Northlake Shipyard Sandblast Grit Study

Project Report

Final

Prepared for

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List of Acronyms and Abbreviations

ARI	Analytical Resources Inc.
ATCO	American Tar Refinery
CSL	Cleanup Screening Level
COPC	chemical of potential concern
CSO	Combined Sewer Overflow
GPS	Global Positioning System
EPA	U.S. Environmental Protection Agency
Ecology	Washington State Department of Ecology
GWSA	Gas Works Sediment Area
GWS-ESA	Gas Works Sediment Eastern Study Area
GWS-WSA	Gas Works Sediment Western Study Area
µm	Micrometer
mg/kg	Milligrams per kilogram
MGP	manufactured-gas plant
MLLW	Mean lower low water
MTCA	(State of Washington) Model Toxics Control Act
NAPL	Non-aqueous phase liquid
NORTAR	North American Tar Refining Company
Northlake Shipyard	Northlake Shipyard site
NSSA	Northlake Sediment Study Area
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PPCD	Prospective Purchaser Consent Decree
ppm	Parts per million
PSEP	Puget Sound Estuary Program
QA	Quality Assurance
QC	Quality Control
RD_l	Lower Recent Deposits
RD_u	Upper Recent Deposits
SAP	Sampling and Analysis Plan
SEIIDG	Summary of Existing Information and Identification of Data Gaps
SMS	Washington State Sediment Management Standards
SQS	Sediment Quality Standard
TBT	tributyltin
TCLP	Toxicity characteristic leaching procedure
UNIMAR	United Marine Shipbuilding
USACE	U.S. Army Corps of Engineers
XRF	X-ray fluorescence

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1.0 Introduction

The Northlake Shipyard, Inc. site (Northlake Shipyard) is one of several sites along the northern shoreline of Lake Union being addressed under the Washington State Model Toxics Control Act (MTCA). The site is the subject of a preliminary sediment investigation under the management of the Washington Department of Ecology (Ecology) Toxics Cleanup Program. The general location of the Northlake Shipyard is illustrated in Figure 1-1. For the purposes of this study, the area of interest pertaining to Northlake Shipyard is referred to herein as the Northlake Shipyard Sediment Area (NSSA). Other sites along the northern shoreline of Lake Union being addressed under MTCA are the Chevron/Metro Lake Union facility and the Gas Works Park uplands and the adjacent Gas Works Sediment Area (GWSA). The GWSA has been subdivided into the western and eastern study areas. The NSSA abuts the Gas Works Sediment Western Study Area (GWS-WSA). East of the GWS-WSA is the Gas Works Sediment Eastern Study Area (GWS-ESA). The NSSA, GWSA, and Chevron/Metro Lake Union facility are shown in Figure 1-2.

Previous investigations at Northlake Shipyard and the GWS-WSA have confirmed the presence of sandblast grit and contaminants of potential concern (COPCs) in Lake Union sediments. These previous investigations and resultant data are summarized in the Northlake Shipyard Site Summary of Existing Information and Identification of Data Gaps Report (SEIIDG, E & E 2007).

The purpose of the sandblast grit study is to delineate the extent of and define the characteristics of sandblast grit-impacted sediments at NSSA to support a removal action to remove the sandblast grit. This preliminary sediment investigation is being performed in accordance with a Prospective Purchaser Consent Decree (PPCD) issued by Ecology to Northlake Shipyard, Inc. in 1994 that requires the cleanup of sandblast grit and other co-mingled contaminants discharged from past shipyard activities at the site. The PPCD does not explicitly define what constitutes sandblast grit; however, it does state that "sediments in which chemical values exceed those of ambient Lake Union sediments, and which exhibit a chemical signature characteristic of sandblast grit, will be considered within the scope" of the PPCD. For the purposes of this preliminary sediment investigation, such sediments are referred to as "grit-impacted sediments," as further discussed below.

The sampling activities evaluated the vertical and horizontal extent and the chemical and geotechnical characteristics of grit-impacted sediments in order to enable the design a dredging program to remove the grit-impacted sediments. The sampling and related activities were conducted in accordance with the revised final Northlake Shipyard Sandblast Grit Study Sampling and Analysis Plan (SAP; E & E 2009). It is expected that additional investigation will follow the completion of the removal action to support the development of a final remedial approach for NSSA that addresses other sediment contamination resulting from shipyard operations at NSSA. Such other contamination may include other metals impacts, including tributyltin (TBT) and metal constituents in marine paint, polycylic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs).

The Sandblast Grit Study Report consists of the following sections:

- Section 1, Introduction
- Section 2, Project Objectives
- Section 3, Field Investigation Methods and Deviations from the SAP
- Section 4, Bathymetric and Sidescan Sonar Survey Results
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1.1 Site Description and History

Northlake Shipyard is located on the north shore of Lake Union, with an office at 1441 North Northlake Way, Seattle, Washington (Figures 1-1 and 1-2). The initial area of investigation (NSSA) is approximately 17 acres in size and consists of sediments beneath the Northlake Shipyard docks and areas farther offshore. NSSA is west of and adjacent to the GWSA, a former industrial site that is the subject of a cleanup effort conducted by the City of Seattle (Seattle City Light) and Puget Sound Energy.

The history of the site is described in the SEIIDG report (E & E 2007) and briefly summarized below. The Northlake Shipyard facility was once owned by Pacific Coast Coal, which operated a coal loading facility using tramp ships to deliver coal to various mills and other industrial customers around Puget Sound. Since approximately 1946, the property has been utilized as a ship repair facility (Ecology 2007). The first dry dock was installed in 1956, and ship building and repair operations have been conducted on the property since that time.

Marine Power and Equipment operated the shipyard during the 1980s and was the subject of a federal criminal investigation of illegal discharges to Lake Union (Floyd Snider and MCS Environmental, Inc. 2005). Marine Power and Equipment and its parent corporation declared bankruptcy in 1986. In 1988 the corporation was reorganized and renamed United Marine International (UNIMAR). Northlake Shipyard, Inc. purchased the shipyard in August 1994 (Ecology 2007).

1.2 Previous Investigations

Previous investigations conducted in the vicinity of the NSSA are described in the SEIIDG report (E & E 2007) and briefly summarized below.

A list of site-specific contaminants of concern has not been developed for the Northlake Shipyard site. The PPCD states that discharges from operations at the property have included PCBs, PAHs, oils, metals, chlorinated and non-chlorinated solvents, pesticides, organo-tin, and copper paints. Ecology's Confirmed and Suspected Contaminated Sites list shows that priority metals have been confirmed in sediments and surface water of Lake Union and that groundwater contamination (metals, petroleum, and PAHs) and sediment PAH contamination is suspected.

Surface and subsurface sediment samples have been collected and analyzed from locations in North Lake Union during investigations conducted over the course of approximately 30 years. In addition, in situ geotechnical tests, diver surveys, and sidescan and multibeam sonar surveys have been completed as part of sediment investigations at the GWS-WSA (Floyd Snider 2007). Previous sampling and survey activities in the area pertinent to the NSSA are summarized in the SEIIDG report (E & E 2007). Results of sediment samples collected in the vicinity of the NSSA during investigations conducted over the last 10 years at the GWS-WSA, as well as those collected during a 1991 investigation at the UNIMAR facility (GeoEngineers 1991), are presented in the SEIIDG report (E & E 2007). The results of the 1991 UNIMAR report (GeoEngineers 1991) are not considered useful for the delineation of the present extent of contamination because the data are more than ten years old. However, the data are considered useful for the purposes of describing the chemical and physical nature of sediments that contained a high proportion of sandblast grit, and were used to guide the development of an approach to identify grit-impacted sediments in the NSSA as part of the present investigation.

Previous investigation results indicate the presence of contamination in the sediments at NSSA, much of which is concluded to be the result of shipyard operations. These operations have involved hull painting and repairs, including sandblasting. During the time that it operated the facility, Marine Power and Equipment allegedly discharged spent sandblast grit and other contaminants onto the bed of Lake Union in violation of state and federal clean water regulations. The allegations were resolved in the CWA Decree entered into by Marine Power, the United States Environmental Protection Agency (EPA), and Ecology (King County 1994).

Typical shipyard contaminants include a range of metals and TBT, which are associated with sandblast grit and ship paints and or biofouling agents in the paints, and PAHs. Sandblasting to remove paint has been conducted at the Northlake Shipyard site. A 1991 study conducted by GeoEngineers for UNIMAR (GeoEngineers 1991) estimated that 6,500 cubic yards of sediments impacted by spent sandblasting grit and associated heavy metals were present in sediments offshore of the facility. It is likely that the bulk of the sandblast grit was originally deposited in the areas generally beneath the ends of the dry docks. It is also likely that a portion of the finer grained fraction of the grit has been dispersed and deposited further from the ends of the dry docks than the coarser fraction. Based on the existing available information, it can be concluded that sediment impacts from metals and sandblast grit from shipyard operations are present both within and outside of the site's administrative boundary (Ecology 2007).

Sediment studies conducted by Puget Sound Energy and City of Seattle on the GWSA have concluded that there were multiple contaminant sources that contributed to Washington State Sediment Management Standards (SMS) biological criteria exceedances in the GWS-WSA. The sandblast grit and associated metals accumulating in the lake bed near the Northlake Shipyard

facility were believed to be one of the sources. The bioassay failures in the sediments adjacent to Northlake Shipyard have been associated with concentrations of PAHs and metals, including arsenic, copper, lead, and zinc (Ecology 2007).

Chemicals, primarily PAHs and metals, detected in sediment samples collected from Lake Union have likely been generated from a variety of sources over the course of its history. Previously identified potential sources of PAHs to North Lake Union sediments include the former UNIMAR/Northlake Shipyard, the Metro/Chevron bulk fuel storage facility, the American Tar Refinery Company (ATCO), the North American Tar Refinery Company (NORTAR), former manufactured gas plant (MGP) operations, municipal incineration, and outfalls (RETEC 2002).

Part of the City of Seattle's municipal separate stormwater system drains to North Lake Union. One city-owned stormwater outfall is located within the GWS WSA. This outfall, built in 1919, discharges stormwater into Waterway #20 at the foot of Densmore Avenue North. The drainage basin contributing stormwater to this outfall is estimated to be between 11 and 16 acres, with present inputs primarily from street rights-of-way. Historical inputs included stormwater discharges from the former MGP facility, the tar refinery, the NORTAR site, and the North Yard of the Metro Lake Union Facility. The next nearest city-owned stormwater outfall is located on the western side of Northlake Shipyard, at Waterway #22 (Figure 1-2). Combined Sewer Overflow (CSO) #146, used for sanitary pump station emergency overflow, is located at Waterway #21 on the west side of Northlake Shipyard between Carr Place North and Woodlawn Avenue North (Figure 1-2). (Floyd Snider and MCS Environmental, Inc. 2005).

2.0 Project Objectives

The objectives of the grit study were developed to address the requirements of the anticipated removal action design to address the sandblast grit impacted sediment at the Northlake Shipyard site. The objectives of the grit study were to:

1. Obtain additional bathymetric information for the areas not adequately covered by existing data.

2. Identify features or conditions in the sediments that could affect dredge design or operations.

3. Determine the horizontal and vertical extent of grit-impacted sediments to guide the development of a dredging program to remove grit-impacted sediments.

4. Assess sediment geotechnical characteristics necessary for dredge design.

5. Characterize the chemical properties of grit-impacted sediment to evaluate waste disposal alternatives and requirements.

The present grit study is not intended to satisfy all the objectives of the eventual final remediation strategy for the NSSA. Such objectives will be addressed in additional investigation work to follow the removal action.

2.1 Bathymetric and Sidescan Sonar Survey

In order to design a dredge program, it is necessary to have high resolution bathymetric data of the area within and near the dredge limits. It is also necessary to locate and identify significant bottom features that could affect dredge design and implementation. The extent of coverage of existing multibeam bathymetry and sidescan sonar surveys conducted at the GWSA is not adequate for NLSSA. Therefore, a bathymetric and sidescan sonar survey was conducted for the project area as part of this study.

2.2 Diver Visual Inspection

Divers visually inspected the sediment surface in the vicinity of the core locations for the purpose of identifying any possible visually observable sediment characteristics, debris, or possible accumulations of grit-impacted sediments based on surface expression.

2.3 Grit Identification and Characterization

The grit study was designed to support an anticipated removal action to remove the bulk of the grit-impacted sediments. Contamination within the grit-impacted sediment is associated with the sandblast grit, either by proximity to the grit, by adsorption to the grit, or as a component of the grit itself. The principal contaminants in grit-impacted sediments are metals. As some previous investigations indicate, other contaminants, including PCBs and PAHs, exist within the

sediments that are believed to contain sandblast grit. These co-mingled contaminants are not the subject of the planned removal action, although the presence of these co-contaminants must be considered in the design of a dredging program to remove grit-impacted sediments.

The success of the subject removal action is contingent upon the ability to identify sandblast grit-impacted sediments. In order to identify grit-impacted sediments, the characteristics of these sediments must be clearly defined. An approach to identify grit-impacted sediments was developed in the SAP (E & E 2009) based on the association between the identified sandblast grit and sediment grain size and concentrations of slag-related metals. This approach was employed in the implementation of the grit study.

2.4 Geotechnical Analysis

Divers collected cores for geotechnical evaluation from four locations within the NSSA. The cores were analyzed for geotechnical parameters to characterize the sediment properties in support of the design a dredging program.

3.0 Field Investigation Methods and Deviations from the SAP

Field activities associated with the implementation of the SAP were completed in accordance with the SAP (E & E 2009) except as noted below.

3.1 Bathymetric and Sidescan Sonar Survey

A high resolution multibeam sonar bathymetry survey and sidescan sonar survey were performed by a subcontractor (Tetra Tech EC, Inc.) on December 10, 12, and 16, 2008. The survey was conducted in accordance with the procedures in the US Army Corps of Engineers Manual 1101-2-1003, Engineering and Design Hydrographic Surveying. The methodologies and equipment employed to perform the surveys are presented in the survey report, provided in Appendix A.

3.2 Diver Visual Inspection

Divers inspected the sediment surface in the vicinity of each core location prior to attempting to collect a core. During the inspection, the divers visually inspected the vicinity of the core location for the presence of debris, bathymetric irregularities, or other features of interest, including conditions that could indicate the presence of sandblast grit. The divers displaced surficial sediments to look for visual evidence of sandblast grit that may be covered by recent sediments. The divers were equipped with underwater communication equipment to maintain direct contact with the dive tender in the coring vessel. The boat tender recorded divers' observations in a waterproof logbook and on core collection forms, provided in Appendix B. Diver visual observations are summarized in Table 3-1.

3.3 Core Collection - Grit Identification and Characterization

A total of 34 sediment cores were collected during the sampling event, completed between April 13 and April 20, 2009. A total of 30 sediment cores were collected for the purpose of identifying and characterizing grit-impacted sediments from April 13 through April 20, 2009. Sediment core collection was generally conducted in accordance with the procedures described in the SAP (E & E 2009). The sediment core collection team consisted of one field technician from Herrera Environmental Consultants (Herrera) and several representatives from Research Support Services, Inc. (RSS), which provided the sampling vessel, equipment, and divers. Coring activities were documented by Herrera in a logbook and on core collection forms, provided in Appendix B. A photographic log is provided in Appendix C.

