49	--	--
Manganese	1,200	245	315	771	400	352	208	596	431	280	340	301	318	345	303	351	508	292	253	210	336
Mercury	0.07	--	--	0.06	--	0.06	--	--	**6.9**	--	**0.10**	**0.08**	--	**0.08**	--	0.07	**0.26**	--	0.07	--	--
Molybdenum	0.5	**1.0**	**1.4**	**3**	**4**	**2.7**	**2.3**	**2.1**	**6**	**1.6**	**2.0**	**3.9**	**1.8**	**2.7**	**1.8**	**2.7**	**2.4**	**3.7**	**4.6**	**1.9**	**5**
Nickel	48	**99**	**81**	**56**	**80**	**83**	**60**	**76**	**90**	**63**	**60**	45	**76**	**75**	**62**	**65**	**62**	**69**	**69**	**67**	34
Strontium	0.1	**24.4**	**19.4**	**72.0**	**29.3**	**35.9**	**33.2**	**33.6**	**33.3**	**47.0**	**29.2**	**58.0**	**46.6**	**48.0**	**47.7**	**32.1**	**31.4**	**26.7**	**30.9**	**32.8**	**64.1**
Titanium	NA	956	1,070	1,200	949	1,210	911	1,370	1,160	1,070	960	1,450	1,350	1,240	1,330	1,070	878	975	1,110	1,120	1,340
Vanadium	560	44.1	57.1	86	45.1	63.9	43.8	60.3	53.8	55.3	55.0	67.4	58.9	59.1	60.6	51.9	61.7	52.7	55.6	53.6	77
Zinc	100.8	43	39	99	**282**	84	40	81	**381**	63	**174**	82	79	**311**	**187**	**225**	**187**	**175**	**345**	59	73
TPH (mg/kg)																					
Gasoline-Range Organics (TPH-G)	30	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.5	**310 J**	--	--	--	--
Diesel-Range Organics (TPH-D)	2,000	--	--	--	--	--	--	12	61	17	21	11	--	64	--	120	280	11	14	6.1	--
Lube Oil (TPH-Oil)	2,000	--	--	--	--	--	--	49	330	39	75	45	20	380	--	480	670	55	48	16	--
SVOCs (µg/kg)																					
1-Methylnaphthalene	24,000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	130	--	--	--	--
2-Methylnaphthalene	320,000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	140	--	--	--	--
4-Methylphenol	400,000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	180	--	--	--	--
Acenaphthylene	NA	--	--	--	--	--	--	--	63	--	--	--	--	--	--	--	--	--	--	--	--
Anthracene	24,000,000	--	--	--	--	--	--	--	85	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)anthracene	129.7	--	--	--	--	--	--	--	**270**	--	--	--	--	--	--	--	**130**	--	--	--	--
Benzo(a)pyrene	100	--	--	--	--	--	--	--	**240**	--	--	--	--	--	--	--	**120**	--	--	--	--
Benzo(b)fluoranthene	575.6	--	--	--	--	--	--	--	160	--	--	--	--	--	--	--	100	--	--	--	--
Benzo(g,h,i)perylene	NA	--	--	--	--	--	--	--	71	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(k)fluoranthene	432.1	--	--	--	--	--	--	--	210	--	--	--	--	--	--	--	110	--	--	--	--
bis(2-Ethylhexyl) phthalate	4,849	--	--	--	--	--	--	--	180	--	--	97	--	490	--	230	**6,000**	--	170	--	--
Chrysene	144.1	--	--	--	--	--	--	--	**320**	--	--	--	--	--	--	--	**180**	--	--	--	--
Fluoranthene	88,560	--	--	--	--	--	--	--	500	--	--	--	--	--	--	--	200	--	--	--	--
Fluorene	553,000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	72	--	--	--	--
Naphthalene	5,000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	280	--	--	68	--
Phenanthrene	NA	--	--	--	--	--	--	--	510	--	--	--	--	--	--	120	300	--	--	--	--
Pyrene	2,400,000	--	--	--	--	--	--	--	530	--	--	--	--	--	--	--	230	--	--	--	--

TABLE 10

SUMMARY OF DETECTED ANALYTES FOR MONITORING WELL AND TEST PIT SOIL SAMPLES
OCTOBER AND NOVEMBER 2008[1,2,3]

March Point (Whitmarsh) Landfill
Skagit County, Washington

	Sample ID	MW-01			MW-03	MW-04		G1[6]		G3[6]			G4[6]		G5[6]			G6[6]		G10[6]	G11[6]
	Depth (ft bgs)	**11.5**	**20.5**	**37**	**11.5**	**8.5**	**19**	**1**	**5.5**	**1**	**8**	**12**	**1**	**5**	**1**	**5**	**9**	**6**	**field dup.**	**8**	**11**
	Sample Date	**10/7/2008**			**10/9/2008**	**10/8/2009**		**11/1/2008**		**10/31/2008**			**10/31/2008**		**11/2/2008**			**11/1/2008**		**11/1/2008**	**10/31/2008**
	PSL[4,5]																				
VOCs (µg/kg)																					
1,2,4-Trimethylbenzene	4,000,000	--	--	--	--	--	--	--	--	--	10	30	--	--	--	--	690	--	--	--	42
1,2-Dichlorobenzene	15,260	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	15 J	--	--	--	--
1,3,5-Trimethylbenzene	4,000,000	--	--	--	--	--	--	--	--	--	3	18	--	--	--	--	240 J	--	--	--	8.3
1,4-Dichlorobenzene	81.21	--	--	--	--	--	--	--	--	--	4.9	--	--	--	--	1.3	20 J	--	--	--	--
2-Butanone	48,000,000	--	--	--	--	23 J	--	41	43	14	22	40	220	540 J	--	18	37 J	22	14	17	12
4-Isopropyltoluene	NA	--	--	--	--	--	--	--	--	--	8.9	26	--	--	--	--	61 J	4	2.7	--	7.2
4-Methyl-2-Pentanone (MIBK)	6,400,000	--	--	--	--	--	--	--	41	--	--	--	150	440 J	--	--	--	--	--	--	--
Acetone	8,000,000	16	11	19	36 J	95 J	11	360	110	160	120	240	240	440 J	37	110	190 J	130	100	130	90
Benzene	30	--	--	--	5.5 J	--	--	--	--	--	--	11	--	--	--	--	14 J	--	--	--	--
Carbon Disulfide	8,000,000	--	1.4	--	9.1 J	--	--	--	--	--	--	21	--	2.5 J	--	29	20 J	1.7	--	2.2	5
Chlorobenzene	13,860	--	--	--	--	--	--	--	--	--	--	3.5	--	--	--	--	39 J	--	--	6.3	--
Dichlorodifluoromethane	16,000,000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.1 J	--	--	--	--
Ethylbenzene	6,000	--	--	--	--	--	--	--	--	--	1.4	3.6	--	--	--	--	33 J	--	--	--	23
Isopropylbenzene	8,000,000	--	--	--	--	--	--	--	--	--	1.7	8.9	--	--	--	--	69 J	--	--	--	7.3
m,p-Xylene	9,000	--	--	--	--	--	--	--	2.6	--	2.8	12	1.8	2.3 J	--	--	120 J	--	--	--	23
Methylene Chloride	20	--	2.4	--	3.4 J	--	2.2	--	--	--	--	--	--	--	2.2	--	--	2.5	--	--	--
n-Butylbenzene	NA	--	--	--	--	--	--	--	--	--	1.2	--	--	--	--	--	79 J	--	--	--	--
n-Propylbenzene	NA	--	--	--	--	--	--	--	--	--	1.5	4.6	--	--	--	--	100 J	--	--	--	4.1
o-Xylene	160,000,000	--	--	--	--	--	--	--	--	--	1.4	5.3	--	--	--	--	64 J	--	--	--	8.4
sec-Butylbenzene	NA	--	--	--	--	--	--	--	--	--	--	4.9	--	--	--	--	59 J	--	--	--	3.1
tert-Butylbenzene	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	19 J	--	--	--	--
Tetrachloroethene	4.173	--	--	--	--	--	--	1.5	3	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	7,000	--	--	--	1.8 J	--	--	--	9.5	--	9.9	2.3	61	120 J	--	1	19 J	8	4.7	--	1.9
PCBs (µg/kg)																					
Aroclor 1248	NA	--	--	--	28	--	--	--	--	--	20	--	--	--	--	--	--	--	--	--	--
Aroclor 1254	4	--	--	--	**27**	--	--	--	--	--	**22**	--	--	**240**	--	--	**110 J**	**76**	**31**	--	--
Aroclor 1260	492.1	--	--	--	--	--	--	--	360	--	13	--	--	--	--	--	--	--	9.9	--	--
Total PCBs[7]	28	--	--	--	**66.7**	--	--	--	**690**	--	**62.6**	--	--	**373**	--	**--**	**267.5**	**133**	**50.4**	--	--
Pesticides (µg/kg)																					
Aldrin	1.7	--	--	--	--	--	**--**	--	--	--	--	--	--	--	--	--	**390**	--	--	--	--
delta-BHC	1.7	--	--	--	**--**	**--**	**--**	--	--	**9.8**	**120**	--	--	--	--	--	--	**2.8**	**3.1**	--	--
Dieldrin	3.3	--	--	--	--	--	--	--	--	--	**24**	--	--	--	--	--	**210**	--	--	--	--
Methoxychlor	48.12	--	--	--	--	--	--	--	--	--	--	--	**71**	--	--	--	--	--	--	--	--

Notes
1. **Results in bold** indicate exceedance of preliminary screening level.
2. Data qualifiers are as follows:
   J = Reported value is an approximation.
3. -- = Analyte not detected.
4. NA = PSL not established, or background concentration not available.
5. The detection limits reported by the laboratory were equal to or less than the PSLs, except for samples that required dilution due to matrix interference.
6. Locations G1 through G11 are test pits.
7. One-half of the reporting limit was used for non-detected Aroclors to calculate total PCBs.

Abbreviations
bgs = below ground surface
ft = feet
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
PCBs = polychlorinated biphenyls
PSL = preliminary screening levels
SVOCs = semivolatile organic compounds
TPH = total petroleum hydrocarbon
VOCs = volatile organic compounds

TABLE 11

SUMMARY OF TEST RESULTS FOR MONITORING WELL, SEEP, AND SURFACE WATER SAMPLES
OCTOBER AND DECEMBER 2008 AND APRIL AND JULY 2009[1,2,3]

March Point (Whitmarsh) Landfill
Skagit County, Washington

	Sample ID	**MW-02**				**MW-03**				**MW-03 (duplicate)**				**MW-04**			
	Sample Date	**10/14/2008**	**12/18/2008**	**4/29/2009**	**7/23/2009**	**10/14/2008**	**12/18/2008**	**4/28/2009**	**7/23/2009**	**10/14/2008**	**12/18/2008**	**4/28/2009**	**7/23/2009**	**10/14/2008**	**12/19/2008**	**4/29/2009**	**7/23/2009**
	PSL[4,5]																
Dissolved Metals[6] (µg/L)																	
Aluminum	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Arsenic	0.2	**1.9**	**2.2**	**2.3 J-**	**2.5**	**4.1**	**0.5**	**0.5 J-**	**4.1**	**4.0**	**0.4**	**0.5 J-**	**4.1**	**4.6**	**4.4**	**5.5 J-**	**5.9**
Barium	NA	20	12	9 J-	10	50	35	50 J-	92	50	36	52 J-	94	66	59	63 J-	89
Copper	2.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron	NA	--	--	--	--	11,800	--	370 J-	13,400	12,000	--	1,360 J-	13,600	620	--	--	740
Manganese	100	41	45	21 J-	25	**332**	**227**	**276 J-**	**319**	**336**	**226**	**284 J-**	**327**	**127**	**121**	**124 J-**	**125**
Molybdenum	NA	11	16	6 J-	6	9	10	--	--	9	10	--	--	7	8	--	--
Nickel	8.2	4.1	4	3.7 J-	4	1.1	0.6	0.8 J-	0.6	1.1	0.6	0.8 J-	0.9	0.6	0.7	0.5 J-	--
Silver	26,000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Selenium	71	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Strontium	NA	154	191	154 J-	137	208	156	186 J-	210	210	159	186 J-	215	121	127	119 J-	122
Titanium	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vanadium	NA	4	--	3 J-	4	--	--	--	--	--	--	--	--	--	--	--	--
Zinc	81	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Metals[6] (µg/L)																	
Aluminum	NA	--	--	80	50	460 J	--	--	--	50 J	--	--	--	160	--	--	--
Arsenic	0.2	**2.0**	**2.2**	**2.3**	**2.8**	**4.9**	**2.7**	**2.8**	**4.1**	**4.4**	**2.8**	**2.7**	**4**	**4.1**	**4.8**	**5.6**	**5.6**
Barium	NA	23	12	9	10	60	63	82	87	53	66	76	90	69	84	88	90
Chromium	240,000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Copper	2.4	--	--	--	--	**3**	--	--	--	--	--	--	--	--	--	--	--
Iron	NA	60	--	70	80	13,400	12,200	14,600	12,500	12,400	12,300	13,300	12,900	870	800	770	770
Lead	8.1	--	--	--	--	**16 J**	--	--	--	2 J	--	--	--	--	--	--	--
Manganese	100	46	46	47	64	**350**	**254**	**301**	**307**	**349**	**258**	**282**	**316**	**136**	**129**	**124**	**127**
Mercury	0.025	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Molybdenum	NA	12	15	6	6	8	9	--	--	9	9	--	--	7	8	--	--
Nickel	8.2	4.7	3.4	4.4	5.4	2.8 J	0.6	0.8	0.9	1.3 J	0.5	0.9	0.8	1.0	--	--	--
Silver	26,000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Strontium	NA	163	195	155	130	214	168	196	193	218	172	186	198	125	133	117	119
Titanium	NA	--	--	6	7	27 J	--	--	--	--	--	--	--	11	--	--	5
Vanadium	NA	4	--	4	4	--	--	--	--	--	--	--	--	--	--	--	--
Zinc	81	--	--	--	--	30 J	--	--	--	--	--	--	--	--	--	--	--
TPH (mg/L)																	
Diesel-Range Organics (TPH-D)	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SVOCs (µg/L)																	
1-Methylnaphthalene	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dimethylphenol	550	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylphenol	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Chloro-3-methylphenol	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methylphenol	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acenaphthene	640	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzoic acid	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzyl alcohol	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl) phthalate	2.2	--	--	--	--	--	--	1.2	--	--	--	--	--	--	--	--	--
Butyl benzyl phthalate	1,300	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbaryl (Sevin)	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Diethyl phthalate	28,000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Di-n-Butyl phthalate	2,900	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	4,900	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenol	1,100,000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

TABLE 11

SUMMARY OF TEST RESULTS FOR MONITORING WELL, SEEP, AND SURFACE WATER SAMPLES
OCTOBER AND DECEMBER 2008 AND APRIL AND JULY 2009[1,2,3]

March Point (Whitmarsh) Landfill
Skagit County, Washington

	Sample ID	MW-02				MW-03				MW-03 (duplicate)				MW-04			
	Sample Date	**10/14/2008**	**12/18/2008**	**4/29/2009**	**7/23/2009**	**10/14/2008**	**12/18/2008**	**4/28/2009**	**7/23/2009**	**10/14/2008**	**12/18/2008**	**4/28/2009**	**7/23/2009**	**10/14/2008**	**12/19/2008**	**4/29/2009**	**7/23/2009**
	PSL[4,5]																
PAHs (µg/L)																	
1-Methylnaphthalene	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	0.018	--	--
2-Methylnaphthalene	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	0.017	--	--
Acenaphthene	640	--	--	--	--	0.032	0.017 J	0.012	0.024	0.032	0.017 J	0.013	0.028	--	--	--	--
Acenaphthylene	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Anthracene	26,000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chrysene	0.02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzofuran	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	90	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluorene	3,500	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	4,900	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenanthrene	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pyrene	2,600	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VOCs (µg/L)																	
1,2,4-Trimethylbenzene	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3,5-Trimethylbenzene	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	1,300	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	4.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Butanone	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetone	NA	4.6	--	--	--	3.1	--	--	--	3.8	--	--	--	--	--	--	--
Benzene	23	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.2	--
Bromoform	140	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbon Disulfide	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chlorobenzene	1,600	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroethane	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroform	280	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloromethane	130	0.4	--	--	--	--	--	--	--	--	0.5 J	--	--	--	--	--	--
Dibromochloromethane	13	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Diethyl ether	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Isopropylbenzene	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
m, p-Xylene	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylene chloride	590	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
o-Xylene	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
sec-Butylbenzene	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	15,000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.3	--
PCBs (µg/L)																	
Aroclor 1232	NA	--	--	--	--	--	0.029 J	0.019	--	--	0.031 J	0.022	--	--	--	--	--
Aroclor 1242	NA	--	--	--	--	0.03	0.013 J	--	--	0.031	0.014 J	--	--	--	--	--	--
Total PCBs[7]	0.07	--	--	--	--	0.06	0.0695	0.049	--	0.061	0.07	0.052	--	--	--	--	--
Pesticides (µg/L)																	
4,4'-DDD	0.00166	--	--	--	--	--	**0.0056 J**	**0.0058**	**0.0075**	--	**0.0061 J**	**0.0061**	**0.0082**	--	--	--	--
alpha-BHC	0.0049	--	--	--	--	**0.015**	**0.031 J**	**0.041**	**0.016**	**0.015**	**0.036 J**	**0.039**	**0.018**	--	--	--	--
beta-BHC	0.017	--	--	--	--	0.0074	0.0075 J	0.0078	0.0041	0.0070	0.0070 J	0.0076	0.0047	--	--	--	--
delta-BHC	0.041	--	--	--	--	--	0.0019 J	0.0012	--	--	0.0016 J	0.0012	--	--	--	--	--
gamma-BHC (Lindane)	0.04	--	--	--	--	--	--	0.00096	--	--	--	0.0011	--	--	--	--	--

TABLE 11

SUMMARY OF TEST RESULTS FOR MONITORING WELL, SEEP, AND SURFACE WATER SAMPLES
OCTOBER AND DECEMBER 2008 AND APRIL AND JULY 2009[1,2,3]

March Point (Whitmarsh) Landfill
Skagit County, Washington

	Sample ID	SP-01				SP-02				SP-03				SW-01				SW-03			
	Sample Date	10/15/2008	12/17/2008	4/28/2009	7/23/2009	10/15/2008	12/18/2008	4/28/2009	7/23/2009	10/15/2008	12/15/2008	4/28/2009	7/24/2009	10/14/2008	12/14/2008	4/28/2009	7/24/2009	10/15/2008	12/17/2008	4/29/2009	7/24/2009
	PSL[4,5]																				
Dissolved Metals[6] (μg/L)																					
Aluminum	NA	60	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	70	--	--	--
Arsenic	0.2	**0.4**	**--**	**0.4 J-**	**1.2**	**--**	**--**	**0.7 J-**	**1.1**	**0.8**	**--**	**0.6 J-**	**0.8**	**3.2**	**2.4**	**2.9 J-**	**5.1**	**1.1**	**--**	**1.8 J-**	**1.8**
Barium	NA	201	181	181 J-	267	76	134	89 J-	160	63	61	72 J-	104	9	6	8 J-	18.0	--	26	10 J-	5
Copper	2.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**3**	--	2
Iron	NA	--	--	--	12,300	--	--	70 J-	18,200	--	--	3,940 J-	25,800	--	120	--	320	530	60	370 J-	370
Manganese	100	**154**	**233**	**225 J-**	**173**	**126**	**364**	**332 J-**	**321**	**434**	**477**	**545 J-**	**444**	13	22	**391 J-**	**150**	**203**	**335**	**159 J-**	**180**
Molybdenum	NA	31	23	20 J-	16	40	13	--	--	17	12	--	--	15	6	--	--	15	20	6 J-	--
Nickel	8.2	0.6	0.6	0.7 J-	--	7	3.5	0.8 J-	--	2.4	2.7	0.6 J-	0.6	4.5	3.4	5.8 J-	3.6	3.0	**9**	5.1 J-	3.8
Silver	26,000	--	--	--	--	11	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Selenium	71	--	--	--	--	--	--	--	--	--	--	--	50	--	--	--	--	--	--	--	--
Strontium	NA	319	398	315 J-	326	3,060	692	383 J-	397	414	582	408 J-	474	196	92	154 J-	196	263	2,770	351 J-	800
Titanium	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	5	--	--	--	9	--	7.0
Vanadium	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3	--	--	--	--
Zinc	81	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Metals[6] (μg/L)																					
Aluminum	NA	60	150	--	--	270	2230	680	900	580	50	--	80	170	650	440	13,200	290	100	3,080	140
Arsenic	0.2	**1.4**	**1.4**	**1.3**	**1.3**	**--**	**1.4**	**1.7**	**2.4**	**1.3**	**--**	**1.1**	**0.8**	**4.8**	**5.8**	**5.0**	**21.3 J**	**2.2**	**--**	**3.0**	**2.5 J**
Barium	NA	300	279	251	258	63	188	178	185	206	89	165	100	12	13	15	86	7.0	27	31	7
Chromium	240,000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	31	--	--	8	--
Copper	2.4	--	--	--	--	--	**5**	2	2	--	--	--	--	--	**5**	2	**38**	--	**4**	**10**	**3**
Iron	NA	15,900	22,100	15,500	12,100	5,890	21,400	25,100	26,400	55,300	19,800	41,100	25,400	800	1,610	890	16,500	1,790	650	7,920	1,360
Lead	8.1	--	--	--	--	--	1	--	--	--	--	--	--	--	2	--	**24**	--	--	3	--
Manganese	100	**173**	**251**	**238**	**163**	85	**409**	**373**	**314**	**557**	**495**	**570**	**395**	50	**660**	**414**	**313**	**230**	**353**	**276**	**195**
Mercury	0.025	--	--	--	--	--	--	--	--	--	--	--	--	--	**0.0284**	**--**	**0.0649**	--	--	--	--
Molybdenum	NA	21	24	20	--	40	14	--	--	8	13	--	--	10	6	--	9.0	7	22	6	--
Nickel	8.2	1.9	1.0	0.8	--	8	5.4	2.4	2.7	3.2	1.2	0.9	1	5.2	8.1	7.4	**72.2 J**	4.2	**9**	**12.6**	4.6 J
Silver	26,000	--	--	--	--	8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Strontium	NA	332	419	320	296	3,830	787	407	377	452	603	424	407	196	100	164	217	265	2,900	381	820
Titanium	NA	--	14	5	5	20	128	41	54	31	7	8	11	10	44	28	777	19	18	156	16
Vanadium	NA	--	--	--	--	--	7	5	5	8	--	3	--	5	5	4	76	--	--	11	3
Zinc	81	--	--	--	--	--	--	--	--	20	--	--	--	--	10	--	**150**	--	--	20	--
TPH (mg/L)																					
Diesel-Range Organics (TPH-D)	NA	0.44	0.56	0.65	0.74	--	0.31	0.33	0.51	0.40	0.55	0.64	0.76	--	--	--	--	--	--	--	--
SVOCs (μg/L)																					
1-Methylnaphthalene	NA	--	--	--	--	--	--	--	--	4.0	5.2	5.3	3.6	--	--	--	--	--	--	--	--
2,4-Dimethylphenol	550	--	--	--	--	--	--	--	--	--	57	13	1.9	--	--	--	--	--	--	--	--
2-Methylnaphthalene	NA	--	--	--	--	--	--	--	--	2.9	4.4	4.2	3.6	--	--	--	--	--	--	--	--
2-Methylphenol	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Chloro-3-methylphenol	NA	--	7.8 J	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methylphenol	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acenaphthene	640	--	--	--	--	--	--	--	--	1.0	1.3	1.2	1.1	--	--	--	--	--	--	--	--
Benzoic acid	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzyl alcohol	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl) phthalate	2.2	--	--	--	--	--	--	--	--	--	--	--	--	--	1.6	--	--	--	--	--	--
Butyl benzyl phthalate	1,300	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbaryl (Sevin)	NA	1.9	3.5 J	2.6	11	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Diethyl phthalate	28,000	--	--	--	--	--	--	--	--	--	1.4	--	--	--	--	--	--	--	--	--	--
Di-n-Butyl phthalate	2,900	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	4,900	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine	6	--	--	--	--	--	1.4 J	1.2	1.2	--	--	--	--	--	--	--	--	--	--	--	--
Phenol	1,100,000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

TABLE 11

SUMMARY OF TEST RESULTS FOR MONITORING WELL, SEEP, AND SURFACE WATER SAMPLES
OCTOBER AND DECEMBER 2008 AND APRIL AND JULY 2009[1,2,3]

March Point (Whitmarsh) Landfill
Skagit County, Washington

	Sample ID	SP-01				SP-02				SP-03				SW-01				SW-03			
	Sample Date	**10/15/2008**	**12/17/2008**	**4/28/2009**	**7/23/2009**	**10/15/2008**	**12/18/2008**	**4/28/2009**	**7/23/2009**	**10/15/2008**	**12/15/2008**	**4/28/2009**	**7/24/2009**	**10/14/2008**	**12/14/2008**	**4/28/2009**	**7/24/2009**	**10/15/2008**	**12/17/2008**	**4/29/2009**	**7/24/2009**
	PSL[4,5]																				
PAHs (μg/L)																					
1-Methylnaphthalene	NA	--	0.38 J	--	0.32	--	0.088 J	--	0.11	--	2.8 J	--	2.8	--	--	--	--	--	--	--	--
2-Methylnaphthalene	NA	--	0.36 J	--	0.28	--	0.024 J	--	0.030	--	2.8 J	--	2.5	--	--	--	--	--	--	--	--
Acenaphthene	640	0.32	0.37 J	0.38	0.38	0.081	0.18 J	0.18	0.14	0.86	0.89 J	1.1	0.91	--	--	--	--	--	--	--	--
Acenaphthylene	NA	--	--	--	--	--	--	--	--	0.029	0.026 J	0.022 J	0.021 J	--	--	--	--	--	--	--	--
Anthracene	26,000	0.024	0.029 J	0.022	0.028	--	--	--	--	0.044	0.059 J	0.047	0.046	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.022	--	--	--	--
Chrysene	0.02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.014	--	--	--	--
Dibenzofuran	NA	--	0.12 J	--	0.12	--	0.039 J	--	0.031	--	0.3 J	--	0.31	--	--	--	--	--	--	--	--
Fluoranthene	90	0.028	0.037 J	0.036	0.035	--	0.026 J	0.021	0.020	0.064	0.07 J	0.087	0.064	--	--	--	0.011	--	--	--	--
Fluorene	3,500	0.18	0.24 J	0.21	0.2	0.058	0.12 J	0.10	0.080	0.51	0.62 J	0.61	0.49	--	--	--	--	--	--	--	--
Naphthalene	4,900	0.25	0.57 J	0.62	0.28	--	0.038 J	--	--	--	0.11 J	0.18	--	--	--	--	--	--	--	--	--
Phenanthrene	NA	0.11	0.11 J	0.15	0.21	0.019	0.035 J	0.026	0.032	0.40	0.42 J	0.52	0.43	--	--	--	0.011	--	--	--	--
Pyrene	2,600	0.024	0.031 J	0.028	0.03	0.012	0.03 J	0.024	0.028	0.05	0.051 J	0.057	0.045	--	--	--	0.013	--	--	--	--
VOCs (μg/L)																					
1,2,4-Trimethylbenzene	NA	0.8	0.4	0.5	1.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3,5-Trimethylbenzene	NA	--	--	--	0.3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	1,300	0.3	0.4	0.4	0.3 J	--	--	--	--	0.3	0.3	0.3	0.3 J	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	4.9	0.7	0.8	0.6	0.6 J	--	0.3	0.2	0.3 J	1.7	2.0	1.8	1.6 J	--	--	--	--	--	--	--	--
2-Butanone	NA	--	--	5.9	--	--	--	3.5	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetone	NA	4.7	--	--	--	6.9	--	--	--	12	--	--	--	--	--	--	--	3.1	--	--	--
Benzene	23	2.6	2.4	1.9	2.2	0.4	--	0.3	0.2	0.8	0.8	0.8	0.6	--	--	--	--	--	--	--	--
Bromoform	140	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	17
Carbon Disulfide	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4.1	--	--	0.2	--
Chlorobenzene	1,600	7.6	8.2	5.7	6.8	0.3	0.7	0.6	0.8	4.1	4.5	4.0	3.9	--	--	--	--	--	--	--	--
Chloroethane	NA	--	--	--	--	--	--	--	--	0.4	0.4	0.3	--	--	--	--	--	--	--	--	--
Chloroform	280	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloromethane	130	--	--	--	--	--	--	--	--	--	0.2	--	--	--	--	--	--	--	--	--	--
Dibromochloromethane	13	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.3
Diethyl ether	NA	0.14 J	--	0.14 J	0.15 J	0.20 J	--	0.42 J	0.56 J	0.84 J	--	0.87 J	0.79 J	--	--	--	--	--	--	--	--
Isopropylbenzene	NA	0.2	--	--	0.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
m, p-Xylene	NA	1.9	1.5	1.2	2.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylene chloride	590	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
o-Xylene	NA	2.7	1.7	1.6	3.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
sec-Butylbenzene	NA	--	--	--	--	--	--	--	--	0.2	--	0.2	0.2	--	--	--	--	--	--	--	--
Toluene	15,000	1.8	1.4	1.3	1.7	--	--	0.3	--	--	--	0.3	--	--	0.4	--	32	--	--	--	--
PCBs (μg/L)																					
Aroclor 1232	NA	--	--	--	--	--	--	0.028	--	--	0.086 J	0.091	--	--	--	--	--	--	--	--	--
Aroclor 1242	NA	--	--	--	--	--	--	--	--	0.035 J	0.029 J	--	--	--	--	--	--	--	--	--	--
Total PCBs[7]	0.07	--	--	--	--	--	--	0.058	--	0.065	**0.14**	**0.121**	**--**	--	--	--	--	--	--	--	--
Pesticides (μg/L)																					
4,4'-DDD	0.00166	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
alpha-BHC	0.0049	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
beta-BHC	0.017	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
delta-BHC	0.041	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
gamma-BHC (Lindane)	0.04	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

TABLE 11

SUMMARY OF TEST RESULTS FOR MONITORING WELL, SEEP, AND SURFACE WATER SAMPLES
OCTOBER AND DECEMBER 2008 AND APRIL AND JULY 2009[1,2,3]

March Point (Whitmarsh) Landfill
Skagit County, Washington

	Sample ID	SW-04				SW-05				SW-06				SW-07	
	Sample Date	10/15/2008	12/18/2008	4/29/2009	7/24/2009	10/15/2008	12/17/2008	4/29/2009	7/24/2009	10/15/2008	12/17/2008	4/29/2009	7/23/2009	12/17/2008	4/28/2009
	PSL[4,5]														
Dissolved Metals[6] (µg/L)															
Aluminum	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Arsenic	0.2	**2**	**--**	**2 J-**	**3**	**--**	**--**	**1.7 J-**	**3**	**3**	**--**	**4 J-**	**5**	**0.5 J**	**0.6 J-**
Barium	NA	4	33	11 J-	12	13	18	22 J-	20	11	18	14 J-	12	43	71 J-
Copper	2.4	--	**5**	**3 J-**	**3**	**--**	**3**	2 J-	**4**	**--**	**3**	**3 J-**	**6**	--	--
Iron	NA	280	--	170 J-	180	--	300	--	70	--	--	--	--	--	--
Manganese	100	68	**246**	**164 J-**	55	**345**	**227**	**795 J-**	75	80	**132**	**289 J-**	32	**229**	**169 J-**
Molybdenum	NA	13	40	7 J-	--	21	13	--	5	40	20	8 J-	--	24	19 J-
Nickel	8.2	2.6	**11**	5 J-	5.0	5.8	3	4 J-	6.0	8	7	6 J-	7	4	1.7 J-
Silver	26,000	--	--	--	--	--	--	--	--	8	--	--	--	--	--
Selenium	71	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Strontium	NA	425	3,750	802 J-	1,740	1,340	729	621 J-	2,480	3,630	2,470	1,860 J-	3,650	280	327 J-
Titanium	NA	--	--	--	7	--	--	--	6	--	7	7 J-	10.0	--	--
Vanadium	NA	--	--	3	4	--	--	--	4	--	--	4 J-	--	--	--
Zinc	81	--	--	--	--	--	20	--	--	--	--	--	--	--	--
Total Metals[6] (µg/L)															
Aluminum	NA	1,570	4,240	440	1,090	120	400	190	90	--	2,250	370	--	110	--
Arsenic	0.2	**2.8**	**8**	**2**	**4.0 J**	**1.5**	**0.8**	**1.6**	**4 J**	**3**	**3**	**3**	**5 J**	**1.7**	**1.4**
Barium	NA	12	49	13	18	15	18	24	20	14	26	15	14	92	115
Chromium	240,000	5	10	--	--	--	--	--	--	--	--	--	--	--	--
Copper	2.4	**4**	**12**	**4**	**6**	--	**4**	**3**	**4**	--	**8**	**4**	**7**	**3**	**--**
Iron	NA	3,490	7,580	1,020	2,440	1,700	1,080	2,010	720	490	4,620	1,370	500	18,000	12,800
Lead	8.1	1	--	--	--	--	--	--	--	--	--	--	--	1	--
Manganese	100	**125**	**382**	**176**	**107**	**366**	**243**	**782**	89	90	**239**	**300**	38	**262**	**197**
Mercury	0.025	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Molybdenum	NA	8	40	6	--	22	13	--	5	40	20	8	--	26	18
Nickel	8.2	6.0	**17**	5	7 J	6.9	4.8	4.1	7 J	8	**11**	6	**10 J**	4.7	2.0
Silver	26,000	--	--	--	--	3	--	--	--	7	--	--	--	--	--
Strontium	NA	431	3,970	805	1,790	1,400	738	606	2,320	3,700	2,530	1,790	3,630	299	347
Titanium	NA	83	250	29	79	6	21	12	14	--	142	27	20	11	--
Vanadium	NA	7	9	5	7	--	--	--	4	--	7	6	6	--	--
Zinc	81	20	--	--	--	20	20	20	--	--	--	--	--	40	--
TPH (mg/L)															
Diesel-Range Organics (TPH-D)	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SVOCs (µg/L)															
1-Methylnaphthalene	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dimethylphenol	550	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylphenol	NA	--	--	--	--	37 J	--	--	--	--	--	--	--	--	--
4-Chloro-3-methylphenol	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methylphenol	NA	--	--	--	--	55	--	--	--	--	--	--	--	--	--
Acenaphthene	640	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzoic acid	NA	--	--	--	--	5,500	--	--	--	--	--	--	--	--	--
Benzyl alcohol	NA	--	--	--	--	600	--	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl) phthalate	2.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Butyl benzyl phthalate	1,300	--	--	--	--	23	--	--	--	--	--	--	--	--	--
Carbaryl (Sevin)	NA	--	--	--	--	--	--	--	--	--	--	--	--	1.8	1.2
Diethyl phthalate	28,000	--	--	--	--	1.9 J	--	--	--	--	--	--	--	--	--
Di-n-Butyl phthalate	2,900	--	--	--	--	2.8	--	--	--	--	--	--	--	--	--
Naphthalene	4,900	--	--	--	--	1.9 J	--	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenol	1,100,000	--	--	--	--	50	--	--	--	--	--	--	--	--	--

TABLE 11

SUMMARY OF TEST RESULTS FOR MONITORING WELL, SEEP, AND SURFACE WATER SAMPLES
OCTOBER AND DECEMBER 2008 AND APRIL AND JULY 2009[1,2,3]

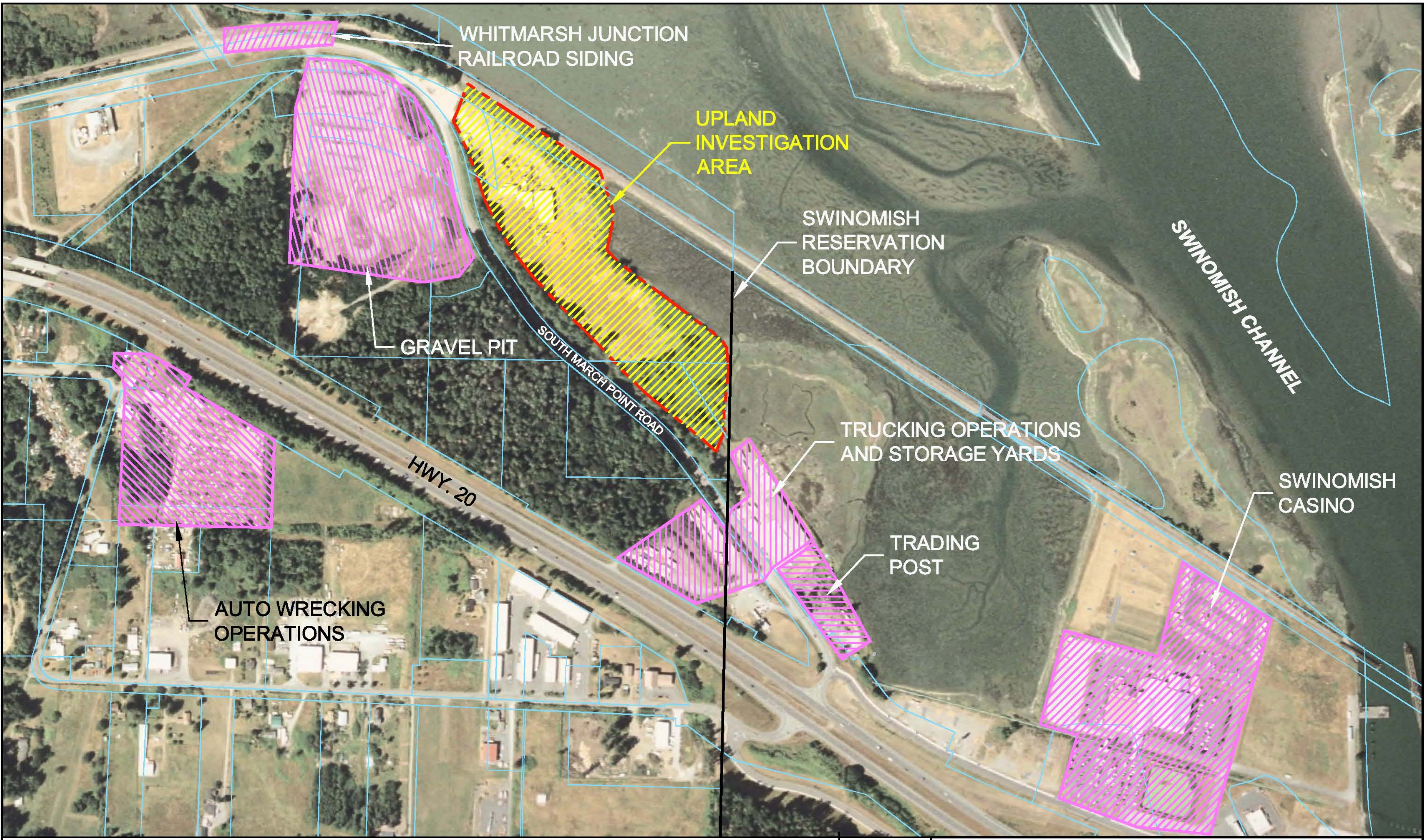
March Point (Whitmarsh) Landfill
Skagit County, Washington

	Sample ID	SW-04				SW-05				SW-06				SW-07	
	Sample Date	10/15/2008	12/18/2008	4/29/2009	7/24/2009	10/15/2008	12/17/2008	4/29/2009	7/24/2009	10/15/2008	12/17/2008	4/29/2009	7/23/2009	12/17/2008	4/28/2009
	PSL[4,5]														
PAHs (µg/L)															
1-Methylnaphthalene	NA	--	--	--	--	--	--	--	--	--	--	--	--	0.15 J	--
2-Methylnaphthalene	NA	--	--	--	--	--	--	--	--	--	--	--	--	0.061 J	--
Acenaphthene	640	--	--	--	--	0.014	0.016 J	0.064	--	--	--	0.010	--	0.37 J	0.40
Acenaphthylene	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Anthracene	26,000	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chrysene	0.02	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzofuran	NA	--	--	--	--	--	--	--	--	--	--	--	--	0.065 J	--
Fluoranthene	90	--	--	--	--	--	--	--	--	--	--	--	--	0.015 J	0.018
Fluorene	3,500	--	--	--	--	--	--	--	--	--	--	--	--	0.15 J	0.13
Naphthalene	4,900	--	--	--	--	--	--	--	--	--	--	--	--	0.097 J	0.11
Phenanthrene	NA	--	--	--	--	--	--	--	--	--	--	--	--	0.059 J	0.062
Pyrene	2,600	--	--	--	--	--	--	--	--	--	--	--	--	0.01 J	0.011
VOCs (µg/L)															
1,2,4-Trimethylbenzene	NA	--	--	--	--	--	--	--	--	--	--	--	--	0.2	0.8
1,3,5-Trimethylbenzene	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	0.2
1,2-Dichlorobenzene	1,300	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	4.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Butanone	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetone	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzene	23	--	--	--	--	--	--	--	--	--	--	--	--	2.2	3.6
Bromoform	140	--	--	--	12	--	--	--	15	--	--	--	12	--	--
Carbon Disulfide	NA	--	--	--	0.2	--	--	--	--	--	--	--	--	--	--
Chlorobenzene	1,600	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroethane	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroform	280	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloromethane	130	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibromochloromethane	13	--	--	--	0.3	--	--	--	0.3	--	--	--	0.3	--	--
Diethyl ether	NA	--	--	--	--	--	--	--	--	--	--	0.40 J	0.27 J	--	0.14 J
Isopropylbenzene	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--
m, p-Xylene	NA	--	--	--	--	--	--	--	--	--	--	--	--	0.6	1.6
Methylene chloride	590	--	--	--	--	--	--	--	--	--	--	--	--	--	--
o-Xylene	NA	--	--	--	--	--	--	--	--	--	--	--	--	0.9	2.2
sec-Butylbenzene	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	15,000	--	--	0.2	--	--	0.2	--	--	--	--	--	--	0.8	1.4
PCBs (µg/L)															
Aroclor 1232	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1242	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs[7]	0.07	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pesticides (µg/L)															
4,4'-DDD	0.00166	--	--	--	--	--	--	--	--	--	**0.0019 J**	**--**	**--**	--	--
alpha-BHC	0.0049	--	--	--	--	--	--	--	--	--	--	--	--	--	--
beta-BHC	0.017	--	--	--	--	--	--	--	--	--	--	--	--	--	--
delta-BHC	0.041	--	--	--	--	--	--	--	--	--	--	--	--	--	--
gamma-BHC (Lindane)	0.04	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Notes
1. Results in **bold** indicate exceedance of preliminary screening level.
2. Flags:
   J = Reported value is an approximation. J- = Value is an approximation with a low bias.
3. -- Not detected.
4. NA = PSL not established.
5. The detection limits reported by the laboratory were equal to or less than the PSLs, except for samples that required dilution due to matrix interference.
6. The following metals were detected in the total fraction of some samples but were not detected in the dissolved fraction: chromium, lead, and, mercury.
7. One-half of the reporting limit was used for non-detected Aroclors to calculate total PCBs.

Abbreviations
µg/L = micrograms per liter
mg/L = milligrams per liter
PCBs = polychlorinated biphenyls
PAHs = polyaromatic hydrocarbon
PCBs = polychlorinated biphenyls
SVOCs = semivolatile organic compounds
TPH = total petroleum hydrocarbon
VOCs = volatile organic compounds
VOCs = volatile organic compounds

FIGURES



Aerial Photo Courtesy of USDA/FSA Aerial Photography Field office (2006)

NOTE:
The March Point (Whitmarsh) Landfill site includes the landfill and other adjacent areas where hazardous substances originating from the landfill are present.

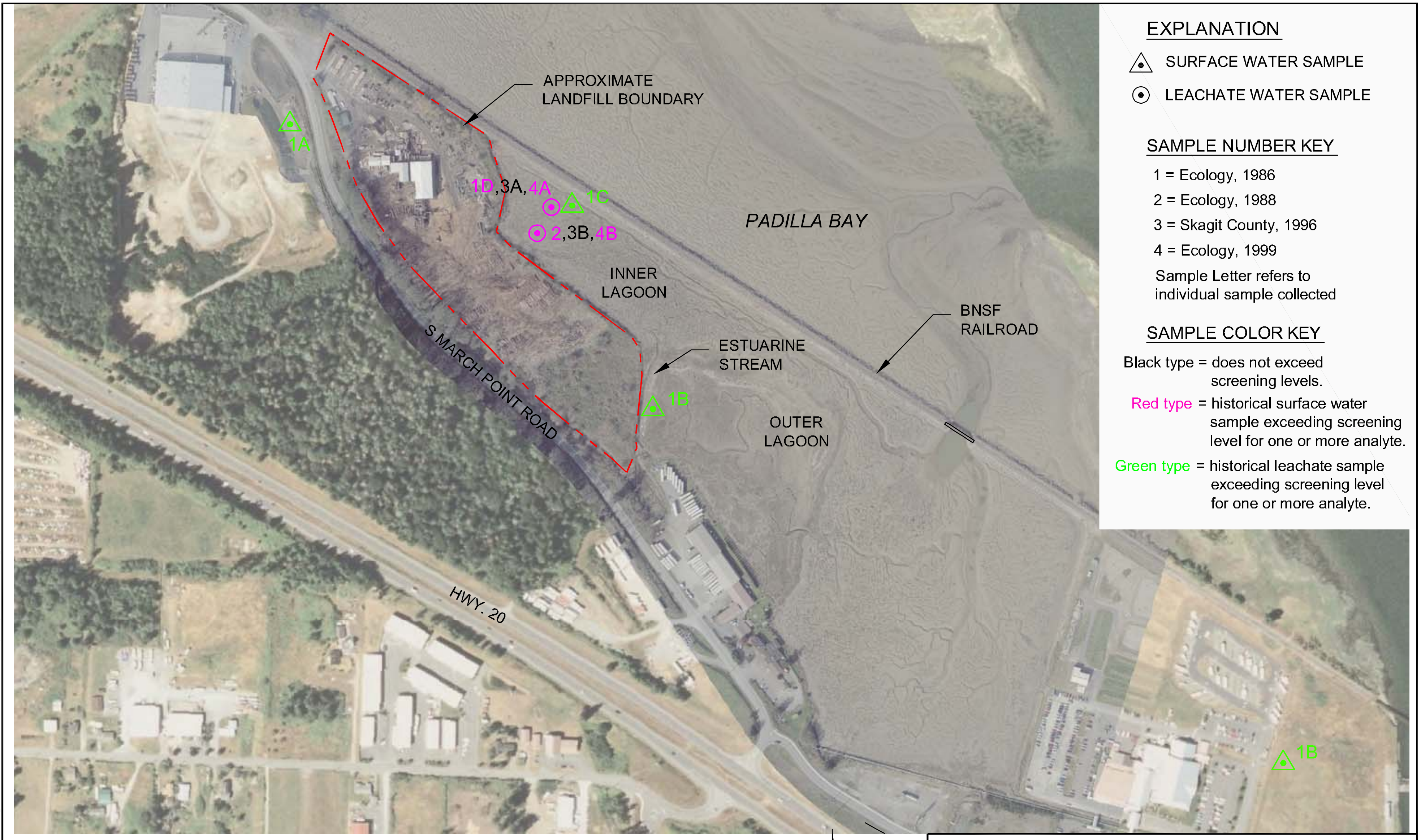
N

0 300 600
APPROXIMATE SCALE IN FEET

UPLAND INVESTIGATION AREA
March Point (Whitmarsh) Landfill
Skagit County, Washington

By: APS	Date: 09/17/09	Project No. 14159
AMEC Geomatrix		Figure 1

Plot Date: 09/17/09 - 8:59am, Plotted by: adam.stenberg
Drawing Path: S:\14159\006_MPR\, Drawing Name: Whitmarsh_VicinityMap_090109.dwg



EXPLANATION

△ SURFACE WATER SAMPLE

⊙ LEACHATE WATER SAMPLE

SAMPLE NUMBER KEY

1 = Ecology, 1986
2 = Ecology, 1988
3 = Skagit County, 1996
4 = Ecology, 1999

Sample Letter refers to individual sample collected

SAMPLE COLOR KEY

Black type = does not exceed screening levels.

Red type = historical surface water sample exceeding screening level for one or more analyte.

Green type = historical leachate sample exceeding screening level for one or more analyte.

Aerial Photo Courtesy of USDA/FSA Aerial Photography Field office (2006) and Skagit County (2008)

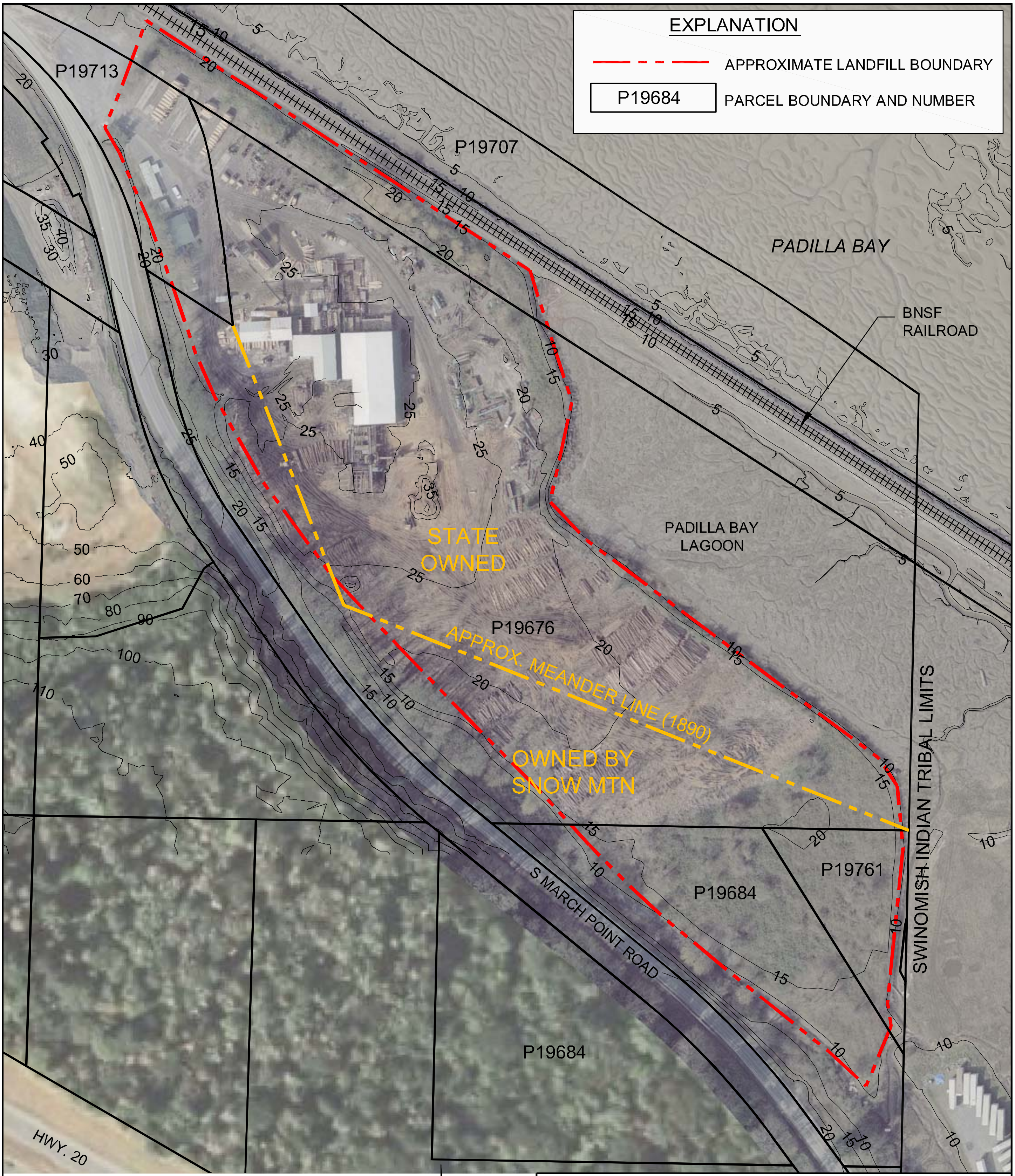
NOTES:

1. Figure adapted from a 2007 Geoengineers report.
2. Location of Sample 1B unclear from previous reports. Both potential locations are plotted.
3. For details on screening levels for previous studies see the Geoengineers report (2007).

HISTORICAL SAMPLE LOCATIONS
March Point (Whitmarsh) Landfill
Skagit County, Washington

By: APS	Date: 09/09/09	Project No. 14159
AMEC Geomatrix		Figure 2

Plot Date: 09/09/09 - 9:47am, Plotted by: adam.stenberg
Drawing Path: S:\14159\006_MPR\, Drawing Name: Whitmarsh_HistoricSampMap_090809.dwg



Aerial Photo Courtesy of USDA/FSA Aerial Photography
Field office (2006) and Skagit County (2008)
Contours generated from Skagit County
aerial photo, 2008. Vertical datum: MLLW

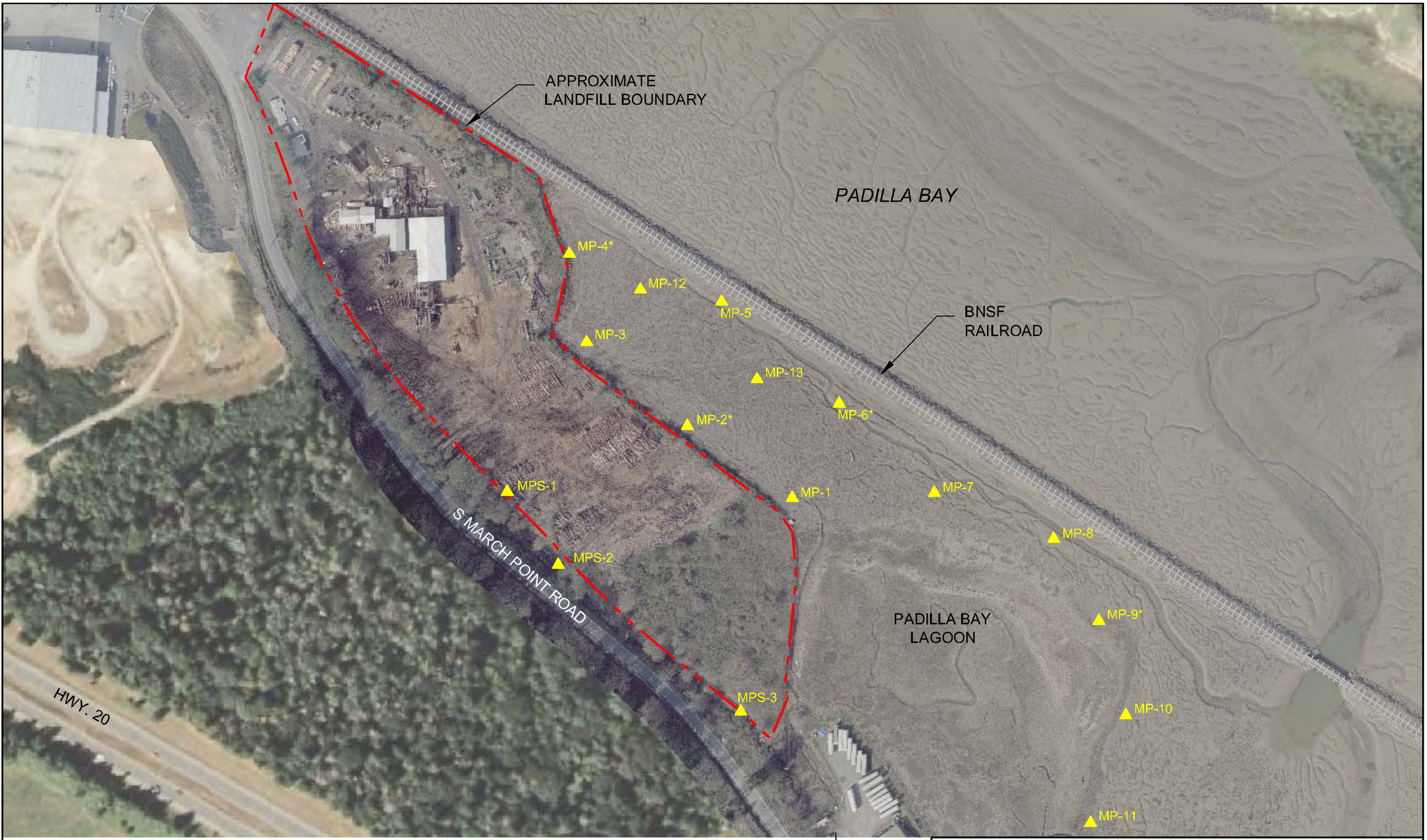
N

0 100 200
APPROXIMATE SCALE IN FEET

SITE PLAN AND PARCEL BOUNDARIES
March Point (Whitmarsh) Landfill
Skagit County, Washington

By: APS	Date: 09/09/09	Project No. 14159
AMEC Geomatrix		Figure 3

Plot Date: 09/09/09 - 9:49am, Plotted by: adam.stenberg
Drawing Path: S:\14159\006_MPR\, Drawing Name: Whitmarsh_HistoricSampMap_090809.dwg



Aerial Photo Courtesy of USDA/FSA Aerial Photography
Field office (2006) and Skagit County (2008)

EXPLANATION

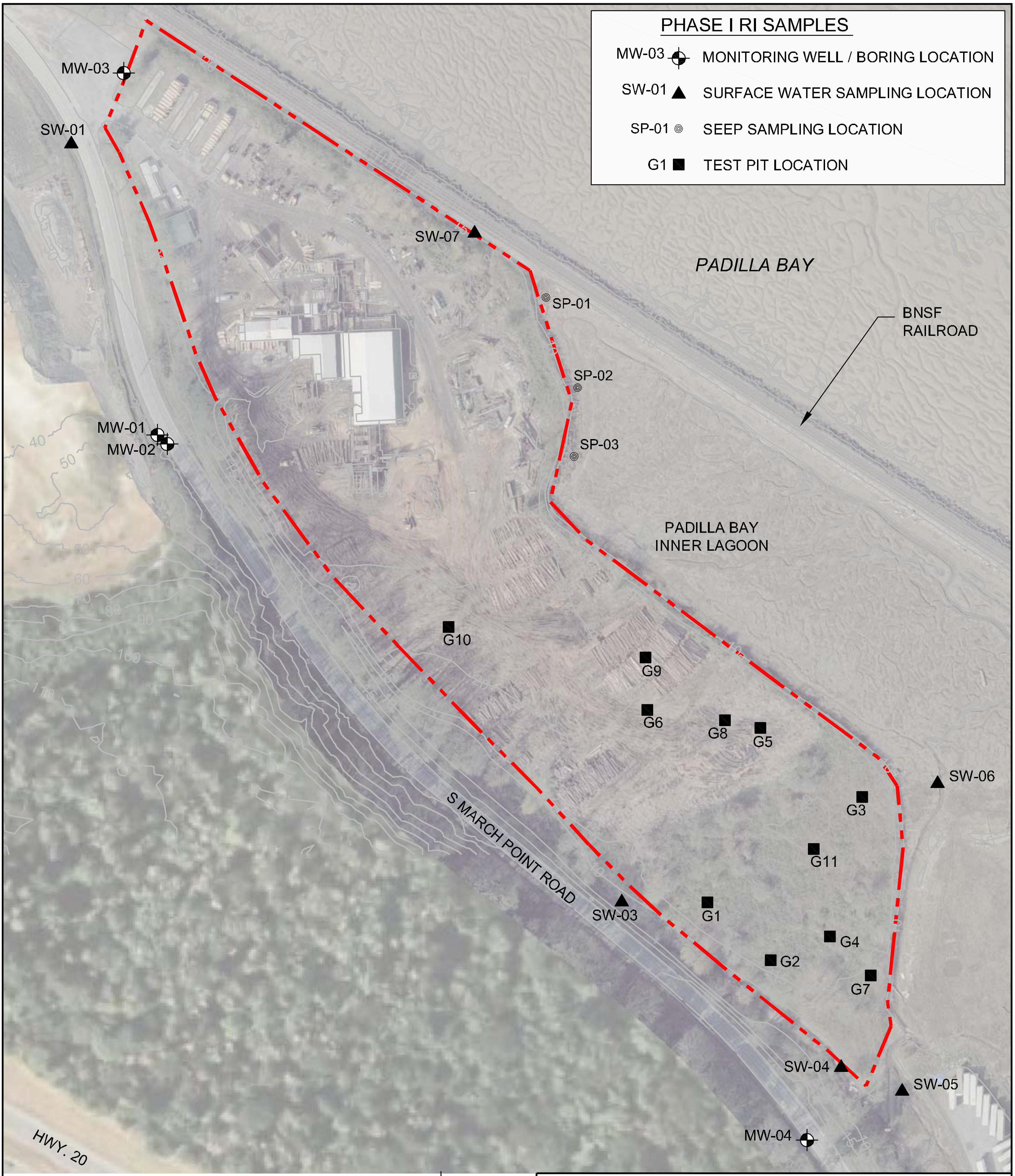
△ ACTUAL SEDIMENT SAMPLE LOCATION

* Duplicate samples were collected at Sample locations marked with an asterisk.

PHASE I SEDIMENT SAMPLE LOCATIONS
March Point (Whitmarsh) Landfill
Skagit County, Washington

By: APS	Date: 09/08/09	Project No. 14159
AMEC Geomatrix		Figure 4

Plot Date: 09/08/09 - 3:39pm, Plotted by: adam.stenberg
Drawing Path: S:\14159\006_MPR\, Drawing Name: Whitmarsh_Phase1ActualSedSamp_090809.dwg



Aerial Photo Courtesy of USDA/FSA Aerial Photography Field office (2006) and Skagit County (2008)

Contours generated from Skagit County aerial photo, 2008. Vertical datum: MLLW

Note: No monitoring well was installed at MW-01 since deep groundwater was not encountered.

EXPLANATION

- - - APPROXIMATE LANDFILL BOUNDARY

N

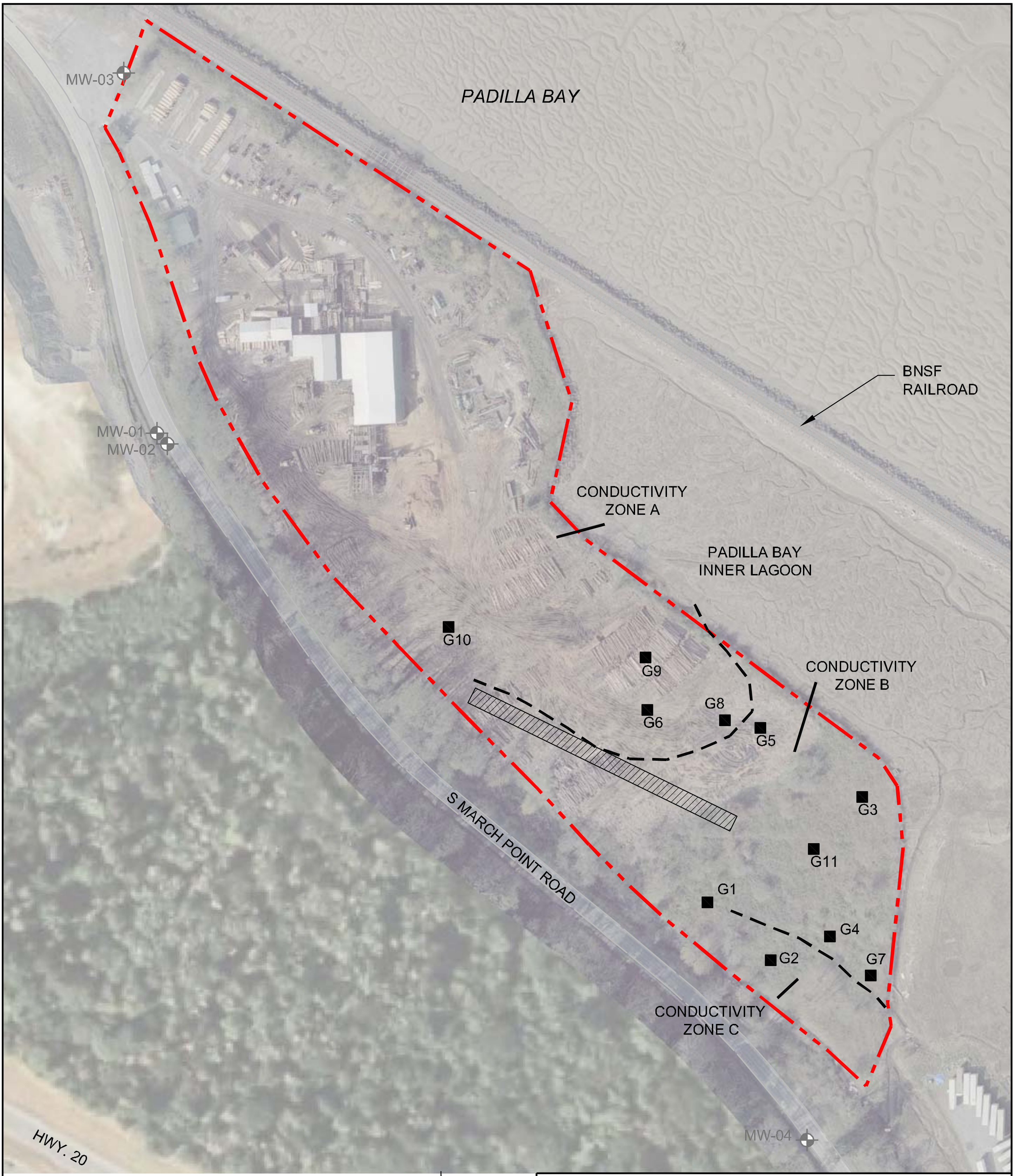
0 100 200

APPROXIMATE SCALE IN FEET

PHASE I UPLANDS SAMPLE LOCATIONS
March Point (Whitmarsh) Landfill
Skagit County, Washington

By: APS	Date: 09/08/09	Project No. 14159
AMEC Geomatrix		Figure 5

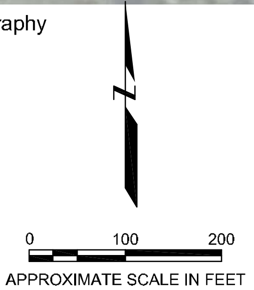
Plot Date: 09/08/09 - 3:27pm, Plotted by: adam.stenberg
Drawing Path: S:\14159\006_MPR\, Drawing Name: Whitmarsh_Phase1SampLoc_090809.dwg



Aerial Photo Courtesy of USDA/FSA Aerial Photography
Field office (2006) and Skagit County (2008)

EXPLANATION

G1 ■	ANOMALY OF INTEREST
— — —	APPARENT CONDUCTIVITY TRANSITION
▨	MAG/EM ANOMALY



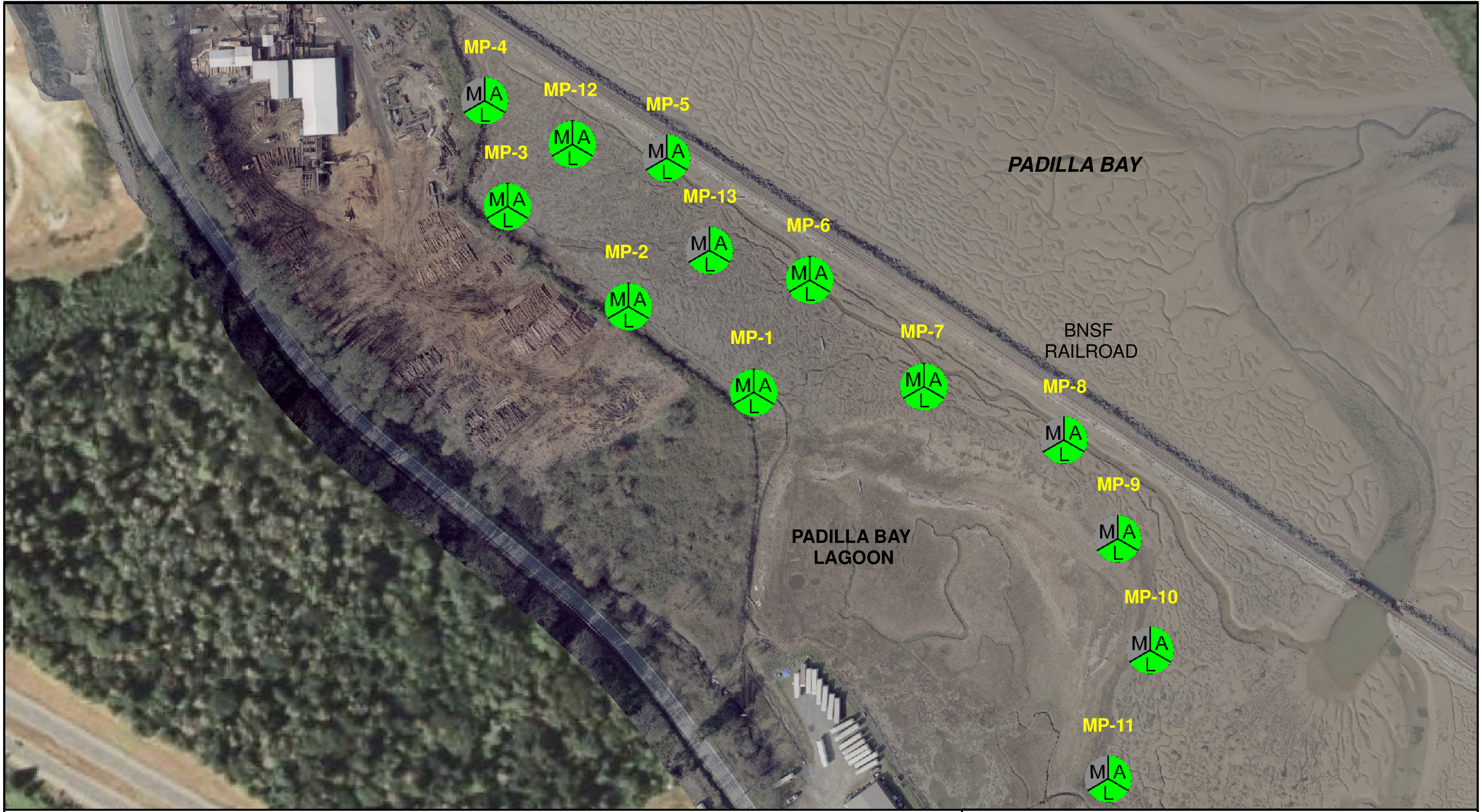
APPROXIMATE SCALE IN FEET

GEOPHYSICAL INVESTIGATION RESULTS
March Point (Whitmarsh) Landfill
Skagit County, Washington

By: APS	Date: 09/08/09	Project No. 14159
AMEC Geomatrix		Figure 6

Plot Date: 09/08/09 - 3:29pm, Plotted by: adam.stenberg
Drawing Path: S:\14159\006_MPR\, Drawing Name: Whitmarsh_GeophysicalInvestigation_090809.dwg

File path: I:\Project\Skagit County\14159 - Skagit Whitmarsh Landfill\1000 BACKGROUND\Field Mobilization\Bioassay Results.mxd



Aerial Photo Courtesy of USDA/FSA Aerial Photography Field Office (2006) and Skagit County (2008)

Sediments for bioassay testing were collected between August 26 and August 28, 2008

EXPLANATION

Microtox Bioassay (M)

Amphipod Bioassay (A)

Sediment Larval Bioassay (L)

🟩 Green indicates SQS Pass

▨ Gray indicates SQS Failure

N

0 150 300 Feet

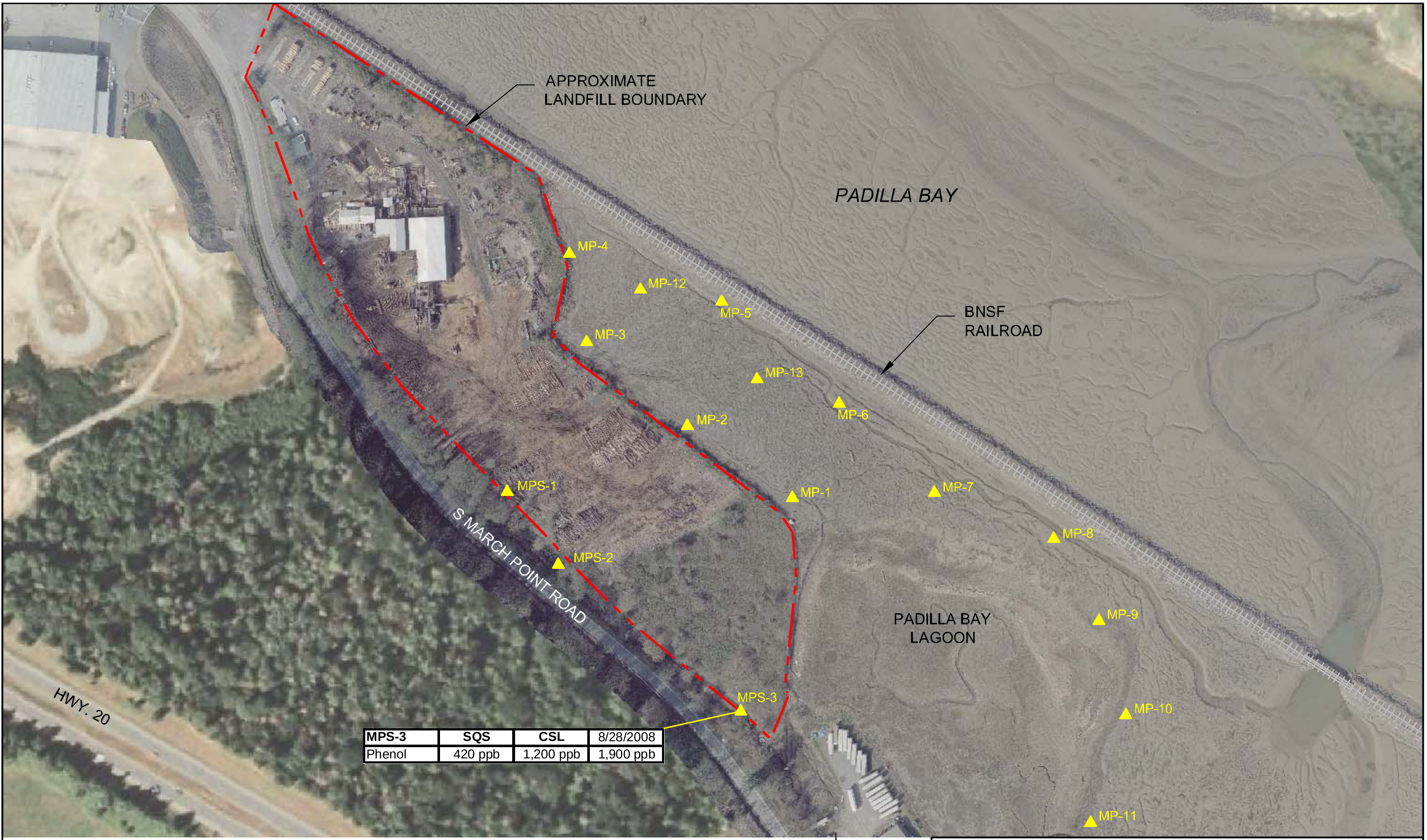
Approximate Scale in Feet

PHASE I BIOASSAY RESULTS FOR
PADILLA BAY LAGOON STATIONS
March Point (Whitmarsh) Landfill
Skagit County, Washington

By: RHG
Date:9/17/09
Project No. 014159.000.0

AMEC Geomatrix

Figure 7



MPS-3	SQS	CSL	8/28/2008
Phenol	420 ppb	1,200 ppb	1,900 ppb

Aerial Photo Courtesy of USDA/FSA Aerial Photography Field office (2006) and Skagit County (2008)

EXPLANATION

△ SEDIMENT SAMPLE LOCATION

SQS = SEDIMENT QUALITY STANDARD
CSL = CLEANUP SCREENING LEVEL
ppb = PARTS PER BILLION

SWALE SAMPLES WERE COMPARED TO THE SEDIMENT MANAGEMENT STANDARDS OR THE DRY WEIGHT EQUIVALENT FOR CARBON NORMALIZED VALUES.

N

0 150 300
APPROXIMATE SCALE IN FEET

PHASE I SEDIMENT INVESTIGATION RESULTS (CHEMISTRY EXCEEDANCES)

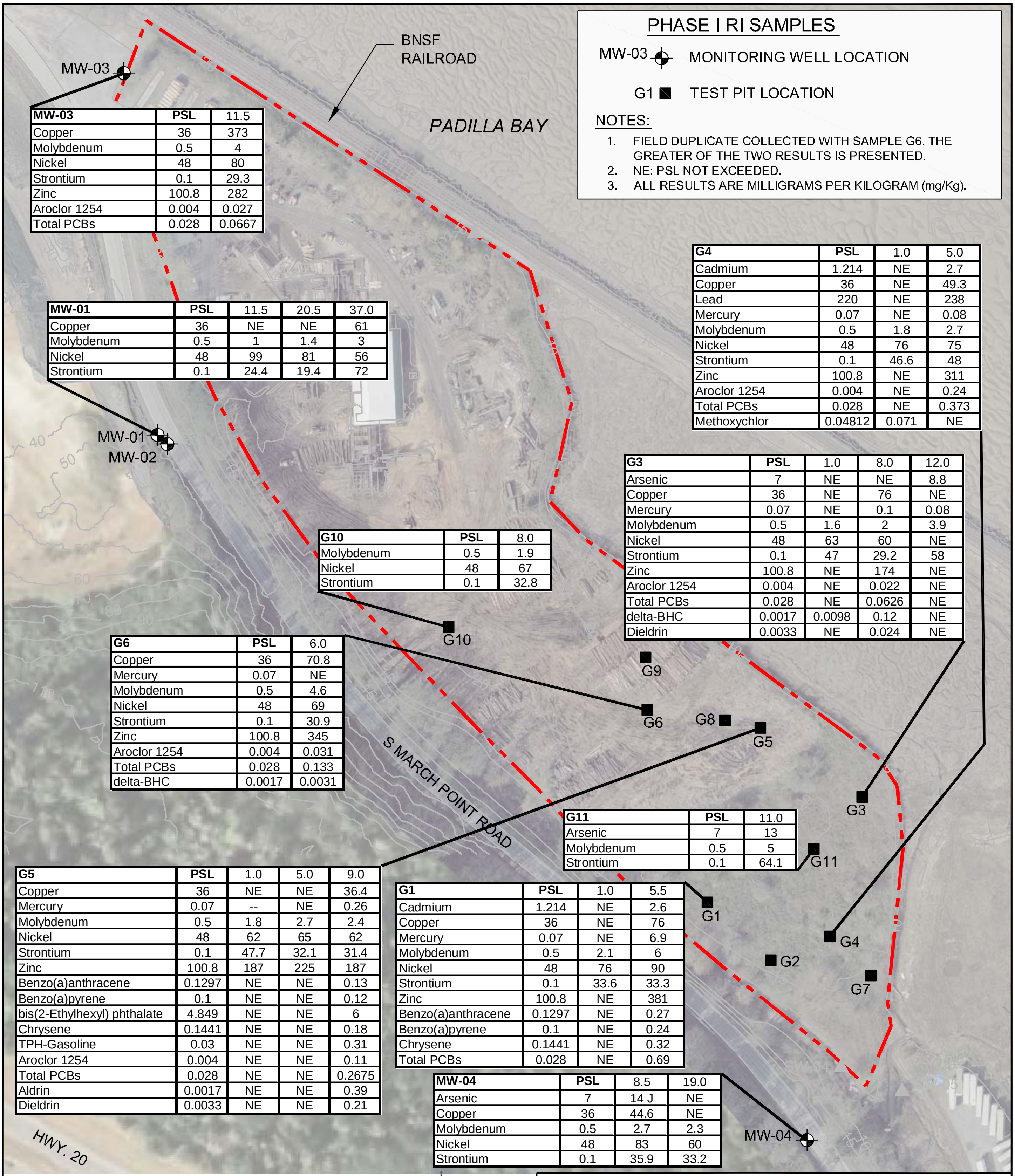
March Point (Whitmarsh) Landfill
Skagit County, Washington

By: APS
Date: 09/08/09
Project No. 14159

AMEC Geomatrix

Figure 8

Plot Date: 09/08/09 - 4:42pm, Plotted by: adam.stenberg
Drawing Path: S:\14159\006_MPR\, Drawing Name: Whitmarsh_Data-Sediment_090809.dwg



PHASE I RI SAMPLES

MW-03 ⌖ MONITORING WELL LOCATION

G1 ■ TEST PIT LOCATION

NOTES:

1. FIELD DUPLICATE COLLECTED WITH SAMPLE G6. THE GREATER OF THE TWO RESULTS IS PRESENTED.
2. NE: PSL NOT EXCEEDED.
3. ALL RESULTS ARE MILLIGRAMS PER KILOGRAM (mg/Kg).

MW-03	**PSL**	11.5
Copper	36	373
Molybdenum	0.5	4
Nickel	48	80
Strontium	0.1	29.3
Zinc	100.8	282
Aroclor 1254	0.004	0.027
Total PCBs	0.028	0.0667

G4	**PSL**	1.0	5.0
Cadmium	1.214	NE	2.7
Copper	36	NE	49.3
Lead	220	NE	238
Mercury	0.07	NE	0.08
Molybdenum	0.5	1.8	2.7
Nickel	48	76	75
Strontium	0.1	46.6	48
Zinc	100.8	NE	311
Aroclor 1254	0.004	NE	0.24
Total PCBs	0.028	NE	0.373
Methoxychlor	0.04812	0.071	NE

MW-01	**PSL**	11.5	20.5	37.0
Copper	36	NE	NE	61
Molybdenum	0.5	1	1.4	3
Nickel	48	99	81	56
Strontium	0.1	24.4	19.4	72

G3	**PSL**	1.0	8.0	12.0
Arsenic	7	NE	NE	8.8
Copper	36	NE	76	NE
Mercury	0.07	NE	0.1	0.08
Molybdenum	0.5	1.6	2	3.9
Nickel	48	63	60	NE
Strontium	0.1	47	29.2	58
Zinc	100.8	NE	174	NE
Aroclor 1254	0.004	NE	0.022	NE
Total PCBs	0.028	NE	0.0626	NE
delta-BHC	0.0017	0.0098	0.12	NE
Dieldrin	0.0033	NE	0.024	NE

G10	**PSL**	8.0
Molybdenum	0.5	1.9
Nickel	48	67
Strontium	0.1	32.8

G6	**PSL**	6.0
Copper	36	70.8
Mercury	0.07	NE
Molybdenum	0.5	4.6
Nickel	48	69
Strontium	0.1	30.9
Zinc	100.8	345
Aroclor 1254	0.004	0.031
Total PCBs	0.028	0.133
delta-BHC	0.0017	0.0031

G11	**PSL**	11.0
Arsenic	7	13
Molybdenum	0.5	5
Strontium	0.1	64.1

G5	**PSL**	1.0	5.0	9.0
Copper	36	NE	NE	36.4
Mercury	0.07	--	NE	0.26
Molybdenum	0.5	1.8	2.7	2.4
Nickel	48	62	65	62
Strontium	0.1	47.7	32.1	31.4
Zinc	100.8	187	225	187
Benzo(a)anthracene	0.1297	NE	NE	0.13
Benzo(a)pyrene	0.1	NE	NE	0.12
bis(2-Ethylhexyl) phthalate	4.849	NE	NE	6
Chrysene	0.1441	NE	NE	0.18
TPH-Gasoline	0.03	NE	NE	0.31
Aroclor 1254	0.004	NE	NE	0.11
Total PCBs	0.028	NE	NE	0.2675
Aldrin	0.0017	NE	NE	0.39
Dieldrin	0.0033	NE	NE	0.21

G1	**PSL**	1.0	5.5
Cadmium	1.214	NE	2.6
Copper	36	NE	76
Mercury	0.07	NE	6.9
Molybdenum	0.5	2.1	6
Nickel	48	76	90
Strontium	0.1	33.6	33.3
Zinc	100.8	NE	381
Benzo(a)anthracene	0.1297	NE	0.27
Benzo(a)pyrene	0.1	NE	0.24
Chrysene	0.1441	NE	0.32
Total PCBs	0.028	NE	0.69

MW-04	**PSL**	8.5	19.0
Arsenic	7	14 J	NE
Copper	36	44.6	NE
Molybdenum	0.5	2.7	2.3
Nickel	48	83	60
Strontium	0.1	35.9	33.2

Aerial Photo Courtesy of USDA/FSA Aerial Photography
Field office (2006) and Skagit County (2008)

Contours generated from Skagit County
aerial photo, 2008. Vertical datum: MLLW

Note: No monitoring well was installed at MW-01
since deep groundwater was not encountered.

EXPLANATION

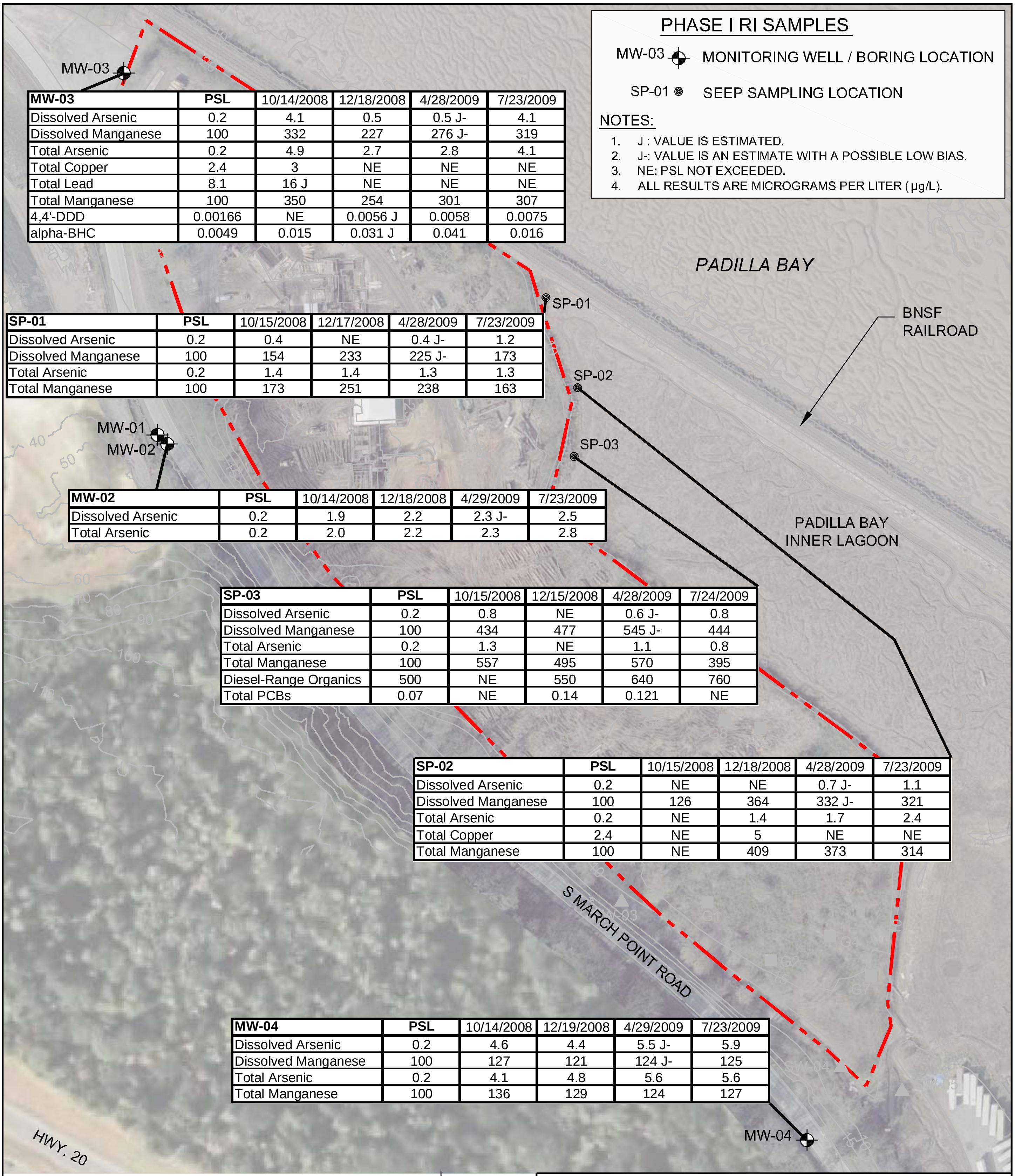
– – – APPROXIMATE LANDFILL BOUNDARY

0 100 200
APPROXIMATE SCALE IN FEET

PHASE I UPLANDS
SUMMARY OF EXCEEDANCES IN SOIL
March Point (Whitmarsh) Landfill
Skagit County, Washington

By: APS	Date: 09/15/09	Project No. 14159
AMEC Geomatrix		Figure 9

Plot Date: 09/15/09 - 12:37pm, Plotted by: adam.stenberg
Drawing Path: S:\14159\006_MPR\, Drawing Name: Whitmarsh_Data-Soil_090109.dwg



PHASE I RI SAMPLES

MW-03 ⊕ MONITORING WELL / BORING LOCATION

SP-01 ◎ SEEP SAMPLING LOCATION

NOTES:

1. J : VALUE IS ESTIMATED.
2. J-: VALUE IS AN ESTIMATE WITH A POSSIBLE LOW BIAS.
3. NE: PSL NOT EXCEEDED.
4. ALL RESULTS ARE MICROGRAMS PER LITER (µg/L).

MW-03	**PSL**	10/14/2008	12/18/2008	4/28/2009	7/23/2009
Dissolved Arsenic	0.2	4.1	0.5	0.5 J-	4.1
Dissolved Manganese	100	332	227	276 J-	319
Total Arsenic	0.2	4.9	2.7	2.8	4.1
Total Copper	2.4	3	NE	NE	NE
Total Lead	8.1	16 J	NE	NE	NE
Total Manganese	100	350	254	301	307
4,4'-DDD	0.00166	NE	0.0056 J	0.0058	0.0075
alpha-BHC	0.0049	0.015	0.031 J	0.041	0.016

SP-01	**PSL**	10/15/2008	12/17/2008	4/28/2009	7/23/2009
Dissolved Arsenic	0.2	0.4	NE	0.4 J-	1.2
Dissolved Manganese	100	154	233	225 J-	173
Total Arsenic	0.2	1.4	1.4	1.3	1.3
Total Manganese	100	173	251	238	163

MW-02	**PSL**	10/14/2008	12/18/2008	4/29/2009	7/23/2009
Dissolved Arsenic	0.2	1.9	2.2	2.3 J-	2.5
Total Arsenic	0.2	2.0	2.2	2.3	2.8

SP-03	**PSL**	10/15/2008	12/15/2008	4/28/2009	7/24/2009
Dissolved Arsenic	0.2	0.8	NE	0.6 J-	0.8
Dissolved Manganese	100	434	477	545 J-	444
Total Arsenic	0.2	1.3	NE	1.1	0.8
Total Manganese	100	557	495	570	395
Diesel-Range Organics	500	NE	550	640	760
Total PCBs	0.07	NE	0.14	0.121	NE

SP-02	**PSL**	10/15/2008	12/18/2008	4/28/2009	7/23/2009
Dissolved Arsenic	0.2	NE	NE	0.7 J-	1.1
Dissolved Manganese	100	126	364	332 J-	321
Total Arsenic	0.2	NE	1.4	1.7	2.4
Total Copper	2.4	NE	5	NE	NE
Total Manganese	100	NE	409	373	314

MW-04	**PSL**	10/14/2008	12/19/2008	4/29/2009	7/23/2009
Dissolved Arsenic	0.2	4.6	4.4	5.5 J-	5.9
Dissolved Manganese	100	127	121	124 J-	125
Total Arsenic	0.2	4.1	4.8	5.6	5.6
Total Manganese	100	136	129	124	127

Aerial Photo Courtesy of USDA/FSA Aerial Photography Field office (2006) and Skagit County (2008)

Contours generated from Skagit County aerial photo, 2008. Vertical datum: MLLW

Note: No monitoring well was installed at MW-01 since deep groundwater was not encountered.

EXPLANATION

– – – APPROXIMATE LANDFILL BOUNDARY

N

0 100 200

APPROXIMATE SCALE IN FEET

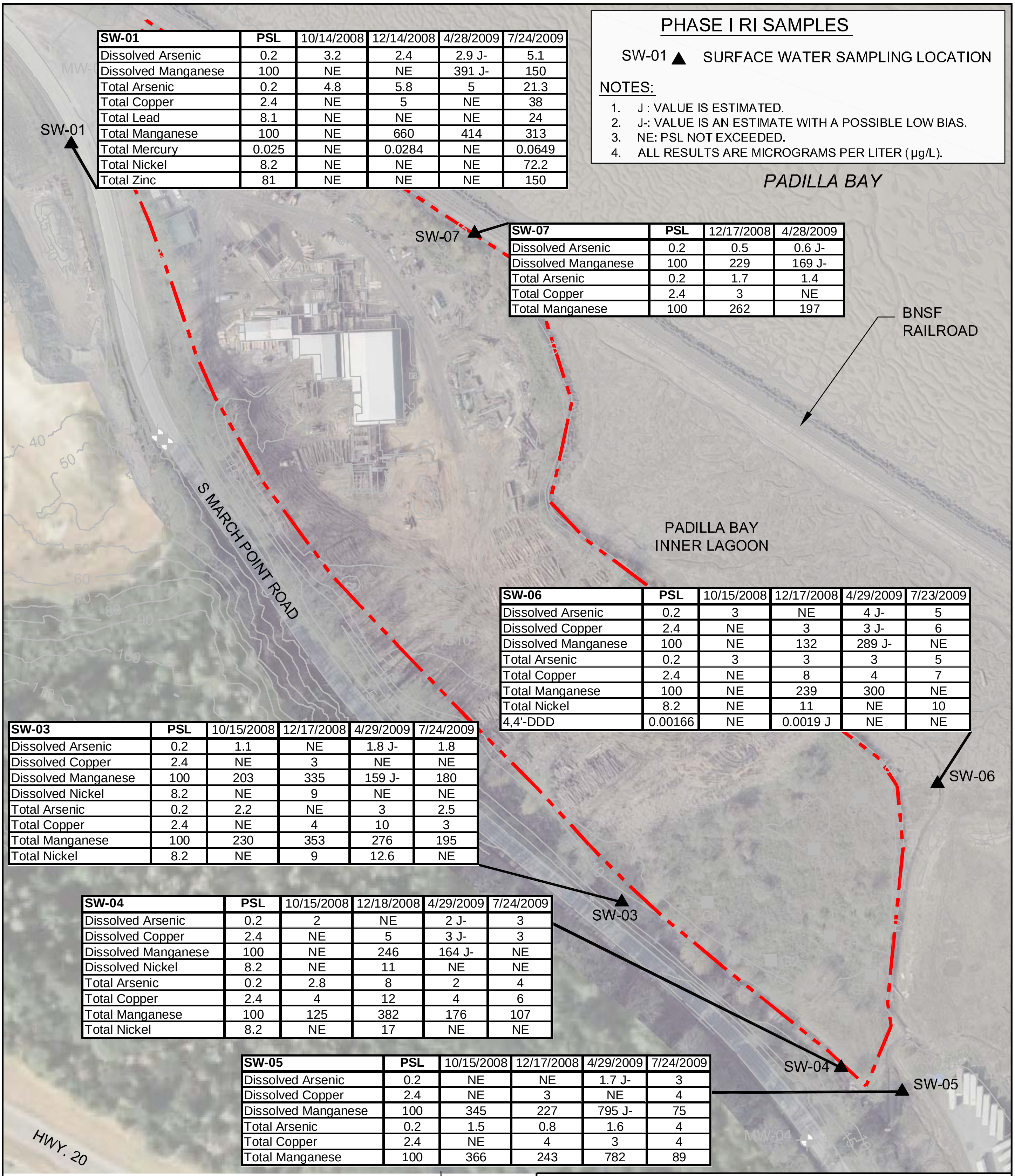
PHASE I UPLANDS
SUMMARY OF EXCEEDANCES IN
GROUNDWATER AND SEEP SAMPLES
March Point (Whitmarsh) Landfill
Skagit County, Washington

By: APS
Date: 09/15/09
Project No. 14159

AMEC Geomatrix

Figure 10

Plot Date: 09/15/09 - 12:51pm, Plotted by: adam.stenberg
Drawing Path: S:\14159\006_MPR\, Drawing Name: Whitmarsh_Data-GW_090109.dwg



NOTES:

1. J : VALUE IS ESTIMATED.
2. J-: VALUE IS AN ESTIMATE WITH A POSSIBLE LOW BIAS.
3. NE: PSL NOT EXCEEDED.
4. ALL RESULTS ARE MICROGRAMS PER LITER (µg/L).

SW-01	PSL	10/14/2008	12/14/2008	4/28/2009	7/24/2009
Dissolved Arsenic	0.2	3.2	2.4	2.9 J-	5.1
Dissolved Manganese	100	NE	NE	391 J-	150
Total Arsenic	0.2	4.8	5.8	5	21.3
Total Copper	2.4	NE	5	NE	38
Total Lead	8.1	NE	NE	NE	24
Total Manganese	100	NE	660	414	313
Total Mercury	0.025	NE	0.0284	NE	0.0649
Total Nickel	8.2	NE	NE	NE	72.2
Total Zinc	81	NE	NE	NE	150

SW-07	PSL	12/17/2008	4/28/2009
Dissolved Arsenic	0.2	0.5	0.6 J-
Dissolved Manganese	100	229	169 J-
Total Arsenic	0.2	1.7	1.4
Total Copper	2.4	3	NE
Total Manganese	100	262	197

SW-06	PSL	10/15/2008	12/17/2008	4/29/2009	7/23/2009
Dissolved Arsenic	0.2	3	NE	4 J-	5
Dissolved Copper	2.4	NE	3	3 J-	6
Dissolved Manganese	100	NE	132	289 J-	NE
Total Arsenic	0.2	3	3	3	5
Total Copper	2.4	NE	8	4	7
Total Manganese	100	NE	239	300	NE
Total Nickel	8.2	NE	11	NE	10
4,4'-DDD	0.00166	NE	0.0019 J	NE	NE

SW-03	PSL	10/15/2008	12/17/2008	4/29/2009	7/24/2009
Dissolved Arsenic	0.2	1.1	NE	1.8 J-	1.8
Dissolved Copper	2.4	NE	3	NE	NE
Dissolved Manganese	100	203	335	159 J-	180
Dissolved Nickel	8.2	NE	9	NE	NE
Total Arsenic	0.2	2.2	NE	3	2.5
Total Copper	2.4	NE	4	10	3
Total Manganese	100	230	353	276	195
Total Nickel	8.2	NE	9	12.6	NE

SW-04	PSL	10/15/2008	12/18/2008	4/29/2009	7/24/2009
Dissolved Arsenic	0.2	2	NE	2 J-	3
Dissolved Copper	2.4	NE	5	3 J-	3
Dissolved Manganese	100	NE	246	164 J-	NE
Dissolved Nickel	8.2	NE	11	NE	NE
Total Arsenic	0.2	2.8	8	2	4
Total Copper	2.4	4	12	4	6
Total Manganese	100	125	382	176	107
Total Nickel	8.2	NE	17	NE	NE

SW-05	PSL	10/15/2008	12/17/2008	4/29/2009	7/24/2009
Dissolved Arsenic	0.2	NE	NE	1.7 J-	3
Dissolved Copper	2.4	NE	3	NE	4
Dissolved Manganese	100	345	227	795 J-	75
Total Arsenic	0.2	1.5	0.8	1.6	4
Total Copper	2.4	NE	4	3	4
Total Manganese	100	366	243	782	89

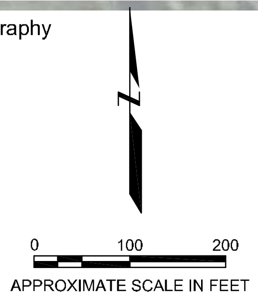
Aerial Photo Courtesy of USDA/FSA Aerial Photography Field office (2006) and Skagit County (2008)

Contours generated from Skagit County aerial photo, 2008. Vertical datum: MLLW

Note: No monitoring well was installed at MW-01 since deep groundwater was not encountered.