The divers collected cores using a coring device consisting of: a stainless steel core cutting shoe outfitted with a stainless steel core catcher; a 7-foot section of 4-inch diameter clear rigid polycarbonate tube; a piston assembly; a driving head and slide hammer; and a core device suspension assembly. The stainless steel cutting shoe was fitted at the bottom of each core tube. Each core cutting shoe was outfitted with a stainless steel core catcher to prevent loss of collected sediment upon retrieval of the cores. The piston was inserted inside the core tube at a

position initially immediately above the core catcher. The piston was attached by a length of rope to the core sampler suspension assembly in a manner such that, as the core sampler was advanced into the sediment, the piston remained at a constant position relative to mudline, thus serving to increase core recovery, minimize disturbance of the surficial sediment in the core, and isolate the sediment in the core from the slide hammer. The driving head was tethered with a rope to a winch via the davit located at the bow of the coring vessel. All of the equipment was cleaned with non-phosphate detergent (Liquinox) and rinsed with distilled water prior to the collection of each core. The core tube was advanced into the sediment by linear percussive force applied by the slide hammer.

Positions of the planned core locations (per the SAP, E & E 2009) were entered into the vessel's navigation system prior to coring activities. Once the vessel arrived at the coring station, the vessel position was stabilized using three anchors (one on each side of the bow and one on the stern). The position of each core station was then recorded to an accuracy of ± 1 meter using a GPS unit with the antenna located on the top of the core winch.

The sediment coring device was raised off the boat and lowered into the lake using the winch, while a diver observed and guided the coring device into position to the sediment surface. The proposed location for core NS03 was located slightly beneath a vessel moored at the time of sampling. To collect this core from as close as possible to the proposed location, the diver moved the coring device laterally a predetermined distance and direction from the sampling vessel. The direction of the lateral offset, measured with a compass, is considered approximate because of the suspected influence of the overlying steel vessel on the compass bearing.

The diver was equipped with underwater voice communication equipment, which enabled the diver to communicate with the dive tender on the vessel core positioning information and descriptions of the sediment surface and any unusual sediment conditions (e.g., large debris, etc.).

Using the slide hammer, the divers manually drove the core sampler into sediment. The core samplers were driven to the entire 7-foot depth or until reaching refusal. Upon reaching the core bottom depth, the divers scored the core tube at the mudline to mark the penetration depth. All cores were collected in one attempt except for the cores collected from stations NS01, NS06, and NS35, where either debris or coarse material (including sandblast grit and/or layers of cemented sandblast grit) resulted in poor penetration. A second attempt to core at these locations resulted in acceptable cores. The core collected from NS01 appears to have penetrated through the base of the sandblast grit-containing layer and into soft underlying sediments. The cores collected at NS06 and NS35 appear to have met refusal within a zone containing sandblast grit.

After the divers advanced the coring device to the final penetration depth, the deck hands retrieved the device by winching it to the deck of the coring vessel. Upon retrieval of the core device onto the deck, a plastic core cap was secured to the bottom of the core cutting shoe with duct tape. The core was then secured to the side of the vessel in a vertical position. The core penetration depth was measured from the bottom of the core cutting shoe to the score mark made by the divers. After allowing the sediment settle in the core tube, the length of recovered sediment was measured from the bottom of the core cutting shoe to the top of the sediment in the core tube. The core tube was cut immediately above the sediment surface and a plastic cap was

secured to the top of the core tube with duct tape. The core was properly labeled and transported to the shore-based core processing area for processing.

Sediment core station coordinates are provided in Table 3-2 and illustrated in Figures 3-1 and 3-2. Field observations recorded for each sediment core are presented in Table 3-1.

Sediment cores were collected from 27 of the 32 core locations proposed in the SAP (E & E 2009). Sediment cores were not collected at proposed locations NS22, NS25, NS30, NS31, and NS32. Cores were collected at three previously unplanned locations, NS33, NS34, and NS35. It was decided, through communications with the Ecology Project Manager, to eliminate cores NS22, NS25, NS30, NS31, and NS32 based on results of field screening, which indicated little evidence of grit-impacted sediment in the adjacent cores. Remaining core collection effort focused on better defining the western extent of potential grit-impacted sediment (core locations NS33 and NS34) and further assessing the possible presence of grit-impacted sediment in the vicinity of the dry docks (core location NS35).

The diver coring method was well suited for coring most of the materials encountered. Core recovery was generally very good, typically greater than 85 percent and commonly greater than 90 percent. Further, the core material was minimally disturbed by the coring device and method, thus allowing detailed lithologic descriptions. Recovery for five cores was less than 80 percent; three of these cores (NS01, NS06, and NS35) contained sandblast grit that proved difficult to penetrate. A fourth core (NS21) contained predominantly sand, also difficult to penetrate. Recovery for core NS27 was 75 percent, considered acceptable, although less than typical for the soft sediments typically encountered in that part of the study area.

3.4 Core Processing - Grit Identification and Characterization

Upon receipt of the core tube from the core collection team, the core processing team recorded the depth of penetration (reported by the divers) and measured the length of recovered sediment. In all cased, due to the very soft, wet sediment conditions, the core material was accessed for processing by laying the core tube on its side and cutting open the polycarbonate core tube lengthwise. A thin layer of the sediment that was potentially disturbed or smeared by the core tube was removed with a spoon visually inspect the core. The core was photographed and observations were recorded on core log forms. The sieved fraction also was inspected for visual indications of sandblast grit. Core log forms and the core processing master logbook notes are provided in Appendix D. Core logging observations are summarized in Table 3-3. A photographic log including photos of representative cores is provided in Appendix C.

After core logging, each core was divided into 12-inch sample intervals, except as noted below, for grit identification and characterization using field screening and laboratory confirmation analysis. Two samples (NS01-GC-15 and NS03-GC-45) were from intervals shorter than 12 inches because insufficient core material was recovered to obtain complete 12-inch intervals over interval of interest. Three samples (NS09-GC-02, NS28-GC-02, and NS34-GC-02) were collected (for XRF total metals analysis only) from the uppermost 2 inches of the core to evaluate metals content of the uppermost sediment at these locations. Sediment from each sample interval was placed directly from the core tube into a decontaminated plastic or stainless steel bowl and thoroughly homogenized with a decontaminated stainless steel spoon. Prior to

homogenization, to the extent feasible, large pieces of debris and organic matter were removed. Aliquots of homogenized sediment for laboratory confirmation analysis for grain size and total metals were placed directly into the appropriate sample containers, stored in a cooler with ice. A subset of these sample aliquots was selected for laboratory confirmation analysis and delivered to the respective analytical laboratories at the end of the field activities. Samples selected for field screening and laboratory analysis are described in Table 3-4. Field screening and laboratory analytical methods are discussed in Section 6. Sample chain-of custody forms are provided in Appendix E.

3.5 Core Collection - Geotechnical Cores

A total of 4 sediment cores were collected for geotechnical analysis on April 20, 2009. Geotechnical cores were collected at core locations NS05-G, NS06-6, NS12-G, and NS12-G. A fifth geotechnical core was attempted at station NS01-G, but the core was rejected due to insufficient recovery. Geotechnical core station coordinates are provided in Table 3-2 and illustrated in Figures 3-1 and 3-2. The geotechnical cores were collected from locations that appeared to be representative of conditions across an area potentially subject to grit removal pending determination by Ecology. Geotechnical core collection was generally conducted in accordance with the procedures described in the SAP (E & E 2009). Cores were collected by the same personnel using the same equipment and methods as for the grit identification and characterization cores, described above. Core recovery ranged from 87 to 94 percent. Geotechnical cores were received by the sample processing team and stored in the core collection tubes in an upright position until delivery to Analytical Resources Incorporated (ARI) for geotechnical analysis.

4.0 Bathymetric and Sidescan Sonar Survey Results

Results of the multibeam bathymetry and sidescan sonar surveys are presented in the survey report, provided in Appendix A. Results are presented graphically in charts provided in the survey report (Tetra Tech 2008). Bathymetry results also are shown in Figures 3-1 and 7-2. Results are briefly summarized below. It should be noted that, due to the presence of overwater structures and moored vessels at the time of the surveys, it was not possible to obtain multibeam coverage over the entire survey area. Those areas not covered are located beneath the eastern dock of the shipyard, and are represented graphically in the chart and Figures 3-1 and 7-2 by the corresponding portion the aerial photographic image of the site.

The overall bathymetry of the study area is characterized by a steep lake bottom near the bank, outward of which the lake bottom gradually flattens to an elevation of approximately -20 feet mean lower low water (MLLW)- U.S. Army Corps of Engineers (USACE)-Locks datum. The USACE maintains the water level of Lake Union and the Ship Canal between +20 feet and +22 feet USACE locks datum.

The surveys revealed at least two sunken vessels (east of core location NS35 and north of core location NS13) as well as rectangular feature (west of core location NS05) that could be a sunken barge or dock section. In addition, a large number of pieces of debris, including elongate objects (pipe sections, logs, cable) and other unidentified objects were located. Some of these other objects are depicted as small, isolated prominences on the lake bottom. Many of these objects are probably tires (lost boat fenders), mooring blocks, or pieces of broken piles. One or two broader bathymetric highs located just southwest of Northlake Shipyard's west pier could potentially be accumulations of sandblast grit.

Many depressions, including elongate trenches probably caused by anchor drag, were mapped. One depression, located approximately 25 feet north of core location NS15 and 400 feet southwest of Northlake Shipyard's west pier (see Figure 3-1), is shaped like a hull of a vessel, suggesting there may have been a sunken vessel there at one time which has since been salvaged. Other irregularly shaped depressions, such as the depression between core locations NS10 and NS11 and the depression between core locations NS07 and NS08, may be the result of propeller wash.

The slopes of several of the depressions were evaluated in order to better understand the geotechnical characteristics of the material in the vicinity of the depressions. High resolution bathymetry transects through several of the depressions were generated. Images of the transects are provided in Appendix A. Slopes were calculated along the transects (for 3-foot horizontal segments) based on depth information provided on a 1-foot or 2-foot (horizontal) basis. Transects through the vessel-shaped depression (located approximately 25 feet north of core location NS15) are shown in Transect A – A' and Transect A1 – A1'. Calculated slope values on the walls of the vessel-shaped depression indicate slopes as steep as 25 percent.

Transect D – D' traverses through two elongate features at and south of core location NS11. Calculated maximum slopes of these features are as high as 46 percent, with most slopes less than 20 percent.

Two transects (B – B' and C – C') traverse through the large, irregularly shaped depression located between core locations NS10, NS11, and NS35 (see Figure 3-1). The western slope of this depression has calculated slopes as high as 36 percent. The northeast slope has calculated slopes as high as 124 percent. These slopes are anomalously high, particularly given the soft, unconsolidated nature of most of the surficial sediment in the area (see discussion of site stratigraphy in Section 7 and discussion of geotechnical results in Section 8). It is likely that the steep slopes at this location, and possibly elsewhere at the site, are attributable to the presence of cemented layers of sandblast grit. Layers of cemented grit were observed in core NS04 and are suspected at core location NS35. Such layers of cemented grit would be resistant to scouring, such as that which could be caused by propeller wash. However, where the cemented layer(s) are breached, thus exposing soft underlying sediments, the broken cemented grit layers and underlying soft sediment would be susceptible to scouring. Such scouring would erode the deeper soft sediment preferentially, resulting in an erosional depression bordered by a "headwall" capped by the resistant cemented grit layer. The bathymetry of the depression located between core locations NS10, NS11, and NS35, coupled with core logging results (Section 7) and diver inspection results (Section 5), supports this hypothesis.

5.0 Diver Visual Inspection Results

Result of the diver visual inspection are presented in Table 3-1 and briefly summarized below.

The divers noted a wide variety of debris in the immediate vicinity of core stations NS01, NS02, NS03, NS05, NS06, NS07, NS08, NS09, NS20, NS21, and NS35. The divers did not report any observations of sunken vessels identified in the bathymetry survey.

At core location NS04, the divers noted the presence of a hard layer approximately 2 inches below mudline. This layer initially prevented the diver from advancing the core sampler, but after breaking up the layer in the area around the core cutting shoe, the diver was able to advance the core sampler through the layer. Upon logging of the core, the layer was determined to consist of cemented sandblast grit. At location NS35, the diver was unable to advance the core deeper than 22 inches below mudline. The diver reported inserting his hand into the upper soft sediment down to the refusal depth and feeling gravel-sized material, which could potentially consist of broken pieces of a cemented layer of sandblast grit. No gravel sized material was recovered in the core.

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6.0 Analytical Methods and Data Quality Assurance

This section summarizes field screening and laboratory analytical methods and associated quality assurance (QA) procedures.

6.1 Field Screening Methods and Data Quality Assurance

Field Screening Methods

Sample aliquots were field screened for the following parameters:

1. Percent moisture content of whole sediment by modified EPA Method 160.4.

2. Weight percent of the sediment, on a dry weight basis, of the fraction of sediment retained by a 125 micrometer (μm) sieve by modified ASTM D 422-63.

3. Percent moisture content for the sediment fraction retained by the 125 μm sieve by modified EPA Method 160.4.

4. Total metal concentrations using X-ray fluorescence (XRF) spectroscopy by EPA Method 6200.

Field screening methodologies are described below.

Grain Size – 125 Micrometers

A modified ASTM Method D422-63 was used to determine the percentage of sample with grain size greater than 125 μm (fine sand and larger). The original ASTM method is to dry the whole sample, weigh the whole dried sample, sieve the sample through successively finer sieves; and weigh the fraction of sample retained on each sieve. This method was modified for the grit study by performing the sieving on a wet sample and limiting the sieving to one sieve size, 125 μm.

An aliquot of wet whole sediment sample and the sieve were weighed prior to sieving. The sediment aliquot was gently washed through a 125 μm sieve tray with water. The sieve was dried as much as feasible with a paper towel. The sieve and wet retained fraction were weighed and the weight of wet sieved fraction was calculated. In order to account for the moisture content, the moisture content of both the whole sediment and the retained fraction were determined following the procedure described below.

Percent weight percent larger than 125 μm was determined for a total of 96 samples. A list of samples field screened for grain size is provided in Table 3-4.

Moisture Content

A modified EPA Method 160.4 was used to determine the moisture content for aliquots of whole sediment as well as the fraction retained by the 125 µm sieve. The method was modified from EPA Method 160.4 by reducing the sample drying time to less than 24 hours. Prior to drying, initial weights of the weighing paper and an aliquot of sample were recorded. The samples were then dried for a minimum of four hours in an oven. Samples were checked for dryness before weighing. If the sample appeared moist, the sample was returned to the oven for continued drying. After each sample was observed to be dry, the dried sample plus paper were weighed to determine the sample dry weight. The percent solid was calculated by dividing the dry sample weight by the wet sample weight and multiplying by 100. The percent moisture was calculated by subtracting the percent solid value from 100.

The dry weight percent of the retained fraction was estimated as follows. A portion of the moist material retained by the 125 µm sieve was removed from the sieve tray and placed on weighing paper. The material was dried as described above and subsequently weighed. The percent solid for this portion of the sieved fraction was calculated as described above. The calculated percent solid value was multiplied by the wet weight of the entire retained fraction to estimate the dry weight of the entire retained fraction. Finally, the dry weight percent retained by the 125 µm sieve was calculated by dividing the calculated dry weight of the sieved fraction by the dry weight of whole sample and multiplying by 100.