EXPLANATION

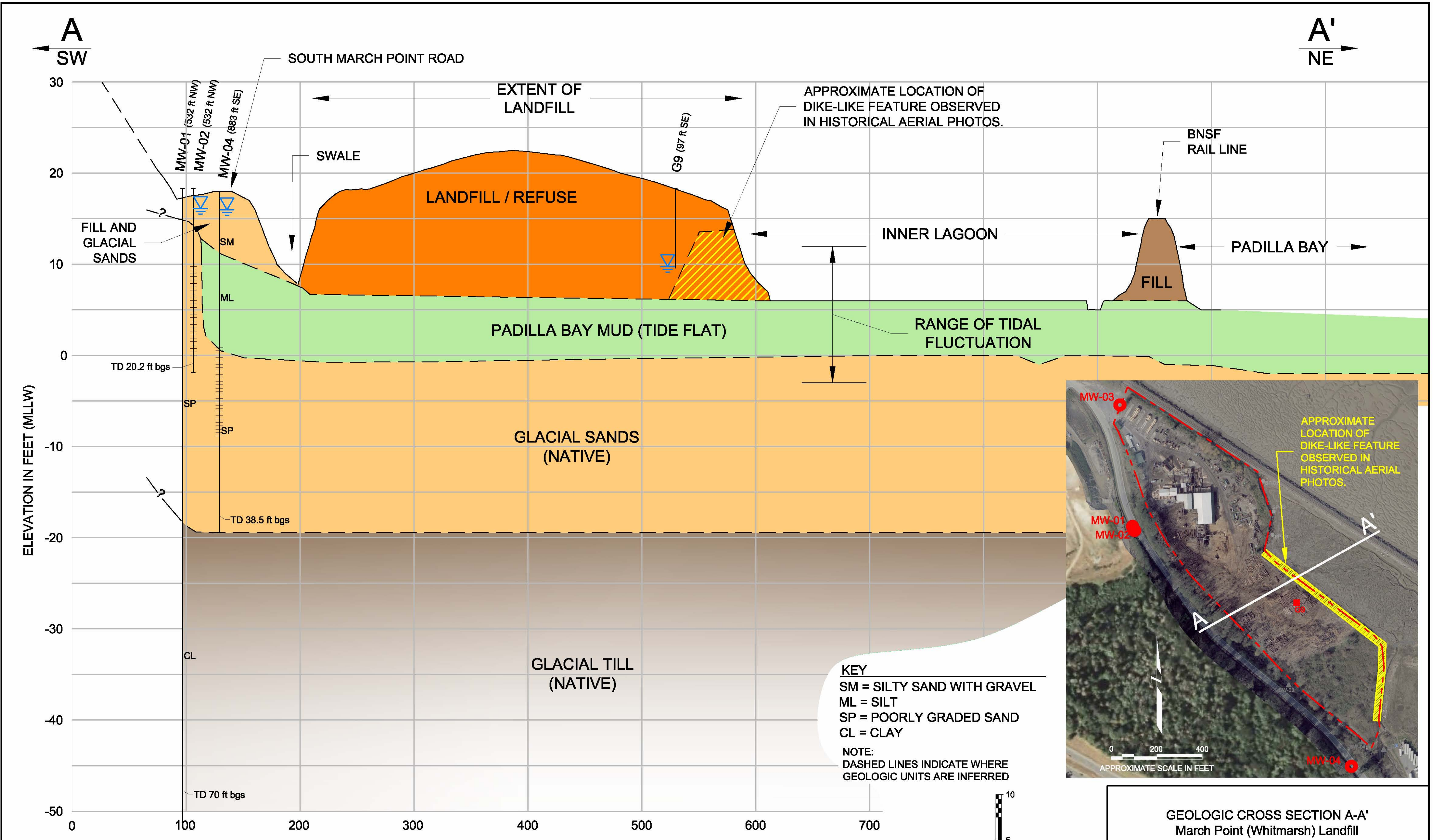
– – – APPROXIMATE LANDFILL BOUNDARY



PHASE I UPLANDS
SUMMARY OF EXCEEDANCES IN
SURFACE WATER SAMPLES
March Point (Whitmarsh) Landfill
Skagit County, Washington

By: APS	Date: 09/08/09	Project No. 14159
AMEC Geomatrix		Figure 11

Plot Date: 09/08/09 - 3:08pm, Plotted by: adam.stenberg
Drawing Path: S:\14159\006_MPR\, Drawing Name: Whitmarsh_Data-SW_090109.dwg



KEY
SM = SILTY SAND WITH GRAVEL
ML = SILT
SP = POORLY GRADED SAND
CL = CLAY

NOTE:
DASHED LINES INDICATE WHERE GEOLOGIC UNITS ARE INFERRED

Vertical Datum: 0 ft = MLLW
Datum derived from Skagit County 2008 Aerial Photography Contours and Puget Sound LIDAR Consortium data that was adjusted +2 ft to match aerial data contours.

WELL SCREEN INTERVAL

APPROXIMATE WATER LEVEL

TD = TOTAL DEPTH

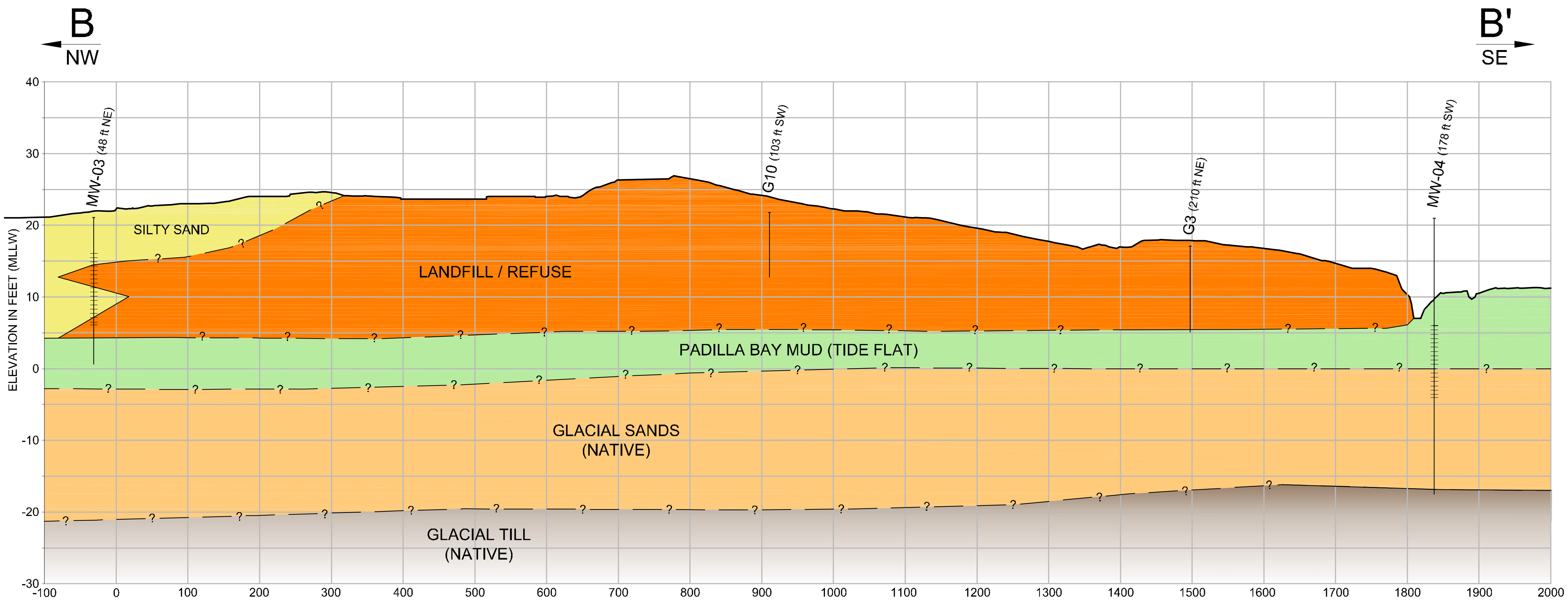
MLLW = MEAN LOWER LOW WATER

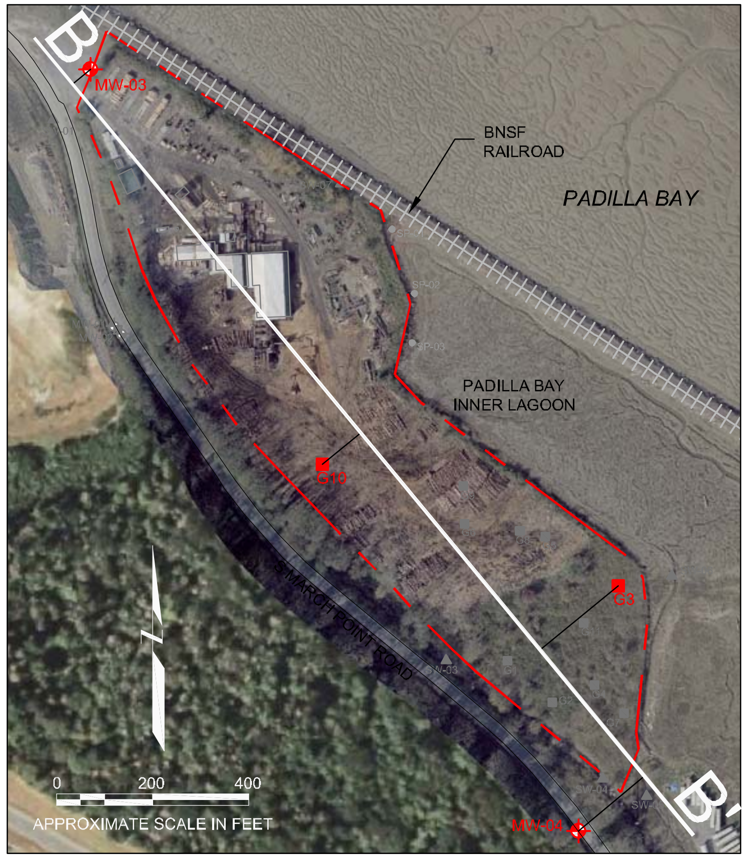
10
5
0
40
80
APPROXIMATE SCALE IN FEET
VERTICAL EXAGGERATION = 8X

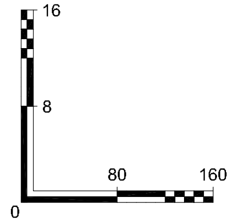
GEOLOGIC CROSS SECTION A-A'
March Point (Whitmarsh) Landfill
Skagit County, Washington

By: APS	Date: 09/08/09	Project No. 14159
AMEC Geomatrix		Figure 12

Plot Date: 09/08/09 - 2:52pm, Plotted by: adam.stenberg
Drawing Path: S:\14159\006_MPR\, Drawing Name: Whitmarsh_Cross-Sect_090809.dwg







APPROXIMATE SCALE IN FEET
VERTICAL EXAGGERATION = 10X

KEY:

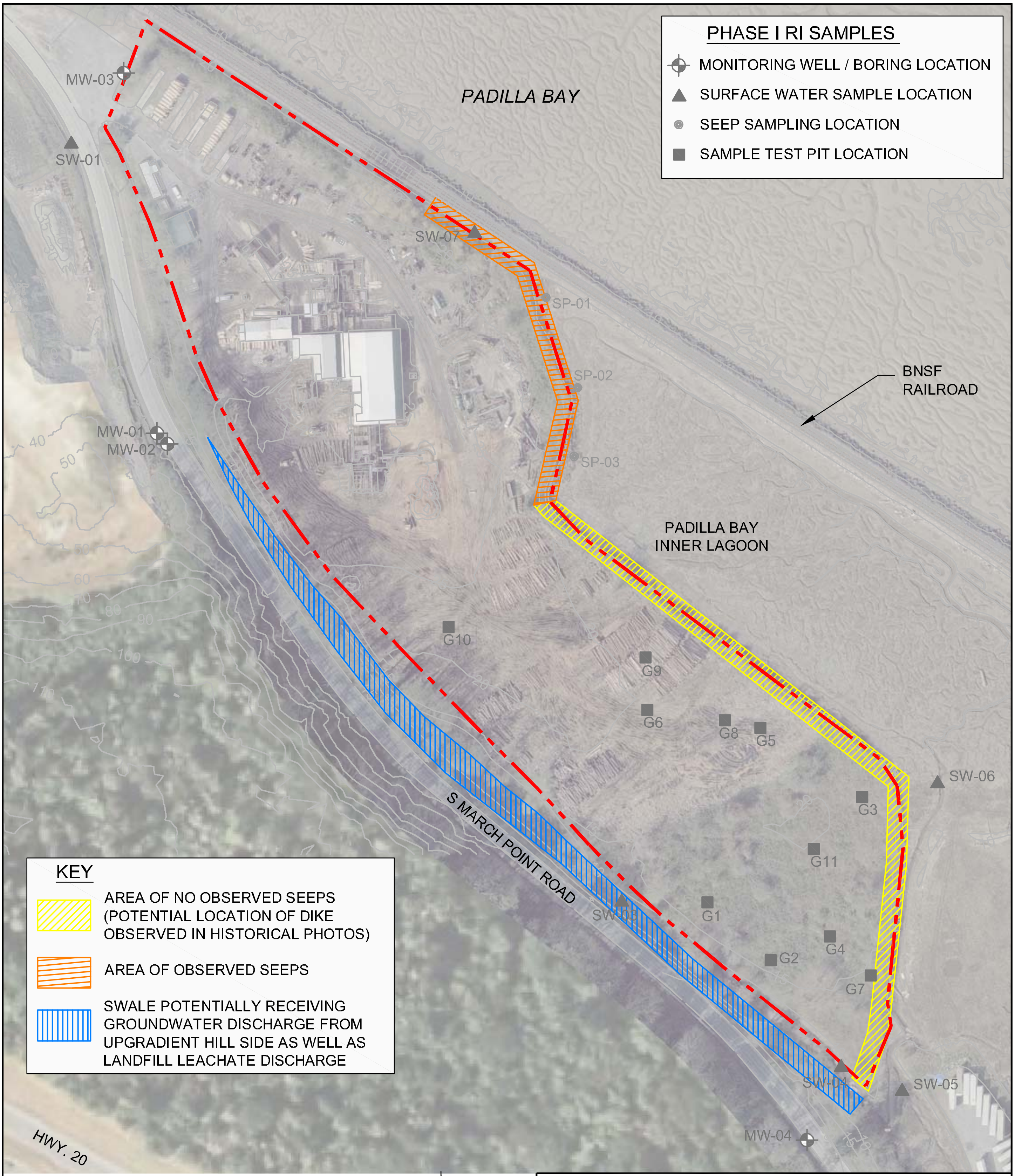
WELL SCREEN INTERVAL

NOTES:
1. Dashed lines indicate where geologic units are inferred.
2. Vertical Datum: 0 ft = MLLW (Mean Lower Low Water)
Datum derived from Skagit County 2008 Aerial Photography Contours.
3. Thickness of Padilla Bay Mud Unit is based on observed thickness in MW-04.

GEOLOGIC CROSS SECTION B-B'
March Point (Whitmarsh) Landfill
Skagit County, Washington

By: APS	Date: 09/09/09	Project No. 14159
AMEC Geomatrix		Figure 13

Plot Date: 09/09/09 - 10:59am, Plotted by: adam.stenberg
Drawing Path: S:\14159\006_MPR\, Drawing Name: Whitmarsh_CrossSectB_090909.dwg



Aerial Photo Courtesy of USDA/FSA Aerial Photography Field office (2006) and Skagit County (2008)

Contours generated from Skagit County aerial photo, 2008. Vertical datum: MLLW

Note: No monitoring well was installed at MW-01 since deep groundwater was not encountered.

EXPLANATION

APPROXIMATE LANDFILL BOUNDARY

N

0 100 200

APPROXIMATE SCALE IN FEET

AREAS OF SEEPS
March Point (Whitmarsh) Landfill
Skagit County, Washington

By: APS
Date: 09/08/09
Project No. 14159

AMEC Geomatrix

Figure 14

Plot Date: 09/08/09 - 3:13pm, Plotted by: adam.stenberg
Drawing Path: S:\14159\006_MPR\, Drawing Name: Whitmarsh_SeepsGWdischargeMap_090809.dwg

APPENDIX A

Summary pages from Historical Investigations were noted entering this feature from under S March Point Road. Wetland vegetation was observed in various locations within this stream; most notably red alder, willow, creeping buttercup and skunk cabbage. A portion of the stream between the site and S March Point Road is tidally influenced and could be considered estuarine habitat. The stream enters the tideland south of the side, turns north and flows along the eastern edge of the landfill into Padilla Bay Lagoon (Figure 4, Photographs 3 and 4). Several unidentified species of juvenile fish were noted within the stream channel on the eastern edge of the landfill, which separates the landfill from the Swinomish Indian Reservation.

On-site upland habitat is minimal because of the active sawmill operations. The extreme edges of the landfill as well as a relatively undisturbed 2 to 3 acre area along the southeast portion of the site contain the only notable upland habitat. Invasive blackberry and scotch broom were the most dominant upland species of vegetation noted on-site. Other upland species observed mostly within the southern portion included red alder, big-leaf maple, bitter cherry and possibly black hawthorn. The vegetation within this area (to the south) was not completely inventoried during the field reconnaissance.

3.0 PREVIOUS INVESTIGATIONS – UPLAND

This section discusses previous investigations where leachate and surface water sampling and testing were conducted at the landfill. Note that some of these studies also included sediment and/or biota sampling and testing but no soil or groundwater sampling has been completed at the site. These results are summarized in the Sediment Data Gaps report (SAIC, 2007). According to Ecology, the Swinomish Tribe collected a water (surface water or leachate) sample in 1997 (Ecology, 1999). The analytical results for this sample were not provided to us and have not been reviewed.

The approximate location of previous leachate/surface water samples are shown on Figure 5. The analytical data associated with these samples are included in this work plan as Tables 2 through 5. Note that the surface water criteria have changed (in general, some criteria have become more stringent) since the studies outlined below have been completed. In Sections 3.1 through 3.6, we have reiterated the conclusions of six environmental studies (primarily related to leachate sampling and testing) that have been completed at the site. We have also compared the detected leachate concentrations to current surface water criteria to evaluate whether chemicals of concern are present and are of regulatory concern based on current criteria. The surface water criteria are being used in this report for screening purposes, and are not intended to represent proposed or final cleanup levels.

3.1 PRELIMINARY ASSESSMENT (ECOLOGY, 1985)

Ecology and EPA conducted a Preliminary Assessment (PA) of the landfill in November 1984 and identified the site as a medium priority. The PA identified potentially contaminated groundwater, tidal incursion into the landfill, and leachate surfacing on the eastern landfill boundary as potential hazards to human health or the environment. The PA identified concerns regarding industries (i.e., Shell and Texaco refineries, Allied Chemical Sulfuric Acid Plant, and the Northwest Petrochemical Company) that were present in the local area at the time of unregulated dumping. Texaco, in a 103(c) notification, called March Point Landfill their "off-site No. 2," which has been interpreted as an offsite disposal facility for Texaco. The PA recommended analyzing leachate for priority pollutants and, if necessary, follow-up sampling including the installation and sampling of groundwater monitoring wells. The PA also recommended that historical data on industrial activities and waste dumping practices should be obtained from industries operating on March Point. However, we do not know if the historical data were obtained.

3.2 SITE INSPECTION (ECOLOGY, 1986)

Based on the results of the 1984 PA, Ecology conducted a site inspection (SI) at the March Point Landfill in December 1985. Ecology collected three surface water samples (NCT091, NCT092, and NCT094), one leachate sample (NCT095), and two sediment samples (surface water and leachate sample locations are shown on Figure 5). The surface water samples were collected at the following locations: 1) borrow pit upgradient of the landfill (NCT091), 2) estuarial stream southeast of landfill (NCT092), and 3) Padilla Bay lagoon surface water at the northeast side of landfill (NCT094). The location where sample NCT092 was collected is not clear. The SI report states that "sample NCT092 was taken from an estuarial stream on the southeast edge of the landfill." However, the sample location figure in the SI report (Figure 1) shows the NCT092 sample location approximately 2,500 feet southeast of the landfill (Ecology, 1986). Figure 5 shows both potential NCT092 sample locations. The leachate sample was collected at the northeast side of landfill. The surface water and leachate samples were analyzed for EPA priority pollutant metals and volatile organic compounds (VOCs). At the time that the report was produced, Ecology concluded that "sampling data do not show a significant problem at this landfill to warrant further sampling or remedial actions."

Based on a review of the 1985 sample results compared to current surface water criteria: arsenic, copper, mercury, and nickel were detected in at least two water samples at concentrations greater than their respective aquatic life or human health surface water criteria (Table 2).

3.3 ANALYSIS OF LEACHATE FROM WHITMARSH LANDFILL (ECOLOGY, 1989)

Ecology collected a grab sample of leachate (sample 88-257426) from the northeast corner of the landfill in June 1988 (Figure 5). The sample was analyzed for priority pollutant metals. The letter concluded that the results were "an indication of a heavy metals problem at Whitmarsh which will require further study."

Based on our review of the 1989 sample results as compared to current surface water criteria: arsenic, cadmium, chromium, copper, lead, nickel, thallium, and zinc were detected at concentrations greater than their respective surface water criteria (Table 3).

3.4 SKAGIT COUNTY DEPARTMENT OF HEALTH SAMPLING (SKAGIT COUNTY, 1996)

Based on Swinomish Indian Tribal Community concerns regarding potential contaminant releases from the March Point Landfill (referred to as the Whitmarsh Landfill in this 1996 letter) into Padilla Bay, the Skagit County Department of Health collected surface water and sediment samples near the landfill in October 1996. Two water sample locations were identified based on the presence of discolored water emanating from the concrete rip-rap wall along the northeast side of the landfill (Figure 5). A leachate and sediment sample were collected at each location (leachate sample numbers WMW-1 and WMW-2; see the Sediment Data Gaps report [SAIC, 2007] for sediment sample information). Samples were analyzed for VOCs, semivolatile organic compounds (SVOCs), pesticides/polychlorinated biphenyls (PCBs), and metals. No analytes were detected at concentrations greater than their respective surface water criteria (Table 4). The report concluded that "further investigation using county resources is not warranted at this time."

Based on a review of the 1996 sample results as compared to current surface water criteria, although there were detected concentrations of VOCs and SVOCs and phenols, none of the chemicals exceeded their respective surface water criteria.

TABLE 2

1986 ECOLOGY SITE INSPECTION REPORT - WATER SAMPLES[1]

MARCH POINT LANDFILL
ANACORTES, WASHINGTON

Analytes	Sample ID				Surface Water Criteria[2]		
	NCT091 (Surface Water)	**NCT092 (Surface Water)**	**NCT094 (Surface Water)**	**NCT095 (Leachate)**	**Aquatic Life Marine/Chronic[3]**	**Human Health Marine[4]**	**MTCA Method B[5]**
	Figure 9 - Location 1A	**Figure 9 - Location 1B**	**Figure 9 - Location 1C**	**Figure 9 - Location 1D**			
Dissolved Metals - EPA Method Not Known (µg/L)							
Antimony	<1	<1	<1	<1	--	640	1000
Arsenic	**5**	<1	**74**	**2**	36	0.14	0.098
Beryllium	<0.1	<0.1	**14.2**	<0.1	--	--	270
Cadmium	<0.2	<0.2	<0.2	<0.2	8.8	--	20
Chromium	<1	<1	<1	<1	50	--	490
Copper	**7**	**11**	**2**	**1**	2.4	--	2700
Lead	<1	<1	<1	<1	8.1	--	--
Mercury	**0.06**	**0.06**	<0.06	<0.06	0.025	0.15	--
Nickel	**5**	**100**	**40**	**6**	8.2	4600	1100
Selenium	**2**	<1	**62**	**5**	71	4200	2700
Silver	<0.1	<0.1	<0.1	<0.1	--	--	26000
Telurium	**1**	<1	**24**	**3**	--	--	--
Zinc	<1	**32**	**3**	**22**	81	26000	17000
Phenolics - EPA Method Not Known (mg/L)							
Phenolics	0.030	0.005	0.010	0.020	--	--	--
Volatile Organic Compounds - EPA Method Not Known (µg/L)							
Benzene	<1	<1	<1	13	--	51	23

Notes:

[1] Ecology, 1986

[2] Surface water criteria identified in WAC 173-340-730(3)(b)(i). The surface water criteria are being used in this report for screening purposes, and are not intended to represent proposed or final cleanup levels.

[3] Lowest available aquatic life marine chronic criteria from Chapter 173-201A, Clean Water Act Section 304, and National Toxics Rule (40 CFR 131)

[4] Lowest available human health marine criteria from Clean Water Act Section 304 and National Toxics Rule (40 CFR 131)

[5] MTCA Method B surface water cleanup level [WAC 173-340-730(3)(b)(iii)]

-- = not available
nd = not detected
n/a = not analyzed or not applicable
bold indicates a detected concentration
underline indicates that detection limit is greater than at least one surface water criteria
shading indicates that detected concentration is greater than at least one surface water criteria

SEA\0\0504037\00\FINALS\050403700HISTORICAL DATA TABLES.XLS

TABLE 3

1989 ECOLOGY LETTER - LEACHATE SAMPLES[1]

MARCH POINT LANDFILL
ANACORTES, WASHINGTON

Analytes	Sample ID	Surface Water Criteria[2]		
	88-257426			
	Figure 9 - Location 2	Aquatic Life Marine/Chronic[3]	Human Health Marine[4]	MTCA Method B[5]
Metals - EPA Method Unknown (µg/L)				
Antimony[6]	1U	--	640	1,000
Arsenic[6]	**91**	36	0.14	0.098
Beryllium[7]	**8.5**	--	--	270
Cadmium[7]	**9.9**	8.8	--	20
Chromium[7]	**324**	50	--	490
Copper[7]	**357**	2.4	--	2,700
Lead[6]	**126**	8.1	--	--
Mercury[6]	--	0.025	0.15	--
Nickel[7]	**959**	8.2	4,600	1,100
Selenium[6]	1U	71	4,200	2,700
Silver[6]	**2.2**	--	--	26,000
Thallium[6]	**1.8**	--	0.47	--
Zinc[7]	**779**	81	26,000	17,000

Notes:

[1] Ecology, 1989

[2] Surface water criteria identified in WAC 173-340-730(3)(b)(i). The surface water criteria are being used in this report for screening purposes, and are not intended to represent proposed or final cleanup levels.

[3] Lowest available aquatic life marine chronic criteria from Chapter 173-201A, Clean Water Act Section 304, and National Toxics Rule (40 CFR 131)

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SEA\0\050403700\FINALS\050403700HISTORICAL DATA TABLES.XLS

SKAGIT COUNTY
DEPARTMENT OF HEALTH

HOWARD L. LEIBRAND, M.D. HEALTH OFFICER
PATRICIA A. PEARCE, DIRECTOR

SKAGIT COUNTY ADMINISTRATION BLDG., ROOM 301
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MOUNT VERNON, WASHINGTON 98273-3864

PHONE: (360) 336-9380
FAX: (360) 336-9401
ANACORTES TOLL-FREE: (360) 293-9508

December 6, 1996

Lauren Rich
Swinomish Indian Tribal Community
P.O. Box 817
La Conner, WA 98257

Re: Whitmarsh Landfill Sample Data Results

Dear Lauren:

The Skagit County Health Department received a complaint from you regarding potential contaminant releases from the Whitmarsh Landfill into Padilla Bay. In response to that complaint, Gary Sorensen of the Skagit County Public Works conducted a site visit with you and Kenneth Edwards to survey the site. Based on that visit it was agreed that Skagit County would conduct some surface water and sediment sampling from sites of suspected contamination.

On October 24, 1996 Britt Pfaff, Gary Sorensen, and I met you at the site to determine sample locations and conduct sampling of surface water and marine sediment. Sample locations were selected based largely on discolored surface water emanating from the concrete rip-rap wall at points where it discharged to the adjacent mudflats. Two such discharge points were identified (see attached map). At each discharge point a surface water sample and a sediment sample were collected. A full priority pollutant analysis was conducted on each of the two surface water and sediment samples.

A summary sheet of the data results is enclosed along with a copy of the full laboratory report. Generally, only a few organic compounds and metals were detected within the surface water sample. Those that were detected were at very low levels. Several organic compounds and metal species were detected within the sediment samples. However, these too were detected at extremely low concentration levels, and many parameters were flagged as estimated values detected below the laboratory reporting limits.

The Washington State Department of Ecology conducted a site inspection (Site Inspection Report March Point Landfill, Anacortes, Washington, March 1986). A copy of that report is enclosed for your information. Two of their samples (leachate sample NCT095 and sediment sample NCT096) appear to be similar to the water and sediment samples collected as part of this investigation and from a similar area.

Observed concentration levels from Ecology's sediment sample NCT096 does show some correlation with the two sediment samples we collected. For example, acetone and methylene chloride were detected in NCT096 and both sediment samples we collected. However, they concluded both compounds were laboratory contaminants and not within the sediments because both compounds were detected in the transport blank. Neither compound was detected in the transport blank submitted with our samples. This would indicate that both compounds were in the sediment samples and not due to laboratory contamination. Additionally, toluene and fluoranthene were detected in NCT096 and one (WM-1) of the two sediment samples we collected. Observed concentration levels for all four compounds in NCT096 ranged from slightly above to significantly above the respective levels observed in the sediment samples we collected.

Ecology concluded from their sampling that it could not be determined whether the slight contamination detected resulted directly from the landfill contents or from other non-point sources in the area (such as fuel spills).

Ecology also concluded that the presence of flouranthene and toluene are not unexpected in the offshore marine sediment samples for such a highly industrialized area. They further concluded that their sampling data did not show a significant problem with the landfill to warrant further sampling or remedial actions, and there was no conclusive indication that hazardous materials were leaching from the landfill into Padilla Bay or its surrounding estuarial area.

Based on the sample results from our investigation and Ecology's investigation, we agree with Ecology's findings and conclude that further investigation using county resources is not warranted at this time. However, we would be pleased to cooperate with any further investigation the Swinomish Tribe may pursue regarding this site.

After your review of the data, we would be happy to meet with you and your representatives to discuss the data results and our findings. If you would like to meet, please contact either Britt Pfaff or me to arrange such a meeting.

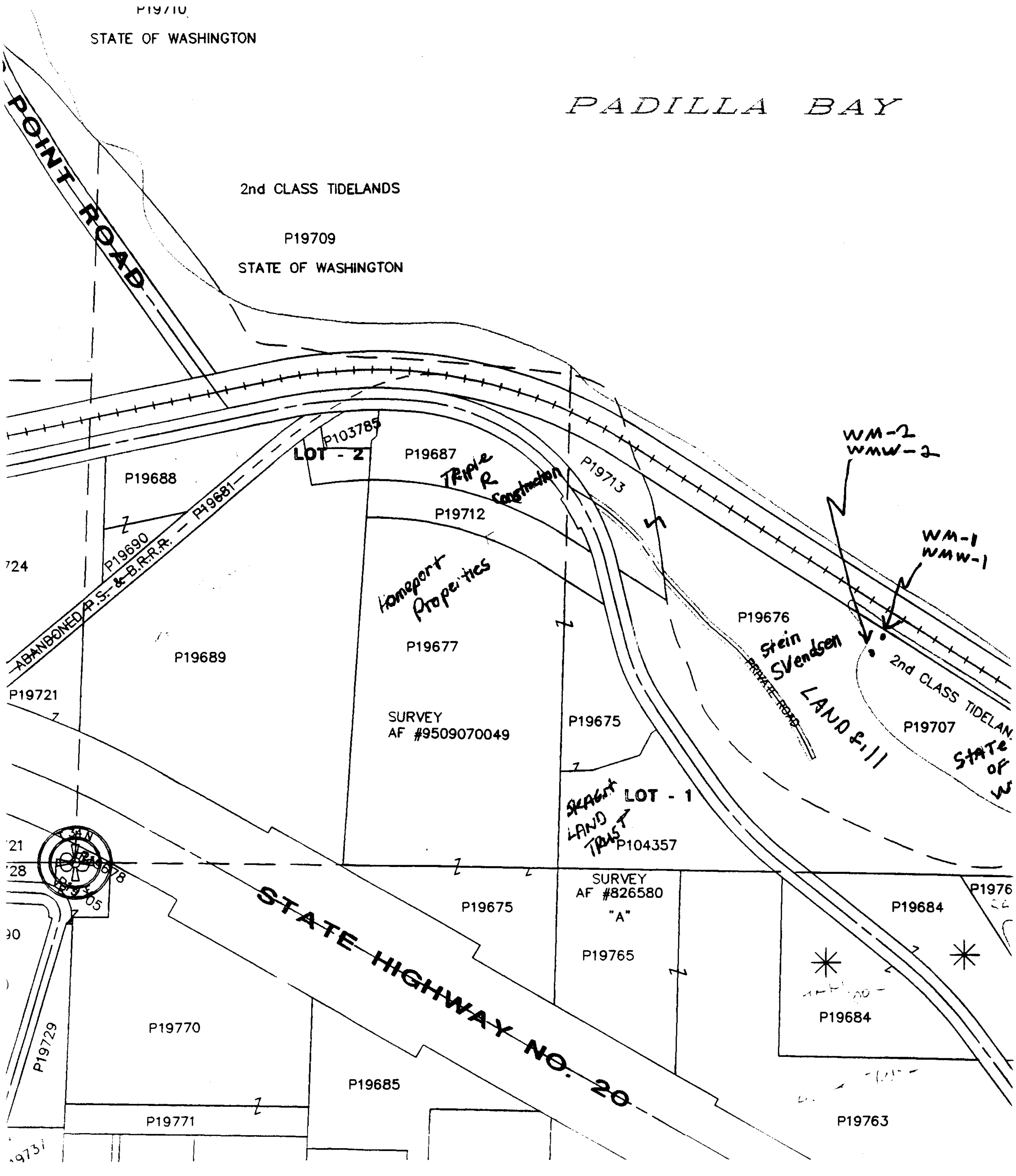
Sincerely,

Ken

Ken Willis
Environmental Health Specialist

Attachments

cc: Gary Sorensen, Public Works
Britt Pfaff, Heath Department
Paul Reilley, Civil Litigator
Dave Fleming, Risk Manager


P19710
STATE OF WASHINGTON
PADILLA BAY
POINT ROAD
2nd CLASS TIDELANDS
P19709
STATE OF WASHINGTON
P103785
LOT - 2
P19687
Triple R Construction
P19688
P19713
WM-2
WMW-2
P19712
P19690
P19681
ABANDONED P.S. & B.R.R.R.
724
Homeport Properties
WM-1
WMW-1
P19676
Stein Svendsen
PRIVATE ROAD
LANDfill
2nd CLASS TIDELAN
P19707
STATE OF W
P19689
P19677
P19721
SURVEY
AF #9509070049
P19675
Skagit LAND TRUST
LOT - 1
P104357
21
28
SURVEY
AF #826580
"A"
P19675
P19684
P1976
STATE HIGHWAY NO. 20
90
P19765
P19684
P19729
P19770
P19685
P19763
P19771
19731

Whitmarsh Landfill

Samples Collected: October 24, 1996

PARAMETER	Water WMW-1	Water WMW-2	Sediment WM-1	Sediment WM-2
8260 Method	**ug/L**	**ug/L**	**mg/kg**	**mg/kg**
Benzene	6			
Chlorobenzene	15	1J		
m,p-Xylenes	3	1J	0.005J	0.008J
o-Xylene	3			
Acetone			0.52	0.7
Carbon Disulfide			0.03	0.05
Methylene Chloride			0.014J	0.016J
2-Butanone			0.17	0.19
4-Methyl-2-pentanone			0.1	
Toluene			0.008J	0.011J
2-Hexanone			0.038J	0.036J
8270 Method	**ug/L**	**ug/L**	**mg/kg**	**mg/kg**
2,4-Dimethylphenol	3			
Naphthalene	2			
2-Methylnaphthalene	1			
N-Nitrosodiphenylamine		1		
Bis(2-ethylhexyl)phthalate		1	0.1	0.44
Fluoranthene			0.046J	
Pyrene			0.084	
Benzo(a)anthracene			0.074	
Chrysene			0.064	
Benzo(b)fluoranthene			0.048J	
Benzo(k)fluoranthene			0.03J	
8080 Method	ND	ND	ND	ND
Metals	**ug/L**	**ug/L**	**mg/kg**	**mg/kg**
Antimony	6U	3U	1U	2U
Arsenic	5U	5U	12	11
Beryllium	10U	10U	0.46U	0.64U
Cadmium	10U	10U	1.3	1.8
Chromium	10U	10U	44	49
Copper	10U	10U	47	39
Cyanide	5U	5U	0.23U	0.56U
Lead	50U	50U	26	27
Mercury	0.2U	0.2U	0.1U	0.3
Nickel	20U	20U	50	51
Selenium	5U	5U	0.8	0.2U
Silver	10U	10U	0.91U	1.3U
Thallium	1U	1U	0.2U	0.4
Total Phenol	10	5U	2.2	1.7U
Total Solids	NT	NT	55.7	33.1
Zinc	26	31	85	110

Note:

1) "J" indicates the analyte of interest was detected below the routine reporting limit.
This value should be regarded as an estimate.

2) "U" indicates the analyte of interest was not detected, to the limit of detection indicated.

3) "ND" indicates the analytes of interest were not detected, to the limit of the detection indicated.

4) "NT" indicates the analyte was not tested.

WASHINGTON STATE
DEPARTMENT OF
ECOLOGY

Investigation of Chemical Contamination at Whitmarsh Landfill and Padilla Bay Lagoon

February 1999
Publication No. 99-306

Printed on Recycled Paper

Summary

In response to concerns of the Swinomish Tribal Community, the Washington State Department of Ecology conducted an investigation to determine the extent to which Padilla Bay Lagoon has been degraded by discharges from the Whitmarsh Landfill. The abandoned fill is located at the head of Padilla Bay on tidelands at the west end of the lagoon. It was used as an unregulated public dump from the 1950s until 1973. Previous investigations had concluded the level of chemical contamination in the lagoon was low and not readily traceable to the fill. Results of toxicity tests on the sediments seemed to contradict these findings.

An extensive chemical screening was first conducted on two samples each of seepage and intertidal sediments collected at the base of the landfill on June 11, 1998. The analyses included a wider range of compounds and lower detection limits than had been done previously.

The contaminants detected in Whitmarsh seepage and their concentration ranges (parts per billion) are listed below. A number of additional benzenes, phenols, and polyaromatic hydrocarbons (PAH) were also tentatively identified

Chemical Contaminant (number of compounds)	Whitmarsh Seepage (ug/L)
iron	5,600 - 16,600
diesel	470 - 850
benzenes (5)	0.1 - 2.5
chlorinated benzenes (4)	0.01 - 0.92
xylenes (3)	0.14 - 1.3
toluene	0.15 - 0.86
ethylether	0.51
polyaromatic hydrocarbons (14)	0.02 - 0.84
phenol and methylphenols (4)	0.08 - 0.52
chloromethylphenol	0.52
diethylphthalate	0.14 - 0.19
nitrosodiphenylamine	0.41 - 1.5
dibenzofuran	0.08 - 0.16
carbazole	0.05
PCB-1242	0.011 - 0.028
carbaryl	0.012 - 5.8

The concentrations in seepage were generally low and, in most cases, beneath thresholds of toxicity. Iron and the higher concentrations of the insecticide carbaryl (Sevin) were potentially toxic until further diluted. PCB-1242 approached the chronic water quality criterion of 0.03 ug/L for marine waters.

Chemicals analyzed but not detected in the seepage were priority pollutants metals, cyanide, organophosphorus pesticides, organochlorine pesticides, and herbicides. Previous investigations by Skagit County and others have also shown that metals, cyanide, and pesticides are not important contaminants in the seepage.

Results from screening the Whitmarsh sediment samples showed elevations in a range of chemicals including, but not limited to, iron, PAH, phenols, phthalates, and 2,3,7,8-TCDD (dioxin). Methylphenols exceeded Ecology's Sediment Management Standards (SMS) Chemicals analyzed but not detected in the sediments were PCBs, organophosphorus pesticides, organochlorine pesticides, and herbicides Organotins were at background levels.

The screening results were consistent with past studies indicating there was a low potential for the landfill to cause toxicity in the lagoon water column. Sediment contamination, however, appeared to be a greater concern than had previously been appreciated. A wider sediment quality survey was therefore conducted in the lagoon.

The objectives of the sediment survey were to:

- Determine the occurrence of chemicals of potential concern
- Determine the extent of contamination
- Assess compliance with SMS chemical and biological criteria
- Evaluate the significance of contamination by non-SMS chemicals
- Draw conclusions about probable sources of contamination

Samples for the expanded sediment survey were collected August 7, 1998 and included three sites farther out in the lagoon (#3, #4, and #5), one site outside the lagoon (#6), and an established reference area nine miles to the north in Samish Bay Sediments in the reference area are known to have a low level of chemical contamination and no significant toxicity. The samples were analyzed for a subset of the screening survey chemicals and tested for acute toxicity to amphipod crustaceans (*Ampelisca abdita*), sea urchins (*Stongylocentrotus purpuratus*), and chronic toxicity to juvenile polychaete worms (*Neanthes arenaceodentata*).

The major findings from Ecology's 1998 investigation on sediment quality in Padilla Bay Lagoon can be summarized as follows:

2-Methylphenol, 4-methylphenol, and 2,4-dimethylphenol in the inner lagoon exceed SMS Cleanup Screening Levels (CSL). A station cluster of potential concern (sites #1, #2, and #3) exists for these compounds, making it a priority for evaluation as a cleanup site

Site	2-Methylphenol	4-Methylphenol	2,4-Dimethylphenol
#1	180	545	288
#2	121	238	118
#3	1740	7950	5580
CSL =	63	670	29

ug/Kg, dry; parts per billion

Except for phenol at inner lagoon site #3, all other SMS chemicals were within Sediment Quality Standards (SQS). Chemicals meeting the SQS are not expected to cause adverse effects on biological resources.

Chemicals, in addition to phenols, that are substantially elevated in the lagoon and appear to be associated with Whitmarsh Landfill include iron, low molecular weight PAH, high molecular weight PAH, bis(2-ethylhexyl)phthalate, di-n-butylphthalate, coprostanol (an indicator of fecal matter), dibenzofuran, retene, and 2,3,7,8-TCDD Sources other than Whitmarsh Landfill are indicated for higher weight PAH in the outer lagoon and outside the lagoon

In terms of equivalent concentrations of 2,3,7,8-TCDD, the levels of polychlorinated dioxin and -furan compounds in the lagoon (up to 5 7 ng/Kg; parts per trillion) are comparable to some industrialized embayments in Puget Sound. EPA has concluded that this level of sediment contamination poses a low risk to fish and wildlife.

Among the chemicals analyzed in the sediments, but either not detected or not substantially elevated, were total petroleum hydrocarbons (except site #3), priority pollutant metals, volatile organic compounds (except #3), and PCBs.

Site #3 is located on the north side of the inner lagoon, approximately 200 yards east of the landfill. It has extremely high levels of petroleum (5,300 mg/Kg diesel; 4,000 mg/Kg lube oil; parts per million) and, as noted above, phenols. The sediments are black, viscous, and have a strong petroleum odor. The hydrocarbons were extremely weathered and do not match any pattern of common petroleum products. All bioassay test organisms died on exposure to this sample. Given its distance from the landfill, the source of this material may be a spill from the adjacent railroad tracks. Alternately, it could be that historical discharge of a dense product from the landfill followed the lagoon drainage channel that passes through this site

The percentage of abnormal larvae in the sea urchin bioassay exceeded CSLs both inside and outside the lagoon. A station cluster of potential concern (sites #3, #4, #5, and #6) exists for this bioassay, making it a priority for cleanup evaluation. The chemical data furnish no clues to the reason for the toxicity seen at sites #4, #5, and #6

Site	Amphipod % Survival	Sea Urchin % Normal	Polychaete % Survival	Polychaete Biomass (g)
Lab Control	90	82	100	11.3
Reference Area	95	77	100	10.9
#6	91	32*	100	9.3*
#5	95	35*	88	9.6*
#4	83	36*	96	11.5
#3	0*	0*	0*	- -

*significantly less ($p < 05$) than reference sediments

The amphipod and polychaete bioassays showed no acute toxicity at any location other than site #3. There was slightly less growth of polychaetes for outer lagoon site #5 and outside the lagoon at site #6, suggesting a low level of chronic toxicity to this species. The two bioassay "hits" at sites #5 and #6 are considered an exceedance of CSLs

Bioassays were not conducted at sites #1 and #2 adjacent to Whitmarsh, but historical data show toxicity to the amphipod *Rhepoxynius abronius* The historical data also indicate there is some toxicity in sediments outside the lagoon

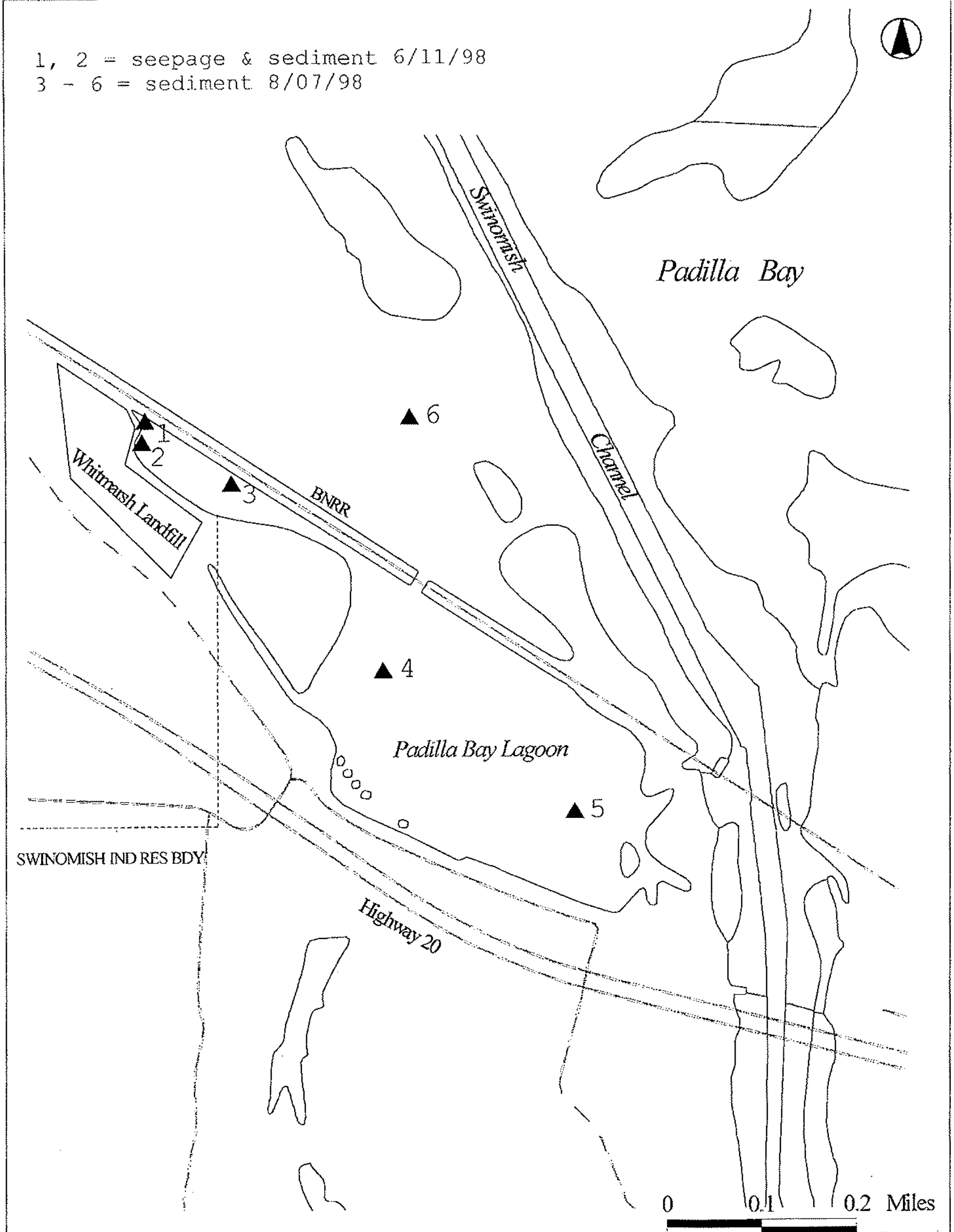


Figure 4. Location of Department of Ecology Samples Collected in 1998

Table 5. Water Quality of Whitmarsh Intertidal Seepage Collected June 11, 1998

Site Number:	1	2
Date:	11-Jun	11-Jun
Sample Number:	248005	248006
Salinity (ppt)	0.0	0.0
Conductivity (umhos/cm)	**1240**	**1020**
pH (lab)	**8.0**	**8.0**
Total Suspended Solids (mg/L)	**25**	**30**
Turbidity (NTU)	**26**	**190**
Ammonia (mg/L)	**3.2**	**6.8**
Nitrite-Nitrate (mg/L)	0.01 U	0.01 U
Phosphorus (mg/L)	**0.17**	**0.25**
Total Organic Carbon (mg/L)	**12**	9.3

U = Not detected at or above reported value (i.e., less than)

Table 6. Chemicals Detected in Whitmarsh Intertidal Samples Collected June 11, 1998

[Volatiles, semivolatiles, and pesticides show detected compounds only.]

Sample Type:	Seepage		Sediment	
Site Number:	1	2	1	2
Sample Number:	248005	248006	248007	248008
Priority Pollutant Metals (ug/L or mg/Kg, dry)				
Antimony	30 UJ	30 U	3 UJ	3 UJ
Arsenic	30 U	30 U	**11**	**12**
Beryllium	1 U	1 U	**0.39**	**0.40** U
Cadmium	4 U	4 U	0.5 U	0.5 U
Chromium	5 U	5 U	**65**	**59**
Copper	5 U	5 U	**44**	**39**
Lead	20 U	20 U	**13**	**13**
Mercury	0.05 U	0.05 U	**0.082**	**0.076**
Nickel	15 U	15 U	**51**	**42**
Selenium	40 U	40 U	**0.50**	**0.42**
Silver	4 U	4 U	0.4 U	0.4 U
Thallium	50 U	50 U	0.3 U	0.3 U
Zinc	5 U	5 U	**98**	**93**
Misc. Trace Elements (ug/L or mg/Kg, dry)				
Aluminum	**106**	**39**	**19900**	**19200**
Barium	**103**	**162**	**50**	**50**
Calcium	**43400**	**54500**	**6680**	**7240**
Cobalt	5 U	5 U	**8.8**	**9.1**
Iron	**5660**	**16200**	**47000**	**47500**
Magnesium	**37300**	**31400**	**13900**	**14000**
Manganese	**127**	**234**	**311**	**296**
Molybdenum	**7.4**	5 U	**3.1**	**3.1**
Potassium	**17400**	**15500**	**3380**	**3400**
Sodium	**137000**	**86200**	**20800**	**21300**
Strontium	**402**	**369**	**79** J	**94** J
Titanium	5 U	5 U	**1120**	**1170**
Vanadium	5 U	5 U	**68**	**66**
Cyanide (ug/L)	5 U	5 U	--	--

Note: Detections indicated in **bold**.
U = Not detected at or above reported value (i.e., less than)
J = The analyte was positively identified; associated numerical value is an estimated.
-- = Not analyzed.

Table 6. Whitmarsh June 1998 Chemicals (continued)

Sample Type:	Seepage		Sediment	
Site Number:	1	2	1	2
Sample Number:	248005	248006	248007	248008
Total Petroleum Hydrocarbons (ug/L or mg/Kg, dry)				
#2 Diesel	**850**	**470**	70 U	44 U
Lube Oil	80 U	80 U	180 U	**190***
Gasoline	120 U	120 U	34 U	38 U
Volatile Organic Compounds (ug/L)				
Benzene	**2.5**	**1.6**	--	--
Ethylbenzene	**0.10** J	1.0 U	--	--
Isopropylbenzene	**0.15** J	**0.29** J	--	--
Chlorobenzene	**0.55**	**0.92** J	--	--
1,2-Dichlorobenzene	**0.33** J	**0.28** J	--	--
1,4-Dichlorobenzene	**0.52** J	**0.42** J	--	--
1,2,4-Trimethylbenzene	**0.79** J	1 U	--	--
1,3,5-Trimethylbenzene	**0.14** J	1 U	--	--
Toluene	**0.86** J	**0.15** J	--	--
m & p-Xylene	**1.2** J	**0.41** J	--	--
o-Xylene	**1.3** J	**0.14** J	--	--
Naphthalene	**2.1**	1 U	--	--
Ethylether	1 U	**0.51** J	--	--
Low Molecular Weight Polyaromatic Hydrocarbons (ug/L or ug/Kg, dry)				
Naphthalene	**0.84**	**0.09** J	**66** J	**44** J
1-Methylnaphthalene	**0.49**	**0.52**	**50** J	**32** J
2-Methylnaphthalene	**0.39**	**0.28**	**87** J	**60** J
2,6-Dimethylnaphthalene	**0.10** J	**0.15**	**352**	**219**
1,6,7-Trimethylnaphthalene	0.12 U	**0.02** J	179 U	**37** J
Acenaphthene	**0.42**	**0.24**	**35** J	115 U
Flourene	**0.26**	**0.16**	**52** J	**29** J
Phenanthrene	**0.24**	**0.06** J	**198**	**112** J
1-Methylphenanthrene	0.12 U	**0.02** J	**287**	**234**
2-Methylphenanthrene	**0.04** J	**0.02** J	**61** J	**26** J
Anthracene	**0.04** J	**0.03** J	**64** J	**27** J

*Concentration was below quantitation limit (160 mg/Kg) in a duplicate analysis of this sample.

Table 6. Whitmarsh June 1998 Chemicals (continued)

Sample Type:	Seepage		Sediment	
Site Number:	1	2	1	2
Sample Number:	248005	248006	248007	248008
High Molecular Weight Polyaromatic Hydrocarbons (ug/L or ug/Kg, dry)				
Fluoranthene	**0.07** J	**0.02** J	**332**	**161**
Pyrene	**0.04** J	**0.04** J	**311**	**146**
Benzo(a)anthracene	**0.03** J	0.12 U	**123** J	**66** J
Chrysene	0 12 U	0.12 U	**240**	**112** J
Benzo(b)fluoranthene	0.12 U	0.12 U	**283**	**138**
Benzo(k)fluoranthene	0.25 U	0.25 U	**79** J	**40** J
Benzo(e)pyrene	0 12 U	0 12 U	**127** J	**72** J
Benzo(a)pyrene	0 25 U	0.25 U	**103** J	**35** J
Perylene	0.12 U	0 12 U	**263**	**123**
Indeno(1,2,3-cd)pyrene	0.62 U	0.62 U	**229** J	576 U
Benzo(g,h,i)perylene	0.12 U	0.12 U	**192**	**116**
Phenols (ug/L or ug/Kg, dry)				
Phenol	**0.08** J	0.12 U	**178** J	**271**
2-Methylphenol	**0.16**	0.25 U	**180**	**121**
4-Methylphenol	**0.30**	**0.10** J	**545**	**238**
2,4-Dimethylphenol	0.12 U	0 12 U	**288**	**118**
4-Chloro-3-methylphenol	**0.52**	0.12 U	179 U	115 U
Chlorinated Benzenes (ug/L or ug/Kg, dry)				
1,2-Dichlorobenzene	**0.18**	**0.13**	179 U	115 U
1,3-Dichlorobenzene	**0.01** J	0.25 U	359 U	231 U
1,4-Dichlorobenzene	**0.34**	**0.24**	179 U	115 U
Phthalate Esters (ug/L or ug/Kg, dry)				
Diethylphthalate	**0.19** J	**0.14** J	**25** J	576 U
Di-n-butylphthalate	0.12 U	0.12 U	**1380**	**698**
Bis(2-ethylhexyl)phthalate	0.12 U	0 25 U	**1630**	**421** J
Miscellaneous Semivolatiles (ug/L or ug/Kg, dry)				
N-Nitrosodiphenylamine	**0.41**	**1.5**	179 U	115 U
Dibenzofuran	**0.16**	**0.08** J	**53** J	**30** J
Carbazole	**0.18**	**0.18**	179 U	115 U
Dibenzothiophene	0 12 U	**0.05** J	179 U	115 U
3B-Coprostanol	0 62 U	0 62 U	**3370**	**2530**
Retene	0.25 U	0.25 U	**184**	**75** J

Table 6. Whitmarsh June 1998 Chemicals (continued)

Sample Type:	Seepage		Sediment	
Site Number:	1	2	1	2
Sample Number:	248005	248006	248007	248008
Polychlorinated Biphenyls (ug/L or ug/Kg, dry)				
PCB-1016	0.033 UJ	0.034 UJ	59 U	12 U
PCB-1221	0.033 UJ	0.034 UJ	59 U	12 U
PCB-1232	0.033 UJ	0.034 UJ	59 U	12 U
PCB-1242	**0.028** J	**0.011** J	59 U	12 U
PCB-1248	0.033 UJ	0.034 UJ	59 U	12 U
PCB-1254	0.033 UJ	0.034 UJ	59 U	12 U
PCB-1260	0.033 UJ	0.034 UJ	59 U	12 U
Organotins (ug/Kg, dry)				
Tributyltin chloride	- -	- -	**3.8** J	**3.6** J
Dibutyltin chloride	- -	- -	**3.9** J	**3.9** J
Monobutyltin chloride	- -	- -	**55** J	**44** J
Nitrogen-Containing Pesticides (ug/L or ug/Kg, dry)			nd	nd
Carbaryl	**4.5** J	**0.13** J	- -	- -
Organophosphorous Pesticides	nd	nd	nd	nd
Organochlorine Pesticides	nd	nd	nd	nd
Carbamate Pesticides				
Carbaryl	**5.8** J	**0.12** J	- -	- -
Herbicides	nd	nd	nd	nd

nd = None detected

Table 6. Whitmarsh June 1998 Chemicals (continued)

Sample Type:	Seepage		Sediment	
Site Number:	1	2	1	2
Sample Number:	248005	248006	248007	248008
Polychlorinated Dioxins (ng/Kg, dry)				
2,3,7,8-TCDD	- -	- -	**0.23** NJ	**0.22** J
1,2,3,7,8-PeCDD	- -	- -	**1.2** J	**0.83** J
1,2,3,4,7,8-HxCDD	- -	- -	**2.0** J	**1.4** J
1,2,3,6,7,8-HxCDD	- -	- -	**6.0**	**4.9** J
1,2,3,7,8,9-HxCDD	- -	- -	**5.8**	**4.5** J
1,2,3,4,6,7,8-HpCDD	- -	- -	**75**	**68**
OCDD	- -	- -	**579**	**490**
Polychlorinated Furans (ng/Kg, dry)				
2,3,7,8-TCDF	- -	- -	**1.8**	**1.9**
1,2,3,7,8-PeCDF	- -	- -	**0.79** J	**0.52** J
2,3,4,7,8-PeCDF	- -	- -	**1.3** J	**0.78** J
1,2,3,4,7,8-HxCDF	- -	- -	**2.1** J	**1.5** J
1,2,3,6,7,8-HxCDF	- -	- -	**1.1** J	**0.73** J
2,3,4,6,7,8-HxCDF	- -	- -	**1.6** J	**1.2** J
1,2,3,7,8,9-HxCDF	- -	- -	0.2 U	0.2 U
1,2,3,4,6,7,8-HpCDF	- -	- -	**14**	**12**
1,2,3,4,7,8,9-HpCDF	- -	- -	**1.0** J	**0.89** J
OCDF	- -	- -	**35**	**30**

NJ = There is evidence that analyte may be present; associated numerical value is an estimate.

Table 7. Chemicals Detected in Padilla Bay Lagoon Sediment Samples in 1998
[Volatiles and semivolatiles show detected compounds only. Metals concentrations are in mg/Kg; organics are in ug/Kg, except ng/Kg for dioxins & furans; all on a dry weight basis.]

						Outside	Samish
Location:	Inner Lagoon			Outer Lagoon		Lagoon	Bay
Site Number:	1	2	3	4	5	6	Ref. Area
Date:	11-Jun	11-Jun	7-Aug	7-Aug	7-Aug	7-Aug	7-Aug
Sample Number:	248007	248008	328004	328003	328002	328001	328000
Ancillary Parameters (%)							
Gravel	--	--	**6**	**4**	**0**	**1**	**0**
Sand	--	--	**21**	**6**	**78**	**24**	**64**
Silt	--	--	**50**	**59**	**15**	**53**	**22**
Clay	--	--	**23**	**31**	**7**	**22**	**13**
Total Organic Carbon	**3.8**	**3.6**	**9.8**	**3.7**	**1.3**	**2.7**	**0.9**
Priority Pollutant Metals							
Zinc	**98**	**93**	**111**	**80**	**48**	**68**	**42**
Chromium	**65**	**59**	**44**	**54**	**35**	**46**	**22**
Nickel	**51**	**42**	**40**	**46**	**31**	**41**	**26**
Copper	**44**	**39**	**35**	**38**	**21**	**33**	**12**
Lead	**13**	**13**	**34**	**12**	**6.6**	**50**	**5.8**
Arsenic	**11**	**12**	**9.8**	**11**	**6.7**	**8.9**	**4.8**
Beryllium	**0.39**	**0.40**	**0.30**	**0.38**	**0.23**	**3.0**	**0.25**
Silver	0.4 U	0.4 U	**0.70** J	**0.54** J	**0.47** J	**0.56** J	0.4 U
Selenium	**0.50**	**0.42**	**0.40**	**0.35**	**0.33**	0.3 U	0.3 U
Cadmium	0.5 U	0.5 U	**0.48**	0.4 U	0.4 U	0.4 U	0.4 U
Mercury	**0.082**	**0.076**	**0.095** J	**0.081** J	**0.047** J	**0.078** J	**0.048** J
Antimony	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ	3 UJ
Thallium	0.3 U	0.3 U	0.3 UJ	0.3 UJ	0.3 UJ	0.3 UJ	0.3 UJ
Other Metals							
Iron	**47000**	**47500**	**28300**	**26400**	**19500**	**25200**	**15100**
Aluminum	**19900**	**19200**	**14200**	**17600**	**10800**	**14100**	**8930**

Note: Detections indicated in **bold**.
-- = Not analyzed.
U = Not detected at or above reported value (i.e., less than)
J = The analyte was positively identified; associated numerical value is an estimated.
UJ = The analyte was not detected at or above the reported estimated result

Table 7. Chemicals in Lagoon Sediments (continued)

Location:	Inner Lagoon			Outer Lagoon		Outside Lagoon	Samish Bay
Site Number:	1	2	3	4	5	6	Ref. Area
Date:	11-Jun	11-Jun	7-Aug	7-Aug	7-Aug	7-Aug	7-Aug
Sample Number:	248007	248008	328004	328003	328002	328001	328000
Total Petroleum Hydrocarbons (mg/L or mg/Kg, dry)							
#2 Diesel	70 U	44 U	**5300** J	56 U	25 U	73 U	31 U
Lube Oil	180 U	**190**	**4000** J	140 U	63 U	180 U	77 U
Volatile Organic Compounds							
Carbon disulfide	- -	- -	**16** J	**5.6** J	**2.4** J	**7.8** J	5 U
2-Butanone	- -	- -	**31**	7.7 U	6 U	**28** U	5 U
Benzene	- -	- -	**10**	3 8 U	3 U	3.3 U	2.5 U
Toluene	- -	- -	**160**	**61**	**0.61** J	3.3 U	**1.1** J
Ethylbenzene	- -	- -	**260** J	3.8 U	3 U	3.3 U	2.5 U
m & p-Xylene	- -	- -	**2070**	7.7 U	6 U	6 7 U	5 U
o-Xylene	- -	- -	**350** J	3.8 U	3 U	3.3 U	2.5 U
Isopropylbenzene	- -	- -	**34**	3 8 U	3 U	3.3 U	2.5 U
n-Propylbenzene	- -	- -	**223** J	3.8 U	3 U	3.3	2.5 U
1,3,5-Trimethylbenzene	- -	- -	**130** J	3 8 U	3 U	3.3	2.5 U
1,2,4-Trimethylbenzene	- -	- -	**506**	3.8 U	3 U	3.3	2 5 U
Sec-Butylbenzene	- -	- -	**46**	3.8 U	3 U	3.3	2.5 U
p-Isopropyltoluene	- -	- -	**78**	3 8 U	3 U	3 3	2.5 U
n-Butylbenzene	- -	- -	**123**	3.8 U	3 U	3.3	2.5 U
Naphthalene	- -	- -	**131**	3.8 U	3 U	3 3 U	2.5 U
Low Molecular Weight Polyaromatic Hydrocarbons							
Naphthalene	**66** J	**44** J	**386**	**8.7** J	**11** J	**7.4** J	**8.4** J
1-Methylnaphthalene	**50** J	**32** J	**986**	**6.6** J	78 U	**4.6** J	**7.1** J
2-Methylnaphthalene	**87** J	**60** J	**1330**	**11** J	**9.5** J	**6.7** J	**8.6** J
2,6-Dimethylnaphthalene	**352**	**219**	**1120**	**14** J	**4.5** J	**29** J	**6.1** J
1,6,7-Trimethylnaphthalene	179 U	**37** J	**515**	61 U	78 U	52 U	**5.7** J
Acenaphthene	**35** J	115 U	**144** J	**4.2** J	**4.0** J	**3.1** J	**4.4** J
Fluorene	**52** J	**29** J	**140** J	**7.7** J	**5.8** J	**7.1** J	**14** J
Acenaphthylene	179 U	115 U	254 U	**6.4** J	**2.8** J	**3.9** J	**7.1** J
Phenanthrene	**198**	**112** J	**390**	**30** J	**18** J	**40** J	**101**
1-Methylphenanthrene	**287**	**234**	254 U	61 U	78 U	52 U	**65**
2-Methylphenanthrene	**61** J	**26** J	254 U	61 U	78 U	52 U	**53**
Anthracene	**64** J	**27** J	254 U	**9.1** J	**6.1** J	**11** J	**25** J
Total LPAH	**1252**	**820**	**5011**	**98**	**62**	**113**	**305**

Table 7. Chemicals in Lagoon Sediments (continued)

Location:	Inner Lagoon			Outer Lagoon		Outside Lagoon	Samish Bay
Site Number:	1	2	3	4	5	6	Ref Area
Date:	11-Jun	11-Jun	7-Aug	7-Aug	7-Aug	7-Aug	7-Aug
Sample Number:	248007	248008	328004	328003	328002	328001	328000
High Molecular Weight Polyaromatic Hydrocarbons							
Fluoranthene	**332**	**161**	254 U	**53** J	**38** J	**119**	**125**
Pyrene	**311**	**146**	254 U	**51** J	**33**	**94**	**110**
Benzo(a)anthracene	**123** J	**66** J	254 U	61 U	78 U	**32** J	**45**
Chrysene	**240**	**112** J	**151** J	121 U	**22** J	**49** J	**40**
Benzo(b)fluoranthene	**283**	**138**	1270 U	**45** J	**40** J	**52** J	**54** J
Benzo(k)fluoranthene	**79** J	**40** J	254 U	**14** J	**8.3** J	**14** J	**17** J
Benzo(e)pyrene	**127** J	**72** J	254 U	**16** J	**13** J	**20** J	**20** J
Benzo(a)pyrene	**103** J	**35** J	254 U	**17** J	**13** J	**18** J	**43**
Perylene	**263**	**123**	254 U	**46** J	**38** J	**42** J	**32** J
Indeno(1,2,3-cd)pyrene	**229** J	576 U	1270 U	**17** J	**9.7** J	**11** J	**27** J
Dibenzo(a,h,)anthracene	359 U	231 U	254 U	61 U	78 U	**28** J	**22** J
Benzo(g,h,i)perylene	**192**	**116**	1270 U	**12** J	392 U	**6.9** J	**25** J
Total HPAH	**2282**	**1009**	**151**	**271**	**215**	**486**	**560**
Phenols							
Phenol	**178** J	**271**	**820**	61 U	78 U	52 U	35 U
2-Methylphenol	**180**	**121**	**1740**	61 U	78 U	52 U	35 U
4-Methylphenol	**545**	**238**	**7950**	**16** J	**44** J	**17** J	**5.9** J
2,4-Dimethylphenol	**288**	**118**	**5580**	161 U	78 U	52 U	35 U
4-Nitrophenol	897 U	576 U	**570** J	605 U	784 U	516 U	349 U
Phthalate Esters							
Bis(2-ethylhexyl)phthalate	**1630**	**421** J	771 U	**119** J	157 U	**63** J	70 U
Di-n-butylphthalate	**1380**	**698**	254 U	61 U	83 U	52 U	71 U
Butylbenzylphthalate	897 U	576 U	**2970** J	303 U	392 U	258 U	174 U
Diethylphthalate	**25** J	576 U	1270 U	303 U	392 U	258 U	174 U

Table 7. Chemicals in Lagoon Sediments (continued)

Location:	Inner Lagoon			Outer Lagoon		Outside Lagoon	Samish Bay
Site Number:	1	2	3	4	5	6	Ref. Area
Date:	11-Jun	11-Jun	7-Aug	7-Aug	7-Aug	7-Aug	7-Aug
Sample Number:	248007	248008	328004	328003	328002	328001	328000
Miscellaneous Semivolatiles							
3B-Coprostanol	**3370**	**2530**	5090 U	**731** J	**432** J	**297** J	**188** J
Dibenzofuran	**53** J	**30** J	**81** J	**8.1** J	**5.9** J	**6.2** J	**6.4** J
Retene	**184**	**75** J	254 U	**22** J	**16** J	**18** J	**13** J
Dibenzothiophene	179 U	115 U	**145** J	61 U	78 U	52 U	35 U
Carbazole	179 U	115 U	254 U	61 U	78 U	52 U	**9.8** J
1,1'-Biphenyl	179 U	115 U	254 U	61 U	78 U	52 U	**6.5** J
Bis(2-chloroethyl)ether	359 U	231 U	254 U	61 U	78 U	**2.5** J	35 U
Polychlorinated Biphenyls							
PCB-1016	59 U	12 U	1.6 UJ	1.3 U	1.3 U	1.6 U	1.1 U
PCB-1221	59 U	12 U	1.6 UJ	1.3 U	1.3 U	1.6 U	1.1 U
PCB-1232	59 U	12 U	22 UJ	1.3 U	1.3 U	1.6 U	1.1 U
PCB-1242	59 U	12 U	2100 UJ	1.3 U	1.3 U	1.6 U	1.1 U
PCB-1248	59 U	12 U	63 UJ	1.3 U	1.3 U	1.6 U	1.1 U
PCB-1254	59 U	12 U	490 UJ	1.3 U	1.3 U	1.6 U	1.1 U
PCB-1260	59 U	12 U	7.9 UJ	1.3 U	1.3 U	1.6 U	1.1 U
Polychlorinated Dioxins							
2,3,7,8-TCDD	**0.23** NJ	**0.22** J	0.29 U	1.4 U	0.12 U	0.13 U	0.2 U
1,2,3,7,8-PeCDD	**1.2** J	**0.83** J	**0.46** J	**2.0** J	0.97 U	0.25 U	0.19 U
1,2,3,4,7,8-HxCDD	**2.0** J	**1.4** J	**0.91** J	**2.6** J	**0.26** J	0.22 U	0.47 U
1,2,3,6,7,8-HxCDD	**6.0**	**4.9** J	**2.2** J	**8.1**	**0.38** J	0.38 U	0.36 U
1,2,3,7,8,9-HxCDD	**5.8**	**4.5** J	**1.2** J	**4.0** J	0.29 U	0.32 U	0.2 U
1,2,3,4,6,7,8-HpCDD	**75**	**68**	**36**	**120**	7.6	1.4 U	**2.8** J
OCDD	**579**	**490**	**270**	**670**	77	**12**	**18** J
Polychlorinated Furans							
2,3,7,8-TCDF	**1.8**	**1.9**	**0.86** J	**0.83** J	0.25 U	0.2 U	0.3 U
1,2,3,7,8-PeCDF	**0.79** J	**0.52** J	1.4 U	**1.1** J	0.49 U	0.1 U	0.15 U
2,3,4,7,8-PeCDF	**1.3** J	**0.78** J	**0.36** J	2.3 U	0.15 U	0.14 U	0.22 U
1,2,3,4,7,8-HxCDF	**2.1** J	**1.5** J	0.43 U	**3.6** J	0.62 U	0.17 U	**0.36** J*
1,2,3,6,7,8-HxCDF	**1.1** J	**0.73** J	**0.61** J	**2.3** J	0.24 U	0.1 U	**0.22** J

NJ = There is evidence that analyte may be present; associated numerical value is an estimate.

*Not detected in a duplicate analysis of this sample

Table 7. Chemicals in Lagoon Sediments (continued)

Location:	Inner Lagoon			Outer Lagoon		Outside Lagoon	Samish Bay
Site Number:	1	2	3	4	5	6	Ref Area
Date:	11-Jun	11-Jun	7-Aug	7-Aug	7-Aug	7-Aug	7-Aug
Sample Number:	248007	248008	328004	328003	328002	328001	328000
Polychlorinated Furans (continued)							
2,3,4,6,7,8-HxCDF	**1.6** J	**1.2** J	**0.89** J	**3.7** J	0.43 U	0.3 U	**0.40** J*
1,2,3,7,8,9-HxCDF	0.2 U	0.2 U	0.21 U	0.93 U	0.42 U	0.2 U	0.18 U
1,2,3,4,6,7,8-HpCDF	**14.0**	**11.9**	20 U	**24**	7.3 U	1 U	**0.55** J
1,2,3,4,7,8,9-HpCDF	**1.0** J	**0.89** J	0.71 U	**2.0** J	0.78 U	0.29 U	0.24 U
OCDF	**35**	**30**	**12**	**38**	**4.5** J	0.7 U	**0.91** J*
TEQ**	**5.1**	**4.0**	**1.7**	**5.7**	**0.22**	**0.012**	**0.15**

*Not detected in a duplicate analysis of this sample.

**2,3,7,8-TCDD Equivalence (summed for all dioxin and furan congeners)

Table 8. Results of Bioassays on Sediments Collected from Padilla Bay Lagoon and Vicinity on August 7, 1998

[Mean of 5 replicates each; +/- 1 standard deviation]

Location	Site No.	Sample No.	Amphipod - 10 day		Polychaete - 20 day		Sea Urchin - 4 day
			% Survival	% Emergence	% Survival	Biomass (mg)	% Normal
Laboratory Control	- -	- -	90 +/- 4	10 +/- 5	100 +/- 0	11.3 +/- 1.3	82 +/- 7
Samish Bay	Ref. Area	32800	95 +/- 6	12 +/- 9	100 +/- 0	10.9 +/- 1.0	77 +/- 13
Outside Lagoon Entrance	6	328001	91 +/- 10	12 +/- 5	100 +/- 0	**9.3 +/- 1.3***	**32 +/- 15***
Outer Lagoon, E. End	5	328002	95 +/- 6	12 +/- 5	88 +/- 27	**9.6 +/- 0.7***	**35 +/- 18***
Outer Lagoon, W. End	4	328003	83 +/- 20	5 +/- 4	96 +/- 9	11.5 +/- 1.1	**36 +/- 19***
Inner Lagoon, N. Side	3	328004	**0 +/- 0***	**73 +/- 5***	**0 +/- 0***	NA	**0 +/- 0***

*Significantly less than reference area (t test, $p<.05$)

NA = Not applicable due to zero percent survival

Table 9. Padilla Bay Lagoon Sediment Chemistry Compared to Ecology Marine Sediment Management Standards

Location:	Inner Lagoon			Outer Lagoon		Outside Lagoon	Samish Bay	Sediment Quality Standard	Cleanup Screening Level
Site Number:	1	2	3	4	5	6	Ref. Area		
Metals (mg/Kg, dry weight)									
Arsenic	**11**	**12**	**9.8**	**11**	**6.7**	**8.9**	**4.8**	57	93
Cadmium	0.5 U	0.5 U	**0.48**	0.4 U	0.4 U	0.4 U	0.4 U	5.1	6.7
Chromium	**65**	**59**	**44**	**54**	**35**	**46**	**22**	260	270
Copper	**44**	**39**	**35**	**38**	**21**	**33**	**12**	390	390
Lead	**13**	**13**	**34**	**12**	**6.6**	**50**	**5.8**	450	530
Mercury	**0.082**	**0.076**	**0.95**	**0.081**	**0.047**	**0.078**	**0.048**	0.41	0.59
Silver	0.4 U	0.4 U	**0.70**	**0.54**	**0.47**	**0.56**	0.4 U	6.1	6.1
Zinc	**98**	**93**	**111**	**80**	**48**	**68**	**42**	410	960
Nonionizable Organic Compounds (mg/Kg TOC)									
Polyaromatic Hydrocarbons									
Total LPAH[a]	**11**	**5.9**	**11**	**1.8**	**3.7**	**2.7**	**18**	370	780
Naphthalene	**1.7**	**1.2**	**3.9**	**0.2**	**0.8**	**0.3**	**0.9**	99	170
Acenaphthylene	4.7 U	3.2 U	2.6 U	**0.2**	**0.2**	**0.1**	**0.8**	66	66
Acenaphthene	**0.9**	3.2 U	**1.5**	**0.1**	**0.3**	**0.1**	**0.5**	16	57
Fluorene	**1.4**	**0.8**	**1.4**	**0.2**	**0.4**	**0.3**	**1.6**	23	79
Phenanthrene	**5.2**	**3.1**	**4.0**	**0.8**	**1.4**	**1.5**	**11**	100	480
Anthracene	**1.7**	**0.8**	2.6 U	**0.2**	**0.5**	**0.4**	**2.8**	220	1200
2-Methylnaphthalene	**2.3**	**1.7**	**14**	**0.3**	**0.7**	**0.2**	**1.0**	38	64

Note: Detections indicated in **bold**

U = Not detected at or above reported value (i.e. less than)

[a] naphthalene+acenaphthylene+acenaphthene+fluorene+phenanthrene+anthracene

Table 9. Comparison to Sediment Management Standards (continued)

Location:	Inner Lagoon			Outer Lagoon		Outside Lagoon	Samish Bay	Sediment Quality Standard	Cleanup Screening Level
Site Number:	1	2	3	4	5	6	Ref. Area		
Nonionizable Organic Compounds (mg/Kg TOC)									
Polyaromatic Hydrocarbons									
Total HPAH[b]	**53**	**25**	**1.5**	**6.1**	**14**	**16**	**56**	960	5300
Fluoranthene	**8.7**	**4.5**	2.6 U	**1.4**	**2.9**	**4.4**	**14**	160	1200
Pyrene	**8.2**	**4.1**	2.6 U	**1.4**	**2.5**	**3.5**	**12**	1000	1400
Benzo[a]anthracene	**3.2**	**1.8**	2.6 U	1.6 U	6.0 U	**1.2**	**5.0**	110	270
Chrysene	**6.3**	**3.1**	**1.5**	3.3 U	**1.7**	**1.8**	**4.4**	110	460
Tot. Benzofluoranthenes	**9.5**	**4.9**	16 U	**1.6**	**3.7**	**2.4**	**7.9**	230	450
Benzo[a]pyrene	**2.7**	**1.0**	2.6 U	**0.5**	**1.0**	**0.7**	**4.8**	99	210
Indeno[1,2,3-c,d]pyrene	**6.0**	16 U	13 U	**0.5**	**0.7**	**0.4**	**3.0**	34	88
Dibenzo[a,h]anthracene	9.4 U	6.4 U	2.6 U	1.6 U	6.0 U	**1.0**	**2.4**	12	33
Benzo[g,h,i]perylene	**5.1**	**3.2**	13 U	**0.3**	30 U	**0.3**	**2.8**	31	78
Chlorinated Benzenes									
1,2-Dichlorobenzene	4.7 U	3.2 U	2.6 U	1.6 U	6.0 U	1.9 U	3.9 U	2.3	2.3
1,4-Dichlorobenzene	9.4 U	6.4 U	2.6 U	1.6 U	6.0 U	1.9 U	3.9 U	3.1	9
1,2,4-Trichlorobenzene	4.7 U	3.2 U	2.6 U	1.6 U	6.0 U	1.9 U	3.9 U	0.81	1.8
Hexachlorobenzene	4.7 U	3.2 U	2.6 U	1.6 U	6.0 U	1.9 U	3.9 U	0.38	2.3

[b] fluoranthene+pyrene+benzo[a]anthracene+chrysene+total benzofluoranthenes+benzo[a]pyrene indeno[1,2,3-c,d]pyrene+dibenzo[a,h]anthracene+benzo[g,h,i]perylene

Table 9. Comparison to Sediment Management Standards (continued)

Location:	Inner Lagoon			Outer Lagoon		Outside Lagoon	Samish Bay	Sediment Quality Standard	Cleanup Screening Level
Site Number:	1	2	3	4	5	6	Ref. Area		
Nonionizable Organic Compounds (mg/Kg TOC)									
Phthalate Esters									
Dimethyl phthalate	4.7 U	3.2 U	2.6 U	1.6 U	6.0 U	1.9 U	3.9 U	53	53
Diethyl phthalate	**0.7**	16 U	13 U	8.2 U	30 U	9.6 U	19 U	61	110
Di-N-butyl phthalate	**36**	**19**	2.6 U	1.6 U	6.4 U	1.9 U	7.9 U	220	1700
Butylbenzyl phthalate	24 U	16 U	**30**	8.2 U	30 U	9.6 U	19 U	4.9	64
Bis(2-ethylhexyl)phthalate	**43**	**12**	7.9 U	**3.2**	12 U	**2.3**	7.8 U	47	78
Di-N-Octyl phthalate	9.4 U	6.4 U	13 U	8.2 U	30 U	9.6 U	19 U	58	4500
Miscellaneous									
Dibenzofuran	**1.4**	**0.8**	**0.8**	**0.2**	**0.5**	**0.2**	**0.7**	15	58
Hexachlorobutadiene	4.7 U	3.2 U	2.6 U	1.6 U	6.0 U	1.9 U	3.9 U	3.9	6.2
N-Nitrosodiphenylamine	4.7 U	3.2 U	2.6 U	1.6 U	6.0 U	1.9 U	3.9 U	11	11
Poychlorinated Biphenyls									
Total PCBs	11 U	2.3 U	27 U	0.2 U	0.7 U	0.4 U	0.9 U	12	65
Ionizable Organic Compounds (ug/Kg, dry weight)									
Phenol	**178**	**271**	**820**	61 U	78 U	52 U	35 U	420	1200
2-Methylphenol	**180**	**121**	**1740**	61 U	78 U	52 U	35 U	63	63
4-Methylphenol	**545**	**238**	**7950**	**16**	**44**	**17**	**5.9**	670	670
2,4-Dimethylphenol	**288**	**118**	**5580**	161 U	78 U	52 U	35 U	29	29
Pentachlorophenol	897 U	576 U	1270 U	303 U	392 U	258 U	174 U	360	690
Benzyl alcohol	179 U	115 U	254 U	61 U	78 U	52 U	35 U	57	73
Benzoic acid	REJ	REJ	REJ	REJ	REJ	REJ	REJ	650	650

REJ = Data rejected ☐ = Exceeds SQS ▨ = Exceeds CSL

Table 10. Chemicals Exceeding or Approaching Sediment Standards in Padilla Bay Lagoon
[Concentrations in ug/Kg, dry; except BEHP in mg/Kg TOC]

Chemical Parameter	Site	Concentration	Standard Exceeded / Factor
Phenol	#3	820	MC / 2.0
2-Methylphenol	#1	180	CSL / 2.8
"	#2	121	CSL / 1.9
"	#3	1740	CSL / 28
4-Methylphenol	#3	7950	CSL / 12
2,4-Dimethylphenol	#1	288	CSL / 10
"	#2	118	CSL / 4.1
"	#3	5580	CSL / 192
Bis(2-ethylhexyl)phthalate	#1	43	MC / 0.9

MC = Marine Criteria
CSL = Cleanup Screening Level

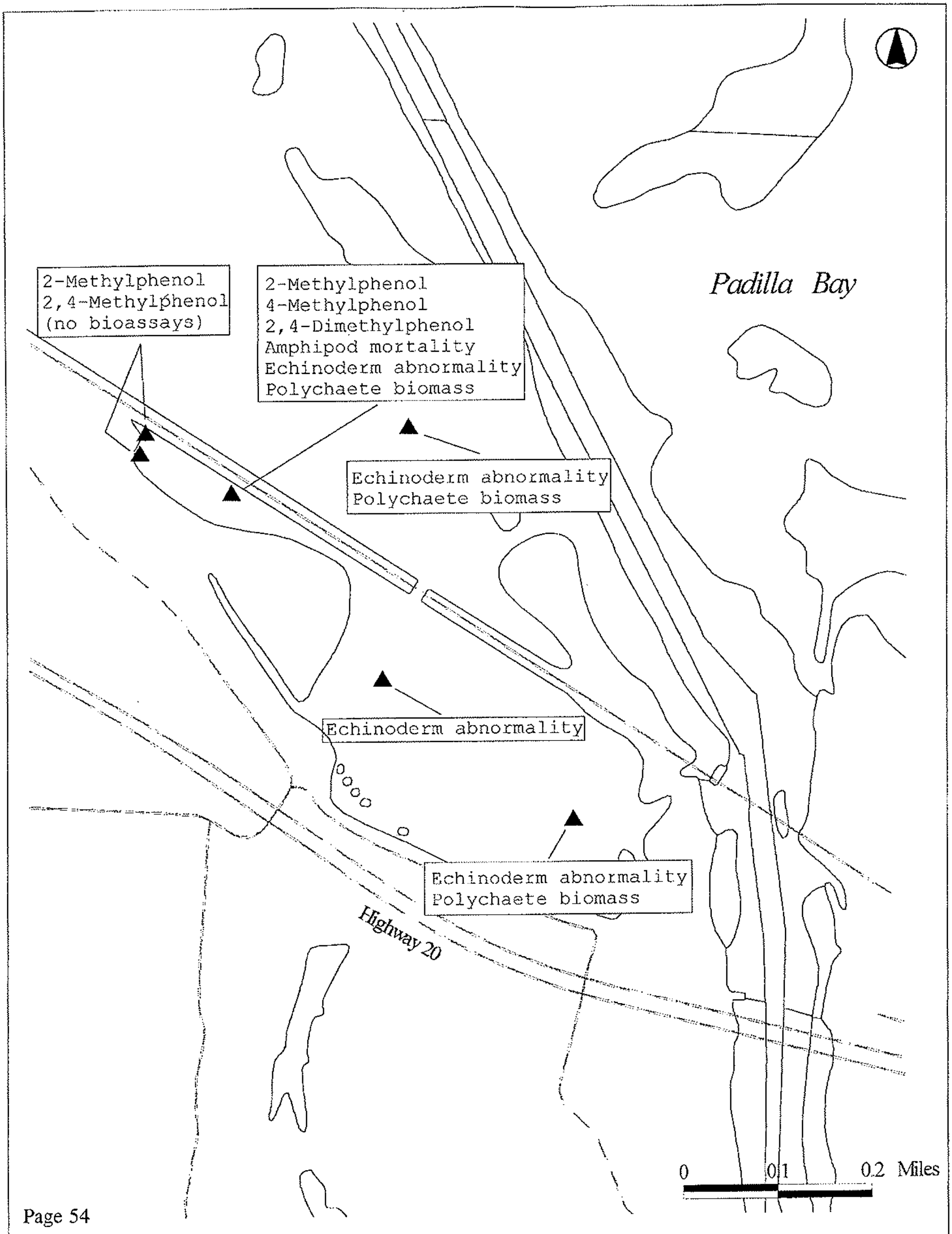


Figure 7. Sites Exceeding Cleanup Screening Levels in Padilla Bay Lagoon, 1998

Table 11. AETs for Non-SMS Chemicals Detected in Padilla Bay Lagoon and Reference Area

	Concentration Range (ug/Kg, dry)	Location of Maximum	Lowest AET	Highest AET
Metals (mg/Kg, dry)				
Antimony	3 UJ - 15 UJ	nd	200	- -
Beryllium	0.5 U - 3.0	#6	0.36	- -
Nickel	26 - 51	#1	>140	>140
Selenium	0.3 U - 0.40	#3	1.0	- -
Thallium	0.3 UJ - 25 U	nd	0.24	0.40
Organics (ug/Kg, dry)				
Ethylbenzene	2.5 U - 260 J	#3	10	37
Total Xylene	2.5 U - 2420 J	#3	40	120
Isopropyltoluene	2.5 U - 34	#3	600	2800
1-Methylphenanthene	52 U - 287 J	#1	370	1300
2-Methylphenanthrene	52 U - 61 J	#1	470	1500
Dibenzothiophene	35 U - 145 J	#3	240	950
Carbazole	52 U - 9.8 J	ref. area	970	3600
Coprostanol	188 - 3370	#1/#2	140	160
Biphenyl	52 U - 6.5 J	ref. area	260	310
Retene	13 J - 184	#1	1700	2000

Sources: PTI (1989) except antimony and nickel from PTI (1988b)
AET = Apparent Effects Threshold
U = Not detected at or above reported value (i.e., less than)
J = The analyte was positively identified; associated numerical value is an estimated.

Table 12 . Dioxin TEQs in Northern Puget Sound Sediments
[ng/Kg, dry]

	TEQ*			
Location	median	range	N =	Reference
Reference Areas				
Dungeness Bay	0.02	0 - 0.12	3	Ecology & Environment (1998)
Samish Bay	0.04	0.034 - 0.044	2	CH2M Hill (1992a,b)
" "	0.15	- -	1	present study
Urban/Industrial Areas				
Padilla Bay, outside lagoon	0.012	- -	1	present study
Outer Port Angeles Harbor	0.23	0.13 - 2.91	4	Ecology & Environment (1998)
March Point, Shell outfall	0.34	0.29 - 0.39	2	CH2M Hill (1992a)
March Point, Texaco outfall	0.32	0.28 - 0.36	2	CH2M Hill (1992b)
Inner Port Angeles Harbor	3.3	0.63 - 4.67	6	Ecology & Environment (1998)
Duwamish Waterway	3.6	1.22 - 4.39	3	Ecology (unpublished)**
Padilla Bay Lagoon	4.0	0.22 - 5.7	5	present study
Bellingham Bay, near pulp mill outfall	83	- -	1	Golding (1994)
Everett Harbor, near pulp mill outfall	110	- -	1	Anderson & Jones (1997)

*2,3,7,8-TCDD Equivalence
**Data provided by Bill Yake

APPENDIX B

Geophysical Report

Northwest
Geophysical
Associates, Inc.
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Phone: (541) 757-7231   FAX: (541) 757-7331
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October 3, 2008
NGA Ref: 683

Mr. David Haddock
CC: Mr. Niklas Bacher
Mr. John Luttinger
Mr. Koorus Tahghighi
AMEC Geomatrix
600 University Street, Suite 1020
Seattle, WA 98101

Re: ***Geophysical Site Investigation***
Whitmarsh Landfill
Anacortes, Washington

Dear Mr. Haddock:

This letter presents the results of the geophysical site investigation that Northwest Geophysical Associates, Inc. (NGA) performed at the Whitmarsh Landfill, Anacortes, Washington (see Figure 1 – Site Location Map). The field work was performed September 11-14, 2008. The purpose of the investigation was to characterize the fill material with the primary objective of identifying anomalies that could be consistent with concentrations of steel drums within the landfill footprint. An interpreted anomaly map is presented in this report as Figure 2.

Scope of Services

NGA conducted a geophysical site investigation, as described below, primarily on the central and southern section of the Whitmarsh Landfill site, measuring approximately 10 acres (Figure 1). The northern portion of the site is currently an active cedar mill and timber storage yard while the southern portion of the site is unoccupied. Northern portions of the site that included substantial surface metallic objects and/or litter (buildings, crane, metallic pipes and cables, export containers) were excluded from the geophysical investigation in consultation with AMEC Geomatrix, Inc. (AMEC) geophysicist, John Luttinger.

Field Methodology

The geophysical investigation included an electromagnetic (EM) survey utilizing the Geonics EM31 terrain conductivity meter and a magnetic (MAG) survey utilizing a Geometrics G858G magnetometer/gradiometer. Basic principles of these techniques are described in Attachment B, *Geophysical Detection of Buried Objects*.

Geophysical Investigation, Mill Operations, and Brush Clearance

Geophysical survey activities were coordinated with mill operations and brush clearance activities throughout the duration of the four survey days. NGA collected geophysical data over the mill and timber storage yard portions of the site during the first few days of the investigation which enabled mill equipment operators to move material stock piles (e.g. log stacks, bark material piles) during the last several days of the investigation. Movement of the material piles allowed NGA to complete the investigation of the site by collecting data in the areas previously covered by the material stock piles.

Also during the first day of the geophysical investigation, the southern third of the site was cleared of brush (e.g. blackberry brambles) which would have prevented the collection of geophysical data. Brush clearance was performed by track mounted, bladed heavy equipment operated by an AMEC subcontractor. NGA collected geophysical data in this area. Some areas with trees and blackberry brambles were left uncleared by the AMEC subcontractor; these were excluded from the geophysical survey.

Magnetic Data Acquisition

The MAG survey was conducted using a Geometrics G858G cesium magnetometer/gradiometer. This instrument was run in the “continuous” sampling mode, recording the magnetic field at 0.2 second intervals (approximately 1 foot). Two magnetic sensors spaced 0.5 meters apart, one above the other, were used to obtain the vertical magnetic gradient. Line spacing for the MAG survey was 10 feet. Magnetic survey lines are shown on Figures 3-5.

Electromagnetic Data Acquisition

EM data were acquired using a Geonics EM-31 terrain conductivity meter. Both quadrature-phase (apparent conductivity) and in-phase data were recorded. Data were recorded at a 0.2 second interval, corresponding to a distance of approximately 1 foot. Data were recorded on an Allegro handheld ruggedized field computer (Windows CE/DOS) running NAV31 software from Geomar of Mississauga, Ontario. EM data points are shown on Figures 6 and 7.

Survey Positioning

Both MAG and EM readings were positioned using individual Trimble AG132 GPS systems. The AG 132 GPS system is a real time differential GPS system using the

Omnistar satellite subscription service for the differential correction. The GPS system has "sub-meter" accuracy; hence positions are generally good to ±1-2 feet, but may be off by 2-3 feet. Positioning data are reported in the UTM zone 10N projection using the WGS 84 datum with units of US survey feet.

Survey Control

Several survey control reference points were located using a Trimble ProXRS DGPS (sub-meter accuracy) system. These Geophysical Survey Reference Points (Table 1 below) were marked in the field with survey lath, and are noted on Figures 1-7.

Table 1 – Geophysical Survey Reference Points
(UTM zone 10N, WGS84, US Survey foot)

Easting	Northing	Geophysical Survey Point
1754372.58	17611200.98	GSP-A
1754215.73	17611108.50	GSP-B
1754825.63	17610762.47	GSP-C
1754882.84	17610607.38	GSP-D
1754927.41	17610460.49	GSP-E
1754718.67	17610638.82	GSP-F
1754525.14	17611089.43	GSP-G
1754304.33	17610943.66	GSP-H

Data Processing

Magnetic (MAG) and electromagnetic (EM) data were gridded and contoured using the Geosoft Oasis Montaj Data Processing and Analysis software system.

Magnetic Field Data

Magnetic data are displayed on three figures, one plot of the analytic signal (Figure 3), the total magnetic signal (Figure 4), and the magnetic vertical gradient (Figure 5). The analytic signal is our preferred presentation as it provides a simplified signature and better resolution of the anomalous areas than unprocessed field data. A high in the analytic signal occurs directly over the magnetic "source." The analytic signal is described below.

The total magnetic field plot shows the data from the top sensor of the G858, which was also used to calculate the analytic signal. The vertical gradient is obtained by taking the difference in the magnetic field as measured by two sensors spaced 0.5 meters apart, one above the other. Anomalies will have both high and low values associated with them.

Analytic Signal

The analytic signal is derived from the total magnetic field data. It is presented here as a more concise display of that data set. On the color contour plot (Figure 3) values of the analytic signal below a threshold value are not colored (i.e., are white) and represent areas where little or no metallic material may be present. Higher amplitude anomalies generally indicate "stronger" source objects. A "stronger" source object may be more magnetic (generally a larger mass of steel), or it may be closer to the surface, or both. The amplitudes of the anomalies also depend upon the orientation of the source objects in the earth's magnetic field. This is especially true for elongate bodies such as pipes and cables.

The analytic signal is defined as the amplitude of the gradient vector of the total magnetic field data. The gradient (rate of change) of the total magnetic field is a vector field. The analytic signal is the magnitude of that vector, or the rate of change in the direction of maximum rate of change. The color contour plot shows the amplitude of the gradient.

Mathematically, the analytic signal can be expressed as:

$$A = \left[\left[\frac{\partial M}{\partial x} \right]^2 + \left[\frac{\partial M}{\partial y} \right]^2 + \left[\frac{\partial M}{\partial z} \right]^2 \right]^{\frac{1}{2}}$$

where:

A	is the analytic signal,
M	is the observed total magnetic field, and
∂	is the partial derivative operator.