Moisture content was determined for both whole sediment and the retained fraction for a total of 96 samples. A list of samples field screened for moisture content is provided in Table 3-4.

XRF Metals Field Screening

The sediment samples were analyzed for total metals using XRF by EPA Method 6200. An aliquot of whole sediment was dried in an oven, pulverized to a consistency of fine sand, and analyzed for total metals using an Innov-X Systems XRF analyzer. The XRF analyzer was used following manufacturers specifications to determine concentrations of arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc. A total of 104 samples were analyzed for total metals.

The metal concentrations are reported in units of parts per million (ppm) total metals, which is equivalent to the confirmation laboratory's reporting units of milligrams per kilogram (mg/kg) dry weight. The Innov-X analyzer uses X-ray fluorescence spectrometry by measuring characteristic X-ray emissions of elements. The amount of analyte present in the sample is quantified by the intensity of the emissions. The detection limit for each element is sample-specific and can be influenced by a number of factors. The primary interferences that affect detection limits can include: presence of other elements in the sample; moisture; sample geometry (particularly particle size); and analysis time. Typical detection limits for the Innov-X analyzer for arsenic, chromium, copper, lead, mercury, nickel, selenium, and zinc are 10 ppm. Typical detection limits for barium, cadmium, and silver are 50 ppm.

Field Screening Data Quality Assurance

All field screening followed procedures outlined in the methods and modified for field screening as described above. Due to the limited amount of sample volume collected, no field laboratory

quality control (QC) samples (e.g., laboratory or field duplicates) were collected for metals, percent moisture, or grain size analyses. The field team followed good laboratory practices to ensure high data quality. The metals field screening followed all manufacturer and Method QA/QC requirements for instrument operation. The field results were verified with confirmatory laboratory analyses. A comparison of field screening results and laboratory results is discussed in Section 7.

6.2 Laboratory Analytical Methods and Data Quality Assurance

Laboratory Confirmation Analysis

Sediment sample aliquots were collected for laboratory confirmation analysis for total metals and grain size analysis and placed in pre-labeled sample jars. The samples were stored in a cooler with ice until the completion of core sampling and field screening. A total of 29 samples were selected for total metals confirmation analysis, performed by Ecology's Manchester Environmental Laboratory using EPA Method 200.8 (for arsenic, barium, cadmium, chromium, copper, lead, selenium, silver, and zinc) and EPA Method 245.5 for mercury. A total of 21 samples were selected for total solids and grain size analysis by Puget Sound Estuary Program (PSEP) protocol at ARI. Samples were selected for laboratory analysis based on the grain size and XRF total metals field analytical results. Samples for laboratory confirmation analysis were generally selected to provide a wide range of grain size and total metals concentrations and, to the extent possible, to assist with delineation of the margins of the grit impacted sediments. Two of the 21 samples submitted for laboratory grain size analysis (NS19-GC-10 and NS19-GC20) were not field screened for grain size due to presence of NAPL. Samples were delivered to the respective laboratories on April 21, 2009. A list of samples submitted for laboratory confirmation analysis is provided in Table 3-4.

Toxicity Characteristic Leaching Procedure Analysis

Sediment sample aliquots were collected for possible Toxicity Characteristic Leaching Procedure (TCLP) metals analysis to assist with determination of disposal requirements for dredged material. Samples were submitted to Ecology's Manchester Environmental Laboratory on April 21, 2009, for possible TCLP metals analysis, pending results of total metals analysis. Based on the total metals field screening results and laboratory confirmation total metals results (provided by the Manchester laboratory on May 28, 2009), TCLP metals analysis was requested on June 8, 2009 for a total of ten samples. Selected samples displayed a range of total metals concentrations high enough to potentially exceed TCLP limits, depending on the degree of solubility. Analysis was requested only for those metals that could potentially exceed TCLP limits. A list of samples selected for TCLP metals analysis is provided in Table 3-4. As of the date of preparation of this report, the TCLP metals results were not available.

Laboratory Data Quality Assurance

An E & E chemist performed Ecology QA1 data review of the Manchester and ARI laboratory. The quality assurance review memoranda and laboratory data packages are provided in Appendix E.

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7.0 Grit Identification and Characterization Results

7.1 Core Logging Observations

Results of visual inspection of the sediment cores are summarized in Table 3-3 and Figures 7-1 and 7-2.

Sandblast Grit

Based on visual observations of black and greenish black, angular, fine to coarse sand in whole sediment and the field-sieved fraction, sandblast grit was identified in five samples: NS01-GC-10, NS04-GC-10, NS06-GC-10, NS06-GC-20, and NS35-GC-10. Black sand, tentatively identified as sandblast grit, was identified in the sieved fraction of samples NS05-GC-10 and NS05-GC-20. Paint chips associated with the sandblast grit were observed in samples NS01-GC-10 and NS04-GC-10. The sandblast grit observed in NS04-GC-10 included well-cemented layers in addition to loose grains.

Debris

Debris was encountered in several cores, including: wood (NS01 and NS02); brick fragments (NS06); a piece of a glass jar (NS06); pieces of tar-like material (NS05 and NS21); coal (NS05); and suspected coke briquettes (NS05).

Hydrocarbons

Staining, sheen, and non-aqueous phase liquid (NAPL), and olfactory observations of hydrocarbon contamination (including petroleum and naphthalene odors), were noted in several cores, including NS01, NS02, NS03, NS04, NS05, NS07, NS08, NS09, NS10, NS11, NS12, NS16, NS17, NS18, NS19, NS20, NS21, NS23, NS33, NS34, and NS35.

Stratigraphy

Lithologic descriptions of the cores are provided in Table 3-3. Based on interpretation of the core lithologic descriptions, the sediment stratigraphy in the NSSA is generally similar to that described for the GWS-WSA (Floyd Snider 2007) except for the local presence of sandblast grit. Study area stratigraphy is discussed below.

All cores, except as noted below, encountered a very soft, gelatinous brown organic silt/clay interpreted to be the Recent Lower Deposits (RD_l) unit described at GWS-WSA (Floyd Snider 2007). The RD_l unit has been characterized as homogeneous, very soft, wet, olive brown to dark brown, sandy organic silt with localized thin fine- to medium-grained sand lenses. This unit is interpreted to comprise Holocene, post-glacial lacustrine sediments deposited prior to the urbanization of Lake Union (Floyd Snider 2007). The RD_l unit was not observed in cores NS01,

NS06, and NS35, probably due to inadequate core penetration depth. In core NS02, brown organic silt/clay similar to the material interpreted to represent RD_l sediment elsewhere was interlayered with sand; this material may represent RD_l deposits. At location NS21, located near the shoreline, only sand and debris was recovered in the core. At location NS20, dark brown (heavily hydrocarbon stained) gelatinous silt/clay was encountered; this material is tentatively interpreted to represent the RD_l unit.

The uppermost stratigraphic unit described in previous investigations (Floyd Snider 2007) is the upper recent deposits (RD_u). Sediments interpreted to comprise RD_u deposits were encountered in all grit study cores, except as noted below, and commonly included organic silt/clay, ranging in color from reddish brown to brown to grayish brown to brownish gray. This material is locally overlain by black, dark brownish gray, or dark grayish brown fines with some sand. The organic silt/clay locally included very thin (less than ¼ or ½ inch) layers of light gray, very soft, wet clay. Almost all cores included a light gray clay layer up to several inches thick marking the base of the RD_u unit. Deposition of the RD_u is believed to have begun during the initiation of industrial practices along the shores of Lake Union (Floyd Snider 2007). The gray clay layer present at the base of the RD_u serves as a visual marker of the unit boundary, and is thought to have been deposited during the construction of the ship canal system. The range of depths at which the basal gray clay layer was observed in the cores is shown in Table 3-3. The depth to the top of the basal gray clay layer, where it is present, ranges from 0 to 48 inches below the top of the core. Typical depths to the top of the basal gray clay layer, and thus the thickness of RD_u deposits, are between 1 and 2 feet. The basal gray clay layer was observed at the top of cores NS08, NS10, and NS11, and at a depth of 2 inches in core NS15. The basal gray clay layer was absent in core NS07, with RD_l deposits overlain by 4 inches of brownish gray to black silt, clay, and fine sand. The lack of RD_u sediments in these cores compared to nearby cores could be attributable to lack of recovery of the upper sediment interval during coring at these locations; however, this seems unlikely considering the high recovery for these cores. More likely, the lack of RD_u sediments could indicate little deposition of RD_u sediments or removal of RD_u sediments subsequent to deposition at those locations.

7.2 Metals Results

Results of field screening and laboratory confirmation for total metals are presented in Table 7-1 and summarized in Figures 7-1 and 7-2.

Thirty samples were sent to Manchester Laboratory for total metals confirmation analyses. Results of the confirmation analysis were compared with the XRF field screening results. Results were paired and a linear regression correlation coefficient was calculated for 29 of the sample pairs. The lead field screening result for sample NS07-GC-30 was non-detect, so the sample was not included in the pairing. The calculated correlation coefficient for arsenic, copper, lead, and zinc are $R^2 = 0.9304$, 0.9435, 0.9423, and 0.9368 respectively. These R^2 values indicate that there was an excellent comparability between field and laboratory total metals data for these metals.

For sample NS03-GC-10 the laboratory results for arsenic, copper, lead, and zinc were a factor of approximately two greater than the respective field screening results. For sample NS01-GC-10, the field results were consistently greater than the laboratory results for arsenic, copper, lead,

and zinc. These disparate results may be due to heterogeneities in sample composition, and the results are considered outliers for the purposes of comparison of field screening and laboratory results. If results pairs for samples NS01-GC-10 and NS03-GC-10 are removed from the linear regression, the new correlation coefficient values increase to R^2 = 0.9959, 0.9456, 0.9875, and 0.9839 for arsenic, copper, lead, and zinc, respectively. These very high correlation coefficients indicate excellent comparability between field and laboratory data for most of the samples.

7.3 Grain Size Results

Results of field screening for percent fine sand and coarser material (greater than 125 µm) and laboratory confirmation grain size analysis (PSEP) are presented in Table 7-2 and summarized in Figures 7-1 and 7-2.

Twenty-one samples were sent to ARI for laboratory confirmation grain size analysis. Two of the samples analyzed at the lab were not field screened for grain size due to the presence of NAPL in the sample. The remaining nineteen samples were both field screened and analyzed at ARI for grain size. The field screening results for weight percent material greater than 125 µm were compared to the equivalent laboratory results (the sum of weight percent for fractions Phi <-1, Phi -1 to 0, Phi 0 to 1, Phi 1 to 2, and Phi 2 to 3). A linear regression correlation coefficient was calculated for sample pairs. The calculated correlation coefficient value of 0.976 indicates that there was an excellent comparability between field and laboratory data.

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8.0 Geotechnical Analysis and Results

Geotechnical analytical results for cores collected from locations NS05-G, NS06-G, NS12-G, and NS18-G are presented in Appendix F.

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9.0 Summary

Results of the sandblast grit identification and characterization sampling are useful for identifying and determining the extent of grit-impacted sediments, as discussed below.

9.1 Development of Sandblast Grit Identification Approach

An approach to identify sandblast grit impacted sediment was developed in the SAP (E & E 2009) based on the results of previous investigations in the area of the site. This approach is briefly described below.

One previous investigation at the site positively identified sandblast grit in sediment in the immediate vicinity of the shipyard (GeoEngineers 1991). Most of the intervals in which sandblast grit material was identified were described as dark gray to black sand with varying amounts of silt and clay. By contrast, most of the sediment core intervals in which sandblast grit material was not visually identified were described as mixtures of silt and clay with little sand. These observations are consistent with the description of the sediment stratigraphy of the general area, in which the native lake sediments (RD_u) consist predominantly of silt with lesser sand. Associations were identified between grain size (i.e., predominantly sand) and elevated concentrations of certain metals (arsenic, copper, lead, and zinc) in sediment reported to contain sandblast material. The presence of elevated concentrations of arsenic, copper, lead, and zinc in sandblast grit is consistent with the understanding that sandblasting grit commonly consists of metal ore processing slag, which is enriched in these metals (E & E 2009).

As described in previous investigations, the native lake sediment unit within which the sandblast grit has been deposited (RD_u) consists of very soft, wet, brown to black, sandy silt and organic silt, with wood chunks and debris grading to very soft, wet, gray clay with varying amounts of silt (e.g., Floyd Snider 2007). Based on similarities in the descriptions of the sediments that were identified as containing grit in the Northlake Shipyard cores (GeoEngineers 1991), including overall color and grain size, it was expected that visual observations of whole sediment would not easily distinguish grit-impacted sediments from ambient RD_u sediments. Therefore, an approach based on a combination of grain size and concentrations of arsenic, copper, lead, and zinc in sediment was developed (E & E 2009).

As described in the SAP (E & E 2009), for surface sediment samples collected in the vicinity of Northlake Shipyard (as summarized in Floyd Snider 2007), the percentage of sand (particularly fine sand and larger) correlated well with concentrations of total arsenic, copper, lead, and zinc. In other words, where sediment contained material consisting of fine sand or larger material (greater than 125 μm), the proportion of this material correlated well with the concentrations of the metals. However, it was noted that sandblast grit particles of smaller grain size are likely to exist as well, due either to gradation in grain size of the original sandblast grit or to breakdown, either as a result of impact from sandblasting operations or subsequent weathering (E & E 2009).

To further evaluate the association between sandblast grit and slag-related metals, the correlation between concentrations of arsenic, copper, lead, and zinc in surface sediment samples collected

within the NSSA during previous investigations (as summarized in Floyd Snider 2007) were evaluated. Overall, the concentrations of these metals correlated fairly well, suggesting a common source (assuming little change in concentrations post-deposition). A likely such source is sandblast grit derived from smelter slag (E & E 2009).

Data from previous investigations (as summarized in Floyd Snider 2007) indicate that east of the NSSA, the concentrations of arsenic, copper, lead, and zinc in surface sediment samples decrease to consistently lower levels. The degree of correlation between the metals concentrations and percent fine sand and coarser decreases further to the east as well. Further, the degree of correlation between concentrations of arsenic, copper, lead, and zinc decrease for these samples. These observations suggest that that much of the arsenic, copper, lead, and zinc in sediments within the NSSA and immediate vicinity is contained within sandblast grit particles, a significant proportion of which is fine sand or larger (E & E 2009).

9.2 Application of Sandblast Grit Identification Approach

Following the SAP (E & E 2009), the approach to identify grit-impacted sediments was accomplished using a combination of visual observations and physical and chemical properties. In addition, results of the multibeam bathymetry sonar survey and diver inspection were integrated into a conceptual site model to facilitate the understanding of the distribution of grit-impacted sediments at the site.

9.3 Results

Results of the grit identification and characterization effort are summarized in Table 9-1 and discussed below. For the purposes of comparison, total metals results in Table 9-1 are highlighted for those concentrations that are greater than the SMS Cleanup Screening Level (CSL) and Sediment Quality Standard (SQS) values for those metals. It should be noted that these criteria are not applicable to the freshwater sediments of Lake Union.

Visual Observations

Sandblast grit was identified in sediment based on visual observations in cores NS01, NS04, NS06, and NS35. Sandblast grit was tentatively identified based on visual inspection of the sieved fraction in samples from core NS05.