Derivatives are calculated in the frequency domain, from the gridded total field data.

Further discussion of the concept of the analytic signal can be found in the following publication:

Roest, W.R., Verhoef, J., and Pilkington, M., 1992, "Magnetic interpretation using the 3-D analytic signal:" Geophysics, vol.57(1); p.116-125.

Electromagnetic Data

Both quadrature phase (conductivity) and in-phase EM data were recorded in the field. Appendix B includes a discussion of these two measured parameters of the EM response. Plots of both data sets are presented on Figures 6 and 7.

Generally, the ground conductivity was moderate, 40-50 millisiemen/meter (mS/m). Hence, any deviation, positive or negative, from that background likely indicates the presence of a metallic conductor or anomalous ground. Likewise the background in-phase response is +5.0 to +6.0 and any deviation, positive or negative, from that background likely indicates the presence of a metallic conductor.

RESULTS AND INTERPRETATION

Electromagnetic and magnetic data plots are presented on Figures 3-7. The interpretation of those data, in terms of possible locations of buried objects is summarized in Figure 2 and discussed below.

Electromagnetic Interpretation - Apparent Conductivity Trend

Electromagnetic data plots are presented on Figures 6 and 7. Three noticeable zones of apparent conductivity are present across the site, divided by two fairly abrupt transition zones. It is likely that these trends can be attributed to past activities at the site (e.g. landfill activities); however, it is just as likely that these trends are the result of more recent activities at the site (e.g. mill activities). Higher apparent conductivity values appearing in the southwest corner of the site may be related to the presence of a drainage ditch (and its contents) adjacent to the western edge of the survey area. Several EM anomalies likely indicative of metallic bodies appear throughout Conductivity Zone B.

> Conductivity Zone A:
> Figure 6 shows gridded quadrature phase (apparent conductivity) EM data. The northern portion of the site exhibits higher apparent conductivity values, averaging 50 mS/m. This area has been labeled Conductivity Zone A on Figures 2 and 6.
> Conductivity Zone B:
> An apparent conductivity transition appears in the southern third of the surveyed area where apparent conductivities are lower, averaging 25 mS/m. Both conductivity and in-phase readings are somewhat chaotic through this area, showing considerable small scale variations. This signature is indicative of concentrations of buried debris or landfill deposits. The area of lower apparent conductivity values is labeled as Conductivity Zone B on Figures 2 and 6.
> Conductivity Zone C:
> Another transition occurs in the southeast corner of the surveyed area, leaving an area of high conductivities, 90 mS/m and higher. The area of high apparent conductivity values is labeled as Conductivity Zone C on Figures 2 and 6.

Magnetic Anomalies

Magnetic Anomalies appear throughout the site, and are concentrated largely in the southern third of the surveyed area. Magnetic data plots are presented on figures 3-5. It is NGA's preference to select anomalies of interest from the analytic signal data, and magnetic anomalies discussed below have been selected from the analytic signal data with consideration being given to the total field and vertical magnetic gradient data.

> Small (single source) Magnetic Anomalies:
> Individual magnetic anomalies likely indicative of smaller single source bodies appear in abundance throughout the southern end of the site and are likely attributable to near surface landfill materials (e.g. appliances).

Large Magnetic Anomalies:
Several larger magnetic anomalies, displaying magnetic signature across two or more survey transect lines, also appear in this southern section of the site. These are likely attributable to concentrations of landfill materials/metallic items in the near subsurface.

Linear MAG/EM Anomaly:
A long linear anomaly appears in the magnetic analytic signal between GSP-H and the western property survey marker. This anomaly also appears in the conductivity data, and may indicate the presence of a deeper steel pipe, and/or perhaps a reinforced concrete pipe. The anomaly is not consistent with MAG or EM data signatures exhibited by buried drums; such anomalies exhibit much stronger and more chaotic MAG and EM readings than those observed from this linear pipe-like anomaly.

Anomalies of Interest

NGA selected eleven Anomalies of Interest from the MAG and EM geophysical data. The anomalies are listed in Table 2 and discussed below.

Table 2 – Anomalies of Interest Locations
(UTM zone 10N, WGS84, US Survey foot)

TargetID	Easting X	Northing Y	Type
G1	1754679.3	17610635.4	MAG
G2	1754774.4	17610551.6	MAG
G3	1754906.4	17610810.4	MAG
G4	1754869.6	17610593.8	MAG
G5	1754754.7	17610895.9	MAG
G6	1754582.2	17610924.6	MAG
G7	1754924.2	17610532.9	MAG
G8	1754696.4	17610909.1	MAG
G9	1754576.9	17610997.9	EM
G10	1754288.8	17611033.2	EM
G11	1754842.7	17610724.9	EM

Targets G1-G8 were selected from MAG data (primarily from analytic signal data), and are targets which exhibited a magnetic signature across two or more transect survey lines. Anomalies exhibiting signatures across two or more transect survey lines are more likely to be concentrations of metallic debris in the subsurface than single source items. Anomalies G9-G11 were selected from EM data (primarily from the in-phase data), and are anomalies which exhibited EM signatures across two or more data transects, and were consistent with anomalies exhibited by metallic conductive bodies.

Closure

Northwest Geophysical Associates, Inc. performed this work in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No warranty, express or implied, beyond exercise of reasonable care and professional diligence, is made. This report is intended for use only in accordance with the purposes of the study described within.

Please feel free to contact us if you have any questions or comments regarding this information, or if you require further assistance. We appreciated the opportunity to work with you on this project.

Sincerely,

Northwest Geophysical Associates, Inc.

Neil McKay
Project Geophysicist

Attachments:	Figures 1-7 Attachment B: Geophysical Detection of Buried Objects

File: Whitmarsh LF_rpt03.doc
NGA Project: 683

NGA PROJECT #: 683 FILE: Fig1_SiteMap.DWG DATE: Sept 2008 REVISION: A-19-SEPT-08

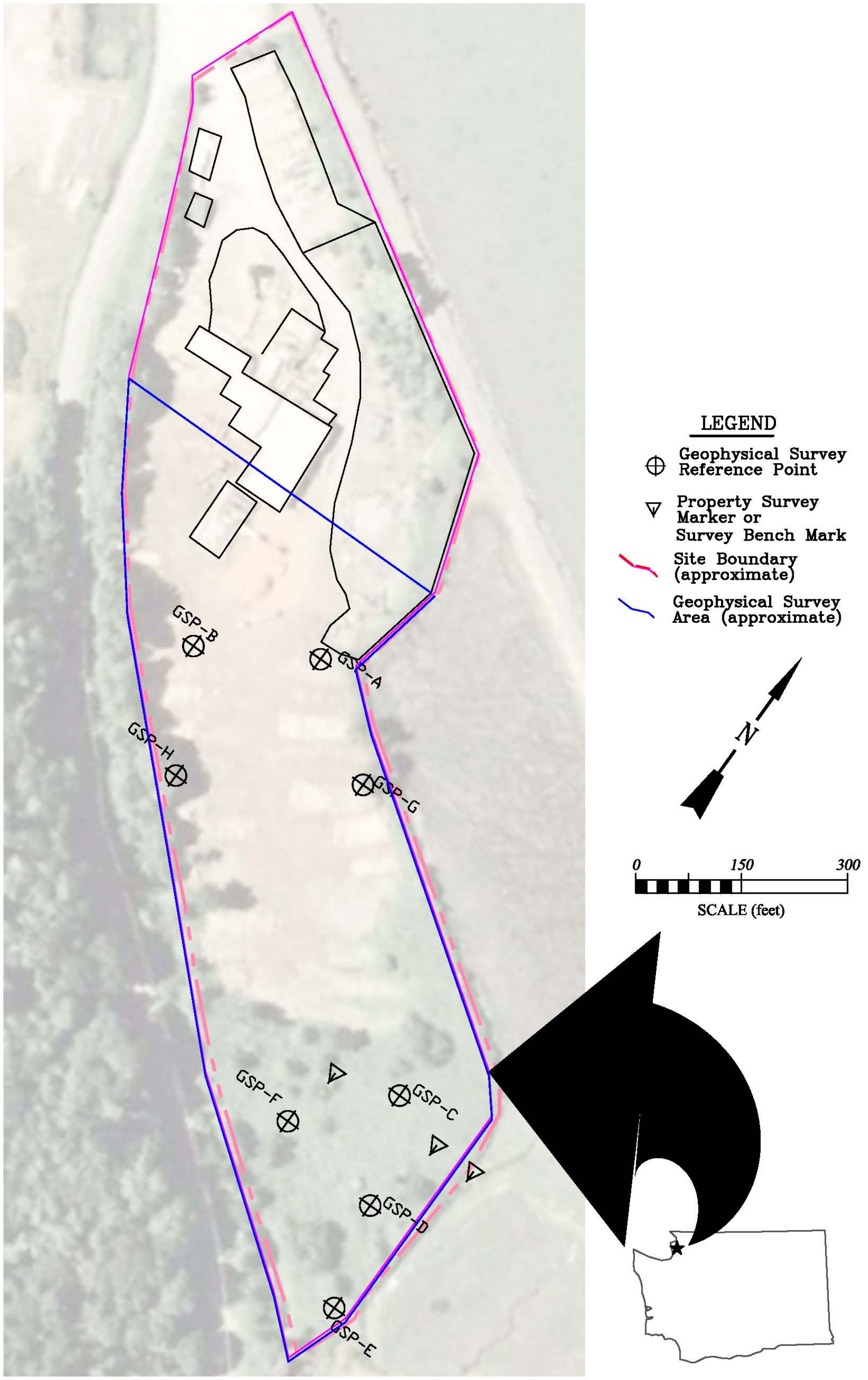


*Image from AMEC-Geomatrix Consultants
Image geo-referenced to site features

FIGURE 1

Site Map

Geophysical Investigation
Whitmarsh Landfill
Skagit County, Washington

Prepared by:
Northwest Geophysical Associates, Inc.
P.O. Box 1063, Corvallis, Oregon 97339

NGA PROJECT #: 683 FILE: Fig2_GeoInterp.DWG DATE: Sept 2008 REVISION: A-19-SEPT-08

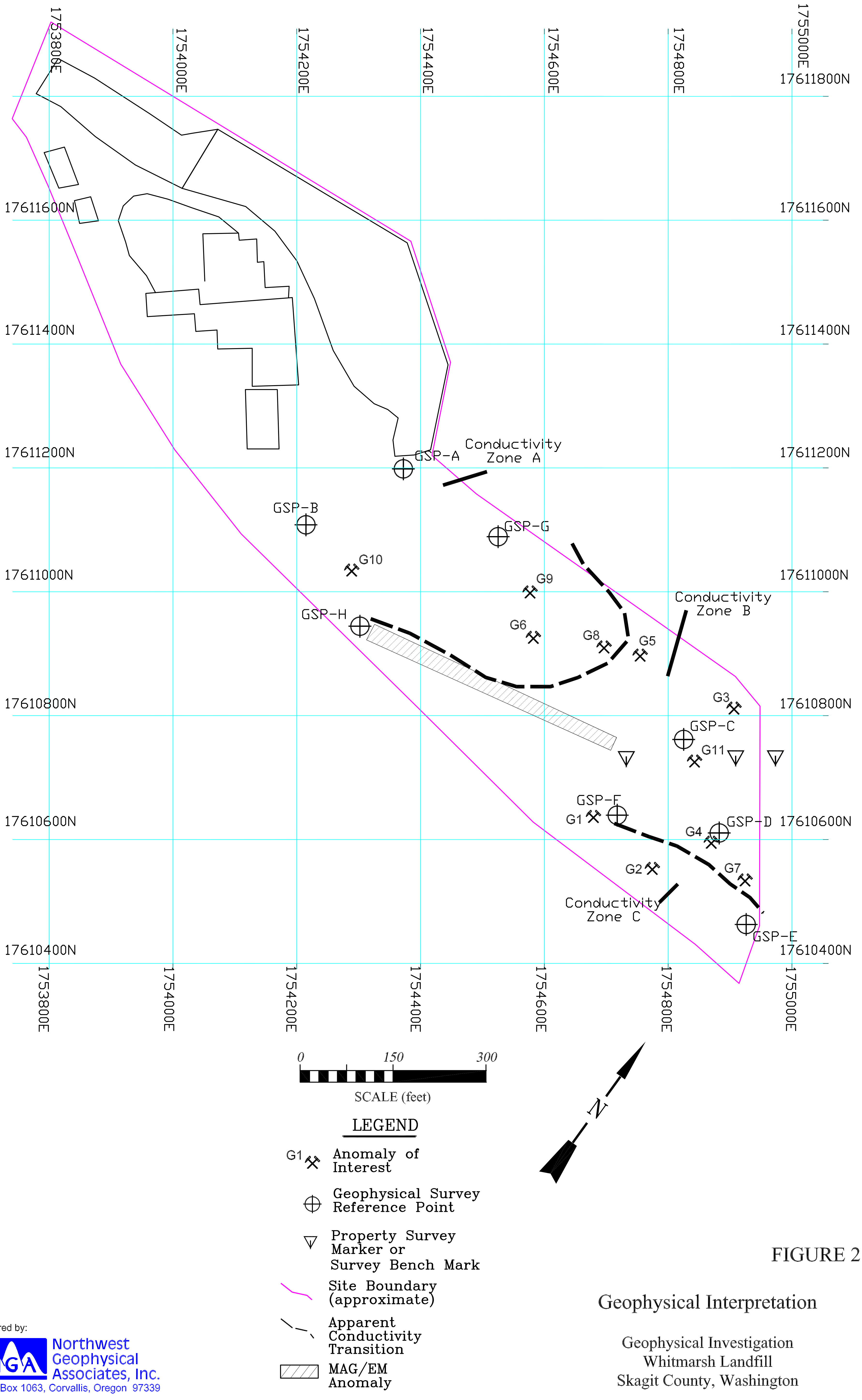


FIGURE 2

Geophysical Interpretation

Geophysical Investigation
Whitmarsh Landfill
Skagit County, Washington

Prepared by:
Northwest Geophysical Associates, Inc.
P.O. Box 1063, Corvallis, Oregon 97339

REVISION: A-17-SEPT-08 DATE: SEPT-2008 FILENAME: Fig 3_AnSig_UTMfeet.map NGA PROJECT #: 683

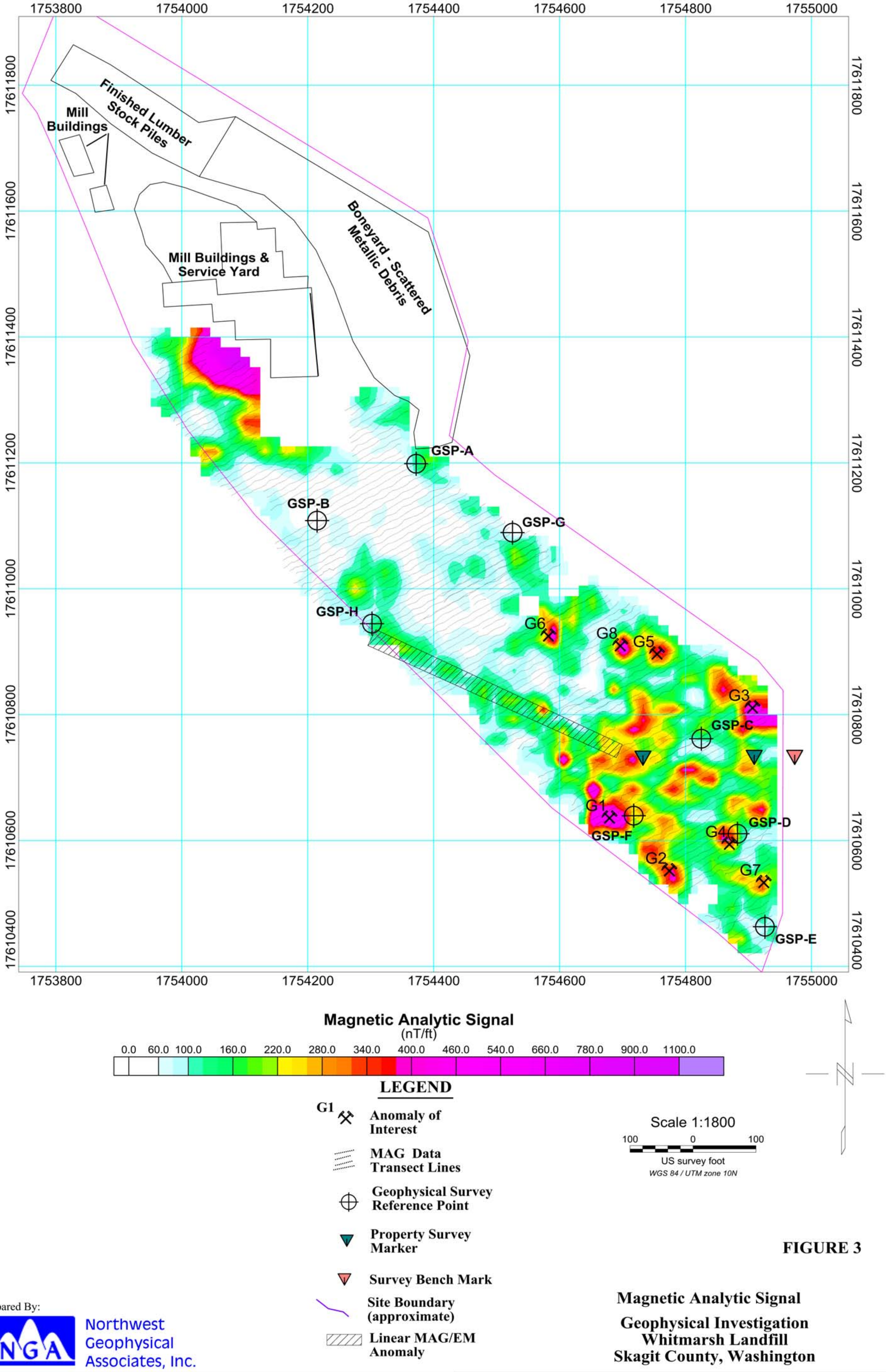


FIGURE 3

Magnetic Analytic Signal

Geophysical Investigation
Whitmarsh Landfill
Skagit County, Washington

Prepared By:
Northwest Geophysical Associates, Inc.

REVISION: A-17-SEPT-08 DATE: SEPT-2008 FILENAME: Fig 4_TotalFieldTop_UTMfeet.map NGA PROJECT #: 683

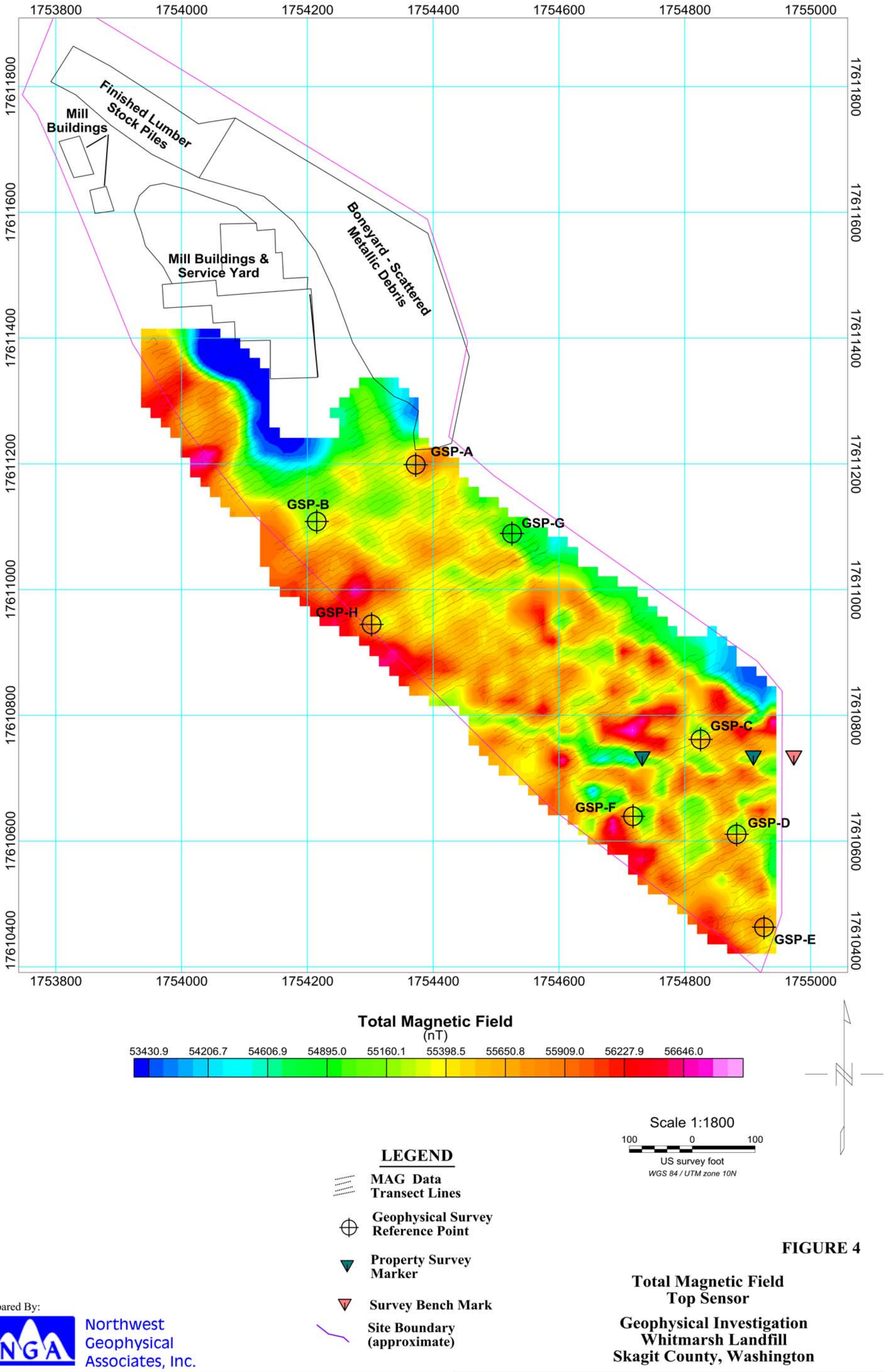


FIGURE 4

Total Magnetic Field
Top Sensor

Geophysical Investigation
Whitmarsh Landfill
Skagit County, Washington

Prepared By:
Northwest Geophysical Associates, Inc.

REVISION: A-17-SEPT-08 DATE: SEPT-2008 FILENAME: Fig 5_Vgrad_UTMfeet.map NGA PROJECT #: 683

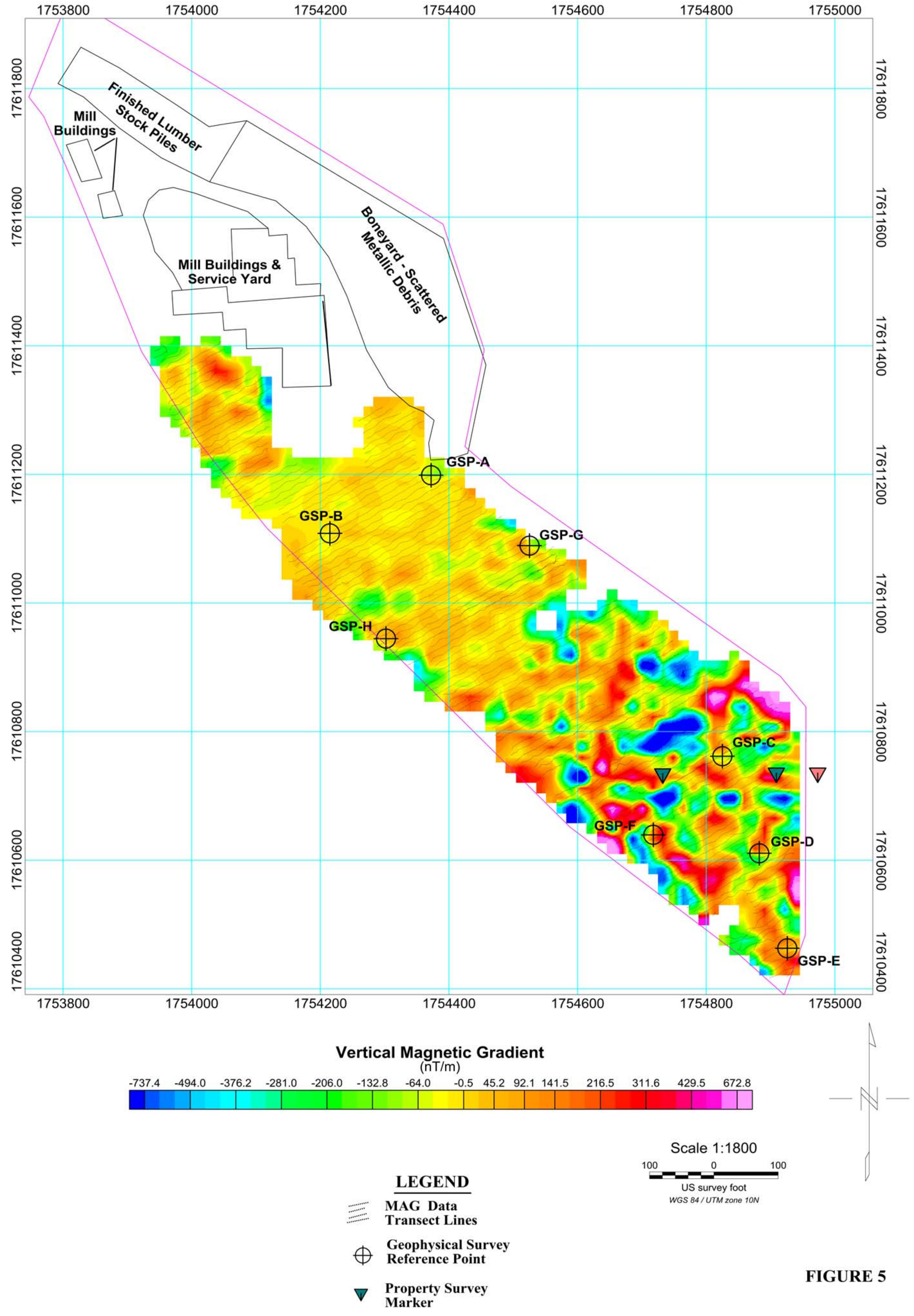


FIGURE 5

Vertical Magnetic Gradient

Geophysical Investigation
Whitmarsh Landfill
Skagit County, Washington

Prepared By:
Northwest Geophysical Associates, Inc.

REVISION: A-17-SEPT-08 DATE: SEPT-2008 FILENAME: Fig 6_EMQ_UTMfeet.map NGA PROJECT #: 683

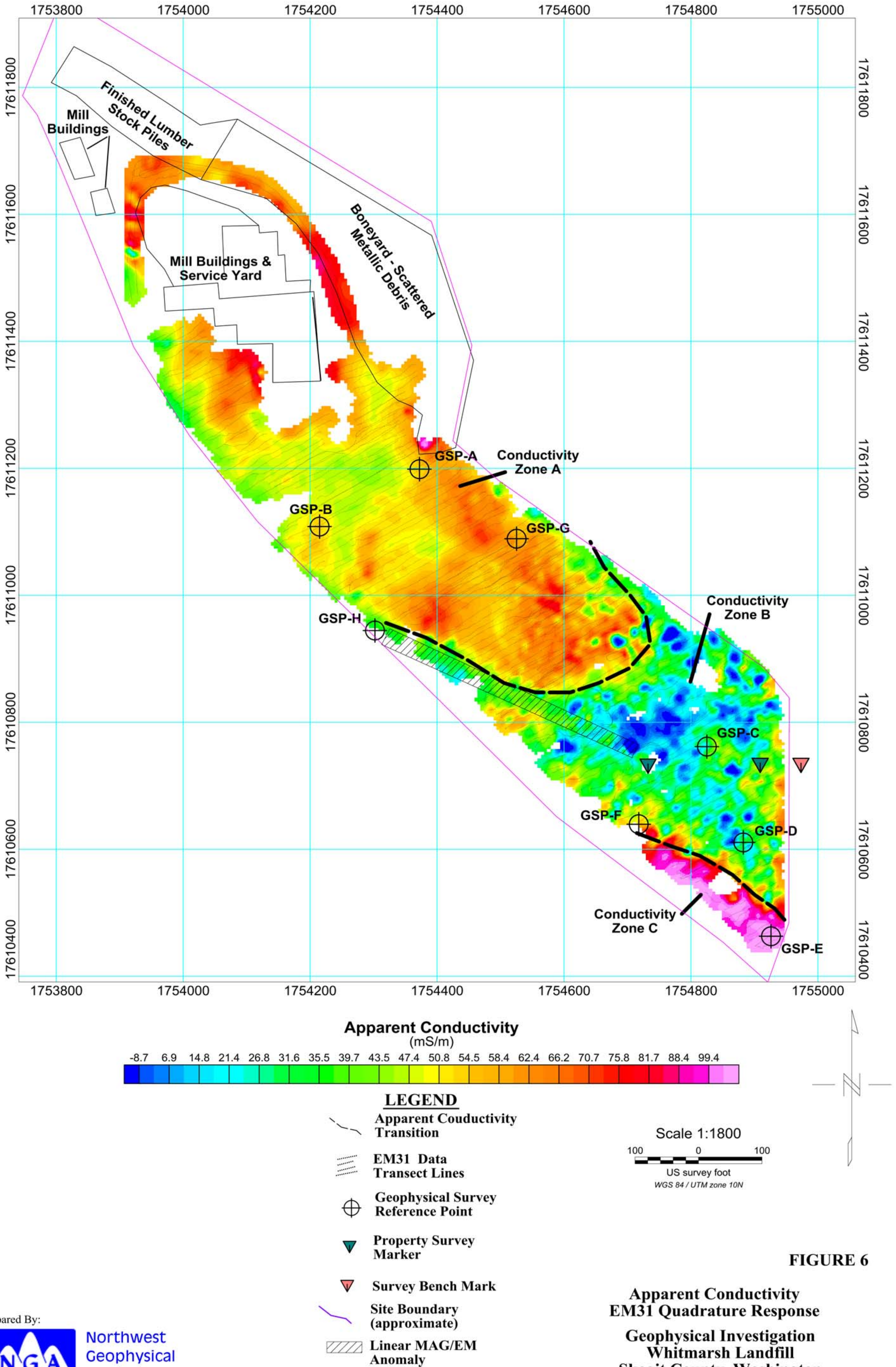


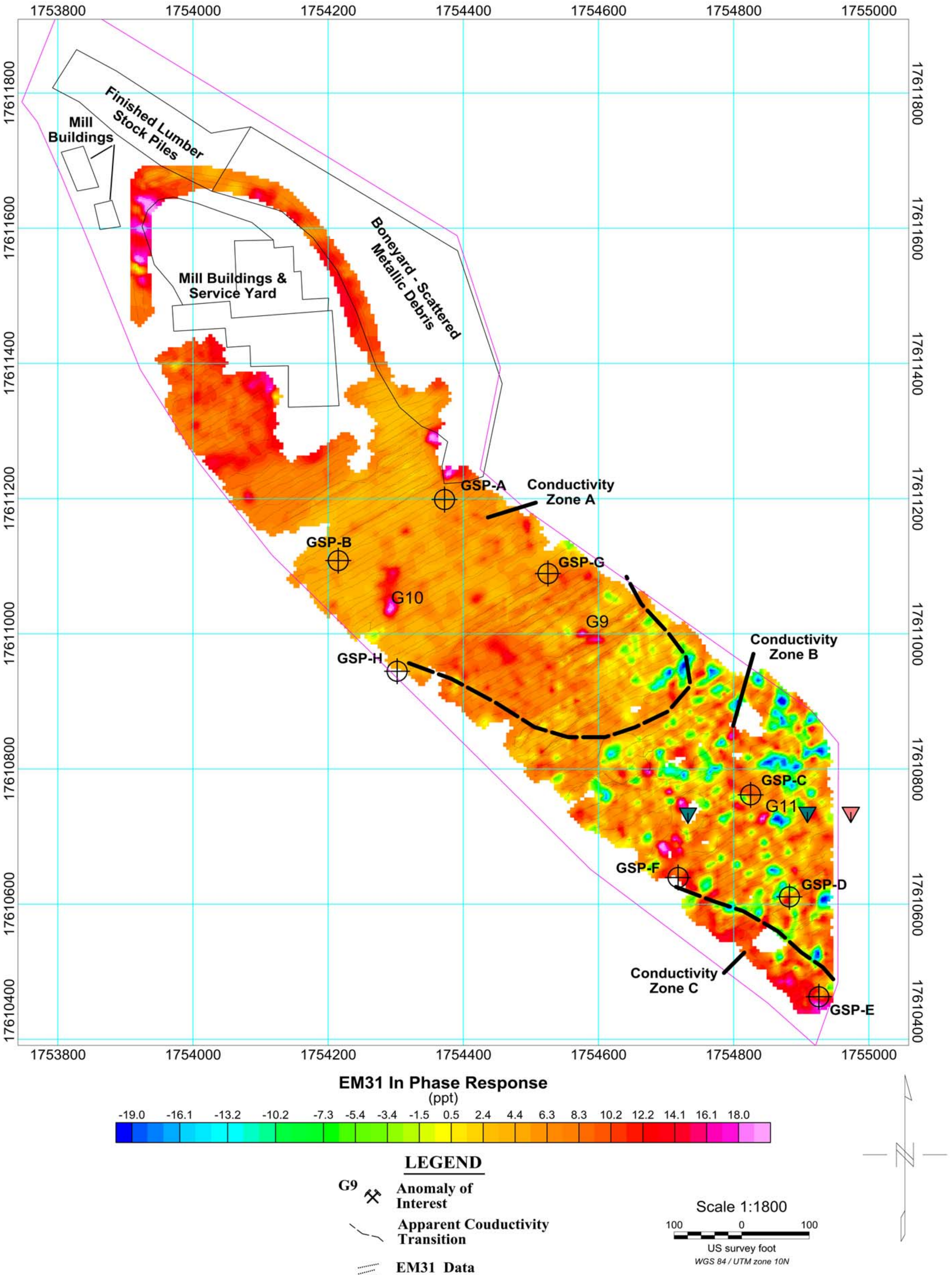
FIGURE 6

Apparent Conductivity
EM31 Quadrature Response

Geophysical Investigation
Whitmarsh Landfill
Skagit County, Washington

Prepared By:
Northwest
Geophysical
Associates, Inc.

REVISION: A-17-SEPT-08 DATE: SEPT-2008 FILENAME: Fig 7_EMI_UTMfeet.map NGA PROJECT #: 683



LEGEND

G9 ⚒ Anomaly of Interest

Apparent Couductivity Transition

EM31 Data Transect Lines

⊕ Geophysical Survey Reference Point

▼ Property Survey Marker

▼ Survey Bench Mark

Site Boundary (approximate)

FIGURE 7

EM31 In Phase Response

Geophysical Investigation
Whitmarsh Landfill
Skagit County, Washington

Prepared By:
NGA Northwest Geophysical Associates, Inc.

Geophysical Site Investigation
Whitmarsh Landfill
Skagit County, Washington

Attachment B

NGA Technical Note

Geophysical Detection of Buried Objects

Geophysical Detection of Buried Objects

Ground Penetrating Radar

Electromagnetics *EM31*

Magnetics

Electromagnetics - *EM61-MK2*

COVER rev.4, JUNE 2006

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DISCUSSION OF GEOPHYSICAL TECHNIQUES

GEOPHYSICAL DETECTION OF BURIED OBJECTS

Revision June 2006

INTRODUCTION

Several geophysical techniques are used for locating buried objects such as underground storage tanks, pipes, utilities, drums and other debris. These techniques are used routinely, and are often recommended or required by state agencies, funding institutions and/or the EPA, particularly on sites where underground burial of steel drums or other debris may have occurred or where underground storage tanks are suspected.

Geophysics is generally used in the early reconnaissance phase of these investigations as a guide to sampling, excavation and/or placement of monitoring wells. In this paper we discribe three of the most common geophysical techniques, electromagnetics (EM), magnetics (MAG) and ground penetrating radar (GPR).

UTILITY OF GEOPHYSICS:

First, a few words about "geophysics" as used for environmental and geotechnical engineering applications. Surface geophysical techniques probe subsurface materials (soils and rock) using surface instruments. This is done by measuring physical signals which have interacted with the earth materials. These signals may be electrical, magnetic, acoustic (seismic) or electromagnetic.

Surface geophysics offers several advantages over other exploration techniques:

1) Surface geophysical methods are *"non-intrusive"* in that they do not disturb the ground surface, or stir up any contaminants which might be in the soil.

2) Geophysical methods *measure earth properties over a large volume*. Whereas drilling only samples the earth at the point of the borehole, the measured geophysical response is affected by earth materials several feet, or tens of feet, away from the instrument sensor. This allows broad areas to be effectively "screened" with a series of surface measurements.

3) Most geophysical equipment used in environmental and geotechnical applications *can be hand carried*. Geophysical surveys do not require vehicular access, but only a walking path, clear of brush and obstacles.

4) Geophysical surveys are relatively *inexpensive* and can be performed quickly.

TYPICAL OBJECTIVES:

Geophysics may be used in either the reconnaissance mode, or in a detailed survey mode. In the reconnaissance mode, geophysics is used to "screen" large areas to determine the presence or absence of buried objects. In more detailed surveys, the location and extent of the object is mapped in greater detail. This facilitates the efficient excavation of tanks or debris, aids the effective placement of monitoring wells, or improves the design of a sampling program.

The techniques discussed here are also useful for objectives other than identifying buried objects. Electromagnetic induction (EM) is especially useful in mapping changes in soil (e.g. sand or gravel channels), mapping clay aquitards and mapping contaminant leachate plumes in groundwater. GPR can be used to map shallow stratigraphy or to map zones of disturbed soils.

GEOPHYSICAL METHODS:

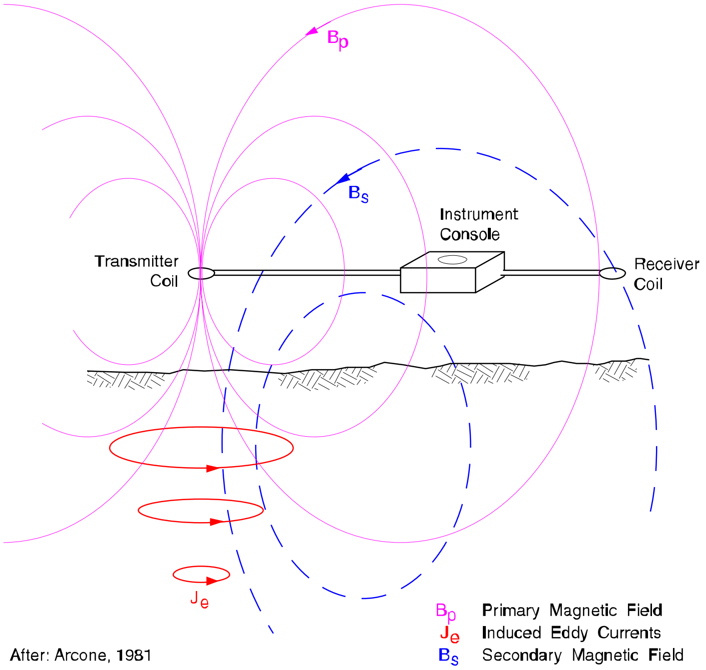
Three geophysical methods are commonly used in the search for buried objects: 1) electromagnetic induction (EM), 2) magnetics (MAG), and 3) ground penetrating radar (GPR). EM and magnetics are complementary methods, most effective in the reconnaissance mode but also useful for more detailed work. GPR is most effective for detailed work, but may also be used in reconnaissance surveys.

Electromagnetic Methods:

The electromagnetic induction (EM) technique measures the electrical conductivity of the earth by inducing a time varying electric current in the earth. This is shown schematically in Figure 1. The EM technique was developed to measure natural soil conductivity to aid in identifying soil types and to measure rock conductivity in order to identify zones of conductive mineralization.

FIGURE 1

PRINCIPLES OF ELECTROMAGNETIC INDUCTION



After: Arcone, 1981

Man-made metallic objects are generally orders of magnitude more conductive than natural soils. Thus, the electric currents induced in the ground by EM instruments will be dramatically affected by the presence of any man-made metallic object. Examples include pipes, tanks, cables, concrete reinforcing steel, or steel drums. By looking for anomalous signals which cannot be attributed to natural soils, buried metallic objects can readily be identified.

Frequency-domain EM – EM31

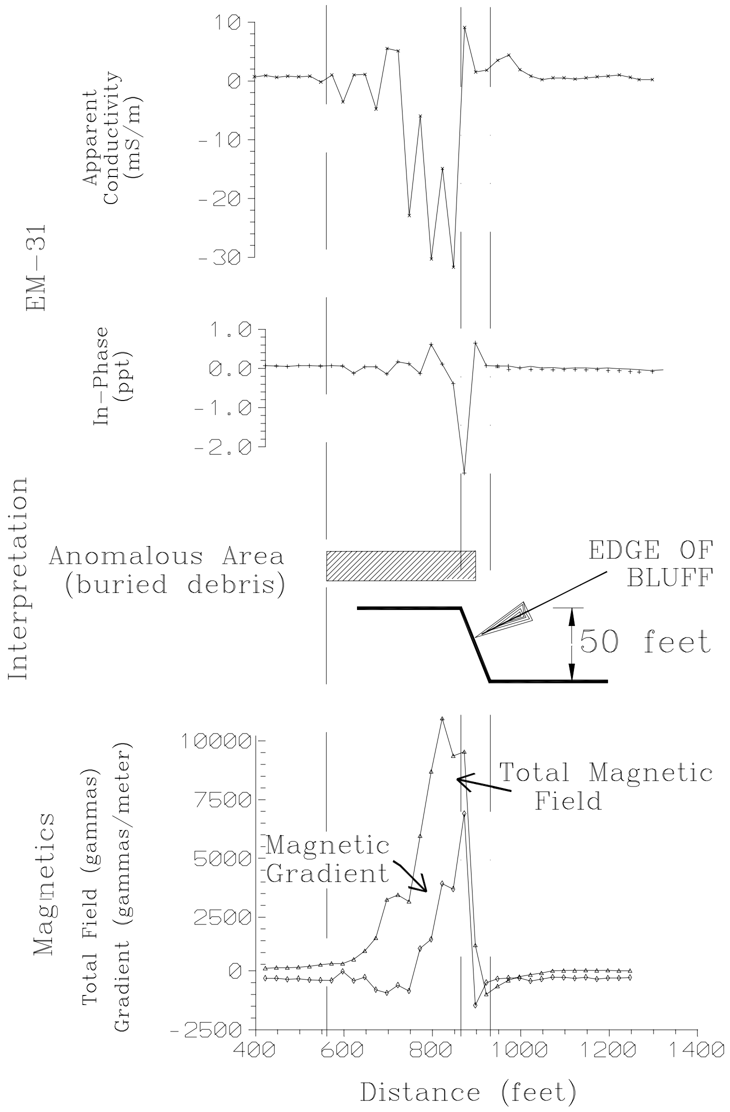
Frequency domain EM systems transmit a sinusoidal waveform at a fixed frequency, or multiple frequencies. The resulting secondary magnetic field may be phase shifted, depending on the nature of the target. Both the in-phase component (in phase with the primary magnetic field) and the quadrature phase component (shifted 90° from the primary field) can be measured to provide the phase shift information.

The Geonics EM-31 is a common frequency domain EM instrument, often used for buried object detection. The upper left photo on the cover shows the EM-31 in a field situation. A transmitter coil is in one end of the boom and a receiver coil in the other end. Depth of investigation is generally 10-15 feet, but the EM-31 may detect large metal objects at a somewhat greater distance. The instrument can quickly cover a wide area, mapping anomalous areas (metallic object locations) as well as changes in the soil character.

Figure 2 shows some sample data over a disposal site where 55 gallon steel drums had been dumped on the edge of a bluff and then covered with soil, extending the bluff for tens of feet (cross hatched block in Figure 2). The noisy and/or negative "apparent" conductivity is a clear indicator of metallic objects. The EM-31 also records an "in-phase response" which aids in identifying metallic conductors. Data in Figure 2 indicate the zone of burial extends from 560 feet to 940 feet along the line of the profile.

FIGURE 2

SAMPLE EM31 & MAGNETIC PROFILES



LINE 831S, King Salmon, AK

Time-domain EM – EM61

Time-domain EM systems transmit a magnetic pulse, with a duration in the order of 10s of micro-seconds (µs). That magnetic pulse induces electric currents in the ground as well as in any metallic object which is buried (or on the surface) within its range of influence. Currents induced in metallic conductors decay at a much slower rate than currents induced in the ground. Hence, metallic conductors can be easily identified.

The EM61-MK2 is a time domain metal detector manufactured by Geonics, Ltd., of Toronto, Canada. The EM61-MK2 instrument consists of two horizontal air cored coils, 1.0 meter by 0.5 meters in size. The bottom coil acts as a receiver and transmitter and the top coil as a receiver. The top coil is mounted 28 centimeters above the bottom coil. The instrument weighs about 75 lbs. and is pulled by one operator.

The Geonics EM61-MKII has 4 time gates, to measure the rate of decay of the signal, and two receiver coils, to measure the field gradient. The rate of decay is dependant on the size, shape, and orientation of the metallic object. Generally, they are used to estimate gross target parameters, but can be used for more detailed discrimination of targets, particularly in identifying unexploded ordnance (UXO) materials.

The two receiver coils are very helpful in the recognition of near surface objects from deeper objects. Since the amplitude of the response is highly dependent on the distance between the coil assembly and target, small near surface targets often produce a response orders of magnitude larger than targets having greater size at deeper depths. This masking effect form the near surface materials is drastically reduced by processing output of the two coils, essentially subtracting the bottom coil data from the top coil data. This is referred to as the differential mode or the differential signal.

Figure 3 shows some sample data over a 55 gallon steel drums partially buried, essentially flush with the surface of the ground. The response from the top and bottom coils is indicative of a substantial metallic presence. The relatively weak differential response is indicative of a shallow target.

FIGURE 3

EM61 & MAGNETIC PROFILES OVER PRATIALLY BURRIED 55 GALLON DRUM

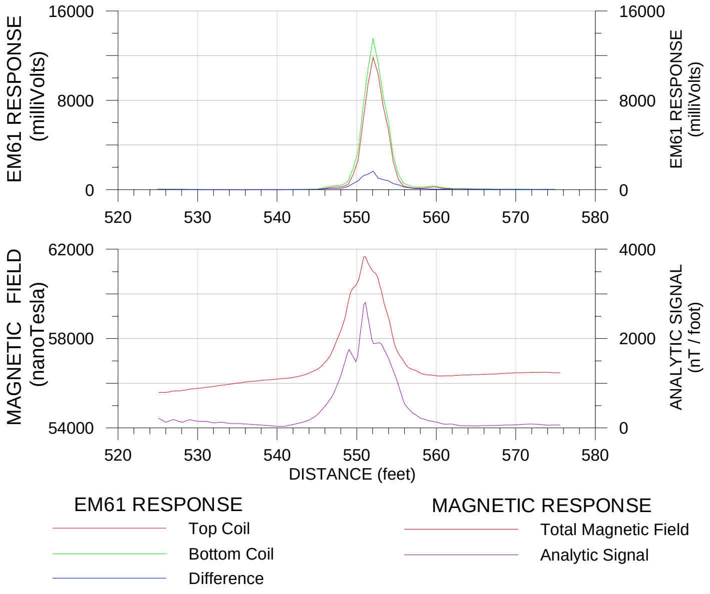
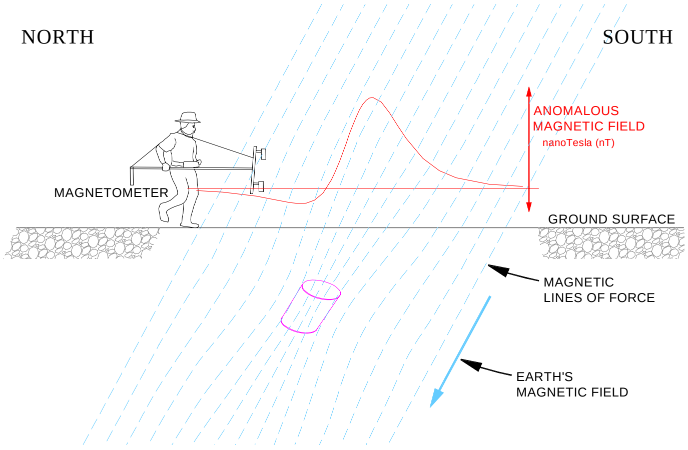


FIGURE 4

PRINCIPLES OF MAGNETIC EXPLORATION



Magnetic Methods:

Magnetic methods measure disturbances in the earth's natural magnetic field. These disturbances are caused by magnetic materials, either magnetic rocks, or man made objects containing iron or steel. This is shown schematically in Figure 4. Most soils have negligible magnetization (both induced and remanent). Thus, most magnetic disturbances from shallow sources can be attributed to iron or steel objects which have been placed there by man's activities.

Magnetometers used for buried object detection usually measure the gradient of the magnetic field. This is done by measuring the difference between the magnetic field at two sensors separated vertically by two or three feet. This configuration is more sensitive to nearby disturbances, and is less effected by disturbances caused by distant objects or shallow bedrock.

The upper right photo on the cover shows a magnetometer/gradiometer. This instrument can also cover wide areas quickly, providing complementary data to the EM. Figure 2 includes total magnetic field data and gradiometer data over the barrel disposal area. The large deviations in both total field and gradient are indicative of steel objects in close proximity.

Ground Penetrating Radar:

Ground penetrating radar (GPR), like other radar techniques, sends out an electromagnetic pulse (radio wave or microwave) which is reflected off a "target" and returns to the receiver. GPR operates at lower frequencies (80-500 MHz) than other radar to obtain better penetration in the earth materials. The antenna is pulled slowly along the ground surface to produce a continuous subsurface profile.

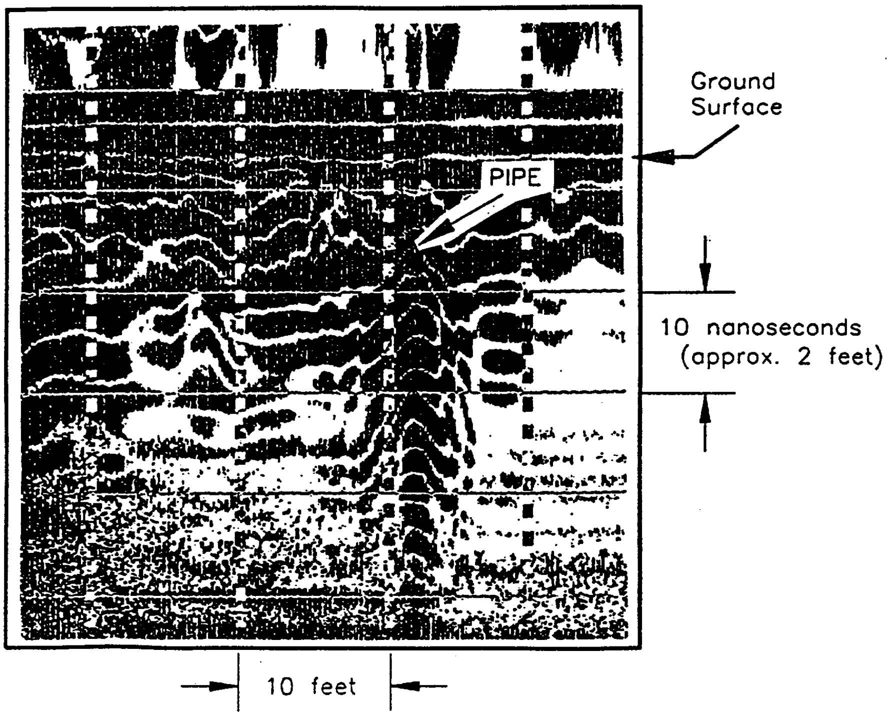
The lower photo on the cover shows a GPR unit in operation. The 500 MHz antenna shown is being pulled along the sidewalk. The control and recording unit, on the tailgate of the truck, is powered by a 12 volt automobile battery.

Figure 4 is an example GPR profile over a shallow pipe. The vertical scale is a time scale, giving the time for the radar pulse to travel down to the reflector and return to the receiver. Knowing the pulse velocity in the soils, we can convert this to depth. The horizontal scale corresponds to distance along the surface. Fiducial time marks on the record are placed at ten foot intervals. The pipe reflector shown appears as a hyperbola on the record. The pipe produces a strong reflection with a characteristic ringing of the electronics, which appears as a dark band below the first arrival from the pipe.

GPR is a tool for looking at selected areas in detail. Its continuous subsurface profiles give a graphic portrayal of subsurface conditions, and often provide an excellent means of accurately locating pipes and tanks. However, the GPR depth of exploration is strongly dependent on soil conductivity and subsurface conditions. In dry, sandy soils useful data may be obtained from depths down to 15 feet, whereas in conductive clay soils, investigation depth is often limited to two or three feet.

FIGURE 4

SAMPLE GPR PROFILE



DISCUSSION:

As we have stressed, EM and magnetics are effective in screening large areas quickly to identify areas where buried objects may be present. Often these techniques can provide a rough estimate of the size and depth of the object causing the anomalous readings.

The choice of frequency domain EM (i.e. EM31) versus time-domain EM (i.e. EM61) depends on the objectives and the site. The EM61 is very effective at identifying small pieces of metal (e.g. unexploded ordnance), and offers some depth and discrimination capability. It is also less sensitive to cultural noise (e.g. buildings, vehicles, etc.) than the EM31. The EM61 can often resolve anomalies which are close together, where the EM31 could not. However, the EM61 requires a tight line spacing, typically 1 meter, to assure the area is covered. Also, the wheeled cart is difficult or impossible to operate on some sites (the EM61 can also be carried on a shoulder harness but is very awkward).

The EM31 is favored over the EM61 on more open sites where the objective is to locate underground tanks, drums, or collections of debris. The broader sphere of influence of the EM31 allows it to be run on a coarser line spacing, typically 5-20 feet depending on the target.

A major limitation of both EM and MAG is their sensitivity to "cultural noise". Buildings, fences, metallic surface debris, and vehicles all create cultural noise. The EM and magnetic instruments respond to any metallic objects, whether buried or in plain view above ground. Thus, areas within 20 to 40 feet of buildings, vehicles or pipelines will be masked by the strong response from those objects. EM and magnetics will not be able to definitively identify other buried objects within that masked zone.

GPR on the other hand is fairly immune to those forms of cultural noise. The radar signal is confined to a broad beam, spreading at roughly a 45° angle, beneath the antenna. Most antennas are well shielded with little upward propagation of the pulse. Thus GPR can be run next to buildings, fences and parked vehicles. GPR may be run inside buildings and even over reinforced concrete.

Because the GPR beam is directional, it does not have the same utility as a reconnaissance tool as the EM and magnetics. Whereas the latter techniques would readily detect a large tank 10 or 20 feet off the survey line, GPR would not detect the tank unless the survey line passed directly over the tank.

CONCLUSIONS

No geophysical technique should be used without some form of "ground truth" by drilling, excavation, or some other form of sampling. The geophysical signature of an underground storage tank may be very similar to that of a buried automobile. However, geophysics can eliminate random drilling or extensive excavation when searching for underground tank or other materials.

To conclude, EM, magnetic and GPR techniques are effective, complimentary techniques used in the detection and delineation of subsurface metallic objects. The choice of technique or techniques depends very much on both site conditions and the survey objective.

FURTHER READING:

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DISCUSSION OF GEOPHYSICAL TECHNIQUES

GEOPHYSICAL DETECTION OF BURIED OBJECTS

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Revision: June 2006

Printed :July 14, 2006
File: b_b_teq_2006B.doc

APPENDIX C

Field Notes

Geomatrix

WELL SAMPLING AND/OR DEVELOPMENT RECORD

Well ID: MW-02
Sample ID: ______ Duplicate ID: ______
Sample Depth: ~18'
Project and Task No.: ______
Project Name: Whitmarsh
Date: 10/14/08
Sampled By: C.B
Method of Purging: Perastaltic
Method of Sampling: " "

Initial Depth to Water: 5'
Depth to Water after Sampling: ______
Total Depth to Well: ______
Well Diameter: 2"
1 Casing/Borehole Volume: ______ (Circle one)
4 Casing/Borehole Volumes: ______ (Circle one)
Total Casing/Borehole Volumes Removed: ______

Time	Intake Depth	ml/min Rate (gpm)	Cum. Vol. (gal.)	Temp. (°C)	pH (units)	Specific Electrical Conductance (~~µ~~S/cm)	Dissolved Oxygen (mg/l)	Redox Potential (mV; SSCE)	Remarks (color, turbidity, and sediment)
recalibrated 1156	18	200	0.1	11.6	7.18	9.99	0.00	200	Turb 130
1207		200	0.15	11.7	6.72	.584	4.99	198	60
1210			0.2	11.7	6.93	2.42	1.11	189	56
1213			0.25	11.7	7.08	1.85	0.00	182	44
1216			~~0.30~~	11.7	7.15	1.37	0.00	176	35
1219			~2	11.7	7.23	0.93	0.00	167	26
1222			~2.2	11.7	7.25	0.57	0.00	161	20
1225			~2.4	11.7	7.27	0.44	0.00	155	21
1228			~2.6	11.7	7.28	0.35	0.00	145	19
1231			~2.8	11.7	7.30	0.30	0.00	137	17
1234			~3	11.7	7.31	0.28	0.00	132	15
1237			3.2	11.7	7.31	0.25	0.00	126	~~13~~ 14

pH CALIBRATION (choose two)

Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Field Temperature °C				
Instrument Reading				

Model or Unit No.: U-22 Horiba

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION

KCL Solution (µS/cm=µmhos/cm)	1413 at 25°C	12880 at 25°C	
Field Temperature °C			
Instrument Reading			

Model or Unit No.:

REDOX CALIBRATION

Standard Solution	468 mV
Field Temperature °C	
Instrument Reading	

Model or Unit No.:

Ag/AgCl Electrode (SSCE)

DISSOLVED OXYGEN CALIBRATION

Salinity %	
Altitude	
Instrument Reading	

Model or Unit No.:

Notes:

Time	gallons	temp	pH	cond	DO	ORP	turb
1240	3.5	11.7	7.31	0.24	0.00	123	10
1243	3.7	11.7	7.31	0.22	0.00	120	10
1246		11.8	7.32	0.22	0.00	118	10

Geomatrix

WELL SAMPLING AND/OR DEVELOPMENT RECORD

Well ID: MW-3

Sample ID: ______ **Duplicate ID:** ______

Sample Depth: 15 - bfm

Project and Task No.: 14159

Project Name: Whitmarsh

Date: 10/14/08

Sampled By: C.B

Method of Purging: peristaltic

Method of Sampling: " "

Initial Depth to Water: 9.9

Depth to Water after Sampling: ______

Total Depth to Well: ______

Well Diameter: 2"

1 Casing/Borehole Volume: ______
(Circle one)

4 Casing/Borehole Volumes: ______
(Circle one)

Total Casing/Borehole Volumes Removed: ______

Time	Intake Depth	Rate (gpm)	Cum. Vol. (gal.)	Temp. (°C)	pH (units)	Specific Electrical Conductance (µS/cm)	Dissolved Oxygen (mg/l)	Redox Potential (mV; SSCE)	Remarks (color, turbidity, and sediment
1545	15	200	0.2	14.3	7.96	8.01	0.00	-130	Turb 780
1548			0.4	14.5	7.90	5.03	0.00	-143	333
1551			1.0	14.5	7.86	2.06	0.00	-154	193
1554			1.3	14.5	7.86	1.15	0.00	-158	170
1557			1.75	14.4	7.85	0.421	0.00	-161	106
1600			2.2	14.4	7.85	0.314	0.00	-163	67
1603			2.4	14.4	7.85	0.293	0.00	-164	59
1606			2.5	14.5	7.86	0.261	0.00	-166	55
1609			2.6	14.5	7.85	0.225	0.00	-167	35
1612			2.75	14.5	7.86	0.212	0.00	-168	32
1615			2.9	14.5	7.86	0.196	0.00	-169	20
1618			3.2	14.4	7.87	0.180	0.00	-169	16

pH CALIBRATION (choose two)

Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Field Temperature °C				
Instrument Reading				

Model or Unit No.:

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION

KCL Solution (µS/cm=µmhos/cm)	1413 at 25°C	12880 at 25°C	
Field Temperature °C			
Instrument Reading			

Model or Unit No.:

REDOX CALIBRATION

Standard Solution	468 mV
Field Temperature °C	
Instrument Reading	

Model or Unit No.:

Ag/AgCl Electrode (SSCE)

DISSOLVED OXYGEN CALIBRATION

Salinity %	
Altitude	
Instrument Reading	

Model or Unit No.:

Notes:

time	gallons	pH	cond	turb	DO	temp	orp
1621	3.3	7.86	0.176	10.7	0.0	14.4	-172
1624	3.5	7.87	.175	9.8	0.0	14.4	-173
1627	3.75	7.87	.169	6.7	0.0	14.4	-175
1630	4.2	7.87	.156	7.7	0.0	14.6	-176

Geomatrix

WELL SAMPLING
AND/OR DEVELOPMENT RECORD

Well ID: MW-04

Sample ID: ______ **Duplicate ID:** ______

Sample Depth: 8tm

Project and Task No.: ______

Project Name: Whitmarsh

Date: 10/14/08

Sampled By: CB

Method of Purging: Parastaltic

Method of Sampling: ______

Initial Depth to Water: 3.8'

Depth to Water after Sampling: 3.65'

Total Depth to Well: ______

Well Diameter: ______

1 Casing/Borehole Volume: ______
(Circle one)

4 Casing/Borehole Volumes: ______
(Circle one)

Total Casing/Borehole Volumes Removed: E 4 gal

Time	Intake Depth	Rate (gpm)	Cum. Vol. (gal.)	Temp. (°C)	pH (units)	Specific Electrical Conductance (µS/cm)	Dissolved Oxygen (mg/l)	Redox Potential ([✓ mV]; SSCE)	Remarks (color, turbidity, and sedimen	
									turb	Sal %
1358	8tm	200	0	11.4	8.05	1.68	2.86	140	106	2.5
1401			0.2	11.2	8.04		0.00	44	70	
1404			0.4	11.2	8.06		0.00	-16	62	
1407			0.6	11.2	8.07	5.23	0.00	-24	70	
1410			0.8	11.2	8.08	3.25	0.00	-29	45	1.8
1413			1.0	11.2	8.1	1.47	0.00	-73	49	0.9
1416			1.2	11.2	8.1	1.13	0.00	-96	61	0.6
1419			1.5	11.2	8.09	0.542	0.00	-103	63	0.3
1422			~2.0	11.2	8.09	0.374	0.00	-111	60	0.2
1425			~2.5	11.1	8.09	0.329	0.00	-114	47	0.2
1428			~2.8	11.1	8.09	0.282	0.00	-116	37	0.1
1431			3.1	11.1	8.10	0.228	0.00	-118	35	0.1

pH CALIBRATION (choose two)

Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Field Temperature °C				
Instrument Reading				

Model or Unit No.:

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION

KCL Solution (µS/cm=µmhos/cm)	1413 at 25°C	12880 at 25°C	
Field Temperature °C			
Instrument Reading			

Model or Unit No.:

REDOX CALIBRATION

Standard Solution	468 mV
Field Temperature °C	
Instrument Reading	

Model or Unit No.:

Ag/AgCl Electrode (SSCE)

DISSOLVED OXYGEN CALIBRATION

Salinity %	
Altitude	
Instrument Reading	

Model or Unit No.:

Notes: Cond. acting weird

time	gal	pH	cond	turb	DO	temp	Sal	ORP
1434	3.3	8.09	.186	35	0.00	11.1	0.1	-119

Geomatrix

WELL SAMPLING 4 pres
AND/OR DEVELOPMENT RECORD

Well ID: SP-01

Sample ID: ______ **Duplicate ID:** ______

Sample Depth: ______

Project and Task No.: 14159

Project Name: Whitmarsh

Date: 10/15/08

Sampled By: NB, CB

Method of Purging: ______

Method of Sampling: peristaltic into shallow water

Initial Depth to Water: ______

Depth to Water after Sampling: ______

Total Depth to Well: ______

Well Diameter: ______

1 Casing/Borehole Volume: ______
(Circle one)

4 Casing/Borehole Volumes: ______
(Circle one)

Total Casing/Borehole Volumes Removed: ______

Time	Turb ~~Intake Depth~~ NTU	Sal Rate (gpm) %	Cum. Vol. (gal.)	Temp. (°C)	pH (units)	Specific Electrical Conductance (µS/cm)	Dissolved Oxygen (mg/l)	Redox Potential (mV; ~~SSCE~~)	Remarks (color, turbidity, and sediment
1100	100	1.2		10.9	8.08	1.92S/m	3.66	53	slightly yellow
									clearish.

pH CALIBRATION (choose two)

Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Field Temperature °C				
Instrument Reading				

Model or Unit No.:

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION

KCL Solution (µS/cm=µmhos/cm)	1413 at 25°C	12880 at 25°C	
Field Temperature °C			
Instrument Reading			

Model or Unit No.:

REDOX CALIBRATION

Standard Solution	468 mV
Field Temperature °C	
Instrument Reading	

Model or Unit No.:

Ag/AgCl Electrode (SSCE)

DISSOLVED OXYGEN CALIBRATION

Salinity %	
Altitude	
Instrument Reading	

Model or Unit No.:

Notes:

Geomatrix

WELL SAMPLING
AND/OR DEVELOPMENT RECORD

Well ID: SP-02

Sample ID: ____________ **Duplicate ID:** ____________

Sample Depth: ____________

Project and Task No.: 14159

Project Name: Whitmarsh

Date: 10/15/08

Sampled By: ____________

Method of Purging: ____________

Method of Sampling: ____________

Initial Depth to Water: ____________

Depth to Water after Sampling: ____________

Total Depth to Well: ____________

Well Diameter: ____________

1 Casing/Borehole Volume: ____________
(Circle one)

4 Casing/Borehole Volumes: ____________
(Circle one)

Total Casing/Borehole Volumes Removed: ____________

Time	Turb ~~Intake Depth~~ NTU	Sal ~~Rate (gpm)~~ %	Cum. Vol. (gal.)	Temp. (°C)	pH (units)	Specific Electrical Conductance (µS/cm)	Dissolved Oxygen (mg/l)	Redox Potential (mV; SSCE)	Remarks (color, turbidity, and sediment
	43	2.1		13.4	7.57	3.44 S/m	8.90	-5	

pH CALIBRATION (choose two)

Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Field Temperature °C				
Instrument Reading				

Model or Unit No.:

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION

KCL Solution (µS/cm=µmhos/cm)	1413 at 25°C	12880 at 25°C	
Field Temperature °C			
Instrument Reading			

Model or Unit No.:

REDOX CALIBRATION

Standard Solution	468 mV
Field Temperature °C	
Instrument Reading	

Model or Unit No.:

Ag/AgCl Electrode (SSCE)

DISSOLVED OXYGEN CALIBRATION

Salinity %	
Altitude	
Instrument Reading	

Model or Unit No.:

Notes:

Geomatrix

WELL SAMPLING AND/OR DEVELOPMENT RECORD

Well ID: SP-03

Sample ID: ____ **Duplicate ID:** ____

Sample Depth: ____

Project and Task No.: 14159

Project Name: Whitmarsh

Date: 11/15/08

Sampled By: ____

Method of Purging: ____

Method of Sampling: ____

Initial Depth to Water: 2"

Depth to Water after Sampling: ____

Total Depth to Well: ____

Well Diameter: ____

1 Casing/Borehole Volume: ____
(Circle one)

4 Casing/Borehole Volumes: ____
(Circle one)

Total Casing/Borehole Volumes Removed: ____

Time	Turb ~~Intake Depth~~ NTU	Sal Rate (gpm) %	Cum. Vol. (gal.)	Temp. (°C)	pH (units)	Specific Electrical Conductance (µS/cm)	Dissolved Oxygen (mg/l)	Redox Potential (mV; SSCE)	Remarks (color, turbidity, and sediment
1240	395	0.1		13.2	7.75	0.193S/m	12.15	-64	orange cloudy
									flocculent, orange
									OM material.

Peeper failed, screen clogged during purging.

pH CALIBRATION (choose two)				
Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Field Temperature °C				
Instrument Reading				

Model or Unit No.:

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION			
KCL Solution (µS/cm=µmhos/cm)	1413 at 25°C	12880 at 25°C	
Field Temperature °C			
Instrument Reading			

Model or Unit No.:

REDOX CALIBRATION	
Standard Solution	468 mV
Field Temperature °C	
Instrument Reading	

Model or Unit No.:

Ag/AgCl Electrode (SSCE)

DISSOLVED OXYGEN CALIBRATION	
Salinity %	
Altitude	
Instrument Reading	

Model or Unit No.:

Notes:

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Geomatrix

WELL SAMPLING AND/OR DEVELOPMENT RECORD

Well ID: SW-01

Sample ID: ______ **Duplicate ID:** ______

Sample Depth: ______

Project and Task No.: 14159

Project Name: Whitmarsh

Date: 10/14/08 0910

Sampled By: CB, NB

Method of Purging: none,

Method of Sampling: Submerge bottle.

Initial Depth to Water: ______

Depth to Water after Sampling: ______

Total Depth to Well: ______

Well Diameter: ______

1 Casing/Borehole Volume: ______
(Circle one)

4 Casing/Borehole Volumes: ______
(Circle one)

Total Casing/Borehole Volumes Removed: ______

Time	Turb ~~Intake Depth~~ NTU	Rate (gpm)	Cum. Vol. (gal.)	Temp. (°C)	pH (units)	Specific Electrical Conductance (µS/cm)	Dissolved Oxygen (mg/l)	Redox Potential (mV; SSCE)	Remarks (color, turbidity, and sediment
0910	12.8			10.9	6.34	0.234 S/m	11.85	190	

Water is clear, scattered small vegetation petals floating (milfoil?)

pH CALIBRATION (choose two)				
Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Field Temperature °C				
Instrument Reading				

Model or Unit No.:

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION			
KCL Solution (µS/cm=µmhos/cm)	1413 at 25°C	12880 at 25°C	
Field Temperature °C			
Instrument Reading			

Model or Unit No.:

REDOX CALIBRATION	
Standard Solution	468 mV
Field Temperature °C	
Instrument Reading	

Model or Unit No.:

Ag/AgCl Electrode (SSCE)

DISSOLVED OXYGEN CALIBRATION	
Salinity %	
Altitude	
Instrument Reading	

Model or Unit No.:

Notes:

Geomatrix

WELL SAMPLING
AND/OR DEVELOPMENT RECORD

Well ID: SW-03

Sample ID: ______ **Duplicate ID:** ______

Sample Depth: ______

Project and Task No.: 14159

Project Name: Whitmarsh

Date: 10/15/08

Sampled By: ______

Method of Purging: NA

Method of Sampling: submerge bottle

Initial Depth to Water: ______

Depth to Water after Sampling: ______

Total Depth to Well: ______

Well Diameter: ______

1 Casing/Borehole Volume: ______
(Circle one)

4 Casing/Borehole Volumes: ______
(Circle one)

Total Casing/Borehole Volumes Removed: ______

Time	Turb ~~Intake Depth~~ NTU	Salinity ~~Rate (gpm)~~ %	~~Cum. Vol. (gal)~~	Temp. (°C)	pH (units)	Specific Electrical Conductance (µS/cm)	Dissolved Oxygen ~~(ppm)~~ mg/L	Redox Potential (mV; SSCE)	Remarks (color, turbidity, and sediment
0940	50	0.2		6.3	9.~~8~~20	0,340 S/m	11.63	47	slight yellow tint, trace OM material floating around.

pH CALIBRATION (choose two)

Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Field Temperature °C				
Instrument Reading				

Model or Unit No.:

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION

KCL Solution (µS/cm=µmhos/cm)	1413 at 25°C	12880 at 25°C	
Field Temperature °C			
Instrument Reading			

Model or Unit No.:

REDOX CALIBRATION

Standard Solution	468 mV
Field Temperature °C	
Instrument Reading	

Model or Unit No.:

Ag/AgCl Electrode (SSCE)

DISSOLVED OXYGEN CALIBRATION

Salinity %	
Altitude	
Instrument Reading	

Model or Unit No.:

Notes:

Geomatrix

WELL SAMPLING
AND/OR DEVELOPMENT RECORD

Well ID: SW-04

Sample ID: ____ **Duplicate ID:** ____

Sample Depth: ____

Project and Task No.: 14159

Project Name: Whitmarsh

Date: 10/15/08

Sampled By: NB, CB

Method of Purging: None

Method of Sampling: Submerge bottle.

Initial Depth ~~to~~ of Water: 3"

Depth to Water after Sampling: ____

Total Depth to Well: ____

Well Diameter: ____

1 Casing/Borehole Volume: ____
(Circle one)

4 Casing/Borehole Volumes: ____
(Circle one)

Total Casing/Borehole Volumes Removed: ____

Time	Turb ~~Intake Depth~~ NTU	Salinity ~~Rate (gpm)~~	~~Cum. Vol. (gal.)~~	Temp. (°C)	pH (units)	Specific Electrical Conductance (µS/cm)	Dissolved Oxygen (mg/l)	Redox Potential (mV; SSCE)	Remarks (color, turbidity, and sediment
0800	220	0.2%		4.4	8.00	0.417 S/m	11.45	143	very light brown,
									Few small pieces
									of OM
									floating. ~~ds~~
									water is clear
									though

pH CALIBRATION (choose two)

Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Field Temperature °C				
Instrument Reading				

Model or Unit No.:

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION

KCL Solution (µS/cm=µmhos/cm)	1413 at 25°C	12880 at 25°C	
Field Temperature °C			
Instrument Reading			

Model or Unit No.:

REDOX CALIBRATION

Standard Solution	468 mV
Field Temperature °C	
Instrument Reading	

Model or Unit No.:

Ag/AgCl Electrode (SSCE)

DISSOLVED OXYGEN CALIBRATION

Salinity %	
Altitude	
Instrument Reading	

Model or Unit No.:

Notes:

Geomatrix

WELL SAMPLING AND/OR DEVELOPMENT RECORD

Well ID: SW-05

Initial Depth ~~to~~ of Water: 5"

Sample ID: ______ **Duplicate ID:** ______

Depth to Water after Sampling: ______

Sample Depth: ______

Total Depth to Well: ______

Project and Task No.: 14159

Well Diameter: ______

Project Name: Whitmarsh

1 Casing/Borehole Volume: ______ **(Circle one)**

Date: 10/15/08

Sampled By: NB, CB

4 Casing/Borehole Volumes: ______ **(Circle one)**

Method of Purging: ______

Total Casing/Borehole Volumes Removed: ______

Method of Sampling: submerge bottle.

Time	Turb ~~Intake Depth~~ NTU	Sal Rate (gpm) %	~~Cum Vol. (gal.)~~	Temp. (°C)	pH (units)	Specific Electrical Conductance (µS/cm)	Dissolved Oxygen (mg/l)	Redox Potential (mV; SSCE)	Remarks (color, turbidity, and sediment
0832	107	1.7		5.1	8.07	3,08 S/m	9.37	97	clear, slight yellow tint.

pH CALIBRATION (choose two)

Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Field Temperature °C				
Instrument Reading				

Model or Unit No.:

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION

KCL Solution (µS/cm=µmhos/cm)	1413 at 25°C	12880 at 25°C	
Field Temperature °C			
Instrument Reading			

Model or Unit No.:

REDOX CALIBRATION

Standard Solution	468 mV
Field Temperature °C	
Instrument Reading	

Model or Unit No.:

Ag/AgCl Electrode (SSCE)

DISSOLVED OXYGEN CALIBRATION

Salinity %	
Altitude	
Instrument Reading	

Model or Unit No.:

Notes:

Geomatrix

WELL SAMPLING
AND/OR DEVELOPMENT RECORD

Well ID: SW-06

Sample ID: ____________ **Duplicate ID:** ____________

Sample Depth: ____________

Project and Task No.: 14159

Project Name: Whitmarsh

Date: 10/15/08

Sampled By: NB, CB

Method of Purging: ____________

Method of Sampling: Submerge bottle

Initial Depth ~~to~~ of Water: 10"

Depth to Water after Sampling: ____________

Total Depth to Well: ____________

Well Diameter: ____________

1 Casing/Borehole Volume: ____________
(Circle one)

4 Casing/Borehole Volumes: ____________
(Circle one)

Total Casing/Borehole Volumes Removed: ____________

Time	Turb ~~Intake Depth~~ NTU	Sal ~~Rate (gpm)~~ %	~~Cum. Vol. (gal.)~~	Temp. (°C)	pH (units)	Specific Electrical Conductance (µS/cm)	Dissolved Oxygen (mg/l)	Redox Potential (mV; SSCE)	Remarks (color, turbidity, and sediment
0900	29.0	2.3		6.7	7.93	3.61 S/m	8.68	76	clear, live wired to water quality parameters

pH CALIBRATION (choose two)

Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Field Temperature °C				
Instrument Reading				

Model or Unit No.:

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION

KCL Solution (µS/cm=µmhos/cm)	1413 at 25°C	12880 at 25°C	
Field Temperature °C			
Instrument Reading			

Model or Unit No.:

REDOX CALIBRATION

Standard Solution	468 mV
Field Temperature °C	
Instrument Reading	

Model or Unit No.:

Ag/AgCl Electrode (SSCE)

DISSOLVED OXYGEN CALIBRATION

Salinity %	
Altitude	
Instrument Reading	

Model or Unit No.:

Notes:

CHAIN-OF-CUSTODY RECORD

SEA 10405

PROJECT NAME: Whitmarsh Landfill

DATE: 10/14/08

PAGE 1 OF 1

PROJECT NUMBER: 14159

LABORATORY NAME: ARI

CLIENT INFORMATION: Skagit County

REPORTING REQUIREMENTS:

RESULTS TO: Nick Bacher

LABORATORY ADDRESS: Tukwila, WA

TURNAROUND TIME: Standard

SAMPLE SHIPMENT METHOD: hand delivered

LABORATORY CONTACT: Mark Harris

LABORATORY PHONE NUMBER:

GEOTRACKER REQUIRED YES NO

SITE SPECIFIC GLOBAL ID NO.

SAMPLERS (SIGNATURE): Alan Bacher

			ANALYSES																					
DATE	TIME	SAMPLE NUMBER	VOCs	SVOCs	Phenols	PAHs	PCBs	OC Pesticides	Carbanyl	HCID (TPH)	TPH-Gx	TPH-Dx	Diss. Metals	Total Metals	pH	TDS		CONTAINER TYPE AND SIZE	Soil (S), Water (W), Vapor (V), or Other (O)	Filtered	Preservative Type	Cooled	MS/MSD	No. of Containers	ADDITIONAL COMMENTS
10/14/08	0910	SW-01-1008	X	X	X	X	X	X	X				X	X	X	X		Various	W	No				18	Diss. Met not filtered
10/14/08	1250	MW-02-1008	X	X	X	X	X	X	X	X	X	X	X	X	X	X		"	W	Yes				18	
10/14/08	1455	MW-04-1008	X	X	X	X	X	X	X	X	X	X	X	X	X	X		"	W	Yes				18	
10/14/08	1640	MW-02-1008	X	X	X	X	X	X	X	X	X	X	X	X	X	X		"	W	Yes				18	
10/14/08	1710	MW-103-1008	X	X	X	X	X	X	X	X	X	X	X	X				"	W	Yes				16	
10/15/08	0800	SW-04-1008	X	X	X	X	X	X	X				X	X	X	X		"	W	No				18	Diss. Met not filtered
10/15/08	0832	SW-05-1008	X	X	X	X	X	X	X				X	X	X	X		"	W	No				18	"
10/15/08	0900	SW-06-1008	X	X	X	X	X	X	X				X	X	X	X		"	W	No				18	"
10/15/08	0940	SW-03-1008	X	X	X	X	X	X	X				X	X	X	X		"	W	No				18	"
10/15/08	1100	SP-01-1008	X	X	X	X	X	X	X				X	X	X	X		"	W	No				18	"
10/15/08	1200	SP-02-1008	X	X	X	X	X	X	X				X	X	X	X		"	W	No				18	"
10/15/08	1240	SP-03-1008	X	X	X	X	X	X	X				X	X	X	X		"	W	No				18	"
10/15/08	1520	EB-01-1008	X	X	X	X	X	X	X	X	X	X	X	X	X	X		"	W	No				18	"
		TB-01-1008	X								X							40 mL	W	Yes				8	

RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME
SIGNATURE: Alan Bacher	10/15/08	1748	SIGNATURE:	10/15/08	1748
PRINTED NAME: Nick Bacher			PRINTED NAME: Jonathon Walte		
COMPANY: AMEC GMX			COMPANY: ARI		
SIGNATURE:			SIGNATURE:		
PRINTED NAME:			PRINTED NAME:		
COMPANY:			COMPANY:		
SIGNATURE:			SIGNATURE:		
PRINTED NAME:			PRINTED NAME:		
COMPANY:			COMPANY:		

TOTAL NUMBER OF CONTAINERS:

SAMPLING COMMENTS:

✻ Diss. Metals NOT field filtered for all samples starting with SW. Please filter in lab.

Please see Mark Harris & QAPP for combination of analyses (SVOCs, phenols, PAHs, etc.)

One Union Square, 600 University Street, Suite 1020
Seattle, Washington 98101-4107
Tel 206.342.1760 Fax 206.342.1761

Geomatrix

AMEC Geomatrix

WELL SAMPLING AND/OR DEVELOPMENT RECORD

Well ID: MW-02
Sample ID: MW-02-1208 Duplicate ID:
Sample Depth:
Project and Task No.: 14159
Project Name: Whitmarsh LF
Date: 12/18/08
Sampled By: NB, CB
Method of Purging: peristaltic
Method of Sampling: peristaltic

Initial Depth to Water: 7.83'
Depth to Water after Sampling:
Total Depth to Well:
Well Diameter:
1 Casing/Borehole Volume: (Circle one)
3 Casing/Borehole Volumes: (Circle one)
Total Casing/Borehole Volumes Removed:

Time	Turb ~~Intake Depth~~	ORP ~~Rate (gpm)~~ mV	Cum. Vol. (gal.)	Temp. (°C)	pH (units)	Specific Electrical Conductance ~~(µS/cm)~~ mS/cm	DO mg/L	DTW	Remarks (color, turbidity, and sediment)
0955	179	251	0.15	6.4	5.60	67.8	3.71	7.89	clear
1000	163	244	0.65	8.7	6.32	61.6	2.54	7.89	clear
1005	211	250	0.9	9.6	7.31	60.2	1.94	7.88	clear
1008	199	261	1.2	10.0	7.00	58.7	1.66	7.88	clear
1011	221	266	1.5	10.0	7.03	58.2	1.51	7.88	clear
1014	220	271	1.9	10.1	7.03	58.2	1.39	7.88	clear
1017	221	276	2.2	10.0	7.05	58.1	1.26	7.88	clear
1024	218	278	2.8	10.0	7.01	58.7	1.09	7.88	clear
1027	206	274	3.0	9.9	7.03	59.1	1.02	7.88	clear
1030	213	273	3.2	9.9	7.05	58.9	1.01	7.88	clear

pH CALIBRATION (choose two)				
Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Temperature C				
Instrument Reading				

Model or Unit No.: Sample time 1040

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION			
KCL Solution (µS/cm=µmhos/cm)			
Temperature C			
Instrument Reading			

Model or Unit No.:

Notes:
Water is really clear. Turb meter might be fouled.

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AMEC Geomatrix

WELL SAMPLING
AND/OR DEVELOPMENT RECORD

Well ID: MW-03

Sample ID: MW-03-1208 Duplicate ID: MW-103-1208

Sample Depth:

Project and Task No.: 14159

Project Name: Whitmarsh LF

Date: 12/15/08

Sampled By: MB, CB

Method of Purging:

Method of Sampling:

Initial Depth to Water: 8.02

Depth to Water after Sampling:

Total Depth to Well:

Well Diameter:

1 Casing/Borehole Volume:
(Circle one)

3 Casing/Borehole Volumes:
(Circle one)

Total Casing/Borehole Volumes Removed:

Time	Turb ~~Intake Depth~~ NTU	ORP ~~Rate (gpm)~~ mV	Cum. Vol. (gal.)	Temp. (°C)	pH (units)	Specific Electrical Conductance ~~(µS/cm)~~ mS/m	DO mg/L	Remarks (color, turbidity, and sediment)
1252	40.2	-3	0	7.4	9.31	43.2	4.06	clear
1255	46.0	-16	0.25	7.6	10.12	43.3	3.12	clear
1258	47.3	-32	0.5	7.5	9.91	43.5	2.48	clear
1301	47.9	-47	0.75	7.6	9.83	42.7	1.20	clear
1304	34.5	-54	1	7.9	9.94	42.7	0.84	clear
1307	37.8	-62	1.3	7.3	10.11	42.8	0.54	clear
1310	26.6	-68	1.55	7.8	10.41	42.5	0.33	clear
1313	16.1	-72	1.9	7.8	10.65	42.6	0.34	clear
1316	9.6	-76	2.2	7.9	10.89	42.6	0.20	clear
1319	9.9	-77	2.5	7.9	10.91	41.9	0.18	clear
1322	4.7	-78	2.8	7.9	10.90	41.8	0.18	clear

pH CALIBRATION (choose two)

Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Temperature C				
Instrument Reading				

Model or Unit No.:

Sample @ 1330

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION

KCL Solution (µS/cm=µmhos/cm)			
Temperature C			
Instrument Reading			

Model or Unit No.:

Sample @ 1340

Notes:

Sandman, motel 8 regent inn

AMEC Geomatrix

WELL SAMPLING AND/OR DEVELOPMENT RECORD

Well ID: MW-04

Sample ID: MW-04-1208 Duplicate ID: ____

Sample Depth: ____

Project and Task No.: 14159

Project Name: Whitmarsh

Date: 12/19/08

Sampled By: NB, CB

Method of Purging: peristaltic

Method of Sampling: peristaltic.

Initial Depth to Water: 3.37

Depth to Water after Sampling: ____

Total Depth to Well: ____

Well Diameter: ____

1 Casing/Borehole Volume: ____ (Circle one)

3 Casing/Borehole Volumes: ____ (Circle one)

Total Casing/Borehole Volumes Removed: ____

Time	Intake Depth	Rate (gpm)	Cum. Vol. (gal.)	Temp. (°C)	pH (units)	Specific Electrical Conductance (μS/cm)	Remarks (color, turbidity, and sediment) turb DO ORP
1037			0.4	8.8	8.87	48.1	3.2 4.06 274
1040			0.5	8.7	9.15	46.6	0.0 3.51 275
1043			0.7	9.0	9.37	46.1	0.0 3.24 261
1046			0.9	9.0	9.38	46.1	0.0 3.23 257
1049			1.1	9.1	9.42	45.9	0.0 3.14 241
1052			1.4	9.1	9.38	45.8	0.0 2.76 177
1055			1.7	9.2	9.46	45.8	0.0 2.37 109
1058			2.0	9.2	9.65	47.2	0.0 2.12 63
1101			2.2	9.3	9.73	46.3	0.0 1.84 18
1104			2.5	9.3	9.74	46.7	0.0 1.81 7
1107			2.7	9.3	9.74	47.1	0.0 1.64 -8
1110			2.9	9.3	9.75	47.3	0.0 1.32 -31

pH CALIBRATION (choose two)

Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Temperature C				
Instrument Reading				

Model or Unit No.: Horiba U-22

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION

KCL Solution (μS/cm=μmhos/cm)			
Temperature C			
Instrument Reading			

Model or Unit No.:

Notes:

	vel	pH	cond	turb	dO	temp	orp
1113	3.1	9.76	46.7	0.0	1.15	9.3	-41
1116	3.3	9.84	46.3	0.0	1.08	9.2	-48
1119	3.5	9.87	46.4	0.0	1.05	9.2	-49
1122	3.7	9.88	46.4	0.0	1.05	9.2	-51
1125	3.9	9.89	46.4	0.0	1.01	9.2	-54

AMEC Geomatrix

WELL SAMPLING AND/OR DEVELOPMENT RECORD

Well ID: SP-01

Sample ID: SP-01-1208 Duplicate ID:

Sample Depth:

Project and Task No.: 14159

Project Name: Whitmarsh LF

Date: 12/17/08

Sampled By: NB, CB

Method of Purging: ~~SB~~ NA

Method of Sampling: submerge bottle

Initial Depth to Water: —

Depth to Water after Sampling: —

Total Depth to Well:

Well Diameter:

1 Casing/Borehole Volume: (Circle one)

3 Casing/Borehole Volumes: (Circle one)

Total Casing/Borehole Volumes Removed:

Time	Turb. ~~Intake Depth~~ NTU	DO ~~Rate (gpm)~~ mg/L	ORP ~~Cum. Vol. (gal)~~ mV	Temp. (°C)	pH (units)	Specific Electrical Conductance (~~µS/cm~~) mS/m	Remarks (color, turbidity, and sediment)
1150	~~[illegible]~~	9.42	83	0.5	8.66	99.7	orange cloudy (slight)
	113						

pH CALIBRATION (choose two)

Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Temperature C				
Instrument Reading				

Model or Unit No.: Horiba U-22

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION

KCL Solution (µS/cm=µmhos/cm)			
Temperature C			
Instrument Reading			

Model or Unit No.:

Notes:

Sample @ 1155

AMEC Geomatrix

WELL SAMPLING AND/OR DEVELOPMENT RECORD

Well ID: SP-02

Sample ID: SP-02-1208 Duplicate ID:

Sample Depth:

Project and Task No.: 14159

Project Name: Whitmarsh LF

Date: 12/18/08

Sampled By: NB, CB

Method of Purging: /

Method of Sampling: peristaltic

Initial Depth to Water:

Depth to Water after Sampling:

Total Depth to Well:

Well Diameter:

1 Casing/Borehole Volume:
(Circle one)

3 Casing/Borehole Volumes:
(Circle one)

Total Casing/Borehole Volumes Removed:

Time	Turb ~~Intake Depth~~ NTU	DO ~~Rate (gpm)~~ mg/L	ORP ~~Cum. Vol. (gal.)~~ mV	Temp. (°C)	pH (units)	Specific Electrical Conductance ~~(µS/cm)~~ mS/m	Remarks (color, turbidity, and sediment)
1555	78	6.92	73	0.1	10.02	1.23	slightly cloudy

pH CALIBRATION (choose two)				
Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Temperature C				
Instrument Reading				

Model or Unit No.:

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION			
KCL Solution (µS/cm=µmhos/cm)			
Temperature C			
Instrument Reading			

Model or Unit No.:

Notes:

Sampled @ 1600

AMEC Geomatrix

WELL SAMPLING
AND/OR DEVELOPMENT RECORD

Well ID: SP-03

Sample ID: SP-03-1208 Duplicate ID: ______

Sample Depth: ______

Project and Task No.: 14159

Project Name: whitmarsh LF

Date: 12/18/08

Sampled By: AB, CB

Method of Purging: /

Method of Sampling: peristaltic

Initial Depth to Water:

Depth to Water after Sampling: ______

Total Depth to Well: ______

Well Diameter: ______

1 Casing/Borehole Volume: ______
(Circle one)

3 Casing/Borehole Volumes: ______
(Circle one)

Total Casing/Borehole
Volumes Removed: ______

Time	Turb ~~Intake Depth~~ NTU	Do ~~Rate (gpm)~~ mg/L	ORP ~~Cum. Vol. (gal)~~ mV	Temp. (°C)	pH (units)	Specific Electrical Conductance ~~(µS/cm)~~ mS/m	Remarks (color, turbidity, and sediment)
1640	363	11.95	95	0.3	10.15	0.43	slightly orange.

pH CALIBRATION (choose two)

Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Temperature C				
Instrument Reading				

Model or Unit No.:

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION

KCL Solution (µS/cm=µmhos/cm)			
Temperature C			
Instrument Reading			

Model or Unit No.:

Notes:

Sampled @ 1645

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AMEC Geomatrix

WELL SAMPLING AND/OR DEVELOPMENT RECORD

Well ID: SW-1

Sample ID: SW-01-1208 Duplicate ID:

Sample Depth:

Project and Task No.: 14159

Project Name: Whitmarsh LF

Date: 12/17/08

Sampled By: NB, CB

Method of Purging: —

Method of Sampling: submerging bottle

Initial Depth to Water:

Depth to Water after Sampling:

Total Depth to Well:

Well Diameter:

1 Casing/Borehole Volume:
(Circle one)

3 Casing/Borehole Volumes:
(Circle one)

Total Casing/Borehole Volumes Removed:

Time	Turb ~~Intake Depth~~ NTU	DO ~~Rate (gpm)~~ mg/L	ORP ~~Cum. Vol. (gal.)~~ mV	Temp. (°C)	pH (units)	Specific Electrical Conductance ~~(µS/cm)~~ mS/m	Remarks (color, turbidity, and sediment)
1300	26.7	8.41	142	0.9	7.45	21.4	clear, some floating
							organic matter

pH CALIBRATION (choose two)				
Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Temperature C				
Instrument Reading				

Model or Unit No.:

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION			
KCL Solution (µS/cm=µmhos/cm)			
Temperature C			
Instrument Reading			

Model or Unit No.:

Notes:

Sample @ 1355

AMEC Geomatrix

WELL SAMPLING AND/OR DEVELOPMENT RECORD

Well ID: SW-3
Sample ID: SW-03-1208 Duplicate ID:
Sample Depth:
Project and Task No.: 14159
Project Name: Whitmarsh LF
Date: 12/17/08
Sampled By: NB, CB
Method of Purging: /
Method of Sampling: submerged bottle

Initial Depth to Water:
Depth to Water after Sampling:
Total Depth to Well:
Well Diameter:
1 Casing/Borehole Volume: (Circle one)
3 Casing/Borehole Volumes: (Circle one)
Total Casing/Borehole Volumes Removed:

Time	Turb ~~Intake Depth~~ NTU	DO ~~Rate (gpm)~~ mg/L	ORP ~~Cum. Vol. (gal)~~ mV	Temp. (°C)	pH (units)	Specific Electrical Conductance ~~(µS/cm)~~ mS/m	Remarks (color, turbidity, and sediment)
1515	125	8.99	163	1.9	6.83	1.35	slighty brown

pH CALIBRATION (choose two)

Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Temperature C				
Instrument Reading				

Model or Unit No.:

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION

KCL Solution (µS/cm=µmhos/cm)			
Temperature C			
Instrument Reading			

Model or Unit No.:

Notes:

Sample @ 1520

AMEC Geomatrix

WELL SAMPLING AND/OR DEVELOPMENT RECORD

Well ID: SW-04

Sample ID: SW-04-1208 Duplicate ID:

Sample Depth:

Project and Task No.: 14159

Project Name: Whitmarsh LF

Date: 12/18/08

Sampled By: CB, NB

Method of Purging:

Method of Sampling: submerged bottle.

Initial Depth to Water:

Depth to Water after Sampling:

Total Depth to Well:

Well Diameter:

1 Casing/Borehole Volume:
(Circle one)

3 Casing/Borehole Volumes:
(Circle one)

Total Casing/Borehole Volumes Removed:

Time	Turb ~~Intake Depth~~ NTU	DO ~~Rate~~ (~~gpm~~) mg/L	ORP ~~Cum. Vol.~~ (~~gal.~~) mV	Temp. (°C)	pH (units)	Specific Electrical Conductance (~~µS/cm~~) mS/m	Remarks (color, turbidity, and sediment)
1510	198	8.99	163	9.8	6.8	0.903	slightly brown

pH CALIBRATION (choose two)				
Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Temperature C				
Instrument Reading				

Model or Unit No.:

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION			
KCL Solution (µS/cm=µmhos/cm)			
Temperature C			
Instrument Reading			

Model or Unit No.:

Notes:

Sampled @ 1515

AMEC Geomatrix

WELL SAMPLING AND/OR DEVELOPMENT RECORD

Well ID: SW-05

Sample ID SW-05-1208 Duplicate ID:

Sample Depth:

Project and Task No.: 14159

Project Name: Whitmark LF

Date: 12/17/08

Sampled By: NB, CB

Method of Purging: /

Method of Sampling: submerge bottle

Initial Depth to Water:

Depth to Water after Sampling:

Total Depth to Well:

Well Diameter:

1 Casing/Borehole Volume:
(Circle one)

3 Casing/Borehole Volumes:
(Circle one)

Total Casing/Borehole Volumes Removed:

Time	Turb ~~Intake Depth~~ NTU	DO ~~Rate (gpm)~~ mg/L	ORP ~~Cum. Vol. (gal)~~ mV	Temp. (°C)	pH (units)	Specific Electrical Conductance ~~(µS/cm)~~ mS/m	Remarks (color, turbidity, and sediment)
1505	133	9.03	175	2.2	6.78	0.791	slightly yellow

pH CALIBRATION (choose two)				
Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Temperature C				
Instrument Reading				

Model or Unit No.:

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION			
KCL Solution (µS/cm=µmhos/cm)			
Temperature C			
Instrument Reading			

Model or Unit No.:

Notes:

Sample @ 1510

AMEC Geomatrix

WELL SAMPLING AND/OR DEVELOPMENT RECORD

Well ID: SW-06

Sample ID: SW-06-1208 Duplicate ID: ______

Sample Depth: ______

Project and Task No.: 14159

Project Name: Whitmarsh LF

Date: 12/17/08

Sampled By: CB, NB

Method of Purging: –

Method of Sampling: submerged bottle

Initial Depth to Water:

Depth to Water after Sampling: ______

Total Depth to Well: ______

Well Diameter: ______

1 Casing/Borehole Volume: ______
(Circle one)

3 Casing/Borehole Volumes: ______
(Circle one)

Total Casing/Borehole Volumes Removed: ______

Time	Turb. ~~Intake Depth~~ NTU	DO ~~Rate (gpm)~~ mg/L	ORP ~~Cum. Vol. (gal)~~ mV	Temp. (°C)	pH (units)	Specific Electrical Conductance ~~(μS/cm)~~ S/m	Remarks (color, turbidity, and sediment)
1540	43	9.10	206	0.9	6.57	2.15	clear.

pH CALIBRATION (choose two)				
Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Temperature C				
Instrument Reading				

Model or Unit No.:

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION			
KCL Solution (μS/cm=μmhos/cm)			
Temperature C			
Instrument Reading			

Model or Unit No.:

Notes:

Sampled @ 1545

AMEC Geomatrix

WELL SAMPLING AND/OR DEVELOPMENT RECORD

Well ID: SW-07

Sample ID: SW-07-1208 Duplicate ID:

Sample Depth:

Project and Task No.: 14159

Project Name: Whitmarsh LF

Date: 12/17/08

Sampled By: NB, CB

Method of Purging: NA

Method of Sampling: peristaltic

Initial Depth to Water:

Depth to Water after Sampling:

Total Depth to Well:

Well Diameter:

1 Casing/Borehole Volume: (Circle one)

3 Casing/Borehole Volumes: (Circle one)

Total Casing/Borehole Volumes Removed:

Time	Turb. ~~Intake Depth~~ NTU	DO ~~Rate (gpm)~~ mg/L	ORP ~~Cum. Vol. (gal.)~~ mV	Temp. (°C)	pH (units)	Specific Electrical Conductance ~~(µS/cm)~~ mS/m	Remarks (color, turbidity, and sediment)
1240	91.3	10.08	108	3.8	8.20	60.6	slightly orange

pH CALIBRATION (choose two)				
Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Temperature C				
Instrument Reading				

Model or Unit No.:

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION			
KCL Solution (µS/cm=µmhos/cm)			
Temperature C			
Instrument Reading			

Model or Unit No.:

Notes:

Sample @ 1245

Chain of Custody Record & Laboratory Analysis Request

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

ARI Assigned Number:
Turn-around Requested: Standard
Page: 1 of 2
ARI Client Company: AMEC Geomatrix
Phone: 206-342-1760
Date: 12/17/08
Ice Present?
Client Contact: Nick Bacher
No. of Coolers:
Cooler Temps:
Client Project Name: Whitmarsh Landfill
Client Project #: 14159
Samplers: Nick Bacher, Chris Brown

					Analysis Requested														Notes/Comments
Sample ID	Date	Time	Matrix	No. Containers	VOCs	SVOCs	Phenols	PAHs	PCBs	OC Pest.	Hcid (TPH)	TPH-Gx	TPH-Dx	Diss. Met	Tot. Met	pH	TDS	Carbonyl	
SP-1-1208	12/17/08	1155	H2O	25	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
SW-7-1208	12/17/08	1245	H2O	25	X	X	X	X	X	X				X	X	X	X	X	
SW-1-1208	12/17/08	1355	H2O	25	X	X	X	X	X	X				X	X	X	X	X	
SW-5-1208	12/17/08	1510	H2O	25	X	X	X	X	X	X				X	X	X	X	X	
SW-3-1208	12/17/08	1520	H2O	25	X	X	X	X	X	X				X	X	X	X	X	
SW-6-1208	12/17/08	1545	H2O	25	X	X	X	X	X	X				X	X	X	X	X	
MW-02-1208	12/18/08	1040	H2O	25	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
MW-03-1208	12/18/08	1330	H2O	25	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
MW-103-1208	12/18/08	1340	H2O	25	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
SW-04-1208	12/18/08	1515	H2O	25	X	X	X	X	X	X				X	X	X	X	X	

Comments/Special Instructions

Relinquished by:	Received by:	Relinquished by:	Received by:
(Signature)	(Signature)	(Signature)	(Signature)
Printed Name: Nick Bacher	Printed Name: Jami Heyes	Printed Name:	Printed Name:
Company: AMEC GMX	Company: ARI	Company:	Company:
Date & Time: 12/19/08 1553	Date & Time: 12/19/08 1553	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.

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number:

Turn-around Requested: Standard

ARI Client Company: AMEC Geomatrix

Phone: 206-342-1760

Client Contact: Nick Bacher

Client Project Name: Whitmarsh Landfill

Client Project #: 14159

Samplers: Nick Bacher, Chris Brown

Page: 2 of 2

Date: 12/18/08

Ice Present?

No. of Coolers:

Cooler Temps:

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

					Analysis Requested															Notes/Comments
Sample ID	Date	Time	Matrix	No. Containers	VOCs	SVOCs	Phenols	PAHs	PCBs	OC Pest.	HCID (TPH)	TPH-Gx	TPH-Dx	Diss. Met	Tot. Met	pH	TDS	Carbonyl		
SP-02-1208	12/18/08	1600	H2O	25	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
SP-03-1208	12/18/08	1645	H2O	25	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
MW-04-1208	12/18/08	1145	H2O	25	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
EB-1208	12/19/08	1545	H2O	25	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Trip Blank	–	–	H2O	6	X															

Comments/Special Instructions	Relinquished by: (Signature) Nick Bacher	Received by: (Signature) Dani Hayes	Relinquished by: (Signature)	Received by: (Signature)
	Printed Name: Nick Bacher	Printed Name: Dani Hayes	Printed Name:	Printed Name:
	Company: AMEC GMX	Company: ARI	Company:	Company:
	Date & Time: 12/19/08 1553	Date & Time: 12/19/08 1553	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.

AMEC Geomatrix

GROUNDWATER SAMPLING LOG
Low Flow Sampling

MONITORING WELL/PIEZOMETER NUMBER MW02

Project Name: Skagit Whitmarsh Landfill

Date: 4/29/09

Project Number: 14159

Weather Conditions:

Location: Anacortes, WA

Sampler: Chris Brown & Nik Bacher

Wind Speed/Direction:

WELL INFORMATION

Casing Diameter (in): 2"

Top of Casing Elevation (ft):

Initial Depth to Water (ft): 7.56

Wellhead Condition: good

Groundwater Elevation (ft):

Depth of Well Casing (ft):

Actual Purge Volume (gal):

PURGING MEASUREMENTS

WL (ft btoc)	Time	pH (std. units)	SC (ms/cm)	Temp. (°C)	ORP (mv)	DO (mg/L)	Turbidity (NTUs)	Notes
	1147	7.65	0.241	13.00	145	2.44	15	
	1150	7.44	0.144	11.65	139	1.38	11	
	1153	7.37	0.100	10.72	140	0.72	14	
	1156	7.23	mS/m 84.1	10.72	138	0.63	15	
	1159	7.13	73.9	10.56	142	0.39	15	
	1203	7.05	71.0	10.44	146	0.24	16	
	1206	7.02	68.5	10.42	146	0.14	22	
	1210	6.99	66.7	10.46	147	0.02	27	
	1213	6.99	63.2	10.30	147	0.00	37	
	1216	6.97	63.2	10.33	146	0.00	36	
	1219	6.97	62.7	10.32	146	0.00	37	
	1222	6.97	62.3	10.43	145	0.00	37	

Sample ID No.:

Water Level Ind. Model & No.:

ORP/DO Meter Model & No.: Horiba U-22

Purge Equipment Used:

Sampling Equipment Used:

Purge Start Time: 1145

Sample Collection Time: 1230

Purge Completion Time:

Purging Method:

Average Purge Rate (mL/min):

Sample Containers Used:

Analytical Lab:

Chemical Analyses:

Other Field Observations:

Updated 3/7/06

Page 1 of

AMEC Geomatrix

GROUNDWATER SAMPLING LOG
Low Flow Sampling

MONITORING WELL/PIEZOMETER NUMBER MW-03

Project Name: Skagit Whitmarsh Landfill

Date: 4/28/09

Project Number: 14159

Weather Conditions: Ocast 50's

Location: Anacortes, WA

Sampler: Chris Brown & Nik Bacher

Wind Speed/Direction: —

WELL INFORMATION

Casing Diameter (in): 2"

Top of Casing Elevation (ft):

Initial Depth to Water (ft): 7.86

Wellhead Condition: OK

Groundwater Elevation (ft):

Depth of Well Casing (ft):

Actual Purge Volume (gal):

PURGING MEASUREMENTS

WL (ft btoc)	Time	pH (std. units)	SC (ms/cm)	Temp. (°C)	ORP (mv)	DO (mg/L)	Turbidity (NTUs)	Notes
7.87	914	7.39	84.2	11.20	-122	3.67	19.4	
7.88	917	7.23	71.2	10.09	-124	0.23	12.6	
7.87	920	7.09	68.9	9.81	-128	0.35	6.3	
7.88	923	6.99	65.5	9.45	-129	0.00	1.9	
7.88	926	6.97	64.8	9.41	-130	0.00	~~27.3~~ 2.6	
7.89	929	6.94	64.3	9.40	-133	0.00	0.1	

Sample ID No.: MW-03-0409, MW-103-0409

Water Level Ind. Model & No.:

ORP/DO Meter Model & No.: Horiba U-22

Purge Equipment Used:

Sampling Equipment Used:

Purge Start Time: 913

Purge Completion Time:

Average Purge Rate (mL/min):

Analytical Lab:

Sample Collection Time: 930 / 1020

Purging Method: Parastaltic

Sample Containers Used:

Chemical Analyses:

Other Field Observations: Duplicate collected

Updated 3/7/06

AMEC Geomatrix

GROUNDWATER SAMPLING LOG
Low Flow Sampling

MONITORING WELL/PIEZOMETER NUMBER MW-04

Project Name: Skagit Whitmarsh Landfill

Date: 4/29/09

Project Number: 14159

Weather Conditions: P. Sunny 50'S

Location: Anacortes, WA

Sampler: Chris Brown & Nik Bacher

Wind Speed/Direction:

WELL INFORMATION

Casing Diameter (in): 2"

Groundwater Elevation (ft):

Top of Casing Elevation (ft):

Depth of Well Casing (ft):

Initial Depth to Water (ft): 2.95

Actual Purge Volume (gal):

Wellhead Condition: good

PURGING MEASUREMENTS

WL (ft btoc)	Time	pH (std. units)	SC (ms/cm)	Temp. (°C)	ORP (mv)	DO (mg/L)	Turbidity (NTUs)	Notes
	846	7.54	51.6	10.15	24	3.42	0	
	849	7.30	51.8	10.25	-80	0.00	0	
	852	7.22	51.7	10.32	-95	0.00	1.1	
	855	7.20	51.6	10.40	-101	0.00	0	
	858	7.26	51.5	10.45	-107	0.00	0	
	901	7.24	51.3	10.51	-112	0.00	0	
	904	7.26	51.3	10.52	-116	0.06	0	

Sample ID No.:

Water Level Ind. Model & No.:

ORP/DO Meter Model & No.: Horiba U-22

Purge Equipment Used:

Sampling Equipment Used:

Purge Start Time: 845

Sample Collection Time: ~~940~~ 920

Purge Completion Time:

Purging Method:

Average Purge Rate (mL/min):

Sample Containers Used:

Analytical Lab:

Chemical Analyses:

Other Field Observations:

GROUNDWATER SAMPLING LOG
Low Flow Sampling

MONITORING WELL/PIEZOMETER NUMBER SP-01

Project Name: Skagit Whitmarsh Landfill

Date: ______

Project Number: 14159

Weather Conditions: ______

Location: Anacortes, WA

Sampler: Chris Brown & Nik Bacher

Wind Speed/Direction: ______

WELL INFORMATION

Casing Diameter (in):
Top of Casing Elevation (ft): NA
Initial Depth to Water (ft):
Wellhead Condition: ______

Groundwater Elevation (ft): ______
Depth of Well Casing (ft): ______
Actual Purge Volume (gal): ______

PURGING MEASUREMENTS

WL (ft btoc)	Time	pH (std. units)	SC (ms/cm)	Temp. (°C)	ORP (mv)	DO (mg/L)	Turbidity (NTUs)	Notes
	1315	7.31	74.9	13.61	-26	5.45	13.7	

Sample ID No.: ______
Water Level Ind. Model & No.: ______
ORP/DO Meter Model & No.: Horiba U-22
Purge Equipment Used: NA
Sampling Equipment Used: ______

Purge Start Time: ______
Purge Completion Time: ______
Average Purge Rate (mL/min): ______
Analytical Lab: ______

Sample Collection Time: 1315
Purging Method: ______
Sample Containers Used: ______
Chemical Analyses: ______

Other Field Observations: ______

AMEC Geomatrix

GROUNDWATER SAMPLING LOG
Low Flow Sampling

MONITORING WELL/PIEZOMETER NUMBER SP-07

Project Name: Skagit Whitmarsh Landfill

Date:

Project Number: 14159

Weather Conditions:

Location: Anacortes, WA

Sampler: Chris Brown & Nik Bacher

Wind Speed/Direction:

WELL INFORMATION

Casing Diameter (in): NA

Top of Casing Elevation (ft): NA

Initial Depth to Water (ft): NA

Wellhead Condition:

Groundwater Elevation (ft):

Depth of Well Casing (ft):

Actual Purge Volume (gal):

PURGING MEASUREMENTS

WL (ft btoc)	Time	pH (std. units)	SC (~~µ~~s/cm)	Temp. (°C)	ORP (mv)	DO (mg/L)	Turbidity (NTUs)	Notes
	1405	6.99	0.132	13.84	-86	7.60	9.0	

Sample ID No.:

Water Level Ind. Model & No.:

ORP/DO Meter Model & No.: Horiba U-22

Purge Equipment Used:

Sampling Equipment Used:

Purge Start Time: 1405

Purge Completion Time:

Average Purge Rate (mL/min):

Analytical Lab:

Sample Collection Time: 1415

Purging Method:

Sample Containers Used:

Chemical Analyses:

Other Field Observations:

AMEC Geomatrix

GROUNDWATER SAMPLING LOG
Low Flow Sampling

MONITORING WELL/PIEZOMETER NUMBER SP-03

Project Name: Skagit Whitmarsh Landfill

Date: 4/28/09

Project Number: 14159

Weather Conditions: P. Sunny 60°

Location: Anacortes, WA

Sampler: Chris Brown & Nik Bacher

Wind Speed/Direction:

WELL INFORMATION

Casing Diameter (in): NA
Top of Casing Elevation (ft):
Initial Depth to Water (ft):
Wellhead Condition:

Groundwater Elevation (ft):
Depth of Well Casing (ft):
Actual Purge Volume (gal):

PURGING MEASUREMENTS

WL (ft btoc)	Time	pH (std. units)	SC (µs/cm)	Temp. (°C)	ORP (mv)	DO (mg/L)	Turbidity (NTUs)	Notes
	1509	6.95	0.129	14.31	-66	5.48	145	

Sample ID No.:
Water Level Ind. Model & No.:
ORP/DO Meter Model & No.: Horiba U-22
Purge Equipment Used:
Sampling Equipment Used:

Purge Start Time: 1510
Purge Completion Time:
Average Purge Rate (mL/min):
Analytical Lab: ARI

Sample Collection Time: 1520
Purging Method:
Sample Containers Used:
Chemical Analyses:

Other Field Observations:

AMEC Geomatrix

GROUNDWATER SAMPLING LOG
Low Flow Sampling

MONITORING WELL/PIEZOMETER NUMBER SW-01

Project Name: Skagit Whitmarsh Landfill

Date: 4/28/09

Project Number: 14159

Weather Conditions: overcast, 50s

Location: Anacortes, WA

Sampler: Chris Brown & Nik Bacher

Wind Speed/Direction:

WELL INFORMATION

Casing Diameter (in): NA

Top of Casing Elevation (ft): NA

Initial Depth to Water (ft): NA

Wellhead Condition: NA

Groundwater Elevation (ft): NA

Depth of Well Casing (ft): NA

Actual Purge Volume (gal): NA

PURGING MEASUREMENTS

WL (ft btoc)	Time	pH (std. units)	SC (ms/cm)	Temp. (°C)	ORP (mv)	DO (mg/L)	Turbidity (NTUs)	Notes
/	1020	6.97	46.0	10.56	76	8.76	4.1	clear,
								some algae
								in water

Sample ID No.:

Water Level Ind. Model & No.:

ORP/DO Meter Model & No.: Horiba U-22

Purge Equipment Used:

Sampling Equipment Used:

Purge Start Time:

Purge Completion Time:

Average Purge Rate (mL/min):

Analytical Lab:

Sample Collection Time: 1000

Purging Method:

Sample Containers Used:

Chemical Analyses:

Other Field Observations:

AMEC Geomatrix

GROUNDWATER SAMPLING LOG
Low Flow Sampling

MONITORING WELL/PIEZOMETER NUMBER SW.03

Project Name: Skagit Whitmarsh Landfill

Date: 4/29/09

Project Number: 14159

Weather Conditions:

Location: Anacortes, WA

Sampler: Chris Brown & Nik Bacher

Wind Speed/Direction:

WELL INFORMATION

Casing Diameter (in):
Top of Casing Elevation (ft): N/A
Initial Depth to Water (ft):
Wellhead Condition:

Groundwater Elevation (ft):
Depth of Well Casing (ft):
Actual Purge Volume (gal):

PURGING MEASUREMENTS

WL (ft btoc)	Time	pH (std. units)	SC (~~µ~~s/~~c~~m)	Temp. (°C)	ORP (mv)	DO (mg/L)	Turbidity (NTUs)	Notes
	1004	7.82	0.221	16.34	90	14.09	15	

Sample ID No.:
Water Level Ind. Model & No.:
ORP/DO Meter Model & No.: Horiba U-22
Purge Equipment Used:
Sampling Equipment Used:

Purge Start Time:
Purge Completion Time:
Average Purge Rate (mL/min):
Analytical Lab:

Sample Collection Time: 1020
Purging Method: dunk
Sample Containers Used:
Chemical Analyses:

Other Field Observations: Stagnant water w/ foam & oily sheen on surface

Updated 3/7/06

Page 1 of ___

AMEC Geomatrix

GROUNDWATER SAMPLING LOG
Low Flow Sampling

MONITORING WELL/PIEZOMETER NUMBER SW-04

Project Name: Skagit Whitmarsh Landfill

Date: 4/29/09

Project Number: 14159

Weather Conditions:

Location: Anacortes, WA

Sampler: Chris Brown & Nik Bacher

Wind Speed/Direction:

WELL INFORMATION

Casing Diameter (in):

Groundwater Elevation (ft):

Top of Casing Elevation (ft):

Depth of Well Casing (ft):

Initial Depth to Water (ft):

Actual Purge Volume (gal):

Wellhead Condition:

PURGING MEASUREMENTS

WL (ft btoc)	Time	pH (std. units)	SC (mS/cm)	Temp. (°C)	ORP (mv)	DO (mg/L)	Turbidity (NTUs)	Notes
	923	6.74	.735	12.49	66	7.52	17.2	

Sample ID No.:

Water Level Ind. Model & No.:

ORP/DO Meter Model & No.: Horiba U-22

Purge Equipment Used:

Sampling Equipment Used:

Purge Start Time:

Sample Collection Time: 940

Purge Completion Time:

Purging Method:

Average Purge Rate (mL/min):

Sample Containers Used:

Analytical Lab:

Chemical Analyses:

Other Field Observations:

Updated 3/7/06

AMEC Geomatrix

GROUNDWATER SAMPLING LOG
Low Flow Sampling

MONITORING WELL/PIEZOMETER NUMBER SW-05

Project Name: Skagit Whitmarsh Landfill

Date: 4/29/09

Project Number: 14159

Weather Conditions:

Location: Anacortes, WA

Sampler: Chris Brown & Nik Bacher

Wind Speed/Direction:

WELL INFORMATION

Casing Diameter (in):

Top of Casing Elevation (ft):

Initial Depth to Water (ft):

Wellhead Condition:

Groundwater Elevation (ft):

Depth of Well Casing (ft):

Actual Purge Volume (gal):

PURGING MEASUREMENTS

WL (ft btoc)	Time	pH (std. units)	SC (mS/cm)	Temp. (°C)	ORP (mv)	DO (mg/L)	Turbidity (NTUs)	Notes
	1041	7.54	.687	10.47	95	10.55	4	

Sample ID No.:

Water Level Ind. Model & No.:

ORP/DO Meter Model & No.: Horiba U-22

Purge Equipment Used:

Sampling Equipment Used:

Purge Start Time:

Purge Completion Time:

Average Purge Rate (mL/min):

Analytical Lab:

Sample Collection Time: 1100

Purging Method:

Sample Containers Used:

Chemical Analyses:

Other Field Observations:

AMEC Geomatrix

GROUNDWATER SAMPLING LOG
Low Flow Sampling

MONITORING WELL/PIEZOMETER NUMBER SW-06

Project Name: Skagit Whitmarsh Landfill

Date: 4/29/09

Project Number: 14159

Weather Conditions:

Location: Anacortes, WA

Sampler: Chris Brown & Nik Bacher

Wind Speed/Direction:

WELL INFORMATION

Casing Diameter (in):

Top of Casing Elevation (ft):

Initial Depth to Water (ft):

Wellhead Condition:

Groundwater Elevation (ft):

Depth of Well Casing (ft):

Actual Purge Volume (gal):

PURGING MEASUREMENTS

WL (ft btoc)	Time	pH (std. units)	SC (ms/cm)	Temp. (°C)	ORP (mv)	DO (mg/L)	Turbidity (NTUs)	Notes
	1053	7.41	1.83	16.81	115	13.85	14	

Sample ID No.:

Water Level Ind. Model & No.:

ORP/DO Meter Model & No.: Horiba U-22

Purge Equipment Used:

Sampling Equipment Used:

Purge Start Time:

Purge Completion Time:

Average Purge Rate (mL/min):

Analytical Lab:

Sample Collection Time: 1100

Purging Method:

Sample Containers Used:

Chemical Analyses:

Other Field Observations:

AMEC Geomatrix

WELL SAMPLING AND/OR DEVELOPMENT RECORD

Well ID: MW-02
Sample ID: MW-2-0709 Duplicate ID:
Sample Depth: btm
Project and Task No.: 14159
Project Name: ~~HH~~ Whitmarsh
Date: 7/24/09
Sampled By: C.B., I.O
Method of Purging: Parastaltic
Method of Sampling: " "

Initial Depth to Water: 8.20
Depth to Water after Sampling: 8.24
Total Depth to Well:
Well Diameter: 2"
1 Casing/Borehole Volume:
(Circle one)
3 Casing/Borehole Volumes:
(Circle one)
Total Casing/Borehole Volumes Removed:

Time	Intake Depth	Rate ~~(gpm)~~ mL/min	Cum. Vol. (gal.)	Temp. (°C)	pH (units)	Specific Electrical Conductance (~~µ~~S/~~c~~m)	Remarks (color, turbidity, and sediment) Turb DO ORP
849	btm	200	0	11.8	6.77	1.14	25 8.80 201
852			0.2	11.8	6.61	over	13 0.0 206
855			0.4	11.8	6.50	over	11 0.0 210
858			0.7	11.8	6.42	over	11 0.0 210
901			1.0	11.8	6.40	over	9.7 0.0 211
904			1.3	12.5	6.39	over	14.7 0.07 210
907			1.7	12.1	6.38	over	13.2 0.0 209
912			1.9	12.1	6.37	over	13.3 0.0 209
915			2.1	12.1	6.36	over	11.5 0.0 207
919			2.3	12.2	6.36	over	10.2 0.0 206

pH CALIBRATION (choose two)

Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Temperature C				
Instrument Reading				

Model or Unit No.:

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION

KCL Solution (µS/cm=µmhos/cm)			
Temperature C			
Instrument Reading			

Model or Unit No.:

Notes: Seems the conductivity is not working correctly again, and is out of range, recalibration efforts didn't help.
sample collected @ 920

AMEC Geomatrix

WELL SAMPLING AND/OR DEVELOPMENT RECORD

Sample 1805

Dup 1915

5236

Well ID: MW-03

Sample ID: MW-03-0709 Duplicate ID: MW-103-0709

Sample Depth:

Project and Task No.: 14159

Project Name: Whitmarsh

Date: 7/23/09

Sampled By: C.B. T.O.

Method of Purging: Parastaltic

Method of Sampling: " "

Initial Depth to Water: 9.40

Depth to Water after Sampling:

Total Depth to Well: 17.52

Well Diameter: 2" →8.12'

1 Casing/Borehole Volume:
(Circle one)

3 Casing/Borehole Volumes:
(Circle one)

Total Casing/Borehole Volumes Removed:

Time	Intake Depth	Rate ~~(gpm)~~ mL/min	Cum. Vol. (gal.)	Temp. (°C)	pH (units)	Specific Electrical Conductance (µS/cm)	Remarks (color, turbidity, and sediment) Turb DO ORP
1730 ~~1640~~	btm	200	0.1	16.5	7.02 ~~8.3~~	—	16 1.16 -53
17 1733			0.15	16.0	7.09	9.99 +	6.8 3.19 -100
1737			0.2	16.0	7.11	9.44	6.9 7.84 -115
1741			0.5	16.0	7.11	4.38	7.3 8.28 -133
1744			0.6	15.9	7.11	3.20	8.5 8.51 -137
1747			0.8	15.9	7.12	2.02	8.0 8.64 -144
1751			1.1	15.8	7.12	1.51	8.5 8.67 -147
1754			1.4	15.8	7.14	1.18	9.3 8.61 -152
1758			1.7	15.8	7.14	0.30	10.3 8.54 -156
1801			2.0	15.7	7.15	0.162	11.6 8.48 -160

pH CALIBRATION (choose two)

Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Temperature C				
Instrument Reading				

Model or Unit No.:

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION

KCL Solution (µS/cm=µmhos/cm)			
Temperature C			
Instrument Reading			

Model or Unit No.:

Notes: After recalibrating instrument, we cannot get Cond. sensor to work right, may be damaged. ~~Sample~~ Sample collected @ 1805, Dup. collected @ 1915.

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AMEC Geomatrix

WELL SAMPLING AND/OR DEVELOPMENT RECORD

Well ID: MW-04
Sample ID: MW-04-0709 Duplicate ID:
Sample Depth:
Project and Task No.: 14159
Project Name: Whitmarsh
Date: 7/24/09
Sampled By: CB, TO
Method of Purging: Peristaltic
Method of Sampling: " "

Initial Depth to Water: 3.05
Depth to Water after Sampling: 3.07
Total Depth to Well:
Well Diameter:
1 Casing/Borehole Volume: (Circle one)
3 Casing/Borehole Volumes: (Circle one)
Total Casing/Borehole Volumes Removed:

Time	Intake Depth	Rate (gpm)	Cum. Vol. (gal.)	Temp. (°C)	pH (units)	Specific Electrical Conductance (µS/cm)	Remarks (color, turbidity, and sediment)		
							Turb	DO	ORP
10:47				14.0	7.20	73.0 mS/m	4.2	9.58	193.
10:50				13.6	7.26	0.350	3.3	9.43	176
10:54				13.2	7.30	~~6~~5.90	3.7	7.44	129
10:57				13.2	7.31	4.05	2.6	7.72	100
11:01				13.0	7.31	3.55	2.6	8.0	79
11:04				13.1	7.29	2.43	2.6	8.15	44
11:07				13.1	7.33	2.43	3.3	8.12	13
11:10				13.1	7.33	1.55	3.4	8.37	-14
11:14				12.9	7.32	0.93	2.8	8.61	-42
11:18				12.8	7.33	0.17	2.9	8.82	-52
11:21				12.7	7.33	0.128	2.8	8.87	-64
11:24				12.6	7.33	0.103	2.8	8.87	-69

pH CALIBRATION (choose two)

Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Temperature C				
Instrument Reading				

Model or Unit No.:

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION

KCL Solution (µS/cm=µmhos/cm)			
Temperature C			
Instrument Reading			

Model or Unit No.:

Notes: Sample collected @ 11:30.

AMEC Geomatrix

WELL SAMPLING AND/OR DEVELOPMENT RECORD

Well ID: SP-01

Sample ID: SP-01-0709 Duplicate ID:

Sample Depth:

Project and Task No.: 14159

Project Name: Whitmarsh

Date: 7/24/09

Sampled By: CB, TO

Method of Purging: Peristaltic

Method of Sampling: " "

Initial Depth to Water: 0

Depth to Water after Sampling:

Total Depth to Well:

Well Diameter:

1 Casing/Borehole Volume: (Circle one)

3 Casing/Borehole Volumes: (Circle one)

Total Casing/Borehole Volumes Removed:

Time	Intake Depth	Rate (gpm)	Cum. Vol. (gal.)	Temp. (°C)	pH (units)	Specific Electrical Conductance (µS/cm)	Remarks (color, turbidity, and sediment)		
							Turb.	DO	ORP
13:58				16.0	7.37	0.308	14.0	12.90	133

pH CALIBRATION (choose two)

Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Temperature C				
Instrument Reading				

Model or Unit No.:

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION

KCL Solution (µS/cm=µmhos/cm)			
Temperature C			
Instrument Reading			

Model or Unit No.:

Notes: Sample collected @ 14:00.

AMEC Geomatrix

WELL SAMPLING AND/OR DEVELOPMENT RECORD

Well ID: SP-02

Sample ID: SP-02-0709 Duplicate ID: ____________

Sample Depth: -0

Project and Task No.: 14157

Project Name: Whitmarsh

Date: 7/24/09

Sampled By: CB TO

Method of Purging: Peristaltic

Method of Sampling: " "

Initial Depth to Water:

Depth to Water after Sampling: ____________

Total Depth to Well: ____________

Well Diameter: ____________

1 Casing/Borehole Volume: ____________
(Circle one)

3 Casing/Borehole Volumes: ____________
(Circle one)

Total Casing/Borehole Volumes Removed: ____________

Time	Intake Depth	Rate (gpm)	Cum. Vol. (gal.)	Temp. (°C)	pH (units)	Specific Electrical Conductance (µS/cm)	Remarks (color, turbidity, and sediment)
~~1555~~	1555			18.0	7.26	0.152	Turb DO ORP 55 11.63 54

pH CALIBRATION (choose two)

Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Temperature C				
Instrument Reading				

Model or Unit No.:

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION

KCL Solution (µS/cm=µmhos/cm)			
Temperature C			
Instrument Reading			

Model or Unit No.:

Notes: Sample Collection @ 1600

AMEC Geomatrix

WELL SAMPLING AND/OR DEVELOPMENT RECORD

Well ID: SP-03

Sample ID: SP-03-0709 Duplicate ID:

Sample Depth: 0

Project and Task No.: 14159

Project Name: Whitmarsh

Date: 7/24/09

Sampled By: CB, TO

Method of Purging: Peristaltic

Method of Sampling: " "

Initial Depth to Water: 0

Depth to Water after Sampling:

Total Depth to Well:

Well Diameter:

1 Casing/Borehole Volume:
(Circle one)

3 Casing/Borehole Volumes:
(Circle one)

Total Casing/Borehole Volumes Removed:

Time	Intake Depth	Rate (gpm)	Cum. Vol. (gal.)	Temp. (°C)	pH (units)	Specific Electrical Conductance (µS/cm)	Remarks (color, turbidity, and sediment) Turb / DO / ORP
15:05				19.3	6.86	0.206	45.0 / 11.65 / 41

pH CALIBRATION (choose two)				
Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Temperature C				
Instrument Reading				

Model or Unit No.:

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION			
KCL Solution (µS/cm=µmhos/cm)			
Temperature C			
Instrument Reading			

Model or Unit No.:

Notes: Sample collected @ 15:10.

AMEC Geomatrix

WELL SAMPLING AND/OR DEVELOPMENT RECORD

Well ID: SW-01
Sample ID: SW-01-0709 Duplicate ID:
Sample Depth:
Project and Task No.: 14159
Project Name: Whitmarsh
Date: 7/23/09
Sampled By: C. Brown
Method of Purging: ~~dunk~~ NA
Method of Sampling: dunk

Initial Depth to Water:
Depth to Water after Sampling:
Total Depth to Well:
Well Diameter:
1 Casing/Borehole Volume: (Circle one)
3 Casing/Borehole Volumes: (Circle one)
Total Casing/Borehole Volumes Removed:

Time	Intake Depth	Rate (gpm)	Cum. Vol. (gal.)	Temp. (°C)	pH (units)	Specific Electrical Conductance (µS/cm)	Remarks (color, turbidity, and sediment)
10:34				16.0	6.81	0.250*	57.0 NTU, 7.72 g/L, 4.0%s
							−71 mV

pH CALIBRATION (choose two)

Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Temperature C				
Instrument Reading				

Model or Unit No.:

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION

KCL Solution (µS/cm=µmhos/cm)			
Temperature C			
Instrument Reading			

Model or Unit No.:

Notes:

* S/m
Sample collected @ 10:35.

AMEC Geomatrix

WELL SAMPLING AND/OR DEVELOPMENT RECORD

Well ID: SW-03

Sample ID: SW-03-0709 Duplicate ID:

Sample Depth:

Project and Task No.: 14159

Project Name: Whitmarsh

Date: 7/23/09

Sampled By: CB, TO

Method of Purging: NA

Method of Sampling: Dunk

Initial Depth to Water:

Depth to Water after Sampling:

Total Depth to Well:

Well Diameter:

1 Casing/Borehole Volume: (Circle one)

3 Casing/Borehole Volumes: (Circle one)

Total Casing/Borehole Volumes Removed:

Time	Intake Depth	Rate (gpm)	Cum. Vol. (gal.)	Temp. (°C)	pH (units)	Specific Electrical Conductance (μS/cm)	Remarks (color, turbidity, and sediment) turb DO ORP
11:25				17.4	6.79	9.99+	20.0 1.52 137

pH CALIBRATION (choose two)

Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Temperature C				
Instrument Reading				

Model or Unit No.:

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION

KCL Solution (μS/cm=μmhos/cm)			
Temperature C			
Instrument Reading			

Model or Unit No.:

Notes: Sample collected @ 11:30.

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AMEC Geomatrix

WELL SAMPLING AND/OR DEVELOPMENT RECORD

Well ID: SW-04

Sample ID: SW-04-0709 Duplicate ID: ____

Sample Depth: ____

Project and Task No.: 14159

Project Name: Whitmarsh

Date: 7/23/09

Sampled By: CB, TO

Method of Purging: NA

Method of Sampling: Dunk

Initial Depth to Water:

Depth to Water after Sampling: ____

Total Depth to Well: ____

Well Diameter: ____

1 Casing/Borehole Volume: ____
(Circle one)

3 Casing/Borehole Volumes: ____
(Circle one)

Total Casing/Borehole Volumes Removed: ____

Time	Intake Depth	Rate (gpm)	Cum. Vol. (gal.)	Temp. (°C)	pH (units)	Specific Electrical Conductance (µS/cm)	Remarks (color, turbidity, and sediment) Turb | DO | ORP | SAL
15:15				22.7	8.27	9.99	~~90.4~~ | 2.59 | 57mV | 4.0%
							45.7

pH CALIBRATION (choose two)

Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Temperature C				
Instrument Reading				

Model or Unit No.:

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION

KCL Solution (µS/cm=µmhos/cm)			
Temperature C			
Instrument Reading			

Model or Unit No.:

Notes: Sample collected @ 15:20

AMEC Geomatrix

WELL SAMPLING
AND/OR DEVELOPMENT RECORD

Well ID: SW-05

Sample ID: SW-05-0709 Duplicate ID: ______

Sample Depth: ______

Project and Task No.: 14159

Project Name: Whitmarsh

Date: 7/23/09

Sampled By: CB, TO

Method of Purging: NA

Method of Sampling: Dunk

Initial Depth to Water:

Depth to Water after Sampling: ______

Total Depth to Well: ______

Well Diameter: ______

1 Casing/Borehole Volume: ______
(Circle one)

3 Casing/Borehole Volumes: ______
(Circle one)

Total Casing/Borehole Volumes Removed: ______

Time	Intake Depth	Rate (gpm)	Cum. Vol. (gal.)	Temp. (°C)	pH (units)	Specific Electrical Conductance (µS/cm)	Remarks (color, turbidity, and sediment)
							Turb DO ORP SAL
14:38				26.4	8.66	~~6. 9.18~~	12,3 4,18 74mV 4.0%
						3.13	

pH CALIBRATION (choose two)

Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Temperature C				
Instrument Reading				

Model or Unit No.:

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION

KCL Solution (µS/cm=µmhos/cm)			
Temperature C			
Instrument Reading			

Model or Unit No.:

Notes: Sample collected @

\\sf3\ppingree$\FORMATS\WELL SAMPLING Record.doc

AMEC Geomatrix

WELL SAMPLING
AND/OR DEVELOPMENT RECORD

Well ID: SW-06

Sample ID: SW-06-0709 Duplicate ID: ____________

Sample Depth: ____________

Project and Task No.: 14159

Project Name: Whitmarsh

Date: 7/23/09

Sampled By: CB, TD

Method of Purging: NA

Method of Sampling: Dunk

Initial Depth to Water:

Depth to Water after Sampling: ____________

Total Depth to Well: ____________

Well Diameter: ____________

1 Casing/Borehole Volume: ____________
(Circle one)

3 Casing/Borehole Volumes: ____________
(Circle one)

Total Casing/Borehole
Volumes Removed: ____________

Time	Intake Depth	Rate (gpm)	Cum. Vol. (gal.)	Temp. (°C)	pH (units)	Specific Electrical Conductance (µS/cm)	Remarks (color, turbidity, and sediment) Turb. | ~~Cond~~ | DO | ORP
14:00				23.5	7.62	9,994.0	27 | [illegible] | 3.76 mg/L | 150

pH CALIBRATION (choose two)

Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Temperature C				
Instrument Reading				

Model or Unit No.:

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION

KCL Solution (µS/cm=µmhos/cm)			
Temperature C			
Instrument Reading			

Model or Unit No.:

Notes: Sample collected @ 14:05

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number:
Turn-around Requested: Standard
ARI Client Company: AMEC Geomatrix, Inc.
Phone: 206-342-1760
Client Contact: Nikolas Bacher
Client Project Name: Whitmarsh Landfill
Client Project #: 14159
Samplers: Chris Brown (CB), Toni Olson (TO)

Page: 1 of 2
Date: 7/24/06
Ice Present?
No. of Coolers:
Cooler Temps:

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

					Analysis Requested													
Sample ID	Date	Time	Matrix	No. Containers	~~VOC~~ Diethyl ether	~~SVOC~~	~~Pest~~	Total Metals	~~PCBs~~	Dissolved Metals	TPH-Dx	pH/TDS	TPH-HCID	TPH-G	Total Hg	Dissolved Hg	Pahs	Notes/Comments
SW-01-0709	7/23/09	10:35	W	16	X	X	X	X	X	X		X			X	X	X	JTO ~~2~~,6,4,7
SW-03-0709	7/23/09	11:30	W	16	X	X	X	X	X	X		X			X	X	X	4,6,7
SW-06-0709	7/23/09	14:05	W	18	X	X	X	X	X	X		X			X	X	X	4,6,7
SW-05-0709	7/23/09	14:40	W	18	X	X	X	X	X	X		X			X	X	X	4,6,7
SW-04-0709	7/23/09	15:20	W	18	X	X	X	X	X	X		X			X	X	X	4,6,7
MW-03-0709	7/23/09	18:05	W	26	X	X	X	X	X	X	X	X	X	X	X	X	X	3,6,7
MW-103-0709	7/23/09	19:05	W	26	X	X	X	X	X	X	X	X	X	X	X	X	X	3,6,7
MW-02-0709	7/24/09	9:20	W	26	X	X	X	X	X	X	X	X	X	X	X	X	X	4,2,6,7
MW-04-0709	7/24/09	11:30	W	26	X	X	X	X	X	X	X	X	X	X	X	X	X	2,6,7,3
~~MW~~ JTO SP-01-0709	7/24/09	14:00	W	26	X	X	X	X	X	X	X	X	X	X	X	X	X	2,6,7,3

Comments/Special Instructions
1-Tot. Metals Samp. Need Pres. Added
2-Total Hg Samp. Needs Pres. Added
3-Diss Met. = Field-filtered
4-Diss Met. = Not field-filtered
5-Diss Hg = Field-filtered
6-Diss Hg = Not field-filtered
7-Sub out diethyl ether analysis

Relinquished by:	Received by:	Relinquished by:	Received by:
(Signature) Toni Olson	(Signature) Jonathon Walter	(Signature)	(Signature)
Printed Name: Toni Olson	Printed Name: Jonathon Walter	Printed Name:	Printed Name:
Company: AMEC Gmx	Company: ARI	Company:	Company:
Date & Time: 7/25/09 8:10	Date & Time: 7/25/09 8/0	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.

Chain of Custody Record & Laboratory Analysis Request

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

ARI Assigned Number:	Turn-around Requested: Standard	Page: 2 of 2
ARI Client Company: AMEC Geomatrix, Inc.	Phone: 206-342-1760	Date: 7/24/09
Client Contact: Nikolas Bacher		Ice Present?
Client Project Name: Whitmarsh Landfill		No. of Coolers:
Client Project #: 14159	Samplers: CB, TO	Cooler Temps:

Analysis Requested

Sample ID	Date	Time	Matrix	No. Containers	VOC Diethyl Ether	SVOC	Reat	Total Metals	PCBs	Dissolved Metals	TPH-Dx	pH/TDS	TPH-HCID	TPH-G	Total Hg	Dissolved Hg	PAHs		Notes/Comments
SP-03-0709	7/24/09	15:10	W	26	X	X	X	X	X	X	X	X	X	X	X	X	X		3, 2, 6, 7
SMW-05-0709	7/24/09	17:05	W	26	X	X	X	X	X	X	X	X	X	X	X	X	X		1, 4, 6, 7
SP-02-0709	7/24/09	16:00	W	26	X	X	X	X	X	X	X	X	X	X	X	X	X		2, 6, 7, 3
Trip Blanks	—	—	W	11	X														

Comments/Special Instructions
1-Tot. Metals Sample needs preserv.
2-Tot. Hg Sample Needs Preserv.
3-Diss. Met. = Field-filtered
4-Diss. Met. = Not field-filtered
5-Diss. Hg. = Field-filtered
6-Diss. Hg. = Not field-filtered
7-Sub out diethyl ether analysis

Relinquished by: (Signature) Tai Olson	Received by: (Signature)	Relinquished by: (Signature)	Received by: (Signature)
Printed Name: Toni Olson	Printed Name: Jonathon Walter	Printed Name:	Printed Name:
Company: Amec Geomatrix	Company: ARI	Company:	Company:
Date & Time: 7/25/09 8:10	Date & Time: 7/25/09 810	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

Sediment Logs

QUALITATIVE SAMPLE CHARACTERISTICS

Page 1 of 20

Coordinate Datum	Date (mm/dd/yy)	Project Location	Sample Identification Number
SPC WA N NAD 1983	08/28/08	March Pt	MP-1

Coordinates		Water Depth				
North	East	Depth	Unit	Rep	Gear	Time
537993	122 9337	0	ft		Cookie	0809

Penetration		Initials	Sulfide	VOA	Weather	Fines (%)
Depth	Unit					
10	cm	RHG			OVERCAST	

Surficial Wood Estimate:

Contact Points ______ X 5 = ______ %

Surficial sediment characteristics:

Biological: ______ % **Debris:** ______ % **Oil Sheen:** None Trace (<5%) ______ %

Moisture
Very Wet Wet [✓ Moist] Damp Dry

Color **(Circle major & underline modifying)**
Light [✓ Medium] Dark [✓ Olive] Gray Brown Black Other ______

Major Constituent **(Circle major & underline modifying)**
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay ______

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ______

Subsurface sediment characteristics:

Density / Consistency

Sand / Gravel - Very Loose Loose Medium Dense Dense Very Dense

Silt / Clay - Very Soft [✓ Soft] Medium Stiff Stiff Very Stiff Hard

Moisture
Very Wet Wet [✓ Moist] Damp Dry

Color **(Circle major & underline modifying)**
Light Medium [✓ Dark] Olive [✓ Gray] Brown Black Other ______

Major Constituent **(Circle major & underline modifying)**
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay ______

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ______

Biological: ______ % **Debris:** ______ % **Oil Sheen:** None Trace (<5%) ______ %

Comments:
Thin (1/2 cm) sulfide layer just below surface
then dark gray to bottom
chunks (1 to 3 in) of wood on surface of core

AMEC Geomatrix
MP-1
Description Form
Initials: RHG
Date: 8/28/08 Time: 0809

QUALITATIVE SAMPLE CHARACTERISTICS

Coordinate Datum	Date (mm/dd/yy)	Project Location	Sample Identification Number
SPC WA N NAD 1983	8/26/08	March Pt	MP-2A

Coordinates		Water Depth		Rep	Gear	Time
North	East	Depth	Unit			
5 38 148	1229111	0	f t		Cookie	1145

Penetration		Initials	Sulfide	VOA	Weather	Fines (%)
Depth	Unit					
10	c m	RHG			OVERCAST	

Surficial Wood Estimate:

Contact Points ________ X 5 = ________ %

Surficial sediment characteristics:

Algal mat

Biological: 100 % **Debris:** ________ % **Oil Sheen:** None Trace (<5%) ________ %

Moisture
Very Wet Wet [✓ Moist] Damp Dry

Color **(Circle major & underline modifying)**
Light [✓ Medium] [✓ Dark] Olive Gray Brown Black Other Greenish brown

Major Constituent **(Circle major & underline modifying)**
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay ________

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ________

Subsurface sediment characteristics:

Density / Consistency

Sand / Gravel - Very Loose Loose Medium Dense Dense Very Dense

Silt / Clay - Very Soft [✓ Soft] Medium Stiff Stiff Very Stiff Hard

Moisture
Very Wet Wet Moist [✓ Damp] Dry

Color **(Circle major & underline modifying)**
Light [✓ Medium] [✓ Dark] [✓ Olive] [✓ Gray] Brown Black Other ________

Major Constituent **(Circle major & underline modifying)**
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay ________

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ________

Biological: ________ % **Debris:** ________ % **Oil Sheen:** None Trace (<5%) ________ %

Comments:

AMEC Geomatrix
MP-2D
Description Form
Initials: KVO
Date: 8/26/08 Time: 1208

Plant Material & Trace
WOODY DEBRIS

QUALITATIVE SAMPLE CHARACTERISTICS

Page 3 of 20

Coordinate Datum	Date (mm/dd/yy)	Project Location	Sample Identification Number
SPC WA N NAD 1983	8/26/08	March Pt	MP-2D

Coordinates		Water Depth		Rep	Gear	Time
North	East	Depth	Unit			
538148	1229111	0	f t		Cookie	1205

Penetration		Initials	Sulfide	VOA	Weather	Fines (%)
Depth	Unit					
10	c m	RHG			OVERCAST	

Surficial Wood Estimate:

Contact Points ______ X 5 = ______ %

Surficial sediment characteristics:

Biological: Algal mat % **Debris:** ______ % **Oil Sheen:** None Trace (<5%) ______ %

Moisture
Very Wet Wet [✓ Moist] Damp Dry

Color (Circle major & underline modifying)
Light [✓ Medium] Dark Olive Gray Brown Black Other Greenish brown

Major Constituent (Circle major & underline modifying)
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay ______

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ______

Subsurface sediment characteristics:

Density / Consistency

Sand / Gravel - Very Loose Loose Medium Dense Dense Very Dense

Silt / Clay - Very Soft [✓ Soft] Medium Stiff Stiff Very Stiff Hard

Moisture
Very Wet Wet Moist [✓ Damp] Dry

Color (Circle major & underline modifying)
Light [✓ Medium] Dark Olive [✓ Gray] Brown Black Other ______

Major Constituent (Circle major & underline modifying)
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay ______

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ______

Biological: ______ % **Debris:** ______ % **Oil Sheen:** None Trace (<5%) ______ %

Comments:

Plant Material & Trace
Woody debris

AMEC Geomatrix
MP-2
Description Form
Initials: KW
Date: 8/26/08 Time: 1145

QUALITATIVE SAMPLE CHARACTERISTICS

Page 4 of 20

Coordinate Datum	Date (mm/dd/yy)	Project Location	Sample Identification Number
SPC WA N NAD 1983	8/26/08	March Pt	MP-3A

Coordinates		Water Depth				
North	East	Depth	Unit	Rep	Gear	Time
538 328	1228894	0	f t		Cookie	1100

Penetration						
Depth	Unit	Initials	Sulfide	VOA	Weather	Fines (%)
10	c m	RHG			OVERCAST	

Surficial Wood Estimate:

Contact Points ________ X 5 = ________ %

Surficial sediment characteristics:

Biological: Algal mat 100 % **Debris:** ________ % **Oil Sheen:** None Trace (<5%) ________ %

Moisture
Very Wet Wet [✓ Moist] Damp Dry

Color **(Circle major & underline modifying)**
Light Medium [✓ Dark] Olive Gray Brown Black Other Greenish brown

Major Constituent **(Circle major & underline modifying)**
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay ________

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ________

Subsurface sediment characteristics:

Density / Consistency

Sand / Gravel - Very Loose Loose Medium Dense Dense Very Dense

Silt / Clay - Very Soft [✓ Soft] Medium Stiff Stiff Very Stiff Hard

Moisture
Very Wet Wet Moist [✓ Damp] Dry

Color **(Circle major & underline modifying)**
Light Medium [✓ Dark] Olive Gray Brown [✓ Black] Other ________

Major Constituent **(Circle major & underline modifying)**
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay ________

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ________

Biological: ________ % **Debris:** ________ % **Oil Sheen:** None Trace (<5%) ________ %

Comments:
significant plant material & trace of wood

AMEC Geomatrix
MP-3
Description Form
Initials: KW
Date: 8/26/08 Time: 1100

QUALITATIVE SAMPLE CHARACTERISTICS

Page 5 of 20

Coordinate Datum	Date (mm/dd/yy)	Project Location	Sample Identification Number
SPC WA N NAD 1983	8/27/08	March Pt	MP-4a

Coordinates North	Coordinates East	Water Depth Depth	Water Depth Unit	Rep	Gear	Time
538518	1228857	0	ft		Cookie	0800

Penetration Depth	Penetration Unit	Initials	Sulfide	VOA	Weather	Fines (%)
10	cm	RHG			OVERCAST	

Surficial Wood Estimate:

Contact Points ______ X 5 = ______ %

Surficial sediment characteristics:

Biological: ______ % **Debris:** ______ % **Oil Sheen:** None Trace (<5%) ______ %

Moisture
Very Wet [✓ Wet] Moist Damp Dry

Color (Circle major & underline modifying)
Light Medium [✓ Dark] Olive [✓ Gray] Brown Black Other Gray to olive gray mottled

Major Constituent (Circle major & underline modifying)
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay ______

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ______

Subsurface sediment characteristics:

Density / Consistency

Sand / Gravel - Very Loose Loose Medium Dense Dense Very Dense

Silt / Clay - [✓ Very Soft] Soft Medium Stiff Stiff Very Stiff Hard

Moisture
Very Wet [✓ Wet] Moist Damp Dry

Color (Circle major & underline modifying)
Light Medium [✓ Dark] Olive Gray Brown [✓ Black] Other ______

Major Constituent (Circle major & underline modifying)
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay ______

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ______

Biological: ______ % **Debris:** ______ % **Oil Sheen:** None Trace (<5%) ______ %

Comments: Trace of plant material

AMEC Geomatrix
MP-4
Description Form
Initials: RHG
Date: 8/27/08 Time: 0800

QUALITATIVE SAMPLE CHARACTERISTICS

Page 6 of 20

Coordinate Datum	Date (mm/dd/yy)	Project Location	Sample Identification Number
SPC WA N NAD 1983	8/27/08	March Pt	MP-4D

Coordinates		Water Depth		Rep	Gear	Time
North	East	Depth	Unit			
538518	1228857	0	ft		Cookie	0810

Penetration		Initials	Sulfide	VOA	Weather	Fines (%)
Depth	Unit					
10	cm	RHG			OVERCAST	

Surficial Wood Estimate:

Contact Points

________ X 5 = ________ %

Surficial sediment characteristics:

Biological: ________ % **Debris:** ________ % **Oil Sheen:** None Trace (<5%) ______ %

Moisture
Very Wet [✓ Wet] Moist Damp Dry

Color **(Circle major & underline modifying)**
Light [✓ Medium] [✓ Dark] [✓ Olive] [✓ Gray] Brown Black Other Mottled

Major Constituent **(Circle major & underline modifying)**
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay ________

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ________

Subsurface sediment characteristics:

Density / Consistency

Sand / Gravel - Very Loose Loose Medium Dense Dense Very Dense

Silt / Clay - [✓ Very Soft] Soft Medium Stiff Stiff Very Stiff Hard

Moisture
Very Wet [✓ Wet] Moist Damp Dry

Color **(Circle major & underline modifying)**
Light Medium [✓ Dark] Olive [✓ Gray] Brown [✓ Black] Other ________

Major Constituent **(Circle major & underline modifying)**
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay ________

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ________

Biological: ________ % **Debris:** ________ % **Oil Sheen:** None Trace (<5%) ______ %

Comments:
Trace of plant material

AMEC Geomatrix
MP-4D
Description Form
Initials: RHG
Date: 8/27/08 Time: 0810

QUALITATIVE SAMPLE CHARACTERISTICS

Page 7 of 20

Coordinate Datum	Date (mm/dd/yy)	Project Location	Sample Identification Number
SPC WA N NAD 1983	8/27/09	March Pt	MP-5

Coordinates		Water Depth		Rep	Gear	Time
North	East	Depth	Unit			
538415	1229185	0	f t		Cookie	0836

Penetration		Initials	Sulfide	VOA	Weather	Fines (%)
Depth	Unit					
10	c m	RHG			OVERCAST	

Surficial Wood Estimate:

Contact Points ________ X 5 = ________ %

Surficial sediment characteristics:

Biological: ________ % **Debris:** ________ % **Oil Sheen:** None Trace (<5%) ________ %

Moisture
Very Wet [✓ Wet] Moist Damp Dry

Color (Circle major & underline modifying)
Light [✓ Medium] Dark [✓ Olive] [✓ Gray] Brown Black Other ________

Major Constituent (Circle major & underline modifying)
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay ________

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ________

Subsurface sediment characteristics:

Density / Consistency

Sand / Gravel - Very Loose Loose Medium Dense Dense Very Dense

Silt / Clay - Very Soft [✓ Soft] to [✓ Medium Stiff] Stiff Very Stiff Hard

Moisture
Very Wet Wet [✓ Moist] Damp Dry

Color (Circle major & underline modifying)
Light [✓ Medium] [✓ Dark] Olive [✓ Gray] Brown Black Other ________

Major Constituent (Circle major & underline modifying)
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay ________

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ________

Biological: ________ % **Debris:** ________ % **Oil Sheen:** None Trace (<5%) ________ %

Comments:
Lighter 1/2 to 1 cm layer on surface then dark gray
trace plant material

AMEC Geomatrix
MP-5
Description Form
Initials: RG
Date: 8/27/08 Time: 0836

QUALITATIVE SAMPLE CHARACTERISTICS

Page 8 of 20

Coordinate Datum	Date (mm/dd/yy)	Project Location	Sample Identification Number
SPC WA N NAD 1983	08/28/08	March Pt	MP-6

Coordinates		Water Depth				
North	East	Depth	Unit	Rep	Gear	Time
539196	1229438	0	f t		Cookie	0823

Penetration						
Depth	Unit	Initials	Sulfide	VOA	Weather	Fines (%)
10	c m	RHG			OVERCAST	

Surficial Wood Estimate:

Contact Points ______ X 5 = ______ %

Surficial sediment characteristics:

Biological: ______ % **Debris:** ______ % **Oil Sheen:** None Trace (<5%) ______ %

Moisture
Very Wet Wet Moist [✓ Damp] Dry

Color (Circle major & underline modifying)
Light [✓ Medium] Dark [✓ Olive] Gray [✓ Brown] Black Other ______

Major Constituent (Circle major & underline modifying)
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay ______

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ______

Subsurface sediment characteristics:

Density / Consistency

Sand / Gravel - Very Loose Loose Medium Dense Dense Very Dense

Silt / Clay - Very Soft Soft Medium Stiff [✓ Stiff] to [✓ Very Stiff] Hard

Moisture
Very Wet Wet Moist [✓ Damp] Dry

Color (Circle major & underline modifying)
Light [✓ Medium] Dark Olive Gray [✓ Brown] Black Other ______

Major Constituent (Circle major & underline modifying)
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay ______

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ______

Biological: ______ % **Debris:** ______ % **Oil Sheen:** None Trace (<5%) ______ %

Comments:
Thin (1/2 cm or less) black sulfide stained layer
just below surface medium brown layer
Soil/sediment breaks into layer
pockets of red oxidized silt around worm/animal
burrows

AMEC Geomatrix
MP-6
Description Form
Initials: RHG
Date: 8/28/08 Time: 8:37

QUALITATIVE SAMPLE CHARACTERISTICS

Page 9 of 20

Coordinate Datum	Date (mm/dd/yy)	Project Location	Sample Identification Number
SPC WA N NAD 1983	8/28/08	March Pt	MP-6D

Coordinates		Water Depth				
North	East	Depth	Unit	Rep	Gear	Time
538196	1229438	0	f t		Cookie	0827

Penetration						
Depth	Unit	Initials	Sulfide	VOA	Weather	Fines (%)
10	c m	RHG			OVERCAST	

Surficial Wood Estimate:

Contact Points ______ X 5 = ______ %

Surficial sediment characteristics:

Biological: ______ % **Debris:** ______ % **Oil Sheen:** None Trace (<5%) ______ %

Moisture
Very Wet Wet Moist [✓ Damp] Dry

Color **(Circle major & underline modifying)**
Light [✓ Medium] Dark [✓ Olive] Gray [✓ Brown] Black Other ______

Major Constituent **(Circle major & underline modifying)**
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay ______

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ______

Subsurface sediment characteristics:

Density / Consistency

Sand / Gravel - Very Loose Loose Medium Dense Dense Very Dense

Silt / Clay - Very Soft Soft Medium Stiff [✓ Stiff] to [✓ Very Stiff] Hard

Moisture
Very Wet Wet Moist [✓ Damp] Dry

Color **(Circle major & underline modifying)**
Light [✓ Medium] Dark Olive Gray [✓ Brown] Black Other ______

Major Constituent **(Circle major & underline modifying)**
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay ______

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ______

Biological: ______ % **Debris:** ______ % **Oil Sheen:** None Trace (<5%) ______ %

Comments:
Same as MP-6

AMEC Geomatrix
MP-6D
Description Form
Initials: KAA
Date: 8-28-08 Time: 8:37

QUALITATIVE SAMPLE CHARACTERISTICS

Page 10 of 20

Coordinate Datum	Date (mm/dd/yy)	Project Location	Sample Identification Number
SPC WA N NAD 1983	8/27/08	March Pt	MP-7

Coordinates		Water Depth		Rep	Gear	Time
North	East	Depth	Unit			
538004	1229643	0	f t		Cookie	1311

Penetration		Initials	Sulfide	VOA	Weather	Fines (%)
Depth	Unit					
10	c m	RHG			OVERCAST	

Surficial Wood Estimate:

Contact Points ________ X 5 = ________ %

Surficial sediment characteristics:

Algae mat

Biological: 100 % **Debris:** ________ % **Oil Sheen:** None Trace (<5%) ________ %

Moisture
Very Wet Wet [✓ Moist] Damp Dry

Color (Circle major & underline modifying)
Light Medium [✓ Dark] [✓ Olive] Gray Brown Black Other ________

Major Constituent (Circle major & underline modifying)
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay ________

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ________

Subsurface sediment characteristics:

Density / Consistency

Sand / Gravel - Very Loose Loose Medium Dense Dense Very Dense

Silt / Clay - Very Soft [✓ Soft] Medium Stiff Stiff Very Stiff Hard

Moisture
Very Wet Wet to [✓ Moist] Damp Dry

Color (Circle major & underline modifying)
Light Medium [✓ Dark] Olive Gray Brown [✓ Black] Other ________

Major Constituent (Circle major & underline modifying)
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay ________

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ________

Biological: ________ % **Debris:** ________ % **Oil Sheen:** None Trace (<5%) ________ %

Comments:
Large 1½ x 1½ x 4in piece of wood
strong H_2S odor
upper medium olivegray
oxidized layer ½ cm or less

AMEC Geomatrix
MP-7
Description Form
Initials: KAA
Date: 8/27/08 Time: 13:11

QUALITATIVE SAMPLE CHARACTERISTICS

Page 11 of 20

Coordinate Datum	Date (mm/dd/yy)	Project Location	Sample Identification Number
SPC WA N NAD 1983	08/27/08	March Pt	MP-8

Coordinates		Water Depth		Rep	Gear	Time
North	East	Depth	Unit			
537 905	122 9900	0	f t		Cookie	1242

Penetration		Initials	Sulfide	VOA	Weather	Fines (%)
Depth	Unit					
10	c m	RHG			OVERCAST	

Surficial Wood Estimate:

Contact Points ________ X 5 = ________ %

Surficial sediment characteristics:

Biological: Algal mat 100 % **Debris:** ________ % **Oil Sheen:** None Trace (<5%) ________ %

Moisture
Very Wet Wet [✓ Moist] Damp Dry

Color (Circle major & underline modifying)
Light [✓ Medium] Dark [✓ Olive] Gray Brown Black Other ________

Major Constituent (Circle major & underline modifying)
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay ________

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ________

Subsurface sediment characteristics:

Density / Consistency

Sand / Gravel - Very Loose Loose Medium Dense Dense Very Dense

Silt / Clay - Very Soft Soft [✓ Medium Stiff] to Stiff Very Stiff Hard

Moisture
Very Wet Wet Moist [✓ Damp] Dry

Color (Circle major & underline modifying)
Light [✓ Medium] Dark [✓ Olive] Gray Brown Black Other Some sulfide staining

Major Constituent (Circle major & underline modifying)
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay ________

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ________

Biological: ________ % **Debris:** ________ % **Oil Sheen:** None Trace (<5%) ________ %

Comments:
Sediment has a black sulfide layer ½ cm thick or thinner just below surface then olive gray silt with rust colored areas (worm and animal tubes) and scattered lences of rust colored sediment

AMEC Geomatrix
MP-8
Description Form
Initials: KAA
Date: 8/27/08 Time: 12:42

QUALITATIVE SAMPLE CHARACTERISTICS

Coordinate Datum	Date (mm/dd/yy)	Project Location	Sample Identification Number
SPC WA N NAD 1983	8/27/08	March Pt	MP-9

Coordinates		Water Depth		Rep	Gear	Time
North	East	Depth	Unit			
537728	1229997	0	ft		Cokie	1048

Penetration		Initials	Sulfide	VOA	Weather	Fines (%)
Depth	Unit					
10	cm	RHG			OVERCAST	

Surficial Wood Estimate:

Contact Points ______ X 5 = ______ %

Surficial sediment characteristics:

Biological: ______ % **Debris:** ______ % **Oil Sheen:** None Trace (<5%) ______ %

Moisture
Very Wet Wet [✓ Moist] Damp Dry

Color **(Circle major & underline modifying)**
Light [✓ Medium] Dark [✓ Olive] [✓ Gray] Brown Black Other ______

Major Constituent **(Circle major & underline modifying)**
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay ______

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ______

Subsurface sediment characteristics:

Density / Consistency

Sand / Gravel - Very Loose Loose Medium Dense Dense Very Dense

Silt / Clay - Very Soft [✓ Soft] to [✓ Medium Stiff] Stiff Very Stiff Hard

Moisture
Very Wet Wet [✓ Moist] [✓ Damp] Dry

Color **(Circle major & underline modifying)**
Light [✓ Medium] Dark [✓ Olive] [✓ Gray] Brown Black Other ______

Major Constituent **(Circle major & underline modifying)**
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] [✓ Clay] ______

Minor Constituent with trace
Fine [✓ Medium] Coarse [✓ Gravel] Sand Silt Clay rounded 1/2in

Biological: ______ % **Debris:** ______ % **Oil Sheen:** None Trace (<5%) ______ %

Comments:
No apparent redox layer some patches of sulfide staining, large number of worms

AMEC Geomatrix
MP-9
Description Form
Initials: KAA
Date: 8/27/08 Time: 10:48

QUALITATIVE SAMPLE CHARACTERISTICS

Page #3 of 20

Coordinate Datum	Date (mm/dd/yy)	Project Location	Sample Identification Number
SPC WA N NAD 1983	08/27/08	March Pt	MP-9D

Coordinates		Water Depth		Rep	Gear	Time
North	East	Depth	Unit			
537728	1229997	0	f t		Cookie	1048

Penetration		Initials	Sulfide	VOA	Weather	Fines (%)
Depth	Unit					
10	c m	RHG			OVERCAST	

Surficial Wood Estimate:

Contact Points

________ X 5 = ________ %

Surficial sediment characteristics:

Biological: ________ % **Debris:** ________ % **Oil Sheen:** None Trace (<5%) ________ %

Moisture
Very Wet Wet [✓ Moist] Damp Dry

Color **(Circle major & underline modifying)**
Light [✓ Medium] Dark [✓ Olive] [✓ Gray] Brown Black Other ________

Major Constituent **(Circle major & underline modifying)**
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay ________

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ________

Subsurface sediment characteristics:

Density / Consistency

Sand / Gravel - Very Loose Loose Medium Dense Dense Very Dense

Silt / Clay - Very Soft [✓ Soft] Medium Stiff Stiff Very Stiff Hard

Moisture
Very Wet Wet [✓ Moist] Damp Dry

Color **(Circle major & underline modifying)**
Light [✓ Medium] to [✓ Dark] [✓ Olive] [✓ Gray] Brown Black Other ________

Major Constituent **(Circle major & underline modifying)**
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] [✓ Clay] ________

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ________

Biological: ________ % **Debris:** ________ % **Oil Sheen:** None Trace (<5%) ________ %

Comments:
1 cm thick layer to apparent redox sediment darkens
below horizon with solfide staining
large number of worms
trace of plant material

AMEC Geomatrix
MP-9D
Description Form
Initials: KAA
Date: 8/27/08 Time: 10:48

QUALITATIVE SAMPLE CHARACTERISTICS

Page 14 of 20

Coordinate Datum	Date (mm/dd/yy)	Project Location	Sample Identification Number
SPC WA N NAD 1983	8/27/08	March Pt	MP-10

Coordinates North	Coordinates East	Water Depth Depth	Water Depth Unit	Rep	Gear	Time
537525	1230055	0	ft		Cookie	10:09

Penetration Depth	Penetration Unit	Initials	Sulfide	VOA	Weather	Fines (%)
10	cm	RHG			OVERCAST	

Surficial Wood Estimate:

Contact Points ______ X 5 = ______ %

Surficial sediment characteristics:

Biological: Algae Trace % **Debris:** ______ % **Oil Sheen:** None Trace (<5%) ______ %

Moisture
Very Wet [✓ Wet] Moist Damp Dry

Color (Circle major & underline modifying)
Light [✓ Medium] Dark [✓ Olive] [✓ Gray] Brown Black Other ______

Major Constituent (Circle major & underline modifying)
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay ______

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ______

Subsurface sediment characteristics:

Density / Consistency

Sand / Gravel - Very Loose Loose Medium Dense Dense Very Dense

Silt / Clay - Very Soft [✓ Soft] to [✓ Medium Stiff] with depth Stiff Very Stiff Hard

Moisture
Very Wet Wet [✓ Moist] Damp Dry

Color (Circle major & underline modifying)
Light [✓ Medium] [✓ Dark] [✓ Olive] [✓ Gray] Brown to Black Other ______

Major Constituent (Circle major & underline modifying)
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] [✓ Clay] ______

Minor Constituent with trace
Fine Medium [✓ Coarse] [✓ Gravel] [✓ Sand] Silt Clay Gravel to coarse Sand ½in to Smaller

Biological: ______ % **Debris:** ______ % **Oil Sheen:** None Trace (<5%) ______ %

Comments:

No apparent Redox layer some staining (sulfide) or mottling at depth

Layer of gravel (rounded to subangular) at ≈10cm and deeper

Piece of glass 1½x2

AMEC Geomatrix
MP-10
Description Form
Initials: KAA
Date: 8/27/08 Time: 10:09

QUALITATIVE SAMPLE CHARACTERISTICS

Page 15 of 20

Coordinate Datum	Date (mm/dd/yy)	Project Location	Sample Identification Number
SPC WA N NAD 1983	08/27/08	March Pt	MP-11

Coordinates		Water Depth				
North	East	Depth	Unit	Rep	Gear	Time
537 293	1229979	0	f t		Cokie	1128

Penetration		Initials	Sulfide	VOA	Weather	Fines (%)
Depth	Unit					
10	c m	RHG			Overcast	

Surficial Wood Estimate:

Contact Points

______ X 5 = ______ %

Surficial sediment characteristics:

Biological: ______ % **Debris:** ______ % **Oil Sheen:** None Trace (<5%) ______ %

Moisture
Very Wet Wet [✓ Moist] Damp Dry

Color **(Circle major & underline modifying)**
Light [✓ Medium] Dark [✓ Olive] Gray Brown Black Other ______

Major Constituent **(Circle major & underline modifying)**
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay ______

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ______

Subsurface sediment characteristics:

Density / Consistency

Sand / Gravel - Very Loose Loose Medium Dense Dense Very Dense

Silt / Clay - Very Soft Soft [✓ Medium Stiff] Stiff Very Stiff Hard

Moisture
Very Wet Wet [✓ Moist] Damp Dry

Color **(Circle major & underline modifying)**
Light [✓ Medium] Dark [✓ Olive] Gray Brown Black Other ______

Major Constituent **(Circle major & underline modifying)**
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay ______

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ______

Biological: ______ % **Debris:** ______ % **Oil Sheen:** None Trace (<5%) ______ %

Comments:
1½ in L Macoma nasuta
Some sulfide staining (mottled)
No apparent redox layer
Trace plant material and bark

AMEC Geomatrix
MP-11
Description Form
Initials: RG
Date: 8/27/08 Time: 1128

QUALITATIVE SAMPLE CHARACTERISTICS

Page 16 of 20

Coordinate Datum	Date (mm/dd/yy)	Project Location	Sample Identification Number
SPC WA N NAD 1983	8/27/08	March Pt	MP-12

Coordinates		Water Depth		Rep	Gear	Time
North	East	Depth	Unit			
538441	1229010	0	f t		Cookie	0912

Penetration		Initials	Sulfide	VOA	Weather	Fines (%)
Depth	Unit					
10	c m	RHG			Overcast	

Surficial Wood Estimate:

Contact Points

_______ X 5 = _______ %

Surficial sediment characteristics:

Biological: Algal mat 100 % **Debris:** _______ % **Oil Sheen:** None Trace (<5%) _______ %

Moisture
Very Wet [✓ Wet] Moist Damp Dry

Color **(Circle major & underline modifying)**
Light [✓ Medium] Dark [✓ Olive] Gray [✓ Brown] Black Other _______

Major Constituent **(Circle major & underline modifying)**
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay _______

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay _______

Subsurface sediment characteristics:

Density / Consistency

Sand / Gravel - Very Loose Loose Medium Dense Dense Very Dense

Silt / Clay - Very Soft [✓ Soft] Medium Stiff Stiff Very Stiff Hard

Moisture
Very Wet Wet [✓ Moist] Damp Dry

Color **(Circle major & underline modifying)**
Light Medium [✓ Dark] Olive [✓ Gray] Brown [✓ Black] Other _______

Major Constituent **(Circle major & underline modifying)**
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] [✓ Clay] _______

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay _______

Biological: _______ % **Debris:** _______ % **Oil Sheen:** None Trace (<5%) _______ %

Comments:
1/2 to 1 cm oxidized surface layer then dark
gray to black mottled sediment
strong H_2S odor

AMEC Geomatrix
MP-12
Description Form
Initials: KHG
Date: 8/27/08 Time: 0912

QUALITATIVE SAMPLE CHARACTERISTICS

Page 17 of 20

Coordinate Datum	Date (mm/dd/yy)	Project Location	Sample Identification Number
SPC WA N NAD 1983	8/27/08	March Pt	MP-13

Coordinates		Water Depth		Rep	Gear	Time
North	East	Depth	Unit			
538248	122 9261	0	f t		Cookie	1348

Penetration		Initials	Sulfide	VOA	Weather	Fines (%)
Depth	Unit					
10	c m	RHG			Overcast	

Surficial Wood Estimate:

Contact Points ______ X 5 = ______ %

Surficial sediment characteristics:
Algal mat

Biological: 100 % **Debris:** ______ % **Oil Sheen:** None Trace (<5%) ______ %

Moisture
Very Wet Wet [✓ Moist] Damp Dry

Color **(Circle major & underline modifying)**
Light [✓ Medium] Dark [✓ Olive] [✓ Gray] Brown Black Other ______

Major Constituent **(Circle major & underline modifying)**
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay ______

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ______

Subsurface sediment characteristics:

Density / Consistency

Sand / Gravel - Very Loose Loose Medium Dense Dense Very Dense

Silt / Clay - Very Soft [✓ Soft] Medium Stiff Stiff Very Stiff Hard

Moisture
Very Wet Wet [✓ Moist] Damp Dry

Color **(Circle major & underline modifying)**
Light [✓ Medium] [✓ Dark] Olive [✓ Gray] Brown Black Other ______

Major Constituent **(Circle major & underline modifying)**
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay ______

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ______

Biological: ______ % **Debris:** ______ % **Oil Sheen:** None Trace (<5%) ______ %

Comments:
Some sulfide staining below surface
No apparent Redox layer

AMEC Geomatrix
MP-13
Description Form
Initials: RES
Date: 8/27/08 Time: 1348

QUALITATIVE SAMPLE CHARACTERISTICS

Page 18 of 20

Coordinate Datum	Date (mm/dd/yy)	Project Location	Sample Identification Number
SPC WA N NAD 1983	8/28/08	March Pt	MPS-1

Coordinates		Water Depth				
North	East	Depth	Unit	Rep	Gear	Time
538006	1228723	0	f t		Cookie	1022

Penetration						
Depth	Unit	Initials	Sulfide	VOA	Weather	Fines (%)
10	c m	RHG			Overcast	

Surficial Wood Estimate:

Contact Points ______ X 5 = ______ %

Surficial sediment characteristics:

Biological: ______ % **Debris:** ______ % **Oil Sheen:** None Trace (<5%) ______ %

Moisture
Very Wet Wet [✓ Moist] Damp Dry

Color **(Circle major & underline modifying)**
Light Medium [✓ Dark] Olive Gray [✓ Brown] Black Other ______

Major Constituent **(Circle major & underline modifying)**
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay ______

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ______

Subsurface sediment characteristics:

Density / Consistency

Sand / Gravel - Very Loose Loose Medium Dense Dense Very Dense

Silt / Clay - Very Soft Soft [✓ Medium Stiff] Stiff Very Stiff Hard

Moisture
Very Wet Wet [✓ Moist] Damp Dry

Color **(Circle major & underline modifying)**
Light Medium [✓ Dark] Olive Gray [✓ Brown] Black Other ______

Major Constituent **(Circle major & underline modifying)**
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay ______

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ______

Biological: ______ % **Debris:** ______ % **Oil Sheen:** None Trace (<5%) ______ %

Comments:
Salinity 0‰ from porewater extractor
Fibrous roots (white) throughout
stained plant debris throughout core

AMEC Geomatrix
MPS-1
Description Form
Initials: KAA
Date: 8-28-08 Time: ~~11:40~~ 1122

QUALITATIVE SAMPLE CHARACTERISTICS

Page 19 of 20

Coordinate Datum	Date (mm/dd/yy)	Project Location	Sample Identification Number
SPC WA N NAD 1983	08/28/06	March Pt	MPS-2

Coordinates		Water Depth				Time
North	East	Depth	Unit	Rep	Gear	
537849	1228833	0.1	f t		Cookie	10 00

Penetration						
Depth	Unit	Initials	Sulfide	VOA	Weather	Fines (%)
10	c m	RHG			Overcast	

Surficial Wood Estimate:

Contact Points ________ X 5 = ________ %

Surficial sediment characteristics:

Biological: ________ % **Debris:** ________ % **Oil Sheen:** None Trace (<5%) ________ %

Moisture
Very Wet Wet [✓ Moist] Damp Dry

Color **(Circle major & underline modifying)**
Light Medium [✓ Dark] Olive Gray [✓ Brown] Black Other ________

Major Constituent **(Circle major & underline modifying)**
Fine Medium Coarse Gravel Sand [✓ Silt] Clay ________

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ________

Subsurface sediment characteristics:

Density / Consistency

Sand / Gravel - Very Loose Loose Medium Dense Dense Very Dense

Silt / Clay - Very Soft [✓ Soft] Medium Stiff Stiff Very Stiff Hard

Moisture
Very Wet [✓ Wet] Moist Damp Dry

Color **(Circle major & underline modifying)**
Light Medium [✓ Dark] Olive Gray [✓ Brown] Black Other ________

Major Constituent **(Circle major & underline modifying)**
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay ________

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ________

Biological: ________ % **Debris:** ________ % **Oil Sheen:** None Trace (<5%) ________ %

Comments:
Salinity 7 ppt slight current in channel
Large amount of plant material & wood debris
in core

AMEC Geomatrix
MPS-2
Description Form
Initials: KAC
Date: 3-28-08 Time: 10:00

QUALITATIVE SAMPLE CHARACTERISTICS

Page 20 of 20

Coordinate Datum	Date (mm/dd/yy)	Project Location	Sample Identification Number
SPC WA N NAD 1983	8/28/08	March Pt	MPS 3

Coordinates		Water Depth		Rep	Gear	Time
North	East	Depth	Unit			
537533	1229226	0	f t		Cookie	1020

Penetration		Initials	Sulfide	VOA	Weather	Fines (%)
Depth	Unit					
10	c m	RHG			Overcast	

Surficial Wood Estimate:

Contact Points ______ X 5 = ______ %

Surficial sediment characteristics:

Biological: ______ % **Debris:** ______ % **Oil Sheen:** None Trace (<5%) ______ %

Moisture
Very Wet [✓ Wet] Moist Damp Dry

Color **(Circle major & underline modifying)**
Light Medium [✓ Dark] Olive Gray [✓ Brown] Black Other ______

Major Constituent **(Circle major & underline modifying)**
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay ______

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ______

Subsurface sediment characteristics:

Density / Consistency

Sand / Gravel - Very Loose Loose Medium Dense Dense Very Dense

Silt / Clay - Very Soft [✓ Soft] Medium Stiff Stiff Very Stiff Hard

Moisture
Very Wet [✓ Wet] Moist Damp Dry

Color **(Circle major & underline modifying)**
Light Medium [✓ Dark] Olive Gray [✓ Brown] Black Other ______

Major Constituent **(Circle major & underline modifying)**
[✓ Fine] Medium Coarse Gravel Sand [✓ Silt] Clay ______

Minor Constituent with trace
Fine Medium Coarse Gravel Sand Silt Clay ______

Biological: ______ % **Debris:** ______ % **Oil Sheen:** None Trace (<5%) ______ %

Comments:
Salinity 17‰ Fucus sp. and amphipods present
Large amount of fibrous plant material
Some pockets of sulfide staining

AMEC Geomatrix
MPS-3
Description
Initials: RHG
Date: 8/28/08 Time: 1020

APPENDIX E

Site Photographs

APPENDIX E1

SEDIMENT PHOTOGRAPHS

March Point (Whitmarsh) Landfill
Skagit County, Washington

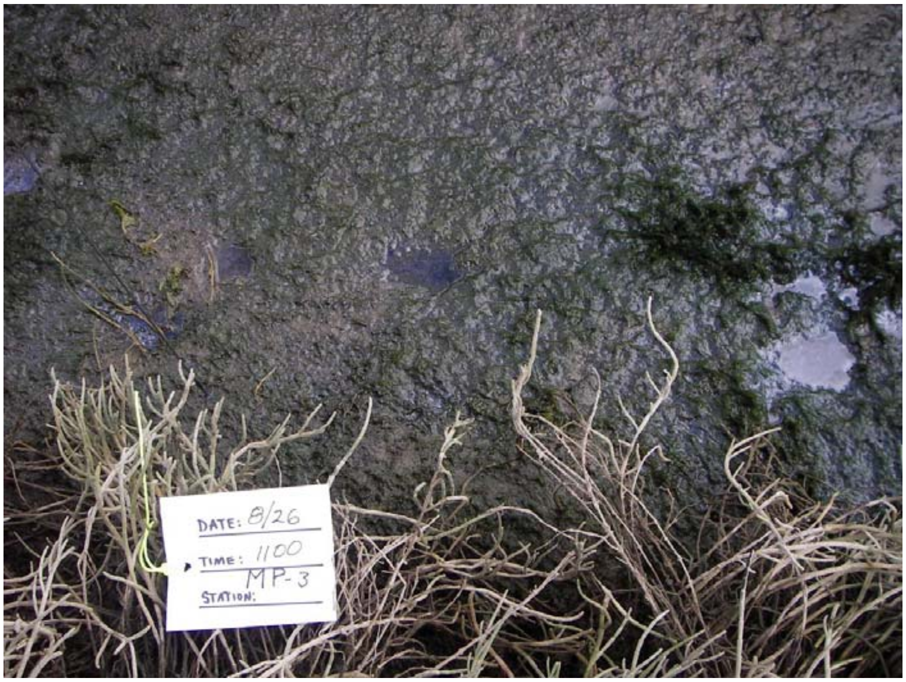
Photograph 1 MP-1

Photograph 2 MP-2

APPENDIX E1

SEDIMENT PHOTOGRAPHS

March Point (Whitmarsh) Landfill
Skagit County, Washington



Photograph 3 MP-3

Photograph 4 MP-4

APPENDIX E1

SEDIMENT PHOTOGRAPHS

March Point (Whitmarsh) Landfill
Skagit County, Washington

Photograph 5   MP-5

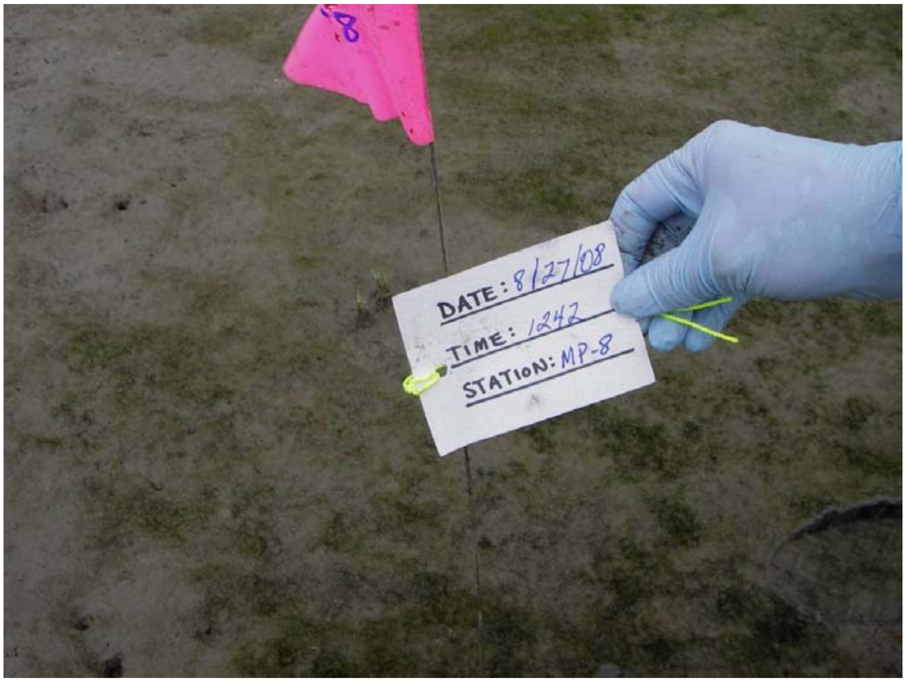
Photograph 6   MP-6

APPENDIX E1

SEDIMENT PHOTOGRAPHS

March Point (Whitmarsh) Landfill
Skagit County, Washington

Photograph 7 MP-7



Photograph 8 MP-8

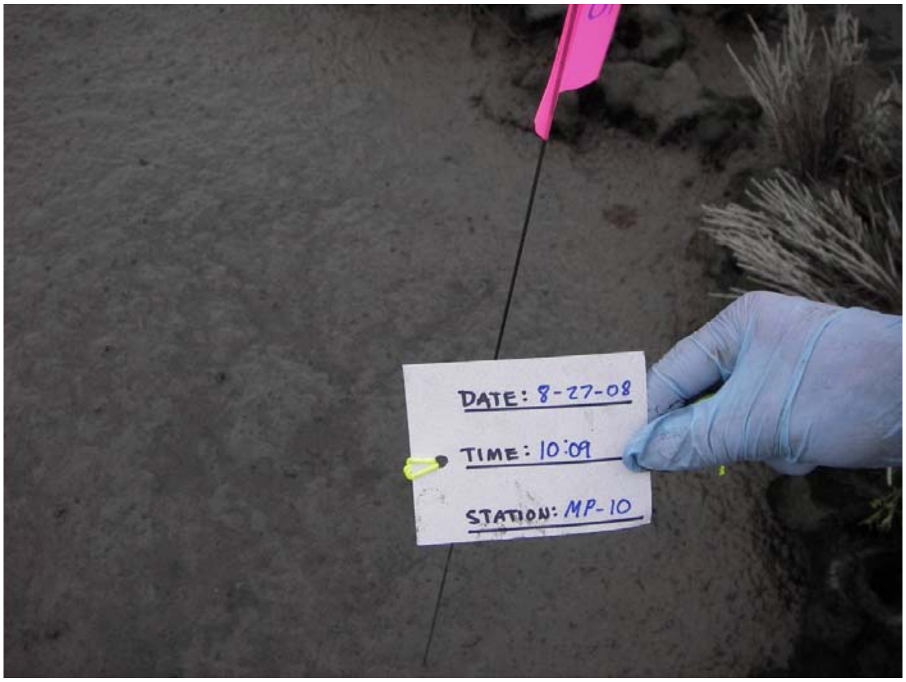
APPENDIX E1

SEDIMENT PHOTOGRAPHS

March Point (Whitmarsh) Landfill
Skagit County, Washington

DATE: 8-27-08
TIME: 10:48 AM
STATION: MP-9

Photograph 9 MP-9



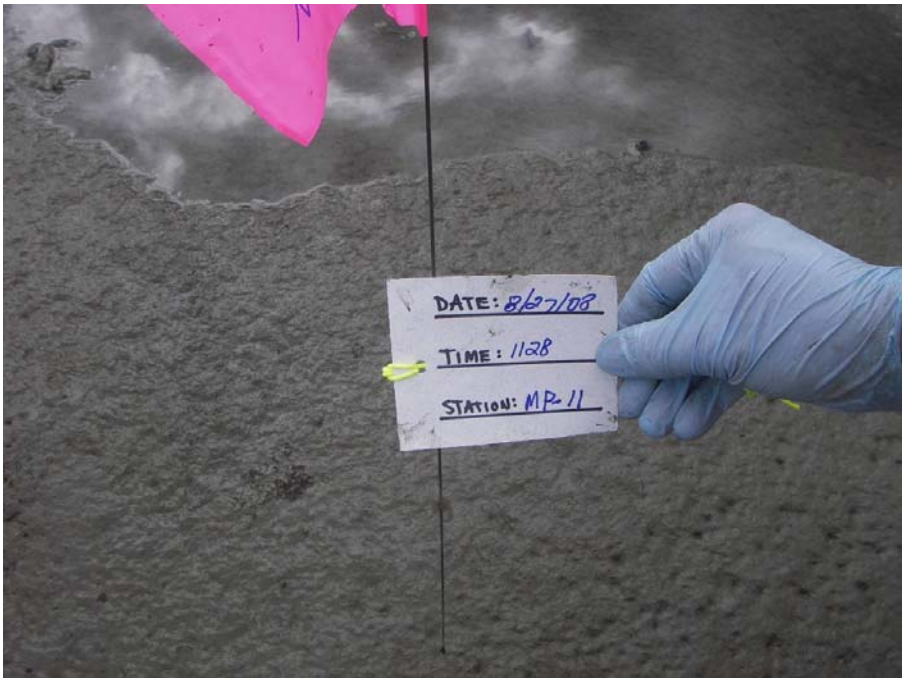
DATE: 8-27-08
TIME: 10:09
STATION: MP-10

Photograph 10 MP-10

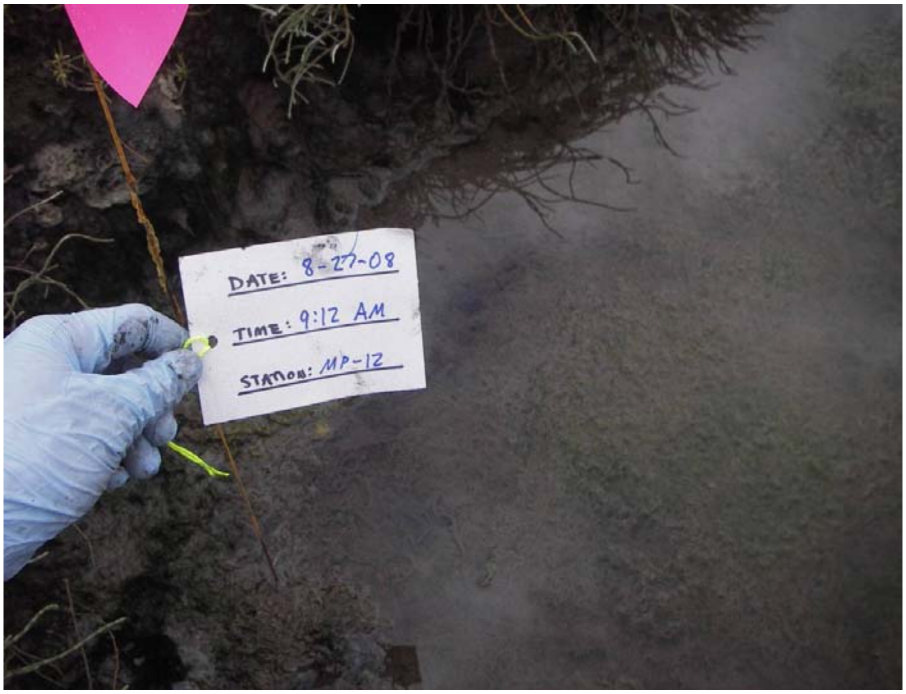
APPENDIX E1

SEDIMENT PHOTOGRAPHS

March Point (Whitmarsh) Landfill
Skagit County, Washington



Photograph 11 MP-11



Photograph 12 MP-12

APPENDIX E1

SEDIMENT PHOTOGRAPHS

March Point (Whitmarsh) Landfill
Skagit County, Washington

Photograph 13 MP-13

Photograph 14 MPS-1

APPENDIX E1

SEDIMENT PHOTOGRAPHS
March Point (Whitmarsh) Landfill
Skagit County, Washington

Photograph 15 MPS-2

Photograph 16 MPS-3

APPENDIX E2

WASTE PHOTOGRAPHS

March Point (Whitmarsh) Landfill
Skagit County, Washington

Photograph 1 Drum at TP-G-9.

Photograph 2 Drum at TP-G-9

APPENDIX E2

WASTE PHOTOGRAPHS

March Point (Whitmarsh) Landfill
Skagit County, Washington

Photograph 3 Drum at TP-G-10.

Photograph 4 Drum at TP-G-10

APPENDIX E2

WASTE PHOTOGRAPHS

March Point (Whitmarsh) Landfill
Skagit County, Washington

Photograph 5 Washing machine at TP-G-1.

Photograph 6 Tank at TP-G-2.

APPENDIX E2

WASTE PHOTOGRAPHS

March Point (Whitmarsh) Landfill
Skagit County, Washington

Photograph 7 Washing machine at TP-G-4.

Photograph 8 Metal siding at TP-G-5.

APPENDIX F

Test Pit Logs and Boring Logs

PROJECT: Skagit Whitmarsh Landfill Anacortes, Washington	**Log of Well No. MW-01**
BORING LOCATION: Not Measured	GROUND SURFACE ELEVATION AND DATUM: Ground Surface
DRILLING CONTRACTOR: Cascade Drilling, Inc.	DATE STARTED: 10/7/08 DATE FINISHED: 10/7/08
DRILLING METHOD: Hollow-stem auger (Limited Access)	TOTAL DEPTH (ft.): 70.0 SCREEN INTERVAL (ft.): NA
DRILLING EQUIPMENT: CME 75	DEPTH TO WATER: FIRST 9.5 COMPL. NA CASING: NA
SAMPLING METHOD: Dames & Moore (1.5' x 3.25")	LOGGED BY: N. Bacher
HAMMER WEIGHT: 300 DROP: 30"	RESPONSIBLE PROFESSIONAL: N. Bacher REG. NO. L.G. 2528

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: NM	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
0					Postholed through roadbase to 4 feet below ground surface.	Well MW-01 was not constructed. Borehole used to log lithology for adjacent well MW-02.
4			17 21 30		POORLY GRADED SAND with SILT (SP-SM): olive brown (2.5Y 4/3), dry, 80% fine sand, 10% non-plastic fines, oxidized mottling no mottling	
5.5			12 21 24			
6.5					POORLY GRADED SAND (SP): grayish brown (10YR 5/2), moist, 95% fine sand, 5% non-plastic fines	
7			20 21 24			
7.5					WELL GRADED SAND with GRAVEL (SW): light gray (10R 7/1), moist, 80% fine to coarse sand, 20% fine gravel	
8.5			21 23 27		POORLY GRADED SAND (SP): grayish brown (10YR 5/2), moist, 95% fine sand, 5% non-plastic fines, oxidized SILTY SAND (SM) SILTY SAND (SM) wet	
10	MW-01-10-11.5	■	24 27 22			
11.5			50/6"			
14.5			24 50/6"			
15						

OAKWELLV (REV. 9/2007)

PROJECT: Skagit Whitmarsh Landfill
Anacortes, Washington

Log of Well No. MW-01 (cont'd)

DEPTH (feet)	SAMPLES			OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot			
15						
16			22 50/6"		POORLY GRADED SAND with GRAVEL (SP): grayish brown (10YR 5/2), wet, 80% medium sand, 15% fine subangular gravel, 5% non-plastic fines	
17			50/6"		80% medium to coarse sand, 15% fine gravel, 5% non-plastic fines	
18					75% medium to coarse sand, 20% fine gravel, 5% non-plastic fines	
19	MW-01-19-20.5		19 50/6"			
20			50/6"			
21						
22			50/6"			
23			50/6"			
24						
25			50/6"		WELL GRADED GRAVELS (GW)	
26			50/6"			
27						
28			50/6"			
29			50/6"			
30						
31			50/6"		SILTY SAND (SM): bluish gray (10B 5/1), wet, 70% fine to coarse sand, 15% fine gravel, 15% non-plastic fines increasing fines	
32						
33						

OAKWELLV (REV. 9/2007)

PROJECT: Skagit Whitmarsh Landfill
Anacortes, Washington

Log of Well No. MW-01 (cont'd)

DEPTH (feet)	SAMPLES Sample No.	Sample	Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
33			50/6"		LEAN CLAY (CL): bluish gray (10B 5/1), wet, 100% fines, non-plastic, very stiff	
34						
35			50/6"			
	MW-01-35.5-37	■	17 22 25			
36						
37			10 15 20			
38			19 24 25			
39						
40			10 14 25			
41			12 19 50/6"			
42					▼ wet, 95% fines, 5% fine sand, non-plastic	
43			19			
44			50/6"			
			14 21 24			
45						
46			16 20 22			
47			18 24 30			
48						
49			16 22 25			
50			10 18			
51						

OAKWELLV (REV. 9/2007)

PROJECT: Skagit Whitmarsh Landfill
Anacortes, Washington

Log of Well No. MW-01 (cont'd)

DEPTH (feet)	SAMPLES Sample No.	Sample	Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
51			27		LEAN CLAY (CL): cont'd.	
52			12 18 23			
					fine sand laminations	
53						
			10 19 26			
54					fine sand laminations	
55			12 20 25			
56						
			12 21 28			
57						
					fine sand laminations	
58			16 20 22			
59						
			12 18 21			
60						
61			12 20 26			
62						
			14 22 27			
63						
64			18 20 25			
65					fine sand laminations	
			12 21 26			
66						
67			16 20 22			
68						
			13 20			
69						

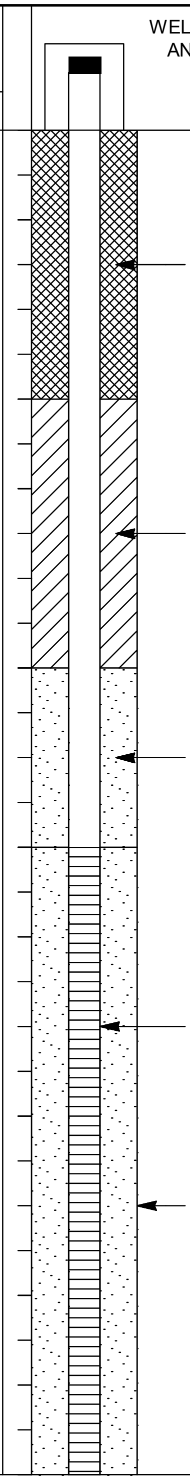
OAKWELLV (REV. 9/2007)

DEPTH (feet)	SAMPLES Sample No.	Sample	Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
69			22		LEAN CLAY (CL): cont'd.	
70					Bottom of Boring at 70 feet. Shallow well MW-02 installed 4 feet east of MW-01.	
71						
72						
73						
74						
75						
76						
77						
78						
79						
80						
81						
82						
83						
84						
85						
86						
87						

PROJECT: Skagit Whitmarsh Landfill Anacortes, Washington	**Log of Well No. MW-02**
BORING LOCATION: N: 538427.9; E: 1228251.8	GROUND SURFACE ELEVATION AND DATUM: Ground Surface
DRILLING CONTRACTOR: Cascade Drilling, Inc.	DATE STARTED: 10/8/08 | DATE FINISHED: 10/8/08
DRILLING METHOD: Hollow-stem auger (Limited Access)	TOTAL DEPTH (ft.): 20.2 | SCREEN INTERVAL (ft.): 8-18
DRILLING EQUIPMENT: CME 75	DEPTH TO WATER: FIRST 9.5 | COMPL. NA | CASING: 2" Sch. 40 PVC
SAMPLING METHOD: Dames & Moore (1.5' x 3.25")	LOGGED BY: N. Bacher
HAMMER WEIGHT: 300 | DROP: 30"	RESPONSIBLE PROFESSIONAL: N. Bacher | REG. NO. L.G. 2528

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: 28.04 feet MLLW
0					See boring log for MW-01 for lithology.
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS



* OVM = Photovac 2020 calibrated to 100 ppm isobutylene standard

Basalite Concrete

Medium bentonite chip (Pure Gold) seal

Cemex 2/12 Lapis Lustre Sand filter pack

2" diameter Schedule 40 PVC casing

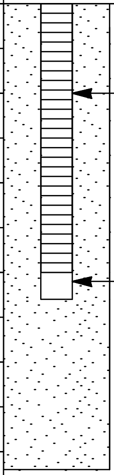
8.25" diameter bore hole

OAKWELLV (REV. 9/2007)

AMEC Geomatrix | Project No. 14159.000.0 |

PROJECT: Skagit Whitmarsh Landfill
Anacortes, Washington

Log of Well No. MW-02 (cont'd)

DEPTH (feet)	SAMPLES Sample No.	Sample	Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.		WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
15							
16							Schedule 40 PVC well screen with 2" diameter and 0.010" slot
17							
18							2" diameter Schedule 40 PVC end cap
19							
20					Bottom of boring at 20.2 feet.		
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							
33							

PROJECT: Skagit Whitmarsh Landfill
Anacortes, Washington

Log of Well No. MW-03

BORING LOCATION: N: 538979.1; E: 1228187.2

GROUND SURFACE ELEVATION AND DATUM: Ground Surface

DRILLING CONTRACTOR: Cascade Drilling, Inc.