Metals Concentrations and Grain Size

Concentrations of grit-related metals (arsenic, copper, lead, and zinc) are notably elevated in samples containing visually identifiable sandblast grit (NS01-GC-10, NS04-GC-10, NS05-GC-10, NS05-GC-20, NS06-GC-10, NS06-GC-20, and NS35-GC-10). The correlation between concentrations of these metals and percent fine sand and larger material (percent greater than 125 um) in these grit-containing samples is generally good. Further, the correlations between concentrations of the grit-related metals in these samples are generally high, generally indicating a common source of the metals in the sediment, such as sandblast grit derived from smelter slag.

Some samples in which grit was not visually identified had fairly high concentrations of the grit-related metals and percentages of fine sand and larger material (NS02-GC-10, NS03-GC-10, NS20-GC-10). The correlation between concentrations of grit-related metals and percent fine sand and larger material in these samples also is generally good. As with the samples containing

visually identified grit, the correlations between the grit-related metals in these samples are generally high, suggesting a common source such as sandblast grit derived from smelter slag.

Several samples (NS12-GC-10, NS13-GC-10 and to a lesser degree NS18-GC-10, NS19-GC-10, NS33-GC-10, and NS34-GC-10) exhibited fairly high concentrations of grit-related metals but lower percentages (2.4 to 5.4 percent) of fine sand and larger material than would be expected based on the trends for the samples described above. The uppermost intervals in each of these samples consisted of dark (black, dark gray, dark grayish brown, or dark brown) mixtures of silt and clay with some sand. It is likely that the sand component in these samples is sandblast grit. The correlation between grit-related metals concentrations and percentages of fine sand and larger in these samples show a fairly high degree of correlation, suggesting that the fine sand and larger material in these samples consists of sandblast grit. It is likely that some of the very fine sand and silt (i.e., material less than 125 μm) in these samples also is composed of sandblast grit. Each of these samples is located radially outboard of the samples described above.

The general decrease in both concentrations of grit-related metals and percentage of fine sand and larger grit material outboard of the Northlake Shipyard dry dock area is expected. Grit-related metals concentrations in the samples from NS07, NS08, NS10, NS11, and NS15, located near the dry docks, are notably lower than the concentrations in adjacent locations, both outboard and closer to the dry dock area. The basal gray clay layer representing the base of RD_u deposits was observed at the top of cores NS08, NS10, and NS11, and at a depth of 2 inches in core NS15. The basal gray clay layer was absent in core NS07. The relative lack of RD_u sediments, including grit-impacted sediment, in these cores may be attributable to removal of RD_u sediments from those locations at some time after deposition. As discussed in Section 4, the bathymetric survey revealed irregularly shaped depressions at several locations in the study area, particularly between core locations NS07 and NS08, and between core locations NS10 and NS11. These features may have resulted from localized intense scouring by propeller wash. Such propeller wash may also have scoured some of the soft surficial sediments, including grit-impacted sediment, at locations near the depressions, including core locations NS07, NS08, NS10, NS11, and NS15. Such scouring, if it occurred, would likely have resulted in the redistribution of grit-impacted sediments from the dry dock area to more distal areas.

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10.0 References

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Tables

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Table 3-1. Core Collection and Diver Visual Inspection Summary

Core Location ID	Coring Attempts	Date	Time	Water depth (feet)	Distance from target location (feet)	Bearing from target location (degrees)	Penetration Depth (inches)	Measured Core Recovery (inches)	Core Recovery (%)	Diver Visual Inspection Observations
NS01	2	4/13/09	1244	26	0	0	32	25	78	Divers encountered debris on the sediment surface, including steel plates and rods, cables, tree branches, leaves, and street signs. A combination of what appeared to be sandblast grit and debris caused refusal during first attempt, and limited the penetration depth for the second attempt.
NS02	1	4/13/09	1450	40	0	0	50	48	96	Divers encountered debris on the sediment surface, including metal piping and other miscellaneous metal and organic debris.
NS03	1	4/13/09	1610	41	12	NA	66	60	91	Divers encountered miscellaneous metal debris. Organic debris was also observed, but not as much relative to stations NS01 and NS02. Sediment core was taken on top of a mound approximately 3 feet high relative to the sediment surface in the immediate vicinity. The bearing was not available because the sediment core was taken under a large boat, which prevented the compass from working properly.
NS04	1	4/15/09	1140	40	17.8	132	31	28	90	Divers encountered a hard layer attempting to drive the core. The layer was later determined to be cemented sandblast grit. The divers broke up the hard layer around the core cutting shoe in order to penetrate the sediment.
NS05	1	4/15/09	1312	37	13.6	118	66.5	58	87	Divers encountered minor amounts of debris on the sediment surface, including mussel shells and a large concrete block (likely from the dry dock). A strong petroleum odor was also present when the core was removed from the water.
NS06	2	4/14/09	1015	33	19.5	231	39.0	26.0	67	Divers encountered a substantial amount of debris at the sediment surface, including miscellaneous metal debris, tires, a large log, and other debris. A prominent oil sheen was observed oozing out of the bottom of the core when it was raised out of the water.
NS07	1	4/14/09	1142	41	15	241	66	59	89	Minor amounts of debris were observed in the vicinity of where the core was collected, including an acetylene tank (used for welding).
NS08	1	4/14/09	1255	41	0.4	40	74	72	97	A variety of debris was observed by the divers while they collected the sediment core, including tires, metal rods, various metal scraps, and garbage. Sediment dark gray to brown in color. Fine organic matter suspended in the upper 8 inches, most fines (i.e., silt) throughout.
NS09	1	4/20/09	0905	40	46.7	314	54	45	83	Divers encountered a soft silt bottom with an assortment of debris, including two large tires and a welding mask near the sediment core station.
NS10	1	4/14/09	1440	40	1.9	154	NA	72	>86*	No debris was observed by the divers. No unusual conditions or odors from the core were observed.
NS11	1	4/14/09	1618	40	0.6	326	49.5	46	93	No debris was observed by the divers. An oil sheen was observed on the top of the sediment core and a strong petroleum odor was noted.
NS12	1	4/14/09	1752	40	0.8	335	75	75	100	Divers encountered a soft silt sediment surface with no debris in the immediate vicinity of where the sediment core was collected.
NS13	1	4/15/09	1502	40	0.8	295	68	62	91	Divers encountered a soft silt sediment surface with no debris in the immediate vicinity of where the sediment core was collected.
NS14	1	4/15/09	1625	39	0.3	288	65	62	95	Divers encountered a soft silt sediment surface with no debris in the immediate vicinity of where the sediment core was collected.
NS15	1	4/15/09	1745	40	7.7	83	56.5	56	99	Divers encountered a soft silt sediment surface with no debris in the immediate vicinity of where the sediment core was collected.
NS16	1	4/15/09	1001	39	2.6	71	74.5	70	94	Divers encountered a soft silt sediment surface with no debris in the immediate vicinity of where the sediment core was collected.
NS17	1	4/16/09	0933	39	2.6	198	70	62.5	89	Divers encountered a soft silt sediment surface with no debris in the immediate vicinity of where the sediment core was collected.
NS18	1	4/16/09	1005	39	0.7	56	76.5	75	98	Divers encountered a soft silt sediment surface with no debris in the immediate vicinity of where the sediment core was collected.
NS19	1	4/16/09	1227	40	0.8	97	72	63	88	Divers encountered a soft silt sediment surface with no debris in the immediate vicinity of where the sediment core was collected. A strong petroleum odor was noted from the core, with an oil sheen present in the sediment from the bottom of the core.
NS20	1	4/16/09	1420	36	7.4	226	42	38	90	Divers encountered a soft silt sediment surface with minor amounts of debris in the immediate vicinity of where the sediment core was collected, including sections of carpet and metal piping. A minor oil sheen was also observed at the sediment surface of the core when it was removed from the water.
NS21	1	4/16/09	1622	35	1.6	177	31	21	68	Divers encountered a combination of silt and pea-sized gravel at the sediment surface. They also observed a variety of debris, including wood and bark, a rusty car tire, and metal piping/scraps. The divers also noted that there were several freshwater mussels living near where the sediment core was collected. An oil sheen was also observed in material at the bottom of the core.
NS22	NA	NA	NA	NA	NA	NA	NA	NA	NA	No core was collected at this station.

Table 3-1. Core Collection and Diver Visual Inspection Summary

Core Location ID	Coring Attempts	Date	Time	Water depth (feet)	Distance from target location (feet)	Bearing from target location (degrees)	Penetration Depth (inches)	Measured Core Recovery (inches)	Core Recovery (%)	Diver Visual Inspection Observations
NS23	1	4/17/09	1607	39	1.8	219	83.5	74	89	Divers encountered a soft silt sediment surface with several aquatic plants growing in close proximity to where the sediment core was collected. A vacuum also formed when the core was extracted, causing the core tube to become oblong in shape in the middle section (at approximately 25 inches from the top). The core tube returned to its original round shape as soon as the vacuum was broken when the top of the core tube was cut off.
NS24	1	4/17/09	1725	39	0.3	256	54	49	91	Divers encountered a soft silt sediment surface with minor amounts of organic debris in the immediate vicinity of where the sediment core was collected. Woody debris was also observed in the bottom of the core.
NS25	NA	NA	NA	NA	NA	NA	NA	NA	NA	No core was collected at this station.
NS26	1	4/17/09	1215	39	1.3	81	49	46	94	Divers encountered a soft silt sediment surface with minor amounts of organic debris in the immediate vicinity of where the sediment core was collected.
NS27	1	4/17/09	1100	38	1.2	78	70.5	53	75	Divers encountered a soft silt sediment surface with minor amounts of fine organic debris in the immediate vicinity of where the sediment core was collected.
NS28	1	4/17/09	0940	38	1.5	156	68.5	61	89	Divers encountered a soft silt sediment surface with minor amounts of fine organic debris in the immediate vicinity of where the sediment core was collected.
NS29	1	4/16/09	1748	38	1.4	234	62	60	97	Divers encountered a soft silt sediment surface with no debris in the immediate vicinity of where the sediment core was collected.
NS30	NA	NA	NA	NA	NA	NA	NA	NA	NA	No core was collected at this station.
NS31	NA	NA	NA	NA	NA	NA	NA	NA	NA	No core was collected at this station.
NS32	NA	NA	NA	NA	NA	NA	NA	NA	NA	No core was collected at this station.
NS33	1	4/16/09	1305	41	1	214	54	43	80	Divers encountered a soft silt sediment surface with no debris in the immediate vicinity of where the sediment core was collected. The divers also noted the visibility was very poor, which hindered their ability to observe debris in the vicinity of the coring location.
NS34	1	4/16/09	1452	39	0.7	266	54	50	93	Divers encountered a soft silt sediment surface with minor amounts of wood and bark debris in the immediate vicinity of where the sediment core was collected.
NS35	2	4/20/09	1400	44	0	0	22	11	50	Divers encountered a soft silt sediment surface with some debris, including a large metal plate near the sediment core sampling station. The divers could not advance the core beyond approximately 22 inches. One of the divers inspected the sediment near the core by inserting his hand into the sediment and reported that he felt gravel sized rocks at the depth where the refusal occurred.
NS05-G	1	4/20/09	1305	39	18.5	128	67.5	63.5	94	Divers observed the hole left from the grit identification core (NS05) at this location, and did not observe any debris on this occasion due to poor visibility conditions during the coring activities.
NS06-G	1	4/20/09	1730	30	1.8	17	31	27.5	89	Divers encountered a silty sand sediment surface with minor amounts of gravel. The divers also observed a variety of debris, including metal cables and piping and wood debris within close proximity to the core sample location. An oil sheen was also observed at the sediment surface in the core.
NS12-G	1	4/20/09	1505	40	NA	NA	71.5	62	87	Divers observed a soft silty sediment surface with no debris. The GPS coordinates were inadvertently not logged at this location. However, the divers said they observed that the hole from the grit identification core (NS12) at this location was approximately 2 to 3 feet from this geotechnical core.
NS18-G	1	4/20/09	1620	39	2.5	42	74	65.5	89	Divers observed a soft silty sediment surface with no debris. The divers also observed that the hole from the grit identification core at this location (NS18) was in close proximity to the geotechnical sediment core.
NS01-G	2	4/20/09	1205	26	4.7	209	26	10	38	Divers observed the hole left from the grit identification core at this location (NS01), and saw similar amounts of debris described for core NS01. Due to the large amount of debris at this location, refusal was encountered during the first geotech core. A second attempt was made at a nearby location. The second attempt resulted in poor recovery, likely caused by debris. The core was rejected because of inadequate recovery for geotechnical analysis. The location was abandoned.

Key:

NA = Not available and/or not applicable.

* = The penetration depth was not recorded for core NS10. The measured recovery was 72 inches. The maximum possible penetration depth of the core sampling device used for the project is 84 inches. Therefore, the minimum percent recovery is 86%.

Table 3-2. Core Location Coordinates

Core Location ID	UTM Zone 10N NAD83		NAD83							
			Longtitude	Latitude	Longitude			Latitude		
	Northing (meters)	Easting (meters)	(degrees)	(degrees)	Deg	Minute	Second	Deg	Minute	Second
NS01	5277277.865	549565.241	-122.3400348	47.64699956	-122	20	24.1251756	47	38	49.19839944
NS01-G1 (rejected)	5277277.864	549564.701	-122.340042	47.64699959	-122	20	24.1510596	47	38	49.19851572
NS01-G2 (rejected)	5277276.784	549564.604	-122.3400434	47.64698988	-122	20	24.15615	47	38	49.16356152
NS02	5277248.955	549540.743	-122.3403642	47.64674132	-122	20	25.3111812	47	38	48.26876532
NS03	5277218.599	549515.807	-122.3406997	47.64647011	-122	20	26.5187544	47	38	47.29241292
NS04	5277181.194	549554.642	-122.3401868	47.6461306	-122	20	24.6726312	47	38	46.07017404
NS05	5277217.213	549584.634	-122.3397834	47.64645237	-122	20	23.2204056	47	38	47.22854964
NS05-G	5277215.735	549585.441	-122.3397729	47.64643902	-122	20	23.182332	47	38	47.18045508
NS06	5277216.166	549619.948	-122.3393134	47.64644025	-122	20	21.5282184	47	38	47.18489352
NS06-G	5277220.407	549624.742	-122.3392491	47.64647804	-122	20	21.296706	47	38	47.320935
NS07	5277191.879	549599.551	-122.3395877	47.6462233	-122	20	22.5157704	47	38	46.40387316
NS08	5277159.823	549573.690	-122.3399357	47.64593687	-122	20	23.7683796	47	38	45.37272156
NS09	5277131.101	549529.433	-122.3405281	47.64568184	-122	20	25.9013292	47	38	44.45462256
NS10	5277150.094	549514.201	-122.3407288	47.64585389	-122	20	26.6236548	47	38	45.0739968
NS11	5277180.477	549480.196	-122.3411781	47.64612985	-122	20	28.2411384	47	38	46.06745676
NS12	5277210.479	549445.865	-122.3416318	47.64640241	-122	20	29.8744188	47	38	47.0486598
NS12-G	5277210.479	549445.865	-122.3416318	47.64640241	-122	20	29.8744188	47	38	47.0486598
NS13	5277244.815	549475.779	-122.3412296	47.64670905	-122	20	28.4266428	47	38	48.15256308
NS14	5277154.148	549417.098	-122.3420212	47.64589778	-122	20	31.2761508	47	38	45.23202348
NS15	5277114.369	549465.459	-122.3413818	47.64553619	-122	20	28.9744044	47	38	43.93029156
NS16	5277074.274	549509.861	-122.3407952	47.64517206	-122	20	26.8625688	47	38	42.61940196
NS17	5277033.357	549554.793	-122.3402016	47.64480048	-122	20	24.7256988	47	38	41.28173124
NS18	5277080.088	549595.345	-122.3396564	47.64521782	-122	20	22.763004	47	38	42.78415344
NS18-G	5277080.537	549595.671	-122.339652	47.64522184	-122	20	22.7471964	47	38	42.79860672
NS19	5277125.932	549635.409	-122.3391178	47.64562721	-122	20	20.8240296	47	38	44.25797112
NS20	5277161.536	549665.249	-122.3387165	47.64594526	-122	20	19.3792524	47	38	45.40293348
NS21	5277124.343	549714.224	-122.3380686	47.64560687	-122	20	17.0471004	47	38	44.18472552
NS23	5277039.628	549640.748	-122.3390565	47.64485031	-122	20	20.6034	47	38	41.46113364
NS24	5276993.979	549601.016	-122.3395907	47.64444265	-122	20	22.5263508	47	38	39.99354144
NS26	5276988.062	549515.174	-122.3407342	47.64439599	-122	20	26.6430588	47	38	39.82555428
NS27	5277028.168	549469.476	-122.341338	47.64476032	-122	20	28.8169692	47	38	41.13715776
NS28	5277067.680	549423.323	-122.341948	47.64511934	-122	20	31.012962	47	38	42.42963552
NS29	5277107.901	549376.823	-122.3425626	47.64548477	-122	20	33.2253276	47	38	43.7451612
NS33	5277251.098	549412.732	-122.3420683	47.64677039	-122	20	31.4459772	47	38	48.37340904
NS34	5277143.984	549341.782	-122.343025	47.64581208	-122	20	34.8901764	47	38	44.92350168
NS35	5277184.073	549525.181	-122.3405788	47.64615876	-122	20	26.0835324	47	38	46.17154284