DATE STARTED: 10/9/08

DATE FINISHED: 10/9/08

DRILLING METHOD: Hollow-stem auger (Limited Access)

TOTAL DEPTH (ft.): 20.5

SCREEN INTERVAL (ft.): 5-15

DRILLING EQUIPMENT: CME 75

DEPTH TO WATER: FIRST 6 ft COMPL. NA

CASING: 2" Sch. 40 PVC

SAMPLING METHOD: Dames & Moore (1.5' x 3.25")

LOGGED BY: N. Bacher

HAMMER WEIGHT: 300

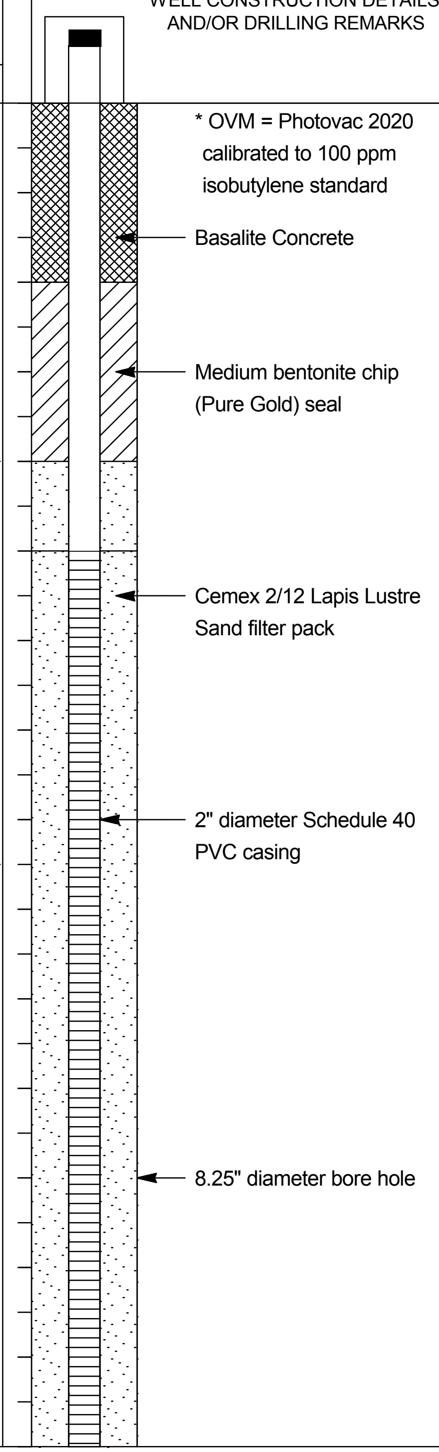
DROP: 30"

RESPONSIBLE PROFESSIONAL: N. Bacher

REG. NO. L.G. 2528

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: 23.76 feet MLLW
0				Postholed through roadbase to 4 feet below ground surface.
4		17 15 50/6"		SILTY SAND with GRAVEL (SM): brown (10YR 4/3), dry, 70% fine to medium sand, 15% fine subrounded gravel, 15% non-plastic fines, oxidized mottling
5		1 1 1		
6				wet
7		1 2 3		wood fragment, black
8.5		4 2 2		SILTY SAND (SM): black (N 2.5/), wet, 70% medium sand, 20% non-plastic fines, 10% fine gravel, wood fragments, glass decreasing wood content
10	MW-03-10.5-1008	7 6 18		
11.5		5 3 2		
14.5		7 9		
15				

WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS



OAKWELLV (REV. 9/2007)

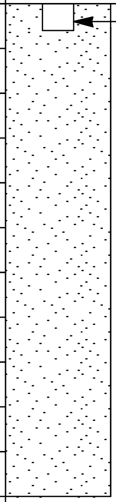
AMEC Geomatrix

Project No. 14159.000.0

PROJECT: Skagit Whitmarsh Landfill
Anacortes, Washington

Log of Well No. MW-03 (cont'd)

DEPTH (feet)	SAMPLES Sample No.	Sample	Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
15			11		SILTY SAND (SM): cont'd.	2" diameter Schedule 40 PVC end cap
					increasing wood content, glass fragments	*10% Wood*
16			5 5 2			
17					wet, 75% fine sand, 25% non-plastic fines	*15% Wood*
			4 7 7		wet, 50% fine to medium sand, 25% non-plastic fines, 10% fine subrounded gravel	
18						
					LEAN CLAY (CL): dark bluish gray (5B 3/1), wet, 95% non-plastic fines, 5% fine gravel, very stiff	
19			50/6"			
					fine sand laminations	
20						
					Bottom of boring at 20.5 feet.	
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						



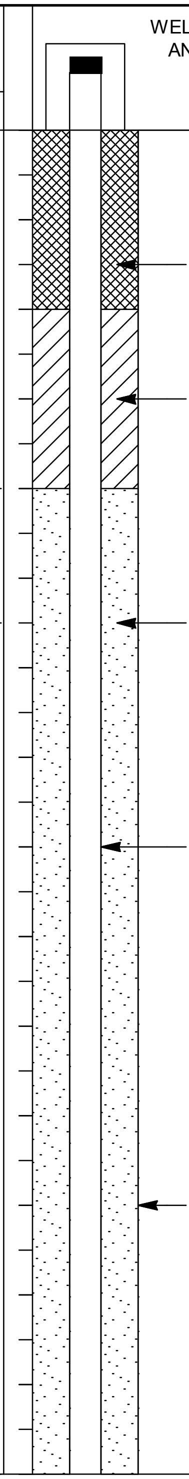
PROJECT: Skagit Whitmarsh Landfill
Anacortes, Washington

Log of Well No. MW-04

BORING LOCATION: N: 537393.7; E: 1229202.5	GROUND SURFACE ELEVATION AND DATUM: Ground Surface
DRILLING CONTRACTOR: Cascade Drilling, Inc.	DATE STARTED: 7/16/08 · DATE FINISHED: 7/16/08
DRILLING METHOD: Hollow-stem auger (Limited Access)	TOTAL DEPTH (ft.): 38.5 · SCREEN INTERVAL (ft.): 15-25
DRILLING EQUIPMENT: CME 75	DEPTH TO WATER: FIRST 15.5 · COMPL. NA · CASING: 2" Sch. 40 PVC
SAMPLING METHOD: Dames & Moore (1.5' x 3.25")	LOGGED BY: N. Bacher
HAMMER WEIGHT: 300 · DROP: 30"	RESPONSIBLE PROFESSIONAL: N. Bacher · REG. NO. L.G. 2528

DEPTH (feet)	SAMPLES Sample No.	Sample	Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: 20.6 feet MLLW
0					Postholed through roadbase to 4 feet below ground surface.
4			8 14 21		SILTY SAND (SM): olive brown (2.5Y 4/3), dry, 80% fine sand, 20% non-plastic fines
5.5					SILT (ML): gray (10YR 5/1), dry to moist, 90% fines, 10% fine sand, non-plastic, contains metallic flecks
7			8 20 32		
8					peat lenses, light brown, contains metallic flecks
9			19 50/6"		
10					PEAT (PT), dark brown
10.5			22 50/6"		
11.5					brownish gray, 20% peat fragments, contains metallic flecks
12			50/6"		
13			12 16 18		gray, contains metallic flecks, fine sand laminations
14.5			20 43		
15					

WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS



* OVM = Photovac 2020 calibrated to 100 ppm isobutylene standard

Basalite Concrete

Medium bentonite chip (Pure Gold) seal

Cemex 2/12 Lapis Lustre Sand filter pack

2" diameter Schedule 40 PVC casing

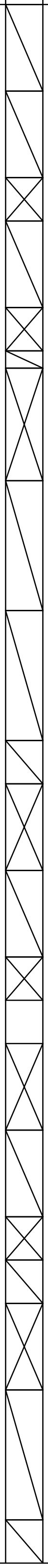
8.25" diameter bore hole

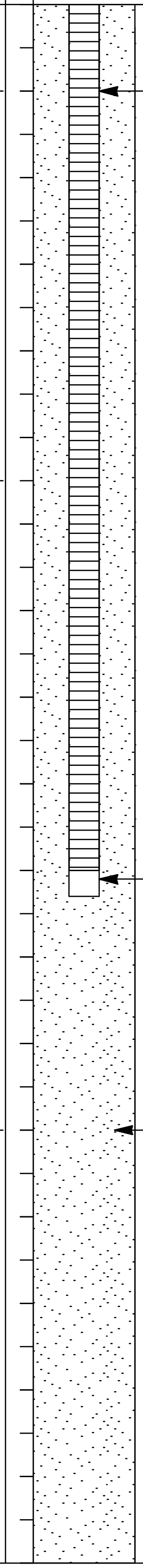
OAKWELLV (REV. 9/2007)

PROJECT: Skagit Whitmarsh Landfill
Anacortes, Washington

Log of Well No. MW-04 (cont'd)

DEPTH (feet)	SAMPLES Sample No.	Sample	Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
15			25		SILTY SAND (SM): gray (10YR 5/1), moist, 75% fine sand, 25% non-plastic fines wet	10% Wood
16			17 50/6"		POORLY GRADED SAND (SP): gray (10YR 5/1), wet, 95% fine sand, 5% non-plastic fines	Schedule 40 PVC well screen with 2" diameter and 0.010" slot 15% Wood
17			18 50/6"			
18						
19			50/6"			
20			8 12 20		WELL GRADED SAND with GRAVEL (SW): gray (10YR 5/1), wet, 75% fine to medium sand, 25% fine subrounded gravel	
21						
22			16 50/6"			
23						
24			50/6"			
25			14 50/6"			2" diameter Schedule 40 PVC end cap
26						
27			50/6"			
28			15 50/6"		POORLY GRADED SAND (SP): gray (10YR 5/1), wet, 90% medium sand, 10% fine gravel	Cemex 2/12 Lapis Lustre Sand filter pack
29						
30			50/6"			
31			12 17 22			
32			50/6"			
33						





PROJECT: Skagit Whitmarsh Landfill
Anacortes, Washington

Log of Well No. MW-04 (cont'd)

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ Foot	OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
33					POORLY GRADED SAND (SP): cont'd.	
34			50/6"			
35						
			17 50/6"			Cemex 2/12 Lapis Lustre Sand filter pack
36						
37			19 50/6"			
					LEAN CLAY (CL): bluish black (10B 2.5/1), wet, 100% fines, trace fine gravel, non-plastic, very stiff	
38						
					Bottom of boring at 38.5 feet	
39						
40						
41						
42						
43						
44						
45						
46						
47						
48						
49						
50						
51						

OAKWELLV (REV. 9/2007)

PROJECT: Skagit Whitmarsh Landfill
Anacortes, Washington

Test Pit Log No. TP-G-1

TEST PIT LOCATION: N: 537747.4; E: 1229054.8

ELEVATION AND DATUM: 15.57 feet MLLW

EXCAVATION CONTRACTOR: Philip Services Corporation

DATE STARTED: 11/1/08

DATE FINISHED: 11/1/08

OPERATOR: John Rodriquez

TOTAL DEPTH (ft): 5.5

MEASURING POINT: Ground Surface

EXCAVATION EQUIPMENT: CAT 320C

DEPTH TO WATER: FIRST ND | NA

EXCAVATION BUCKET DIMENSIONS: 1.5 Cubic Yard Bucket

LOGGED BY: K. Tahghighi

SAMPLING METHOD: Grab

RESPONSIBLE PROFESSIONAL: K. Tahghighi

REG. NO. P.E. 32240

DEPTH (feet)	SAMPLES Sample No.	 Sample	OVM READING (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: 15.57 feet	REMARKS
1	TP-G-1-1.0-1008	■		COVER SOIL: WELL GRADED SAND WITH GRAVEL (SW): brown (10YR 4/3), moist, 75% fine to coarse sand, 20% fine to coarse gravel, < 5% non-plastic fines, roots, 2x3 foot metal (oil) pan, 3 pieces of appliance (e.g. washer)	
2				HOUSEHOLD GARBAGE: plastics, cans, bottles, paper, cardboard with interbedded soil	
3				pieces of asbestos containing insulation present	
4	TP-G-1-4-1008	■			50-70% Garbage Soil sample TP-G-1-4-108 contained 23% crysotile.
5					
6				Bottom of test pit at 5.5 feet. Terminated due to asbestos containing material in test pit.	
7					
8					
9					
10					
11					
12					
13					
14					
15					

OAKTESTPIT (REV. 6/03)

AMEC Geomatrix

PROJECT: Skagit Whitmarsh Landfill Anacortes, Washington	**Test Pit Log No. TP-G-2**	
TEST PIT LOCATION: N: 537661.3; E: 1229148.8	ELEVATION AND DATUM: 15.37 feet MLLW	
EXCAVATION CONTRACTOR: Philip Services Corporation	DATE STARTED: 10/30/08	DATE FINISHED: 10/30/08
OPERATOR: John Rodriquez	TOTAL DEPTH (ft): 8.0	MEASURING POINT: Ground Surface
EXCAVATION EQUIPMENT: CAT 320C	DEPTH TO WATER: FIRST 7.5	NA
EXCAVATION BUCKET DIMENSIONS: 1.5 Cubic Yard Bucket	LOGGED BY: K. Tahghighi	
SAMPLING METHOD: Grab	RESPONSIBLE PROFESSIONAL: K. Tahghighi	REG. NO. P.E. 32240

DEPTH (feet)	SAMPLES		OVM READING (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: 15.37 feet	REMARKS
	Sample No.	Sample			
0–3				COVER SOIL: POORLY GRADED SAND with SILT (SP-SM): light brown (7.5YR 6/3), moist, 90% fine to coarse sand, 10% non-plastic fines, roots, garbage, 3 appliances (e.g. washer)	Layer thickness increased from 2 feet on the north to 3 feet on the south.
3–8				HOUSEHOLD GARBAGE: soil interbedded with bottles, plastics, and metal pieces concrete foundation with I-beam; appliances present on the south sidewall CONTAINER/TANK: approximately 30 gallon capacity perforated tank at 6 feet below ground surface ▽ wet	20-30% Garbage
8				Bottom of test pit at 8.0 feet. Terminated due to groundwater entering test pit.	

OAKTESTPIT (REV. 6/03)

PROJECT: Skagit Whitmarsh Landfill
Anacortes, Washington

Test Pit Log No. TP-G-3

TEST PIT LOCATION: N: 537903.6; E: 1229285.1

ELEVATION AND DATUM: 17.87 feet MLLW

EXCAVATION CONTRACTOR: Philip Services Corporation

DATE STARTED: 10/31/08

DATE FINISHED: 10/31/08

OPERATOR: John Rodriquez

TOTAL DEPTH (ft): 12.0

MEASURING POINT: Ground Surface

EXCAVATION EQUIPMENT: CAT 320C

DEPTH TO WATER: FIRST 11.5 | NA

EXCAVATION BUCKET DIMENSIONS: 1.5 Cubic Yard Bucket

LOGGED BY: K. Tahghighi

SAMPLING METHOD: Grab

RESPONSIBLE PROFESSIONAL: K. Tahghighi

REG. NO. P.E. 32240

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	OVM READING (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: 17.87 feet	REMARKS
				COVER SOIL: WELL GRADED SAND (SW): brown (10YR 4/3), moist, 90% fine to medium sand, < 5% fine gravel, < 5% non-plastic fines, roots, metal sink, plate, lawn mower	
2				HOUSEHOLD GARBAGE: bottles, plastics, rags, wood, metallic tub in south side wall with white fibrous material below	White fibrous material extended from the south wall to the north side of test pit. Possible dry wall.
				Greater concentration of garbage on the north side of test pit.	
5	TP-G-3-5.0-1008	■		SANDY SILT (ML): moist, bluish gray (10B 6/1), petroleum odor	
6				plastic sheeting with other miscellaneous waste	
8	TP-G-3-8.0-1008	■			
9				WELL GRADED SAND (SW): light bluish gray (5B 7/1), moist, 90% fine to coarse sand, < 5% fine gravel, < 5% non-plastic fines	
				LEAN CLAY (CL): light bluish gray (5B 7/1), moist, 90% fines, < 5% fine sand, < 5% roots, low plasticity, native	
12				Bottom of test pit at 12.0 feet. Terminated in native deposit.	

OAKTESTPIT (REV. 6/03)

AMEC Geomatrix

Project No. 14159.000.0

PROJECT: Skagit Whitmarsh Landfill
Anacortes, Washington

Test Pit Log No. TP-G-4

TEST PIT LOCATION: N: 537696.3; E: 1229236.7

ELEVATION AND DATUM: 15.27 feet MLLW

EXCAVATION CONTRACTOR: Philip Services Corporation

DATE STARTED: 10/31/08

DATE FINISHED: 10/31/08

OPERATOR: John Rodriquez

TOTAL DEPTH (ft): 6.0

MEASURING POINT: Ground Surface

EXCAVATION EQUIPMENT: CAT 320C

DEPTH TO WATER: FIRST ND | NA

EXCAVATION BUCKET DIMENSIONS: 1.5 Cubic Yard Bucket

LOGGED BY: K. Tahghighi

SAMPLING METHOD: Grab

RESPONSIBLE PROFESSIONAL: K. Tahghighi

REG. NO. P.E. 32240

DEPTH (feet)	SAMPLES		OVM READING (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	REMARKS
	Sample No.	Sample		Surface Elevation: 15.27 feet	
	TP-G-4-1.0-1008	■		COVER SOIL: WELL GRADED SAND (SW): brown (10YR 4/3), moist, 95% fine to medium sand, < 5% non-plastic fines, appliance	
1				HOUSEHOLD GARBAGE: soil interbedded with bottles, cans, metallic pieces, plastics, clothes	
2					
3					70-80% Garbage
4	TP-G-4-4.0-1008	■			
5				washing machine drum	
6				CONCRETE PAD - COBBLES	
				Bottom of test pit at 6.0 feet. Terminated due to concrete pad in test pit.	
7					
8					
9					
10					
11					
12					
13					
14					
15					

OAKTESTPIT (REV. 6/03)

PROJECT: Skagit Whitmarsh Landfill
Anacortes, Washington

Test Pit Log No. TP-G-5

TEST PIT LOCATION: N: 538006.3; E: 1229133.7	ELEVATION AND DATUM: 16.87 feet MLLW		
EXCAVATION CONTRACTOR: Philip Services Corporation	DATE STARTED: 11/2/08	DATE FINISHED: 11/2/08	
OPERATOR: John Rodriquez	TOTAL DEPTH (ft): 9.0	MEASURING POINT: Ground Surface	
EXCAVATION EQUIPMENT: CAT 320C	DEPTH TO WATER:	FIRST 9.0	NA
EXCAVATION BUCKET DIMENSIONS: 1.5 Cubic Yard Bucket	LOGGED BY: K. Tahghighi		
SAMPLING METHOD: Grab	RESPONSIBLE PROFESSIONAL: K. Tahghighi		REG. NO. P.E. 32240

DEPTH (feet)	SAMPLES		OVM READING (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	REMARKS
	Sample No.	Sample		Surface Elevation: 16.87 feet	
				LOG BARK WELL GRADED SAND (SW): brown (10YR 4/3), moist, 85% fine to coarse sand, <10% fine to coarse gravel, < 5% non-plastic fines, garbage including an appliance (refridgerator), metal siding, and bed frame	
1	TP-G-5-1.0-1008	■			
2					
3				HOUSEHOLD GARBAGE: bottles, rags, pipes mixed with soil	
4					
5	TP-G-5-5.0-1008	■		three pieces of rounded wood chunks (from power poles?)	Discovered a clip of blank bullets with powder on belt. Bullets were marked *1969 Lake City*.
6					
7				sheen, chemical odor	
8	TP-G-5-8.5-1008	■			
9				Bottom of test pit at 9.0 feet. Terminated due to groundwater entering test pit.	
10					
11					
12					
13					
14					
15					

OAKTESTPIT (REV. 6/03)

AMEC Geomatrix Project No. 14159.000.0

PROJECT: Skagit Whitmarsh Landfill
Anacortes, Washington

Test Pit Log No. TP-G-6

TEST PIT LOCATION: N: 538032.9; E: 1228965.4

ELEVATION AND DATUM: 18.87 feet MLLW

EXCAVATION CONTRACTOR: Philip Services Corporation

DATE STARTED: 11/1/08

DATE FINISHED: 11/1/08

OPERATOR: John Rodriquez

TOTAL DEPTH (ft): 10.0

MEASURING POINT: Ground Surface

EXCAVATION EQUIPMENT: CAT 320C

DEPTH TO WATER: FIRST 10.0 | NA

EXCAVATION BUCKET DIMENSIONS: 1.5 Cubic Yard Bucket

LOGGED BY: K. Tahghighi

SAMPLING METHOD: Grab

RESPONSIBLE PROFESSIONAL: K. Tahghighi

REG. NO. P.E. 32240

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	OVM READING (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	REMARKS
				Surface Elevation: 18.87 feet	
0				LOG BARK	
4				WELL GRADED SAND with SILT (SW-SM): light bluish gray (10B 7/1), moist, 90% fine to coarse sand, 10% non-plastic fines with household garbage (plastics, metal debris, bottles, wood), petroleum/organic odor	
6	TP-G-6-6.0-1008	■			
8				▽ burnt material with 50-100 foot industrial air hose	
9					Excavated 5.0 feet on the south sidewall perpendicular to the pit to explore for more metallic objects. Metal plate found ~2 feet to 4 feet in diameter.
10				Bottom of test pit at 10.0 feet. Terminated due to groundwater entering test pit.	

OAKTESTPIT (REV. 6/03)

AMEC Geomatrix

Project No. 14159.000.0

PROJECT: Skagit Whitmarsh Landfill
Anacortes, Washington

Test Pit Log No. TP-G-7

TEST PIT LOCATION: N: 537638.4; E: 1229297.3

ELEVATION AND DATUM: 14.57 feet MLLW

EXCAVATION CONTRACTOR: Philip Services Corporation

DATE STARTED: 10/30/08

DATE FINISHED: 10/30/08

OPERATOR: John Rodriquez

TOTAL DEPTH (ft): 8.0

MEASURING POINT: Ground Surface

EXCAVATION EQUIPMENT: CAT 320C

DEPTH TO WATER: FIRST ND | NA

EXCAVATION BUCKET DIMENSIONS: 1.5 Cubic Yard Bucket

LOGGED BY: K. Tahghighi

SAMPLING METHOD: Grab

RESPONSIBLE PROFESSIONAL: K. Tahghighi

REG. NO. P.E. 32240

DEPTH (feet)	SAMPLES Sample No.	Sample		OVM READING (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: 14.57 feet	REMARKS
0–1					COVER SOIL: WELL GRADED SAND WITH SILT (SW-SM): brown (10YR 4/3), moist, 90% fine to coarse sand, 10% non-plastic fines, appliance	
1–7.5					POORLY GRADED SAND (SP) interbedded with household garbage (bottles, metal pieces, rags, automotive parts, wood, tires)	30-50% Garbage
7.5–8					LEAN CLAY (CL): gray (10YR 6/1), moist, 95% fines, < 5% sand, trace organics, low plasticity, native	
8					Bottom of test pit at 8.0 feet. Terminated in native deposit.	

Depth scale: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

OAKTESTPIT (REV. 6/03)

PROJECT: Skagit Whitmarsh Landfill
Anacortes, Washington

Test Pit Log No. TP-G-8

TEST PIT LOCATION: N: 538017.9; E: 1229080.9

ELEVATION AND DATUM: 16.97 feet MLLW

EXCAVATION CONTRACTOR: Philip Services Corporation

DATE STARTED: 11/2/08

DATE FINISHED: 11/2/08

OPERATOR: John Rodriquez

TOTAL DEPTH (ft): 8.0

MEASURING POINT: Ground Surface

EXCAVATION EQUIPMENT: CAT 320C

DEPTH TO WATER: FIRST 8.0 | NA

EXCAVATION BUCKET DIMENSIONS: 1.5 Cubic Yard Bucket

LOGGED BY: K. Tahghighi

SAMPLING METHOD: Grab

RESPONSIBLE PROFESSIONAL: K. Tahghighi

REG. NO. P.E. 32240

DEPTH (feet)	SAMPLES Sample No.	Sample		OVM READING (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: 16.97 feet	REMARKS
					LOG BARK	
1					WELL GRADED SAND with SILT (SP-SM): light brown (7.5YR 6/3), moist, 85% fine to coarse sand, 10% non-plastic fines, < 5% fine gravel, automotive bumper and front end	
2					COMMERCIAL WOODWASTE: cellulose based wood strips	
3						
4						
5					treated wood with chemical odor	
6						
7					pipe/hose	
8					Bottom of test pit at 8.0 feet. Terminated due to groundwater entering test pit.	
9						
10						
11						
12						
13						
14						
15						

PROJECT: Skagit Whitmarsh Landfill
Anacortes, Washington

Test Pit Log No. TP-G-9

TEST PIT LOCATION: N: 538110.8; E: 1228962.5

ELEVATION AND DATUM: 19.07 feet MLLW

EXCAVATION CONTRACTOR: Philip Services Corporation

DATE STARTED: 11/2/08

DATE FINISHED: 11/2/08

OPERATOR: John Rodriquez

TOTAL DEPTH (ft): 9.5

MEASURING POINT: Ground Surface

EXCAVATION EQUIPMENT: CAT 320C

DEPTH TO WATER: FIRST 9.5 | NA

EXCAVATION BUCKET DIMENSIONS: 1.5 Cubic Yard Bucket

LOGGED BY: K. Tahghighi

SAMPLING METHOD: Grab

RESPONSIBLE PROFESSIONAL: K. Tahghighi

REG. NO. P.E. 32240

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	OVM READING (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: 19.07 feet	REMARKS
				LOG BARK	
1				WELL GRADED SAND with GRAVEL (SW): brown (10YR 4/3), moist, 75% fine to coarse sand, 20% fine to coarse gravel, < 5% non-plastic fines	
2					
3				miscellaneous trash including a tire, wood, and metal pieces partially crushed drum containing fiberglass and solidified resin	
4	TP-G-9-4-1008	■			Resin sample TP-G-9-4-1008 collected from drum.
5				▽ chemical odor	
6					
7					
8				WOODWASTE: plywood and lumber, chemical odor, sheen	
9	TP-G-9-9-1008	■			
10				Bottom of test pit at 9.5 feet. Terminated due to groundwater entering test pit.	
11					
12					
13					
14					
15					

PROJECT: Skagit Whitmarsh Landfill
Anacortes, Washington

Test Pit Log No. TP-G-10

TEST PIT LOCATION: N: 538156.1; E: 1228669.9

ELEVATION AND DATUM: 22.57 feet MLLW

EXCAVATION CONTRACTOR: Philip Services Corporation

DATE STARTED: 11/1/08

DATE FINISHED: 11/1/08

OPERATOR: John Rodriquez

TOTAL DEPTH (ft): 9.0

MEASURING POINT: Ground Surface

EXCAVATION EQUIPMENT: CAT 320C

DEPTH TO WATER: FIRST 9.0 | NA

EXCAVATION BUCKET DIMENSIONS: 1.5 Cubic Yard Bucket

LOGGED BY: K. Tahghighi

SAMPLING METHOD: Grab

RESPONSIBLE PROFESSIONAL: K. Tahghighi

REG. NO. P.E. 32240

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	OVM READING (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: 22.57 feet	REMARKS
				LOG BARK	
1					
2					
3					
4					
5					
6				SILTY SAND (SM): light bluish gray (10B 7/1), moist, 85% fine to coarse sand, 15% non-plastic fines, odor	
7				MISCELANEOUS WASTE: woodwaste, 5 to 6 crushed drums, plastics mixed with soil	Steel drums. One poly inside steel drum. Drum labels included *Amoco 543*, *Nalco*, *UOP Polymerization Catalyst*
8	TP-G-8-8.5-1008	■			
9				rust colored oxidation in groundwater Bottom of test pit at 9.0 feet. Terminated due to groundwater entering test pit.	
10					
11					
12					
13					
14					
15					

PROJECT: Skagit Whitmarsh Landfill
Anacortes, Washington

Test Pit Log No. TP-G-11

TEST PIT LOCATION: N: 537826.2; E: 1229212.9

ELEVATION AND DATUM: 18.27 feet MLLW

EXCAVATION CONTRACTOR: Philip Services Corporation

DATE STARTED: 10/31/08

DATE FINISHED: 10/31/08

OPERATOR: John Rodriquez

TOTAL DEPTH (ft): 11.0

MEASURING POINT: Ground Surface

EXCAVATION EQUIPMENT: CAT 320C

DEPTH TO WATER: FIRST 10.5 | NA

EXCAVATION BUCKET DIMENSIONS: 1.5 Cubic Yard Bucket

LOGGED BY: K. Tahghighi

SAMPLING METHOD: Grab

RESPONSIBLE PROFESSIONAL: K. Tahghighi

REG. NO. P.E. 32240

DEPTH (feet)	SAMPLES Sample No.	Sample	OVM READING (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation: 18.27 feet	REMARKS
				WELL GRADED SAND (SW): brown (10YR 4/3), moist, 85% fine to medium sand, < 5% gravel, < 5% non-plastic fines, < 5% garbage	
1					
2					
3				↓ POORLY GRADED SAND (SP) interbedded with household garbage (bottles, rags, plastics)	
4				AUTOMOTIVE DEBRIS: automotive parts including car hood from 4 to 6 feet below ground surface	
5					
6				POORLY GRADED SAND (SP): brown (10YR 4/3), moist, 90% fine to medium sand, < 5% gravel, < 5% non-plastic fines, interbedded garbage	
7				SILT with SAND (ML): bluish gray (10B 6/1), dry to moist, 85% fines, 15% fine to coarse sand, moderate plasticity, stiff, petroleum odor	
8				MISCELANEOUS GARBAGE: soil interbedded with burned garbage and woodwaste	
9					
10				LEAN CLAY (CL): gray (10YR 5/1), moist, 90% fines, < 5% fine sand, < 5% roots/organics, moderate plasticity, native	
11				Bottom of test pit at 11.0 feet. Terminated in native deposit.	
12					
13					
14					
15					

OAKTESTPIT (REV. 6/03)

APPENDIX G

Bioassay Report

BIOLOGICAL TESTING OF SEDIMENT FOR MARCH POINT (WHITMARSH) LANDFILL ANACORTES, WASHINGTON

NOVEMBER 2008

PREPARED FOR:
AMEC GEOMATRIX, INC.
600 University, Suite 1020
Seattle, Washington 98101

PREPARED BY:
NEWFIELDS
PO Box 216
4729 View Drive
Port Gamble, Washington 98364

1.0 INTRODUCTION

NewFields conducted toxicity tests with sediment samples collected by AMEC Geomatrix at the March Point Landfill in Padilla Bay. Biological effects were evaluated relative to the biological criteria defined in the Sediment Management Standards (SMS). This report presents the results for the toxicity testing portion of the March Point Landfill sediment investigation.

2.0 METHODS

This section summarizes the test methods that were followed for this biological characterization. Test methods followed guidance provided by the Puget Sound Estuary Program (PSEP 1995), the WDOE Sampling and Analysis Plan Appendix (SAPA; Ecology 2008), the various updates presented during the Annual Sediment Management Review meetings (SMARM), and the Sediment Investigation Work Plan March Point (Whitmarsh) Landfill Skagit County, Washington prepared by AMEC Geomatrix (AMEC 2008). Sediment toxicity was evaluated using three standard PSEP bioassays, the 10-day amphipod test, the 48 to 96-hour benthic larval test, and the Microtox® porewater test. NewFields performed the amphipod and benthic larval tests, the Microtox® test was performed by Nautilus Environmental LLC. The amphipod test species, *Ampelisca abdita*, was selected by the Ecology based on the predominant grain size distribution of the test sediments.

2.1 SAMPLE AND ANIMAL RECEIPT

Thirteen test sediments were received by NewFields on August 29, 2008. Reference sediment was collected from Carr Inlet on September 12, 2008 and from Sequim Bay on September 16, 2008 by NewFields. Sediment samples were stored in a walk-in cold room at 4 ± 2ºC in the dark. Test sediment was not sieved prior to testing. All tests were conducted within the eight week holding time.

Amphipods (*Ampelisca abdita*) were supplied by Brezina and Associates in Dillon Beach, California. Animals were held in native sediment at 20°C prior to test initiation. *Dendraster excentricus* (sand dollar) broodstock was collected by NewFields staff from Hood Canal, Washington. Broodstock were held in unfiltered seawater from Hood Canal prior to spawning.

Native *Ampelisca* sediment from Dillon Beach, California was also provided by Brezina and Associates for use as control sediment for the amphipod test.

2.2 ULTRA-VIOLET LIGHT EXPOSURE

Test sediment samples were exposed to ultra-violet (UV) light during the entire test exposure. The UV light regime followed guidance provided by Sub-Appendix D (Ecology 2008) and in consultation with Ecology. UV light was provided by fluorescent light ballast containing one Duro-Test Vita-Lite® (40W, 5500°K, 91 CRI) fluorescent bulb and one standard fluorescent bulb (Phillips F40CW). The UV bulbs were placed within 12" above the sediment surface. All test chambers in the UV exposures were left uncovered to prevent any UV loss. Tests were conducted on water-tables to ensure that the additional lighting did not alter water temperatures in the test chambers. In all other respects, the methods followed the standard testing protocols are summarized below.

2.3 10-DAY AMPHIPOD BIOASSAY

The 10-day acute toxicity test with *A. abdita* was initiated on September 23, 2008. To prepare the test exposures, approximately 175 mL of sediment was placed in clean, acid and solvent-rinsed 1-L glass jars, which were then filled with 775 mL of 0.45-µm filtered seawater at 28 ppt. Seven replicate chambers were prepared for each test treatment, the two reference sediments, and the native control sediment. The control and reference sediments were tested with the test treatments. Five replicates were used to evaluate sediment toxicity while the remaining two replicates were designated as sacrificial surrogate chambers. One surrogate chamber was sacrificed at test initiation to measure porewater and overlying ammonia and sulfides. The remaining surrogate chamber was used for measuring daily water quality throughout the test, as well as porewater and overlying ammonia and sulfides at test termination. Total ammonia as nitrogen was monitored using an Orion meter fitted with an ammonia ion-specific probe. Total sulfides as S^{2-} were monitored using a HACH DR/4000V Spectrophotometer.

Test chambers were placed in randomly assigned positions in a 20°C water bath and allowed to equilibrate overnight. Trickle-flow aeration was provided to prevent dissolved oxygen concentrations from dropping below acceptable levels.

Immediately prior to test initiation, water quality parameters were measured in the surrogate chamber for each treatment. Dissolved oxygen (DO), temperature, pH, and salinity were then monitored in the surrogate chambers daily until test termination. Target test parameters were:

Dissolved Oxygen:	≥4.6 mg/L
pH:	7.8 ± 0.5 units
Temperature:	20 ± 1°C
Salinity:	28 ± 1‰

The tests were initiated by randomly allocating 20 *A. abdita* into each test chamber, ensuring that each of the amphipods successfully buried into the sediment. Amphipods that did not bury within approximately one hour were replaced with healthy amphipods. The 10-day amphipod bioassay was conducted as a static test with no feeding during the exposure period. At test termination, sediment from each test chamber was sieved through a 0.5-mm screen and all recovered amphipods transferred into a Petri dish. The number of surviving and dead amphipods was recorded. A water-only, 4-day reference-toxicant test was conducted concurrently with the sediment tests, using cadmium chloride. The cadmium reference-toxicant test was used to ensure animals used in the test were healthy and of similar sensitivity to prior tests.

2.4 LARVAL DEVELOPMENTAL BIOASSAY

Test sediment was evaluated using the larval benthic toxicity test with the sand dollar, *D. excentricus*. The sand dollar larval test was initiated on September 24, 2008. A sea water control and the two reference sediments were tested with the test treatments. To prepare the test exposures, 18 g (±1 g) of test sediment was placed in clean, acid and solvent-rinsed 1-L glass jars, which were then filled to 900 mL with 0.45-µm of filtered seawater. Six replicate chambers were prepared for each test treatment, reference sediment, and the native sediment control treatment. Five of the replicates were used to evaluate the test; the sixth replicate was used as a water quality surrogate. Each chamber was shaken for 10 seconds and then placed in predetermined randomly-assigned positions in a water bath at 15°C.

To collect gametes for each test, spawning was induced by injecting 0.5 mL of 0.5M KCl into the coelomic cavity of the sand dollar. Spawning males and females were placed aboral surface down into a beaker with clean seawater. Gametes from at least two males and two females were used to initiate the test. Once sufficient eggs and sperm had been collected, the eggs were rinsed to remove any detritus or feces and a homogenized sperm solution was added to the egg solutions. Egg-sperm solutions were periodically homogenized with a perforated plunger during the fertilization process. Approximately 60 minutes after fertilization, embryo solutions were checked for fertilization rate. Only those embryo stocks with >90% fertilization were used to initiate the tests. Embryo solutions were rinsed free of excess sperm and then combined to create one embryo stock solution. Density of the embryo stock solution was determined by counting the number of embryos in a sub sample of stock solution. This was used to determine the volume of embryo stock solution to deliver approximately 27,000 embryos to each test chamber. The tests were initiated by randomly allocating an aliquot of the embryo stock solution into each test chamber four hours after sediments were shaken and within two hours of egg fertilization. Embryos were held in suspension during initiation using a perforated plunger.

Dissolved oxygen, temperature, pH, and salinity were monitored in water quality surrogates to prevent loss or transfer of larvae by adhesion to water-quality probes. Overlying water ammonia and sulfides were measured on Day 0 and Day 3. Total ammonia as nitrogen was monitored using an Orion meter fitted with an ammonia ion-specific probe. Total sulfides as S^{2-} were monitored using a HACH DR/4000V Spectrophotometer. Target test parameters were as follows:

Dissolved Oxygen:	≥4.8 mg/L
pH:	7.8 ± 0.5 units
Temperature:	15 ± 1°C
Salinity:	28 ± 1‰

The larval developmental tests were terminated approximately 71 hours after initiation when approximately 90% of the control larvae had achieved the pluteus stage. To terminate the test, the overlying seawater was decanted into a clean 1-L jar and mixed with a perforated plunger. From this container, a 10 mL sub sample was transferred to a scintillation vial and preserved in 5% buffered formalin. The number of normal and abnormal larvae was enumerated on an inverted microscope. Normal larvae included all pluteus stage larvae. Abnormal larvae included abnormally shaped pluteus larvae and all early stage larvae. A 72-h water-only reference-toxicant test with copper sulfate was conducted concurrently with each test.

2.5 MICROTOX® TEST

The Microtox® test was performed by Nautilus Environmental LLC. A complete report on the test is included as Appendix A.

2.6 DATA ANALYSIS AND QA/QC

All water quality and endpoint data were entered into Excel spreadsheets. Water quality parameters were summarized by calculating the mean, minimum, and maximum values for each test treatment. Endpoint data were calculated for each replicate and mean values and standard deviations were determined for each test treatment.

All hand-entered data was reviewed for data entry errors, which were corrected prior to summary calculations. A minimum of 10% of all calculations and data sorting were reviewed for errors. Review counts were conducted on any apparent outliers.

For the larval test, the normalized combined mortality and abnormality endpoint was used to evaluate the test sediment. This was based on the number of normal larvae in the treatment and reference divided by the number of normal larvae in the control, as defined in Ecology (2005).

For SMS suitability determinations, comparisons were made according to SAPA and Fox et al. (1998). Data reported as percent mortality or survival was transformed using an arcsine square root transformation prior to statistical analysis. All data were tested for normality using the Wilk-

Shapiro test and equality of variance using Levene's test. Determinations of statistical significance were based on one-tailed Student's t-tests with an alpha of 0.05. A comparison of the larval endpoint, relative to the reference was made using an alpha level of 0.10. For samples failing to meet assumptions of normality, a Mann-Whitney test was conducted to determine significance. For those samples failing to meet the assumptions of normality and equality of variance, a t-test on rankits was used.

3.0 RESULTS

The results of the sediment testing, including a summary of test results and water quality observations are presented in this section. Data for each of the replicates, as well as laboratory bench sheets are provided Appendix B and statistical analyses are provided in Appendix C.

3.1 10-DAY AMPHIPOD BIOASSAY

A summary of test conditions is shown in Table 1, *A. abdita* survival is presented in Table 2, and a summary of water quality observations is presented in Table 3. Mean percent survival in the control was 91%, above the 90% acceptance criterion. This indicates that the test conditions were suitable for adequate amphipod survival.

Initial observations on the SBREF-80 samples showed high numbers of amphipods emerging from the sediment and mortalities. Initial sulfide measurements on the interstitial water for this sample were 13.1 mg/L S^{2-} and likely contributed to the amphipod response. To determine if the sulfides were responsible for the mortality, a second set of samples was set up and allowed to acclimate for three days while measuring ammonia and sulfides before initiating the test with amphipods. The acclimated sediment showed an acceptable reference sediment response and the results from this test were used for comparisons. This deviation was discussed with the AMEC project manager prior to initiating the test. A general discussion regarding acclimation of test sediments prior to testing was discussed with Department of Ecology.

The LC_{50} for the cadmium reference-toxicant test was 0.58 mg Cd/L, which is within the control chart limits (0.12 to 1.14 mg Cd/L), indicating that the test organisms used in this study were of similar sensitivity of those previously tested at NewFields. Temperature and dissolved oxygen measurements were within acceptable limits throughout the test. Salinity was recorded above the recommended limit in the control sample and the Carr Inlet reference (CR-1), likely due to higher interstitial salinities in the sediments. The salinities in these two samples were constant throughout the tests and do not appear to have impaired survival which was acceptable at 90% for the Control and 85% for the CR-1 reference sample. The measurements of pH was just above the recommended range at the end of the test for several samples, but all measurements were 8.6 or below. This was within the tolerance range for this species and would not be expected to affect the test results. Initial and final interstitial ammonia concentrations were all below the threshold concentration of 30 mg/L total ammonia (Barton 2002). Initial and final interstitial sulfide concentrations were below 5 mg/L with the exception of the initial reading of 13.1 mg/L for sample SBREF-80 as discussed previously.

Mean mortality in the reference treatments were 15% (CR-1) and 19% (SBREF-80) which met the SMS (<25% mortality) performance criteria and indicated that the reference sediment was acceptable for suitability determination. Mean percentage mortality in the test treatments ranged between 71% and 90% (Table 2).

Table 1. Test Condition Summary for *Ampelisca abdita*.

Test Conditions: PSEP *A. abdita* (SMS)		
Sample Identification	MP-1 to MP-13, Reference CR-1, SBREF-80	
Date sampled	8/26 – 8/28/2008 test samples; 9/12/2008 CR-1; 9/16/2008 SBREF-80	
Date received at NewFields Northwest	8/29/2008; 9/12/2008; 9/17/2008	
Sample storage conditions	4°C, dark	
Weeks of holding	4 weeks	
Source of control sediment	Brezina and Associates (Dillon Beach)	
Test Species	***A. abdita***	
Supplier	Brezina and Associates	
Date acquired	9/17/2008	
Acclimation/holding time	6 days	
Age class	Adult	
Test Procedures	PSEP 1995 with SMARM revisions	
Regulatory Program	SMS	
Test location	NewFields Northwest Laboratory	
Test type/duration	10-Day static	
Test dates	9/23/08 – 10/3/08 ; 10/1/08-10/10/08 acclimated SBREF-80	
Control water	North Hood Canal, sand filtered	
Test temperature	Recommended: 20 ± 1 °C	Achieved: 19.6 – 20.8 °C
Test Salinity	Recommended: 28 ± 2 ppt	Achieved: 28-29 ppt test sediments, 29-31 Control and Reference sediments
Test dissolved oxygen	Recommended: > 4.6 mg/L	Achieved: 5.6-8.9 mg/L
Test pH	Recommended: 7.8 ± 0.5	Achieved: 7.4-8.6
SMS control performance standard	Recommended: Control ≤ 10% mortality	Achieved: 9%
SMS reference performance standard	Recommended: Reference mortality < 25%	Achieved: 15% CR-1; 19% SBREF-80
SMS pass/fail SQS	Treatment – Reference < 25% mortality = **PASS**	All Pass
SMS pass/fail CSL	Treatment – Reference < 30% mortality = **PASS**	All Pass
Reference Toxicant LC50	0.59 mg/L cadmium	
Acceptable Range	0.12 to 1.14 mg/L cadmium	
Test Lighting	Continuous UV exposure	
Test chamber	1-Liter Glass Chamber	
Replicates/treatment	5 + 2 surrogates (one that is used for WQ measurements throughout the test)	
Organisms/replicate	20	
Exposure volume	175 mL sediment/ 950 mL water	
Feeding	None	
Water renewal	None	
Deviations from Test Protocol	High salinities in Control and Reference samples pH above 8.3 on last days of test in several samples	

Table 2. Test Results for *Ampelisca abdita*.

Sample ID	Mean survival (%)	Standard Deviation
Control	91	5.5
CR-1	85	9.4
SBREF-80	81	17.8
MP-1	82	8.4
MP-2	90	5.0
MP-3	76	8.2
MP-4	73	2.7
MP-5	71	2.2
MP-6	88	9.1
MP-7	74	14.7
MP-8	88	2.7
MP-9	75	22.9
MP-10	84	9.6
MP-11	83	17.2
MP-12	77	13.5
MP-13	72	16.8

Table 3. Water Quality Summary for *Ampelisca abdita*.

Treatment	Dissolved Oxygen (mg/L)			Temperature (°C)			pH (units)			Salinity (ppt)		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Control	7.4	6.8	7.7	20.4	20.0	20.7	8.0	7.8	8.3	30.3	30.0	31.0
CR-1	7.4	6.8	7.7	20.3	20.0	20.6	8.0	7.7	8.3	30.1	29.0	31.0
SBREF-80	7.6	6.9	8.9	20.0	19.4	20.3	8.0	7.3	8.2	28.5	27.0	30.0
MP-1	7.3	6.6	7.7	20.3	20.0	20.7	7.9	7.7	8.2	26.9	26.0	28.0
MP-2	7.3	6.8	7.7	20.4	20.0	20.8	8.2	7.7	8.6	28.1	27.0	29.0
MP-3	7.0	6.0	7.6	20.0	19.6	20.5	8.1	7.5	8.5	27.9	27.0	29.0
MP-4	7.4	6.9	7.7	20.3	19.8	20.7	8.0	7.7	8.3	27.3	26.0	28.0
MP-5	7.4	6.8	7.7	20.3	20.0	20.7	8.1	7.7	8.3	28.1	27.0	29.0
MP-6	7.4	6.7	7.6	20.4	20.1	20.7	7.8	7.4	8.3	28.0	27.0	29.0
MP-7	7.4	7.0	7.6	20.4	20.0	20.7	8.2	7.9	8.6	28.3	28.0	29.0
MP-8	7.0	5.6	7.6	20.2	19.9	20.6	7.8	7.5	8.1	28.2	28.0	29.0
MP-9	7.3	6.8	7.6	20.1	19.8	20.6	7.9	7.6	8.2	28.1	27.0	29.0
MP-10	7.2	6.7	7.6	20.3	19.9	20.7	8.0	7.6	8.3	28.2	28.0	29.0
MP-11	7.5	7.0	7.8	20.3	19.8	20.6	8.1	7.7	8.4	28.5	28.0	30.0
MP-12	7.5	6.9	7.7	20.3	19.9	20.7	8.1	7.8	8.4	28.2	27.0	29.0
MP-13	7.5	7.0	7.8	20.4	20.0	20.7	8.3	7.8	8.6	28.4	28.0	29.0

3.2 LARVAL DEVELOPMENT BIOASSAY

Test conditions for the larval development bioassay are shown in Table 4, a summary of the test results from the *D. excentricus* test is presented in Table 5 and a summary of water quality observations is shown in Table 6. The larval test was validated by 11% mean combined mortality in the control treatment, within the acceptability criteria of <30%. Water quality parameters pH and salinity remained within the target limits throughout the 70-hour test. Dissolved oxygen below the recommended range was observed in one test chamber on Day 1 of the test, aeration was applied to the sample to increase the dissolved oxygen. Temperature observations were slightly above the recommended range on the last day of the test in several chambers. The deviations did not exceed 0.5 °C. Neither of these deviations were large enough to invalidate the test and did not appear to affect larval development.

Ammonia values detected in the test chambers were below the NOEC values for *D. excentricus*. The EC_{50} for the copper reference-toxicant test for proportion normal was 12.5 µg Cu/L, within the control chart limits (5.4 to 16.7 µg Cu/L). The results of the reference-toxicant test indicate that the test organisms used in this study were similar in sensitivity to those previously tested at NewFields. Mean control-normalized normal survival in the reference sediments were 87.3% (CR-1) and 93.9% (SB Ref-80); mean normal survival in the test treatments ranged from 87.3% to 99.4%.

Table 4. Test Condition Summary for *Dendraster excentricus*.

Test Conditions: PSEP *D. excentricus* (SMS)		
Sample Identification	MP-1 to MP-13, Reference CR-1, SBREF-80	
Date sampled	8/26 – 8/28/2008 test samples; 9/12/2008 CR-1; 9/16/2008 SBREF-80	
Date received at NewFields Northwest	8/29/2008; 9/12/2008; 9/17/2008	
Sample storage conditions	4°C, dark	
Weeks of holding	4 weeks	
Test Species	***D. excentricus***	
Supplier	Field collected (north Hood Canal)	
Date acquired	9/23/2008	
Acclimation/holding time	1 day	
Age class	<2-h old embryos	
Test Procedures	PSEP 1995 with SMARM revisions	
Regulatory Program	SMS	
Test location	NewFields Northwest Laboratory	
Test type/duration	48-96 Hour static test	
Test dates	9/24/08-9/27/08 – 70 hours	
Control water	Sand-filtered North Hood Canal sea water	
Test temperature	Recommended: 15 ± 1 °C	Achieved: 14.3-16.5 °C
Test Salinity	Recommended: 28 ± 2 ppt	Achieved: 28-30 ppt
Test dissolved oxygen	Recommended: > 4.8 mg/L	Achieved: 4.2-8.4 mg/L
Test pH	Recommended: 7.8 ± 0.5	Achieved: 7.3-7.9
Stocking Density	Recommended: 20 – 30 embryos/mL	Achieved: 24 embryos/mL
SMS control performance standard	Recommended: Control normal survival ≥ 70%	Achieved: 89%
SMS reference performance standard	Recommended: Reference survival/Control survival ≥ 65%	Achieved: CR-1 87% SB Ref-80 94%
SMS pass/fail SQS	(Treatment normal/Control Normal)/ (Reference normal/ Control Normal) > 0.85 = **PASS**	All pass
SMS pass/fail CSL	(Treatment normal/Control Normal)/ (Reference normal/ Control Normal) > 0.70 = **PASS**	All pass
Reference Toxicant LC50	12.5 mg/L copper	
Acceptable Range	5.4 to 16.7 mg/L copper	
Test Lighting	Continuous UV Exposure	
Test chamber	1-Liter Glass Chamber	
Replicates/treatment	5 + 1 surrogate (used for WQ measurements throughout the test)	
Exposure volume	18 g sediment/ 900 mL water	
Feeding	none	
Water renewal	none	
Deviations from Test Protocol	Low DO in one sample, aeration applied. Temperature above recommended range on last day of test in several samples.	

Table 5. Test Results for *Dendraster excentricus*.

Treatment	Mean Normal Survival (%)[1]	Standard Deviation
Control	89.0	6.4
CR-1	87.3	13.2
SBREF-80	93.9	7.0
MP-1	97.9	3.1
MP-2	96.4	4.7
MP-3	93.0	6.9
MP-4	91.5	7.3
MP-5	87.3	10.6
MP-6	99.4	1.2
MP-7	97.9	2.2
MP-8	94.2	5.6
MP-9	96.3	6.5
MP-10	95.3	4.4
MP-11	98.1	4.3
MP-12	95.7	5.8
MP-13	95.5	4.4

[1] Reference and treatment normal survivals are normalized to Control normal survival.

Table 6. Water Quality Summary for *Dendraster excentricus*.

Treatment	Dissolved Oxygen (mg/L)			Temperature (°C)			pH (units)			Salinity (ppt)		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Control	7.6	7.2	7.9	15.7	15.3	16.0	7.7	7.4	7.8	29.0	29.0	29.0
CR-1	6.9	6.0	7.7	15.8	15.1	16.1	7.7	7.6	7.8	29.0	29.0	29.0
SBREF-80	6.8	4.2	8.6	15.4	14.4	16.2	7.8	7.7	7.8	28.8	28.0	29.0
MP-1	5.8	5.2	6.6	15.5	14.7	16.0	7.5	7.3	7.8	28.8	28.0	29.0
MP-2	6.1	5.5	6.6	15.6	15.1	15.9	7.7	7.5	7.8	28.8	28.0	29.0
MP-3	8.2	8.0	8.4	14.9	14.3	15.4	7.8	7.7	7.9	28.8	28.0	29.0
MP-4	8.0	7.5	8.2	14.9	14.3	15.6	7.6	7.4	7.7	28.8	28.0	29.0
MP-5	6.1	5.2	7.0	15.6	15.0	16.5	7.6	7.4	7.7	29.0	29.0	29.0
MP-6	6.3	5.6	7.2	16.0	15.2	16.4	7.6	7.4	7.8	29.3	29.0	30.0
MP-7	5.9	5.4	6.6	15.5	15.0	15.8	7.6	7.5	7.8	29.0	29.0	29.0
MP-8	6.2	5.5	6.8	15.5	15.2	16.2	7.5	7.3	7.7	29.0	29.0	29.0
MP-9	6.1	5.5	7.0	15.7	14.9	16.2	7.6	7.4	7.8	29.3	29.0	30.0
MP-10	5.8	5.2	6.9	15.6	14.8	16.3	7.6	7.4	7.8	29.3	29.0	30.0
MP-11	6.5	5.7	7.3	15.8	15.5	16.2	7.7	7.4	7.8	29.0	29.0	29.0
MP-12	6.8	6.5	7.0	15.6	15.0	16.1	7.7	7.6	7.8	28.8	28.0	29.0
MP-13	6.0	5.6	6.5	15.6	15.1	16.0	7.7	7.5	7.8	29.0	29.0	29.0

4.0 DISCUSSION

Sediments were evaluated based on Sediment Management Standards (SMS) criteria. The biological criteria are based on both statistical significance (a statistical comparison) and the degree of biological response (a numerical comparison). The SMS criteria are derived from the Washington Department of Ecology Sampling and Analysis Plan Appendix (WDOE 2008). Comparisons were made for each treatment against each of the reference sample. Two numerical comparisons were made under SMS, the Sediment Quality Standards (SQS) and the Cleanup Standards Limit (CSL).

4.1 AMPHIPOD TEST SUITABILITY DETERMINATION

Under the SMS program, a test treatment will fail SQS if mean mortality in the test is >25% more than the mean mortality in the appropriate reference sediment and the difference is statistically significant ($p \leq 0.05$). Treatments fail the CSL if mean mortality in the test treatment >30%, relative to the reference sediment and the difference is statistically significant.

Test treatment MP-5 showed significantly higher mortality than the CR-1 reference sediment, but the mortality relative to the reference did not exceed the numerical criteria, therefore all test treatments meet the SQS and CSL for *A. abdita* (Table 7).

Table 7. SMS Comparison for *Ampelisca abdita*.

Treatment	Mean Mortality (%)	Estimated Percent Fines*	Reference Comparison**	Statistically More than Reference?	M_T-M_R	Fails SQS?	Fails CSL?
Control	9						
CR-1	15	60%					
SBREF-80	19	80%					
MP-1	18	83%	SBREF-80	No	-1	No	No
MP-2	10	81%	SBREF-80	No	-9	No	No
MP-3	24	67%	CR-1	No	9	No	No
MP-4	27	77%	SBREF-80	No	8	No	No
MP-5	29	66%	CR-1	Yes	14	No	No
MP-6	12	61%	CR-1	No	-3	No	No
MP-7	26	70%	SBREF-80	No	7	No	No
MP-8	12	60%	CR-1	No	-3	No	No
MP-9	25	78%	SBREF-80	No	6	No	No
MP-10	16	74%	SBREF-80	No	-3	No	No
MP-11	17	84%	SBREF-80	No	-2	No	No
MP-12	23	80%	SBREF-80	No	4	No	No
MP-13	28	76%	SBREF-80	No	9	No	No

SQS: Statistical Significance and M_T-M_R >25%
CSL: Statistical Significance and MT-MR >30%
* Percent fines for reference samples determined in the field. Percent fines for test treatments supplied by client (AMEC)
** Reference sediment pairings with test sediment based on similarity of percent fines and were approved by Pete Adolphson of Ecology.

4.2 LARVAL TEST SUITABILITY DETERMINATION

Larval test treatments fail SQS criteria if the percentage of normal larvae in the test treatment is significantly lower than that of the reference and if the normal larval development in the test treatment is less than 85% of the normal development in the reference. Treatments fail CSL criteria if the normal development is less than 70% of the response observed in the reference.

All test treatments met the SQS and CSL criteria (Table 8).

Table 8. SMS Comparison for *Dendraster excentricus*.

Treatment	Mean Normal Survival (%)	Estimated Percent Fines*	Reference Comparison**	Statistically Less than Associated Reference?	Normal Survival Comparison to Reference $(N_T/N_C)/(N_R/N_C)$	Fails SQS?	Fails CSL?
Control	89.0						
CR-1	87.3	60%					
SBREF80	93.9	80%					
MP-1	97.9	83%	SBREF-80	No	1.04	No	No
MP-2	96.4	81%	SBREF-80	No	1.03	No	No
MP-3	93.0	67%	CR-1	No	1.06	No	No
MP-4	91.5	77%	SBREF-80	No	0.97	No	No
MP-5	87.3	66%	CR-1	No	1.00	No	No
MP-6	99.4	61%	CR-1	No	1.14	No	No
MP-7	97.9	70%	SBREF-80	No	1.04	No	No
MP-8	94.2	60%	CR-1	No	1.08	No	No
MP-9	96.3	78%	SBREF-80	No	1.03	No	No
MP-10	95.3	74%	SBREF-80	No	1.01	No	No
MP-11	98.1	84%	SBREF-80	No	1.04	No	No
MP-12	95.7	80%	SBREF-80	No	1.02	No	No
MP-13	95.5	76%	SBREF-80	No	1.02	No	No

SQS: Statistical Significance and $M_T/M_R < 0.85$
CSL: Statistical Significance and $M_T/M_R < 0.70$
* Percent fines for reference samples supplied by NewFields. Percent fines for test treatments supplied by client (AMEC)
** Reference sediment pairings with test sediment based on similarity of percent fines were approved by Pete Adolphson of Ecology

4.3 MICROTOX TEST SUITABILITY DETERMINATION

The SMS program criteria state that a test sediment fails the SQS criteria when the mean light output of the highest concentration of the test sediment is less than 80% of the mean light output of the reference sediment and the two means are statistically different ($p \leq 0.05$). No criteria exist for the Microtox test for CSL.

The SBREF-80 reference sample performed poorly in the Microtox test; therefore in the test batches using this reference sample, the test treatments were compared to the Control sample (deviation approved by Pete Adolphson of Ecology via email to Nautilus). Treatments MP-4, MP-9, MP-10, MP-11, and MP-13 fail SQS criteria compared to the Control; treatments MP-5 and MP-8 fail SQS compared to reference CR-1 (Table 9).

Table 9. SMS Comparison for Microtox®.

Treatment	5-minute reading		15 minute reading		Fails SQS?
	Mean % output	Statistically Less than Reference and > 20% Difference?	Mean % output	Statistically Less than Reference and > 20% Difference?	
Test 1[1]					
Control	96 ± 2	---	83 ± 2	---	
SBREF-80	76 ± 3	---	67 ± 2	---	
MP-1	76 ± 5	---	70 ± 3	---	
MP-2	102 ± 3	---	98 ± 3	---	
MP-4	67 ± 3	Yes	62 ± 2	Yes	Yes
MP-7	93 ± 3	---	70 ± 5	---	
Test 2[1]					
Control	98 ± 2	---	93 ± 4	---	
SBREF-80	66 ± 1	---	68 ± 4	---	
MP-9	71 ± 4	Yes	71 ± 8	Yes	Yes
MP-10	74 ± 3	Yes	72 ± 2	Yes	Yes
MP-11	66 ± 3	Yes	63 ± 4	Yes	Yes
MP-12	112 ± 3	---	121 ± 5	---	
Test 3[1]					
Control	96 ± 3	---	99 ± 5	---	
SBREF-80	72 ± 5	---	76 ± 4	---	
MP-13	43 ± 2	Yes	46 ± 2	Yes	Yes
Test 4					
Control	92 ± 2	---	81 ± 5	---	
CR-1	102 ± 2	---	91 ± 3	---	
MP-3	104 ± 2	---	94 ± 3	---	
MP-5	73 ± 6	Yes	72 ± 4	Yes	Yes
MP-6	97 ± 1	---	90 ± 5	---	
MP-8	74 ± 11	Yes	67 ± 7	Yes	Yes

[1] Reference sample was significantly less than Control; test treatments compared to the Control.
SQS: > 20% difference and statistically significant difference (p<0.05) relative to the reference.
CSL: No failure criteria for Microtox under SMS rule.

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APPENDIX A

MICROTOX REPORT

Nautilus Environmental

Toxicological Evaluation of Sediment March Point Landfill

Microtox

Report date: November 7, 2008

Submitted to:

NEWFIELDS NORTHWEST
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Washington Laboratory
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SIGNATURE PAGE

Eric Tollefson

Eric Tollefson
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1.0 INTRODUCTION

Sediment samples were collected and evaluated for toxicity as part of a project being conducted by NewFields Northwest. Sediment samples were tested for toxicity using Microtox tests.

2.0 METHODS

2.1 Samples

Thirteen sediment and two reference site subsamples were collected by NewFields personnel on August 26, 27, 28, 2008 and September 17, 2008 and were delivered on September 3 and September 18 to the Nautilus Environmental laboratory in Tacoma, WA. The condition of the sample containers were inspected upon receipt and the identities compared with the information provided on the chain-of-custody forms. The samples were stored at 4±2°C in the dark prior to test initiation.

2.2 Test Procedures

The luminescent marine bacterium *Vibrio fischeri* was used as the test organism for the Microtox test. The bacteria were exposed to porewater extracted from sediment samples and light readings were measured after 5 minutes and 15 minutes of exposure. Test equipment included the Microtox Model 500 Analyzer, which measures light output and is equipped with a 15°C chamber to maintain test temperature in the samples and a 4°C chamber to keep the rehydrated bacteria chilled.

Vials of freeze-dried bacteria (Microtox® Acute Reagent Lot # 8E1080, Expiration date 8/2010) were obtained from Strategic Diagnostics, Inc. and stored at -20°C until use. On the day of the test, a vial was rehydrated with 1.0 ml of Microtox Reconstitution Solution, mixed thoroughly, and allowed to equilibrate for 30 minutes at 4°C. The bacteria were used within 2 hours of rehydration.

The tests were conducted in accordance with WDOE (2008) test protocol. These methods are summarized in Table 1. Approximately 50 ml of porewater was extracted from each sample by centrifuging for 30 minutes at 4500 G. The DO in each sample was between 50 and 100 percent saturation and, as a result, the samples did not require aeration. The pH was adjusted to 7.8 to 8.2 using NaOH or HCl, if necessary. The control was deionized water adjusted to 20 ppt with artificial seasalt. Each porewater was tested within 3 hours of extraction.

Tests were conducted using five replicates. Disposable glass cuvettes were placed in the Microtox test wells and 1 ml of salinity adjusted porewater was added. The rehydrated bacteria (reagent) were thoroughly mixed and 10 µl was added to each test cuvette. After an initial incubation period of 5 minutes, the control cuvette was placed in the read chamber of the Microtox Analyzer to set the instrument. Initial light readings (I_0) were then taken by placing each cuvette in the read chamber of the Microtox Analyzer and measurements were recorded on a data sheet. Light output was measured in each cuvette after an additional 5 minutes (I_5) and 15 minutes (I_{15}) of exposure.

Test acceptability criterion was final mean control light output greater than or equal to 80 percent of initial control mean output. The reference sample acceptability criterion was a final mean output greater than or equal to 80 percent of control final mean output. The data were evaluated statistically by conducting one-tailed t-tests (or Man-Whitney U tests for non-normal distributed data) on the change in output over time for porewater extracts compared to the reference. Where the reference did not meet acceptability criteria, comparisons were made against the control.

A reference toxicant test using phenol was conducted in conjunction with the soil tests to ensure that the sensitivity of the test was within the acceptable range of historical values determined in this laboratory.

Table 1. **Summary of methods for the Microtox test.**

Test date	September 22, 25, October 2, 2008
Test organism source	Strategic Diagnostics
Batch number and expiration date	Lot#8E1080, Expiry 8/2010
Control	Saltwater (20 ppt) prepared with Crystal Sea artificial seasalt
Sample preparation	Centrifugation at 4500 G for 30 minutes; salinity adjustment to 20 ppt using Crystal Sea salt; pH adjustment to 7.8-8.2 ppt
Test chamber	Glass cuvette
Test volume	1 mL
Volume of inoculum/replicate	10 µL
Number of replicates/sample	5
Test temperature	15 ± 1°C
Aeration	None
Reference toxicant	Phenol

3.0 RESULTS

The results of toxicity tests conducted using Microtox are provided in Tables 2 and 3.

Table 2. Results of Microtox tests showing change in light output of samples as a percentage of change in light output of control after 5 and 15 minute of exposure.

Sample	Change in light output as a % of Control (5 minutes)	Change in light output as a % of Control (15 minutes)
Test #1		
SBREF80	79	81
MP-1	80	85
MP-2	107	118
MP-4	70	74
MP-7	98	84
Test #2		
SBREF80	67	73
MP-9	72	77
MP-10	75	78
MP-11	67	68
MP-12	113	131
Test #3		
SBREF80	74	77
MP-13	45	47
Test #4		
CR-1	110	114
MP-3	113	117
MP-5	79	90
MP-6	105	111
MP-8	80	83

Table 3. Statistical analyses of Microtox results. Shaded data indicates > 20% difference and statistically significant difference ($p<0.05$) relative to the control or reference

	5-minute reading		15 minute reading	
Sample	Mean % change in light output	Statistical Comparison To	Mean % change in light output	Statistical Comparison To
Test 1				
Control	96 ± 2	---	83 ± 2	---
SBRef80	76 ± 3	---	67 ± 2	---
MP-1	76 ± 5	Control	70 ± 3	Reference
MP-2	102 ± 3	Control	98 ± 3	Reference
MP-4	67 ± 3	Control	62 ± 2	Reference
MP-7	93 ± 3	Control	70 ± 5	Reference
Test 2				
Control	98 ± 2	---	93 ± 4	---
SBRef80	66 ± 1	---	68 ± 4	---
MP-9	71 ± 4	Control	71 ± 8	Control
MP-10	74 ± 3	Control	72 ± 2	Control
MP-11	66 ± 3	Control	63 ± 4	Control
MP-12	112 ± 4	Control	121 ± 5	Control
Test 3				
Control	96 ± 3	---	99 ± 5	---
SBREF80	72 ± 5	---	76 ± 4	---
MP-13	43 ± 2	Control	46 ± 2	Control
Test 4				
Control	92 ± 2	---	81 ± 5	---
CR-1	102 ± 2	---	91 ± 3	---
MP-3	104 ± 2	Reference	94 ± 3	Reference
MP-5	73 ± 6	Reference	72 ± 4	Reference
MP-6	97 ± 1	Reference	90 ± 5	Reference
MP-8	74 ± 11	Reference	67 ± 7	Reference

3.1 QA/QC

The Microtox tests met control acceptance criteria and there were no deviations from protocol. There was no correlation between turbidity and initial light output ($R^2 \geq 0.01$) therefore it is unlikely there was interference with the reading.

Results of reference toxicant tests conducted in conjunction with this testing program are provided in Table 4. The results of these test fell within the range of mean ± two standard deviations of historical results for *Vibrio fischeri*, indicating that the sensitivity of the test organisms was appropriate.

Table 4. Reference toxicant test results.

Exposure Duration	Test date	Toxicant	EC50	Acceptable Range	CV (%)
5 Minutes	September 22, 2008	Phenol	35.8 mg/L	18.8-49.8	22.6
15 Minutes			49.5 mg/L	27.8-50.9	14.6
5 Minutes	September 25, 2008	Phenol	28.3 mg/L	18.9-49.8	22.5
15 Minutes			33.7 mg/L	27.8-50.9	14.7
5 Minutes	October 2, 2008	Phenol	33.6 mg/L	19.2-49.9	22.2
15 Minutes			42.1 mg/L	30.3-50.0	12.2

4.0 DISCUSSION

Samples MP-4, MP-5, MP-8, MP-9, MP-10, MP-11, and MP-13 exceeded sediment quality standards for microtox analysis per WDOE 2008 guidelines.

5.0 REFERENCES

American Society of Testing and Materials (ASTM). 2000. Test Method for Measuring the Toxicity of Sediment-Associated Contaminants with Freshwater Invertebrates. ASTM Designation E 1706-00.

U.S. Environmental Protection Agency (USEPA). 2000. Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates. EPA/600/R-99/064.

Washington Department of Ecology (WDOE). 2008. Sediment Sampling and Analysis Plan Appendix: Guidance on the Development of Sediment Sampling and Analysis Plans Meeting the Requirements of the Sediment Management Standards Publication No. 03-09-043. Revised February 2008.

APPENDIX A – Results Summaries

Appendix Table A. Microtox 100 Percent Sediment Porewater Test
Sites SBREF80,MP-1,MP-2,MP-4,MP-7
NewFields Northwest
Test Date: October 2, 2008

Site	Light Reading									Quality Control Steps	
		Replicate							$T_{(mean)}/C_{(mean)}$	Change in control light readings compared to initial control	Evaluation of initial light output in site sediments
	Reading	1	2	3	4	5	Mean	St.Dev.		$F_{c(mean)}/I_{c(mean)}$	$I_{(0)T(mean)}/I_{(0)C(mean)}$
CON	$I_{(0)}$	**95**	**97**	**99**	**105**	**106**	100				
	$I_{(5)}$	**92**	**91**	**92**	**104**	**101**	96			0.96	
	$I_{(15)}$	**78**	**79**	**82**	**87**	**91**	83			0.83	
	$C_{(5)}$	0.97	0.94	0.93	0.99	0.95	0.96	0.02			
	$C_{(15)}$	0.82	0.81	0.83	0.83	0.86	0.83	0.02			
SBREF80	$I_{(0)}$	**85**	**76**	**78**	**76**	**76**	78				0.78
	$I_{(5)}$	**79**	**71**	**78**	**75**	**78**	76				
	$I_{(15)}$	**68**	**65**	**68**	**68**	**69**	68				
	$T_{(5)}$	0.79	0.71	0.78	0.75	0.78	0.76	0.03	0.79		
	$T_{(15)}$	0.68	0.65	0.68	0.68	0.69	0.67	0.02	0.81		
MP-1	$I_{(0)}$	**77**	**80**	**77**	**77**	**76**	77				0.77
	$I_{(5)}$	**70**	**81**	**80**	**74**	**78**	77				
	$I_{(15)}$	**65**	**70**	**72**	**72**	**74**	71				
	$T_{(5)}$	0.70	0.81	0.80	0.74	0.78	0.76	0.05	0.80		
	$T_{(15)}$	0.65	0.70	0.72	0.72	0.74	0.70	0.03	0.85		
MP-2	$I_{(0)}$	**80**	**85**	**78**	**77**	**83**	81				0.80
	$I_{(5)}$	**81**	**92**	**78**	**78**	**84**	83				
	$I_{(15)}$	**76**	**88**	**76**	**76**	**80**	79				
	$T_{(5)}$	1.01	1.08	1.00	1.01	1.01	1.02	0.03	1.07		
	$T_{(15)}$	0.95	1.04	0.97	0.99	0.96	0.98	0.03	1.18		
MP-4	$I_{(0)}$	**73**	**67**	**66**	**70**	**63**	68				0.68
	$I_{(5)}$	**70**	**66**	**66**	**71**	**65**	68				
	$I_{(15)}$	**65**	**61**	**60**	**62**	**61**	62				
	$T_{(5)}$	0.70	0.66	0.66	0.71	0.65	0.67	0.03	0.70		
	$T_{(15)}$	0.65	0.61	0.60	0.62	0.61	0.62	0.02	0.74		
MP-7	$I_{(0)}$	**83**	**87**	**86**	**86**	**88**	86				0.86
	$I_{(5)}$	**74**	**82**	**82**	**83**	**81**	80				
	$I_{(15)}$	**52**	**64**	**62**	**64**	**58**	60				
	$T_{(5)}$	0.89	0.94	0.95	0.97	0.92	0.93	0.03	0.98		
	$T_{(15)}$	0.63	0.74	0.72	0.74	0.66	0.70	0.05	0.84		

$I_{(0)}$ is the light reading after the initial five minute incubation period

$I_{(5)}$ is the light reading five minutes after $I_{(0)}$

$I_{(15)}$ is the light reading fifteen minutes after $I_{(0)}$

$C_{(t)}$, $R_{(t)}$, and $T_{(t)}$ are the changes in light readings from the intial reading in each sample container for the control, reference sediment

Quality Control Steps:

1. Is control final mean output greater than or equal to 80% control initial mean output?

$I_{(5)}$:$F_{c(mean)}/I_{c(mean)}$; **96%** YES
$I_{(15)}$:$F_{c(mean)}/I_{c(mean)}$: **83%** YES

YES: Control results are acceptable and can be used for statistical analyses.
NO: Control results are unacceptable (retest required).

2. Are test initial mean values greater than or equal to 80% of control initial mean values?

S1 $I_{T(mean)}/I_{C(mean)}$: **78%** NO
S2 $I_{T(mean)}/I_{C(mean)}$: **77%** NO
S3 $I_{T(mean)}/I_{C(mean)}$: **80%** YES
S4 $I_{T(mean)}/I_{C(mean)}$: **68%** NO
S5 $I_{T(mean)}/I_{C(mean)}$: **86%** YES

YES: Use initial site values to calculate change in final light readings
NO: Use control initial mean value to calculate change in final light readings for each site.

Appendix Table A. Microtox 100 Percent Sediment Porewater Test
Sites SBREF80, MP-9, MP-10, MP-11, MP-12
NewFields Northwest
Test Date: September 22, 2008

Site	Light Reading									Quality Control Steps	
		Replicate								Change in control light readings compared to initial control	Evaluation of initial light output in site sediments
	Reading	1	2	3	4	5	Mean	St.Dev.	$T_{(mean)}/C_{(mean)}$	$F_{c(mean)}/I_{c(mean)}$	$I_{(0)T(mean)}/I_{(0)C(mean)}$
CON	$I_{(0)}$	96	88	91	91	91	91				
	$I_{(5)}$	92	86	91	89	92	90			0.98	
	$I_{(15)}$	83	83	87	84	87	85			0.93	
	$C_{(5)}$	0.96	0.98	1.00	0.98	1.01	0.98	0.02			
	$C_{(15)}$	0.86	0.94	0.96	0.92	0.98	0.93	0.04			
SBREF80	$I_{(0)}$	62	59	61	61	60	61				0.66
	$I_{(5)}$	61	59	61	62	60	61				
	$I_{(15)}$	61	57	67	64	60	62				
	$T_{(5)}$	0.67	0.65	0.67	0.68	0.66	0.66	0.01	0.67		
	$T_{(15)}$	0.67	0.62	0.73	0.70	0.66	0.68	0.04	0.73		
MP-9	$I_{(0)}$	70	62	65	59	63	64				0.70
	$I_{(5)}$	69	64	68	59	66	65				
	$I_{(15)}$	77	62	63	57	67	65				
	$T_{(5)}$	0.75	0.70	0.74	0.65	0.72	0.71	0.04	0.72		
	$T_{(15)}$	0.84	0.68	0.69	0.62	0.73	0.71	0.08	0.77		
MP-10	$I_{(0)}$	68	70	67	66	62	67				0.73
	$I_{(5)}$	70	71	65	66	64	67				
	$I_{(15)}$	67	67	67	66	63	66				
	$T_{(5)}$	0.77	0.78	0.71	0.72	0.70	0.74	0.03	0.75		
	$T_{(15)}$	0.73	0.73	0.73	0.71	0.69	0.72	0.02	0.78		
MP-11	$I_{(0)}$	56	58	63	54	61	58				0.64
	$I_{(5)}$	61	61	62	55	61	60				
	$I_{(15)}$	58	61	60	52	59	58				
	$T_{(5)}$	0.67	0.67	0.68	0.60	0.67	0.66	0.03	0.67		
	$T_{(15)}$	0.63	0.67	0.66	0.57	0.65	0.63	0.04	0.68		
MP-12	$I_{(0)}$	72	74	72	79	80	75				0.82
	$I_{(5)}$	81	79	78	91	92	84				
	$I_{(15)}$	83	89	85	101	100	92				
	$T_{(5)}$	1.13	1.07	1.08	1.15	1.15	1.12	0.04	1.13		
	$T_{(15)}$	1.15	1.20	1.18	1.28	1.25	1.21	0.05	1.31		

$I_{(0)}$ is the light reading after the initial five minute incubation period

$I_{(5)}$ is the light reading five minutes after $I_{(0)}$

$I_{(15)}$ is the light reading fifteen minutes after $I_{(0)}$

$C_{(t)}$, $R_{(t)}$, and $T_{(t)}$ are the changes in light readings from the intial reading in each sample container for the control, reference sediment

Quality Control Steps:

1. Is control final mean output greater than or equal to 80% control initial mean output?

$I_{(5)}$:$F_{c(mean)}/I_{c(mean)}$:	98%	YES
$I_{(15)}$:$F_{c(mean)}/I_{c(mean)}$:	93%	YES

YES: Control results are acceptable and can be used for statistical analyses.
NO: Control results are unacceptable (retest required).

2. Are test initial mean values greater than or equal to 80% of control initial mean values?

S1	$I_{T(mean)}/I_{C(mean)}$:	66%	NO
S2	$I_{T(mean)}/I_{C(mean)}$:	70%	NO
S3	$I_{T(mean)}/I_{C(mean)}$:	73%	NO
S4	$I_{T(mean)}/I_{C(mean)}$:	64%	NO
S5	$I_{T(mean)}/I_{C(mean)}$:	82%	YES

YES: Use initial site values to calculate change in final light readings
NO: Use control initial mean value to calculate change in final light readings for each site.

Appendix Table A. Microtox 100 Percent Sediment Porewater Test
Sites SBREF80, MP-13
NewFields Northwest
Test Date: September 22, 2008

Site	Light Reading									Quality Control Steps	
	Replicate								$T_{(mean)}/C_{(mean)}$	Change in control light readings compared to initial control	Evaluation of initial light output in site sediments
	Reading	1	2	3	4	5	Mean	St.Dev.		$F_{c(mean)}/I_{c(mean)}$	$I_{(0)T(mean)}/I_{(0)C(mean)}$
CON	$I_{(0)}$	92	95	95	94	95	94				
	$I_{(5)}$	92	92	94	86	90	91			0.96	
	$I_{(15)}$	91	88	100	96	89	93			0.99	
	$C_{(5)}$	1.00	0.97	0.99	0.91	0.95	0.96	0.03			
	$C_{(15)}$	0.99	0.93	1.05	1.02	0.94	0.99	0.05			
SBREF80	$I_{(0)}$	74	69	64	63	61	66				0.70
	$I_{(5)}$	74	72	64	64	64	68				
	$I_{(15)}$	76	76	67	71	69	72				
	$T_{(5)}$	0.79	0.76	0.68	0.68	0.68	0.72	0.05	0.74		
	$T_{(15)}$	0.81	0.81	0.71	0.75	0.73	0.76	0.04	0.77		
MP-13	$I_{(0)}$	38	41	39	41	40	40				0.42
	$I_{(5)}$	38	42	40	42	41	41				
	$I_{(15)}$	42	44	43	46	44	44				
	$T_{(5)}$	0.40	0.45	0.42	0.45	0.44	0.43	0.02	0.45		
	$T_{(15)}$	0.45	0.47	0.46	0.49	0.47	0.46	0.02	0.47		

$I_{(0)}$ is the light reading after the initial five minute incubation period

$I_{(5)}$ is the light reading five minutes after $I_{(0)}$

$I_{(15)}$ is the light reading fifteen minutes after $I_{(0)}$

$C_{(t)}$, $R_{(t)}$, and $T_{(t)}$ are the changes in light readings from the intial reading in each sample container for the control, reference sediment

Quality Control Steps:

1. Is control final mean output greater than or equal to 80% control initial mean output?

$I_{(5)}$:$F_{c(mean)}/I_{c(mean)}$:	**96%**	**YES**
$I_{(15)}$:$F_{c(mean)}/I_{c(mean)}$:	**99%**	**YES**

YES: Control results are acceptable and can be used for statistical analyses.
NO: Control results are unacceptable (retest required).

2. Are test initial mean values greater than or equal to 80% of control initial mean values?

S1	$I_{T(mean)}/I_{C(mean)}$:	**70%**	**NO**
S2	$I_{T(mean)}/I_{C(mean)}$:	**42%**	**NO**

YES: Use initial site values to calculate change in final light readings
NO: Use control initial mean value to calculate change in final light readings for each site.

Appendix Table A. Microtox 100 Percent Sediment Porewater Test
Sites CR-1, MP-3, MP-5, MP-6, MP-8
NewFields Northwest
Test Date: September 25, 2008

Site	Light Reading								$T_{(mean)}/C_{(mean)}$	Quality Control Steps	
		Replicate								Change in control light readings compared to initial control	Evaluation of initial light output in site sediments
	Reading	1	2	3	4	5	Mean	St.Dev.		$F_{c(mean)}/I_{c(mean)}$	$I_{(0)T(mean)}/I_{(0)C(mean)}$
CON	$I_{(0)}$	90	95	93	92	99	94				
	$I_{(5)}$	84	86	85	87	91	87			0.92	
	$I_{(15)}$	77	78	77	73	72	75			0.80	
	$C_{(5)}$	0.93	0.91	0.91	0.95	0.92	0.92	0.02			
	$C_{(15)}$	0.86	0.82	0.63	0.79	0.73	0.81	0.05			
CR-1	$I_{(0)}$	87	77	78	74	73	78				0.83
	$I_{(5)}$	88	79	80	73	76	79				
	$I_{(15)}$	82	72	68	66	68	71				
	$T_{(5)}$	1.01	1.03	1.03	0.99	1.04	1.02	0.02	1.10		
	$T_{(15)}$	0.94	0.94	0.87	0.89	0.93	0.91	0.03	1.14		
MP-3	$I_{(0)}$	76	79	74	73	75	75				0.80
	$I_{(5)}$	81	81	76	76	79	79				
	$I_{(15)}$	74	75	70	66	71	71				
	$T_{(5)}$	1.07	1.03	1.03	1.04	1.05	1.04	0.02	1.13		
	$T_{(15)}$	0.97	0.95	0.95	0.90	0.95	0.94	0.03	1.17		
MP-5	$I_{(0)}$	78	73	74	67	69	72				0.77
	$I_{(5)}$	74	67	74	62	66	69				
	$I_{(15)}$	73	66	72	64	65	68				
	$T_{(5)}$	0.79	0.71	0.79	0.66	0.70	0.73	0.06	0.79		
	$T_{(15)}$	0.78	0.70	0.77	0.68	0.69	0.72	0.04	0.90		
MP-6	$I_{(0)}$	81	76	74	75	81	77				0.83
	$I_{(5)}$	80	73	71	74	78	75				
	$I_{(15)}$	72	69	65	73	68	69				
	$T_{(5)}$	0.99	0.96	0.96	0.99	0.96	0.97	0.01	1.05		
	$T_{(15)}$	0.89	0.91	0.88	0.97	0.84	0.90	0.05	1.11		
MP-8	$I_{(0)}$	87	81	67	64	71	74				0.79
	$I_{(5)}$	85	74	62	60	64	69				
	$I_{(15)}$	72	66	56	58	62	63				
	$T_{(5)}$	0.91	0.79	0.66	0.64	0.68	0.74	0.11	0.80		
	$T_{(15)}$	0.77	0.70	0.60	0.62	0.66	0.67	0.07	0.83		

$I_{(0)}$ is the light reading after the initial five minute incubation period

$I_{(5)}$ is the light reading five minutes after $I_{(0)}$

$I_{(15)}$ is the light reading fifteen minutes after $I_{(0)}$

$C_{(t)}$, $R_{(t)}$, and $T_{(t)}$ are the changes in light readings from the intial reading in each sample container for the control, reference sediment

Quality Control Steps:

1. Is control final mean output greater than or equal to 80% control initial mean output?

$I_{(5)}$:$F_{c(mean)}/I_{c(mean)}$:	92%	YES
$I_{(15)}$:$F_{c(mean)}/I_{c(mean)}$:	80%	YES

YES: Control results are acceptable and can be used for statistical analyses.
NO: Control results are unacceptable (retest required).

2. Are test initial mean values greater than or equal to 80% of control initial mean values?

S1	$I_{T(mean)}/I_{C(mean)}$:	83%	YES
S2	$I_{T(mean)}/I_{C(mean)}$:	80%	YES
S3	$I_{T(mean)}/I_{C(mean)}$:	77%	NO
S4	$I_{T(mean)}/I_{C(mean)}$:	83%	YES
S5	$I_{T(mean)}/I_{C(mean)}$:	79%	NO

YES: Use initial site values to calculate change in final light readings
NO: Use control initial mean value to calculate change in final light readings for each site.

Project Name: March Point

Sample: x1
Samp ID: MP-1
Alias: 5 minute reading
Replicates: 5
Mean: 0.766
SD: 0.046
Tr Mean: 5.019
Trans SD: 0.151

Ref Samp: x2
Ref ID: Control
Alias: 5 minute reading
Replicates: 5
Mean: 0.956
SD: 0.024
Tr Mean: 5.611
Trans SD: 0.071

Shapiro-Wilk Results:

Residual Mean: 0
Residual SD: 0.077
SS: 0.111
K: 5
b: 0.325

Alpha Level: 0.05
Calculated Value: 0.9523
Critical Value: <= 0.842

Normally Distributed: Yes

Override Option: N/A

Levene's Results:

Test Residual Mean: 0.122
Test Residual SD: 0.065
Ref. Residual Mean: 0.056
Ref. Residual SD: 0.032
Deg. of Freedom: 8

Alpha Level: 0.1
Calculated Value: 2.0036
Critical Value: >= 1.860

Variances Homogeneous: No

Test Results:

Statistic: Approximate t
Balanced Design: Yes
Transformation: ArcSin

Experimental Hypothesis
Null: x1 >= x2
Alternate: x1 < x2

Degrees of Freedom: 6
Experimental Alpha Level: 0.05
Calculated Value: 7.9315
Critical Value: >= 1.943
Accept Null Hypothesis: No

Power:
Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shipiro-Wilk Residuals
1	0.7	4.799	0.97	5.652	0.22	0.041			-0.22
2	0.81	5.164	0.94	5.564	0.144	0.047			-0.084
3	0.8	5.132	0.93	5.534	0.112	0.077			-0.077
4	0.74	4.935	0.99	5.71	0.084	0.1			-0.047
5	0.78	5.067	0.95	5.593	0.048	0.017			-0.017
6									0.041
7									0.048
8									0.1
9									0.112
10									0.144

Project Name: March Point

Sample: x1
Samp ID: MP-4
Alias: 5 minute reading
Replicates: 5
Mean: 0.676
SD: 0.027
Tr Mean: 4.715
Trans SD: 0.094

Ref Samp: x2
Ref ID: Control
Alias: 5 minute reading
Replicates: 5
Mean: 0.956
SD: 0.024
Tr Mean: 5.611
Trans SD: 0.071

Shapiro-Wilk Results:

Residual Mean: 0
Residual SD: 0.054
SS: 0.055
K: 5
b: 0.221

Alpha Level: 0.05
Calculated Value: 0.8802
Critical Value: <= 0.842

Normally
Distributed: Yes

Override Option: N/A

Levene's Results:

Test Residual Mean: 0.081
Test Residual SD: 0.026
Ref. Residual Mean: 0.056
Ref. Residual SD: 0.032
Deg. of Freedom: 8

Alpha Level: 0.1
Calculated Value: 1.315
Critical Value: >= 1.860

Variances
Homogeneous: Yes

Test Results:

Statistic: Student's t
Balanced Design: Yes
Transformation: ArcSin

Experimental Hypothesis
Null: x1 >= x2
Alternate: x1 < x2

Degrees of Freedom: 8
Experimental Alpha Level: 0.05
Calculated Value: 16.9985
Critical Value: >= 1.860
Accept Null Hypothesis: No

Power:
Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shipiro-Wilk Residuals
1	0.7	4.799	0.97	5.652	0.084	0.041			-0.091
2	0.66	4.66	0.94	5.564	0.056	0.047			-0.077
3	0.66	4.66	0.93	5.534	0.056	0.077			-0.056
4	0.71	4.834	0.99	5.71	0.118	0.1			-0.056
5	0.65	4.624	0.95	5.593	0.091	0.017			-0.047
6									-0.017
7									0.041
8									0.084
9									0.1
10									0.118

Project Name: March Point

Sample: x1
Samp ID: MP-4
Alias: 15-minute reading
Replicates: 5
Mean: 0.618
SD: 0.019
Tr Mean: 4.508
Trans SD: 0.07

Ref Samp: x2
Ref ID: SPRef80
Alias: 15-minute reading
Replicates: 5
Mean: 0.676
SD: 0.015
Tr Mean: 4.716
Trans SD: 0.053

Shapiro-Wilk Results:

Residual Mean: 0
Residual SD: 0.04
SS: 0.031
K: 5
b: 0.172

Alpha Level: 0.05
Calculated Value: 0.9535
Critical Value: <= 0.842

Normally Distributed: Yes

Override Option: N/A

Levene's Results:

Test Residual Mean: 0.049
Test Residual SD: 0.043
Ref. Residual Mean: 0.037
Ref. Residual SD: 0.034
Deg. of Freedom: 8

Alpha Level: 0.1
Calculated Value: 0.5257
Critical Value: >= 1.860

Variances Homogeneous: Yes

Test Results:

Statistic: Student's t
Balanced Design: Yes
Transformation: ArcSin

Experimental Hypothesis
Null: x1 >= x2
Alternate: x1 < x2

Degrees of Freedom: 8
Experimental Alpha Level: 0.05
Calculated Value: 5.2795
Critical Value: >= 1.860
Accept Null Hypothesis: No

Power:
Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shipiro-Wilk Residuals
1	0.65	4.624	0.68	4.73	0.116	0.014			-0.092
2	0.61	4.479	0.65	4.624	0.029	0.092			-0.066
3	0.6	4.443	0.68	4.73	0.066	0.014			-0.029
4	0.62	4.516	0.68	4.73	0.008	0.014			-0.029
5	0.61	4.479	0.69	4.765	0.029	0.049			0.008
6									0.014
7									0.014
8									0.014
9									0.049
10									0.116

Project Name: March Point

Sample: x1
Samp ID: MP-7
Alias: 5-minute reading
Replicates: 5
Mean: 0.934
SD: 0.03
Tr Mean: 5.545
Trans SD: 0.091

Ref Samp: x2
Ref ID: Control
Alias: 5-minute reading
Replicates: 5
Mean: 0.956
SD: 0.024
Tr Mean: 5.611
Trans SD: 0.071

Shapiro-Wilk Results:

Residual Mean: 0
Residual SD: 0.053
SS: 0.053
K: 5
b: 0.227

Alpha Level: 0.05
Calculated Value: 0.9681
Critical Value: <= 0.842

Normally Distributed: Yes

Override Option: N/A

Levene's Results:

Test Residual Mean: 0.069
Test Residual SD: 0.048
Ref. Residual Mean: 0.056
Ref. Residual SD: 0.032
Deg. of Freedom: 8

Alpha Level: 0.1
Calculated Value: 0.5009
Critical Value: >= 1.860

Variances Homogeneous: Yes

Test Results:

Statistic: Student's t
Balanced Design: Yes
Transformation: ArcSin

Experimental Hypothesis
Null: x1 >= x2
Alternate: x1 < x2

Degrees of Freedom: 8
Experimental Alpha Level: 0.05
Calculated Value: 1.2676
Critical Value: >= 1.860
Accept Null Hypothesis: Yes

Power:
Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shipiro-Wilk Residuals
1	0.89	5.413	0.97	5.652	0.132	0.041			-0.132
2	0.94	5.564	0.94	5.564	0.018	0.047			-0.077
3	0.95	5.593	0.93	5.534	0.048	0.077			-0.047
4	0.97	5.652	0.99	5.71	0.107	0.1			-0.041
5	0.92	5.504	0.95	5.593	0.041	0.017			-0.017
6									0.018
7									0.041
8									0.048
9									0.1
10									0.107

Project Name: March Point

Sample: x1
Samp ID: MP-9
Alias: 5 minute
Replicates: 5
Mean: 0.712
SD: 0.04
Tr Mean: 4.839
Trans SD: 0.136

Ref Samp: x2
Ref ID: Control
Alias: 5 minute
Replicates: 5
Mean: 0.986
SD: 0.019
Tr Mean: 5.698
Trans SD: 0.057

Shapiro-Wilk Results:

Residual Mean: 0
Residual SD: 0.068
SS: 0.087
K: 5
b: 0.286

Alpha Level: 0.05
Calculated Value: 0.9392
Critical Value: <= 0.842

Normally Distributed: Yes

Override Option: N/A

Levene's Results:

Test Residual Mean: 0.102
Test Residual SD: 0.075
Ref. Residual Mean: 0.044
Ref. Residual SD: 0.028
Deg. of Freedom: 8

Alpha Level: 0.1
Calculated Value: 1.6032
Critical Value: >= 1.860

Variances Homogeneous: Yes

Test Results:

Statistic: Student's t
Balanced Design: Yes
Transformation: ArcSin

Experimental Hypothesis
Null: x1 >= x2
Alternate: x1 < x2

Degrees of Freedom: 8
Experimental Alpha Level: 0.05
Calculated Value: 13.0242
Critical Value: >= 1.860
Accept Null Hypothesis: No

Power:
Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shipiro-Wilk Residuals
1	0.75	4.968	0.96	5.623	0.129	0.076			-0.215
2	0.7	4.799	0.98	5.681	0.04	0.017			-0.076
3	0.74	4.935	1	5.739	0.096	0.041			-0.04
4	0.65	4.624	0.98	5.681	0.215	0.017			-0.017
5	0.72	4.868	1.01	5.768	0.029	0.069			-0.017
6									0.029
7									0.041
8									0.069
9									0.096
10									0.129

Project Name: March Point

Sample: x1
Samp ID: MP-9
Alias: 15 minutes
Replicates: 5
Mean: 0.712
SD: 0.082
Tr Mean: 4.834
Trans SD: 0.275

Ref Samp: x2
Ref ID: Control
Alias: 15 minute
Replicates: 5
Mean: 0.928
SD: 0.041
Tr Mean: 5.527
Trans SD: 0.125

Shapiro-Wilk Results:

Residual Mean: 0
Residual SD: 0.138
SS: 0.364
K: 5
b: 0.587

Alpha Level: 0.05
Calculated Value: 0.9474
Critical Value: <= 0.842

Normally Distributed: Yes

Override Option: N/A

Levene's Results:

Test Residual Mean: 0.197
Test Residual SD: 0.164
Ref. Residual Mean: 0.091
Ref. Residual SD: 0.072
Deg. of Freedom: 8

Alpha Level: 0.1
Calculated Value: 1.3091
Critical Value: >= 1.860

Variances Homogeneous: Yes

Test Results:

Statistic: Student's t
Balanced Design: Yes
Transformation: ArcSin

Experimental Hypothesis
Null: x1 >= x2
Alternate: x1 < x2

Degrees of Freedom: 8
Experimental Alpha Level: 0.05
Calculated Value: 5.1339
Critical Value: >= 1.860
Accept Null Hypothesis: No

Power:
Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shipiro-Wilk Residuals
1	0.84	5.259	0.86	5.321	0.424	0.206			-0.318
2	0.68	4.73	0.94	5.564	0.104	0.037			-0.206
3	0.69	4.765	0.96	5.623	0.069	0.096			-0.104
4	0.62	4.516	0.92	5.504	0.318	0.023			-0.069
5	0.73	4.901	0.96	5.623	0.067	0.096			-0.023
6									0.037
7									0.067
8									0.096
9									0.096
10									0.424

Project Name: March Point

Sample: x1
Samp ID: MP-10
Alias: 5 minute
Replicates: 5
Mean: 0.736
SD: 0.036
Tr Mean: 4.92
Trans SD: 0.122

Ref Samp: x2
Ref ID: Control
Alias: 5 minute
Replicates: 5
Mean: 0.986
SD: 0.019
Tr Mean: 5.698
Trans SD: 0.057

Shapiro-Wilk Results:

Residual Mean: 0
Residual SD: 0.062
SS: 0.072
K: 5
b: 0.262

Alpha Level: 0.05
Calculated Value: 0.9515
Critical Value: <= 0.842

Normally Distributed: Yes

Override Option: N/A

Levene's Results:

Test Residual Mean: 0.104
Test Residual SD: 0.036
Ref. Residual Mean: 0.044
Ref. Residual SD: 0.028
Deg. of Freedom: 8

Alpha Level: 0.1
Calculated Value: 2.967
Critical Value: >= 1.860

Variances Homogeneous: No

Test Results:

Statistic: Approximate t
Balanced Design: Yes
Transformation: ArcSin

Experimental Hypothesis
Null: x1 >= x2
Alternate: x1 < x2

Degrees of Freedom: 6
Experimental Alpha Level: 0.05
Calculated Value: 12.9557
Critical Value: >= 1.943
Accept Null Hypothesis: No

Power:
Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shipiro-Wilk Residuals
1	0.77	5.034	0.96	5.623	0.114	0.076			-0.121
2	0.78	5.067	0.98	5.681	0.147	0.017			-0.087
3	0.71	4.834	1	5.739	0.087	0.041			-0.076
4	0.72	4.868	0.98	5.681	0.053	0.017			-0.053
5	0.7	4.799	1.01	5.768	0.121	0.069			-0.017
6									-0.017
7									0.041
8									0.069
9									0.114
10									0.147

Project Name: March Point

Sample: x1
Samp ID: MP-10
Alias: 15 minute
Replicates: 5
Mean: 0.718
SD: 0.018
Tr Mean: 4.86
Trans SD: 0.061

Ref Samp: x2
Ref ID: Control
Alias: 15 minute
Replicates: 5
Mean: 0.928
SD: 0.041
Tr Mean: 5.527
Trans SD: 0.125

Shapiro-Wilk Results:

Residual Mean: 0
Residual SD: 0.064
SS: 0.078
K: 5
b: 0.259

Alpha Level: 0.05
Calculated Value: 0.8631
Critical Value: <= 0.842

Normally Distributed: Yes

Override Option: N/A

Levene's Results:

Test Residual Mean: 0.049
Test Residual SD: 0.027
Ref. Residual Mean: 0.091
Ref. Residual SD: 0.072
Deg. of Freedom: 8

Alpha Level: 0.1
Calculated Value: 1.2339
Critical Value: >= 1.860

Variances Homogeneous: Yes

Test Results:

Statistic: Student's t
Balanced Design: Yes
Transformation: ArcSin

Experimental Hypothesis
Null: x1 >= x2
Alternate: x1 < x2

Degrees of Freedom: 8
Experimental Alpha Level: 0.05
Calculated Value: 10.7027
Critical Value: >= 1.860
Accept Null Hypothesis: No

Power:
Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shipiro-Wilk Residuals
1	0.73	4.901	0.86	5.321	0.041	0.206			-0.206
2	0.73	4.901	0.94	5.564	0.041	0.037			-0.096
3	0.73	4.901	0.96	5.623	0.041	0.096			-0.027
4	0.71	4.834	0.92	5.504	0.027	0.023			-0.023
5	0.69	4.765	0.96	5.623	0.096	0.096			0.037
6									0.041
7									0.041
8									0.041
9									0.096
10									0.096

Project Name: March Point

Sample: x1
Samp ID: MP-11
Alias: 5 minute
Replicates: 5
Mean: 0.658
SD: 0.033
Tr Mean: N/A
Trans SD: N/A

Ref Samp: x2
Ref ID: Control
Alias: 5 minute
Replicates: 5
Mean: 0.986
SD: 0.019
Tr Mean: N/A
Trans SD: N/A

Shapiro-Wilk Results:

Residual Mean: 0
Residual SD: 0.06
SS: 0.068
K: 5
b: 0.233

Alpha Level: 0.05
Calculated Value: 0.7966
Critical Value: <= 0.842

Normally
Distributed: No

Override Option: Not Invoked

Levene's Results:

Test Residual Mean: 0.084
Test Residual SD: 0.072
Ref. Residual Mean: 0.044
Ref. Residual SD: 0.028
Deg. of Freedom: 8

Alpha Level: 0.1
Calculated Value: 1.1507
Critical Value: >= 1.860

Variances
Homogeneous: Yes

Test Results:

Statistic: Mann-Whitney
Balanced Design: Yes
Transformation: rank-order

Experimental Hypothesis
Null: x1 >= x2
Alternate: x1 < x2

Mann-Whitney N1: 5
Mann-Whitney N2: 5
Degrees of Freedom:
Experimental Alpha Level: 0.05
Calculated Value: 25
Critical Value: >= 21.000
Accept Null Hypothesis: No

Power:
Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shipiro-Wilk Residuals
1	0.67	3	0.96	6	0.044	0.076	1		-0.209
2	0.67	3	0.98	7.5	0.044	0.017	3		-0.076
3	0.68	5	1	9	0.079	0.041	3		-0.017
4	0.6	1	0.98	7.5	0.209	0.017	3		-0.017
5	0.67	3	1.01	10	0.044	0.069	5		0.041
6							6		0.044
7							7.5		0.044
8							7.5		0.044
9							9		0.069
10							10		0.079

Project Name: March Point

Sample: x1
Samp ID: MP-11
Alias: 15 minutes
Replicates: 5
Mean: 0.636
SD: 0.04
Tr Mean: N/A
Trans SD: N/A

Ref Samp: x2
Ref ID: Control
Alias: 15 minute
Replicates: 5
Mean: 0.928
SD: 0.041
Tr Mean: N/A
Trans SD: N/A

Shapiro-Wilk Results:

Residual Mean: 0
Residual SD: 0.088
SS: 0.147
K: 5
b: 0.348

Alpha Level: 0.05
Calculated Value: 0.8227
Critical Value: <= 0.842

Normally
Distributed: No

Override Option: Not Invoked

Levene's Results:

Test Residual Mean: 0.105
Test Residual SD: 0.086
Ref. Residual Mean: 0.091
Ref. Residual SD: 0.072
Deg. of Freedom: 8

Alpha Level: 0.1
Calculated Value: 0.2678
Critical Value: >= 1.860

Variances
Homogeneous: Yes

Test Results:

Statistic: Mann-Whitney
Balanced Design: Yes
Transformation: rank-order

Experimental Hypothesis
Null: x1 >= x2
Alternate: x1 < x2

Mann-Whitney N1: 5
Mann-Whitney N2: 5
Degrees of Freedom:
Experimental Alpha Level: 0.05
Calculated Value: 25
Critical Value: >= 21.000
Accept Null Hypothesis: No

Power:
Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shipiro-Wilk Residuals
1	0.63	2	0.86	6	0.02	0.206	1		-0.242
2	0.67	5	0.94	8	0.123	0.037	2		-0.206
3	0.66	4	0.96	9.5	0.088	0.096	3		-0.023
4	0.57	1	0.92	7	0.242	0.023	4		-0.02
5	0.65	3	0.96	9.5	0.052	0.096	5		0.037
6							6		0.052
7							7		0.088
8							8		0.096
9							9.5		0.096
10							9.5		0.123

Project Name: March Point

Sample: x1
Samp ID: MP-13
Alias: 5 minute
Replicates: 5
Mean: 0.432
SD: 0.022
Tr Mean: 3.768
Trans SD: 0.095

Ref Samp: x2
Ref ID: Control
Alias: 5 minute
Replicates: 5
Mean: 0.964
SD: 0.036
Tr Mean: 5.634
Trans SD: 0.105

Shapiro-Wilk Results:

Residual Mean: 0
Residual SD: 0.065
SS: 0.081
K: 5
b: 0.268

Alpha Level: 0.05
Calculated Value: 0.8859
Critical Value: <= 0.842

Normally
Distributed: Yes

Override Option: N/A

Levene's Results:

Test Residual Mean: 0.077
Test Residual SD: 0.04
Ref. Residual Mean: 0.08
Ref. Residual SD: 0.056
Deg. of Freedom: 8

Alpha Level: 0.1
Calculated Value: 0.0898
Critical Value: >= 1.860

Variances
Homogeneous: Yes

Test Results:

Statistic: Student's t
Balanced Design: Yes
Transformation: ArcSin

Experimental Hypothesis
Null: x1 >= x2
Alternate: x1 < x2

Degrees of Freedom: 8
Experimental Alpha Level: 0.05
Calculated Value: 29.3488
Critical Value: >= 1.860
Accept Null Hypothesis: No

Power:
Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shipiro-Wilk Residuals
1	0.4	3.626	1	5.739	0.141	0.105			-0.16
2	0.45	3.846	0.97	5.652	0.079	0.018			-0.141
3	0.42	3.716	0.99	5.71	0.052	0.077			-0.052
4	0.45	3.846	0.91	5.474	0.079	0.16			-0.04
5	0.44	3.803	0.95	5.593	0.036	0.04			0.018
6									0.036
7									0.077
8									0.079
9									0.079
10									0.105

Project Name: March Point

Sample: x1
Samp ID: MP-13
Alias: 15 minute
Replicates: 5
Mean: 0.468
SD: 0.015
Tr Mean: 3.922
Trans SD: 0.062

Ref Samp: x2
Ref ID: Control
Alias: 15minute
Replicates: 5
Mean: 0.986
SD: 0.051
Tr Mean: 5.697
Trans SD: 0.149

Shapiro-Wilk Results:

Residual Mean: 0
Residual SD: 0.074
SS: 0.104
K: 5
b: 0.318

Alpha Level: 0.05
Calculated Value: 0.971
Critical Value: <= 0.842

Normally Distributed: Yes

Override Option: N/A

Levene's Results:

Test Residual Mean: 0.044
Test Residual SD: 0.038
Ref. Residual Mean: 0.119
Ref. Residual SD: 0.067
Deg. of Freedom: 8

Alpha Level: 0.1
Calculated Value: 2.1682
Critical Value: >= 1.860

Variances Homogeneous: No

Test Results:

Statistic: Approximate t
Balanced Design: Yes
Transformation: ArcSin

Experimental Hypothesis
Null: x1 >= x2
Alternate: x1 < x2

Degrees of Freedom: 5
Experimental Alpha Level: 0.05
Calculated Value: 24.6344
Critical Value: >= 2.015
Accept Null Hypothesis: No

Power:
Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shipiro-Wilk Residuals
1	0.45	3.846	0.99	5.71	0.076	0.013			-0.163
2	0.47	3.931	0.93	5.534	0.009	0.163			-0.133
3	0.46	3.889	1.05	5.881	0.033	0.184			-0.076
4	0.49	4.014	1.02	5.796	0.092	0.099			-0.033
5	0.47	3.931	0.94	5.564	0.009	0.133			0.009
6									0.009
7									0.013
8									0.092
9									0.099
10									0.184

Project Name: March Point

Sample: x1
Samp ID: MP-5
Alias: 5 minute
Replicates: 5
Mean: 0.73
SD: 0.058
Tr Mean: 4.898
Trans SD: 0.195

Ref Samp: x2
Ref ID: CR-1
Alias: 5 minute
Replicates: 5
Mean: 1.02
SD: 0.02
Tr Mean: 5.796
Trans SD: 0.057

Shapiro-Wilk Results:

Residual Mean: 0
Residual SD: 0.093
SS: 0.165
K: 5
b: 0.395

Alpha Level: 0.05
Calculated Value: 0.9483
Critical Value: <= 0.842

Normally Distributed: Yes

Override Option: N/A

Levene's Results:

Test Residual Mean: 0.161
Test Residual SD: 0.075
Ref. Residual Mean: 0.046
Ref. Residual SD: 0.026
Deg. of Freedom: 8

Alpha Level: 0.1
Calculated Value: 3.2591
Critical Value: >= 1.860

Variances Homogeneous: No

Test Results:

Statistic: Approximate t
Balanced Design: Yes
Transformation: ArcSin

Experimental Hypothesis
Null: x1 >= x2
Alternate: x1 < x2

Degrees of Freedom: 5
Experimental Alpha Level: 0.05
Calculated Value: 9.8951
Critical Value: >= 2.015
Accept Null Hypothesis: No

Power:
Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shapiro-Wilk Residuals
1	0.79	5.099	1.01	5.768	0.201	0.028			-0.238
2	0.71	4.834	1.03	5.825	0.065	0.029			-0.099
3	0.79	5.099	1.03	5.825	0.201	0.029			-0.086
4	0.66	4.66	0.99	5.71	0.238	0.086			-0.065
5	0.7	4.799	1.04	5.853	0.099	0.057			-0.028
6									0.029
7									0.029
8									0.057
9									0.201
10									0.201

Project Name: March Point

Sample: x1
Samp ID: MP-5
Alias: 15 minute
Replicates: 5
Mean: 0.724
SD: 0.047
Tr Mean: 4.879
Trans SD: 0.159

Ref Samp: x2
Ref ID: CR-1
Alias: 15 minute
Replicates: 5
Mean: 0.914
SD: 0.032
Tr Mean: 5.485
Trans SD: 0.097

Shapiro-Wilk Results:

Residual Mean: 0
Residual SD: 0.085
SS: 0.139
K: 5
b: 0.354

Alpha Level: 0.05
Calculated Value: 0.9025
Critical Value: <= 0.842

Normally Distributed: Yes

Override Option: N/A

Levene's Results:

Test Residual Mean: 0.137
Test Residual SD: 0.041
Ref. Residual Mean: 0.082
Ref. Residual SD: 0.031
Deg. of Freedom: 8

Alpha Level: 0.1
Calculated Value: 2.3739
Critical Value: >= 1.860

Variances Homogeneous: No

Test Results:

Statistic: Approximate t
Balanced Design: Yes
Transformation: ArcSin

Experimental Hypothesis
Null: x1 >= x2
Alternate: x1 < x2

Degrees of Freedom: 7
Experimental Alpha Level: 0.05
Calculated Value: 7.2847
Critical Value: >= 1.895
Accept Null Hypothesis: No

Power:
Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shipiro-Wilk Residuals
1	0.78	5.067	0.94	5.564	0.188	0.078			-0.149
2	0.7	4.799	0.94	5.564	0.08	0.078			-0.133
3	0.77	5.034	0.87	5.352	0.155	0.133			-0.114
4	0.68	4.73	0.89	5.413	0.149	0.072			-0.08
5	0.69	4.765	0.93	5.534	0.114	0.049			-0.072
6									0.049
7									0.078
8									0.078
9									0.155
10									0.188

Project Name: March Point

Sample: x1
Samp ID: MP-6
Alias: 5 min
Replicates: 5
Mean: 0.972
SD: 0.016
Tr Mean: 5.658
Trans SD: 0.048

Ref Samp: x2
Ref ID: CR-1
Alias: 5 minute
Replicates: 5
Mean: 1.02
SD: 0.02
Tr Mean: 5.796
Trans SD: 0.057

Shapiro-Wilk Results:

Residual Mean: 0
Residual SD: 0.034
SS: 0.022
K: 5
b: 0.14

Alpha Level: 0.05
Calculated Value: 0.8754
Critical Value: <= 0.842

Normally Distributed: Yes

Override Option: N/A

Levene's Results:

Test Residual Mean: 0.042
Test Residual SD: 0.01
Ref. Residual Mean: 0.046
Ref. Residual SD: 0.026
Deg. of Freedom: 8

Alpha Level: 0.1
Calculated Value: 0.3053
Critical Value: >= 1.860

Variances Homogeneous: Yes

Test Results:

Statistic: Student's t
Balanced Design: Yes
Transformation: ArcSin

Experimental Hypothesis
Null: x1 >= x2
Alternate: x1 < x2

Degrees of Freedom: 8
Experimental Alpha Level: 0.05
Calculated Value: 4.1492
Critical Value: >= 1.860
Accept Null Hypothesis: No

Power:
Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shipiro-Wilk Residuals
1	0.99	5.71	1.01	5.768	0.052	0.028			-0.086
2	0.96	5.623	1.03	5.825	0.035	0.029			-0.035
3	0.96	5.623	1.03	5.825	0.035	0.029			-0.035
4	0.99	5.71	0.99	5.71	0.052	0.086			-0.035
5	0.96	5.623	1.04	5.853	0.035	0.057			-0.028
6									0.029
7									0.029
8									0.052
9									0.052
10									0.057

Project Name: March Point

Sample: x1
Samp ID: MP-6
Alias: 15 minute
Replicates: 5
Mean: 0.898
SD: 0.048
Tr Mean: 5.436
Trans SD: 0.144

Ref Samp: x2
Ref ID: CR-1
Alias: 15 minute
Replicates: 5
Mean: 0.914
SD: 0.032
Tr Mean: 5.485
Trans SD: 0.097

Shapiro-Wilk Results:

Residual Mean: 0
Residual SD: 0.08
SS: 0.121
K: 5
b: 0.343

Alpha Level: 0.05
Calculated Value: 0.9735
Critical Value: <= 0.842

Normally Distributed: Yes

Override Option: N/A

Levene's Results:

Test Residual Mean: 0.102
Test Residual SD: 0.089
Ref. Residual Mean: 0.082
Ref. Residual SD: 0.031
Deg. of Freedom: 8

Alpha Level: 0.1
Calculated Value: 0.4604
Critical Value: >= 1.860

Variances Homogeneous: Yes

Test Results:

Statistic: Student's t
Balanced Design: Yes
Transformation: ArcSin

Experimental Hypothesis
Null: x1 >= x2
Alternate: x1 < x2

Degrees of Freedom: 8
Experimental Alpha Level: 0.05
Calculated Value: 0.6336
Critical Value: >= 1.860
Accept Null Hypothesis: Yes

Power:
Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shipiro-Wilk Residuals
1	0.89	5.413	0.94	5.564	0.023	0.078			-0.178
2	0.91	5.474	0.94	5.564	0.038	0.078			-0.133
3	0.88	5.383	0.87	5.352	0.053	0.133			-0.072
4	0.97	5.652	0.89	5.413	0.216	0.072			-0.053
5	0.84	5.259	0.93	5.534	0.178	0.049			-0.023
6									0.038
7									0.049
8									0.078
9									0.078
10									0.216

Project Name: March Point

Sample: x1
Samp ID: MP-8
Alias: 5 minute
Replicates: 5
Mean: 0.736
SD: 0.113
Tr Mean: 4.91
Trans SD: 0.372

Ref Samp: x2
Ref ID: CR-1
Alias: 5 minute
Replicates: 5
Mean: 1.02
SD: 0.02
Tr Mean: 5.796
Trans SD: 0.057

Shapiro-Wilk Results:

Residual Mean: 0
Residual SD: 0.172
SS: 0.565
K: 5
b: 0.72

Alpha Level: 0.05
Calculated Value: 0.9168
Critical Value: <= 0.842

Normally Distributed: Yes

Override Option: N/A

Levene's Results:

Test Residual Mean: 0.301
Test Residual SD: 0.157
Ref. Residual Mean: 0.046
Ref. Residual SD: 0.026
Deg. of Freedom: 8

Alpha Level: 0.1
Calculated Value: 3.5798
Critical Value: >= 1.860

Variances Homogeneous: No

Test Results:

Statistic: Approximate t
Balanced Design: Yes
Transformation: ArcSin

Experimental Hypothesis
Null: x1 >= x2
Alternate: x1 < x2

Degrees of Freedom: 4
Experimental Alpha Level: 0.05
Calculated Value: 5.2696
Critical Value: >= 2.132
Accept Null Hypothesis: No

Power:
Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shipiro-Wilk Residuals
1	0.91	5.474	1.01	5.768	0.564	0.028			-0.322
2	0.79	5.099	1.03	5.825	0.189	0.029			-0.25
3	0.66	4.66	1.03	5.825	0.25	0.029			-0.18
4	0.64	4.589	0.99	5.71	0.322	0.086			-0.086
5	0.68	4.73	1.04	5.853	0.18	0.057			-0.028
6									0.029
7									0.029
8									0.057
9									0.189
10									0.564

Project Name: March Point

Sample: x1
Samp ID: MP-8
Alias: 15 minute
Replicates: 5
Mean: 0.67
SD: 0.068
Tr Mean: 4.69
Trans SD: 0.236

Ref Samp: x2
Ref ID: CR-1
Alias: 15 minute
Replicates: 5
Mean: 0.914
SD: 0.032
Tr Mean: 5.485
Trans SD: 0.097

Shapiro-Wilk Results:

Residual Mean: 0
Residual SD: 0.117
SS: 0.26
K: 5
b: 0.5

Alpha Level: 0.05
Calculated Value: 0.9586
Critical Value: <= 0.842

Normally Distributed: Yes

Override Option: N/A

Levene's Results:

Test Residual Mean: 0.181
Test Residual SD: 0.121
Ref. Residual Mean: 0.082
Ref. Residual SD: 0.031
Deg. of Freedom: 8

Alpha Level: 0.1
Calculated Value: 1.7659
Critical Value: >= 1.860

Variances Homogeneous: Yes

Test Results:

Statistic: Student's t
Balanced Design: Yes
Transformation: ArcSin

Experimental Hypothesis
Null: x1 >= x2
Alternate: x1 < x2

Degrees of Freedom: 8
Experimental Alpha Level: 0.05
Calculated Value: 6.9669
Critical Value: >= 1.860
Accept Null Hypothesis: No

Power:
Min. Difference for Power:

Replicate Number	Test Data	Trans. Test Data	Reference Data	Trans. Reference Data	Levene's Test Residuals	Levene's Reference Residuals	Mann-Whitney Ranks	Rankits	Shapiro-Wilk Residuals
1	0.77	5.034	0.94	5.564	0.344	0.078			-0.248
2	0.7	4.799	0.94	5.564	0.109	0.078			-0.174
3	0.6	4.443	0.87	5.352	0.248	0.133			-0.133
4	0.62	4.516	0.89	5.413	0.174	0.072			-0.072
5	0.66	4.66	0.93	5.534	0.031	0.049			-0.031
6									0.049
7									0.078
8									0.078
9									0.109
10									0.344

APPENDIX B – Laboratory Bench Sheets

Nautilus Environmental
Washington Laboratory
5009 Pacific Hwy. E., Suite 2
Tacoma, WA 98424

Raw Data Sheet
Microtox
100% Sediment Porewater Toxicity

Client Name: Newfields **Test Date:** 10/2/08

Sample ID: SBREF80, MP-1, MP-2, MP-4, MP-7 **Test No.:** 0809-T062-T068

Site	Light Reading	Time	Replicate				
			1	2	3	4	5
CON	$I_{(0)}$	5 min	95	97	99	105	106
	$I_{(5)}$	10min	92	91	92	104	101
	$I_{(15)}$	20 min	78	79	82	87	91
SBREF80	$I_{(0)}$	5 min	85	76	78	76	76
	$I_{(5)}$	10min	79	71	78	75	78
	$I_{(15)}$	20 min	68	65	68	68	69
MP-1	$I_{(0)}$	5 min	77	80	77	77	76
	$I_{(5)}$	10min	70	81	80	74	78
	$I_{(15)}$	20 min	65	70	72	72	74
MP-2	$I_{(0)}$	5 min	80	85	78	77	83
	$I_{(5)}$	10min	81	92	78	78	84
	$I_{(15)}$	20 min	76	88	76	76	80
MP-4	$I_{(0)}$	5 min	73	67	66	70	63
	$I_{(5)}$	10min	70	66	66	71	65
	$I_{(15)}$	20 min	65	61	60	62	61
MP-7	$I_{(0)}$	5 min	83	87	86	86	88
	$I_{(5)}$	10min	74	82	82	83	81
	$I_{(15)}$	20 min	52	64	62	64	58

Comments:

Nautilus Environmental
Washington Laboratory
5009 Pacific Hwy. E., Suite 2
Tacoma, WA 98424

Raw Data Sheet
Microtox
100% Sediment Porewater Toxicity

Client Name: Newfields **Test Date:** 9/22/08

Sample ID: March Point Landfill **Test No.:** 0809-T067-T070

Site	Light Reading	Time	Replicate 1	2	3	4	5
	$I_{(0)}$	5 min	96	88	91	91	91
	$I_{(5)}$	10min	92	86	91	89	92
CON	$I_{(15)}$	20 min	83	83	87	84	87
S08-~~0769U~~ 091	$I_{(0)}$	5 min	62	59	61	61	60
	$I_{(5)}$	10min	61	59	61	62	60
SBREF80	$I_{(15)}$	20 min	61	57	67	64	60
S08-084	$I_{(0)}$	5 min	70	62	65	59	63
	$I_{(5)}$	10min	69	64	68	59	66
MP-9	$I_{(15)}$	20 min	77	62	63	57	67
S08-085	$I_{(0)}$	5 min	68	70	67	66	62
	$I_{(5)}$	10min	70	71	65	66	64
MP-10	$I_{(15)}$	20 min	67	67	67	65	63
S08-086	$I_{(0)}$	5 min	56	58	63	54	61
	$I_{(5)}$	10min	61	61	62	55	61
MP-11	$I_{(15)}$	20 min	58	61	60	52	59
S08-087	$I_{(0)}$	5 min	72	74	72	79	80
	$I_{(5)}$	10min	81	79	78	91	92
MP-12	$I_{(15)}$	20 min	83	89	85	101	100

Comments:

Nautilus Environmental
Washington Laboratory
5009 Pacific Hwy. E., Suite 2
Tacoma, WA 98424

Raw Data Sheet
Microtox
100% Sediment Porewater Toxicity

Client Name: Newfields
Test Date: 9/22/08
Sample ID: March Point Landfill
Test No.: 0809-T071

Site	Light Reading	Time	Replicate 1	2	3	4	5
	$I_{(0)}$	5 min	92	95	95	94	95
CON	$I_{(5)}$	10min	92	92	94	86	90
	$I_{(15)}$	20 min	91	88	100	96	89
508-091	$I_{(0)}$	5 min	74	69	64	63	61
	$I_{(5)}$	10min	74	72	64	64	64
SBREF80	$I_{(15)}$	20 min	76	76	67	71	69
508-088	$I_{(0)}$	5 min	38	41	39	41	40
	$I_{(5)}$	10min	38	42	40	42	41
MP-13	$I_{(15)}$	20 min	42	44	43	46	44
	$I_{(0)}$	5 min					
	$I_{(5)}$	10min					
	$I_{(15)}$	20 min					
	$I_{(0)}$	5 min					
	$I_{(5)}$	10min					
	$I_{(15)}$	20 min					
	$I_{(0)}$	5 min					
	$I_{(5)}$	10min					
	$I_{(15)}$	20 min					

Comments:

Nautilus Environmental
Washington Laboratory
5009 Pacific Hwy. E., Suite 2
Tacoma, WA 98424

Raw Data Sheet
Microtox
100% Sediment Porewater Toxicity

Client Name: Newfields

Test Date: 9/25/08

Sample ID: CR-1, MP-3, MP-5, MP-6, MP-8

Test No.: 0809-T072-T076

Site	Light Reading	Time	Replicate				
			1	2	3	4	5
CON	$I_{(0)}$	5 min	90	95	93	92	99
	$I_{(5)}$	10min	84	86	85	87	91
	$I_{(15)}$	20 min	77	78	77	73	72
508-090 CR-1	$I_{(0)}$	5 min	87	77	78	74	73
	$I_{(5)}$	10min	88	79	80	73	76
	$I_{(15)}$	20 min	82	72	68	66	68
508-078 MP-3	$I_{(0)}$	5 min	76	79	74	73	75
	$I_{(5)}$	10min	81	81	76	76	79
	$I_{(15)}$	20 min	74	75	70	66	71
508-080 MP-5	$I_{(0)}$	5 min	78	73	74	67	69
	$I_{(5)}$	10min	74	67	74	62	66
	$I_{(15)}$	20 min	73	66	72	64	65
508-081 MP-6	$I_{(0)}$	5 min	81	76	74	75	81
	$I_{(5)}$	10min	80	73	71	74	78
	$I_{(15)}$	20 min	72	69	65	73	68
508-083 MP-8	$I_{(0)}$	5 min	87	81	67	64	71
	$I_{(5)}$	10min	85	74	62	60	64
	$I_{(15)}$	20 min	72	66	56	58	62

Comments:

APPENDIX C – Water Quality Results

Nautilus Environmental
Washington Laboratory
5009 Pacific Hwy. E., Suite 2
Tacoma, WA 98424

Physical and Chemical
Measurements of Porewaters
Sediment Bioassays

Analyst: Et

Client : Newfields

Test Date: 9/22/08

Test Type: Microtox 100% Porewater Toxicity Test

Test No: 0809-T062-T068

Test Species: *Vibrio fischeri*

Site	Initial Salinity (ppt)	Final Salinity (ppt)	Initial D.O. (mg/L)	Final D.O (mg/L)	Initial pH	Adjusted pH	NaOH or HCl Vol. Used	Final Porewater Conc.	Ammonia
S08-091 SBREF80	32.4	32.4	5.8	5.8	7.49	7.92	30µL 0.1N NaOH	99.9	21.2
S08-076 MP-1	3.6	20.8	6.8	6.8	7.23	7.90	180µL 0.1N NaOH	99.3	43.7
S08-077 MP-2	25.7	25.7	6.9	6.9	7.27	7.91	225µL 0.1N NaOH	99.1	25.5
S08-079 MP4	17.7	19.4	6.1	6.1	7.42	7.97	150µL 0.1N NaOH	99.4	14.3
S08-082 MP-7	27.2	27.2	6.5	6.5	7.46	7.98	150µL 0.1N NaOH	99.4	11.3
S08-084 MP-9	26.7	26.7	6.7	6.7	7.12	7.95	300µL 0.1N NaOH	98.8	15.0
S08-085 MP-10	27.4	27.4	6.7	6.7	7.09	7.94	300µL 0.1N NaOH	98.8	13.6

Sample Description: ______________________

Comments: ______________________

QA Check: ______________

Nautilus Environmental
Washington Laboratory
5009 Pacific Hwy. E., Suite 2
Tacoma, WA 98424

Physical and Chemical
Measurements of Porewaters
Sediment Bioassays

Analyst:

Client : Newfields

Test Date: 9/22/08

Test Type: Microtox 100% Porewater Toxicity Test

Test No: 0809-T069-T071

Test Species: *Vibrio fischeri*

Site	Initial Salinity (ppt)	Final Salinity (ppt)	Initial D.O. (mg/L)	Final D.O (mg/L)	Initial pH	Adjusted pH	NaOH or HCl Vol. Used	Final Porewater Conc.	Ammonia
S08-086 MP-11	27.3	27.3	6.4	6.4	7.12	7.93	300µL 0.1N NaOH	98.8	17.5
S08-087 MP-12	28.7	28.7	6.7	6.7	7.60	7.92	75µL 0.1N NaOH	99.7	22.7
S08-088 MP-13	29.0	29.0	6.8	6.8	7.22	7.91	375µL 0.1N NaOH	98.5	26.7
CON	20.1	20.1	7.0	7.0	8.95	8.16	90µL 0.1N HCl	99.6	—

Sample Description:

Comments:

QA Check:

Nautilus Environmental
Washington Laboratory
5009 Pacific Hwy. E., Suite 2
Tacoma, WA 98424

Physical and Chemical
Measurements of Porewaters
Sediment Bioassays

Analyst: et

Client : Newfields

Test Date: 9/25/08

Test Type: **Microtox 100% Porewater Toxicity Test**

Test No: 0809-T072-T076

Test Species: *Vibrio fischeri*

Site	Initial Salinity (ppt)	Final Salinity (ppt)	Initial D.O. (mg/L)	Final D.O (mg/L)	Initial pH	Adjusted pH	NaOH or HCl Vol. Used	Final Porewater Conc.	Ammonia
508-090 CR-1	30.8	30.8	6.7	6.7	7.35	7.90	0.1N NaOH 100µL	99.6	27.2
508-079 MP-3	28.5	28.5	6.5	6.5	7.65	7.91	0.1N NaOH 100µL	99.6	37.8
508-080 MP-5	26.4	26.4	6.8	6.8	7.40	7.96	0.1N NaOH 100µL	99.6	22.5
508-081 MP-6	27.9	27.9	6.7	6.7	7.07	7.90	0.1N NaOH 200µL	99.2	8.5
508-083 MP-8	26.9	26.9	6.8	6.8	7.29	8.17	0.1N NaOH 200µL	99.2	8.9
CON	19.2	19.2	6.8	6.8	9.20	8.18	0.1N HCl 100µL	99.6	—

Sample Description: ____________________

Comments: ____________________

QA Check: ____________________

Nautilus Environmental
Washington Laboratory
5009 Pacific Hwy. E., Suite 2
Tacoma, WA 98424

Physical and Chemical Measurements of Porewaters Sediment Bioassays

Analyst: Ut

Client : Newfields

Test Date: 10/2/08

Test Type: Microtox 100% Porewater Toxicity Test

Test No:

Test Species: *Vibrio fischeri*

Site	Initial Salinity (ppt)	Final Salinity (ppt)	Initial D.O. (mg/L)	Final D.O (mg/L)	Initial pH	Adjusted pH	NaOH or HCl Vol. Used	Final Porewater Conc.	Ammonia
CON	19.2	19.2	6.7	6.7	8.99	8.18	60μL 0.1N HCl	99.8	—
SBREF80	32.5	32.5	6.3	6.3	7.44	7.98	150μL 0.1N NaOH	99.4	22.9
MP-1	4.3	20.6	6.3	6.3	7.54	8.00	150μL 0.1N NaOH	99.4	45.2
MP-2	25.6	25.6	6.5	6.5	7.37	7.91	200μL 0.1N NaOH	99.2	26.2
MP-4	17.6	19.2	6.6	6.6	7.36	8.11	250μL 0.1N NaOH	99.0	17.4
MP-7	27.5	27.5	6.7	6.7	7.29	8.19	250μL 0.1N NaOH	99.0	16.3

Sample Description:

Comments:

QA Check:

Nautilus Environmental
Washington Laboratory
5009 Pacific Hwy E., Suite 2
Tacoma, WA 98424

Turbidity Measurements

Client: Newfields
Date: 9/22/08
Analyst: et

Sample ID	Measurement (NTU)
Standard 0-10	4.97
Standard 0-100	50.0
Standard 0-1000	481
DI	0.79
CON	4.43
S08-91 SBREF80	43.4
S08-76 MP-1	99.6
S08-77 MP-2	168
S08-79 MP-4	244
S08-82 MP-7	19.3
S08-84 MP-9	29.1
S08-85 MP-10	38.3
S08-86 MP-11	53.0
S08-87 MP-12	42.4
S08-88 MP-13	41.4
STANDARD 0-10	4.90
STANDARD 0-100	49.8
STANDARD 0-1000	479
DI	0.63
Standard 0-10	
Standard 0-100	
Standard 0-1000	
DI	

Measure standards and DI at beginning and end of analysis.

Nautilus Environmental
Washington Laboratory
5009 Pacific Hwy E., Suite 2
Tacoma, WA 98424

Turbidity Measurements

Client: Newfields
Date: 9/25/08
Analyst: qt

Sample ID	Measurement (NTU)
Standard 0-10	5.02
Standard 0-100	49.7
Standard 0-1000	493
DI	0.47
CON	0.62
508-090 CR-1	31.2
508-078 MP-3	67.9
508-080 MP-5	24.3
508-081 MP-6	38.4
508-083 MP-8	16.4
Standard 0-10	qt ~~49.~~ 4.94
Standard 0-100	49.6
Standard 0-1000	485
DI	0.55

Measure standards and DI at beginning and end of analysis.

Nautilus Environmental
Washington Laboratory
5009 Pacific Hwy E., Suite 2
Tacoma, WA 98424

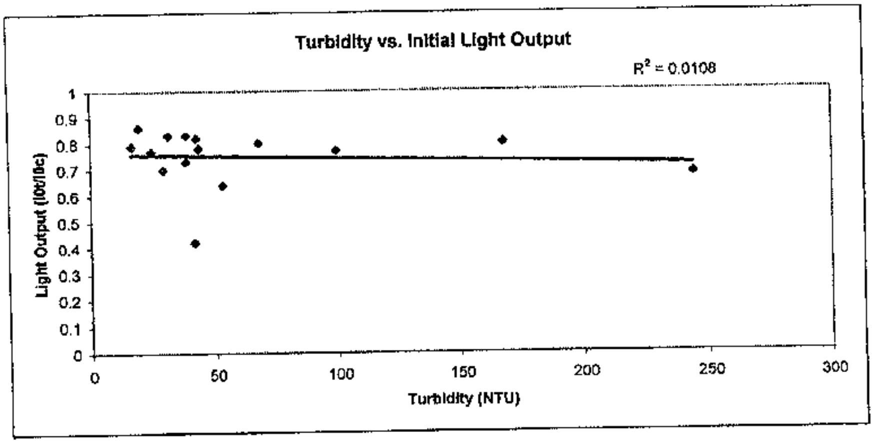
Turbidity Measurements

Client: Newfields
Date: 10/2/08
Analyst: gt

Sample ID	Measurement (NTU)
Standard 0-10	4.92
Standard 0-100	49.8
Standard 0-1000	484
DI	0.40
REF-80	41.7
MP-1	60.8
MP-2	30.5
MP-4	248
MP-7	17.6
Standard 0-10	4.99
Standard 0-100	49.6
Standard 0-1000	484
DI	0.41

Measure standards and DI at beginning and end of analysis.

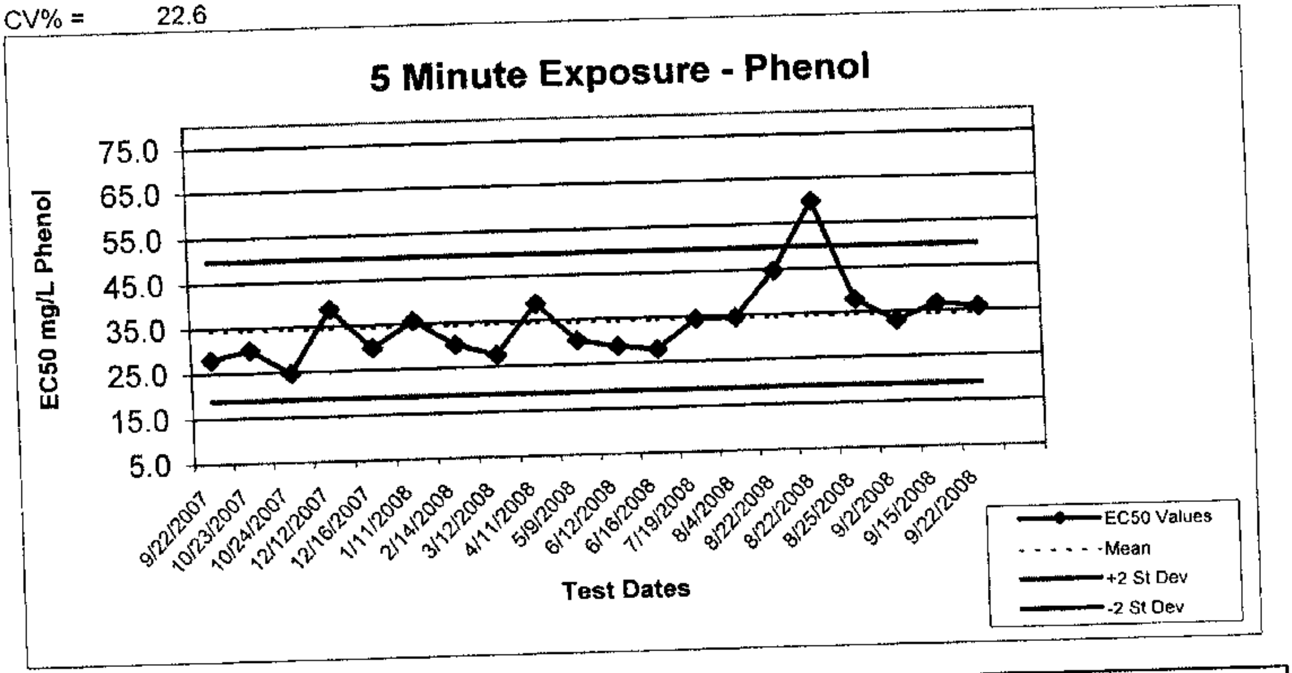
	I0t/I0c	turbidity
sbref80	0.78	43.4
mp-1	0.77	99.6
mp-2	0.8	168
mp-4	0.68	244
mp-7	0.86	19.3
mp-9	0.7	29.1
mp-10	0.73	38.3
mp-11	0.64	53
mp-12	0.82	42.4
mp-13	0.42	41.4
cr-1	0.83	31.2
mp-3	0.8	67.9
mp-5	0.77	24.3
mp-6	0.83	38.4
mp-8	0.79	16.4



APPENDIX D – Reference Toxicant Tests

Reference Toxicant Control Chart
Microtox 5-Minute Exposure

CV% = 22.6

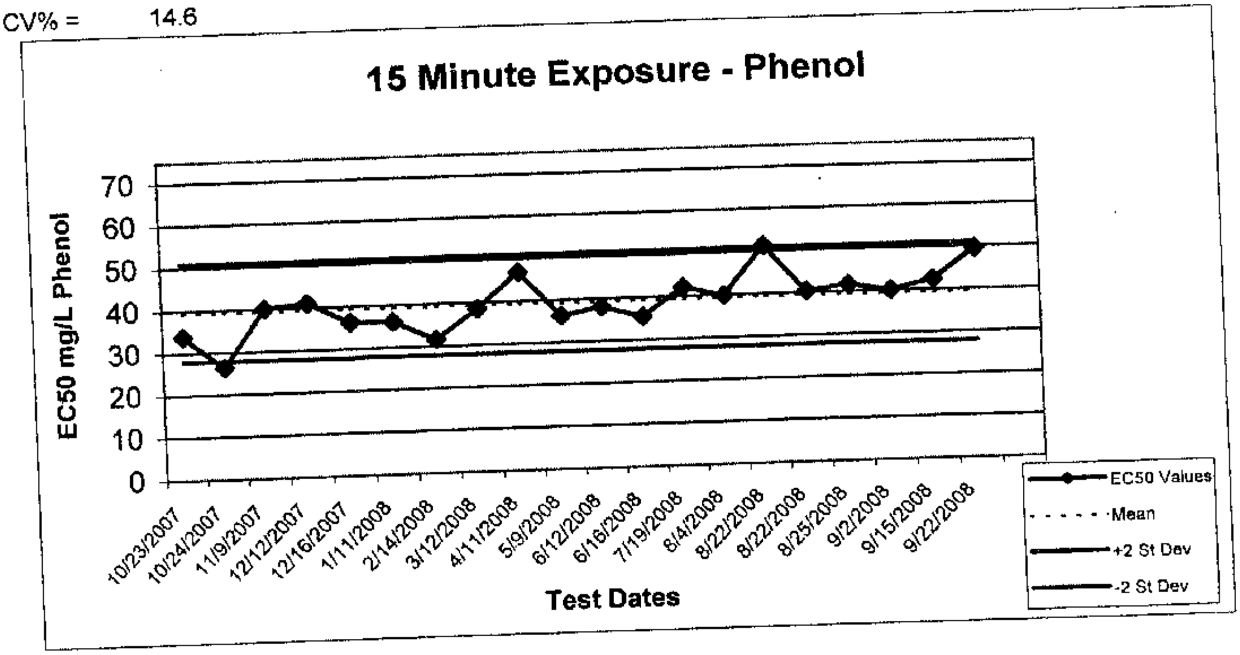


Date	Time	EC50 %	EC50 mg/L Phenol [a]	Mean	StDev	-2 SD	+2 SD
9/22/2007	1044	27.4	27.9	34.3	7.8	18.8	49.8
10/23/2007	830	29.4	30.0	34.3	7.8	18.8	49.8
10/24/2007	1114	24.2	24.7	34.3	7.8	18.8	49.8
12/12/2007	1316	38.0	38.8	34.3	7.8	18.8	49.8
12/16/2007	1140	29.3	29.9	34.3	7.8	18.8	49.8
1/11/2008	1015	34.9	35.6	34.3	7.8	18.8	49.8
2/14/2008	1239	29.5	30.1	34.3	7.8	18.8	49.8
3/12/2008	1245	27.0	27.6	34.3	7.8	18.8	49.8
4/11/2008	928	38.0	38.8	34.3	7.8	18.8	49.8
5/9/2008	1002	29.7	30.3	34.3	7.8	18.8	49.8
6/12/2008	1314	28.2	28.8	34.3	7.8	18.8	49.8
6/16/2008	1249	27.3	27.8	34.3	7.8	18.8	49.8
7/19/2008	1335	33.7	34.4	34.3	7.8	18.8	49.8
8/4/2008	1352	33.8	34.5	34.3	7.8	18.8	49.8
8/22/2008	856	43.8	44.7	34.3	7.8	18.8	49.8
8/22/2008	1108	58.6	59.8	34.3	7.8	18.8	49.8
8/25/2008	1343	37.1	37.8	34.3	7.8	18.8	49.8
9/2/2008	1327	32.3	32.9	34.3	7.8	18.8	49.8
9/15/2008	843	35.9	36.6	34.3	7.8	18.8	49.8
9/22/2008	1246	35.1	35.8	34.3	7.8	18.8	49.8

a - Highest concentration of Phenol is 102 mg/L

Reference Toxicant Control Chart
Microtox 15-Minute Exposure

CV% = 14.6



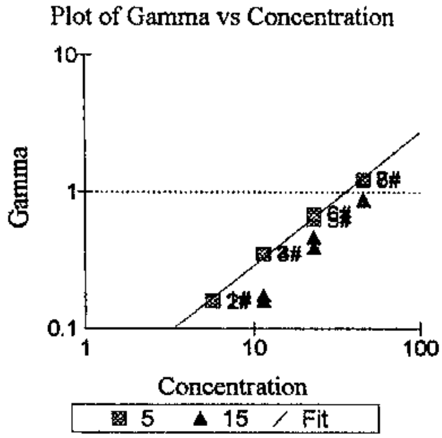
Date	Time	EC50 %	EC50 mg/L Phenol [a]	Mean	StDev	-2 SD	+2 SD
10/23/2007	830	33.2	33.9	39.4	5.8	27.8	50.9
10/24/2007	1114	25.8	26.3	39.4	5.8	27.8	50.9
11/9/2007	1337	39.3	40.1	39.4	5.8	27.8	50.9
12/12/2007	1316	40.2	41.0	39.4	5.8	27.8	50.9
12/16/2007	1140	35.6	36.3	39.4	5.8	27.8	50.9
1/11/2008	1015	35.4	36.1	39.4	5.8	27.8	50.9
2/14/2008	1239	31.0	31.6	39.4	5.8	27.8	50.9
3/12/2008	1245	37.7	38.5	39.4	5.8	27.8	50.9
4/11/2008	928	45.9	46.8	39.4	5.8	27.8	50.9
5/9/2008	1002	35.6	36.3	39.4	5.8	27.8	50.9
6/12/2008	1314	37.3	38.0	39.4	5.8	27.8	50.9
6/16/2008	1249	34.8	35.5	39.4	5.8	27.8	50.9
7/19/2008	1335	41.2	42.0	39.4	5.8	27.8	50.9
8/4/2008	1352	39.1	39.9	39.4	5.8	27.8	50.9
8/22/2008	856	50.2	51.2	39.4	5.8	27.8	50.9
8/22/2008	1108	39.6	40.4	39.4	5.8	27.8	50.9
8/25/2008	1343	40.8	41.6	39.4	5.8	27.8	50.9
9/2/2008	1327	39.3	40.1	39.4	5.8	27.8	50.9
9/15/2008	843	41.6	42.4	39.4	5.8	27.8	50.9
9/22/2008	1246	48.5	49.5	39.4	5.8	27.8	50.9

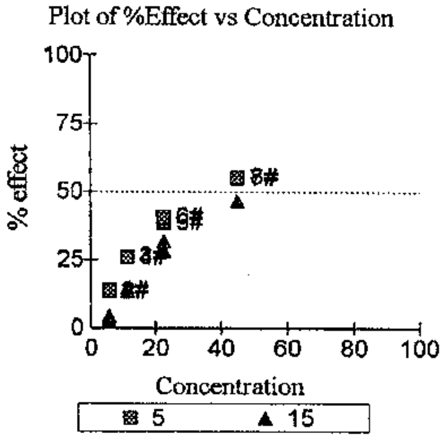
a - Highest concentration of Phenol is 102 mg/L

MicrotoxOmni Test Report

Date: 09/22/2008 12:46 PM

Test Protocol: Basic Test
Sample: 102mg/L Phenol
Toxicant: 102mg/L Phenol
Reagent Lot no.: 8E1080
Test description: Reference Toxicant
Test name: RT092208VF
Database file: \\Fif-ws3\alldata\Nautilus\former staff Folders\Karen\Microtox\MicrotoxOmni\Edge Analytical.mdb





			5 Mins Data:			15 Mins Data:		
Sample	Conc	Io	It	Gamma	% effect	It	Gamma	% effect
Control	0.000	101.43	94.59	0.9326 #		76.45	0.7537 #	
Control	0.000	107.59	102.50	0.9527 #		82.58	0.7675 #	
1	5.625	103.21	83.64	0.1632 #	14.03%	75.91	0.0341 *	3.305%
2	5.625	102.05	83.06	0.1581 #	13.65%	74.08	0.0478 *	4.564%
3	11.25	102.25	71.31	0.3516 #	26.01%	67.05	0.1600 #	13.79%
4	11.25	98.11	68.48	0.3505 #	25.95%	63.51	0.1750 #	14.90%
5	22.50	103.20	59.85	0.6254 #	38.48%	56.34	0.3933 #	28.23%
6	22.50	107.61	60.08	0.6884 #	40.77%	55.79	0.4671 #	31.84%
7	45.00	104.86	44.51	1.221 #	54.97%	42.53	0.8754 #	46.68%
8	45.00	109.25	45.96	1.241 #	55.37%	44.55	0.8653 #	46.39%

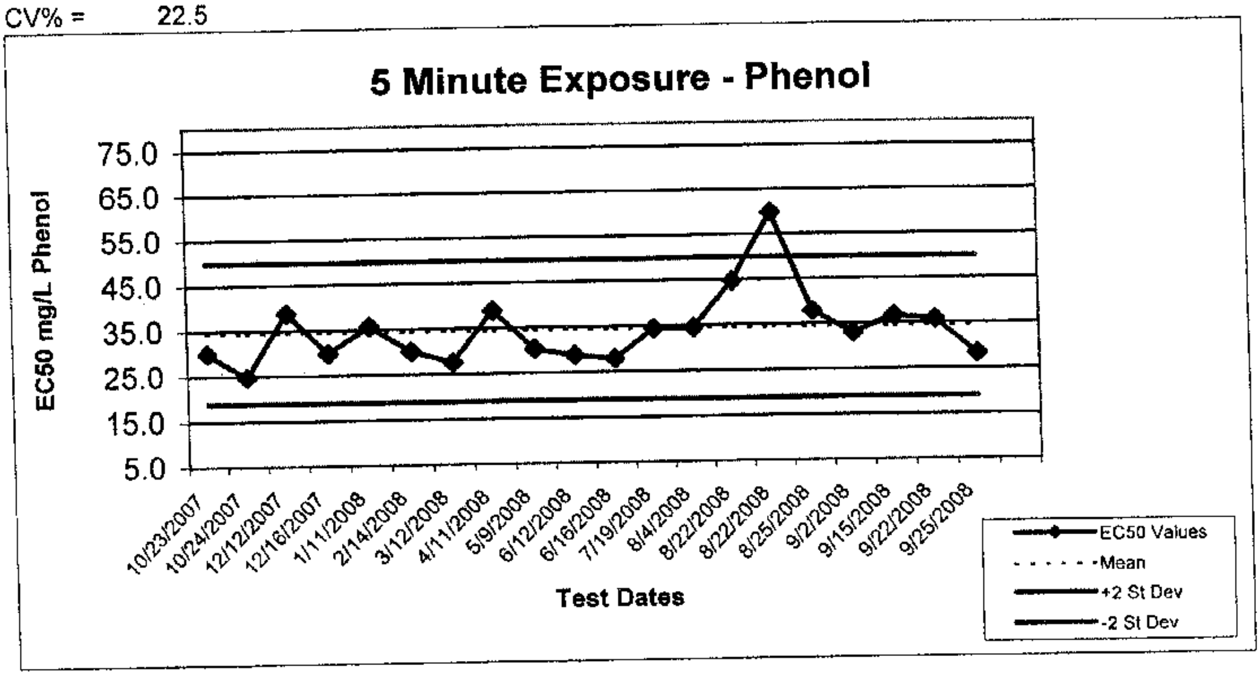
- used in calculation; * - invalid data; D - deleted from calcs.

Calculations on 5 Mins data:
EC50 Concentration:35.11% (95% confidence range: 32.66 to 37.75)
95% Confidence Factor: 1.075
Estimating Equation:LOG C =1.025 x LOG G +1.545
Coeff. of Determination (R^2):0.9957
Slope: 0.9715
Correction Factor: 0.9426

Calculations on 15 Mins data:
EC50 Concentration:48.45% (95% confidence range: 41.54 to 56.50)
95% Confidence Factor: 1.166
EC50 value was calculated from extrapolated data.
Estimating Equation:LOG C =0.8294 x LOG G +1.685
Coeff. of Determination (R^2):0.9866
Slope: 1.189
Correction Factor: 0.7606

Reference Toxicant Control Chart
Microtox 5-Minute Exposure

CV% = 22.5

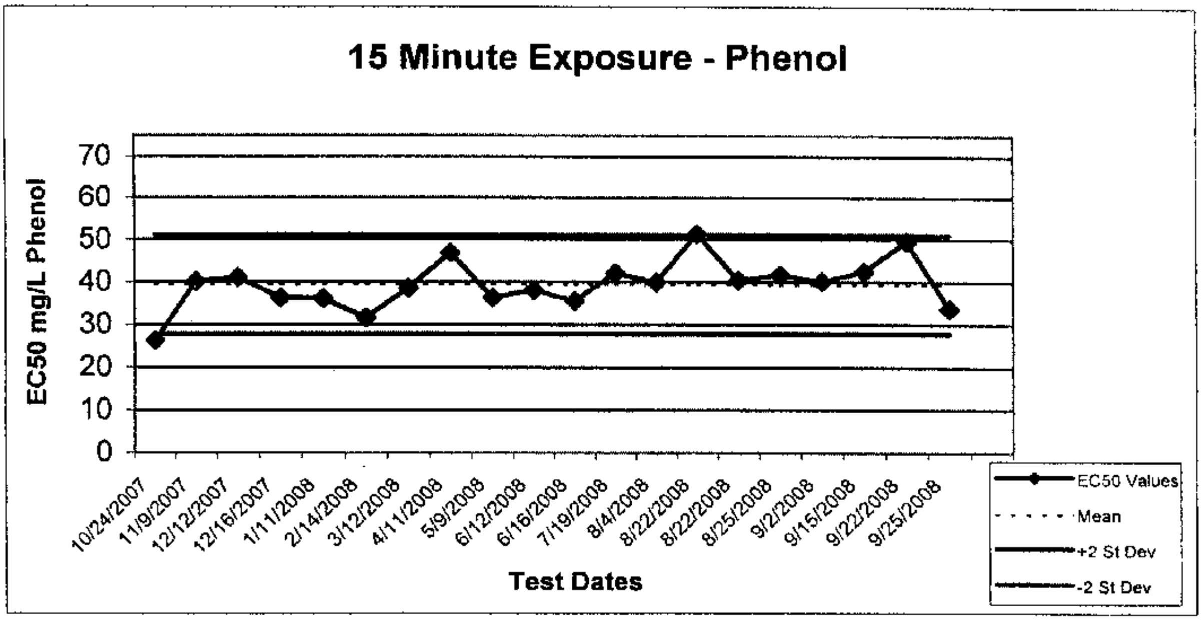


Date	Time	EC50 %	EC50 mg/L Phenol [a]	Mean	StDev	-2 SD	+2 SD
10/23/2007	830	29.4	30.0	34.3	7.7	18.9	49.8
10/24/2007	1114	24.2	24.7	34.3	7.7	18.9	49.8
12/12/2007	1316	38.0	38.8	34.3	7.7	18.9	49.8
12/16/2007	1140	29.3	29.9	34.3	7.7	18.9	49.8
1/11/2008	1015	34.9	35.6	34.3	7.7	18.9	49.8
2/14/2008	1239	29.5	30.1	34.3	7.7	18.9	49.8
3/12/2008	1245	27.0	27.6	34.3	7.7	18.9	49.8
4/11/2008	928	38.0	38.8	34.3	7.7	18.9	49.8
5/9/2008	1002	29.7	30.3	34.3	7.7	18.9	49.8
6/12/2008	1314	28.2	28.8	34.3	7.7	18.9	49.8
6/16/2008	1249	27.3	27.8	34.3	7.7	18.9	49.8
7/19/2008	1335	33.7	34.4	34.3	7.7	18.9	49.8
8/4/2008	1352	33.8	34.5	34.3	7.7	18.9	49.8
8/22/2008	856	43.8	44.7	34.3	7.7	18.9	49.8
8/22/2008	1108	58.6	59.8	34.3	7.7	18.9	49.8
8/25/2008	1343	37.1	37.8	34.3	7.7	18.9	49.8
9/2/2008	1327	32.3	32.9	34.3	7.7	18.9	49.8
9/15/2008	843	35.9	36.6	34.3	7.7	18.9	49.8
9/22/2008	1246	35.1	35.8	34.3	7.7	18.9	49.8
9/25/2008	1323	27.7	28.3	34.3	7.7	18.9	49.8

a - Highest concentration of Phenol is 102 mg/L

Reference Toxicant Control Chart
Microtox 15-Minute Exposure

CV% = 14.7



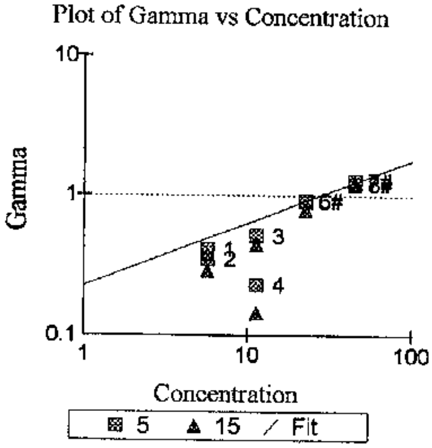
Date	Time	EC50 %	EC50 mg/L Phenol [a]	Mean	StDev	-2 SD	+2 SD
10/24/2007	1114	25.8	26.3	39.4	5.8	27.8	50.9
11/9/2007	1337	39.3	40.1	39.4	5.8	27.8	50.9
12/12/2007	1316	40.2	41.0	39.4	5.8	27.8	50.9
12/16/2007	1140	35.6	36.3	39.4	5.8	27.8	50.9
1/11/2008	1015	35.4	36.1	39.4	5.8	27.8	50.9
2/14/2008	1239	31.0	31.6	39.4	5.8	27.8	50.9
3/12/2008	1245	37.7	38.5	39.4	5.8	27.8	50.9
4/11/2008	928	45.9	46.8	39.4	5.8	27.8	50.9
5/9/2008	1002	35.6	36.3	39.4	5.8	27.8	50.9
6/12/2008	1314	37.3	38.0	39.4	5.8	27.8	50.9
6/16/2008	1249	34.8	35.5	39.4	5.8	27.8	50.9
7/19/2008	1335	41.2	42.0	39.4	5.8	27.8	50.9
8/4/2008	1352	39.1	39.9	39.4	5.8	27.8	50.9
8/22/2008	856	50.2	51.2	39.4	5.8	27.8	50.9
8/22/2008	1108	39.6	40.4	39.4	5.8	27.8	50.9
8/25/2008	1343	40.8	41.6	39.4	5.8	27.8	50.9
9/2/2008	1327	39.3	40.1	39.4	5.8	27.8	50.9
9/15/2008	843	41.6	42.4	39.4	5.8	27.8	50.9
9/22/2008	1246	48.5	49.5	39.4	5.8	27.8	50.9
9/25/2008	1323	33	33.7	39.4	5.8	27.8	50.9

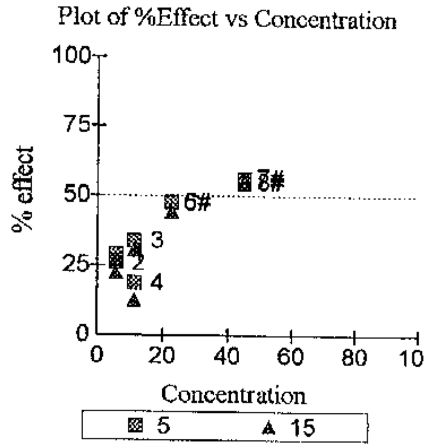
a - Highest concentration of Phenol is 102 mg/L

MicrotoxOmni Test Report

Date: 09/25/2008 01:23 PM

Test Protocol: Basic Test
Sample: 102mg/L Phenol
Toxicant: 102mg/L Phenol
Reagent Lot no.: 8E1080
Test description: Reference Toxicnat
Test name: RT092508VF#3
Database file: C:\Program Files\MicrotoxOmni\Edge Analytical.mdb


Plot of Gamma vs Concentration


Plot of %Effect vs Concentration

			5 Mins Data:			15 Mins Data:		
Sample	Conc	Io	It	Gamma	% effect	It	Gamma	% effect
Control	0.000	95.51	65.67	0.6876 #		60.83	0.6369 #	
Control	0.000	96.37	66.62	0.6913 #		62.72	0.6508 #	
1	5.625	103.19	50.39	0.4118	29.17%	48.17	0.3793	27.50%
2	5.625	111.04	56.59	0.3528	26.08%	55.50	0.2882	22.37%
3	11.25	104.69	47.73	0.5122	33.87%	46.64	0.4452	30.81%
4	11.25	108.42	60.72	0.2310	18.77%	60.99	0.1446	12.63%
5	22.50	110.34	39.93	0.9051 #	47.51%	39.72	0.7886 #	44.09%
6	22.50	108.84	39.08	0.9201 #	47.92%	39.18	0.7886 #	44.09%
7	45.00	119.30	36.10	1.278 #	56.11%	34.42	1.232 #	55.19%
8	45.00	112.23	35.04	1.208 #	54.71%	33.00	1.190 #	54.33%

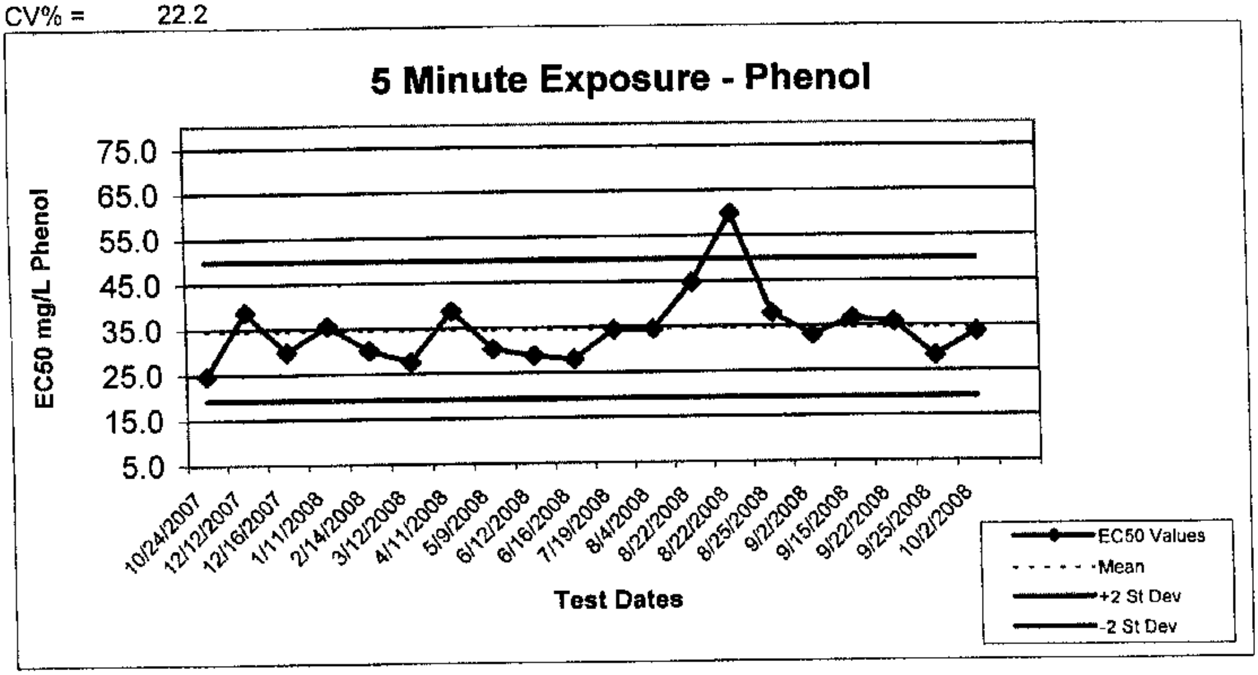
- used in calculation; * - invalid data; D - deleted from calcs.
Autocalc has been used.

Calculations on 5 Mins data:
EC50 Concentration:27.70% (95% confidence range: 23.80 to 32.24)
95% Confidence Factor: 1.164
Estimating Equation:LOG C =2.205 x LOG G +1.442
Coeff. of Determination (R^2):0.9822
Slope: 0.4455
Correction Factor: 0.6894

Calculations on 15 Mins data:
EC50 Concentration:33.03% (95% confidence range: 31.09 to 35.09)
95% Confidence Factor: 1.062
Estimating Equation:LOG C =1.612 x LOG G +1.519
Coeff. of Determination (R^2):0.9967
Slope: 0.6182
Correction Factor: 0.6439

Reference Toxicant Control Chart
Microtox 5-Minute Exposure

CV% = 22.2

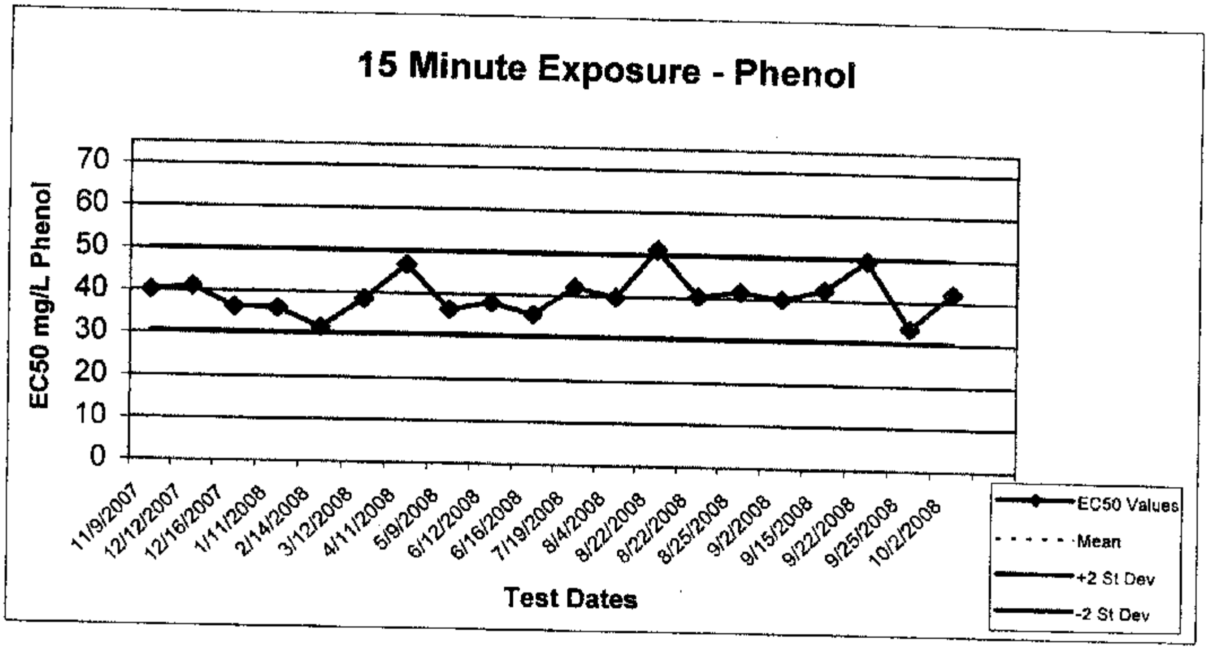


Date	Time	EC50 %	EC50 mg/L Phenol [a]	Mean	StDev	-2 SD	+2 SD
10/24/2007	1114	24.2	24.7	34.5	7.7	19.2	49.9
12/12/2007	1316	38.0	38.8	34.5	7.7	19.2	49.9
12/16/2007	1140	29.3	29.9	34.5	7.7	19.2	49.9
1/11/2008	1015	34.9	35.6	34.5	7.7	19.2	49.9
2/14/2008	1239	29.5	30.1	34.5	7.7	19.2	49.9
3/12/2008	1245	27.0	27.6	34.5	7.7	19.2	49.9
4/11/2008	928	38.0	38.8	34.5	7.7	19.2	49.9
5/9/2008	1002	29.7	30.3	34.5	7.7	19.2	49.9
6/12/2008	1314	28.2	28.8	34.5	7.7	19.2	49.9
6/16/2008	1249	27.3	27.8	34.5	7.7	19.2	49.9
7/19/2008	1335	33.7	34.4	34.5	7.7	19.2	49.9
8/4/2008	1352	33.8	34.5	34.5	7.7	19.2	49.9
8/22/2008	856	43.8	44.7	34.5	7.7	19.2	49.9
8/22/2008	1108	58.6	59.8	34.5	7.7	19.2	49.9
8/25/2008	1343	37.1	37.8	34.5	7.7	19.2	49.9
9/2/2008	1327	32.3	32.9	34.5	7.7	19.2	49.9
9/15/2008	843	35.9	36.6	34.5	7.7	19.2	49.9
9/22/2008	1246	35.1	35.8	34.5	7.7	19.2	49.9
9/25/2008	1323	27.7	28.3	34.5	7.7	19.2	49.9
10/2/2008	1237	19.8	33.6	34.5	7.7	19.2	49.9

a - Highest concentration of Phenol is 170 mg/L as of 10/1/08

Reference Toxicant Control Chart
Microtox 15-Minute Exposure

CV% = 12.2



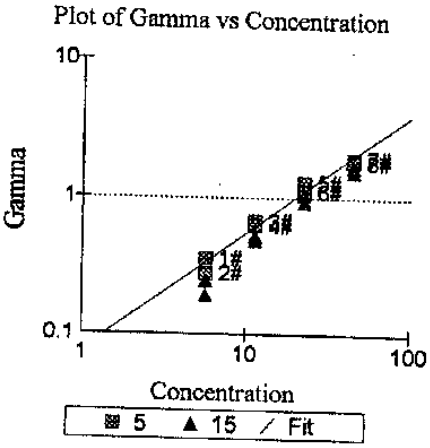
Date	Time	EC50 %	EC50 mg/L Phenol [a]	Mean	StDev	-2 SD	+2 SD
11/9/2007	1337	39.3	40.1	40.2	4.9	30.3	50.0
12/12/2007	1316	40.2	41.0	40.2	4.9	30.3	50.0
12/16/2007	1140	35.6	36.3	40.2	4.9	30.3	50.0
1/11/2008	1015	35.4	36.1	40.2	4.9	30.3	50.0
2/14/2008	1239	31.0	31.6	40.2	4.9	30.3	50.0
3/12/2008	1245	37.7	38.5	40.2	4.9	30.3	50.0
4/11/2008	928	45.9	46.8	40.2	4.9	30.3	50.0
5/9/2008	1002	35.6	36.3	40.2	4.9	30.3	50.0
6/12/2008	1314	37.3	38.0	40.2	4.9	30.3	50.0
6/16/2008	1249	34.8	35.5	40.2	4.9	30.3	50.0
7/19/2008	1335	41.2	42.0	40.2	4.9	30.3	50.0
8/4/2008	1352	39.1	39.9	40.2	4.9	30.3	50.0
8/22/2008	856	50.2	51.2	40.2	4.9	30.3	50.0
8/22/2008	1108	39.6	40.4	40.2	4.9	30.3	50.0
8/25/2008	1343	40.8	41.6	40.2	4.9	30.3	50.0
9/2/2008	1327	39.3	40.1	40.2	4.9	30.3	50.0
9/15/2008	843	41.6	42.4	40.2	4.9	30.3	50.0
9/22/2008	1246	48.5	49.5	40.2	4.9	30.3	50.0
9/25/2008	1323	33	33.7	40.2	4.9	30.3	50.0
10/2/2008	1237	24.79	42.1	40.2	4.9	30.3	50.0

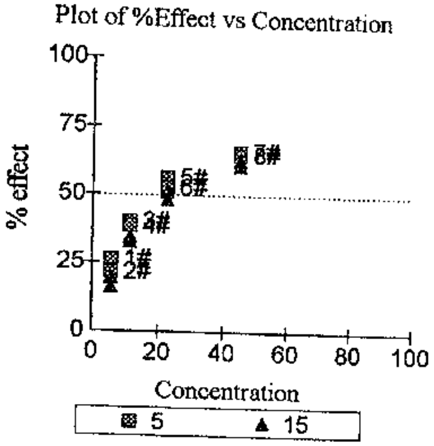
a - Highest concentration of Phenol is 170 mg/L as of 10/1/08

MicrotoxOmni Test Report

Date: 10/02/2008 12:37 PM

Test Protocol: Basic Test
Sample: Phenol
Toxicant: Phenol
Reagent Lot no.: 8E1080
Test description: Reference Toxicant
Test name: RT100208VF
Database file: \\Fif-ws3\alldata\Nautilus\former staff Folders\Karen\Microtox\MicrotoxOmni\Edge Analytical.mdb


Plot of Gamma vs Concentration


Plot of %Effect vs Concentration

			5 Mins Data:			15 Mins Data:		
Sample	Conc	Io	It	Gamma	% effect	It	Gamma	% effect
Control	0.000	99.31	95.92	0.9659 #		77.04	0.7758 #	
Control	0.000	104.17	101.57	0.9750 #		81.70	0.7843 #	
1	5.625	109.47	78.18	0.3589 #	26.41%	71.60	0.1926 #	16.15%
2	5.625	111.63	84.73	0.2786 #	21.79%	70.00	0.2439 #	19.61%
3	11.25	110.04	63.75	0.6751 #	40.30%	56.29	0.5249 #	34.42%
4	11.25	110.67	66.02	0.6268 #	38.53%	58.09	0.4861 #	32.71%
5	22.50	120.67	51.10	1.292 #	56.36%	45.94	1.049 #	51.19%
6	22.50	113.07	52.02	1.109 #	52.59%	45.78	0.9265 #	48.09%
7	45.00	109.98	36.35	1.936 #	65.94%	32.04	1.677 #	62.65%
8	45.00	113.14	38.75	1.833 #	64.71%	34.69	1.544 #	60.69%

- used in calculation; * - invalid data; D - deleted from calcs.

Calculations on 5 Mins data:
EC50 Concentration:19.79% (95% confidence range: 17.51 to 22.36)
95% Confidence Factor: 1.130
Estimating Equation:LOG C =1.135 x LOG G +1.296
Coeff. of Determination (R^2):0.9769
Slope: 0.8605
Correction Factor: 0.9705

Calculations on 15 Mins data:
EC50 Concentration:24.79% (95% confidence range: 21.64 to 28.39)
95% Confidence Factor: 1.145
Estimating Equation:LOG C =1.013 x LOG G +1.394
Coeff. of Determination (R^2):0.9770
Slope: 0.9642
Correction Factor: 0.7800

APPENDIX E – Chain-of Custody Forms

NEWFIELDS

NewFields Northwest, LLC.
Shipping: 4729 NE View Dr.
Mailing: P.O. Box 216
Port Gamble, WA. 98364
Tel: (360) 297-6040, Fax: (360)297-7268

CHAIN OF CUSTODY

13293

Destination Lab: Nautilus
Destination Contact: Eric Tollefson
Date: 9/3/08
Turn-Around-Time: standard
Project Name: March Point Landfill
Contract/PO:

Sample Originator: Newfields
Contact Name: Brian Hester
Address: Same as above
Phone: —
Fax: —
E-mail: bhester@newfields.com

Report Results To: NewFields
Contact Name: Brian Hester
Address: Same

Phone: —
Fax: —
Email: —

Invoicing To: NewFields
Comments or Special Instructions: —

No.	Sample ID	Matrix	No. & Type of Container	Date & Time	Analysis: Microtox						Preservation	Sample Temp Upon Receipt	LAB ID
1	mp-1	SS	1-16oz	8/26/08 0809	X						4°C	3.2	S08-076
2	mp-2	SS	1-16oz	8/26/08 1145	X							4.2	S08-077
3	MP-3	SS	1-16oz	8/26/08 1100	X							2.6	S08-078
4	MP-4	SS	1-16oz	8/27/08 0800	X							3.7	S08-079
5	MP-5	SS	1-16oz	8/27/08 0836	X							2.5	S08-080
6	MP-6	SS	1-1LG(32oz)	8/28/08 0837	X							3.8	S08-081
7	MP-7	SS	1-16oz	8/27/08 1311	X							4.2	S08-082
8	MP-8	SS	1-16oz	8/27/08 1242	X							5.8	S08-083
9	MP-9	SS	1-16oz	8/27/08 1048	X							5.5	S08-084
10	MP-10	SS	1-16oz	8/27/08 1009	X							5.2	S08-085
11	MP-11	SS	1-16oz	8/27/08 1128	X							5.2	S08-086
12	MP-12	SS	1-16oz	8/27/08 0912	X							5.3	S08-087
13	MP-13	SS	1-16oz	8/27/08 1348	X							5.5	S08-088
14													
15													
16													
17													
18													
19													
20													

Relinquished by:	Recieved by:	Relinquished by:	Recieved by:
Print Name: Brian Hester	Print Name:	Print Name:	Print Name:
Signature:	Signature: Mary Ann Rempel-Hester	Signature:	Signature:
Affiliation: NewFields	Affiliation: Nautilus	Affiliation:	Affiliation:
Date/Time: 9/3/08 0645	Date/Time: 9/3/08 0645	Date/Time:	Date/Time:

Matrix Codes
FW = Fresh Water
WW = Waste Water
SB = Salt & Brackish Water
SS = Soil & Sediment
TS = plant & Animal Tissue
OT = Other

WHITE – return to originator • YELLOW – lab • PINK – retained by originator

NEWFIELDS

NewFields Northwest, LLC.
Shipping: 4729 NE View Dr.
Mailing: P.O. Box 216
Port Gamble, WA. 98364
Tel: (360) 297-6040, Fax: (360)297-7268

CHAIN OF CUSTODY

13308

Destination Lab: Nautilus
Destination Contact:
Date: 9/18/08
Turn-Around-Time
Project Name: ① March Point
② Log Haul Out
Contract/PO:

Sample Originator: NewFields
Contact Name: Brian Hester
Address: see Above
Phone:
Fax:
E-mail: bhester@newfields.com

Report Results To: NewFields
Contact Name: Brian Hester
Address:
Phone:
Fax:
Email:

Invoicing To: NewFields
Comments or Special Instructions: will provide correlation between Ref stations and project seds

No.	Sample ID	Matrix	No. & Type of Container	Date & Time	Analysis: Microtox						Preservation	Sample Temp Upon Receipt	LAB ID
1	CR-1 ①	SS	1 1L-G	9/17/08	X						4°C	6.6	S08-090
2	SBREF80 (1,2)	↓	2 1L-G	9/17/08	X						↓	6.9	S08-091
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													

Please Archive any leftover Reference Sed.

	Relinquished by:	Recieved by:	Relinquished by:	Recieved by:
Print Name:	BRIAN HESTER	MaryAnn Rempel-Hester		
Signature:				
Affiliation:	NewFields	Nautilus		
Date/Time:	9/18/08 0800	9/18/08 0800		

Matrix Codes
FW = Fresh Water
WW = Waste Water
SB = Salt & Brackish Water
SS = Soil & Sediment
TS = plant & Animal Tissue
OT = Other

APPENDIX B

LABORATORY DOCUMENTS

CHAIN OF CUSTODY

AMEC Geomatrix, Inc
3500 – 188th Street SW, Suite 600
Lynnwood, WA 98037
(425) 921-4000

CHAIN OF CUSTODY

New Fields

Checked by: __________

Place COC Form Number Label Here or write in seq. number below.

		Requested Analysis												
		SMS List of COCs	Mercury (digest and ho		TOC/TVS/TS	Grainsize	NH4		Bioassay	Microtox			Archive	
AMEC Geomatrix MP-12 COC Form Initials: RHG Date: 8/27/08 Time: 0912	Date: Time:								2	1				Number of containers 3
AMEC Geomatrix MP-13 COC Form Initials: RES Date: 8/27/08 Time: 1348	Date: Time:								2	1				Number of containers 3
AMEC Geomatrix MP-8 COC Form Initials: KAA Date: 8/27/08 Time: 12:42	Date: Time:								2	1				Number of containers 3
AMEC Geomatrix MP-9 COC Form Initials: KAA Date: 8/27/08 Time: 10:48	Date: Time:								2	1				Number of containers 3
AMEC Geomatrix MP-1 COC Form Initials: RHG Date: 8/28/08 Time: 0809	Date: Time:								2	1				Number of containers 3
AMEC Geomatrix MP-6 COC Form Initials: RHG Date: 8/28/08 Time: 8:37	Date: Time:								2	1				Number of containers 3
Place Sample ID Label Here or Write ID Number Here	Date: Time:													Number of containers

Laboratory/Analysis Comments

AMEC Geomatrix Project 14159.000
Dave Haddock Project Manager 206-342-1787 Cell 425-246-7409
AMEC Geomatrix Contact Rob Gilmour 425-921-4003 Cell 206-940-7635 or
Cliff Whitmus 425-921-4023

Relinquished By	Transported By	Received By
Name: Date: 8/29/08 Time: 0825		Name: Date: 8/29/08 Time: 0825
Name: Date: Time:		Name: Date: Time:

AMEC Geomatrix, Inc
3500 – 188th Street SW, Suite 600
Lynnwood, WA 98037
(425) 921-4000

CHAIN OF CUSTODY

Place COC Form Number Label Here
or write in seq. number below.

New Fields

Checked by: ____________

		Requested Analysis												
		SMS List of COCs	Mercury (digest and ho		TOC/TVS/TS	Grainsize	NH4		Bioassay	Microtox			Archive	
AMEC Geomatrix MP-3 COC Form Initials: KW Date: 8/26/08 Time: 1100	Date: Time:								X X 2	X 1				Number of containers 3
AMEC Geomatrix MP-2 COC Form Initials: Kw Date: 8/26/04 Time: 1145	Date: Time:								X X 2	X 1				Number of containers 3
AMEC Geomatrix MP-4 COC Form Initials: RGG Date: 8/27/08 Time: 0800	Date: Time:								2	1				Number of containers 3
AMEC Geomatrix MP-10 COC Form Initials: KAA Date: 8/27/08 Time: 10:09	Date: Time:								2	1				Number of containers 3
AMEC Geomatrix MP-5 COC Form Initials: RG Date: 08/27/08 Time: 0836	Date: Time:								2	1				Number of containers 3
AMEC Geomatrix MP-7 COC Form Initials: KAA Date: 8/27/08 Time: 13:11	Date: Time:								2	1				Number of containers 3
AMEC Geomatrix MP-11 COC Form Initials: KG Date: 8/27/08 Time: 1128	Date: Time:								2	1				Number of containers 3

Laboratory/Analysis Comments

AMEC Geomatrix Project 14159.000
Dave Haddock Project Manager 206-342-1787 Cell 425-246-7409
AMEC Geomatrix Contact Rob Gilmour 425-921-4003 Cell 206-940-7635 or
Cliff Whitmus 425-921-4023

Relinquished By	Transported By	Received By
Name: Date: 8/29/08 Time: 0820		Name: Date: 8/29/08 Time: 0825
Name: Date: Time:		Name: Date: Time:

NEWFIELDS

NewFields N west, LLC.
Shipping: 4729 NE View Dr.
Mailing: P.O. Box 216
Port Gamble, WA. 98364
Tel: (360) 297-6040, Fax: (360)297-7268

CHAIN OF CUSTC Y

13306

Destination Lab: New Fields
Destination Contact: Brian Hester
Date: 9/12/08
Turn-Around-Time: NA
Project Name
Contract/PO:

Sample Originator:
Contact Name:
Address:
Phone:
Fax:
E-mail

Report Results To:
Contact Name:
Address:
Phone:
Fax:
Email:

Invoicing To:
Comments or Special Instructions:

No.	Sample ID	Matrix	No. & Type of Container	Date & Time	Analysis						Preservation	Sample Temp Upon Receipt	LAB ID
1	CR-7 (53% fines)	Sed	5 gal/bag	9/12/08 1200									
2	CR-22 (15% fines)	↓	↓	↓ 1305									
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													

Relinquished by:	Recieved by:	Relinquished by:	Recieved by:
Print Name: Jay Word	Print Name: Brian Hester	Print Name:	Print Name:
Signature: Jay Word	Signature:	Signature:	Signature:
Affiliation: New Fields	Affiliation: NewFields	Affiliation:	Affiliation:
Date/Time: 9/12/08 1540	Date/Time: 9/12/08 1540	Date/Time:	Date/Time:

Matrix Codes
FW = Fresh Water
WW = Waste Water
SB = Salt & Brackish Water
SS = Soil & Sediment
TS = plant & Animal Tissue
OT = Other

WHITE – return to originator • YELLOW – lab • PINK – retained by originator

NEWFIELDS

NewFields N west, LLC.
Shipping: 4729 NE View Dr.
Mailing: P.O. Box 216
Port Gamble, WA. 98364
Tel: (360) 297-6040, Fax: (360)297-7268

CHAIN OF CUSTC Y

13307

Destination Lab: NewFields
Destination Contact: Brian Hester
Date: 9/16/08
Turn-Around-Time:

Project Name: Reference Sediment Collection
Contract/PO:

Sample Originator: Meg Pinza
Contact Name:
Address: NewFields
Phone: 297-6066
Fax:
E-mail

Report Results To:
Contact Name:
Address:

Phone:
Fax:
Email:

Invoicing To:

Comments or Special Instructions:

No.	Sample ID	Matrix	No. & Type of Container	Date & Time	Analysis: Bioassay						Preservation	Sample Temp Upon Receipt	LAB ID
1	SBREF 80	Sed	5gal/Bag	9/16/08 10:53	✓								
2	SBREF 35	Sed	5gal/Bag	9/16/08 10:53	✓								
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													

Relinquished by:	Recieved by:	Relinquished by:	Recieved by:	Matrix Codes
Print Name: Meg Pinza	Print Name: BRIAN HESTER	Print Name:	Print Name:	FW = Fresh Water WW = Waste Water
Signature: Meg Pinza	Signature:	Signature:	Signature:	SB = Salt & Brackish Water SS = Soil & Sediment
Affiliation: NewFields	Affiliation: NewFields	Affiliation:	Affiliation:	TS = plant & Animal Tissue OT = Other
Date/Time: 9/~~15~~/08 16 10:53	Date/Time: 9/16/08 1055	Date/Time:	Date/Time:	

WHITE – return to originator • YELLOW – lab • PINK – retained by originator

BIOLOGICAL TESTING OF SEDIMENT FOR
MARCH POINT (WHITMARSH) LANDFILL
ANACORTES, WASHINGTON

ORGANISM RECIEPT LOGS

NEWFIELDS

ORGANISM RECEIPT LOG

Date: 9/17/08

Time: 1345

NewFields Batch No. JB 9173

Organism: Ampelisca

Source: Brezina & Assoc.