Table 3-3. Core Description Summary

Core Location ID	Sample ID	Core Penetration (inches below mudline)	Measured Core Recovery (inches)	Core % Recovery	Depth Interval (feet below top of core)	Description	Depth of Basal Light Gray Clay or Brownish Gray Fines Immediately Overlying Brown Organic Silt/Clay (inches)
NS01	NS01-GC-10	32	25	78	0 - 1	0 - 7": Sand, fine to very coarse with est. 20% dark brown fines. Sand is angular, greenish black and black (apparently sandblast grit). Includes red and blue paint chips. Wood fragments to 1.5" and several pebbles. Petroleum odor and sheen. 7 - 18": Dark brown organic silt/clay with minor fine sand and small wood debris.	
	NS01-GC-15				1 - 1.5	7 - 18": Dark brown organic silt/clay with minor fine sand and small wood debris.	Not observed
NS02	NS02-GC-10	50	48	96	0 - 1	0 - 5": Dark brown to black organic silt/clay, very wet and soft. Bivalve shell and wood debris to 1". Petroleum odor. 5 - 12": Grayish brown clay with minor sand and silt, very soft.	Gray clay at 5 - 12" underlain by sand
	NS02-GC-20				1 - 2	12 - 20": Sand, very fine to coarse, with minor brown fines. Sand contains quartz and black mineral grains and green lithics. Overall color is greenish, brownish gray. 20 - 29": Brown organic silt/clay, very soft.	
	NS02-GC-30				2 - 3	20 - 29": Brown organic silt/clay, very soft. 29 - 35": Sand, very fine to coarse, with minor brown fines. Sand contains quartz and black mineral grains and green lithics. Overall color is greenish, brownish gray. 35 - 48": Brown organic silt/clay, very soft.	
	NS02-GC-40				3 - 4	35 - 48": Brown organic silt/clay, very soft.	
NS03	NS03-GC-10	66	60	91	0 - 1	0 - 4": Dark gray to black soupy mixture of fines with some sand, wood fragments, and bivalve shell. Petroleum odor and sheen. 4 - 29": Brownish gray organic silt and clay, very soft, wet. Petroleum odor.	4 - 29
	NS03-GC-20				1 - 2	4 - 29": Brownish gray organic silt and clay, very soft, wet. Petroleum odor.	
	NS03-GC-30				2 - 3	4 - 29": Brownish gray organic silt and clay, very soft, wet. Petroleum odor. 29 - 60": Brown organic silt/clay with trace very fine sand, very soft. Petroleum odor.	
	NS03-GC-40				3 - 4	29 - 60": Brown organic silt/clay with trace very fine sand, very soft. Petroleum odor.	
	NS03-GC-45				4 - 4.5	29 - 60": Brown organic silt/clay with trace very fine sand, very soft. Petroleum odor.	
NS04	NS04-GC-10	31	28	90	0 - 1	0 - 6": Sand, black, angular, fine to very coarse (apparently sandblast grit) with some black fines. Sand occurs as loose particles and cemented layers. Petroleum odor and sheen. 6 - 8": Well-cemented layer of black sand (apparently sandblast grit) and paint chips. 8 - 10": Grayish brown to brownish gray silt and clay with some black sand (possibly sandblast grit), very soft, wet. 10 - 18": Finely interlayered (1/4 - 2" layers) brown and grayish brown organic silt/clay and light gray clay, very soft, wet. Petroleum odor.	
	NS04-GC-20				1 - 2	10 - 18": Finely interlayered (1/4 - 2" layers) brown and grayish brown organic silt/clay and light gray clay, very soft, wet. Petroleum odor. 18 - 23": Brownish gray organic silt/clay, soft. 23 - 28": Brown organic silt/clay, very soft.	18 - 23
NS05	NS05-GC-10	66.5	58	87	0 - 1	0 - 12": Black silt and clay and fine or very fine sand, very soupy, with mussel shells. Petroleum staining and odor. Sieved fraction includes some fine black sand (possible sandblast grit).	
	NS05-GC-20				1 - 2	12 - 24": Black and dark brown organic silt and clay with heavy black hydrocarbon stain and odor, very soft. Sieved fraction includes coarse black sand (possible sandblast grit).	
	NS05-GC-30				2 - 3	24 - 36": Mottled black and dark brown organic silt/clay with abundant fibrous plant matter, very soft. Brown material appears as isolated blobs to 1/2" in overall black matrix. Black material appears hydrocarbon stained. Hydrocarbon and naphthalene odor.	
	NS05-GC-40				3 - 4	36 - 45": Mottled black and dark brown organic silt/clay with abundant fibrous plant matter, very soft. Brown material appears as isolated blobs to 1/2" in overall black matrix. Black material appears hydrocarbon stained. Hydrocarbon and naphthalene odor. Includes piece of tar-like material 1/4 - 1/2" thick, 4" wide, and 7" long. 45 - 48": Grayish brown organic silt/clay, very soft.	
	NS05-GC-50				4 - 5	48 - 52": Brownish gray silt and clay, very soft, naphthalene odor. 52 - 58": Brown organic silt/clay, very soft. Also noted in core cutting shoe below sand catcher (probably dragged down from higher interval): piece of coal to 1" and two black briquettes (probably coke) measuring 2.5" by 2" by 1.5".	48 - 52
NS06	NS06-GC-10	39	26	67	0 - 1	0 - 24": Dark brown to black soupy fines with sand, to very coarse, and debris, including glass jar, brick fragments and wood. Sand is black, angular (apparently sandblast grit).	
	NS06-GC-20				1 - 2	0 - 24": Dark brown to black soupy fines with sand, to very coarse, and debris, including glass jar, brick fragments and wood. Sand is black, angular (apparently sandblast grit).	Not encountered
NS07	NS07-GC-10	66	59	89	0 - 1	0 - 4": Brownish gray to black silt and clay with fine sand and bivalve shell, very soft. Petroleum odor. 4 - 52": Brown organic silt/clay with decomposed wood fragments to 1/4", very soft, gelatinous.	Not present
	NS07-GC-20				1 - 2	4 - 52": Brown organic silt/clay with decomposed wood fragments to 1/4", very soft, gelatinous.	
	NS07-GC-30				2 - 3	4 - 52": Brown organic silt/clay with decomposed wood fragments to 1/4", very soft, gelatinous.	
	NS07-GC-40				3 - 4	4 - 52": Brown organic silt/clay with decomposed wood fragments to 1/4", very soft, gelatinous.	
NS08	NS08-GC-10	74	72	97	0 - 1	0 - 4": Light gray to black fines with minor sand, very soft and wet. Petroleum odor. 4 - 12": Brown organic silt/clay with minor plant material to 1/4", wet, very soft, gelatinous.	0 - 4
	NS08-GC-20				1 - 2	12 - 65": Brown organic silt/clay with minor plant material to 1/4", wet, very soft, gelatinous. Naphthalene odor.	
	NS08-GC-30				2 - 3	12 - 65": Brown organic silt/clay with minor plant material to 1/4", wet, very soft, gelatinous. Naphthalene odor.	
	NS08-GC-40				3 - 4	12 - 65": Brown organic silt/clay with minor plant material to 1/4", wet, very soft, gelatinous. Naphthalene odor.	
	NS08-GC-50				4 - 5	12 - 65": Brown organic silt/clay with minor plant material to 1/4", wet, very soft, gelatinous. Naphthalene odor.	

Table 3-3. Core Description Summary

Core Location ID	Sample ID	Core Penetration (inches below mudline)	Measured Core Recovery (inches)	Core % Recovery	Depth Interval (feet below top of core)	Description	Depth of Basal Light Gray Clay or Brownish Gray Fines Immediately Overlying Brown Organic Silt/Clay (inches)
NS09	NS09-GC-02	54	45	83	0 - 0.2	See NS09-GC-10	
	NS09-GC-10				0 - 1	0 - 4": Very dark grayish brown organic silt/clay with trace fine or very fine sand, soupy, hydrocarbon odor. 4 - 6.5": Organic silt/clay, mostly brown with thin (1/4 - 1/2") reddish brown and dark grayish brown layers, very soft. 6.5 - 8": Light gray clay, soft, with thin brown layers at 6.75" and 7.75". 8 - 10": Brownish gray organic silt/clay with fibrous plant matter. 10 - 12": Organic silt/clay, very soft, grading down from brownish gray to brown.	6.5 - 8
	NS09-GC-20				1 - 2	12 - 38": Brown organic silt/clay, very soft, gelatinous.	
	NS09-GC-30				2 - 3	12 - 38": Brown organic silt/clay, very soft, gelatinous.	
NS10	NS10-GC-10	NA	72	>86*	0 - 1	0 - 5": Light gray clay and silt with minor sand, very soft, wet. Slight petroleum odor. Thin (1/4") dark gray layer at 2". 5 - 8": Light gray clay and silt, very soft, grading down to brownish gray then grayish brown organic silt/clay. Slight petroleum odor. 8 - 65": Brown organic silt/clay with minor plant matter, very soft, gelatinous.	0 - 8
	NS10-GC-20				1 - 2	8 - 65": Brown organic silt/clay with minor plant matter, very soft, gelatinous.	
	NS10-GC-30				2 - 3	8 - 65": Brown organic silt/clay with minor plant matter, very soft, gelatinous.	
	NS10-GC-40				3 - 4	8 - 65": Brown organic silt/clay with minor plant matter, very soft, gelatinous.	
	NS10-GC-50				4 - 5	8 - 65": Brown organic silt/clay with minor plant matter, very soft, gelatinous.	
NS11	NS11-GC-10	49.5	46	93	0 - 1	0 - 5": Light gray clay and silt, very soft, wet. Thin (1/4") dark gray clay layer at 2". Slight petroleum odor. 5 - 7": Light gray clay and silt grading downward to grayish brown organic clay and silt, very soft, wet. 7 - 37": Brown organic silt/clay, minor clastic material, very soft, gelatinous.	0 - 7
	NS11-GC-20				1 - 2	7 - 37": Brown organic silt/clay, minor clastic material, very soft, gelatinous.	
	NS11-GC-30				2 - 3	7 - 37": Brown organic silt/clay, minor clastic material, very soft, gelatinous.	
NS12	NS12-GC-10	75	75	100	0 - 1	0 - 6": Dark gray to black silt, clay, and sand, fine and very fine, soupy. Petroleum odor. 6 - 9": Light gray clay, very soft, with interlayers of grayish brown to brownish gray very soft, gelatinous organic silt/clay. 9 - 19": Grayish brown organic silt/clay with abundant fibrous plant material, very soft.	
	NS12-GC-20				1 - 2	9 - 19": Grayish brown organic silt/clay with abundant fibrous plant material, very soft. 19 - 22": Light gray clay, very soft. 22 - 28": Organic silt/clay, very soft, gelatinous, grading down from brownish gray to grayish brown.	19 - 22
	NS12-GC-30				2 - 3	22 - 28": Organic silt/clay, very soft, gelatinous, grading down from brownish gray to grayish brown. 28 - 68": Brown organic silt/clay, very soft, gelatinous.	
	NS12-GC-40				3 - 4	28 - 68": Brown organic silt/clay, very soft, gelatinous.	
	NS12-GC-50				4 - 5	28 - 68": Brown organic silt/clay, very soft, gelatinous.	
NS13	NS13-GC-10	68	62	91	0 - 1	0 - 11": Black silt and clay, soupy. 11 - 22": Grayish brown organic silt/clay with some very fine sand, very soft.	
	NS13-GC-20				1 - 2	11 - 22": Grayish brown organic silt/clay with some very fine sand, very soft. 22 - 30": Interlayered light gray clay and brownish gray organic silt/clay, very soft.	22 - 30
	NS13-GC-30				2 - 3	22 - 30": Interlayered light gray clay and brownish gray organic silt/clay, very soft. 30 - 33": Brownish gray organic silt/clay, very soft. 30 - 62": Brown organic silt/clay, very soft, gelatinous.	
	NS13-GC-40				3 - 4	30 - 62": Brown organic silt/clay, very soft, gelatinous.	
NS14	NS14-GC-10	65	62	95	0 - 1	0 - 11": Brownish gray organic silt/clay with minor very fine sand, soupy (0 - 4") to very soft (4 - 11"). 11 - 13": Light gray clay, very soft.	11 - 13
	NS14-GC-20				1 - 2	11 - 13": Light gray clay, very soft. 13 - 17": Brownish gray organic silt/clay, very soft. 17 - 20": Organic silt/clay, very soft, grading down from brownish gray to brown. 20 - 62": Brown organic silt/clay, very soft, gelatinous.	
	NS14-GC-30				2 - 3	20 - 62": Brown organic silt/clay, very soft, gelatinous.	
	NS14-GC-40				3 - 4	20 - 62": Brown organic silt/clay, very soft, gelatinous.	
NS15	NS15-GC-10	56.5	56	99	0 - 1	0 - 2": Dark gray fines, soupy. 2 - 3": Light gray clay, very soft. 3 - 6": Grayish brown fines, very soft. 6 - 9": Grayish brown organic silt/clay, very soft. 9 - 56": Brown organic silt/clay, very soft, gelatinous.	2 - 3
	NS15-GC-20				1 - 2	9 - 56": Brown organic silt/clay, very soft, gelatinous.	
	NS15-GC-30				2 - 3	9 - 56": Brown organic silt/clay, very soft, gelatinous.	
	NS15-GC-40				3 - 4	9 - 56": Brown organic silt/clay, very soft, gelatinous.	
NS16	NS16-GC-10	74.5	70	94	0 - 1	0 - 14": Organic silt and clay, ranging in color from dark brown (0 - 5") to dark grayish brown (5 - 8") to reddish brown (8 - 11") to brownish gray (11 14"). Very soft, wet. Petroleum odor. Thin (1/4") gray clay layer at 3".	
	NS16-GC-20				1 - 2	0 - 14": Organic silt and clay, ranging in color from dark brown (0 - 5") to dark grayish brown (5 - 8") to reddish brown (8 - 11") to brownish gray (11 14"). Very soft, wet. Petroleum odor. 14 - 16": Light gray clay, very soft. 16 - 17": Light gray organic silt/clay, very soft. 17 - 19": Organic silt/clay, brownish gray, very soft. 19 - 63": Organic silt/clay, very soft, gelatinous, grading down from grayish brown (19 - 24") to brown (24 - 63").	16 - 17
	NS16-GC-30				2 - 3	24 - 63": Brown organic silt/clay, very soft, gelatinous.	
	NS16-GC-40				3 - 4	24 - 63": Brown organic silt/clay, very soft, gelatinous.	
	NS16-GC-50				4 - 5	24 - 63": Brown organic silt/clay, very soft, gelatinous.	
NS17	NS17-GC-10	70	62.5	89	0 - 1	0 - 3": Dark brownish gray organic silt/clay with trace very fine sand, very soft. Petroleum odor. 3 - 3.5": Light gray clay layer, very soft. 3.5 - 12": Dark grayish brown organic silt/clay and trace very fine sand, with several very thin (<1/4") gray clay layers, very soft. Petroleum odor.	
	NS17-GC-20				1 - 2	12 - 12.5": Light gray clay, soft. 12.5 - 13": Brownish gray organic silt/clay with blobs of brown liquid (NAPL?). 13 - 13.5" Light gray clay, soft. 13.5 16": Brownish gray organic silt/clay, very soft. 16 - 16.5": Light gray clay. 16.5 - 18": Grayish brown organic silt/clay, very soft. 18" - 56": Brown organic silt/clay, very soft.	16 - 16.5
	NS17-GC-30				2 - 3	18" - 56": Brown organic silt/clay, very soft.	
	NS17-GC-40				3 - 4	18" - 56": Brown organic silt/clay, very soft.	
NS18	NS18-GC-10	76.5	75	98	0 - 1	0 - 6": Dark grayish brown organic silt/clay with trace sand, very soupy. Petroleum odor. 6 - 6.25" Light gray clay. 6.25 - 13": Dark grayish brown organic silt/clay and trace very fine sand, very soft. Petroleum odor. At 7.25" thin layer with brown liquid (NAPL?).	
	NS18-GC-20				1 - 2	6.25 - 13": Dark grayish brown organic silt/clay and trace very fine sand, very soft. Petroleum odor. 13 - 15": Reddish brown organic silt/clay with abundant fibrous plant material, very soft. 15 - 18.5": Finely interlayered thin (<1/4") gray clay layers and grayish brown organic silt/clay layers, very soft. Petroleum odor. 18.5 - 19": Light gray clay layer (lowermost in core). 19 - 22": Organic silt/clay, very soft, grading down from brownish gray to brown. 22 - 68": Brown organic silt/clay, very soft, gelatinous	18.5 - 19
	NS18-GC-30				2 - 3	22 - 68": Brown organic silt/clay, very soft, gelatinous	
	NS18-GC-40				3 - 4	22 - 68": Brown organic silt/clay, very soft, gelatinous	
NS19	NS19-GC-10	72	63	88	0 - 1	0 - 4": Dark brown to black fines with trace sand, soupy. 4 - 4.25": Light gray clay. 4.25 - 7": Dark grayish brown organic silt/clay with trace sand and brown NAPL. 7 - 9.5": Reddish brown organic silt/clay, very soft, with brown NAPL. 9.5 - 13": Dark brownish gray organic silt/clay, very soft, with NAPL and strong naphthalene odor.	
	NS19-GC-20				1 - 2	9.5 - 13": Dark brownish gray organic silt/clay, very soft, with NAPL and strong naphthalene odor. 13 - 13.5": Light gray clay. 13.5 - 16.5": Brownish gray organic silt/clay, very soft, with blobs of brown NAPL concentrated immediately below gray clay (13 - 13.5"). Strong naphthalene odor. 16.5 - 17": Light gray clay. 17 - 24": Organic silt/clay, very soft, grading down from grayish brown to brown. Brown NAPL at 17 - 17.5", immediately below gray clay layer (16.5 - 17").	16.5 - 17
	NS19-GC-30				2 - 3	24 - 57": Brown organic silt/clay, very soft.	
	NS20-GC-10				0 - 1	0 - 11": Dark brown to black fines with minor very fine or fine sand, very soft. Petroleum odor. 11 - 11.5": Light gray clay, soft. 11.5 - 26": Organic silt/clay with minor fine or very fine sand and abundant fibrous plant material, very soft. Dark brown hydrocarbon staining, sheen, and strong naphthalene odor (not observed in interval above 11").	Gray clay at 11 - 11.5" underlain by heavily stained organic silt/clay.