Address: On File

Invoice Attached Yes [✓ No]

Phone: On File

Contact: On File

No. Ordered:

No. Received:

Source Batch: Field collected

Condition of Organisms: Good

Approximate Size or Age:

Shipper: FedEx

B of L (Tracking No.) 8662 6888 9173

Condition of Container: Good

Received By: MMB

Confirmation of ID of Organism: Yes [✓ No]

Technician (Initials): MMB

Notes:

pH (Units)	Temp. (°C)	D.O. (mg/L)	Conductivity or Salinity (Include Units)	Technician (Initials)
6.6	17.5	> 20.0	29 ppt	MMB

Notes:

NEWFIELDS

ORGANISM RECEIPT LOG

Date: 9/23/08

Time: 0900

NewFields Batch No. De 092308

Organism: Dendraster excentricus

Source: Field

Address: NA

Invoice Attached Yes [✓ No]

Phone:

Contact:

No. Ordered: 200

No. Received: ~200

Source Batch:

Condition of Organisms: Good

Approximate Size or Age: Adult

Shipper: NF courier

B of L (Tracking No.) NA

Condition of Container: Good

Received By: CR

Confirmation of ID of Organism: Yes [✓ No]

Technician (Initials):

Notes:

pH (Units)	Temp. (°C)	D.O. (mg/L)	Conductivity or Salinity (Include Units)	Technician (Initials)
* Received dry →				CK

Notes:

BIOLOGICAL TESTING OF SEDIMENT FOR
MARCH POINT (WHITMARSH) LANDFILL
ANACORTES, WASHINGTON

AMPHIPOD TEST

NEWFIELDS

10-DAY SOLID PHASE TEST OBSERVATION DATA

CLIENT	PROJECT	NEWFIELDS JOB NO.	PROJECT MAN.	NEWFIELDS LABORATOR	PROTOCOL	SPECIES
AMEC - Geomatrix	March Point	1437-001-860-1	M. Pinza	Port Gamble Bath 4	PSEP 1995	*Ampelisca abdida*

#E= Emergence
(Surface of sediment, swimming in water column, or floating on surface)
#M= Number of Mortality
D=No Air Flow (DO?)
N=Normal
G=Growth
(Fungal, algal, or bacterial mats)

INITIAL # OF ORGANISMS

ENDPOINT DATA & OBSERVATIONS

CLIENT/ NEWFIELDS ID	REP	JAR #	INITIAL #	DATE 9/24	DATE 9/25	DATE 9/26	DATE 9/27	DATE 9/28	DATE 9/29	DATE 9/30	DATE 10/1	DATE 10/2	DATE	NUMBER ALIVE
				TECHNICIAN CR	TECHNICIAN TT	TECHNICIAN CR	TECHNICIAN CR	TECHNICIAN CR	TECHNICIAN CR	TECHNICIAN TS	TECHNICIAN TS	TECHNICIAN t	TECHNICIAN	
				OBSERVNS	OBSERVNS	OBSERVNS	OBSERVNS	OBSERVNS	OBSERVNS	OBSERVNS	OBSERVNS	OBSERVNS	OBSERVNS	
Control /	1	38		N	N	N	N	N	G	G	G	N		18
	2	73		↓	↓	↓	↓	↓	G	↓	↓	↓		18
	3	48		↓	↓	↓	↓	↓	G	↓	↓	↓		17
	4	45		↓	↓	↓	↓	↓	G	↓	↓	↓		18
	5	66		↓	↓	↓	↓	↓	G	↓	↓	↓		20
CR-1 / .	1	59		↓	↓	↓	↓	↓	N	N	N	N		17
	2	3		↓	↓	↓	↓	↓	↓	↓	↓	↓		15
	3	8		↓	↓	↓	↓	↓	↓	↓	↓	↓		20
	4	16		↓	↓	↓	↓	↓	↓	↓	↓	↓		17
	5	85		↓	↓	↓	↓	↓	↓	↓	G	↓		16
SBREF-80 / .	1	62		11E	N	↓	N	N	↓	↓	N	N		0
	2	10		10E	4E	12E	5E 7M	4E	↓	↓	↓	↓		0
	3	19		N	N	N	N	N	↓	↓	↓	↓		0
	4	15		3E	4E	6E	4M	N	↓	↓	↓	↓		1
	5	78		N	N	N	N	2E	↓	↓	↓	↓		0
MP-1 / .	1	30		N	N	N	G	G	G	G	G	G		18
	2	89		↓	G	G	↓	↓	↓	↓	↓	↓		18
	3	21		↓	N	G	↓	↓	↓	↓	↓	↓		14
	4	76		↓	G	G	↓	↓	↓	↓	↓	↓		16
	5	47		1E	G	G	↓	↓	↓	↓	↓	↓		16

10-DAY SOLID PHASE TEST OBSERVATION DATA

NEWFIELDS

CLIENT: AMEC - Geomatrix
PROJECT: March Point
NEWFIELDS JOB NO.: 1437-001-860-1
PROJECT MAN.: M. Pinza
NEWFIELDS LABORATOR: Port Gamble Bath 4
PROTOCOL: PSEP 1995
SPECIES: *Ampelisca abdida*

#E= Emergence (Surface of sediment, swimming in water column, or floating on surface)
#M= Number of Mortality
D=No Air Flow (DO?)
N=Normal
G=Growth (Fungal, algal, or bacterial mats)

INITIAL # OF ORGANISMS

ENDPOINT DATA & OBSERVATIONS

				DATE 9/24	DATE 9/25	DATE 9/26	DATE 9/27	DATE 9/28	DATE 9/29	DATE 9/30	DATE 10/1	DATE 10/2	DATE	
				TECHNICIAN CR	TECHNICIAN TS	TECHNICIAN CR	TECHNICIAN CR	TECHNICIAN CR	TECHNICIAN CR	TECHNICIAN TS	TECHNICIAN	TECHNICIAN	TECHNICIAN	
CLIENT/ NEWFIELDS ID	REP	JAR #	INITIAL #	OBSERVNS	OBSERVNS	OBSERVNS	OBSERVNS	OBSERVNS	OBSERVNS	OBSERVNS	OBSERVNS	OBSERVNS	OBSERVNS	NUMBER ALIVE
MP-2 / .	1	37		N	G	G	G	G	G	G	G	G		17
	2	24			G	G								19
	3	58			G	G								19
	4	28			G	G								17
	5	36			N	G								18
MP-3 / .	1	91		↓	G	G								14
	2	95		G	G	G								14
	3	56		N	G	G								15
	4	70			G	G								18
	5	33			N	G								15
MP-4 / .	1	94				G								14
	2	11				G								15
	3	1			↓	N								15
	4	84			G	G								15
	5	60			G	G								14
MP-5 / .	6	54			N	G								14
	7	67				G								15
	8	44				G								14
	9	23				G		↓	↓	↓	↓	↓		14
	10	9		↓	↓	N	↓							14

10-DAY SOLID PHASE TEST OBSERVATION DATA

NEWFIELDS

CLIENT: AMEC - Geomatrix
PROJECT: March Point
NEWFIELDS JOB N0.: 1437-001-860-1
PROJECT MAN.: M. Pinza
NEWFIELDS LABORATOR: Port Gamble Bath 4
PROTOCOL: PSEP 1995
SPECIES: *Ampelisca abdida*

#E= Emergence
(Surface of sediment, swimming in water column, or floating on surface)
#M= Number of Mortality
D=No Air Flow (DO?)
N=Normal
G=Growth
(Fungal, algal, or bacterial mats)

INITIAL # OF ORGANISMS

ENDPOINT DATA & OBSERVATIONS

CLIENT/ NEWFIELDS ID	REP	JAR #	INITIAL #	DATE 9/24 TECHNICIAN CR OBSERVNS	DATE 9/25 TECHNICIAN TS OBSERVNS	DATE 9/26 TECHNICIAN CR OBSERVNS	DATE 9/27 TECHNICIAN CR OBSERVNS	DATE 9/28 TECHNICIAN CR OBSERVNS	DATE 9/29 TECHNICIAN CR OBSERVNS	DATE 9/30 TECHNICIAN TJ OBSERVNS	DATE 10/1 TECHNICIAN TS OBSERVNS	DATE 10/2 TECHNICIAN + OBSERVNS	DATE TECHNICIAN OBSERVNS	NUMBER ALIVE
MP-6 / .	1	34		N	N	N	G	G	G	G	G	G		17
	2	80		↓	G	G	↓	↓	↓	↓	↓	↓		20
	3	40		↓	N	N	↓	↓	↓	↓	↓	↓		18
	4	32		↓	G	G	↓	↓	↓	↓	↓	↓		18
	5	13		↓	G	N	↓	↓	↓	↓	↓			15
MP-7 / .	1	83		↓	N	↓	N	N	N	N	G	G		15
	2	14		↓	↓	↓	↓	↓	↓	↓	G	↓		10
	3	93		↓	↓	↓	↓	↓	↓	↓	N	↓		15
	4	81		↓	↓	↓	↓	↓	↓	↓	G	↓		16
	5	26		↓	↓	↓	↓	↓	↓	↓	G	↓		18
MP-8 / .	1	87		↓	G	G	G	G	G	G	G	N		18
	2	92		↓	G	N	↓	↓	↓	↓	↓	↓		18
	3	53		↓	N	G	↓	↓	↓	↓	↓	↓		17
	4	79		↓	G	G	↓	↓	↓	↓	↓	↓		18
	5	41		1E	N	G	↓	↓	↓	↓	↓			17
MP-9 / .	1	77		N	↓	G	G	G	G	G	↓	N		18
	2	57		↓	↓	N	N	N	N	↓	↓	↓		16
	3	49		↓	↓	↓	N	N	N	↓	↓	↓		18
	4	29		↓	↓	↓	G	G	G	↓	↓	↓		16
	5	61		1E	↓	↓	G	G	G	↓	↓	↓		7

NEWFIELDS

10-DAY SOLID PHASE TEST OBSERVATION DATA

CLIENT	PROJECT	NEWFIELDS JOB NO.	PROJECT MAN.	NEWFIELDS LABORATOR	PROTOCOL	SPECIES
AMEC - Geomatrix	March Point	1437-001-860-1	M. Pinza	Port Gamble Bath 4	PSEP 1995	*Ampelisca abdida*

#E= Emergence
(Surface of sediment, swimming in water column, or floating on surface)
#M= Number of Mortality
D=No Air Flow (DO?)
N=Normal
G=Growth
(Fungal, algal, or bacterial mats)

INITIAL # OF ORGANISMS

ENDPOINT DATA & OBSERVATIONS

CLIENT/ NEWFIELDS ID	REP	JAR #	INITIAL #	DATE 9/24 TECHNICIAN CR OBSERVNS	DATE 9/25 TECHNICIAN TS OBSERVNS	DATE 9/26 TECHNICIAN CR OBSERVNS	DATE 9/27 TECHNICIAN CR OBSERVNS	DATE 9/28 TECHNICIAN CR OBSERVNS	DATE 9/29 TECHNICIAN CR OBSERVNS	DATE 9/30 TECHNICIAN TS OBSERVNS	DATE 10/1 TECHNICIAN TS OBSERVNS	DATE 10/2 TECHNICIAN J OBSERVNS	DATE TECHNICIAN OBSERVNS	NUMBER ALIVE
MP-10 / .	1	35		N	G	G	G	G	G	G	G	G		20
	2	88		N	G	G								16
	3	82		N	G	G								15
	4	17		2E	G	G								16
	5	52		N	G	G								17
MP-11 / .	1	64		G	G	G								20
	2	74		G	G	G								18
	3	68		N	N	G								18
	4	90		G	G	G								16
	5	22		N	N	G	↓							11
MP-12 / .	1	42				N	G							18
	2	43					G							11
	3	72					1M							15
	4	31					G							17
	5	69			↓	↓	G							16
MP-13 / .	1	86			G	G	G							15
	2	65			G	G								9
	3	96			N	G								14
	4	39			G	G	↓							16
	5	25		↓	G	G		↓	↓	↓	↓	↓		18

NEWFIELDS

10-DAY SOLID PHASE TEST OBSERVATION DATA

CLIENT	PROJECT	NEWFIELDS JOB NO.	PROJECT MAN.	NEWFIELDS LABORATOR	PROTOCOL	SPECIES
AMEC - Geomatrix	March Point	1437-001-860-1	M. Pinza	Port Gamble Bath 4	PSEP 1995	*Ampelisca abdida*

#E= Emergence
(Surface of sediment, swimming in water column, or floating on surface)
#M= Number of Mortality
D=No Air Flow (DO?)
N=Normal
G=Growth
(Fungal, algal, or bacterial mats)

INITIAL # OF ORGANISMS: 20

ENDPOINT DATA & OBSERVATIONS

				DATE 10/1	DATE 10/2	DATE 10/3	DATE 10/4	DATE 10/5	DATE 10/6	DATE 10/7	DATE 10/8	DATE 10/9	DATE 10/10	
				TECHNICIAN TS	TECHNICIAN [illegible]	TECHNICIAN [illegible]	TECHNICIAN MMB	TECHNICIAN MMB	TECHNICIAN MMB	TECHNICIAN TS	TECHNICIAN MMB	TECHNICIAN TS	TECHNICIAN CR	
CLIENT/ NEWFIELDS ID	REP	JAR #	INITIAL #	OBSERVNS	OBSERVNS	OBSERVNS	OBSERVNS	OBSERVNS	OBSERVNS	OBSERVNS	OBSERVNS	OBSERVNS	OBSERVNS	NUMBER ALIVE
SBREF-80 /	1	38	▨	N	N	N	N	N	N	N	N	N	N	12
	2	73	▨	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	13
	3	48	▨	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	19
	4	45	▨	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	17
	5	66	▨	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	20

NEWFIELDS

10 DAY SOLID PHASE TEST WATER QUALITY DATA

CLIENT AMEC - Geomatrix	**PROJECT** March Point	**START TIME/ END TIME** /	**DILUTION WATER BATCH** FSW092208.01	**TEST SPECIES** *Ampelisca abdida*
				TEST START DATE 23-Sep-2008
NEWFIELDS JOB NUMBER 1437-001-860-1	**PROJECT MANAGER** M. Pinza	**NEWFIELDS LABORATORY** Port Gamble/Bath 4	**TEMP. RECDR./HOBO#**	**TEST END DATE** 3-Oct-2008

13.5

WATER QUALITY DATA

Test Conditions				DO (mg/L) > 4.6		Temp ° C 20 ± 1		SALINITY (ppt) 28 ± 1		pH (pH units) 7.8 ± 0.5		Initials & Date	
CLIENT/NEWFIELDS ID	DAY	REP	JAR #	D.O.		TEMP		SALINITY		pH		TECH.	Date
				meter	mg/L	meter	°C	meter	ppt	meter	unit		
Control /	0	Surr	51	4	7.6	4	20.1	1	~~28~~ ①30	1	7.8	CR	9/23
Control /	1	Surr	51	4	7.5	4	20.5	1	30	1	8.0	CR	9/24
Control /	2	Surr	51	3	6.8	3	20.2	R	30	3	7.9	TS	9/25
Control /	3	Surr	51	3	7.0	3	20.3	R	30	3	7.8	TS	9/26
Control /	4	Surr	51	4	7.5	4	20.7	1	31	1	8.1	CR	9/27
Control /	5	Surr	51	4	7.7	4	20.0	1	31	1	8.1	CR	9/28
Control /	6	Surr	51	4	7.7	4	20.6	1	30	1	8.1	CR	9/29
Control /	7	Surr	51	4	7.7	4	20.6	1	30	1	8.1	TJ	9/30
Control /	8	Surr	51	4	7.6	4	20.3	1	30	1	8.1	TS	10/1
Control /	9	Surr	51	3	7.1	3	20.3	R	31	3	8.1	[illegible]	10/2
Control /	10	Surr	51	4	7.6	4	20.3	1	30	1	8.3	MPP	10/3

①WP CR 9/23

NEWFIELDS

10 DAY SOLID PHASE TEST WATER QUALITY DATA

CLIENT AMEC - Geomatrix	**PROJECT** March Point	**START TIME/ END TIME** /	**DILUTION WATER BATCH** FSW092208.01	**TEST SPECIES** *Ampelisca abdida* **TEST START DATE** 23-Sep-2008
NEWFIELDS JOB NUMBER 1437-001-860-1	**PROJECT MANAGER** M. Pinza	**NEWFIELDS LABORATORY** Port Gamble/Bath 4	**TEMP. RECDR./HOBO#**	**TEST END DATE** 3-Oct-2008

1315

WATER QUALITY DATA

Test Conditions				DO (mg/L) > 4.6		Temp ° C 20 ± 1		SALINITY (ppt) 28 ± 1		pH (pH units) 7.8 ± 0.5		Initials & Date	
				D.O.		TEMP		SALINITY		pH			
CLIENT/NEWFIELDS ID	DAY	REP	JAR #	meter	mg/L	meter	°C	meter	ppt	meter	unit	TECH.	Date
CR-1 / .	0	Surr	46	4	7.4	4	20.2	1	29	1	7.7	CR	9/23
CR-1 / .	1	Surr	46	4	7.6	4	20.4	1	30	1	8.0	CR	9/24
CR-1 / .	2	Surr	46	3	6.8	3	20.2	R	30	3	7.9	TS	9/25
CR-1 / .	3	Surr	46	3	7.2	3	20.3	R	30	3	7.9	TS	9/26
CR-1 / .	4	Surr	46	4	7.6	4	20.6	1	31	1	8.1	CR	9/27
CR-1 / .	5	Surr	46	4	7.7	4	20.0	1	31	1	8.0	CR	9/28
CR-1 / .	6	Surr	46	4	7.6	4	20.6	1	30	1	8.1	CR	9/29
CR-1 / .	7	Surr	46	4	7.6	4	20.6	1	30	1	8.1	TS	9/30
CR-1 / .	8	Surr	46	4	7.6	4	20.3	1	30	1	8.2	TS	10/1
CR-1 / .	9	Surr	46	3	7.1	3	20.3	R	30	3	8.2	[illegible]	10/2
CR-1 / .	10	Surr	46	4	7.6	4	20.3	1	30	1	8.3	MPP	10/3

NEWFIELDS

10 DAY SOLID PHASE TEST WATER QUALITY DATA

CLIENT AMEC - Geomatrix	PROJECT March Point	START TIME/ END TIME /	DILUTION WATER BATCH FSW092208.01	TEST SPECIES *Ampelisca abdida*
				TEST START DATE 23-Sep-2008 1315
NEWFIELDS JOB NUMBER 1437-001-860-1	PROJECT MANAGER M. Pinza	NEWFIELDS LABORATORY Port Gamble/Bath 4	TEMP. RECDR./HOBO#	TEST END DATE 3-Oct-2008

WATER QUALITY DATA

Test Conditions				DO (mg/L) > 4.6		Temp ° C 20 ± 1		SALINITY (ppt) 28 ± 1		pH (pH units) 7.8 ± 0.5		Initials & Date	
				D.O.		TEMP		SALINITY		pH			
CLIENT/NEWFIELDS ID	DAY	REP	JAR #	meter	mg/L	meter	°C	meter	ppt	meter	unit	TECH.	Date
SBREF-80 / .	0	Surr	50	4	7.5	4	20.2	1	28	1	7.8	CR	9/23
SBREF-80 / .	1	Surr	50	4	7.5	4	20.4	1	29	1	8.0	CR	9/24
SBREF-80 / .	2	Surr	50	3	6.8	3	20.2	R	29	3	7.9	TS	9/25
SBREF-80 / .	3	Surr	50	3	7.1	3	20.3	R	28	3	7.9	TS	9/26
SBREF-80 / .	4	Surr	50	4	7.5	4	20.7	1	30	1	8.2	CR	9/27
SBREF-80 / .	5	Surr	50	4	7.6	4	20.1	1	30	1	8.2	CR	9/28
SBREF-80 / .	6	Surr	50	4	7.6	4	20.6	1	29	1	8.3	CR	9/29
SBREF-80 / .	7	Surr	50	4	7.6	4	20.7	1	29	1	8.3	TS	9/30
SBREF-80 / .	8	Surr	50	4	7.5	4	20.3	1	29	1	8.3	TS	10/1
SBREF-80 / .	9	Surr	50	3	7.1	2	20.3	R	30	3	8.3	[illegible]	10/2
SBREF-80 / .	10	Surr	50	4	7.5	4	20.3	1	29	1	8.4	MPP	10/3

NEWFIELDS

10 DAY SOLID PHASE TEST WATER QUALITY DATA

				TEST SPECIES *Ampelisca abdida*
CLIENT AMEC - Geomatrix	**PROJECT** March Point	**START TIME/ END TIME** /	**DILUTION WATER BATCH** FSW092208.01	**TEST START DATE** 23-Sep-2008
NEWFIELDS JOB NUMBER 1437-001-860-1	**PROJECT MANAGER** M. Pinza	**NEWFIELDS LABORATORY** Port Gamble/Bath 4	**TEMP. RECDR./HOBO#**	**TEST END DATE** 3-Oct-2008

1315

WATER QUALITY DATA

Test Conditions				DO (mg/L) > 4.6		Temp ° C 20 ± 1		SALINITY (ppt) 28 ± 1		pH (pH units) 7.8 ± 0.5		Initials & Date	
CLIENT/NEWFIELDS ID	DAY	REP	JAR #	D.O.		TEMP		SALINITY		pH		TECH.	Date
				meter	mg/L	meter	°C	meter	ppt	meter	unit		
MP-1 / .	0	Surr	7	4	7.7	4	20.1	1	28	1	7.7	CR	9/23
MP-1 / .	1	Surr	7	4	7.4	4	20.4	1	28	1	8.0	CR	9/24
MP-1 / .	2	Surr	7	3	6.9	3	20.2	R	28	3	7.8	TS	9/25
MP-1 / .	3	Surr	7	3	6.6	3	20.2	R	26	3	7.8	TS	9/26
MP-1 / .	4	Surr	7	4	7.3	4	20.7	1	28	1	8.0	CR	9/27
MP-1 / .	5	Surr	7	4	7.5	4	20.0	1	28	1	8.0	CR	9/28
MP-1 / .	6	Surr	7	4	7.5	4	20.6	1	26	1	7.9	CR	9/29
MP-1 / .	7	Surr	7	4	7.7	4	20.5	1	① ~~28~~ 24	1	① ~~8.2~~ 7.9	TS	9/30
MP-1 / .	8	Surr	7	4	7.5	4	20.2	1	26	1	8.0	TS	10/1
MP-1 / .	9	Surr	7	3	7.0	3	20.1	R	26	3	7.9	J	10/2
MP-1 / .	10	Surr	7	4	7.6	4	20.2	1	26	1	8.2		10/3

① WE 9/30/08 TS

NEWFIELDS

10 DAY SOLID PHASE TEST WATER QUALITY DATA

				TEST SPECIES *Ampelisca abdida*
CLIENT AMEC - Geomatrix	**PROJECT** March Point	**START TIME/ END TIME** /	**DILUTION WATER BATCH** FSW092208.01	**TEST START DATE** 23-Sep-2008
NEWFIELDS JOB NUMBER 1437-001-860-1	**PROJECT MANAGER** M. Pinza	**NEWFIELDS LABORATORY** Port Gamble/Bath 4	**TEMP. RECDR./HOBO#**	**TEST END DATE** 3-Oct-2008

1315

WATER QUALITY DATA

Test Conditions				DO (mg/L) > 4.6		Temp °C 20 ± 1		SALINITY (ppt) 28 ± 1		pH (pH units) 7.8 ± 0.5		Initials & Date	
CLIENT/NEWFIELDS ID	DAY	REP	JAR #	D.O.		TEMP		SALINITY		pH		TECH.	Date
				meter	mg/L	meter	°C	meter	ppt	meter	unit		
MP-2 / .	0	Surr	71	4	7.6	4	20.2	1	28	1	7.7	CR	9/23
MP-2 / .	1	Surr	71	4	7.5	4	20.5	1	28	1	7.8	CR	9/24
MP-2 / .	2	Surr	71	3	6.9	3	20.3	R	28	3	7.8	TS	9/25
MP-2 / .	3	Surr	71	3	6.9	3	20.3	R	28	3	7.9	TS	9/26
MP-2 / .	4	Surr	71	4	6.8	4	20.8	1	29	1	8.1	CR	9/27
MP-2 / .	5	Surr	71	4	7.2	4	20.0	1	29	1	8.1	CR	9/28
MP-2 / .	6	Surr	71	4	7.5	4	20.7	1	27	1	8.4	CR	9/29
MP-2 / .	7	Surr	71	4	7.7	4	20.7	1	28	1	8.6	TS	9/30
MP-2 / .	8	Surr	71	4	7.7	4	20.3	1	28	1	8.5	TS	10/1
MP-2 / .	9	Surr	71	3	7.1	3	20.3	R	28	3	8.5	L	10/2
MP-2 / .	10	Surr	71	4	7.6	4	20.4	1	28	1	8.5	MPP	10/3

NEWFIELDS

10 DAY SOLID PHASE TEST WATER QUALITY DATA

1315

CLIENT AMEC - Geomatrix	**PROJECT** March Point	**START TIME/ END TIME** /	**DILUTION WATER BATCH** FSW092208.01	**TEST SPECIES** *Ampelisca abdida*
				TEST START DATE 23-Sep-2008
NEWFIELDS JOB NUMBER 1437-001-860-1	**PROJECT MANAGER** M. Pinza	**NEWFIELDS LABORATORY** Port Gamble/Bath 4	**TEMP. RECDR./HOBO#**	**TEST END DATE** 3-Oct-2008

WATER QUALITY DATA

Test Conditions				DO (mg/L) > 4.6		Temp ° C 20 ± 1		SALINITY (ppt) 28 ± 1		pH (pH units) 7.8 ± 0.5		Initials & Date	
				D.O.		TEMP		SALINITY		pH			
CLIENT/NEWFIELDS ID	DAY	REP	JAR #	meter	mg/L	meter	°C	meter	ppt	meter	unit	TECH.	Date
MP-3 / .	0	Surr	2	4	7.5	4	19.6	1	28	1	7.6	CR	9/23
MP-3 / .	1	Surr	2	4	7.1	4	19.6	1	28	1	7.5	CR	9/24
MP-3 / .	2	Surr	2	3	6.4	3	19.9	R	28	3	8.0	TS	9/25
MP-3 / .	3	Surr	2	3	6.6	3	20.0	R	28	3	7.9	TS	9/26
MP-3 / .	4	Surr	2	4	7.2	4	20.5	1	29	1	8.1	CR	9/27
MP-3 / .	5	Surr	2	4	6.0	4	19.7	1	29	1	8.2	CR	9/28
MP-3 / .	6	Surr	2	4	7.3	4	20.3	1	27	1	8.4	CR	9/29
MP-3 / .	7	Surr	2	4	7.5	4	20.4	1	27	1	8.5	TS	9/30
MP-3 / .	8	Surr	2	4	① ~~8.8~~ 7.5	4	20.0	1	27	1	8.4	TS	10/1
MP-3 / .	9	Surr	2	3	6.4	3	19.9	R	28	3	8.4	J	10/2
MP-3 / .	10	Surr	2	4	7.6	4	19.6	1	28	1	8.3	MRP	10/3

① WE 10/1/08 TS

NEWFIELDS

10 DAY SOLID PHASE TEST WATER QUALITY DATA

				TEST SPECIES *Ampelisca abdida*
CLIENT AMEC - Geomatrix	**PROJECT** March Point	**START TIME/ END TIME** /	**DILUTION WATER BATCH** FSW092208.01	**TEST START DATE** 23-Sep-2008
NEWFIELDS JOB NUMBER 1437-001-860-1	**PROJECT MANAGER** M. Pinza	**NEWFIELDS LABORATORY** Port Gamble/Bath 4	**TEMP. RECDR./HOBO#**	**TEST END DATE** 3-Oct-2008

1315

WATER QUALITY DATA

Test Conditions				DO (mg/L) > 4.6		Temp ° C 20 ± 1		SALINITY (ppt) 28 ± 1		pH (pH units) 7.8 ± 0.5		Initials & Date	
				D.O.		TEMP		SALINITY		pH			
CLIENT/NEWFIELDS ID	DAY	REP	JAR #	meter	mg/L	meter	°C	meter	ppt	meter	unit	TECH.	Date
MP-4 / .	0	Surr	20	4	7.4	4	20.1	1	28	1	7.7	CR	9/23
MP-4 / .	1	Surr	20	4	7.5	4	204	1	28	1	8.0	CR	9/24
MP-4 / .	2	Surr	20	3	7.1	3	20.2	R	28	3	7.9	TS	9/25
MP-4 / .	3	Surr	20	3	6.9	3	20.2	R	27	3	7.9	TS	9/26
MP-4 / .	4	Surr	20	4	7.5	4	20.7	1	28	1	8.1	CR	9/27
MP-4 / .	5	Surr	20	4	7.7	4	19.8	1	28	1	8.0	CR	9/28
MP-4 / .	6	Surr	20	4	7.6	4	20.5	1	26	1	8.0	CR	9/29
MP-4 / .	7	Surr	20	4	7.7	4	20.6	1	26	1	8.1	TS	9/30
MP-4 / .	8	Surr	20	4	7.7	4	20.2	1	27	1	8.1	TS	10/1
MP-4 / .	9	Surr	20	3	7.2	3	20.2	R	27	3	8.1	[illegible]	10/2
MP-4 / .	10	Surr	20	4	7.6	4	20.2	1	27	1	8.3	MPP	10/3

NEWFIELDS

10 DAY SOLID PHASE TEST WATER QUALITY DATA

				TEST SPECIES *Ampelisca abdida*
CLIENT AMEC - Geomatrix	**PROJECT** March Point	**START TIME/ END TIME** /	**DILUTION WATER BATCH** FSW092208.01	**TEST START DATE** 23-Sep-2008 1315
NEWFIELDS JOB NUMBER 1437-001-860-1	**PROJECT MANAGER** M. Pinza	**NEWFIELDS LABORATORY** Port Gamble/Bath 4	**TEMP. RECDR./HOBO#**	**TEST END DATE** 3-Oct-2008

WATER QUALITY DATA

Test Conditions				DO (mg/L) > 4.6		Temp ° C 20 ± 1		SALINITY (ppt) 28 ± 1		pH (pH units) 7.8 ± 0.5		Initials & Date	
				D.O.		TEMP		SALINITY		pH			
CLIENT/NEWFIELDS ID	DAY	REP	JAR #	meter	mg/L	meter	°C	meter	ppt	meter	unit	TECH.	Date
MP-5 / .	0	Surr	12	4	7.5	4	20.1	1	28	1	7.7	CR	9/23
MP-5 / .	1	Surr	12	4	7.5	4	20.4	1	28	1	8.0	CR	9/24
MP-5 / .	2	Surr	12	3	6.9	3	20.1	R	28	3	7.9	TS	9/25
MP-5 / .	3	Surr	12	3	6.8	3	20.2	R	27	3	7.9	TS	9/26
MP-5 / .	4	Surr	12	4	7.5	4	20.7	1	29	1	8.1	CR	9/27
MP-5 / .	5	Surr	12	4	7.7	4	20.0	1	29	1	8.1	CR	9/28
MP-5 / .	6	Surr	12	4	7.7	4	20.5	1	28	1	8.1	CR	9/29
MP-5 / .	7	Surr	12	4	7.6	4	20.4	1	28	1	8.2	TS	9/30
MP-5 / .	8	Surr	12	4	7.7	4	20.2	1	28	1	8.1	TS	10/1
MP-5 / .	9	Surr	12	3	7.1	3	20.1	R	28	3	8.2	[illegible]	10/2
MP-5 / .	10	Surr	12	4	7.6	4	20.2	1	28	1	8.3	MPP	10/3

NEWFIELDS

10 DAY SOLID PHASE TEST WATER QUALITY DATA

CLIENT AMEC - Geomatrix	PROJECT March Point	START TIME/ END TIME /	DILUTION WATER BATCH FSW092208.01	TEST SPECIES *Ampelisca abdida*	
				TEST START DATE 23-Sep-2008	1315
NEWFIELDS JOB NUMBER 1437-001-860-1	PROJECT MANAGER M. Pinza	NEWFIELDS LABORATORY Port Gamble/Bath 4	TEMP. RECDR./HOBO#	TEST END DATE 3-Oct-2008	

WATER QUALITY DATA

Test Conditions				DO (mg/L) > 4.6		Temp °C 20 ± 1		SALINITY (ppt) 28 ± 1		pH (pH units) 7.8 ± 0.5		Initials & Date	
CLIENT/NEWFIELDS ID	DAY	REP	JAR #	D.O.		TEMP		SALINITY		pH		TECH.	Date
				meter	mg/L	meter	°C	meter	ppt	meter	unit		
MP-6 / .	0	Surr	63	4	7.4	4	20.1	1	28	1	7.6	CR	9/23
MP-6 / .	1	Surr	63	4	7.3	4	20.5	1	28	1	7.8	CR	9/24
MP-6 / .	2	Surr	63	3	6.7	3	20.3	R	28	3	7.5	TB	9/25
MP-6 / .	3	Surr	63	3	6.9	3	20.3	R	27	3	7.4	TS	9/26
MP-6 / .	4	Surr	63	4	7.4	4	20.7	1	29	1	7.9	CL	9/27
MP-6 / .	5	Surr	63	4	7.6	4	20.1	1	29	1	7.6	CR	9/28
MP-6 / .	6	Surr	63	4	7.6	4	20.6	1	27	1	8.0	CR	9/29
MP-6 / .	7	Surr	63	4	7.6	4	20.7	1	28	1	8.1	TS	9/30
MP-6 / .	8	Surr	63	4	7.6	4	20.4	1	28	1	8.0	TS	10/1
MP-6 / .	9	Surr	63	3	7.2	3	20.3	R	28	3	7.4	[illegible]	10/2
MP-6 / .	10	Surr	63	4	7.6	4	20.3	1	28	1	8.3	MRP	10/3

NEWFIELDS

10 DAY SOLID PHASE TEST WATER QUALITY DATA

1315

				TEST SPECIES *Ampelisca abdida*
CLIENT AMEC - Geomatrix	**PROJECT** March Point	**START TIME/ END TIME** /	**DILUTION WATER BATCH** FSW092208.01	**TEST START DATE** 23-Sep-2008
NEWFIELDS JOB NUMBER 1437-001-860-1	**PROJECT MANAGER** M. Pinza	**NEWFIELDS LABORATORY** Port Gamble/Bath 4	**TEMP. RECDR./HOBO#**	**TEST END DATE** 3-Oct-2008

WATER QUALITY DATA

Test Conditions				DO (mg/L) > 4.6		Temp °C 20 ± 1		SALINITY (ppt) 28 ± 1		pH (pH units) 7.8 ± 0.5		Initials & Date	
CLIENT/NEWFIELDS ID	DAY	REP	JAR #	D.O.		TEMP		SALINITY		pH		TECH.	Date
				meter	mg/L	meter	°C	meter	ppt	meter	unit		
MP-7 / .	0	Surr	55	4	7.6	4	20.1	1	28	1	7.9	CR	9/23
MP-7 / .	1	Surr	55	4	7.5	4	20.5	1	28	1	8.1	CR	9/24
MP-7 / .	2	Surr	55	3	7.1	3	20.2	R	28	3	7.9	TS	9/25
MP-7 / .	3	Surr	55	3	7.0	3	20.3	R	28	3	7.9	TS	9/26
MP-7 / .	4	Surr	55	4	7.5	4	20.7	1	29	1	8.2	CR	9/27
MP-7 / .	5	Surr	55	4	7.5	4	20.0	1	29	1	8.1	CR	9/28
MP-7 / .	6	Surr	55	4	7.4	4	20.6	1	28	1	8.2	CR	9/29
MP-7 / .	7	Surr	55	4	7.6	4	20.7	1	28	1	8.3	TS	9/30
MP-7 / .	8	Surr	55	4	7.6	4	20.3	1	28	1	8.3	TS	10/1
MP-7 / .	9	Surr	55	3	7.2	3	20.3	R	29	3	8.5	✓	10/2
MP-7 / .	10	Surr	55	4	7.4	4	20.3	1	28	1	8.6	MPP	10/3

NEWFIELDS

10 DAY SOLID PHASE TEST WATER QUALITY DATA

1315

				TEST SPECIES *Ampelisca abdida*
CLIENT AMEC - Geomatrix	**PROJECT** March Point	**START TIME/ END TIME** /	**DILUTION WATER BATCH** FSW092208.01	**TEST START DATE** 23-Sep-2008
NEWFIELDS JOB NUMBER 1437-001-860-1	**PROJECT MANAGER** M. Pinza	**NEWFIELDS LABORATORY** Port Gamble/Bath 4	**TEMP. RECDR./HOBO#**	**TEST END DATE** 3-Oct-2008

WATER QUALITY DATA

Test Conditions				DO (mg/L) > 4.6		Temp ° C 20 ± 1		SALINITY (ppt) 28 ± 1		pH (pH units) 7.8 ± 0.5		Initials & Date	
CLIENT/NEWFIELDS ID	DAY	REP	JAR #	D.O.		TEMP		SALINITY		pH		TECH.	Date
				meter	mg/L	meter	°C	meter	ppt	meter	unit		
MP-8 / .	0	Surr	5	4	7.3	4	20.0	1	28	1	7.5	CR	9/23
MP-8 / .	1	Surr	5	4	6.6	4	20.3	1	28	1	7.6	CR	9/24
MP-8 / .	2	Surr	5	3	5.6	3	20.2	R	28	3	7.5	TS	9/25
MP-8 / .	3	Surr	5	3	6.1	3	20.2	R	28	3	7.6	TS	9/26
MP-8 / .	4	Surr	5	4	7.3	4	20.6	1	29	1	7.9	CR	9/27
MP-8 / .	5	Surr	5	4	7.4	4	19.9	1	29	1	7.8	CR	9/28
MP-8 / .	6	Surr	5	4	7.5	4	20.5	1	28	1	7.9	CR	9/29
MP-8 / .	7	Surr	5	4	7.6	4	20.5	1	28	1	8.1	TS	9/30
MP-8 / .	8	Surr	5	4	7.5	4	20.1	1	28	1	8.0	TS	10/1
MP-8 / .	9	Surr	5	3	7.0	3	20.1	R	28	3	8.0	J	10/2
MP-8 / .	10	Surr	5	4	7.5	4	20.0	1	28	1	8.1	MRP	10/3

NEWFIELDS

10 DAY SOLID PHASE TEST WATER QUALITY DATA

				TEST SPECIES *Ampelisca abdida*
CLIENT AMEC - Geomatrix	**PROJECT** March Point	**START TIME/ END TIME** /	**DILUTION WATER BATCH** FSW092208.01	**TEST START DATE** 23-Sep-2008
NEWFIELDS JOB NUMBER 1437-001-860-1	**PROJECT MANAGER** M. Pinza	**NEWFIELDS LABORATORY** Port Gamble/Bath 4	**TEMP. RECDR./HOBO#**	**TEST END DATE** 3-Oct-2008

1315

WATER QUALITY DATA

Test Conditions				DO (mg/L) > 4.6		Temp ° C 20 ± 1		SALINITY (ppt) 28 ± 1		pH (pH units) 7.8 ± 0.5		Initials & Date	
CLIENT/NEWFIELDS ID	DAY	REP	JAR #	D.O.		TEMP		SALINITY		pH		TECH.	Date
				meter	mg/L	meter	°C	meter	ppt	meter	unit		
MP-9 / .	0	Surr	4	4	7.3	4	19.9	1	28	1	7.6	CR	9/23
MP-9 / .	1	Surr	4	4	7.5	4	20.1	1	28	1	7.7	CR	9/24
MP-9 / .	2	Surr	4	3	6.8	3	20.0	R	28	3	7.8	TB	9/25
MP-9 / .	3	Surr	4	3	7.0	3	20.1	R	28	3	7.7	TS	9/26
MP-9 / .	4	Surr	4	4	7.3	4	20.6	1	29	1	8.0	CR	9/27
MP-9 / .	5	Surr	4	4	7.5	4	19.9	1	29	1	7.9	CR	9/28
MP-9 / .	6	Surr	4	4	7.5	4	20.4	1	27	1	8.2	CR	929
MP-9 / .	7	Surr	4	4	7.6	4	20.5	1	28	1	8.2	TJ	9/30
MP-9 / .	8	Surr	4	4	7.6	4	20.1	1	28	1	8.1	TS	10/1
MP-9 / .	9	Surr	4	3	7.0	3	20.0	R	28	3	7.9	L	10/2
MP-9 / .	10	Surr	4	4	7.6	4	19.8	1	28	1	8.2	MPP	10/3

NEWFIELDS

10 DAY SOLID PHASE TEST WATER QUALITY DATA

				TEST SPECIES *Ampelisca abdida*
CLIENT AMEC - Geomatrix	**PROJECT** March Point	**START TIME/ END TIME** /	**DILUTION WATER BATCH** FSW092208.01	**TEST START DATE** 23-Sep-2008
NEWFIELDS JOB NUMBER 1437-001-860-1	**PROJECT MANAGER** M. Pinza	**NEWFIELDS LABORATORY** Port Gamble/Bath 4	**TEMP. RECDR./HOBO#**	**TEST END DATE** 3-Oct-2008

1315

WATER QUALITY DATA

Test Conditions				DO (mg/L) > 4.6		Temp ° C 20 ± 1		SALINITY (ppt) 28 ± 1		pH (pH units) 7.8 ± 0.5		Initials & Date	
CLIENT/NEWFIELDS ID	DAY	REP	JAR #	D.O.		TEMP		SALINITY		pH		TECH.	Date
				meter	mg/L	meter	°C	meter	ppt	meter	unit		
MP-10 / .	0	Surr	6	4	7.4	4	20.1	1	28	1	7.6	CR	9/23/08
MP-10 / .	1	Surr	6	4	7.1	4	20.4	1	28	1	7.7	CR	9/24
MP-10 / .	2	Surr	6	4	6.8	4	20.2	R	28	3	7.7	TS	9/25
MP-10 / .	3	Surr	6	3	6.7	3	20.2	R	28	3	7.8	TS	9/26
MP-10 / .	4	Surr	6	4	7.2	4	20.7	1	29	1	8.1	CR	9/27
MP-10 / .	5	Surr	6	4	7.3	4	19.9	1	29	1	8.1	CR	9/28
MP-10 / .	6	Surr	6	4	7.5	4	20.5	1	28	1	8.2	CR	9/29
MP-10 / .	7	Surr	6	4	7.6	4	20.6	1	28	1	8.2	TS	9/30
MP-10 / .	8	Surr	6	4	7.4	4	20.1	1	28	1	8.2	TS	10/1
MP-10 / .	9	Surr	6	3	7.1	3	20.1	R	28	3	8.2	L	10/2
MP-10 / .	10	Surr	6	4	7.6	4	20.2	1	28	1	8.3	MRP	10/3

NEWFIELDS

10 DAY SOLID PHASE TEST WATER QUALITY DATA

				TEST SPECIES *Ampelisca abdida*
CLIENT AMEC - Geomatrix	**PROJECT** March Point	**START TIME/ END TIME** /	**DILUTION WATER BATCH** FSW092208.01	**TEST START DATE** 23-Sep-2008
NEWFIELDS JOB NUMBER 1437-001-860-1	**PROJECT MANAGER** M. Pinza	**NEWFIELDS LABORATORY** Port Gamble/Bath 4	**TEMP. RECDR./HOBO#**	**TEST END DATE** 3-Oct-2008

13.5

WATER QUALITY DATA

Test Conditions				DO (mg/L) > 4.6		Temp °C 20 ± 1		SALINITY (ppt) 28 ± 1		pH (pH units) 7.8 ± 0.5		Initials & Date	
				D.O.		TEMP		SALINITY		pH			
CLIENT/NEWFIELDS ID	DAY	REP	JAR #	meter	mg/L	meter	°C	meter	ppt	meter	unit	TECH.	Date
MP-11 / .	0	Surr	27	4	7.5	4	20.2	1	28	1	7.7	CR	9/23
MP-11 / .	1	Surr	27	4	7.6	4	20.4	1	28	1	8.0	CR	9/24
MP-11 / .	2	Surr	27	3	7.0	3	20.2	R	28	3	8.0	TS	9/25
MP-11 / .	3	Surr	27	3	7.2	3	20.2	R	28	3	7.9	TS	9/26
MP-11 / .	4	Surr	27	4	7.5	4	20.6	1	29	1	8.1	CK	9/27
MP-11 / .	5	Surr	27	4	7.8	4	19.8	1	29	1	8.0	CK	9/28
MP-11 / .	6	Surr	27	4	7.7	4	20.5	1	28	1	8.2	CR	9/29
MP-11 / .	7	Surr	27	4	7.7	4	20.6	1	28	1	8.2	TJ	9/30
MP-11 / .	8	Surr	27	4	7.7	4	20.1	1	29	1	8.2	TS	10/1
MP-11 / .	9	Surr	27	3	7.3	3	20.2	R	30	3	8.3	[illegible]	10/2
MP-11 / .	10	Surr	27	4	7.6	4	20.3	1	29	1	8.4	MRP	10/3

NEWFIELDS

10 DAY SOLID PHASE TEST WATER QUALITY DATA

1315

				TEST SPECIES *Ampelisca abdida*
CLIENT AMEC - Geomatrix	**PROJECT** March Point	**START TIME/ END TIME** /	**DILUTION WATER BATCH** FSW092208.01	**TEST START DATE** 23-Sep-2008
NEWFIELDS JOB NUMBER 1437-001-860-1	**PROJECT MANAGER** M. Pinza	**NEWFIELDS LABORATORY** Port Gamble/Bath 4	**TEMP. RECDR./HOBO#**	**TEST END DATE** 3-Oct-2008

WATER QUALITY DATA

Test Conditions				DO (mg/L) > 4.6		Temp ° C 20 ± 1		SALINITY (ppt) 28 ± 1		pH (pH units) 7.8 ± 0.5		Initials & Date	
				D.O.		TEMP		SALINITY		pH			
CLIENT/NEWFIELDS ID	DAY	REP	JAR #	meter	mg/L	meter	°C	meter	ppt	meter	unit	TECH.	Date
MP-12 / .	0	Surr	18	4	7.6	4	20.1	1	28	1	7.8	CR	9/23
MP-12 / .	1	Surr	18	4	7.6	4	20.4	1	28	1	8.0	CR	9/24
MP-12 / .	2	Surr	18	3	6.9	3	20.2	R	28	3	7.9	TS	9/25
MP-12 / .	3	Surr	18	3	7.0	3	20.2	R	27	3	8.0	TS	9/26
MP-12 / .	4	Surr	18	4	7.6	4	20.7	1	29	1	8.1	CR	9/27
MP-12 / .	5	Surr	18	4	7.7	4	19.9	1	29	1	8.1	CR	9/28
MP-12 / .	6	Surr	18	4	7.7	4	20.6	1	28	1	8.2	CR	9/29
MP-12 / .	7	Surr	18	4	7.7	4	20.5	1	28	1	8.2	TS	9/30
MP-12 / .	8	Surr	18	4	7.7	4	20.2	1	28	1	8.3	TS	10/1
MP-12 / .	9	Surr	18	3	7.2	3	20.3	R	29	3	8.3	[illegible]	10/2
MP-12 / .	10	Surr	18	4	7.7	4	20.3	1	28	1	8.4	MRP	10/3

NEWFIELDS

10 DAY SOLID PHASE TEST WATER QUALITY DATA

				TEST SPECIES *Ampelisca abdida*
CLIENT AMEC - Geomatrix	**PROJECT** March Point	**START TIME/ END TIME** /	**DILUTION WATER BATCH** FSW092208.01	**TEST START DATE** 23-Sep-2008
NEWFIELDS JOB NUMBER 1437-001-860-1	**PROJECT MANAGER** M. Pinza	**NEWFIELDS LABORATORY** Port Gamble/Bath 4	**TEMP. RECDR./HOBO#**	**TEST END DATE** 3-Oct-2008

1315

WATER QUALITY DATA

Test Conditions				DO (mg/L) > 4.6		Temp ° C 20 ± 1		SALINITY (ppt) 28 ± 1		pH (pH units) 7.8 ± 0.5		Initials & Date	
CLIENT/NEWFIELDS ID	DAY	REP	JAR #	D.O.		TEMP		SALINITY		pH		TECH.	Date
				meter	mg/L	meter	°C	meter	ppt	meter	unit		
MP-13 / .	0	Surr	75	4	7.7	4	20.2	1	28	1	7.8	CR	9/23
MP-13 / .	1	Surr	75	4	7.6	4	20.5	1	28	1	8.1	CR	9/24
MP-13 / .	2	Surr	75	3	7.0	3	20.3	R	28	3	8.0	TS	9/25
MP-13 / .	3	Surr	75	3	7.3	3	20.3	R	29	3	8.0	TS	9/26
MP-13 / .	4	Surr	75	4	7.4	4	20.7	1	29	1	8.3	CR	9/27
MP-13 / .	5	Surr	75	4	7.6	4	20.0	1	29	1	8.2	CR	9/28
MP-13 / .	6	Surr	75	4	7.7	4	20.7	1	28	1	8.4	CR	9/29
MP-13 / .	7	Surr	75	4	7.7	4	20.6	1	28	1	8.5	TS	9/30
MP-13 / .	8	Surr	75	4	7.8	4	20.3	1	28	1	8.4	TS	10/1
MP-13 / .	9	Surr	75	3	7.2	3	20.3	R	29	3	8.5	[illegible]	10/2
MP-13 / .	10	Surr	75	4	7.6	4	20.4	1	28	1	8.6	MPP	10/3

NEWFIELDS

10 DAY SOLID PHASE TEST WATER QUALITY DATA

CLIENT AMEC - Geomatrix	PROJECT March Point	START TIME/ END TIME 1700 /	DILUTION WATER BATCH FSW092908.01	TEST SPECIES *Ampelisca abdida* TEST START DATE 30-Sep-2008
NEWFIELDS JOB NUMBER 1437-001-860-1	PROJECT MANAGER M. Pinza	NEWFIELDS LABORATORY Port Gamble/Bath 4	TEMP. RECDR./HOBO#	TEST END DATE 10-Oct-2008

WATER QUALITY DATA

Test Conditions				DO (mg/L) > 4.6		Temp ° C 20 ± 1		SALINITY (ppt) 28 ± 1		pH (pH units) 7.8 ± 0.5		Initials & Date	
CLIENT/NEWFIELDS ID	DAY	REP	JAR #	D.O.		TEMP		SALINITY		pH		TECH.	Date
				meter	mg/L	meter	°C	meter	ppt	meter	unit		
SBREF-80 /	0	Surr	51	4	8.9	4	20.1	1	28	1	7.6	TS	~~10/1~~ 9/30
SBREF-80 /	1	Surr	51	4	7.6	4	20.2	1	27	1	7.7	TS	10/1
SBREF-80 /	2	Surr	51	3	7.1	3	20.0	R	28	3	8.0	L	10/2
SBREF-80 /	3	Surr	51	4	7.6	4	20.1	1	28	1	8.3	MEP	10/3
SBREF-80 /	4	Surr	51	4	7.6	4	20.3	1	28	1	8.2	MMB	10/4
SBREF-80 /	5	Surr	51	4	7.7	4	20.2	1	28	1	8.2	MMB	10/5
SBREF-80 /	6	Surr	51	4	7.2	4	20.3	R	27	1	8.2	MMB	10/6
SBREF-80 /	7	Surr	51	4	7.8	4	19.4	1	29	1	8.1	TS	10/7
SBREF-80 /	8	Surr	51	3	7.2	3	19.9	R	30	3	8.1	MMB	10/8
SBREF-80 /	9	Surr	51	4	7.7	4	19.7	1	30	1	8.0	TS	10/9
SBREF-80 /	10	Surr	51	3	6.9	3	19.7	R	30	3	8.2	CR	10/10

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NEWFIELDS

Ammonia Analysis
Total Ammonia (mg/L)

Client/Project:	Organism:	NewFields Test ID:	Test Duration (days):
March Point	Ampelisca		10

PRETEST / [✓ INITIAL] / FINAL / OTHER (circle one) DAY OF TEST: 0

[✓ OVERLYING] (OV) / POREWATER (PW) (circle one)

Calibration Standards Temperature		
Date:	**Temperature:**	Sample temperature should be within ±1°C of standards temperature at time and date of analysis.
9/23/08	19.5°C	

Sample ID or Description	Conc. or Rep	Date of Sampling and Initials	Ammonia Value (mg/L)	Temp °C	Date of Reading and Initials	Sample Preserved (Y/N)	pH	Sal (ppt)	Sulf. mg/L
Control	surv	9/23/08 CR	2.21	19.5	9/23/08 CR	N			0.012
CR-1	↓	↓	<0.5		↓	↓			0.017
SB Ref			0.845						0.653
MP-1			3.46						0.005
MP-2			1.67						0.004
MP-3			1.69						0.005
MP-4			1.11						0.008
MP-5			1.36						0.008
MP-6			1.23						0.015 ~~0.037~~ ①
MP-① ~~1~~7			1.17						0.076
MP-8			2.49						0.004
MP-9			0.662						0.007
MP-10			1.40						0.037
MP-11			1.06						0.036
MP-12			1.24						0.060
MP-13			1.02						0.019

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①WC CR 9/23

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NEWFIELDS

Ammonia Analysis
Total Ammonia (mg/L)

Client/Project: Geomatrix/ March Point	**Organism:** Amps	**NewFields Test ID:**	**Test Duration (days):** 10

PRETEST / [✓ INITIAL] / FINAL / OTHER (circle one) **DAY of TEST:** 0
OVERLYING (OV) / [✓ POREWATER] (PW) (circle one)

Calibration Standards Temperature		
Date:	**Temperature:**	Sample temperature should be within ±1°C of standards temperature at time and date of analysis.
23 September 2008	19.5	

Sample ID or Description	Conc. or Rep	Date of Sampling and Initials	Ammonia Value (mg/L)	Temp °C	Date of Reading and Initials	Sample Preserved (Y/N)	pH	Sal (ppt)	Sulf. mg/L
Control	Surr.	9/23/08 MMB	3.20	20.0	9/23/08 CR	N	7.5	30	0.060
CR-1	Surr.		1.85			N	7.4	29	0.088
SBREF-80	Surr.		4.03			N	7.3	30	13.1
MP-1	Surr.		5.39			N	7.2	27	0.059
MP-2	Surr.		3.02			N	7.2	28	0.047
MP-3	Surr.		4.55			N	7.4	28	0.041
MP-4	Surr.		2.62			N	7.2	26	0.032
MP-5	Surr.		2.17			N	7.2	28	0.116
MP-6	Surr.		1.47			N	7.0	28	0.026
MP-7	Surr.		2.30			N	7.2	28	0.034
MP-8	Surr.		3.18			N	7.1	28	0.059
MP-9	Surr.		1.33			N	7.1	28	0.086
MP-10	Surr.		3.02			N	7.1	28	4.06
MP-11	Surr.		2.11			N	7.2	28	1.96
MP-12	Surr.		2.46			N	7.2	28	0.023
MP-13	Surr.		2.90			N	7.3	29	0.035

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NEWFIELDS

Ammonia Analysis
Total Ammonia (mg/L)

Client/Project:	Organism:	NewFields Test ID:	Test Duration (days):
Geomatrix Marchpoint	Amps		~~20~~ 10d

PRETEST / INITIAL / [✓ FINAL] / OTHER (circle one) **DAY of TEST:** _____

[✓ OVERLYING (OV)] / POREWATER (PW) (circle one)

Calibration Standards Temperature		Sample temperature should be within ±1°C of standards temperature at time and date of analysis.
Date:	**Temperature:**	
10/3/08	20.0	

Sample ID or Description	Conc. or Rep	Date of Sampling and Initials	Ammonia Value (mg/L)	Temp °C	Date of Reading and Initials	Sample Preserved (Y/N)	pH	Sal (ppt)	Sulf. mg/L
0	Surr	TS 10/3/08	<0.5	19.0	TS 10/3/08	N	NA →		0.008
CR-1 Ref			<0.5						0.011
SB Ref 80			2.51						0.007
MP-1			<0.5						0.005
2			<0.5						0.007
3			2.02						0.010
4			<0.5						0.005
5			<0.5						0.005
6			<0.5						0.005
7			<0.5						0.007
8			<0.5						0.006
9			<0.5						0.010
10			<0.5						0.014
11			<0.5						0.012
12			<0.5						0.006
13	↓	↓	<0.5	↓	↓	↓	↓		0.004

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NEWFIELDS

Ammonia Analysis
Total Ammonia (mg/L)

Client/Project:	**Organism:**	**NewFields Test ID:**	**Test Duration (days):**
Geomatrix Marchpoint	Amps		10d

PRETEST / INITIAL / [✓ FINAL] / OTHER (circle one) **DAY of TEST:** _____
OVERLYING (OV) / [✓ POREWATER (PW)] (circle one)

Calibration Standards Temperature		Sample temperature should be within ±1°C of standards temperature at time and date of analysis.
Date:	**Temperature:**	
10/3/08	20.0	
10/14/08 (Ammonia)	18	

Reading taken 10/14/08 MRP

Sample ID or Description	Conc. or Rep	Date of Sampling and Initials	Ammonia Value (mg/L)	Temp °C	Date of Reading and Initials	Sample Preserved (Y/N)	pH	Sal (ppt)	Sulf. mg/L
0	Sur	TB 10/3/08	<0.5	20.3	TB 10/3/08	N	7.6	31	0.105
CR-1 Ref			<0.5	20.3			7.5	32	0.082
SB Ref 80			2.02	20.3			7.2	30	0.072
MP-1			0.97	20.4			7.2	26	0.053
2			0.52	20.3			7.2	27	0.030
3			3.41	20.3			7.4	27	0.070
4			0.69	20.3			7.0	26	0.034
5			0.96	20.4			7.0	26	0.053
6			<0.5	20.5			6.9	28	0.036
7			<0.5	20.5			7.0	28	0.033
8			Not Available - sample spilled before measurements taken.						
9			<0.5	20.3			7.1	28	0.070
10			0.65	20.4			7.1	28	0.042
11			<0.5	20.5			7.1	29	0.049
12			<0.5	20.5			7.4	28	0.037
13	↓	↓	<0.5	20.3	↓	↓	7.4	28	0.038

NEWFIELDS

Ammonia Analysis
Total Ammonia (mg/L)

Client/Project:	Organism:	NewFields Test ID:	Test Duration (days):
Marchpoint / SBRef 80	Ampelisca		10d

PRETEST / INITIAL / [✓ FINAL] / OTHER (circle one) DAY of TEST: 14
[✓ OVERLYING (OV)] / POREWATER (PW) (circle one)

Calibration Standards Temperature		Sample temperature should be within +1°C of standards temperature at time and date of analysis.
Date:	Temperature:	
10/14/08	18.0	

Sample ID or Description	Conc. or Rep	Date of Sampling and Initials	Ammonia Value (mg/L)	Temp °C	Date of Reading and Initials	Sample Preserved (Y/N)	pH	Sal (ppt)	Sulf. mg/L
overlying SBRef 80	surr	TS 10/14/08	<0.5	18.0	TS 10/14/08	N	NA →		.015
porewater ↓	↓	↓	<0.5		↓	N	7.2	30	.075

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NEWFIELDS

Ammonia Analysis
Total Ammonia (mg/L)

Client/Project:	**Organism:**	**NewFields Test ID:**	**Test Duration (days):**
Marchpoint	Ampelisca		20

PRETEST / INITIAL / FINAL / [✓ OTHER] (circle one) **DAY of TEST:** _____
[✓ OVERLYING (OV)] / [✓ POREWATER (PW)] (circle one)

Calibration Standards Temperature		Sample temperature should be within ±1°C of standards temperature at time and date of analysis.
Date:	**Temperature:**	
~~NA~~ 9/30/08	20.0	

Sample ID or Description	Conc. or Rep	Date of Sampling and Initials	Ammonia Value (mg/L)	Temp °C	Date of Reading and Initials	Sample Preserved (Y/N)	pH	Sal (ppt)	Sulf. mg/L
SB Ref 80-Acclimated		TS 9/29/08	Overlying sample			N	NA →		0.027
"		↓	porewater sample			N	↓	30	0.202
SB Ref 80-Acc		TS 9/30/08	<0.5 ① ~~Overl~~	19.5	overlying	N	—	—	—
"		↓	0.929	19.5	porewater	N	—	—	—

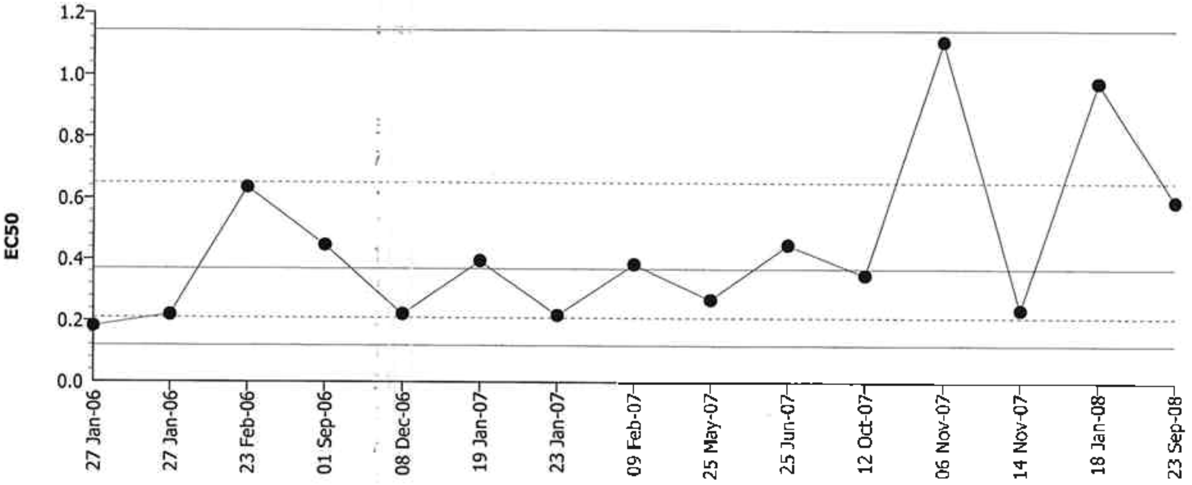
① WE 9/30/08 TS

CETIS QC Chart

Report Date: 04 Nov-08 3:27 PM

Reference Toxicant 96-h Acute Survival Test **NewFields**

Test Type: Survival
Protocol: PSEP (1995)
Organism: Ampelisca abdita (Amphipod)
Endpoint: Proportion Survived
Material: Cadmium chloride
Source: Reference Toxicant-REF



Mean: 0.36924 **Count:** 14 **-1s Warning Limit:** 0.20975 **-2s Action Limit:** 0.11915
Sigma: **CV:** 76.04% **+1s Warning Limit:** 0.65001 **+2s Action Limit:** 1.14427

Quality Control Data

Point	Year	Month	Day	Data	Delta	Sigma	Warning	Action	Test Link	Analysis
1	2006	Jan	27	0.18090	-0.18833	-1.26159	(-)		07-5435-8129	06-2014-1066
2			27	0.21846	-0.15077	-0.92798			02-3876-2955	12-1597-4541
3		Feb	23	0.63498	0.26574	0.95864			17-3687-3273	06-7672-2441
4		Sep	1	0.44694	0.07771	0.33772			11-8706-7493	01-2691-7469
5		Dec	8	0.22112	-0.14812	-0.90662			01-8163-5765	09-7294-9655
6	2007	Jan	19	0.39559	0.02635	0.12188			05-1919-0451	04-7876-6509
7			23	0.21727	-0.15196	-0.93766			13-4550-6899	02-3067-5161
8		Feb	9	0.38474	0.01550	0.07271			04-8872-6896	02-4257-0063
9		May	25	0.26923	-0.10001	-0.55854			16-5938-6055	08-1846-1770
10		Jun	25	0.44847	0.07923	0.34375			02-7818-3113	07-6434-4735
11		Oct	12	0.34850	-0.02073	-0.10218			07-2723-0368	03-4167-3848
12		Nov	6	1.10809	0.73886	1.94319	(+)		02-8822-1003	13-2266-5070
13			14	0.23515	-0.13409	-0.79788			10-0087-4493	11-2555-9069
14	2008	Jan	18	0.97369	0.60446	1.71456	(+)		16-7804-5373	13-2534-3341
15		Sep	23	0.58928	0.22005	0.82659			03-2847-7880	18-3138-3652

Analyst:________ Approval:________

CETIS Analysis Detail

Comparisons: Page 1 of 1
Report Date: 04 Nov-08 1:38 PM
Analysis: 10-7763-5230

Reference Toxicant 96-h Acute Survival Test **NewFields**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Comparison	03-2847-7880	03-2847-7880	04 Nov-08 1:38 PM	CETISv1.1.2

Method	Alt H	Data Transform	Zeta
Dunnett's Multiple Comparison	C > T	Angular (Corrected)	

NOEL	LOEL	Toxic Units	ChV	PMSD
0.25	0.5	400	0.35355	22.57%

Group Comparisons

Control	vs	Conc-mg/L	Statistic	Critical	P-Value	MSD	Decision(0.05)
Dilution Water		0.125	1.70338	2.46559	0.1605	0.29419	Non-Significant Effect
		0.25	1.70338	2.46559	0.1605	0.29419	Non-Significant Effect
		0.5	4.39995	2.46559	0.0022	0.29419	Significant Effect
		1	6.87533	2.46559	0.0001	0.29419	Significant Effect

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P-Value	Decision(0.05)
Between	1.252291	0.3130727	4	14.66	0.00035	Significant Effect
Error	0.2135537	0.0213554	10			
Total	1.46584442	0.3344281	14			

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P-Value	Decision(0.01)
Variances	Modified Levene	6.01492	5.99434	0.00989	Unequal Variances
Distribution	Shapiro-Wilk W	0.88543		0.05723	Normal Distribution

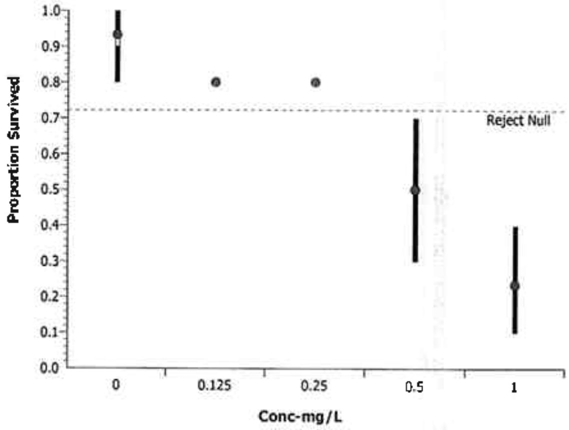
Data Summary

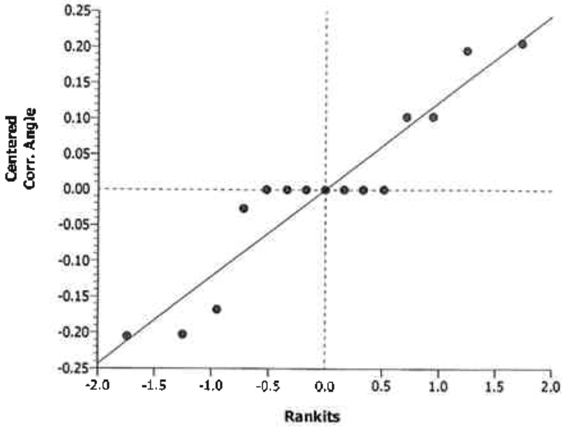
			Original Data				Transformed Data			
Conc-mg/L	Control Type	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
0	Dilution Water	3	0.93333	0.80000	1.00000	0.11547	1.31039	1.10715	1.41202	0.17602
0.125		3	0.80000	0.80000	0.80000	0.00020	1.10715	1.10715	1.10715	0.00027
0.25		3	0.80000	0.80000	0.80000	0.00020	1.10715	1.10715	1.10715	0.00027
0.5		3	0.50000	0.30000	0.70000	0.20000	0.78540	0.57964	0.99116	0.20576
1		3	0.23333	0.10000	0.40000	0.15275	0.49004	0.32175	0.68472	0.18292

Data Detail

Conc-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	1.00000	1.00000	0.80000							
0.125		0.80000	0.80000	0.80000							
0.25		0.80000	0.80000	0.80000							
0.5		0.70000	0.30000	0.50000							
1		0.20000	0.40000	0.10000							

Graphics





Analyst:________ Approval:________

Report Date: 04 Nov-08 1:40 PM
Analysis: 18-3138-3652

CETIS Analysis Detail

Reference Toxicant 96-h Acute Survival Test **NewFields**

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Survived	Linear Regression	03-2847-7880	03-2847-7880	04 Nov-08 1:40 PM	CETISv1.1.2

Linear Regression Options

Model Function	Threshold Option	Threshold	Threshold Opt	Reweighted	Pooled Groups	Het Corr
Log-Normal [NED=A+B*log(X)]	Control Threshold	0.06666667	Yes	Yes	No	No

Regression Summary

Iters	Log Likelihood	Mu	Sigma	G	Chi-Sq	Critical	P-Value	Decision(0.05)
19	-60.16584	1.60851	0.27577	0.16348	9.01521	22.36203	0.77179	Non-Significant Heterogeneity

Point Estimates

% Effect	Conc-mg/L	95% LCL	95% UCL
10	0.2611648	0.1168286	0.380091
15	0.3051479	0.1504196	0.428295
20	0.3453291	0.1835419	0.4717972
25	0.3839925	0.2173257	0.5135376
40	0.5017188	0.3288402	0.6432288
50	0.5892849	0.4163774	0.746276

Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Statistic	P-Value	Decision(0.05)
Threshold	0.1276308	0.04465401	0.04010889	0.2151526	2.858	0.01344	Significant
Slope	3.626239	0.748043	2.160074	5.092403	4.848	0.00032	Significant
Intercept	5.832855	0.219061	5.403496	6.262215	26.627	0.00000	Significant

Residual Analysis

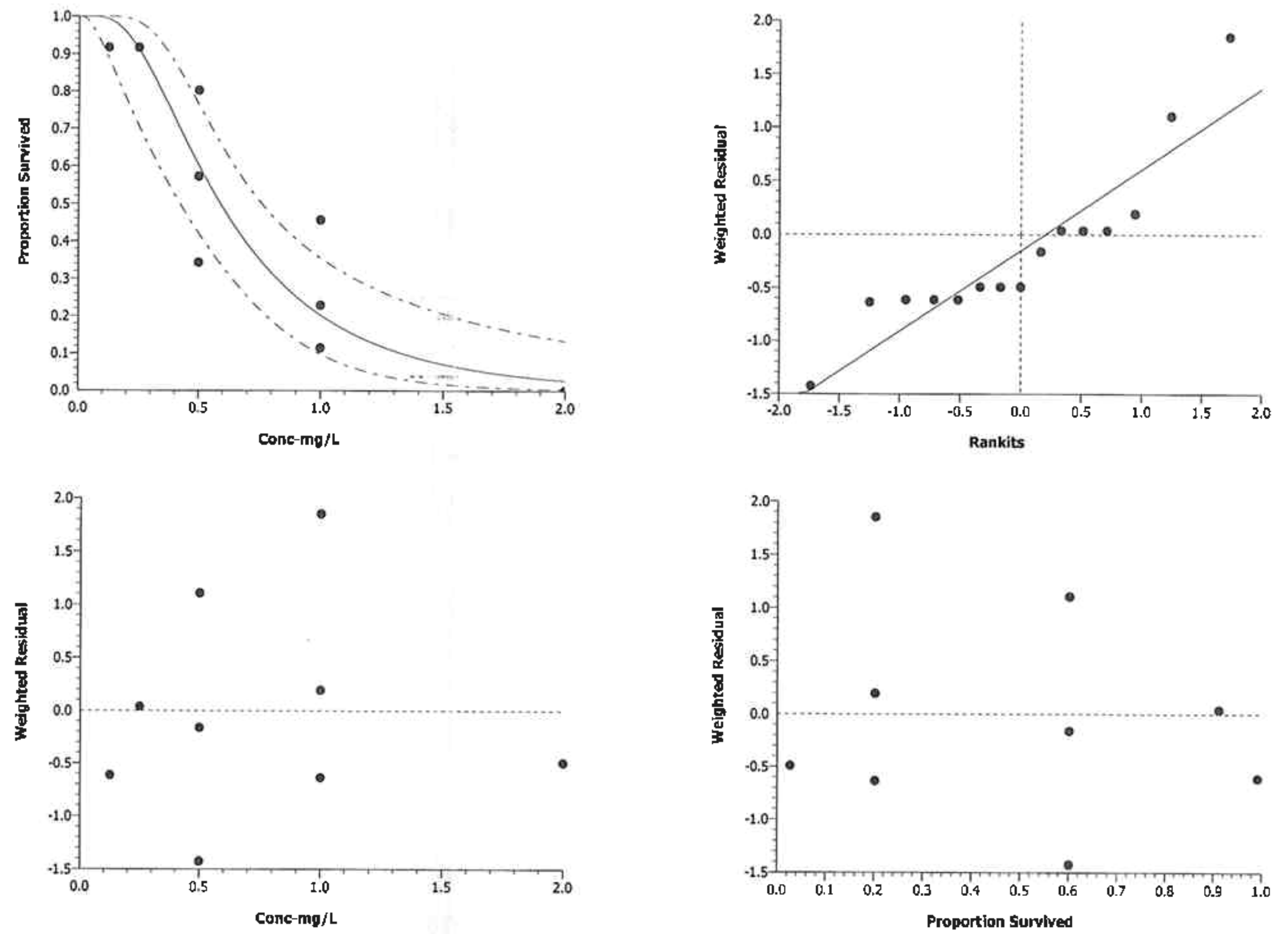
Attribute	Method	Statistic	Critical	P-Value	Decision(0.05)
Variances	Modified Levene	33.60804	3.47805	0.00001	Unequal Variances
Distribution	Shapiro-Wilk W	0.8640122		0.02759	Non-normal Distribution

Data Summary

			Calculated Variate(A/B)						
Conc-mg/	Control Type	Count	Mean	Minimum	Maximum	SE	SD	A	B
0	Dilution Water	3	0.93333	0.80000	1.00000	0.02357	0.11547	28	30
0.125		3	0.80000	0.80000	0.80000	0.00004	0.00020	24	30
0.25		3	0.80000	0.80000	0.80000	0.00004	0.00020	24	30
0.5		3	0.50000	0.30000	0.70000	0.04082	0.20000	15	30
1		3	0.23333	0.10000	0.40000	0.03118	0.15275	7	30
2		3	0.00000	0.00000	0.00000	0.00000	0.00000	0	30

Analyst:________ Approval:________

Graphics



Proportion Survived
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.0
0.5
1.0
1.5
2.0
Conc-mg/L
Weighted Residual
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0
Rankits
Weighted Residual
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.0
0.5
1.0
1.5
2.0
Conc-mg/L
Weighted Residual
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Proportion Survived

Cadmium Reference Toxicant Test Survival Data Sheet for Eohs

NEWFIELDS

CLIENT	PROJECT	NEWFIELDS JOB NO.	SPECIES		
			Ampelisca abdida		
			PROJECT MANAGER	NEWFIELDS LABORATORY	PROTOCOL
AMEC - Geomatrix	March Point	1437-001-860-1	M. Pinza	Port Gamble Bath 4	PSEP 1995

SURVIVAL & BEHAVIOR DATA

OBSERVATION KEY
N = Normal
LOE = Loss of equilibium
Q = Quiescent
DC = Discoloration
NB = No body
F = Floating on surface

INITIAL # OF ORGANISMS: 10

CLIENT/ NEWFIELDS ID	CONC. value	CONC. units	REP	INITIAL NUMBER	DAY 1 #ALIVE	DAY 1 #DEAD	DAY 1 OBS	DAY 2 #ALIVE	DAY 2 #DEAD	DAY 2 OBS	DAY 3 #ALIVE	DAY 3 #DEAD	DAY 3 OBS	DAY 4 #ALIVE	DAY 4 #DEAD	DAY 4 OBS
					DATE 9/24			DATE 9/25			DATE 9/26			DATE 9/27		
					TECHNICIAN CR			TECHNICIAN TS			TECHNICIAN CR			TECHNICIAN CR		
Ref.Tox.- cadmium	0	mg/L	1	10	10	0	N	10	0	1S	10	0	N	10	0	N
			2	↓	10	0	↓	10	0	N	10	0	N	10	0	N
			3	↓	10	0	↓	10	0	3S	9	1	1S	8	1	3S
Ref.Tox.- cadmium	0.125	mg/L	1	↓	10	0	↓	9	1	2S	9	0	1S	8	1	N
			2	↓	10	0	↓	10	0	1S	9	1	1S	8	1	1S
			3	↓	10	0	↓	9	1NB	N	9	1	N	8	1	N
Ref.Tox.- cadmium	0.25	mg/L	1	↓	10	0	↓	10	0	2S	10	0	2S	8	2	N
			2	↓	8	1	1NB	9	1FB	N	9	0	1S	8	1	1S
			3	↓	10	0	N	9	1	1S	8	1	1S	8	0	N
Ref.Tox.- cadmium	0.5	mg/L	1	↓	10	0	①~~DC~~	10	0	1S	8	2	1S	7	1	N
			2	↓	10	0	①~~Q~~	5	3, 2NB	3S	5	0	N	3	2	1S
			3	↓	10	0	①~~Q~~	10	0	1S	7	3	1S	5	2	N
Ref.Tox.- cadmium	1	mg/L	1	↓	10	0	DC,Q	9	1	2S	8	1	1S	2	6	N
			2	↓	10	0	Q	9	1	1S	6	3	1S	4	2	N
			3	↓	10	0	Q	9	1	2S	6	3	2S	1	5	N
Ref.Tox.- cadmium	2	mg/L	1	↓	10	0	4F	4	6	Q	1	3	2S	0	1	N
			2	↓	10	0	2F	6	4	4S	3	3	2S	0	3	N
			3	↓	9	1	1F	8	1	2S,Q	3	5	2S	0	3	N

①WC CR 9/24 Correct entry: N

NEW FIELDS

Cadmium Reference Toxicant Te)Water Quality Data Sheet for Eohs

CLIENT AMEC - Geomatrix	PROJECT March Point	SPECIES *Ampelisca abdida*		NEWFIELDS LABORATORY Port Gamble Bath 4	PROTOCOL PSEP 1995
NEWFIELDS JOB NUMBER 1437-001-860-1	PROJECT MANAGER M. Pinza	QUANTITY OF STOCK : ~~6.0mL~~ 0.3mL	QUANTITY OF DILUENT: 1500mL	INIT ✓	
		ACTUAL: 0.306	ACTUAL: 1500.0	DATE PREP 9/23/08	
TEST ID P080418.15	LOT #: 06 510TC	TEST START DATE 9/23/08 ~~26Jul08~~	TIME 1645 mP	TEST END DATE 9/27/08 ~~30Jul08~~	TIME ~~1745~~ 1600 ①BH

WATER QUALITY DATA

DILTIN.WAT.BATCH	TEMP REC#	REFERENCE TOX. MATERIAL	REFERENCE TOXXICANT		
FSW072608.01	NA	cadmium chloride	cadmium		

TEST CONDITIONS					DO (mg/L)		TEMP(C)		SAL (ppt)		pH		TECHNICIAN	
					≥ 5.0		15 ± 1		28 ± 1		8.0 ± 0.5			
CLIENT/ NEWFIELDS ID	CONCENTRATION		DAY	REP	D.O.		TEMP.		SALINITY		pH		WQ TECH	Date
	value	units			meter	mg/L	meter	°C	meter	ppt	meter	unit		
Ref.Tox.-cadmium	0	mg/L	0	Stock	4	7.5	4	20.0	1	28	1	7.6	✓	9/23/08
			1		4	7.6	4	19.8	1	29	1	7.5	CR	9/24
			2		3	6.8	3	20.1	R	29	3	7.6	TB	9/25
			3		3	7.0	3	20.1	R	29	3	7.8	TB	9/26
			4		4	7.3	4	20.7	1	29	1	7.7	CR	9/27
Ref.Tox.-cadmium	0.125	mg/L	0	Stock	4	7.7	4	20.2	1	28 ~~2~~	1	7.7	✓	9/23/08
			1		4	7.5	4	20.4	1	29	1	7.7	CR	9/24
			2		3	6.5	3	20.2	R	29	3	7.6	TB	9/25
			3		3	7.0	3	20.2	R	29	3	7.8	TB	9/26
			4		4	7.4	4	20.7	1	29	1	7.7	CR	9/27
Ref.Tox.-cadmium	0.25	mg/L	0	Stock	4	7.7	4	20.1	1	26	1	7.7	✓	9/23/08
			1		4	7.5	4	20.4	1	29	1	7.8	CR	9/24
			2		3	6.5	3	20.3	R	29	3	7.7	TB	9/25
			3		3	7.0	3	20.2	R	29	3	7.8	TB	9/26
			4		4	7.5	4	20.7	1	29	1	7.8	CR	9/27

① WT 10/1/08 BH

Cadmium Reference Toxicant Te Water Quality Data Sheet for Eohs

CLIENT AMEC - Geomatrix	PROJECT March Point	SPECIES *Ampelisca abdida*	NEWFIELDS LABORATORY Port Gamble Bath 4	PROTOCOL PSEP 1995
NEWFIELDS JOB NUMBER 1437-001-860-1	PROJECT MANAGER M. Pinza	QUANTITY OF STOCK : 0.3 mL ACTUAL: 0.306	QUANTITY OF DILUENT: 1500mL ACTUAL: 1500.0	INIT ✓ DATE PREP 9/23/08
TEST ID 7080418.15	LOT #: 06510TC	TEST START DATE 9/23/08 ~~26Jul08~~	TIME 1645 mf	TEST END DATE 9/27/08 ~~30Jul08~~	TIME 1600

WATER QUALITY DATA

DILTIN.WAT.BATCH	TEMP REC#	REFERENCE TOX. MATERIAL	REFERENCE TOXXICANT
FSW072608.01	NA	cadmium chloride	cadmium

TEST CONDITIONS	DO (mg/L)	TEMP(C)	SAL (ppt)	pH	TECHNICIAN
	≥ 5.0	15 ± 1	28 ± 1	8.0 ± 0.5	

CLIENT/ NEWFIELDS ID	CONCENTRATION		DAY	REP	D.O.		TEMP.		SALINITY		pH		WQ TECH	Date
	value	units			meter	mg/L	meter	°C	meter	ppt	meter	unit		
Ref.Tox.-cadmium	0.5	mg/L	0	Stock	4	7.7	4	20.2	1	28	1	7.8	✓	9/23/08
			1		4	7.5	4	20.5	1	29	1	7.8	CR	9/24
			2		3	6.6	3	20.3	R	29	3	7.7	TS	9/25
			3		3	7.0	3	20.3	R	29	3	7.8	TS	9/26
			4		4	7.5	4	20.7	1	29	1	7.8	CR	9/27
Ref.Tox.-cadmium	1	mg/L	0	Stock	4	7.7	4	20.3	1	28	1	7.8	✓	9/23/08
			1		4	7.5	4	20.5	1	29	1	7.9	CR	9/24
			2		3	6.6	3	20.3	R	29	3	7.8	TS	9/25
			3		3	6.7	3	20.3	R	29	3	7.8	TS	9/26
			4		4	7.3	4	20.7	1	29	1	7.9	CR	9/27
Ref.Tox.-cadmium	2	mg/L	0	Stock	4	7.7	4	20.2	1	28	1	7.8	✓	9/23/08
			1		4	7.6	4	20.5	1	29	1	7.9	CR	9/24
			2		3	6.5	3	20.3	R	29	3	7.7	TS	9/25
			3		3	6.7	3	20.3	R	29	3	7.8	TS	9/26
			4		4	7.4	4	20.7	1	29	1	7.9	CR	9/27

BIOLOGICAL TESTING OF SEDIMENT FOR
MARCH POINT (WHITMARSH) LANDFILL
ANACORTES, WASHINGTON

LARVAL TEST

QA/QC TS 10/27/08

BIVALVE LARVAE SUSPENDED PARTICULATE PHASE TEST

NEWFIELDS

CLIENT	PROJECT	JOB NUMBER	SPECIES		
			Dendraster excentricus		
			PROJECT MANAGER	**NEWFIELDS LAB / LOCATION**	**PROTOCOL**
AMEC Geomatrix	March Point	1437-001-860	M. Pinza	Port Gamble / Bath 7	PSEP (1995)

LARVAL OBSERVATION DATA

CLIENT/ NEWFIELDS ID	REP	NUMBER NORMAL	NUMBER ABNORMAL	DATE	TECHNICIAN	COMMENTS	
STOCKING DENSITY	1		218				
	2		213				
	3		255				
	4		280				
	5		247				
Control /	1	194	7				
	2	211	4				
	3	230	4				
	4	232	3				
	5	213	4				
Sediment Control /	1	233	2				
	2	213	4				
	3	237	1				
	4	216	4				
	5	197	0				
CR-1 /	1	191	7				
	2	204	5				
	3	191	5				
	4	237	5				
	5	141	4				
SBREF80 /	1	233	5	10/7/08	bwz		~~25~~ 26
	2	~~204~~ 202	~~7~~ ① 1	10/7/08	bwz		27
	3	~~178~~ 214	~~11~~ ① 7	10/7/08	bwz		28
	4	204	7				29
	5	178	11				30

① W.E. bwz 10/7/08

BIVALVE LARVAE SUSPENDED PARTICULATE PHASE TEST

QA/QC TS 100%
11/5/08

NEWFIELDS

CLIENT AMEC Geomatrix	PROJECT March Point	JOB NUMBER 1437-001-860	SPECIES *Dendraster excentricus*			
			PROJECT MANAGER M. Pinza	NEWFIELDS LAB / LOCATION Port Gamble / Bath 7	PROTOCOL PSEP (1995)	

LARVAL OBSERVATION DATA

CLIENT/ NEWFIELDS ID	REP	NUMBER NORMAL	NUMBER ABNORMAL	DATE	TECHNICIAN	COMMENTS
MP-1 /	1	208	4	11/4	✓	
	2	201	7			
	3	233	7			
	4	227	5			
	5	221	5			
MP-2 /	1	236	6			
	2	198	0			
	3	215	5			
	4	196	5			
	5	233	7			
MP-3 /	1	207	6			
	2	175	2			
	3	205	3			
	4	204	3			
	5	213	13			
MP-4 /	1	225	3			
	2	208	2			
	3	199	3			
	4	189	9			
	5	176	12			
MP-5 /	1	197	5			
	2	219	1			
	3	153	6			
	4	190	10			
	5	187	10			

QA/QC 100%
TS 11/5/08

BIVALVE LARVAE SUSPENDED PARTICULATE PHASE TEST

NEWFIELDS

CLIENT	PROJECT	JOB NUMBER	SPECIES		
			Dendraster excentricus		
			PROJECT MANAGER	**NEWFIELDS LAB / LOCATION**	**PROTOCOL**
AMEC Geomatrix	March Point	1437-001-860	M. Pinza	Port Gamble / Bath 7	PSEP (1995)

LARVAL OBSERVATION DATA

CLIENT/ NEWFIELDS ID	REP	NUMBER NORMAL	NUMBER ABNORMAL	DATE	TECHNICIAN	COMMENTS
MP-6 /	1	210	6	11/4	J	
	2	245	2			
	3	227	4			
	4	252	6			
	5	248	2			
MP-7 /	1	205	5			
	2	218	5			
	3	211	4			
	4	209	7			
	5	219	2			
MP-8 /	1	216	8			
	2	199	7			
	3	185	3			
	4	212	4			
	5	205	2			
MP-9 /	1	235	1			
	2	228	4			
	3	213	6			
	4	212	2			
	5	183	2			
MP-10 /	1	206	8			
	2	192	1			
	3	220	5			
	4	202	4			
	5	213	9			

QA/QC 100%
TS 11/5/08

BIVALVE LARVAE SUSPENDED PARTICULATE PHASE TEST

NEWFIELDS

			SPECIES *Dendraster excentricus*		
CLIENT AMEC Geomatrix	PROJECT March Point	JOB NUMBER 1437-001-860	PROJECT MANAGER M. Pinza	NEWFIELDS LAB / LOCATION Port Gamble / Bath 7	PROTOCOL PSEP (1995)

LARVAL OBSERVATION DATA

CLIENT/ NEWFIELDS ID	REP	NUMBER NORMAL	NUMBER ABNORMAL	DATE	TECHNICIAN	COMMENTS
MP-11 /	1	233	4	11/4	✓	
	2	234	1			
	3	195	4			
	4	265	5			
	5	222	6			
MP-12 /	1	~~225~~ 194	3 ~~4~~ al			
	2	220	6			
	3	220	5			
	4	192	5			
	5	217	5			
MP-13 /	1	230	4			
	2	221	5			
	3	204	2			
	4	200	7			
	5	195	4			

① IE 11/4/08

NEWFIELDS

LARVAL DEVELOPMENT TEST
WATER QUALITY DATA

CLIENT	PROJECT	SPECIES		NEWFIELDS LAB / LOCATION	PROTOCOL
AMEC Geomatrix	March Point	*Dendraster excentricus*		Port Gamble / Bath 7	PSEP (1995)
JOB NUMBER	**PROJECT MANAGER**	**TEST START DATE**	**TIME**	**TEST END DATE**	**TIME**
1437-001-860	M. Pinza	24Sep08	2030	9/27/08	1830

* Day 3 observations needed only if development endpoint not met by day 2

WATER QUALITY DATA

TEST CONDITIONS				DO (mg/L) >4.8		Temp (°C) 15 ± 1		Sal (ppt) 28 ± 1		pH 7.8 ± 0.5		Ammonia NA		Sulfide NA		TECH	DATE
				D.O.		TEMP.		SALINITY		pH		AMMONIA		SULFIDE			
CLIENT/ NEWFIELDS ID	DAY	Random #	REP	meter	mg/L	meter	°C	meter	ppt	meter	unit	Techn.	mg/L (total)	Techn.	ug/L (Total)		
Control /	0	10	WQ Surr		7.9		16.0		29		7.8			BH	0.000	BH	9/24
Control /	1	10	WQ Surr	4	7.5	4	15.5	1	29	1	7.7					CR	9/25
Control /	2	10	WQ Surr	3	7.6	3	15.3	R	29	3	7.4					TS	9/26
Control /	3	10	WQ Surr	4	7.2	4	15.8	1	29	1	7.7			BH	0.000	CR	9/27
Control /	4	10	WQ Surr														
Sediment Control /	0	97	WQ Surr		8.0		16.0		29		~~8~~ 7.8			BH	0.000	BH	9/24
Sediment Control /	1	97	WQ Surr	4	7.4	4	15.5	1	29	1	7.7					CR	9/25
Sediment Control /	2	97	WQ Surr	3	8.5	3	15.5	R	29	3	7.7					TS	9/26
Sediment Control /	3	97	WQ Surr	4	~~6.1~~ 9.2 ①	4	~~10.2~~ 16.3 ①	1	29	1	~~7.6~~ 7.8 ①			BH	0.000	CR	9/27
Sediment Control /	4	97	WQ Surr														
CR-1 /	0	84	WQ Surr		7.7		16.1		29		7.8			BH	0.038	BH	9/24
CR-1 /	1	84	WQ Surr	4	6.5	4	15.8	1	29	1	7.7					CR	9/25
CR-1 /	2	84	WQ Surr	3	6.0	3	15.1	R	29	3	7.6					TS	9/26
CR-1 /	3	84	WQ Surr	4	7.2	4	16.0	1	29	1	7.8			BH	0.014	CR	9/27
CR-1 /	4	84	WQ Surr														

① WP CR 9/27

NEWFIELDS

LARVAL DEVELOPMENT TEST
WATER QUALITY DATA

CLIENT AMEC Geomatrix	PROJECT March Point	SPECIES *Dendraster excentricus*	NEWFIELDS LAB / LOCATION Port Gamble / Bath 7	PROTOCOL PSEP (1995)
JOB NUMBER 1437-001-860	PROJECT MANAGER M. Pinza	TEST START DATE 24Sep08 · TIME	TEST END DATE	TIME

* Day 3 observations needed only if development endpoint not met by day 2

WATER QUALITY DATA

TEST CONDITIONS				DO (mg/L) >4.8		Temp (°C) 15 ± 1		Sal (ppt) 28 ± 1		pH 7.8 ± 0.5		Ammonia NA		Sulfide NA		TECH	DATE
CLIENT/ NEWFIELDS ID	DAY	Random #	REP	D.O.		TEMP.		SALINITY		pH		AMMONIA		SULFIDE			
				meter	mg/L	meter	°C	meter	ppt	meter	unit	Techn.	mg/L (total)	Techn.	ug/L (Total)		
SBREF80 /	0	94	WQ Surr		5.8		15.9		29		7.8				0.101		
SBREF80 /	1	94	WQ Surr	4	4.2①	4	16.2	1	29	1	7.7			✓		CR	9/25
SBREF80 /	2	94	WQ Surr	3	8.6	3	14.4	R	28	3	7.7					TS	9/26
SBREF80 /	3	94	WQ Surr	4	8.4	4	15.0	1	29	1	7.8				0.011	CR	9/27
SBREF80 /	4	94	WQ Surr														
MP-1 /	0	45	WQ Surr		6.6		16.0		29		7.8				0.058		
MP-1 /	1	45	WQ Surr	4	5.6	4	15.2	1	29	1	7.5					CR	9/25
MP-1 /	2	45	WQ Surr	3	5.2	3	14.7	R	28	3	7.3					TS	9/26
MP-1 /	3	45	WQ Surr	4	5.7	4	16.0	1	29	1	7.5				0.002	CR	9/27
MP-1 /	4	45	WQ Surr														
MP-2 /	0	77	WQ Surr		6.6		15.9		29		7.8				0.051		
MP-2 /	1	77	WQ Surr	4	5.7	4	15.6	1	29	1	7.6					CR	9/25
MP-2 /	2	77	WQ Surr	3	5.5	3	15.1	R	28	3	7.5					TS	9/26
MP-2 /	3	77	WQ Surr	4	6.4	4	15.8	1	29	1	7.7				0.000	CR	9/27
MP-2 /	4	77	WQ Surr														

① Sample aerated 9/25 CR

NEWFIELDS

LARVAL DEVELOPMENT TEST
WATER QUALITY DATA

CLIENT	PROJECT	SPECIES		NEWFIELDS LAB / LOCATION	PROTOCOL
AMEC Geomatrix	March Point	*Dendraster excentricus*		Port Gamble / Bath 7	PSEP (1995)
JOB NUMBER	**PROJECT MANAGER**	**TEST START DATE**	**TIME**	**TEST END DATE**	**TIME**
1437-001-860	M. Pinza	24Sep08			

* Day 3 observations needed only if development endpoint not met by day 2

WATER QUALITY DATA

TEST CONDITIONS				DO (mg/L) >4.6		Temp (°C) 15 ± 1		Sal (ppt) 28 ± 1		pH 7.8 ± 0.5		Ammonia NA		Sulfide NA		TECH	DATE
				D.O.		TEMP.		SALINITY		pH		AMMONIA		SULFIDE			
CLIENT/ NEWFIELDS ID	DAY	Random #	REP	meter	mg/L	meter	°C	meter	ppt	meter	unit	Techn.	mg/L (total)	Techn.	ug/L (Total)		
MP-3 /	0	95	WQ Surr		~~4.6~~ 8.0		15.4		29		7.9				0.022		
MP-3 /	1	95	WQ Surr	4	8.2	4	14.7	1	29	1	7.7					CR	9/25
MP-3 /	2	95	WQ Surr	3	8.2	3	14.3	R	28	3	7.7					JS	9/26
MP-3 /	3	95	WQ Surr	4	8.4	4	15.0	1	29	1	7.8				0.000	CK	9/27
MP-3 /	4	95	WQ Surr														
MP-4 /	0	48	WQ Surr		~~1.4~~ 8.2		15.6		29		7.4				0.024		
MP-4 /	1	48	WQ Surr	4	7.5	4	15.1	1	29	1	7.5					CR	9/25
MP-4 /	2	48	WQ Surr	3	8.2	3	14.3	R	28	3	7.6					JS	9/26
MP-4 /	3	48	WQ Surr	4	8.1	4	14.7	1	29	1	7.7				0.001	CK	9/27
MP-4 /	4	48	WQ Surr														
MP-5 /	0	34	WQ Surr		6.6		15.5		29		7.7				0.128		
MP-5 /	1	34	WQ Surr	4	5.7	4	15.5	1	29	1	7.7					CR	9/25
MP-5 /	2	34	WQ Surr	3	5.2	3	15.0	R	29	3	7.4					JS	9/26
MP-5 /	3	34	WQ Surr	4	7.0	4	16.5	1	29	1	7.7				0.008	CK	9/27
MP-5 /	4	34	WQ Surr														

LARVAL DEVELOPMENT TEST
WATER QUALITY DATA

CLIENT	PROJECT	SPECIES		NEWFIELDS LAB / LOCATION	PROTOCOL
AMEC Geomatrix	March Point	*Dendraster excentricus*		Port Gamble / Bath 7	PSEP (1995)
JOB NUMBER	**PROJECT MANAGER**	**TEST START DATE**	**TIME**	**TEST END DATE**	**TIME**
1437-001-860	M. Pinza	24Sep08			

* Day 3 observations needed only if development endpoint not met by day 2

WATER QUALITY DATA

TEST CONDITIONS				DO (mg/L) >4.8		Temp (°C) 15 ± 1		Sal (ppt) 28 ± 1		pH 7.8 ± 0.5		Ammonia NA		Sulfide NA			
CLIENT/ NEWFIELDS ID	DAY	Random #	REP	D.O.		TEMP.		SALINITY		pH		AMMONIA		SULFIDE		TECH	DATE
				meter	mg/L	meter	°C	meter	ppt	meter	unit	Techn.	mg/L (total)	Techn.	ug/L (Total)		
MP-6 /	0	92	WQ Surr		7.2		16.1		29		7.8				0.061		
MP-6 /	1	92	WQ Surr	4	6.0	4	16.2	1	29	1	7.6					CR	9/25
MP-6 /	2	92	WQ Surr	3	5.4	3	15.2	R	30	3	7.4					TS	9/26
MP-6 /	3	92	WQ Surr	4	6.2	4	16.4	1	29	1	7.7				0.010	CR	9/27
MP-6 /	4	92	WQ Surr														
MP-7 /	0	54	WQ Surr		6.6		15.9		29		7.8		7		0.058		
MP-7 /	1	54	WQ Surr	4	5.4	4	15.6	1	29	1	7.6					CR	9/25
MP-7 /	2	54	WQ Surr	3	5.4	3	15.0	R	29	3	7.5					TS	9/26
MP-7 /	3	54	WQ Surr	4	6.1	4	15.6	1	29	1	7.6				0.002	CR	9/27
MP-7 /	4	54	WQ Surr														
MP-8 /	0	35	WQ Surr		6.8		15.3		29		7.7				0.091		
MP-8 /	1	35	WQ Surr	4	5.9	4	15.2	1	29	1	7.5					CR	9/25
MP-8 /	2	35	WQ Surr	3	5.5	3	15.3	R	29	3	7.3					TS	9/26
MP-8 /	3	35	WQ Surr	4	6 5	4	16.2	1	29	1	7.6				0.007	CR	9/27
MP-8 /	4	35	WQ Surr														

NEWFIELDS

LARVAL DEVELOPMENT TEST
WATER QUALITY DATA

CLIENT AMEC Geomatrix	PROJECT March Point	SPECIES *Dendraster excentricus*	NEWFIELDS LAB / LOCATION Port Gamble / Bath 7	PROTOCOL PSEP (1995)
JOB NUMBER 1437-001-860	PROJECT MANAGER M. Pinza	TEST START DATE 24Sep08	TIME	TEST END DATE	TIME

* Day 3 observations needed only if development endpoint not met by day 2

WATER QUALITY DATA

TEST CONDITIONS				DO (mg/L) >4.8		Temp (°C) 15 ± 1		Sal (ppt) 28 ± 1		pH 7.8 ± 0.5		Ammonia NA		Sulfide NA			
				D.O.		TEMP.		SALINITY		pH		AMMONIA		SULFIDE			
CLIENT/ NEWFIELDS ID	DAY	Random #	REP	meter	mg/L	meter	°C	meter	ppt	meter	unit	Techn.	mg/L (total)	Techn.	ug/L (Total)	TECH	DATE
MP-9 /	0	89	WQ Surr		7.0		15.8		29		7.8				0.124		
MP-9 /	1	89	WQ Surr	4	5.7	4	15.8	1	29	1	7.7					CR	9/25
MP-9 /	2	89	WQ Surr	3	5.5	3	14.9	R	30	3	7.4					TS	9/26
MP-9 /	3	89	WQ Surr	4	6.1	4	16.2	1	29	1	7.6				0.016	CR	9/27
MP-9 /	4	89	WQ Surr														
MP-10 /	0	60	WQ Surr		5.9		15.7		29		7.8				0.155		
MP-10 /	1	60	WQ Surr	4	5.3	4	15.7	1	29	1	7.6					CR	9/25
MP-10 /	2	60	WQ Surr	3	5.2	3	14.8	R	30	3	7.4					TS	9/26
MP-10 /	3	60	WQ Surr	4	6.9	4	16.3	1	29	1	7.6				0.014	CR	9/27
MP-10 /	4	60	WQ Surr														
MP-11 /	0	12	WQ Surr		7.3		15.8		29		7.8				0.094		
MP-11 /	1	12	WQ Surr	4	6.2	4	15.6	1	29	1	7.7					CR	9/25
MP-11 /	2	12	WQ Surr	3	5.7	3	15.5	R	29	3	7.4					TS	9/26
MP-11 /	3	12	WQ Surr	4	6.6	4	16.2	1	29	1	7.7				0.010	CR	9/27
MP-11 /	4	12	WQ Surr														

NEWFIELDS

LARVAL DEVELOPMENT TEST
WATER QUALITY DATA

CLIENT AMEC Geomatrix	PROJECT March Point	SPECIES *Dendraster excentricus*	NEWFIELDS LAB / LOCATION Port Gamble / Bath 7	PROTOCOL PSEP (1995)
JOB NUMBER 1437-001-860	PROJECT MANAGER M. Pinza	TEST START DATE 24Sep08	TIME	TEST END DATE	TIME

* Day 3 observations needed only if development endpoint not met by day 2

WATER QUALITY DATA

TEST CONDITIONS				DO (mg/L) >4.8		Temp (°C) 15 ± 1		Sal (ppt) 28 ± 1		pH 7.8 ± 0.5		Ammonia NA		Sulfide NA		TECH	DATE
				D.O.		TEMP.		SALINITY		pH		AMMONIA		SULFIDE			
CLIENT/ NEWFIELDS ID	DAY	Random #	REP	meter	mg/L	meter	°C	meter	ppt	meter	unit	Techn.	mg/L (total)	Techn.	ug/L (Total)		
MP-12 /	0	2	WQ Surr		6.8		15.7		29		7.8				0.072		
MP-12 /	1	2	WQ Surr	4	7.0	4	15.4	1	29	1	7.6					CR	9/25
MP-12 /	2	2	WQ Surr	3	6.5	3	15.0	R	28	3	7.6					TB	9/26
MP-12 /	3	2	WQ Surr	4	6.7	4	16.1	1	29	1	7.6				0.006	CR	9/27
MP-12 /	4	2	WQ Surr														
MP-13 /	0	19	WQ Surr		6.2		16.0		29		7.8				0.058		
MP-13 /	1	19	WQ Surr	4	① ~~6~~ 5.6	4	15.3	1	29	1	7.7					CR	9/25
MP-13 /	2	19	WQ Surr	3	5.6	3	15.1	R	29	3	7.5					TI	9/26
MP-13 /	3	19	WQ Surr	4	6.5	4	15.9	1	29	1	7.7				0.007		
MP-13 /	4	19	WQ Surr														

DMC CR 9/25

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NEWFIELDS

Ammonia Analysis
Total Ammonia (mg/L)

Client/Project:	Organism:	NewFields Test ID:	Test Duration (days):
March Point	Dendraster		

PRETEST / [✓ INITIAL] / FINAL / OTHER (circle one) DAY of TEST: _____
[✓ OVERLYING (OV)] / POREWATER (PW) (circle one)

Calibration Standards Temperature		Sample temperature should be within ±1°C of standards temperature at time and date of analysis.
Date:	**Temperature:**	
10/1/08	19.5	

Sample ID or Description	Conc. or Rep	Date of Sampling and Initials	Ammonia Value (mg/L)	Temp °C	Date of Reading and Initials	Sample Preserved (Y/N)	pH	Sal (ppt)	Sulf. mg/L
0			0.00	20	10/1/08 +	Y	NA	NA	NA
Sed 0			0.00	20	↓	↓	↓	↓	↓
SBREF80			0.0233	20					
MP-1			0.297	20					
mP-2			0.0449	20					
mP-3			0.217	20					
mP-4			0.00	20					
mP-5			0.00	20					
mP6			0.00	20					
mP-7			0.00	20					
MP-8			0.0687	20					
mP-9			0.00	20					
MP-10			0.00	20					
MP-11			0.00	20					
mP-12			0.00	20					
mP-13			0.00	20					

Page ____of____

NEWFIELDS

Ammonia Analysis
Total Ammonia (mg/L)

Client/Project:	**Organism:**	**NewFields Test ID:**	**Test Duration (days):**
March Point	Dendraster		

PRETEST / INITIAL / [✓ FINAL] / OTHER (circle one) DAY of TEST: _____

[✓ OVERLYING (OV)] / POREWATER (PW) (circle one)

Calibration Standards Temperature		Sample temperature should be within ±1°C of standards temperature at time and date of analysis.
Date:	**Temperature:**	
10/1/08	19.5	

Sample ID or Description	Conc. or Rep	Date of Sampling and Initials	Ammonia Value (mg/L)	Temp °C	Date of Reading and Initials	Sample Preserved (Y/N)	pH	Sal (ppt)	Sulf. mg/L
0		9/27/08 BH	0.00	20	10/1/08 L	Y	NA	NA	NA
Sed 0		↓	0.00	20	↓	↓	↓	↓	↓
SBREF80			0.00	20					
MP-1			0.178	20					
MP-2			0.00	20					
MP-3			0.0730	20					
MP-4			0.00	20					
MP-5			0.00	20					
MP-6			0.00	20					
MP-7			0.00	20					
MP-8			0.00	20					
MP-9			0.00	20					
MP-10			0.00	20					
MP-11			0.00	20					
MP-12			0.00	20					
MP-13			0.00	20					

\\Fspwa01\projects\BIOASSAY FILES\Lab Logs & Forms\Ammonia Analysis Record.doc
Last printed 10/1/2008 12:21:00 PM

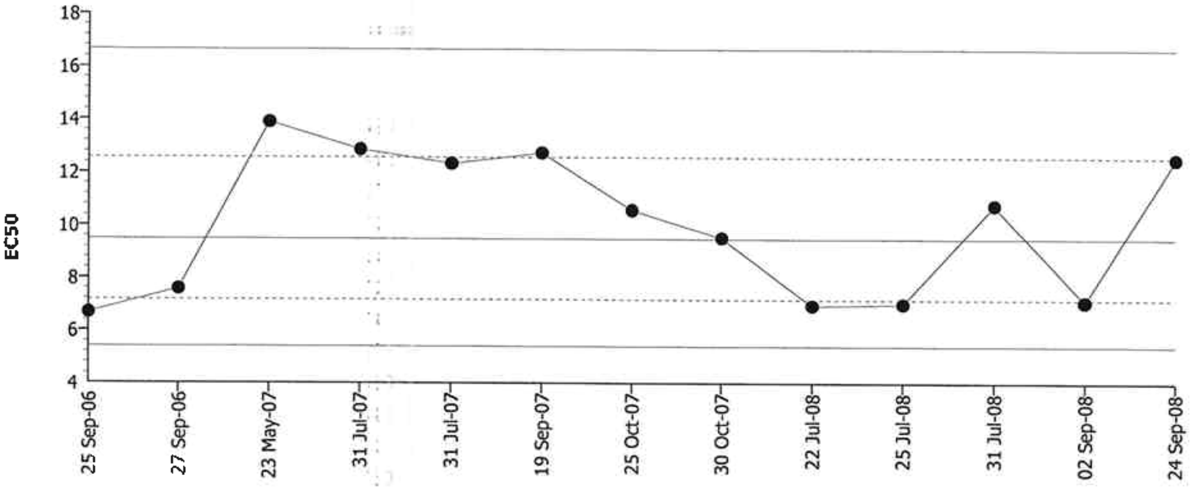
CETIS QC Chart

Page 1 of 1

Report Date: 04 Nov-08 4:22 PM

Echinoid Embryo-Larval Survival and Development Test **NewFields**

Test Type: Development-Survival
Protocol: PSEP (1995)
Organism: Dendraster excentricus (Sand Dollar)
Endpoint: Proportion Normal
Material: Copper sulfate
Source: Reference Toxicant-REF



Mean: 9.47709
Sigma:
Count: 12
CV: 32.57%
-1s Warning Limit: 7.14851
+1s Warning Limit: 12.5642
-2s Action Limit: 5.39208
+2s Action Limit: 16.6569

Quality Control Data

Point	Year	Month	Day	Data	Delta	Sigma	Warning	Action	Test Link	Analysis
1	2006	Sep	25	6.66180	-2.81529	-1.25008	(-)		15-9124-4449	12-6731-0558
2			27	7.56297	-1.91412	-0.80012			12-0508-6315	07-3739-8798
3	2007	May	23	13.89896	4.42187	1.35806	(+)		01-4296-4787	05-7613-5311
4		Jul	31	12.85222	3.37513	1.08039	(+)		13-9151-2777	12-8049-9522
5			31	12.33174	2.85465	0.93378			02-7352-2736	12-1169-5876
6		Sep	19	12.73121	3.25412	1.04684	(+)		09-8513-0350	13-2299-3806
7		Oct	25	10.57427	1.09718	0.38850			12-7566-1317	15-3106-2890
8			30	9.52576	0.04867	0.01817			12-1647-2406	05-3030-1731
9	2008	Jul	22	6.93340	-2.54369	-1.10836	(-)		20-1766-4632	11-5915-4021
10			25	6.99766	-2.47942	-1.07564	(-)		10-7779-9263	09-2506-4650
11			31	10.75282	1.27573	0.44789			21-0046-3420	08-3277-4745
12		Sep	2	7.06949	-2.40760	-1.03942	(-)		06-5417-1326	03-5415-0783
13			24	12.50536	3.02827	0.98336			09-4584-1077	10-5577-6876

Analyst:________ Approval:________

CETIS Analysis Detail

Echinoid Embryo-Larval Survival and Development Test NewFields

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Normal	Linear Regression	09-4584-1077	09-4584-1077	04 Nov-08 4:21 PM	CETISv1.1.2

Linear Regression Options

Model Function	Threshold Option	Threshold	Threshold Opt	Reweighted	Pooled Groups	Het Corr
Log-Normal [NED=A+B*log(X)]	Control Threshold	0.0356564	Yes	Yes	No	No

Regression Summary

Iters	Log Likelihood	Mu	Sigma	G	Chi-Sq	Critical	P-Value	Decision(0.05)
7	-520.87280	-0.39152	0.14111	0.00835	19.71630	22.36203	0.10251	Non-Significant Heterogeneity

Point Estimates

% Effect	Conc-µg/L	95% LCL	95% UCL
10	8.246143	7.802433	8.649971
15	8.929775	8.502647	9.320782
20	9.513303	9.100245	9.894595
25	10.04421	9.642841	10.41868
40	11.51715	11.13445	11.89072
50	12.50536	12.11667	12.90023

Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Statistic	P-Value	Decision(0.05)
Threshold	0.0319507	0.004092542	0.02392932	0.03997209	7.807	0.00000	Significant
Slope	7.086457	0.3303912	6.43889	7.734024	21.449	0.00000	Significant
Intercept	-2.774524	0.3641613	-3.48828	-2.060768	-7.619	0.00000	Significant

Residual Analysis

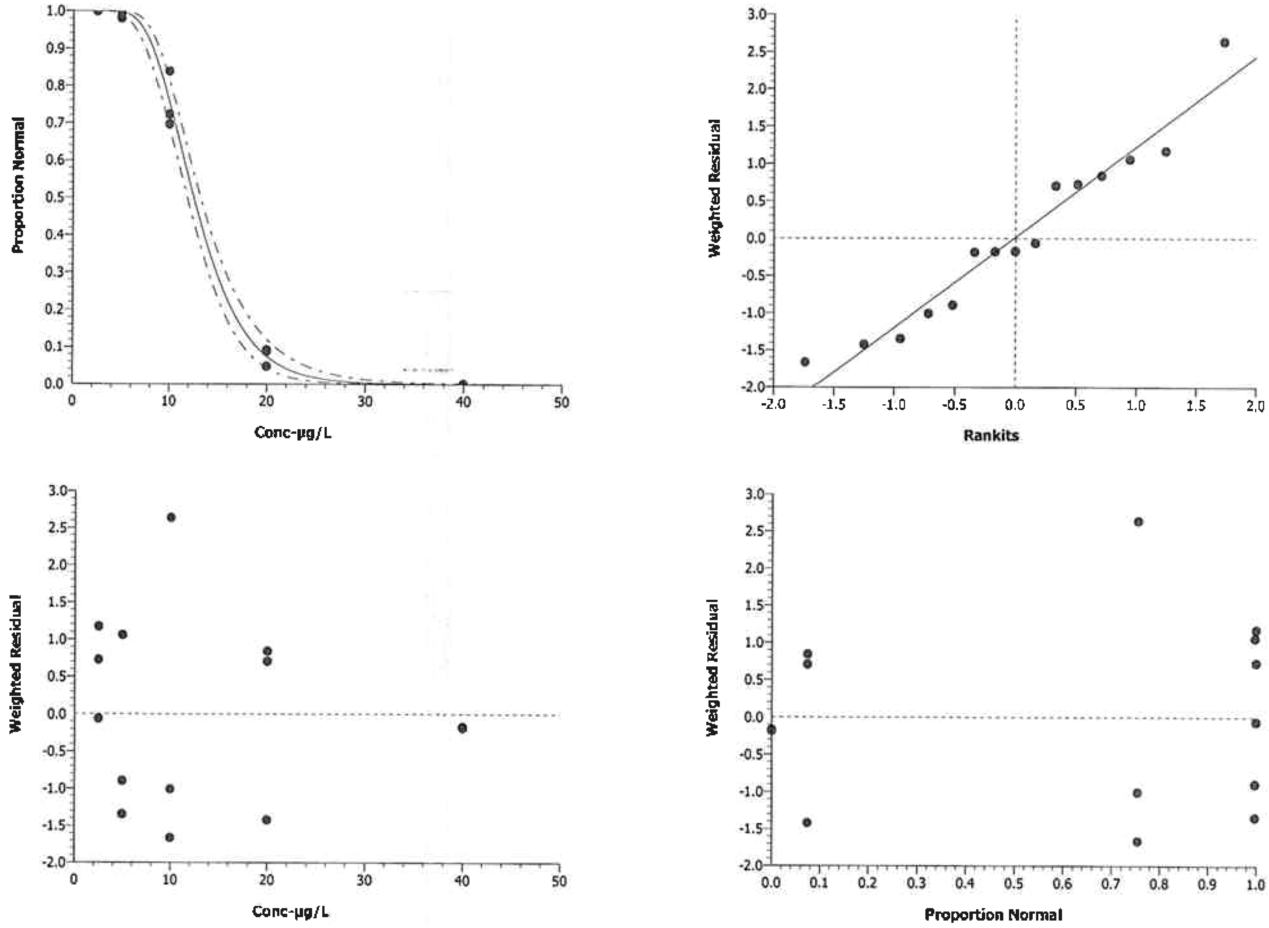
Attribute	Method	Statistic	Critical	P-Value	Decision(0.05)
Variances	Bartlett	18.79718	9.48773	0.00086	Unequal Variances
Distribution	Shapiro-Wilk W	0.9486683		0.50373	Normal Distribution

Data Summary

			Calculated Variate(A/B)						
Conc-µg/L	Control Type	Count	Mean	Minimum	Maximum	SE	SD	A	B
0	Dilution Water	3	0.96444	0.95122	0.98020	0.00299	0.01466	595	617
2.5		3	0.97531	0.96729	0.98190	0.00151	0.00741	634	650
5		3	0.96023	0.94907	0.97753	0.00310	0.01519	653	679
10		3	0.72847	0.67429	0.81159	0.01492	0.07309	435	595
20		3	0.07332	0.04569	0.08917	0.00490	0.02402	39	542
40		3	0.00000	0.00000	0.00000	0.00000	0.00000	0	570

CETIS Analysis Detail

Graphics



CETIS Analysis Detail

Report Date: 04 Nov-08 4:21 PM
Analysis: 10-6638-2953

Echinoid Embryo-Larval Survival and Development Test NewFields

Endpoint	Analysis Type	Sample Link	Control Link	Date Analyzed	Version
Proportion Normal	Comparison	09-4584-1077	09-4584-1077	04 Nov-08 4:21 PM	CETISv1.1.2

Method	Alt H	Data Transform	Zeta
Dunnett's Multiple Comparison	C > T	Angular (Corrected)	

NOEL	LOEL	Toxic Units	ChV	PMSD
5	10	20	7.07107	4.89%

Group Comparisons

Control	vs	Conc-µg/L	Statistic	Critical	P-Value	MSD	Decision(0.05)
Dilution Water		2.5	-0.7086	2.46559	0.9485	0.10488	Non-Significant Effect
		5	0.26435	2.46559	0.7047	0.10488	Non-Significant Effect
		10	8.43347	2.46559	0.0000	0.10488	Significant Effect
		20	26.1531	2.46559	0.0000	0.10488	Significant Effect

ANOVA Table

Source	Sum of Squares	Mean Square	DF	F Statistic	P-Value	Decision(0.05)
Between	2.836377	0.7090942	4	261.27	0.00000	Significant Effect
Error	0.0271403	0.0027140	10			
Total	2.86351693	0.7118082	14			

ANOVA Assumptions

Attribute	Test	Statistic	Critical	P-Value	Decision(0.01)
Variances	Bartlett	2.73241	13.27670	0.60356	Equal Variances
Distribution	Shapiro-Wilk W	0.95546		0.61417	Normal Distribution

Data Summary

			Original Data				Transformed Data			
Conc-µg/L	Control Type	Count	Mean	Minimum	Maximum	SD	Mean	Minimum	Maximum	SD
0	Dilution Water	3	0.96444	0.95122	0.98020	0.01466	1.38402	1.34810	1.42961	0.04161
2.5		3	0.97531	0.96729	0.98190	0.00741	1.41416	1.38894	1.43585	0.02366
5		3	0.96023	0.94907	0.97753	0.01519	1.37278	1.34317	1.42032	0.04159
10		3	0.72847	0.67429	0.81159	0.07309	1.02529	0.96342	1.12180	0.08469
20		3	0.07332	0.04569	0.08917	0.02402	0.27156	0.21540	0.30324	0.04877

Data Detail

Conc-µg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	0.96190	0.95122	0.98020							
2.5		0.98190	0.97674	0.96729							
5		0.97753	0.94907	0.95408							
10		0.69953	0.81159	0.67429							
20		0.04569	0.08917	0.08511							

Analyst:________ Approval:________

NEWFIELDS

LARVAL DEVELOPMENT TEST
COPPER REF TOX OBSERVATION SHEET

			SPECIES *Dendraster excentricus*		
CLIENT Geoengineers ①	PROJECT ① Port of Anacortes - Log Haul Out	JOB NUMBER .	PROJECT MANAGER B. Hester	NEWFIELDS LAB / LOCATION Port Gamble / Incubator	PROTOCOL PSEP (1995)

AMEC-GEOMATRIX MARCH PT.