Table 3-3. Core Description Summary

Core Location ID	Sample ID	Core Penetration (inches below mudline)	Measured Core Recovery (inches)	Core % Recovery	Depth Interval (feet below top of core)	Description	Depth of Basal Light Gray Clay or Brownish Gray Fines Immediately Overlying Brown Organic Silt/Clay (inches)
NS20	NS20-GC-20	42	38	90	1 - 2	11.5 - 26": Organic silt/clay with minor fine or very fine sand and abundant fibrous plant material, very soft. Dark brown hydrocarbon staining, sheen, and strong naphthalene odor (not observed in interval above 11").	
	NS20-GC-30				2 - 3	11.5 - 26": Organic silt/clay with minor fine or very fine sand and abundant fibrous plant material, very soft. Dark brown hydrocarbon staining, sheen, and strong naphthalene odor (not observed in interval above 11"). 26 - 32": Organic silt/clay, very soft, brown, with patchy dark brown hydrocarbon stain, with sheen and strong naphthalene odor. Abundant fibrous plant matter and piece of bark to 3".	
NS21	NS21-GC-10	31	21	68	0 - 1	0 - 16": Sand, very fine to coarse, with some fines, overall color dark brownish gray. Includes white flecks (possibly paint) to 2mm, wood debris, piece of tar-like material to 1.5", and minor sub-rounded gravel to 0.75". Strong hydrocarbon odor.	Not encountered
NS23	NS23-GC-10	83.5	74	89	0 - 1	0 - 5": Dark brown to black silt/clay with trace fine or very fine sand, soupy. Petroleum odor. 5 - 9": Dark grayish brown organic silt/clay with trace very fine sand, very soft. Thin (<1/4") gray clay at 6.5". 9 - 13.5": Brown organic silt/clay, very soft, with thin (<1/4") gray clay layers at 11" and 12.5".	
	NS23-GC-20				1 - 2	9 - 13.5": Brown organic silt/clay, very soft, with thin (<1/4") gray clay layers at 11" and 12.5". 13.5 - 14": Light gray clay, soft. 14 - 14.5": Brown organic silt/clay, very soft. 14.5 - 15": Light gray clay, very soft. 15 - 16": Gray organic silt/clay, very soft. 16 - 16.5": Light gray clay, soft (lowermost layer in core). 16.5 - 21": Organic silt/clay, very soft, grading down from brownish gray to brown. 21 - 24": Brown organic silt/clay, very soft.	16 - 16.5
	NS23-GC-30				2 - 3	24 - 66": Brown organic silt/clay, very soft.	
NS24	NS24-GC-10	54	49	91	0 - 1	0 - 3": Dark grayish brown to black silt/clay with trace fine or very fine sand, soupy. 3 - 3.25": Gray clay. 3.25 - 6": Dark grayish brown organic silt/clay with fibrous plant material, very soft. 6 - 8": Reddish brown organic silt/clay, very soft. 8 - 10": Brown organic silt/clay, very soft. 10 - 11": Light gray clay with thin brown layer in middle. 11 - 14": Organic silt/clay, very soft, grading down from grayish brown to brown.	
	NS24-GC-20				1 - 2	11 - 14": Organic silt/clay, very soft, grading down from grayish brown to brown. 14 - 42": Brown organic silt/clay, very soft.	
	NS24-GC-30				2 - 3	14 - 42": Brown organic silt/clay, very soft.	
NS26	NS26-GC-10	49	46	94	0 - 1	0 - 4": Dark grayish brown fines and trace fine to very fine sand, soupy. Petroleum odor. 4 - 10": Organic silt/clay, very soft, grayish brown (4 - 7"), reddish brown (7 - 8"), brownish gray (8 - 9") and reddish brown (9 - 10"). Thin gray clay layer at 5". 10 - 11": Light gray clay, very soft. 11 - 13": Brownish gray organic silt/clay, very soft.	10 - 11
	NS26-GC-20				1 - 2	11 - 13": Brownish gray organic silt/clay, very soft. 13 - 46": Brown organic silt/clay, very soft.	
	NS26-GC-30				2 - 3	13 - 46": Brown organic silt/clay, very soft.	
NS27	NS27-GC-10	70.5	53	75	0 - 1	0 - 2": Dark grayish brown silt/clay with trace fine or very fine sand, soupy. 2 - 2.25": Gray clay. 2.25 - 6": Thinly interlaminated reddish brown, brown, and gray organic silt/clay, very soft. 6 - 7.5": Light gray clay with thin layer of brown material at 6.5" and dark gray material at 6.75". 7.5 - 8.5": Gray clay with fibrous plant matter. 8.5 - 14": Organic silt/clay, very soft, grading down from brownish gray to grayish brown.	6 - 8.5
	NS27-GC-20				1 - 2	8.5 - 14": Organic silt/clay, very soft, grading down from brownish gray to grayish brown. 14 - 48": Brown organic silt/clay, very soft	
	NS27-GC-30				2 - 3	14 - 48": Brown organic silt/clay, very soft.	
NS28	NS28-GC-02	68.5	61	89	0 - 0.2	0 - 1.5": Dark grayish brown silt/clay, soupy. 1.5 - 1.75": Gray clay. 1.75 - 3": Reddish brown organic silt/clay, very soft	
	NS28-GC-10				0 - 1	0 - 1.5": Dark grayish brown silt/clay, soupy. 1.5 - 1.75": Gray clay. 1.75 - 3": Reddish brown organic silt/clay, very soft. 3 - 6": Finely interlaminated brown, reddish brown, and grayish brown organic silt/clay and thin (<1/4") gray clay layers at 3.5", 4.25", 4.75", and 5.5". 6 - 8": Light gray clay with thin brown and dark gray layers. 8 - 8.5": Light gray clay. 8.5 - 13": Organic silt/clay, grading down from brownish gray to grayish brown, very soft.	6 - 8.5
	NS28-GC-20				1 - 2	8.5 - 13": Organic silt/clay, grading down from brownish gray to grayish brown, very soft. 13 - 54": Brown organic silt/clay, very soft	
	NS28-GC-30				2 - 3	13 - 54": Brown organic silt/clay, very soft.	
NS29	NS29-GC-10	62	60	97	0 - 1	0 - 4": Dark grayish brown fines, soupy. 4 - 4.5": Light gray clay, very soft. 4.5 - 10": Dark grayish brown organic silt/clay, very soft. 10 - 11": Reddish brown organic silt/clay, very soft. 11 - 12": Dark grayish brown organic silt/clay, very soft.	
	NS29-GC-20				1 - 2	12 - 12.5": Light gray clay, very soft. 12.5 - 14": Interlayered reddish brown organic silt/clay and light gray clay, very soft. 14 - 19": Brownish gray organic silt/clay, very soft. 19 - 23": Organic silt/clay, grading down from grayish brown to brown. 23 - 54": Brown organic silt/clay, very soft, gelatinous.	12 - 14
	NS29-GC-30				2 - 3	23 - 54": Brown organic silt/clay, very soft, gelatinous.	
NS33	NS33-GC-10	54	43	80	0 - 1	0 - 6": Dark brown to black fines with trace fine to very fine sand, soupy. Petroleum odor. 6 - 8.5": Brown organic silt/clay, very soft. 8.5 - 14.5": Interlayered gray clay and reddish brown and dark grayish brown organic silt/clay layers with fibrous plant matter, very soft.	8.5 - 14.5
	NS33-GC-20				1 - 2	8.5 - 14.5": Interlayered gray clay and reddish brown and dark grayish brown organic silt/clay layers with fibrous plant matter, very soft. 14.5 - 18": Organic silt/clay, very soft, grading down from brownish gray to brown. 18 - 35": Brown organic silt/clay, very soft.	
	NS33-GC-30				2 - 3	18 - 35": Brown organic silt/clay, very soft.	
NS34	NS34-GC-02	54	50	93	0 - 0.2	See NS34-GC-10.	
	NS34-GC-10				0 - 1	0 - 6": Dark grayish brown organic silt/clay with some fine to very fine sand and fibrous plant matter. Petroleum odor. 6 - 13": Organic silt/clay, very soft, dark grayish brown (6 - 10"), reddish brown (10 - 11"), dark brownish gray (11 - 12.5"), and reddish brown (12.5 - 13"). Thin (<1/4") gray clay at 10".	
	NS34-GC-20				1 - 2	6 - 13": Organic silt/clay, very soft, dark grayish brown (6 - 10"), reddish brown (10 - 11"), dark brownish gray (11 - 12.5"), and reddish brown (12.5 - 13"). 13 - 14.5": Light gray clay with thin layer of brown material in middle. 14.5 - 17": Gray organic silt/clay, very soft. 17 - 23": Organic silt/clay, very soft, grading down from grayish brown to brown. 23 - 44": Brown organic silt/clay, very soft.	13 - 17
	NS34-GC-30				2 - 3	23 - 44": Brown organic silt/clay, very soft.	
NS35	NS35-GC-10	22	11	50	0 - 1	0 - 11": Black fines and black sand (apparently sandblast grit). Hydrocarbon odor.	Not encountered
NS05-G	NS05-GT-20	67.5	63.5	94	0 - 2	Core not logged because the material was retained in the core tube for delivery to geotechical laboratory. See NS05 description.	NA
	NS05-GT-40				2 - 4	Core not logged because the material was retained in the core tube for delivery to geotechical laboratory. See NS05 description.	NA
NS06-G	NS06-GT-15	31	27.5	89	0 - 1.5	Core not logged because the material was retained in the core tube for delivery to geotechical laboratory. See NS06 description.	NA
NS12-G	NS12-GT-20	71.5	62	87	0 - 2	Core not logged because the material was retained in the core tube for delivery to geotechical laboratory. See NS12 description.	NA
	NS12-GT-40				0 - 4	Core not logged because the material was retained in the core tube for delivery to geotechical laboratory. See NS12 description.	NA
NS18-G	NS18-GT-20	74	65.5	89	0 - 2	Core not logged because the material was retained in the core tube for delivery to geotechical laboratory. See NS18 description.	NA
	NS18-GT-40				0 - 4	Core not logged because the material was retained in the core tube for delivery to geotechical laboratory. See NS18 description.	NA

Key:
NAPL = Non-aqueous phase liquid.
NA = Not applicable or not available.
* = The penetration depth was not recorded for core NS10. The measured recovery was 72 inches. The maximum possible penetration depth of the core sampling device used for the project is 84 inches. Therefore, the minimum percent recovery is 86%.

Table 3-4. Sample Collection and Analytical Summary

					Field Analysis			Chemical and Physical Analyses			Geotechnical Analyses						
Core Location ID	Sample ID	Date	Time	Depth Interval (feet below top of core)	Field Sieving (>125 um)	Field Percent Moisture	Field XRF Total Metals	Total Metals	Grain Size (PSEP)	TCLP Metals	Atterberg Limits ASTM D 4318)	Consolidation (ASTM D 2435)	Grain Size Analysis, Sieve and Hydrometer (ASTM D 422)	Moisture Content (ASTM D 2216)	Specific gravity (ASTM D 854) and bulk unit weight (ASTM D 2937)	Unconsolidated, Undrained Triaxial Strength (ASTM D 2850)	Vane Shear (ASTM D 4648)
NS01	NS01-GC-10	4/13/2009	12:44	0 - 1	X	X	X	X	X	As, Cd, Cr, Pb							
	NS01-GC-15	4/13/2009	12:44	1 - 1.5	X	X	X										
NS02	NS02-GC-10	4/13/2009	14:50	0 - 1	X	X	X	X	X	As, Cr, Pb, Hg							
	NS02-GC-20	4/13/2009	14:50	1 - 2	X	X	X	X	X								
	NS02-GC-30	4/13/2009	14:50	2 - 3	X	X	X										
	NS02-GC-40	4/13/2009	14:50	3 - 4	X	X	X										
NS03	NS03-GC-10	4/13/2009	16:10	0 - 1	X	X	X	X	X	As, Cr, Pb, Hg							
	NS03-GC-20	4/13/2009	16:10	1 - 2	X	X	X										
	NS03-GC-30	4/13/2009	16:10	2 - 3	X	X	X										
	NS03-GC-40	4/13/2009	16:10	3 - 4	X	X	X										
	NS03-GC-45	4/13/2009	16:10	4 - 4.5	X	X	X										
NS04	NS04-GC-10	4/15/2009	11:40	0 - 1	X	X	X	X	X	As, Cd, Cr, Pb, Hg							
	NS04-GC-20	4/15/2009	11:40	1 - 2	X	X	X	X	X								
NS05	NS05-GC-10	4/15/2009	13:12	0 - 1	X	X	X	X		As, Cd, Cr, Pb, Hg							
	NS05-GC-20	4/15/2009	13:12	1 - 2	X	X	X	X		As, Cr, Pb, Hg							
	NS05-GC-30	4/15/2009	13:12	2 - 3	X	X	X										
	NS05-GC-40	4/15/2009	13:12	3 - 4	X	X	X										
	NS05-GC-50	4/15/2009	13:12	4 - 5													
NS06	NS06-GC-10	4/14/2009	10:15	0 - 1	X	X	X	X	X	As, Cr, Pb, Hg							
	NS06-GC-20	4/14/2009	10:15	1 - 2	X	X	X	X									
NS07	NS07-GC-10	4/14/2009	11:42	0 - 1	X	X	X	X	X								
	NS07-GC-20	4/14/2009	11:42	1 - 2	X	X	X										
	NS07-GC-30	4/14/2009	11:42	2 - 3	X	X	X	X	X								
	NS07-GC-40	4/14/2009	11:42	3 - 4	X	X	X										
NS08	NS08-GC-10	4/14/2009	12:55	0 - 1	X	X	X	X	X								
	NS08-GC-20	4/14/2009	12:55	1 - 2	X	X	X										
	NS08-GC-30	4/14/2009	12:55	2 - 3	X	X	X										
	NS08-GC-40	4/14/2009	12:55	3 - 4	X	X	X										
	NS08-GC-50	4/14/2009	12:55	4 - 5	X	X	X										
NS09	NS09-GC-02	4/20/2009	9:05	0 - 0.2			X										
	NS09-GC-10	4/20/2009	9:05	0 - 1	X	X	X	X	X								
	NS09-GC-20	4/20/2009	9:05	1 - 2	X	X	X										
	NS09-GC-30	4/20/2009	9:05	2 - 3	X	X	X										
NS10	NS10-GC-10	4/14/2009	14:40	0 - 1	X	X	X	X	X								
	NS10-GC-20	4/14/2009	14:40	1 - 2	X	X	X										
	NS10-GC-30	4/14/2009	14:40	2 - 3	X	X	X										
	NS10-GC-40	4/14/2009	14:40	3 - 4	X	X	X										
	NS10-GC-50	4/14/2009	14:40	4 - 5	X	X	X										
NS11	NS11-GC-10	4/14/2009	16:18	0 - 1	X	X	X	X	X								
	NS11-GC-20	4/14/2009	16:18	1 - 2	X	X	X										
	NS11-GC-30	4/14/2009	16:18	2 - 3	X	X	X										
NS12	NS12-GC-10	4/14/2009	17:52	0 - 1	X	X	X	X		As, Cr, Pb, Hg							
	NS12-GC-20	4/14/2009	17:52	1 - 2	X	X	X	X									
	NS12-GC-30	4/14/2009	17:52	2 - 3	X	X	X										
	NS12-GC-40	4/14/2009	17:52	3 - 4	X	X	X										
	NS12-GC-50	4/14/2009	17:52	4 - 5	X	X	X										
NS13	NS13-GC-10	4/15/2009	15:02	0 - 1	X	X	X	X	X	As, Cr, Pb, Hg							
	NS13-GC-20	4/15/2009	15:02	1 - 2	X	X	X	X	X								
	NS13-GC-30	4/15/2009	15:02	2 - 3	X	X	X										
	NS13-GC-40	4/15/2009	15:02	3 - 4	X	X	X										
NS14	NS14-GC-10	4/15/2009	16:25	0 - 1	X	X	X	X	X								
	NS14-GC-20	4/15/2009	16:25	1 - 2	X	X	X										
	NS14-GC-30	4/15/2009	16:25	2 - 3	X	X	X										
	NS14-GC-40	4/15/2009	16:25	3 - 4	X	X	X										
NS15	NS15-GC-10	4/15/2009	17:45	0 - 1	X	X	X										
	NS15-GC-20	4/15/2009	17:45	1 - 2	X	X	X										
	NS15-GC-30	4/15/2009	17:45	2 - 3	X	X	X										
	NS15-GC-40	4/15/2009	17:45	3 - 4	X	X	X										
NS16	NS16-GC-10	4/15/2009	10:01	0 - 1	X	X	X	X	X								
	NS16-GC-20	4/15/2009	10:01	1 - 2	X	X	X										
	NS16-GC-30	4/15/2009	10:01	2 - 3	X	X	X										
	NS16-GC-40	4/15/2009	10:01	3 - 4	X	X	X										
	NS16-GC-50	4/15/2009	10:01	4 - 5	X	X	X										
NS17	NS17-GC-10	4/16/2009	9:33	0 - 1	X	X	X	X	X								
	NS17-GC-20	4/16/2009	9:33	1 - 2	X	X	X										
	NS17-GC-30	4/16/2009	9:33	2 - 3	X	X	X										
	NS17-GC-40	4/16/2009	9:33	3 - 4	X	X	X										

Table 3-4. Sample Collection and Analytical Summary

Core Location ID	Sample ID	Date	Time	Depth Interval (feet below top of core)	Field Analysis			Chemical and Physical Analyses			Geotechnical Analyses						
					Field Sieving (>125 um)	Field Percent Moisture	Field XRF Total Metals	Total Metals	Grain Size (PSEP)	TCLP Metals	Atterberg Limits ASTM D 4318)	Consolidation (ASTM D 2435)	Grain Size Analysis, Sieve and Hydrometer (ASTM D 422)	Moisture Content (ASTM D 2216)	Specific gravity (ASTM D 854) and bulk unit weight (ASTM D 2937)	Unconsolidated, Undrained Triaxial Strength (ASTM D 2850)	Vane Shear (ASTM D 4648)
NS18	NS18-GC-10	4/16/2009	10:55	0 - 1	X	X	X	X		As, Cr, Pb, Hg							
	NS18-GC-20	4/16/2009	10:55	1 - 2	X	X	X										
	NS18-GC-30	4/16/2009	10:55	2 - 3	X	X	X										
	NS18-GC-40	4/16/2009	10:55	3 - 4	X	X	X										
NS19	NS19-GC-10	4/16/2009	12:27	0 - 1			X	X	X								
	NS19-GC-20	4/16/2009	12:27	1 - 2			X	X	X								
	NS19-GC-30	4/16/2009	12:27	2 - 3			X										
NS20	NS20-GC-10	4/16/2009	14:20	0 - 1	X	X	X	X	X								
	NS20-GC-20	4/16/2009	14:20	1 - 2	X	X	X										
	NS20-GC-30	4/16/2009	14:20	2 - 3			X										
NS21	NS21-GC-10	4/16/2009	16:22	0 - 1	X	X	X										
NS23	NS23-GC-10	4/17/2009	16:07	0 - 1	X	X	X	X									
	NS23-GC-20	4/17/2009	16:07	1 - 2	X	X	X										
	NS23-GC-30	4/17/2009	16:07	2 - 3	X	X	X										
NS24	NS24-GC-10	4/17/2009	17:25	0 - 1	X	X	X	X									
	NS24-GC-20	4/17/2009	17:25	1 - 2	X	X	X										
	NS24-GC-30	4/17/2009	17:25	2 - 3	X	X	X										
NS26	NS26-GC-10	4/17/2009	12:15	0 - 1	X	X	X										
	NS26-GC-20	4/17/2009	12:15	1 - 2	X	X	X										
	NS26-GC-30	4/17/2009	12:15	2 - 3	X	X	X										
NS27	NS27-GC-10	4/17/2009	11:00	0 - 1	X	X	X										
	NS27-GC-20	4/17/2009	11:00	1 - 2			X										
	NS27-GC-30	4/17/2009	11:00	2 - 3	X	X	X										
NS28	NS28-GC-02	4/17/2009	9:40	0 - 0.2			X										
	NS28-GC-10	4/17/2009	9:40	0 - 1	X	X	X										
	NS28-GC-20	4/17/2009	9:40	1 - 2	X	X	X										
	NS28-GC-30	4/17/2009	9:40	2 - 3	X	X	X										
NS29	NS29-GC-10	4/16/2009	17:48	0 - 1	X	X	X										
	NS29-GC-20	4/16/2009	17:48	1 - 2	X	X	X										
	NS29-GC-30	4/16/2009	17:48	2 - 3	X	X	X										
NS33	NS33-GC-10	4/17/2009	13:30	0 - 1	X	X	X										
	NS33-GC-20	4/17/2009	13:30	1 - 2	X	X	X										
	NS33-GC-30	4/17/2009	13:30	2 - 3	X	X	X										
NS34	NS34-GC-02	4/17/2009	14:52	0 - 0.2			X										
	NS34-GC-10	4/17/2009	14:52	0 - 1	X	X	X										
	NS34-GC-20	4/17/2009	14:52	1 - 2	X	X	X										
	NS34-GC-30	4/17/2009	14:52	2 - 3	X	X	X										
NS35	NS35-GC-10	4/20/2009	14:00	0 - 1	X	X	X										
NS05-G	NS05-G (0-24)	4/20/2009	13:05	0 - 2							X	X	X	X	X	X	X
	NS05-G (24-48)	4/20/2009	13:05	2 - 4							X	X	X	X	X	X	X
NS06-G	NS06-G (0-18)	4/20/2009	17:30	0 - 1.5							X	X	X	X	X	X	X
NS12-G	NS12-G (0-24)	4/20/2009	15:05	0 - 2							X	X	X	X	X	X	X
	NS12-G (24-48)	4/20/2009	15:05	2 - 4							X	X	X	X	X	X	X
NS18-G	NS18-G (0-24)	4/20/2009	16:20	0 - 2							X	X	X	X	X	X	X
	NS18-G (24-48)	4/20/2009	16:20	2 - 4							X	X	X	X	X	X	X

Key:
As = Arsenic
ASTM = American Society for Testing and Materials
Cd = Cadmium
Cr = Chromium
ft = Feet
Hg = Mercury
ID = Identification
Pb = Lead
PSEP = Puget Sound Estuary Program
TCLP = Toxicity Characteristic Leaching Procedure
um = Micrometer
XRF = X-ray fluorescence