LARVAL OBSERVATION DATA

CLIENT/ NEWFIELDS ID	CONC. value	CONC. units	VIAL NUMBER	REP	NUMBER NORMAL	NUMBER ABNORMAL	DATE	TECHNICIAN	COMMENTS
Ref.Tox. - Copper	0	µg/L	▨	1	202	8	10/22/08	JW	
			▨	2	195	10			
			▨	3	198	4			
Ref.Tox. - Copper	2.5	µg/L	▨	1	217	4			
			▨	2	210	5			
			▨	3	207	7			
Ref.Tox. - Copper	5	µg/L	▨	1	261	6			
			▨	2	205	11			
			▨	3	187	9			
Ref.Tox. - Copper	10	µg/L	▨	1	149	64			
			▨	2	168	39			
			▨	3	118	57			
Ref.Tox. - Copper	20	µg/L	▨	1	14	143			
			▨	2	16	172			
			▨	3	9	188			
Ref.Tox. - Copper	40	µg/L	▨	1	0	188			
			▨	2	0	177			
			▨	3	0	205	↓	↓	

STOCKING DENSITY	▨	1	▨	245	10/22/08	JW
	▨	2	▨	266		
	▨	3	▨	236	↓	↓

① Same batch of organisms used for both projects, one set of Ref tox tests SW

APPENDIX C

STATISTICAL COMPARISONS

Test	Endpoint	Treatment	Comparison	Probability Normal	Probability Homogeneous	Test Type	Test Probability	Significant?	One-Tail Comparison
10-day Ampelisca abdita	Percentage Survival	CR-1	Control	0.003	0.657	Mann-Whitney	0.098		Treatment >= Comparison
10-day Ampelisca abdita	Percentage Survival	MP-1	CR-1	0.074	0.399	T-test Equal Var	0.251		Treatment >= Comparison
10-day Ampelisca abdita	Percentage Survival	MP-11	CR-1	0.322	0.669	T-test Equal Var	0.469		Treatment >= Comparison
10-day Ampelisca abdita	Percentage Survival	MP-12	CR-1	0.735	0.69	T-test Equal Var	0.144		Treatment >= Comparison
10-day Ampelisca abdita	Percentage Survival	MP-13	CR-1	0.798	0.879	T-test Equal Var	0.085		Treatment >= Comparison
10-day Ampelisca abdita	Percentage Survival	MP-2	CR-1	0.052	0.267	T-test Equal Var	0.66		Treatment >= Comparison
10-day Ampelisca abdita	Percentage Survival	MP-7	CR-1	0.683	0.646	T-test Equal Var	0.099		Treatment >= Comparison
10-day Ampelisca abdita	Percentage Survival	MP-9	CR-1	0.868	0.742	T-test Equal Var	0.175		Treatment >= Comparison
10-day Ampelisca abdita	Percentage Survival	MP-10	CR-1	0.002	0.951	Mann-Whitney	0.417		Treatment >= Comparison
10-day Ampelisca abdita	Percentage Survival	MP-3	CR-1	0.015	0.325	Mann-Whitney	0.085		Treatment >= Comparison
10-day Ampelisca abdita	Percentage Survival	MP-6	CR-1	0.03	0.84	Mann-Whitney	0.731		Treatment >= Comparison
10-day Ampelisca abdita	Percentage Survival	MP-8	CR-1	0.008	0.107	Mann-Whitney	0.848		Treatment >= Comparison
10-day Ampelisca abdita	Percentage Survival	MP-4	CR-1	0.005	0.083	Rankit Equal Var	0.004	Yes	Treatment < Comparison
10-day Ampelisca abdita	Percentage Survival	MP-5	CR-1	0.004	0.067	Rankit Equal Var	0.001	Yes	Treatment < Comparison
10-day Ampelisca abdita	Percentage Survival	SBREF-80	Control	0.538	0.189	T-test Equal Var	0.225		Treatment >= Comparison
10-day Ampelisca abdita	Percentage Survival	MP-1	SBREF-80	0.856	0.085	T-test Unequal Var	0.386		Treatment >= Comparison
10-day Ampelisca abdita	Percentage Survival	MP-10	SBREF-80	0.258	0.43	T-test Equal Var	0.545		Treatment >= Comparison
10-day Ampelisca abdita	Percentage Survival	MP-11	SBREF-80	0.622	0.728	T-test Equal Var	0.544		Treatment >= Comparison
10-day Ampelisca abdita	Percentage Survival	MP-12	SBREF-80	0.614	0.198	T-test Equal Var	0.255		Treatment >= Comparison
10-day Ampelisca abdita	Percentage Survival	MP-13	SBREF-80	0.607	0.313	T-test Equal Var	0.168		Treatment >= Comparison
10-day Ampelisca abdita	Percentage Survival	MP-2	SBREF-80	0.835	0.053	T-test Unequal Var	0.699		Treatment >= Comparison
10-day Ampelisca abdita	Percentage Survival	MP-3	SBREF-80	0.639	0.072	T-test Unequal Var	0.213		Treatment >= Comparison
10-day Ampelisca abdita	Percentage Survival	MP-4	SBREF-80	0.281	0.017	T-test Unequal Var	0.142		Treatment >= Comparison
10-day Ampelisca abdita	Percentage Survival	MP-5	SBREF-80	0.157	0.014	T-test Unequal Var	0.115		Treatment >= Comparison
10-day Ampelisca abdita	Percentage Survival	MP-6	SBREF-80	0.482	0.309	T-test Equal Var	0.681		Treatment >= Comparison
10-day Ampelisca abdita	Percentage Survival	MP-7	SBREF-80	0.54	0.205	T-test Equal Var	0.193		Treatment >= Comparison
10-day Ampelisca abdita	Percentage Survival	MP-8	SBREF-80	0.397	0.021	T-test Unequal Var	0.604		Treatment >= Comparison
10-day Ampelisca abdita	Percentage Survival	MP-9	SBREF-80	0.599	0.648	T-test Equal Var	0.262		Treatment >= Comparison

```
                                                     March Point Statistical Comparison                10:56 Wednesday, October 15, 2008   1
                                                 T-test Results, This is a 2-tailed result
                                                     See Summary Page for 1-tail Result

------------------------------- Test=10-day Ampelisca abdita Endpoint=Percentage Survival Treatment=SBREF-80 -------------------------------

                                                            The TTEST Procedure

                                                                Statistics

                                       Lower CL              Upper CL    Lower CL               Upper CL
  Variable    group               N        Mean      Mean        Mean     Std Dev    Std Dev     Std Dev    Std Err    Minimum    Maximum

  result      Control             5      1.1046    1.2982      1.4918      0.0934     0.1559       0.448     0.0697     1.1731     1.5708
  result      Reference           5      0.8286    1.1826      1.5366      0.1708     0.2851      0.8193     0.1275     0.8861     1.5708
  result      Diff (1-2)                 -0.219    0.1156      0.4507      0.1552     0.2298      0.4402     0.1453


                                                                  T-Tests

                                   Variable    Method           Variances        DF    t Value    Pr > |t|

                                   result      Pooled           Equal             8       0.80      0.4493
                                   result      Satterthwaite    Unequal         6.2       0.80      0.4557


                                                           Equality of Variances

                                       Variable    Method      Num DF    Den DF    F Value    Pr > F

                                       result      Folded F         4         4       3.34    0.2691
```

```
                                                     March Point Statistical Comparison                10:56 Wednesday, October 15, 2008   2
                                                         Mann-Whitney Test Results

--------------------------------- Test=10-day Ampelisca abdita Endpoint=Percentage Survival Treatment=CR-1 ----------------------------------

                                                           The NPAR1WAY Procedure

                                              Wilcoxon Scores (Rank Sums) for Variable result
                                                       Classified by Variable group

                                                          Sum of      Expected       Std Dev          Mean
                                 group           N        Scores      Under H0      Under H0         Score
                                 fffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffff
                                 Control         5         34.50         27.50      4.654747          6.90
                                 Reference       5         20.50         27.50      4.654747          4.10

                                                    Average scores were used for ties.


                                                         Wilcoxon Two-Sample Test

                                                       Statistic             34.5000

                                                       Normal Approximation
                                                       Z                      1.3964
                                                       One-Sided Pr >  Z      0.0813
                                                       Two-Sided Pr > |Z|     0.1626

                                                       t Approximation
                                                       One-Sided Pr >  Z      0.0980
                                                       Two-Sided Pr > |Z|     0.1961

                                                 Z includes a continuity correction of 0.5.


                                                            Kruskal-Wallis Test

                                                       Chi-Square             2.2615
                                                       DF                          1
                                                       Pr > Chi-Square        0.1326
```

```
                                              March Point Statistical Comparison            10:56 Wednesday, October 15, 2008   3
                                           T-test Results, This is a 2-tailed result
                                              See Summary Page for 1-tail Result

--------------------------------- Test=10-day Ampelisca abdita Endpoint=Percentage Survival Treatment=MP-1 ---------------------------------

                                                      The TTEST Procedure

                                                          Statistics

                                        Lower CL              Upper CL    Lower CL               Upper CL
 Variable     group                 N       Mean       Mean       Mean     Std Dev     Std Dev    Std Dev     Std Err     Minimum     Maximum

 Result       CR-1                  5     0.9584     1.2143     1.4702      0.1235      0.2061     0.5922      0.0922      1.0472      1.5708
 Result       Test                  5     1.0046     1.1407     1.2769      0.0657      0.1096     0.3151       0.049      0.9912       1.249
 Result       Diff (1-2)                  -0.167     0.0736     0.3143      0.1115      0.1651     0.3162      0.1044


                                                            T-Tests

                                     Variable     Method           Variances        DF    t Value    Pr > |t|

                                     Result       Pooled           Equal             8       0.70      0.5011
                                     Result       Satterthwaite    Unequal         6.1       0.70      0.5071


                                                     Equality of Variances

                                         Variable     Method       Num DF    Den DF    F Value    Pr > F

                                         Result       Folded F          4         4       3.53    0.2491
```

```
                                            March Point Statistical Comparison             10:56 Wednesday, October 15, 2008   4
                                         T-test Results, This is a 2-tailed result
                                            See Summary Page for 1-tail Result

-------------------------------- Test=10-day Ampelisca abdita Endpoint=Percentage Survival Treatment=MP-11 ---------------------------------

                                                     The TTEST Procedure

                                                         Statistics

                                          Lower CL              Upper CL    Lower CL              Upper CL
  Variable     group                N         Mean       Mean       Mean     Std Dev    Std Dev    Std Dev     Std Err     Minimum     Maximum

  Result       CR-1                 5       0.9584     1.2143     1.4702      0.1235     0.2061     0.5922      0.0922      1.0472      1.5708
  Result       Test                 5       0.8716     1.2023      1.533      0.1596     0.2663     0.7654      0.1191      0.8355      1.5708
  Result       Diff (1-2)                   -0.335      0.012     0.3593      0.1608     0.2381     0.4562      0.1506


                                                           T-Tests

                                     Variable     Method           Variances        DF    t Value    Pr > |t|

                                     Result       Pooled           Equal             8       0.08      0.9386
                                     Result       Satterthwaite    Unequal        7.53       0.08      0.9388


                                                    Equality of Variances

                                         Variable     Method       Num DF    Den DF    F Value    Pr > F

                                         Result       Folded F          4         4       1.67    0.6314
```

```
                                      March Point Statistical Comparison                 10:56 Wednesday, October 15, 2008   5
                                    T-test Results, This is a 2-tailed result
                                      See Summary Page for 1-tail Result

-------------------------------- Test=10-day Ampelisca abdita Endpoint=Percentage Survival Treatment=MP-12 ---------------------------------

                                                       The TTEST Procedure

                                                           Statistics

                                           Lower CL              Upper CL  Lower CL            Upper CL
 Variable     group                 N        Mean      Mean        Mean   Std Dev   Std Dev   Std Dev   Std Err   Minimum   Maximum

 Result       CR-1                  5      0.9584    1.2143      1.4702    0.1235    0.2061    0.5922    0.0922    1.0472    1.5708
 Result       Test                  5      0.8872    1.0824      1.2776    0.0942    0.1572    0.4517    0.0703    0.8355     1.249
 Result       Diff (1-2)                   -0.135    0.1319      0.3992    0.1238    0.1833    0.3511    0.1159


                                                             T-Tests

                                  Variable     Method           Variances        DF    t Value    Pr > |t|

                                  Result       Pooled           Equal             8       1.14      0.2882
                                  Result       Satterthwaite    Unequal        7.48       1.14      0.2904


                                                     Equality of Variances

                                      Variable     Method       Num DF    Den DF    F Value    Pr > F

                                      Result       Folded F          4         4       1.72    0.6125
```

```
                                                     March Point Statistical Comparison                10:56 Wednesday, October 15, 2008   6
                                                 T-test Results, This is a 2-tailed result
                                                     See Summary Page for 1-tail Result

-------------------------------- Test=10-day Ampelisca abdita Endpoint=Percentage Survival Treatment=MP-13 ----------------------------------

                                                            The TTEST Procedure

                                                                Statistics

                                       Lower CL              Upper CL    Lower CL               Upper CL
  Variable    group               N        Mean      Mean        Mean     Std Dev    Std Dev     Std Dev    Std Err    Minimum    Maximum

  Result      CR-1                5      0.9584    1.2143      1.4702      0.1235     0.2061      0.5922     0.0922     1.0472     1.5708
  Result      Test                5      0.7916     1.026      1.2603      0.1131     0.1887      0.5424     0.0844     0.7353      1.249
  Result      Diff (1-2)                   -0.1    0.1883      0.4765      0.1335     0.1976      0.3786      0.125

                                                                  T-Tests

                                   Variable    Method           Variances        DF    t Value    Pr > |t|

                                   Result      Pooled           Equal             8       1.51      0.1703
                                   Result      Satterthwaite    Unequal        7.94       1.51      0.1706

                                                           Equality of Variances

                                       Variable    Method       Num DF    Den DF    F Value    Pr > F

                                       Result      Folded F          4         4       1.19    0.8688
```

```
                                                     March Point Statistical Comparison                10:56 Wednesday, October 15, 2008   7
                                                 T-test Results, This is a 2-tailed result
                                                     See Summary Page for 1-tail Result

--------------------------------- Test=10-day Ampelisca abdita Endpoint=Percentage Survival Treatment=MP-2 ---------------------------------

                                                            The TTEST Procedure

                                                                Statistics

                                       Lower CL              Upper CL    Lower CL               Upper CL
  Variable    group               N        Mean      Mean        Mean     Std Dev    Std Dev     Std Dev    Std Err    Minimum    Maximum

  Result      CR-1                5      0.9584    1.2143      1.4702      0.1235     0.2061      0.5922     0.0922     1.0472     1.5708
  Result      Test                5      1.1501    1.2572      1.3642      0.0517     0.0862      0.2477     0.0386     1.1731     1.3453
  Result      Diff (1-2)                 -0.273    -0.043      0.1875      0.1067      0.158      0.3026     0.0999


                                                                  T-Tests

                                   Variable    Method           Variances      DF    t Value    Pr > |t|

                                   Result      Pooled           Equal           8      -0.43      0.6790
                                   Result      Satterthwaite    Unequal      5.36      -0.43      0.6844


                                                           Equality of Variances

                                       Variable    Method      Num DF    Den DF    F Value    Pr > F

                                       Result      Folded F         4         4       5.71    0.1199
```

```
                                        March Point Statistical Comparison              10:56 Wednesday, October 15, 2008   8
                                     T-test Results, This is a 2-tailed result
                                        See Summary Page for 1-tail Result

--------------------------------- Test=10-day Ampelisca abdita Endpoint=Percentage Survival Treatment=MP-7 ---------------------------------

                                                  The TTEST Procedure

                                                      Statistics

                                      Lower CL              Upper CL    Lower CL              Upper CL
 Variable    group              N        Mean       Mean        Mean     Std Dev    Std Dev    Std Dev    Std Err    Minimum    Maximum

 Result      CR-1               5      0.9584     1.2143      1.4702      0.1235     0.2061     0.5922     0.0922     1.0472     1.5708
 Result      Test               5      0.8386     1.0472      1.2558      0.1006      0.168     0.4827     0.0751     0.7854      1.249
 Result      Diff (1-2)                -0.107     0.1671      0.4413       0.127      0.188     0.3602     0.1189


                                                        T-Tests

                                Variable    Method           Variances        DF    t Value    Pr > |t|

                                Result      Pooled           Equal             8       1.41      0.1976
                                Result      Satterthwaite    Unequal        7.69       1.41      0.1991


                                                 Equality of Variances

                                    Variable    Method       Num DF    Den DF    F Value    Pr > F

                                    Result      Folded F          4         4       1.51    0.7017
```

```
                                        March Point Statistical Comparison          10:56 Wednesday, October 15, 2008   9
                                     T-test Results, This is a 2-tailed result
                                        See Summary Page for 1-tail Result

-------------------------------- Test=10-day Ampelisca abdita Endpoint=Percentage Survival Treatment=MP-9 --------------------------------

                                                 The TTEST Procedure

                                                     Statistics

                                      Lower CL                Upper CL  Lower CL              Upper CL
 Variable    group                 N      Mean       Mean       Mean   Std Dev    Std Dev    Std Dev    Std Err    Minimum    Maximum

 Result      CR-1                  5    0.9584     1.2143     1.4702    0.1235     0.2061     0.5922     0.0922     1.0472     1.5708
 Result      Test                  5    0.7539     1.0691     1.3843    0.1521     0.2539     0.7295     0.1135     0.6331      1.249
 Result      Diff (1-2)                 -0.192     0.1452     0.4824    0.1562     0.2312      0.443     0.1462


                                                       T-Tests

                                  Variable    Method           Variances        DF    t Value    Pr > |t|

                                  Result      Pooled           Equal             8       0.99      0.3499
                                  Result      Satterthwaite    Unequal        7.68       0.99      0.3511


                                                Equality of Variances

                                      Variable    Method       Num DF    Den DF    F Value    Pr > F

                                      Result      Folded F          4         4       1.52    0.6960
```

```
                                                     March Point Statistical Comparison               10:56 Wednesday, October 15, 2008  10
                                                         Mann-Whitney Test Results

-------------------------------- Test=10-day Ampelisca abdita Endpoint=Percentage Survival Treatment=MP-10 ---------------------------------

                                                           The NPAR1WAY Procedure

                                              Wilcoxon Scores (Rank Sums) for Variable Result
                                                       Classified by Variable group

                                                     Sum of      Expected       Std Dev          Mean
                                   group       N     Scores      Under H0      Under H0         Score
                                   ƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒ
                                   CR-1        5       29.0         27.50      4.639804          5.80
                                   Test        5       26.0         27.50      4.639804          5.20

                                                    Average scores were used for ties.


                                                         Wilcoxon Two-Sample Test

                                                       Statistic             29.0000

                                                       Normal Approximation
                                                       Z                      0.2155
                                                       One-Sided Pr >  Z      0.4147
                                                       Two-Sided Pr > |Z|     0.8294

                                                       t Approximation
                                                       One-Sided Pr >  Z      0.4171
                                                       Two-Sided Pr > |Z|     0.8342

                                                 Z includes a continuity correction of 0.5.


                                                            Kruskal-Wallis Test

                                                       Chi-Square             0.1045
                                                       DF                          1
                                                       Pr > Chi-Square        0.7465
```

```
-------------------------------- Test=10-day Ampelisca abdita Endpoint=Percentage Survival Treatment=MP-3 --------------------------------

                                                            The NPAR1WAY Procedure

                                                  Wilcoxon Scores (Rank Sums) for Variable Result
                                                           Classified by Variable group

                                                    Sum of      Expected       Std Dev          Mean
                                   group       N    Scores      Under H0      Under H0         Score
                                   ffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffff
                                   CR-1        5      35.0         27.50      4.699291           7.0
                                   Test        5      20.0         27.50      4.699291           4.0

                                                     Average scores were used for ties.


                                                          Wilcoxon Two-Sample Test

                                                        Statistic             35.0000

                                                        Normal Approximation
                                                        Z                      1.4896
                                                        One-Sided Pr >  Z      0.0682
                                                        Two-Sided Pr > |Z|     0.1363

                                                        t Approximation
                                                        One-Sided Pr >  Z      0.0853
                                                        Two-Sided Pr > |Z|     0.1705

                                                  Z includes a continuity correction of 0.5.


                                                             Kruskal-Wallis Test

                                                        Chi-Square             2.5472
                                                        DF                          1
                                                        Pr > Chi-Square        0.1105
```

```
                          Mann-Whitney Test Results

--------------------------------- Test=10-day Ampelisca abdita Endpoint=Percentage Survival Treatment=MP-6 ---------------------------------

                             The NPAR1WAY Procedure

                  Wilcoxon Scores (Rank Sums) for Variable Result
                           Classified by Variable group

                             Sum of      Expected       Std Dev          Mean
        group       N        Scores      Under H0      Under H0         Score
        ƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒ
        CR-1        5          24.0         27.50      4.684490          4.80
        Test        5          31.0         27.50      4.684490          6.20

                        Average scores were used for ties.


                             Wilcoxon Two-Sample Test

                           Statistic             24.0000

                           Normal Approximation
                           Z                     -0.6404
                           One-Sided Pr <  Z      0.2610
                           Two-Sided Pr > |Z|     0.5219

                           t Approximation
                           One-Sided Pr <  Z      0.2689
                           Two-Sided Pr > |Z|     0.5379

                      Z includes a continuity correction of 0.5.


                                Kruskal-Wallis Test

                           Chi-Square             0.5582
                           DF                          1
                           Pr > Chi-Square        0.4550
```

```
                                                     March Point Statistical Comparison                10:56 Wednesday, October 15, 2008  13
                                                         Mann-Whitney Test Results

--------------------------------- Test=10-day Ampelisca abdita Endpoint=Percentage Survival Treatment=MP-8 ---------------------------------

                                                           The NPAR1WAY Procedure

                                              Wilcoxon Scores (Rank Sums) for Variable Result
                                                       Classified by Variable group

                                                    Sum of      Expected       Std Dev          Mean
                                   group       N     Scores      Under H0      Under H0         Score
                                   ffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffffff
                                   CR-1        5       22.0         27.50      4.579544          4.40
                                   Test        5       33.0         27.50      4.579544          6.60

                                                    Average scores were used for ties.


                                                         Wilcoxon Two-Sample Test

                                                       Statistic             22.0000

                                                       Normal Approximation
                                                       Z                     -1.0918
                                                       One-Sided Pr <  Z      0.1375
                                                       Two-Sided Pr > |Z|     0.2749

                                                       t Approximation
                                                       One-Sided Pr <  Z      0.1516
                                                       Two-Sided Pr > |Z|     0.3033

                                                 Z includes a continuity correction of 0.5.


                                                            Kruskal-Wallis Test

                                                       Chi-Square             1.4424
                                                       DF                          1
                                                       Pr > Chi-Square        0.2298
```

```
                                                     March Point Statistical Comparison                10:56 Wednesday, October 15, 2008  14
                                            T-test Results on Rankits, This is a 2-tailed result
                                                     See Summary Page for 1-tail Result

--------------------------------- Test=10-day Ampelisca abdita Endpoint=Percentage Survival Treatment=MP-4 ---------------------------------

                                                            The TTEST Procedure

                                                                Statistics

                                       Lower CL              Upper CL    Lower CL               Upper CL
  Variable    group               N    Mean      Mean        Mean     Std Dev    Std Dev     Std Dev    Std Err    Minimum    Maximum

  rankit      CR-1                5      -0.161    0.6641       1.489      0.3981     0.6644      1.9091     0.2971     -0.258     1.5466
  rankit      Test                5      -1.355    -0.664      0.0268      0.3334     0.5564      1.5988     0.2488     -1.274     -0.258
  rankit      Diff (1-2)                 0.4344    1.3281      2.2218      0.4139     0.6128      1.1739     0.3876

                                                                  T-Tests

                                   Variable    Method          Variances      DF    t Value    Pr > |t|

                                   rankit      Pooled          Equal           8       3.43      0.0090
                                   rankit      Satterthwaite   Unequal      7.76       3.43      0.0094

                                                           Equality of Variances

                                       Variable    Method      Num DF    Den DF    F Value    Pr > F

                                       rankit      Folded F         4         4       1.43    0.7394
```

```
                                       March Point Statistical Comparison            10:56 Wednesday, October 15, 2008  15
                                  T-test Results on Rankits, This is a 2-tailed result
                                       See Summary Page for 1-tail Result

--------------------------------- Test=10-day Ampelisca abdita Endpoint=Percentage Survival Treatment=MP-5 ---------------------------------

                                                  The TTEST Procedure

                                                      Statistics

                                      Lower CL                Upper CL    Lower CL              Upper CL
  Variable    group                N      Mean        Mean        Mean     Std Dev     Std Dev     Std Dev     Std Err     Minimum     Maximum

  rankit      CR-1                 5    -0.004      0.7156      1.4352      0.3472      0.5796      1.6655      0.2592      73E-18      1.5466
  rankit      Test                 5    -1.212      -0.716      -0.219      0.2397         0.4      1.1495      0.1789      -0.895      73E-18
  rankit      Diff (1-2)                0.7049      1.4312      2.1575      0.3364       0.498       0.954      0.3149


                                                       T-Tests

                                     Variable     Method           Variances        DF    t Value    Pr > |t|

                                     rankit       Pooled           Equal             8       4.54      0.0019
                                     rankit       Satterthwaite    Unequal        7.11       4.54      0.0026


                                                 Equality of Variances

                                         Variable     Method       Num DF    Den DF    F Value    Pr > F

                                         rankit       Folded F          4         4       2.10    0.4903
```

```
                                                        March Point Statistical Comparison             10:56 Wednesday, October 15, 2008  16
                                                    T-test Results, This is a 2-tailed result
                                                        See Summary Page for 1-tail Result

--------------------------------- Test=10-day Ampelisca abdita Endpoint=Percentage Survival Treatment=MP-1 ---------------------------------

                                                              The TTEST Procedure

                                                                  Statistics

                                          Lower CL                  Upper CL    Lower CL                Upper CL
  Variable     group                  N       Mean        Mean        Mean     Std Dev     Std Dev     Std Dev     Std Err     Minimum     Maximum

  Result       SBREF-80               5     0.8286      1.1826      1.5366      0.1708      0.2851      0.8193      0.1275      0.8861      1.5708
  Result       Test                   5     1.0046      1.1407      1.2769      0.0657      0.1096      0.3151       0.049      0.9912       1.249
  Result       Diff (1-2)                    -0.273      0.0419      0.3569      0.1459       0.216      0.4138      0.1366


                                                                    T-Tests

                                     Variable     Method           Variances        DF    t Value    Pr > |t|

                                     Result       Pooled           Equal             8       0.31      0.7669
                                     Result       Satterthwaite    Unequal        5.16       0.31      0.7711


                                                             Equality of Variances

                                         Variable     Method       Num DF     Den DF    F Value    Pr > F

                                         Result       Folded F          4          4       6.76    0.0911
```

```
                                                     March Point Statistical Comparison                10:56 Wednesday, October 15, 2008  17
                                                 T-test Results, This is a 2-tailed result
                                                     See Summary Page for 1-tail Result

-------------------------------- Test=10-day Ampelisca abdita Endpoint=Percentage Survival Treatment=MP-10 ---------------------------------

                                                            The TTEST Procedure

                                                                Statistics

                                       Lower CL              Upper CL    Lower CL               Upper CL
  Variable    group               N        Mean      Mean        Mean     Std Dev    Std Dev     Std Dev    Std Err    Minimum    Maximum

  Result      SBREF-80            5      0.8286    1.1826      1.5366      0.1708     0.2851      0.8193     0.1275     0.8861     1.5708
  Result      Test                5      0.9386    1.2011      1.4636      0.1267     0.2114      0.6075     0.0946     1.0472     1.5708
  Result      Diff (1-2)                 -0.385    -0.018      0.3476      0.1695      0.251      0.4808     0.1587


                                                                  T-Tests

                                   Variable    Method           Variances      DF    t Value    Pr > |t|

                                   Result      Pooled           Equal           8      -0.12      0.9102
                                   Result      Satterthwaite    Unequal      7.38      -0.12      0.9104


                                                           Equality of Variances

                                       Variable    Method      Num DF    Den DF    F Value    Pr > F

                                       Result      Folded F         4         4       1.82    0.5767
```

```
                                                     March Point Statistical Comparison                10:56 Wednesday, October 15, 2008  18
                                                 T-test Results, This is a 2-tailed result
                                                     See Summary Page for 1-tail Result

-------------------------------- Test=10-day Ampelisca abdita Endpoint=Percentage Survival Treatment=MP-11 ---------------------------------

                                                            The TTEST Procedure

                                                                Statistics

                                        Lower CL              Upper CL    Lower CL               Upper CL
  Variable    group               N         Mean      Mean        Mean     Std Dev    Std Dev     Std Dev    Std Err    Minimum    Maximum

  Result      SBREF-80            5       0.8286    1.1826      1.5366      0.1708     0.2851      0.8193     0.1275     0.8861     1.5708
  Result      Test                5       0.8716    1.2023       1.533      0.1596     0.2663      0.7654     0.1191     0.8355     1.5708
  Result      Diff (1-2)                  -0.422     -0.02      0.3827      0.1863     0.2759      0.5285     0.1745


                                                                  T-Tests

                                   Variable    Method           Variances       DF    t Value    Pr > |t|

                                   Result      Pooled           Equal            8      -0.11      0.9129
                                   Result      Satterthwaite    Unequal       7.96      -0.11      0.9129


                                                           Equality of Variances

                                       Variable    Method      Num DF    Den DF    F Value    Pr > F

                                       Result      Folded F         4         4       1.15    0.8983
```

```
                                                  March Point Statistical Comparison             10:56 Wednesday, October 15, 2008  19
                                              T-test Results, This is a 2-tailed result
                                                  See Summary Page for 1-tail Result

-------------------------------- Test=10-day Ampelisca abdita Endpoint=Percentage Survival Treatment=MP-12 ---------------------------------

                                                         The TTEST Procedure

                                                             Statistics

                                       Lower CL               Upper CL    Lower CL              Upper CL
  Variable     group              N        Mean       Mean        Mean     Std Dev     Std Dev     Std Dev     Std Err     Minimum     Maximum

  Result       SBREF-80           5      0.8286     1.1826      1.5366      0.1708      0.2851      0.8193      0.1275      0.8861      1.5708
  Result       Test               5      0.8872     1.0824      1.2776      0.0942      0.1572      0.4517      0.0703      0.8355       1.249
  Result       Diff (1-2)                -0.236     0.1002      0.4359      0.1555      0.2302       0.441      0.1456


                                                               T-Tests

                                   Variable     Method           Variances        DF    t Value    Pr > |t|

                                   Result       Pooled           Equal             8       0.69      0.5108
                                   Result       Satterthwaite    Unequal        6.23       0.69      0.5161


                                                       Equality of Variances

                                       Variable     Method       Num DF    Den DF    F Value    Pr > F

                                       Result       Folded F          4         4       3.29    0.2753
```

```
                                          March Point Statistical Comparison           10:56 Wednesday, October 15, 2008  20
                                        T-test Results, This is a 2-tailed result
                                          See Summary Page for 1-tail Result

-------------------------------- Test=10-day Ampelisca abdita Endpoint=Percentage Survival Treatment=MP-13 ---------------------------------

                                                     The TTEST Procedure

                                                         Statistics

                                      Lower CL              Upper CL  Lower CL              Upper CL
 Variable     group             N         Mean       Mean       Mean   Std Dev    Std Dev    Std Dev    Std Err    Minimum    Maximum

 Result       SBREF-80          5       0.8286     1.1826     1.5366    0.1708     0.2851     0.8193     0.1275     0.8861     1.5708
 Result       Test              5       0.7916      1.026     1.2603    0.1131     0.1887     0.5424     0.0844     0.7353      1.249
 Result       Diff (1-2)                -0.196     0.1566     0.5092    0.1633     0.2418     0.4632     0.1529


                                                          T-Tests

                                  Variable     Method           Variances        DF    t Value    Pr > |t|

                                  Result       Pooled           Equal             8       1.02      0.3357
                                  Result       Satterthwaite    Unequal        6.94       1.02      0.3401


                                                    Equality of Variances

                                      Variable     Method       Num DF    Den DF    F Value    Pr > F

                                      Result       Folded F          4         4       2.28    0.4439
```

```
                                            March Point Statistical Comparison            10:56 Wednesday, October 15, 2008  21
                                        T-test Results, This is a 2-tailed result
                                            See Summary Page for 1-tail Result

--------------------------------- Test=10-day Ampelisca abdita Endpoint=Percentage Survival Treatment=MP-2 ---------------------------------

                                                   The TTEST Procedure

                                                       Statistics

                                        Lower CL             Upper CL    Lower CL              Upper CL
  Variable    group                N        Mean       Mean      Mean     Std Dev    Std Dev    Std Dev    Std Err    Minimum    Maximum

  Result      SBREF-80             5      0.8286     1.1826    1.5366      0.1708     0.2851     0.8193     0.1275     0.8861     1.5708
  Result      Test                 5      1.1501     1.2572    1.3642      0.0517     0.0862     0.2477     0.0386     1.1731     1.3453
  Result      Diff (1-2)                  -0.382     -0.075    0.2326      0.1423     0.2106     0.4035     0.1332


                                                         T-Tests

                                   Variable    Method           Variances        DF    t Value    Pr > |t|

                                   Result      Pooled           Equal             8      -0.56      0.5910
                                   Result      Satterthwaite    Unequal        4.73      -0.56      0.6011


                                                  Equality of Variances

                                       Variable    Method       Num DF    Den DF    F Value    Pr > F

                                       Result      Folded F          4         4      10.94    0.0398
```

```
                                                       March Point Statistical Comparison             10:56 Wednesday, October 15, 2008  22
                                                   T-test Results, This is a 2-tailed result
                                                       See Summary Page for 1-tail Result

--------------------------------- Test=10-day Ampelisca abdita Endpoint=Percentage Survival Treatment=MP-3 ---------------------------------

                                                              The TTEST Procedure

                                                                  Statistics

                                         Lower CL            Upper CL  Lower CL            Upper CL
  Variable    group                N         Mean      Mean      Mean   Std Dev   Std Dev   Std Dev   Std Err   Minimum   Maximum

  Result      SBREF-80             5       0.8286    1.1826    1.5366    0.1708    0.2851    0.8193    0.1275    0.8861    1.5708
  Result      Test                 5       0.9329    1.0652    1.1975    0.0638    0.1066    0.3062    0.0477    0.9912     1.249
  Result      Diff (1-2)                   -0.196    0.1174    0.4313    0.1454    0.2152    0.4123    0.1361


                                                                    T-Tests

                                   Variable    Method           Variances        DF    t Value    Pr > |t|

                                   Result      Pooled           Equal             8       0.86      0.4133
                                   Result      Satterthwaite    Unequal         5.1       0.86      0.4269


                                                             Equality of Variances

                                       Variable    Method       Num DF    Den DF    F Value    Pr > F

                                       Result      Folded F          4         4       7.16    0.0828
```

```
                                                     March Point Statistical Comparison                10:56 Wednesday, October 15, 2008  23
                                                 T-test Results, This is a 2-tailed result
                                                     See Summary Page for 1-tail Result

--------------------------------- Test=10-day Ampelisca abdita Endpoint=Percentage Survival Treatment=MP-4 ----------------------------------

                                                            The TTEST Procedure

                                                                Statistics

                                       Lower CL              Upper CL    Lower CL               Upper CL
  Variable    group               N        Mean      Mean        Mean     Std Dev    Std Dev     Std Dev    Std Err    Minimum    Maximum

  Result      SBREF-80            5      0.8286    1.1826      1.5366      0.1708     0.2851      0.8193     0.1275     0.8861     1.5708
  Result      Test                5      0.9867    1.0248      1.0629      0.0184     0.0307      0.0882     0.0137     0.9912     1.0472
  Result      Diff (1-2)                 -0.138    0.1578      0.4535       0.137     0.2028      0.3884     0.1282


                                                                  T-Tests

                                   Variable    Method           Variances      DF    t Value    Pr > |t|

                                   Result      Pooled           Equal           8       1.23      0.2534
                                   Result      Satterthwaite    Unequal      4.09       1.23      0.2845


                                                           Equality of Variances

                                       Variable    Method      Num DF    Den DF    F Value    Pr > F

                                       Result      Folded F         4         4      86.27    0.0008
```

```
                                                    March Point Statistical Comparison           10:56 Wednesday, October 15, 2008  24
                                                T-test Results, This is a 2-tailed result
                                                    See Summary Page for 1-tail Result

--------------------------------- Test=10-day Ampelisca abdita Endpoint=Percentage Survival Treatment=MP-5 ---------------------------------

                                                          The TTEST Procedure

                                                              Statistics

                                          Lower CL                Upper CL     Lower CL                 Upper CL
  Variable     group                 N        Mean       Mean        Mean      Std Dev     Std Dev      Std Dev     Std Err     Minimum     Maximum

  Result       SBREF-80              5      0.8286     1.1826      1.5366       0.1708      0.2851       0.8193      0.1275      0.8861      1.5708
  Result       Test                  5      0.9712     1.0024      1.0335        0.015      0.0251        0.072      0.0112      0.9912      1.0472
  Result       Diff (1-2)                   -0.115     0.1802      0.4754       0.1367      0.2024       0.3877       0.128


                                                                T-Tests

                                      Variable     Method           Variances        DF    t Value    Pr > |t|

                                      Result       Pooled           Equal             8       1.41      0.1967
                                      Result       Satterthwaite    Unequal        4.06       1.41      0.2308


                                                         Equality of Variances

                                          Variable     Method       Num DF     Den DF    F Value    Pr > F

                                          Result       Folded F          4          4     129.41    0.0004
```

```
                                                  March Point Statistical Comparison            10:56 Wednesday, October 15, 2008  25
                                              T-test Results, This is a 2-tailed result
                                                  See Summary Page for 1-tail Result

---------------------------------- Test=10-day Ampelisca abdita Endpoint=Percentage Survival Treatment=MP-6 ---------------------------------

                                                          The TTEST Procedure

                                                              Statistics

                                         Lower CL                Upper CL   Lower CL              Upper CL
  Variable    group                 N      Mean        Mean       Mean     Std Dev    Std Dev    Std Dev    Std Err    Minimum    Maximum

  Result      SBREF-80              5    0.8286      1.1826     1.5366     0.1708     0.2851     0.8193     0.1275     0.8861     1.5708
  Result      Test                  5    1.0177      1.2578      1.498     0.1159     0.1934     0.5558     0.0865     1.0472     1.5708
  Result      Diff (1-2)                 -0.431      -0.075     0.2801     0.1646     0.2436     0.4667     0.1541


                                                                T-Tests

                                    Variable    Method           Variances        DF    t Value    Pr > |t|

                                    Result      Pooled           Equal             8      -0.49      0.6384
                                    Result      Satterthwaite    Unequal        7.04      -0.49      0.6402


                                                         Equality of Variances

                                        Variable    Method       Num DF    Den DF    F Value    Pr > F

                                        Result      Folded F          4         4       2.17    0.4708
```

```
                                     March Point Statistical Comparison             10:56 Wednesday, October 15, 2008  26
                                   T-test Results, This is a 2-tailed result
                                     See Summary Page for 1-tail Result

--------------------------------- Test=10-day Ampelisca abdita Endpoint=Percentage Survival Treatment=MP-7 ---------------------------------

                                                 The TTEST Procedure

                                                     Statistics

                                      Lower CL              Upper CL   Lower CL              Upper CL
 Variable    group              N        Mean      Mean        Mean    Std Dev    Std Dev    Std Dev    Std Err    Minimum    Maximum

 Result      SBREF-80           5      0.8286    1.1826      1.5366     0.1708     0.2851     0.8193     0.1275     0.8861     1.5708
 Result      Test               5      0.8386    1.0472      1.2558     0.1006      0.168     0.4827     0.0751     0.7854      1.249
 Result      Diff (1-2)               -0.206    0.1354      0.4767      0.158      0.234     0.4483      0.148


                                                       T-Tests

                                 Variable    Method           Variances        DF    t Value    Pr > |t|

                                 Result      Pooled           Equal             8       0.91      0.3870
                                 Result      Satterthwaite    Unequal        6.48       0.91      0.3930


                                                Equality of Variances

                                     Variable    Method       Num DF    Den DF    F Value    Pr > F

                                     Result      Folded F          4         4       2.88    0.3300
```

```
                                           March Point Statistical Comparison            10:56 Wednesday, October 15, 2008  27
                                        T-test Results, This is a 2-tailed result
                                           See Summary Page for 1-tail Result

--------------------------------- Test=10-day Ampelisca abdita Endpoint=Percentage Survival Treatment=MP-8 ---------------------------------

                                                      The TTEST Procedure

                                                          Statistics

                                        Lower CL                Upper CL   Lower CL              Upper CL
  Variable     group               N        Mean       Mean        Mean    Std Dev    Std Dev    Std Dev    Std Err    Minimum    Maximum

  Result       SBREF-80            5      0.8286     1.1826      1.5366     0.1708     0.2851     0.8193     0.1275     0.8861     1.5708
  Result       Test                5       1.167     1.2187      1.2703     0.0249     0.0416     0.1195     0.0186     1.1731      1.249
  Result       Diff (1-2)                 -0.333     -0.036      0.2611     0.1376     0.2037     0.3903     0.1289


                                                            T-Tests

                                    Variable     Method           Variances        DF    t Value    Pr > |t|

                                    Result       Pooled           Equal             8      -0.28      0.7866
                                    Result       Satterthwaite    Unequal        4.17      -0.28      0.7929


                                                     Equality of Variances

                                        Variable     Method       Num DF     Den DF    F Value    Pr > F

                                        Result       Folded F          4          4      46.97    0.0026
```

```
-------------------------------- Test=10-day Ampelisca abdita Endpoint=Percentage Survival Treatment=MP-9 --------------------------------

                                                              The TTEST Procedure

                                                                  Statistics

                                    Lower CL              Upper CL   Lower CL              Upper CL
  Variable    group              N      Mean      Mean      Mean    Std Dev    Std Dev    Std Dev    Std Err    Minimum    Maximum

  Result      SBREF-80           5    0.8286    1.1826    1.5366     0.1708     0.2851     0.8193     0.1275     0.8861     1.5708
  Result      Test               5    0.7539    1.0691    1.3843     0.1521     0.2539     0.7295     0.1135     0.6331      1.249
  Result      Diff (1-2)               -0.28    0.1135    0.5072     0.1823     0.2699     0.5171     0.1707


                                                                    T-Tests

                                  Variable    Method           Variances        DF    t Value    Pr > |t|

                                  Result      Pooled           Equal             8       0.66      0.5248
                                  Result      Satterthwaite    Unequal        7.89       0.66      0.5251


                                                             Equality of Variances

                                      Variable    Method       Num DF    Den DF    F Value    Pr > F

                                      Result      Folded F          4         4       1.26    0.8275
```

Test	Endpoint	Treatment	Comparison	Probability Normal	Probability Homogeneous	Test Type	Test Probability	Significant?	One-Tail Comparison
Larval	Percent Combined Mortality	CR-1	Control	0.672	0.339	T-test Equal Var	0.547		Treatment <= Comparison
Larval	Percent Combined Mortality	SBREF80	Control	0.724	0.387	T-test Equal Var	0.898		Treatment <= Comparison
Larval	Percent Combined Mortality	MP-1	CR-1	0.742	0.532	T-test Equal Var	0.952		Treatment <= Comparison
Larval	Percent Combined Mortality	MP-10	CR-1	0.906	0.484	T-test Equal Var	0.843		Treatment <= Comparison
Larval	Percent Combined Mortality	MP-11	CR-1	0.131	0.503	T-test Equal Var	0.964		Treatment <= Comparison
Larval	Percent Combined Mortality	MP-12	CR-1	0.679	0.946	T-test Equal Var	0.897		Treatment <= Comparison
Larval	Percent Combined Mortality	MP-13	CR-1	0.947	0.757	T-test Equal Var	0.866		Treatment <= Comparison
Larval	Percent Combined Mortality	MP-2	CR-1	0.938	0.765	T-test Equal Var	0.908		Treatment <= Comparison
Larval	Percent Combined Mortality	MP-3	CR-1	0.703	0.358	T-test Equal Var	0.704		Treatment <= Comparison
Larval	Percent Combined Mortality	MP-4	CR-1	0.834	0.74	T-test Equal Var	0.663		Treatment <= Comparison
Larval	Percent Combined Mortality	MP-5	CR-1	0.288	0.839	T-test Equal Var	0.478		Treatment <= Comparison
Larval	Percent Combined Mortality	MP-6	CR-1	0.201	0.18	T-test Equal Var	0.984		Treatment <= Comparison
Larval	Percent Combined Mortality	MP-7	CR-1	0.698	0.364	T-test Equal Var	0.944		Treatment <= Comparison
Larval	Percent Combined Mortality	MP-8	CR-1	0.939	0.577	T-test Equal Var	0.794		Treatment <= Comparison
Larval	Percent Combined Mortality	MP-9	CR-1	0.547	0.601	T-test Equal Var	0.907		Treatment <= Comparison
Larval	Percent Combined Mortality	MP-1	SBREF-80	0.514	0.735	T-test Equal Var	0.868		Treatment <= Comparison
Larval	Percent Combined Mortality	MP-10	SBREF-80	0.764	0.645	T-test Equal Var	0.575		Treatment <= Comparison
Larval	Percent Combined Mortality	MP-11	SBREF-80	0.156	0.674	T-test Equal Var	0.908		Treatment <= Comparison
Larval	Percent Combined Mortality	MP-12	SBREF-80	0.092	0.447	T-test Equal Var	0.734		Treatment <= Comparison
Larval	Percent Combined Mortality	MP-13	SBREF-80	0.382	0.867	T-test Equal Var	0.644		Treatment <= Comparison
Larval	Percent Combined Mortality	MP-2	SBREF-80	0.412	0.855	T-test Equal Var	0.748		Treatment <= Comparison
Larval	Percent Combined Mortality	MP-3	SBREF-80	0.682	0.436	T-test Equal Var	0.326		Treatment <= Comparison
Larval	Percent Combined Mortality	MP-4	SBREF-80	0.836	0.965	T-test Equal Var	0.319		Treatment <= Comparison
Larval	Percent Combined Mortality	MP-5	SBREF-80	0.603	0.892	T-test Equal Var	0.179		Treatment <= Comparison
Larval	Percent Combined Mortality	MP-6	SBREF-80	0.706	0.143	T-test Equal Var	0.966		Treatment <= Comparison
Larval	Percent Combined Mortality	MP-7	SBREF-80	0.612	0.423	T-test Equal Var	0.839		Treatment <= Comparison
Larval	Percent Combined Mortality	MP-8	SBREF-80	0.660	0.798	T-test Equal Var	0.490		Treatment <= Comparison
Larval	Percent Combined Mortality	MP-9	SBREF-80	0.400	0.814	T-test Equal Var	0.750		Treatment <= Comparison

```
---------------- Test=Larval Endpoint=Percent Combined Mortality Treatment=CR-1 ----------------

                                       The TTEST Procedure

                                        Variable:  result

          group           N          Mean      Std Dev      Std Err      Minimum      Maximum

          Control         5        0.3261       0.1054       0.0471       0.2106       0.4641
          Reference       5        0.3125       0.2272       0.1016            0       0.6301
          Diff (1-2)               0.0137       0.1771       0.1120

group          Method                 Mean        95% CL Mean         Std Dev       95% CL Std Dev

Control                             0.3261       0.1953    0.4570      0.1054       0.0631    0.3029
Reference                           0.3125       0.0303    0.5946      0.2272       0.1361    0.6529
Diff (1-2)     Pooled               0.0137      -0.2446    0.2720      0.1771       0.1196    0.3393
Diff (1-2)     Satterthwaite        0.0137      -0.2647    0.2920

                  Method           Variances        DF     t Value     Pr > |t|

                  Pooled           Equal             8        0.12       0.9060
                  Satterthwaite    Unequal      5.6452        0.12       0.9072

                                     Equality of Variances

                       Method        Num DF     Den DF     F Value     Pr > F

                       Folded F           4          4        4.65     0.1659
```

```
-------------- Test=Larval Endpoint=Percent Combined Mortality Treatment=SBREF80 ---------------

                                      The TTEST Procedure

                                       Variable:  result

          group          N        Mean     Std Dev     Std Err     Minimum     Maximum

          Control        5      0.3261      0.1054      0.0471      0.2106      0.4641
          Reference      5      0.2049      0.1655      0.0740           0      0.4328
          Diff (1-2)            0.1212      0.1387      0.0877

 group         Method               Mean       95% CL Mean        Std Dev      95% CL Std Dev

 Control                          0.3261      0.1953   0.4570      0.1054      0.0631   0.3029
 Reference                        0.2049    -0.00058   0.4104      0.1655      0.0992   0.4756
 Diff (1-2)    Pooled             0.1212     -0.0811   0.3236      0.1387      0.0937   0.2658
 Diff (1-2)    Satterthwaite      0.1212     -0.0876   0.3300

                  Method           Variances        DF    t Value    Pr > |t|

                  Pooled           Equal             8       1.38      0.2045
                  Satterthwaite    Unequal      6.7862       1.38      0.2109

                                     Equality of Variances

                       Method      Num DF    Den DF    F Value    Pr > F

                       Folded F         4         4       2.47    0.4034
```

```
---------------- Test=Larval Endpoint=Percent Combined Mortality Treatment=MP-1 ----------------

                                      The TTEST Procedure

                                       Variable:  Result

          group          N        Mean      Std Dev      Std Err      Minimum      Maximum

          CR-1           5      0.3125      0.2272      0.1016            0      0.6301
          Test           5      0.0921      0.1287      0.0575            0      0.2667
          Diff (1-2)            0.2204      0.1846      0.1168

 group        Method                 Mean      95% CL Mean        Std Dev      95% CL Std Dev

 CR-1                            0.3125      0.0303    0.5946      0.2272      0.1361    0.6529
 Test                            0.0921     -0.0677    0.2518      0.1287      0.0771    0.3698
 Diff (1-2)    Pooled            0.2204     -0.0489    0.4897      0.1846      0.1247    0.3537
 Diff (1-2)    Satterthwaite     0.2204     -0.0618    0.5026

                  Method           Variances        DF    t Value    Pr > |t|

                  Pooled           Equal             8       1.89      0.0958
                  Satterthwaite    Unequal      6.3266       1.89      0.1055

                                     Equality of Variances

                       Method      Num DF    Den DF    F Value    Pr > F

                       Folded F         4         4       3.12    0.2966
```

```
--------------- Test=Larval Endpoint=Percent Combined Mortality Treatment=MP-10 ----------------

                                      The TTEST Procedure

                                       Variable:  Result

          group          N         Mean      Std Dev      Std Err      Minimum      Maximum

          CR-1           5       0.3125       0.2272       0.1016            0       0.6301
          Test           5       0.1864       0.1313       0.0587            0       0.3398
          Diff (1-2)             0.1260       0.1855       0.1174

 group         Method                Mean         95% CL Mean         Std Dev       95% CL Std Dev

 CR-1                              0.3125       0.0303    0.5946       0.2272       0.1361    0.6529
 Test                              0.1864       0.0235    0.3494       0.1313       0.0786    0.3772
 Diff (1-2)    Pooled              0.1260      -0.1446    0.3966       0.1855       0.1253    0.3555
 Diff (1-2)    Satterthwaite       0.1260      -0.1568    0.4089

                  Method           Variances        DF    t Value    Pr > |t|

                  Pooled           Equal             8       1.07      0.3142
                  Satterthwaite    Unequal      6.4024       1.07      0.3217

                                     Equality of Variances

                       Method       Num DF    Den DF    F Value    Pr > F

                       Folded F          4         4       3.00    0.3130
```

```
                         T-test Results, This is a 2-tailed result
                             See Summary Page for 1-tail Result
                                                              10:48 Wednesday, November 5, 2008

--------------- Test=Larval Endpoint=Percent Combined Mortality Treatment=MP-11 ----------------

                                    The TTEST Procedure

                                     Variable:  Result

          group           N         Mean      Std Dev      Std Err      Minimum      Maximum

          CR-1            5       0.3125       0.2272       0.1016            0       0.6301
          Test            5       0.0634       0.1418       0.0634            0       0.3171
          Diff (1-2)              0.2491       0.1894       0.1198

 group         Method                 Mean        95% CL Mean          Std Dev       95% CL Std Dev

 CR-1                               0.3125      0.0303    0.5946       0.2272       0.1361    0.6529
 Test                               0.0634     -0.1127    0.2395       0.1418       0.0850    0.4075
 Diff (1-2)    Pooled               0.2491     -0.0272    0.5253       0.1894       0.1279    0.3628
 Diff (1-2)    Satterthwaite        0.2491     -0.0367    0.5348

                  Method           Variances        DF     t Value     Pr > |t|

                  Pooled           Equal             8        2.08       0.0712
                  Satterthwaite    Unequal      6.7056        2.08       0.0779

                                   Equality of Variances

                       Method       Num DF     Den DF     F Value     Pr > F

                       Folded F          4          4        2.57     0.3834
```

```
                              March Point Statistical Comparison
                          T-test Results, This is a 2-tailed result
                              See Summary Page for 1-tail Result
                                                       10:48 Wednesday, November 5, 2008

--------------- Test=Larval Endpoint=Percent Combined Mortality Treatment=MP-12 ----------------

                                     The TTEST Procedure

                                      Variable:  Result

          group          N         Mean      Std Dev      Std Err      Minimum      Maximum

          CR-1           5       0.3125       0.2272       0.1016            0       0.6301
          Test           5       0.1329       0.1821       0.0814            0       0.3398
          Diff (1-2)             0.1795       0.2059       0.1302

 group         Method               Mean       95% CL Mean         Std Dev      95% CL Std Dev

 CR-1                             0.3125      0.0303   0.5946      0.2272      0.1361   0.6529
 Test                             0.1329     -0.0932   0.3590      0.1821      0.1091   0.5233
 Diff (1-2)    Pooled             0.1795     -0.1208   0.4798      0.2059      0.1391   0.3945
 Diff (1-2)    Satterthwaite      0.1795     -0.1233   0.4823

                  Method           Variances        DF    t Value    Pr > |t|

                  Pooled           Equal             8       1.38      0.2053
                  Satterthwaite    Unequal      7.6377       1.38      0.2070

                                    Equality of Variances

                       Method       Num DF     Den DF     F Value    Pr > F

                       Folded F          4          4        1.56    0.6785
```

```
--------------- Test=Larval Endpoint=Percent Combined Mortality Treatment=MP-13 ----------------

                                      The TTEST Procedure

                                       Variable:  Result

          group          N        Mean     Std Dev     Std Err     Minimum     Maximum

          CR-1           5      0.3125      0.2272      0.1016           0      0.6301
          Test           5      0.1661      0.1542      0.0690           0      0.3171
          Diff (1-2)            0.1463      0.1942      0.1228

 group         Method               Mean       95% CL Mean        Std Dev      95% CL Std Dev

 CR-1                             0.3125      0.0303   0.5946      0.2272      0.1361   0.6529
 Test                             0.1661     -0.0254   0.3576      0.1542      0.0924   0.4432
 Diff (1-2)    Pooled             0.1463     -0.1369   0.4295      0.1942      0.1312   0.3720
 Diff (1-2)    Satterthwaite      0.1463     -0.1437   0.4364

                  Method           Variances        DF    t Value    Pr > |t|

                  Pooled           Equal             8       1.19      0.2676
                  Satterthwaite    Unequal      7.0403       1.19      0.2720

                                     Equality of Variances

                       Method      Num DF    Den DF    F Value    Pr > F

                       Folded F         4         4       2.17    0.4714
```

```
                                     T-test Results, This is a 2-tailed result
                                         See Summary Page for 1-tail Result
                                                                  10:48 Wednesday, November 5, 2008

---------------- Test=Larval Endpoint=Percent Combined Mortality Treatment=MP-2 ----------------

                                              The TTEST Procedure

                                               Variable:  Result

          group            N         Mean      Std Dev      Std Err      Minimum      Maximum

          CR-1             5       0.3125       0.2272       0.1016            0       0.6301
          Test             5       0.1340       0.1551       0.0693            0       0.3092
          Diff (1-2)               0.1784       0.1945       0.1230

 group          Method                Mean        95% CL Mean         Std Dev       95% CL Std Dev

 CR-1                               0.3125      0.0303    0.5946      0.2272       0.1361    0.6529
 Test                               0.1340     -0.0585    0.3266      0.1551       0.0929    0.4456
 Diff (1-2)     Pooled              0.1784     -0.1052    0.4621      0.1945       0.1314    0.3726
 Diff (1-2)     Satterthwaite       0.1784     -0.1119    0.4688

                  Method           Variances        DF     t Value    Pr > |t|

                  Pooled           Equal             8        1.45      0.1850
                  Satterthwaite    Unequal      7.0618        1.45      0.1898

                                             Equality of Variances

                       Method       Num DF     Den DF     F Value    Pr > F

                       Folded F          4          4        2.15    0.4775
```

```
---------------- Test=Larval Endpoint=Percent Combined Mortality Treatment=MP-3 ----------------

                                       The TTEST Procedure

                                        Variable:  Result

          group           N         Mean      Std Dev      Std Err      Minimum      Maximum

          CR-1            5       0.3125       0.2272       0.1016            0       0.6301
          Test            5       0.2480       0.1228       0.0549       0.1181       0.4508
          Diff (1-2)              0.0645       0.1826       0.1155

 group         Method               Mean        95% CL Mean          Std Dev       95% CL Std Dev

 CR-1                             0.3125      0.0303    0.5946       0.2272       0.1361    0.6529
 Test                             0.2480      0.0955    0.4005       0.1228       0.0736    0.3528
 Diff (1-2)    Pooled             0.0645     -0.2019    0.3308       0.1826       0.1234    0.3499
 Diff (1-2)    Satterthwaite      0.0645     -0.2165    0.3454

                  Method           Variances        DF     t Value    Pr > |t|

                  Pooled           Equal             8        0.56      0.5921
                  Satterthwaite    Unequal      6.1527        0.56      0.5965

                                     Equality of Variances

                       Method      Num DF     Den DF     F Value    Pr > F

                       Folded F         4          4        3.42    0.2603
```

```
---------------- Test=Larval Endpoint=Percent Combined Mortality Treatment=MP-4 ----------------

                                      The TTEST Procedure

                                       Variable:  Result

          group           N         Mean      Std Dev      Std Err      Minimum      Maximum

          CR-1            5       0.3125       0.2272       0.1016            0       0.6301
          Test            5       0.2568       0.1710       0.0765            0       0.4449
          Diff (1-2)              0.0556       0.2011       0.1272

 group         Method               Mean        95% CL Mean         Std Dev       95% CL Std Dev

 CR-1                             0.3125      0.0303    0.5946      0.2272       0.1361    0.6529
 Test                             0.2568      0.0445    0.4692      0.1710       0.1025    0.4914
 Diff (1-2)    Pooled             0.0556     -0.2377    0.3489      0.2011       0.1358    0.3852
 Diff (1-2)    Satterthwaite      0.0556     -0.2416    0.3529

                  Method           Variances        DF    t Value    Pr > |t|

                  Pooled           Equal             8       0.44      0.6734
                  Satterthwaite    Unequal       7.431       0.44      0.6743

                                     Equality of Variances

                       Method        Num DF    Den DF    F Value    Pr > F

                       Folded F           4         4       1.77    0.5955
```

```
---------------- Test=Larval Endpoint=Percent Combined Mortality Treatment=MP-5 ----------------

                                      The TTEST Procedure

                                       Variable:  Result

          group           N          Mean       Std Dev       Std Err       Minimum       Maximum

          CR-1            5        0.3125        0.2272        0.1016             0        0.6301
          Test            5        0.3202        0.2060        0.0921             0        0.5705
          Diff (1-2)             -0.00775        0.2169        0.1372

 group         Method                  Mean         95% CL Mean         Std Dev       95% CL Std Dev

 CR-1                                0.3125      0.0303    0.5946        0.2272       0.1361    0.6529
 Test                                0.3202      0.0644    0.5760        0.2060       0.1234    0.5919
 Diff (1-2)    Pooled              -0.00775     -0.3240    0.3085        0.2169       0.1465    0.4155
 Diff (1-2)    Satterthwaite       -0.00775     -0.3246    0.3091

                  Method           Variances        DF     t Value     Pr > |t|

                  Pooled           Equal             8       -0.06       0.9563
                  Satterthwaite    Unequal      7.9243       -0.06       0.9564

                                    Equality of Variances

                       Method       Num DF     Den DF     F Value     Pr > F

                       Folded F          4          4        1.22     0.8538
```

```
                          March Point Statistical Comparison
                      T-test Results, This is a 2-tailed result
                          See Summary Page for 1-tail Result
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---------------- Test=Larval Endpoint=Percent Combined Mortality Treatment=MP-6 ----------------

                                 The TTEST Procedure

                                  Variable:  Result

          group           N         Mean      Std Dev      Std Err      Minimum      Maximum

          CR-1            5       0.3125       0.2272       0.1016            0       0.6301
          Test            5       0.0335       0.0749       0.0335            0       0.1674
          Diff (1-2)              0.2790       0.1692       0.1070

 group         Method                Mean        95% CL Mean         Std Dev       95% CL Std Dev

 CR-1                              0.3125      0.0303    0.5946      0.2272      0.1361    0.6529
 Test                              0.0335     -0.0595    0.1265      0.0749      0.0449    0.2152
 Diff (1-2)    Pooled              0.2790      0.0323    0.5257      0.1692      0.1143    0.3241
 Diff (1-2)    Satterthwaite       0.2790     0.00153    0.5564

                  Method           Variances        DF     t Value    Pr > |t|

                  Pooled           Equal             8        2.61      0.0313
                  Satterthwaite    Unequal      4.8588        2.61      0.0492

                                Equality of Variances

                       Method      Num DF     Den DF     F Value    Pr > F

                       Folded F         4          4        9.21    0.0538
```

```
---------------- Test=Larval Endpoint=Percent Combined Mortality Treatment=MP-7 ----------------

                                      The TTEST Procedure

                                       Variable:  Result

          group          N        Mean     Std Dev     Std Err     Minimum     Maximum

          CR-1           5      0.3125      0.2272      0.1016           0      0.6301
          Test           5      0.1123      0.1059      0.0474           0      0.2276
          Diff (1-2)            0.2002      0.1773      0.1121

 group         Method                 Mean        95% CL Mean         Std Dev       95% CL Std Dev

 CR-1                             0.3125      0.0303    0.5946      0.2272      0.1361    0.6529
 Test                             0.1123     -0.0192    0.2438      0.1059      0.0635    0.3044
 Diff (1-2)    Pooled             0.2002     -0.0583    0.4587      0.1773      0.1197    0.3396
 Diff (1-2)    Satterthwaite      0.2002     -0.0782    0.4786

                  Method           Variances        DF    t Value    Pr > |t|

                  Pooled           Equal             8       1.79      0.1120
                  Satterthwaite    Unequal      5.6602       1.79      0.1274

                                     Equality of Variances

                       Method      Num DF    Den DF    F Value    Pr > F

                       Folded F         4         4       4.60    0.1685
```

```
                                   T-test Results, This is a 2-tailed result
                                       See Summary Page for 1-tail Result
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---------------- Test=Larval Endpoint=Percent Combined Mortality Treatment=MP-8 ----------------

                                              The TTEST Procedure

                                               Variable:  Result

          group           N         Mean      Std Dev      Std Err      Minimum      Maximum

          CR-1            5       0.3125       0.2272       0.1016            0       0.6301
          Test            5       0.2074       0.1476       0.0660            0       0.3885
          Diff (1-2)              0.1051       0.1916       0.1212

 group         Method               Mean        95% CL Mean        Std Dev       95% CL Std Dev

 CR-1                             0.3125      0.0303    0.5946      0.2272       0.1361    0.6529
 Test                             0.2074      0.0241    0.3907      0.1476       0.0885    0.4242
 Diff (1-2)    Pooled             0.1051     -0.1744    0.3845      0.1916       0.1294    0.3671
 Diff (1-2)    Satterthwaite      0.1051     -0.1826    0.3927

                  Method           Variances        DF     t Value    Pr > |t|

                  Pooled           Equal             8        0.87      0.4112
                  Satterthwaite    Unequal      6.8665        0.87      0.4152

                                            Equality of Variances

                       Method         Num DF     Den DF     F Value    Pr > F

                       Folded F            4          4        2.37    0.4241
```

```
---------------- Test=Larval Endpoint=Percent Combined Mortality Treatment=MP-9 ----------------

                                    The TTEST Procedure

                                     Variable:  Result

          group           N         Mean      Std Dev      Std Err      Minimum      Maximum

          CR-1            5       0.3125       0.2272       0.1016            0       0.6301
          Test            5       0.1312       0.1641       0.0734            0       0.4016
          Diff (1-2)              0.1812       0.1982       0.1253

 group         Method                Mean        95% CL Mean         Std Dev       95% CL Std Dev

 CR-1                              0.3125      0.0303    0.5946       0.2272       0.1361    0.6529
 Test                              0.1312     -0.0725    0.3350       0.1641       0.0983    0.4716
 Diff (1-2)    Pooled              0.1812     -0.1078    0.4703       0.1982       0.1339    0.3797
 Diff (1-2)    Satterthwaite       0.1812     -0.1129    0.4753

                  Method            Variances         DF     t Value     Pr > |t|

                  Pooled            Equal              8        1.45       0.1862
                  Satterthwaite     Unequal       7.2806        1.45       0.1899

                                   Equality of Variances

                       Method       Num DF     Den DF     F Value    Pr > F

                       Folded F          4          4        1.92    0.5440
```

```
---------------- Test=Larval Endpoint=Percent Combined Mortality Treatment=MP-1 ----------------

                                     The TTEST Procedure

                                      Variable:  Result

          group           N         Mean      Std Dev      Std Err      Minimum      Maximum

          SBREF-80        5       0.2049       0.1655       0.0740            0       0.4328
          Test            5       0.0921       0.1287       0.0575            0       0.2667
          Diff (1-2)              0.1128       0.1482       0.0938

 group          Method                 Mean         95% CL Mean         Std Dev       95% CL Std Dev

 SBREF-80                            0.2049    -0.00058    0.4104        0.1655       0.0992    0.4756
 Test                                0.0921     -0.0677    0.2518        0.1287       0.0771    0.3698
 Diff (1-2)     Pooled               0.1128     -0.1034    0.3290        0.1482       0.1001    0.2840
 Diff (1-2)     Satterthwaite        0.1128     -0.1057    0.3314

                  Method           Variances        DF     t Value    Pr > |t|

                  Pooled           Equal             8        1.20      0.2631
                  Satterthwaite    Unequal      7.5419        1.20      0.2651

                                    Equality of Variances

                       Method       Num DF     Den DF     F Value    Pr > F

                       Folded F          4          4        1.65    0.6378
```

```
--------------- Test=Larval Endpoint=Percent Combined Mortality Treatment=MP-10 ----------------

                                       The TTEST Procedure

                                        Variable:  Result

          group           N         Mean      Std Dev      Std Err      Minimum      Maximum

          SBREF-80        5       0.2049       0.1655       0.0740            0       0.4328
          Test            5       0.1864       0.1313       0.0587            0       0.3398
          Diff (1-2)              0.0185       0.1494       0.0945

 group         Method                 Mean        95% CL Mean         Std Dev      95% CL Std Dev

 SBREF-80                           0.2049    -0.00058    0.4104      0.1655      0.0992    0.4756
 Test                               0.1864      0.0235    0.3494      0.1313      0.0786    0.3772
 Diff (1-2)    Pooled               0.0185     -0.1994    0.2363      0.1494      0.1009    0.2862
 Diff (1-2)    Satterthwaite        0.0185     -0.2014    0.2383

                  Method           Variances        DF    t Value    Pr > |t|

                  Pooled           Equal             8       0.20      0.8499
                  Satterthwaite    Unequal      7.6057       0.20      0.8502

                                     Equality of Variances

                       Method      Num DF     Den DF     F Value    Pr > F

                       Folded F         4          4        1.59    0.6644
```

```
--------------- Test=Larval Endpoint=Percent Combined Mortality Treatment=MP-11 ----------------

                                      The TTEST Procedure

                                       Variable:  Result

          group          N        Mean     Std Dev     Std Err     Minimum     Maximum

          SBREF-80       5      0.2049      0.1655      0.0740           0      0.4328
          Test           5      0.0634      0.1418      0.0634           0      0.3171
          Diff (1-2)            0.1415      0.1541      0.0975

 group         Method              Mean       95% CL Mean        Std Dev      95% CL Std Dev

 SBREF-80                        0.2049    -0.00058   0.4104      0.1655      0.0992   0.4756
 Test                            0.0634     -0.1127   0.2395      0.1418      0.0850   0.4075
 Diff (1-2)    Pooled            0.1415     -0.0833   0.3663      0.1541      0.1041   0.2952
 Diff (1-2)    Satterthwaite     0.1415     -0.0842   0.3672

                  Method           Variances        DF    t Value    Pr > |t|

                  Pooled           Equal             8       1.45      0.1846
                  Satterthwaite    Unequal      7.8164       1.45      0.1855

                                     Equality of Variances

                       Method       Num DF    Den DF    F Value    Pr > F

                       Folded F          4         4       1.36    0.7719
```

```
--------------- Test=Larval Endpoint=Percent Combined Mortality Treatment=MP-12 ----------------

                                     The TTEST Procedure

                                      Variable:  Result

          group            N          Mean       Std Dev       Std Err       Minimum       Maximum

          SBREF-80         5        0.2049        0.1655        0.0740             0        0.4328
          Test             5        0.1329        0.1821        0.0814             0        0.3398
          Diff (1-2)                0.0720        0.1740        0.1100

 group         Method                 Mean        95% CL Mean          Std Dev       95% CL Std Dev

 SBREF-80                           0.2049     -0.00058    0.4104       0.1655       0.0992    0.4756
 Test                               0.1329      -0.0932    0.3590       0.1821       0.1091    0.5233
 Diff (1-2)    Pooled               0.0720      -0.1818    0.3257       0.1740       0.1175    0.3333
 Diff (1-2)    Satterthwaite        0.0720      -0.1822    0.3261

                  Method           Variances        DF    t Value    Pr > |t|

                  Pooled           Equal             8       0.65      0.5314
                  Satterthwaite    Unequal       7.928       0.65      0.5316

                                    Equality of Variances

                       Method      Num DF    Den DF    F Value    Pr > F

                       Folded F         4         4       1.21    0.8575
```

```
--------------- Test=Larval Endpoint=Percent Combined Mortality Treatment=MP-13 ----------------

                                      The TTEST Procedure

                                       Variable:  Result

          group          N        Mean     Std Dev     Std Err     Minimum     Maximum

          SBREF-80       5      0.2049      0.1655      0.0740           0      0.4328
          Test           5      0.1661      0.1542      0.0690           0      0.3171
          Diff (1-2)            0.0388      0.1600      0.1012

 group         Method               Mean       95% CL Mean        Std Dev      95% CL Std Dev

 SBREF-80                         0.2049    -0.00058   0.4104      0.1655      0.0992   0.4756
 Test                             0.1661     -0.0254   0.3576      0.1542      0.0924   0.4432
 Diff (1-2)    Pooled             0.0388     -0.1945   0.2721      0.1600      0.1080   0.3064
 Diff (1-2)    Satterthwaite      0.0388     -0.1947   0.2723

                  Method           Variances        DF    t Value    Pr > |t|

                  Pooled           Equal             8       0.38      0.7115
                  Satterthwaite    Unequal      7.9605       0.38      0.7115

                                     Equality of Variances

                       Method      Num DF    Den DF    F Value    Pr > F

                       Folded F         4         4       1.15    0.8945
```

```
---------------- Test=Larval Endpoint=Percent Combined Mortality Treatment=MP-2 ----------------

                                      The TTEST Procedure

                                       Variable:  Result

          group          N        Mean      Std Dev      Std Err      Minimum      Maximum

          SBREF-80       5      0.2049       0.1655       0.0740            0       0.4328
          Test           5      0.1340       0.1551       0.0693            0       0.3092
          Diff (1-2)            0.0709       0.1604       0.1014

 group         Method                 Mean       95% CL Mean         Std Dev      95% CL Std Dev

 SBREF-80                           0.2049    -0.00058    0.4104      0.1655      0.0992    0.4756
 Test                               0.1340     -0.0585    0.3266      0.1551      0.0929    0.4456
 Diff (1-2)    Pooled               0.0709     -0.1630    0.3048      0.1604      0.1083    0.3072
 Diff (1-2)    Satterthwaite        0.0709     -0.1632    0.3049

                  Method           Variances        DF     t Value    Pr > |t|

                  Pooled           Equal             8        0.70      0.5044
                  Satterthwaite    Unequal      7.9663        0.70      0.5045

                                     Equality of Variances

                       Method      Num DF     Den DF     F Value    Pr > F

                       Folded F         4          4        1.14    0.9026
```

```
---------------- Test=Larval Endpoint=Percent Combined Mortality Treatment=MP-3 ----------------

                                      The TTEST Procedure

                                       Variable:  Result

          group          N        Mean     Std Dev     Std Err     Minimum     Maximum

          SBREF-80       5      0.2049      0.1655      0.0740           0      0.4328
          Test           5      0.2480      0.1228      0.0549      0.1181      0.4508
          Diff (1-2)           -0.0431      0.1457      0.0922

 group         Method                Mean       95% CL Mean        Std Dev      95% CL Std Dev

 SBREF-80                          0.2049    -0.00058   0.4104      0.1655      0.0992   0.4756
 Test                              0.2480      0.0955   0.4005      0.1228      0.0736   0.3528
 Diff (1-2)    Pooled             -0.0431     -0.2556   0.1694      0.1457      0.0984   0.2792
 Diff (1-2)    Satterthwaite      -0.0431     -0.2588   0.1726

                  Method           Variances        DF    t Value    Pr > |t|

                  Pooled           Equal             8      -0.47      0.6525
                  Satterthwaite    Unequal      7.3796      -0.47      0.6535

                                     Equality of Variances

                       Method      Num DF    Den DF    F Value    Pr > F

                       Folded F         4         4       1.82    0.5773
```

```
---------------- Test=Larval Endpoint=Percent Combined Mortality Treatment=MP-4 ----------------

                                     The TTEST Procedure

                                      Variable:  Result

          group           N          Mean      Std Dev      Std Err      Minimum      Maximum

          SBREF-80        5        0.2049       0.1655       0.0740            0       0.4328
          Test            5        0.2568       0.1710       0.0765            0       0.4449
          Diff (1-2)              -0.0519       0.1683       0.1064

 group          Method                Mean         95% CL Mean          Std Dev       95% CL Std Dev

 SBREF-80                           0.2049    -0.00058     0.4104        0.1655       0.0992    0.4756
 Test                               0.2568      0.0445     0.4692        0.1710       0.1025    0.4914
 Diff (1-2)     Pooled             -0.0519     -0.2974     0.1935        0.1683       0.1137    0.3224
 Diff (1-2)     Satterthwaite      -0.0519     -0.2974     0.1935

                  Method           Variances         DF     t Value    Pr > |t|

                  Pooled           Equal              8       -0.49      0.6387
                  Satterthwaite    Unequal       7.9914       -0.49      0.6387

                                    Equality of Variances

                       Method       Num DF     Den DF     F Value    Pr > F

                       Folded F          4          4        1.07    0.9508
```

```
---------------- Test=Larval Endpoint=Percent Combined Mortality Treatment=MP-5 ----------------

                                       The TTEST Procedure

                                        Variable:  Result

          group           N          Mean      Std Dev      Std Err      Minimum      Maximum

          SBREF-80        5        0.2049       0.1655       0.0740            0       0.4328
          Test            5        0.3202       0.2060       0.0921            0       0.5705
          Diff (1-2)              -0.1153       0.1868       0.1182

 group         Method                 Mean        95% CL Mean         Std Dev      95% CL Std Dev

 SBREF-80                           0.2049    -0.00058    0.4104      0.1655      0.0992    0.4756
 Test                               0.3202      0.0644    0.5760      0.2060      0.1234    0.5919
 Diff (1-2)    Pooled              -0.1153     -0.3878    0.1572      0.1868      0.1262    0.3580
 Diff (1-2)    Satterthwaite       -0.1153     -0.3900    0.1594

                  Method           Variances        DF     t Value    Pr > |t|

                  Pooled           Equal             8       -0.98      0.3578
                  Satterthwaite    Unequal      7.6452       -0.98      0.3590

                                     Equality of Variances

                       Method       Num DF     Den DF     F Value    Pr > F

                       Folded F          4          4        1.55    0.6818
```

```
                      T-test Results, This is a 2-tailed result
                           See Summary Page for 1-tail Result
                                                          10:48 Wednesday, November 5, 2008

---------------- Test=Larval Endpoint=Percent Combined Mortality Treatment=MP-6 ----------------

                                    The TTEST Procedure

                                     Variable:  Result

         group           N         Mean      Std Dev      Std Err      Minimum      Maximum

         SBREF-80        5       0.2049       0.1655       0.0740            0       0.4328
         Test            5       0.0335       0.0749       0.0335            0       0.1674
         Diff (1-2)              0.1714       0.1284       0.0812

 group          Method                Mean        95% CL Mean         Std Dev       95% CL Std Dev

 SBREF-80                           0.2049    -0.00058    0.4104       0.1655       0.0992    0.4756
 Test                               0.0335     -0.0595    0.1265       0.0749       0.0449    0.2152
 Diff (1-2)     Pooled              0.1714     -0.0159    0.3588       0.1284       0.0868    0.2461
 Diff (1-2)     Satterthwaite       0.1714     -0.0311    0.3740

                  Method           Variances         DF     t Value     Pr > |t|

                  Pooled           Equal              8        2.11       0.0679
                  Satterthwaite    Unequal        5.572        2.11       0.0829

                                   Equality of Variances

                       Method       Num DF     Den DF     F Value     Pr > F

                       Folded F          4          4        4.88     0.1537
```

```
---------------- Test=Larval Endpoint=Percent Combined Mortality Treatment=MP-7 ----------------

                                        The TTEST Procedure

                                         Variable:  Result

          group           N          Mean      Std Dev      Std Err      Minimum      Maximum

          SBREF-80        5        0.2049       0.1655       0.0740            0       0.4328
          Test            5        0.1123       0.1059       0.0474            0       0.2276
          Diff (1-2)               0.0926       0.1389       0.0879

 group          Method                 Mean        95% CL Mean          Std Dev      95% CL Std Dev

 SBREF-80                            0.2049    -0.00058    0.4104       0.1655       0.0992    0.4756
 Test                                0.1123     -0.0192    0.2438       0.1059       0.0635    0.3044
 Diff (1-2)     Pooled               0.0926     -0.1100    0.2953       0.1389       0.0938    0.2662
 Diff (1-2)     Satterthwaite        0.0926     -0.1164    0.3016

                  Method           Variances        DF    t Value    Pr > |t|

                  Pooled           Equal             8       1.05      0.3226
                  Satterthwaite    Unequal      6.8062       1.05      0.3278

                                      Equality of Variances

                       Method      Num DF    Den DF    F Value    Pr > F

                       Folded F         4         4       2.44    0.4085
```

```
---------------- Test=Larval Endpoint=Percent Combined Mortality Treatment=MP-8 ----------------

                                     The TTEST Procedure

                                      Variable:  Result

         group           N         Mean      Std Dev      Std Err      Minimum      Maximum

         SBREF-80        5       0.2049       0.1655       0.0740            0       0.4328
         Test            5       0.2074       0.1476       0.0660            0       0.3885
         Diff (1-2)            -0.00249       0.1568       0.0992

 group         Method                 Mean        95% CL Mean         Std Dev       95% CL Std Dev

 SBREF-80                           0.2049    -0.00058    0.4104       0.1655       0.0992    0.4756
 Test                               0.2074      0.0241    0.3907       0.1476       0.0885    0.4242
 Diff (1-2)    Pooled             -0.00249     -0.2312    0.2262       0.1568       0.1059    0.3004
 Diff (1-2)    Satterthwaite      -0.00249     -0.2317    0.2267

                 Method           Variances        DF     t Value     Pr > |t|

                 Pooled           Equal             8       -0.03       0.9805
                 Satterthwaite    Unequal      7.8978       -0.03       0.9806

                                    Equality of Variances

                      Method       Num DF     Den DF     F Value     Pr > F

                      Folded F          4          4        1.26     0.8301
```

```
---------------- Test=Larval Endpoint=Percent Combined Mortality Treatment=MP-9 ----------------

                                       The TTEST Procedure

                                        Variable:  Result

          group           N         Mean      Std Dev      Std Err      Minimum      Maximum

          SBREF-80        5       0.2049       0.1655       0.0740            0       0.4328
          Test            5       0.1312       0.1641       0.0734            0       0.4016
          Diff (1-2)              0.0737       0.1648       0.1042

 group          Method                 Mean        95% CL Mean        Std Dev      95% CL Std Dev

 SBREF-80                            0.2049    -0.00058    0.4104      0.1655      0.0992    0.4756
 Test                                0.1312     -0.0725    0.3350      0.1641      0.0983    0.4716
 Diff (1-2)     Pooled               0.0737     -0.1667    0.3140      0.1648      0.1113    0.3157
 Diff (1-2)     Satterthwaite        0.0737     -0.1667    0.3140

                  Method           Variances        DF    t Value    Pr > |t|

                  Pooled           Equal             8       0.71      0.4998
                  Satterthwaite    Unequal      7.9994       0.71      0.4998

                                     Equality of Variances

                       Method       Num DF     Den DF     F Value    Pr > F

                       Folded F          4          4        1.02    0.9873
```

APPENDIX H

Archaeological Report and Recommendations

February 20, 2009
8-915-16558-0

AMEC E&E Geomatrix
One Union Square, Suite 1020
600 University Street
Seattle, Washington 98101-4107

Attention: Dave Haddock

Subject: Archaeological Monitoring of RIFS Sampling in the Whitmarsh Landfill, Skagit County, Washington

Dear Dave:

AMEC-Geomatrix conducted subsurface investigations for an Uplands Remedial Investigation/Feasibility Study (RIFS) at the March Point (Whitmarsh) Landfill in Anacortes, Washington, between October 29 and November 2, 2008. In a letter to you dated October 16, 2008, I reviewed the potential for RIFS activities to affect archaeological resources that might underlie or exist at the surface adjacent to the project area. I stated my finding as follows:

"It is my professional opinion that there is a low potential for archaeological resources in the tide flat beneath the waste deposits. Although that is the case, I advise that a qualified archaeologist should be present during the test pitting to ensure that no unanticipated effects occur to archaeological resources. The observations of the monitoring archaeologist will also serve as an archaeological survey of the landfill area itself."

AMEC-Geomatrix followed that recommendation. Emily Gantz from the Bothell office of AMEC Earth & Environmental, Inc. monitored the excavations at the landfill site at all times and kept a daily record of her monitoring activities and observations (Attachment A). Her observations are summarized below.

Monitoring Observations.

Eleven test pits, numbered G-1 through G-11, were opened using an excavator. Each pit was excavated into native tide flat sediments or to the water table, whichever was encountered first. All pits contained an upper deposit of soil mixed with residential and industrial waste (Attachment B, Photos 1 and 2). Nine of the eleven pits reached groundwater before encountering native tide-flat sediments. Only pits G-7 and G-11 encountered native sediments. Native sediments were encountered at 8 to 10 feet (ft) below ground surface in G-7 (Photo 2) and in G-11 at approximately 8 ft. Sediments consisted of a poorly sorted mix of gravel, sand, and mud reduced to a gray color. No shells or archaeological material of any kind was observed in either of the pits.

Conclusion and Recommendations

Results of archaeological monitoring show that no archaeological resources were affected by RIFS activities at the Whitmarsh Landfill. Because the RIFS excavations reached native sediments at only two points, however, these results cannot be considered to be a full archaeological survey of the underlying landform. They provide no information about the land adjacent to the tide flat, which has a much higher potential for archaeological resources. Therefore, I recommend that to alleviate the concerns of the Suquamish and Swinomish tribes about possible archaeological impacts of later remediation efforts, two actions should be taken.

- An archaeological survey should be conducted along the historic western shoreline of Padilla Bay at the edge of the landfill deposit to identify and document any sites that might be affected by remediation activities. Cost of this activity would be approximately $7,500.
- AMEC-Geomatrix should consider including an archaeological monitor during at least the initial stages of any remediation that entailed removal of landfill material to the contact with natural tide flats. This monitoring would be intended to complete the equivalent of archaeological survey under the landfill deposits and establish with confidence that no archaeological resources are being affected by excavation of contaminated materials. Costs would be dependent on the scale and duration of excavation activities.

If these actions are taken, it is my professional opinion that no significant cultural resources will be affected by remediation activities.

Please feel free to contact me if you have any additional questions.

Sincerely,

AMEC Earth & Environmental, Inc.

James C. Chatters, Ph.D., R.P.A.
Senior Associate Archaeologist

Attachments: Attachment A – Archaeological Monitoring Logs
Attachment B – Photographs

ATTACHMENT A

Archaeological Monitoring Logs

ARCHAEOLOGICAL MONITORING LOG

Date 10/29/08 Monitor's Name/Initials: Emily Scott

Work area # WHITE MARSH (note location of today's monitoring areas on the attached site map)

Description of abatement/demolition work being done
(also note time of day, weather conditions, work performed by construction crew)

Met NIK BACHER (AMEC Geomatrix) At the site a little before 1pm. WENT
OVER SITE ACCESS AND SAFETY WITH PSC personnel (?) or PCS).
Completed a walk over of the test pit locations and measured test pits
based from GPS points previously taken.

Total hours: 5.5 hrs (Including drive time)

Photographic Documentation: roll # DIGITAL

Description of sediments and cultural resources (if any)

Surface sediments included a thick area of woody debris (near
test pit locations G-6, G-8, G-9, and G-10). SURFACE SEDIMENTS AT
The other test pit locations consisted of obviously disturbed sediments,
fill, and lots of surface garbage.

Other notes (continue on back, if necessary)

Completed a visual survey of the site boundary nearest Padilla
Bay Lagoon: No cultural materials noticed (besides modern
garbage. The project area is located on a manmade
rise over a tidal flat.

Pictures of the project area were taken.

Met with the Project Health & Safety Officer, Tim Reinhardt, and
learned about the Ludlum radiation gauge.

ARCHAEOLOGICAL MONITORING LOG

Date 10/30/08 **Monitor's Name/Initials:** Emily Scott

Work area # Whitman (note location of today's monitoring areas on the attached site map)

G-2, G-7

Description of abatement/demolition work being done
(also note time of day, weather conditions, work performed by construction crew)

Met the project crew at a little before 8 Am. Went over safety procedures and policies. Planned to begin test pit excavation as soon as equipment was ready. Delay with the water truck.

Total hours: 9.5 hrs

Photographic Documentation: roll # DIGITAL

Description of sediments and cultural resources (if any)

@ G-7: Top sediment was a dark brown silty loam w/ ≈30% gravels and modern trash underlaid by the land fill deposits with native sediments at ≈ 8ft bgs → 10 ft bgs. No cultural materials of significance observed.
@ G-2: Had a similar sedimentology (all fill) until water level prior to native sediments. No cultural materials of significance were observed.

Other notes (continue on back, if necessary)

No cultural materials of significance were observed during the monitoring of G-7 and G-2.

ARCHAEOLOGICAL MONITORING LOG

Date 10/31/08 **Monitor's Name/Initials:** Emily Scott

Work area # Ulwimarsh (note location of today's monitoring areas on the attached site map)
G-4, G11, G-3

Description of abatement/demolition work being done
(also note time of day, weather conditions, work performed by construction crew)

met project crew prior to 8am for safety meeting. Continuing of test pit excavation and soil sampling.

TOTAL HOURS: 9 hrs

Photographic Documentation: roll # DIGITAL

Description of sediments and cultural resources (if any)

@ G-4: Top sediment consisted of dark brown fill w/ some modern trash over land fill deposits. Reached maximum required depth of test pit. No significant cultural materials observed.
@ G-11: Had similar sediment deposits as previous test pit, with the native tidal flat visible at maximum depth. No significant cultural materials observed.
@ G-3: Sediments same as G-4, with test pit excavation terminated at water level. No significant cultural materials observed.

Other notes (continue on back, if necessary)

No cultural materials of significance were observed during the monitoring of G-4, G-11, and G-3.
Sediments over the native tidal flat consist of fill materials.

ARCHAEOLOGICAL MONITORING LOG

Date 1/1/08 **Monitor's Name/Initials:** Emily Scott

Work area # Untwork (note location of today's monitoring areas on the attached site map)

G-1, G-6, G-10

Description of abatement/demolition work being done
(also note time of day, weather conditions, work performed by construction crew)

Met project crew prior to 8am for safety meeting.
Continuing of test pit excavation.

Total Hours: 10 hrs

Photographic Documentation: roll # DIGITAL

Description of sediments and cultural resources (if any)

@ G-1: Top sediments consisted of med brown to dark brown fill sediment underlaid by land fill materials. Excavation ended at required depth. No significant cultural materials observed.
@ G-6: Top sediments consisted of med. brown to dark brown fill sediments underlain by landfill deposits. Excavation halted at water level. No significant cultural materials observed.
@ G-10: Top sediments consisted of med. med to dark brown fill sediments underlaid by land fill deposits. Excavation ended at required depth. Drums were observed, but no cultural materials.

Other notes (continue on back, if necessary)

No significant cultural materials were observed during the monitoring of G-1, G-6 and G-10.

Sediments other than the native tidal flat consists of fill materials.

ARCHAEOLOGICAL MONITORING LOG

Date 11/2/08 **Monitor's Name/Initials:** Emily Scott

Work area # Whitmarsh (note location of today's monitoring areas on the attached site map)
G·5, G·8, G·9

Description of abatement/demolition work being done
(also note time of day, weather conditions, work performed by construction crew)

Met project crew prior to 7am for safety meeting.
Continuing of test pit excavations.

Photographic Documentation: roll # DIGITAL

Description of sediments and cultural resources (if any)

@ G·5: Top sediments consisted of wood debris, then med. brown to dark brown fill underlain by land fill deposits. Excavation ended at water level. No significant cultural resources were observed.
@ G-8: " same as G-5 "

@ G-9: " same as G·5 and G·8 "
encountered a smashed drum.

Other notes (continue on back, if necessary)

No significant cultural materials were observed during the monitoring of G-9, G-8 and G-5.

Sediments other than the native tidal flat consisted of fill materials

ATTACHMENT B

Photographs

Photo 1. An example of landfill deposits excavated at Whitmarsh Landfill.

Photo 2. Native tide-flats exposed beneath landfill material in test pit G-7 (arrow).