Table 7-1. Total Metals Field Screening and Laboratory Analytical Results

Core Location ID	Sample ID	Depth Interval (feet below top of core)	XRF Field Screening Total Metals Results (ppm DW)											Laboratory Confirmation Total Metals Results (mg/kg DW)																	
			Ag	As	Ba	Cd	Cr	Cu	Pb	Hg	Ni	Se	Zn	Ag		As		Ba		Cd		Cr		Cu		Pb		Hg		Se		Zn	
NS01	NS01-GC-10	0 - 1	ND	4,501	1,258	ND	404	2,667	3,507	ND	ND	ND	9,699	6.61		2680		269		7.96		77.1	JL	2600		2440		0.583	JL	4.39		7050	
	NS01-GC-15	1 - 1.5	ND	127	523	ND	134	89	185	ND	49	ND	352																				
NS02	NS02-GC-10	0 - 1	ND	331	654	ND	ND	356	343	ND	ND	ND	860	1.18		398		219		1.75		64.1	JL	605		417		1.33	JL	1.22		1330	
	NS02-GC-20	1 - 2	ND	29	461	ND	ND	29	11	ND	39	ND	83	0.004	U	17.6		38		0.006	U	28.9	JL	42.2		15.3		0.034	JL	3.03	U	69.4	
	NS02-GC-30	2 - 3	ND	9	ND	ND	ND	ND	ND	ND	ND	ND	32																				
	NS02-GC-40	3 - 4	ND	ND	ND	ND	ND	ND	ND	ND	32	ND	34																				
NS03	NS03-GC-10	0 - 1	ND	559	510	ND	ND	485	599	ND	ND	ND	1,426	2.36		1180		186		3.75		98.8	JL	1070		1210		1.4	JL	3.03	U	3680	
	NS03-GC-20	1 - 2	ND	31	691	ND	157	60	63	ND	ND	ND	197																				
	NS03-GC-30	2 - 3	ND	42	412	ND	ND	43	45	ND	54	ND	139																				
	NS03-GC-40	3 - 4	ND	ND	ND	ND	ND	36	105	ND	ND	ND	46																				
	NS03-GC-45	4 - 4.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	21																				
NS04	NS04-GC-10	0 - 1	ND	4,503	616	ND	322	2,085	3,551	ND	ND	ND	10,519	5.73		4070		406		6.88		96.4	JL	2240		3400		1.02	JL	3.03	U	10600	
	NS04-GC-20	1 - 2	ND	69	403	ND	ND	86	135	ND	ND	ND	291	0.04	U	151		143		0.06	U	53.2	JL	157		205		0.796	JL	3.03	U	582	
NS05	NS05-GC-10	0 - 1	ND	1,968	ND	ND	404	3,353	2,438	ND	ND	ND	6,348	3.75		1830		276		5.38		170	JL	3580		2360		1.73	JL	3.03	U	6040	
	NS05-GC-20	1 - 2	ND	1,043	ND	ND	ND	2,250	1,800	ND	ND	ND	3,940	4.26		838		210		4.12		178	JL	2110		1580		5.82	JL	3.03	U	3420	
	NS05-GC-30	2 - 3	ND	84	536	ND	ND	307	413	ND	61	ND	622																				
	NS05-GC-40	3 - 4	ND	37	575	ND	ND	224	282	ND	71	ND	552																				
	NS05-GC-50	4 - 5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA																				
NS06	NS06-GC-10	0 - 1	ND	907	913	ND	ND	1,614	1,150	ND	ND	ND	4,095	2.52		1030		178		3.87		86.8	JL	1850		1200		12.1	JL	3.03	U	3650	
	NS06-GC-20	1 - 2	ND	266	633	ND	213	706	729	ND	ND	ND	1,734	1.91		284		153		2.73		67.7	JL	647		702		1.71	JL	3.03	U	1500	
NS07	NS07-GC-10	0 - 1	ND	27	289	ND	ND	48	30	ND	ND	ND	115	0.44		34.3		150		0.4		53.4	JL	91		66.5		0.346	JL	3.03	U	223	
	NS07-GC-20	1 - 2	ND	26	ND	ND	ND	24	ND	ND	ND	ND	40																				
	NS07-GC-30	2 - 3	ND	21	ND	ND	ND	17	ND	ND	ND	ND	25	0.004	U	12.5		74.5		0.12		32.4	JL	24.8		3.27		0.0665	JL	3.03	U	60.2	
	NS07-GC-40	3 - 4	ND	19	ND	ND	ND	ND	ND	ND	ND	ND	21																				
NS08	NS08-GC-10	0 - 1	ND	24	726	ND	98	59	45	ND	81	ND	133	0.53		19		167		1.71		59.9	JL	67.4		126		0.441	JL	3.03	U	800	
	NS08-GC-20	1 - 2	ND	26	ND	ND	ND	23	ND	ND	ND	ND	55																				
	NS08-GC-30	2 - 3	ND	21	ND	ND	ND	17	ND	ND	ND	ND	52																				
	NS08-GC-40	3 - 4	ND	22	ND	ND	ND	ND	ND	ND	ND	ND	29																				
	NS08-GC-50	4 - 5	ND	24	ND	ND	ND	ND	ND	ND	ND	ND	24																				
NS09	NS09-GC-02	0 - 0.2	ND	180	582	ND	ND	336	494	ND	132	ND	848																				
	NS09-GC-10	0 - 1	ND	41	724	ND	ND	104	235	ND	93	ND	316	0.61		41.2		147		1.2		65.4	JL	124		194		0.991	JL	3.03	U	309	
	NS09-GC-20	1 - 2	ND	25	ND	ND	ND	ND	18	ND	33	ND	68																				
	NS09-GC-30	2 - 3	ND	17	ND	ND	ND	ND	ND	ND	ND	ND	26																				
NS10	NS10-GC-10	0 - 1	ND	29	584	ND	ND	41	47	ND	59	ND	144	0.4		20.5		159		0.44		63.2	JL	61.3		59.1		0.507	JL	3.03	U	164	
	NS10-GC-20	1 - 2	ND	24	ND	ND	ND	20	15	ND	ND	ND	71																				
	NS10-GC-30	2 - 3	ND	19	ND	ND	ND	ND	ND	ND	ND	ND	32																				
	NS10-GC-40	3 - 4	ND	20	ND	ND	ND	ND	ND	ND	ND	ND	31																				
	NS10-GC-50	4 - 5	ND	24	ND	ND	ND	ND	ND	ND	ND	ND	38																				
NS11	NS11-GC-10	0 - 1	ND	77	421	ND	101	78	104	ND	55	ND	283	0.54		83.1		155		0.06	U	64.5	JL	142		134		0.633	JL	3.03	U	333	
	NS11-GC-20	1 - 2	ND	33	ND	ND	ND	21	ND	ND	ND	ND	65																				
	NS11-GC-30	2 - 3	ND	18	ND	ND	ND	ND	ND	ND	ND	ND	35																				
NS12	NS12-GC-10	0 - 1	ND	181	472	ND	ND	613	715	ND	73	ND	1,090	3.42		180		121		2.89		79	JL	627		653		2	JL	3.03	U	1010	
	NS12-GC-20	1 - 2	ND	29	414	ND	104	84	107	ND	49	ND	224	0.4		18.9		120		0.06	U	55.2	JL	96.3		121		0.761	JL	3.03	U	226	
	NS12-GC-30	2 - 3	ND	26	529	ND	134	64	58	ND	50	ND	158																				
	NS12-GC-40	3 - 4	ND	25	ND	ND	ND	39	19	ND	ND	ND	73																				
	NS12-GC-50	4 - 5	ND	23	ND	ND	ND	ND	ND	ND	ND	ND	ND																				
NS13	NS13-GC-10	0 - 1	ND	380	ND	ND	172	1,087	769	ND	ND	ND	1,651	3.25		422		145		4.07		95.5	JL	1610		1010		1.83	JL	3.03	U	2130	
	NS13-GC-20	1 - 2	ND	30	481	ND	ND	99	177	ND	ND	ND	364	0.66		33		86.2		1.25		43.6	JL	141		164		0.985	JL	3.03	U	300	
	NS13-GC-30	2 - 3	ND	23	505	ND	ND	51	46	ND	63	ND	135																				
	NS13-GC-40	3 - 4	ND	18	ND	ND	ND	22	13	ND	ND	ND	57																				
NS14	NS14-GC-10	0 - 1	ND	44	664	ND	ND	181	301	ND	92	ND	391	1.93		99.3		109		2.05		66.6		344		312		1.49		3.03	U	530	
	NS14-GC-20	1 - 2	ND	25	554	ND	ND	49	50	ND	56	ND	130																				
	NS14-GC-30	2 - 3	ND	22	ND	ND	ND	21	ND	ND	ND	ND	48																				
	NS14-GC-40	3 - 4	ND	17	ND	ND	ND	18	13	ND	ND	ND	46																				
NS15	NS15-GC-10	0 - 1	ND	46	516	ND	ND	91	76	ND	49	ND	205																				
	NS15-GC-20	1 - 2	ND	16	ND	ND	ND	16	9	ND	ND	ND	48																				
	NS15-GC-30	2 - 3	ND	17	ND	ND	ND	15	ND	ND	ND	ND	33																				
	NS15-GC-40	3 - 4	ND	18	ND	ND	ND	17	ND	ND	30	ND	52																				
NS16	NS16-GC-10	0 - 1	ND	46	ND	ND	ND	153	306	ND	78	ND	397	1.97		65.2		105		2.21		64		234		312		1.82		3.03	U	491	
	NS16-GC-20	1 - 2	ND	16	538	ND	129	58	71	ND	54	ND	155																				
	NS16-GC-30	2 - 3	ND	25	ND	ND	ND	14	16	ND	ND	ND	65																				
	NS16-GC-40	3 - 4	ND	19	ND	ND	ND	ND	ND	ND	ND	ND	31																				
	NS16-GC-50	4 - 5	ND	20	ND	ND	ND	17	ND	ND	ND	ND	33																				
NS17	NS17-GC-10	0 - 1	ND	37	421	ND	114	137	281	ND	74	ND	393	2.68		49.1		109		2.39		66.6		1020		327		3.3		3.03	U	554	
	NS17-GC-20	1 - 2	ND	28	464	ND	ND	53	44	ND	57	ND	170																				
	NS17-GC-30	2 - 3	ND	21	ND	ND	ND	16	ND	ND	ND	ND	44																				
	NS17-GC-40	3 - 4	ND	23	ND	ND	ND	16	ND	ND	ND	ND	51																				

Table 7-1. Total Metals Field Screening and Laboratory Analytical Results

Core Location ID	Sample ID	Depth Interval (feet below top of core)	XRF Field Screening Total Metals Results (ppm DW)											Laboratory Confirmation Total Metals Results (mg/kg DW)											
			Ag	As	Ba	Cd	Cr	Cu	Pb	Hg	Ni	Se	Zn	Ag	As	Ba	Cd	Cr	Cu	Pb	Hg	Se		Zn	
NS18	NS18-GC-10	0 - 1	ND	89	429	ND	130	290	465	ND	76	ND	596	2.64	71.6	90.3	2.49	70.3	323	427	1.58	3.03	U	580	
	NS18-GC-20	1 - 2	ND	29	476	ND	128	88	108	ND	84	ND	243												
	NS18-GC-30	2 - 3	ND	35	367	ND	ND	52	58	ND	39	ND	155												
	NS18-GC-40	3 - 4	ND	24	ND	ND	ND	ND	ND	ND	ND	ND	43												
NS19	NS19-GC-10	0 - 1	ND	69	ND	ND	ND	209	312	ND	58	ND	520	1.77	66.8	115	2.11	61.2	328	344	1.69	3.03	U	579	
	NS19-GC-20	1 - 2	ND	18	376	ND	ND	55	52	ND	79	ND	146	0.38	14.8	161	0.42	63.1	55.9	59.6	0.518	3.03	U	144	
	NS19-GC-30	2 - 3	ND	28	ND	ND	ND	17	ND	ND	ND	ND	65												
NS20	NS20-GC-10	0 - 1	ND	89	ND	ND	ND	500	491	ND	ND	ND	1,232	2.84	98.2	129	2.46	68.8	612	601	1.68	3.03	U	1360	
	NS20-GC-20	1 - 2	ND	27	351	ND	ND	221	321	ND	99	ND	486												
	NS20-GC-30	2 - 3	ND	ND	450	ND	ND	165	811	ND	47	ND	757												
NS21	NS21-GC-10	0 - 1	ND	20	540	ND	144	50	44	ND	65	ND	128												
NS23	NS23-GC-10	0 - 1	ND	37	383	ND	102	192	268	ND	78	ND	387	1.91	33.1	122	1.7	63.1	222	266	1.45	3.03	U	387	
	NS23-GC-20	1 - 2	ND	24	527	ND	124	66	57	ND	82	ND	173												
	NS23-GC-30	2 - 3	ND	30	ND	ND	ND	16	ND	ND	ND	ND	64												
NS24	NS24-GC-10	0 - 1	ND	35	424	ND	99 U	125	225	ND	59	ND	337	1.36	27	130	1.42	64.5	141	299	1.16	3.03	U	311	
	NS24-GC-20	1 - 2	ND	36	458	ND	102	36	44	ND	40	ND	129												
	NS24-GC-30	2 - 3	ND	24	ND	ND	ND	ND	ND	ND	ND	ND	33												
NS26	NS26-GC-10	0 - 1	ND	36	536	ND	122	126	192	ND	76	ND	302												
	NS26-GC-20	1 - 2	ND	25	ND	ND	ND	ND	ND	ND	ND	ND	48												
	NS26-GC-30	2 - 3	ND	25	ND	26	ND	ND	ND	ND	ND	ND	41												
NS27	NS27-GC-10	0 - 1	ND	30	619	ND	120	116	139	ND	78	ND	247												
	NS27-GC-20	1 - 2	ND	25	ND	ND	ND	29	22	ND	35	ND	68												
	NS27-GC-30	2 - 3	ND	15	ND	ND	ND	21	12	ND	ND	ND	46												
NS28	NS28-GC-02	0 - 0.2	ND	ND	347	ND	ND	137	390	ND	63	ND	413												
	NS28-GC-10	0 - 1	ND	23	791	ND	ND	88	120	ND	83	ND	225												
	NS28-GC-20	1 - 2	ND	23	ND	ND	ND	24	18	ND	51	ND	71												
	NS28-GC-30	2 - 3	ND	23	ND	ND	ND	ND	ND	ND	ND	ND	37												
NS29	NS29-GC-10	0 - 1	ND	57	445	ND	ND	220	300	ND	64	ND	423												
	NS29-GC-20	1 - 2	ND	25	398	ND	123	61	71	ND	62	ND	175												
	NS29-GC-30	2 - 3	ND	12	ND	ND	ND	18	45	ND	ND	ND	86												
NS33	NS33-GC-10	0 - 1	ND	85	552	ND	ND	216	338	ND	62	ND	440												
	NS33-GC-20	1 - 2	ND	16	552	ND	ND	46	51	ND	58	ND	121												
	NS33-GC-30	2 - 3	ND	24	ND	ND	ND	ND	ND	ND	ND	ND	53												
NS34	NS34-GC-02	0 - 0.2	ND	163	ND	ND	ND	388	661	ND	49	ND	785												
	NS34-GC-10	0 - 1	ND	74	ND	ND	ND	249	490	ND	72	ND	559												
	NS34-GC-20	1 - 2	ND	22	551	ND	ND	63	62	ND	56	ND	140												
	NS34-GC-30	2 - 3	ND	35	ND	ND	ND	24	ND	ND	ND	ND	72												
NS35	NS35-GC-10	0 - 1	ND	1,546	193	ND	ND	2,222	963	ND	ND	ND	3,923												

Key:
Ag = Silver
As = Arsenic
Ba = Barium
Cd = Cadmium
Cr = Chromium
Cu = Copper
DW = Dry weight
ft = Feet
Hg = Mercury
ID = Identification
JL = Analyte was positively identified. The value may be less than the reported estimate
mg/kg = Milligrams per kilogram
NA = Not analyzed
ND = Not detected
Ni = Nickel
Pb = Lead
ppm = Parts per million
Se = Selenium
U = Analyte was not detected at or above ther reported result
XRF = X-ray fluorescence
Zn = Zinc

Table 7-2. Grain Size Field Screening and Laboratory Analytical Results

Core Location ID	Sample ID	Depth Interval (feet below top of core)	Field Screening Weight % >125 um DW	PSEP Grain Size (weight % DW)													
				Sum Phi <-1 to 3 (> 125 um)	Phi < -1 (>2000 um)	Phi -1 to 0 (2000 - 1000 um)	Phi 0 to 1 (1000 - 500 um)	Phi 1 to 2 (500 - 250 um)	Phi 2 to 3 (250 - 125 um)	Phi 3 to 4 (125 - 62.5 um)	Phi 4 to 5 (62.5 - 31 um)	Phi 5 to 6 (31 - 15.6 um)	Phi 6 to 7 (15.6 - 7.8 um)	Phi 7 to 8 (7.8 - 3.9 um)	Phi 8 to 9 (3.9 - 2.0 um)	Phi 9 to 10 (2.0 - 1.0 um)	Phi >10 (<1.0 um)
				Fine Sand and Coarser	Gravel	Very Coarse Sand	Coarse Sand	Medium Sand	Fine Sand	Very Fine Sand	Coarse Silt	Medium Silt	Fine Silt	Very Fine Silt	Clay	Clay	Clay
NS01	NS01-GC-10	0 - 1	76.37	74.8	6.3	18.4	24	18	8.2	4.1	5.1	5	3.7	3.4	1.7	0.9	1.4
	NS01-GC-15	1 - 1.5	12.48														
NS02	NS02-GC-10	0 - 1	20.05	12.6	0.3	2.2	3.5	3.5	3.2	4.1	8	19.8	15.7	13.6	8.1	6.8	11.3
	NS02-GC-20	1 - 2	80.75	80.1	4.7	6.4	12	28.9	28.1	10.8	1.5	1.5	0.9	1.2	1.1	0.9	1.8
	NS02-GC-30	2 - 3	43.88														
	NS02-GC-40	3 - 4	60.72														
NS03	NS03-GC-10	0 - 1	25.17	20.7	0.5	3.2	5.4	5.5	6.1	5	4	14.4	17.1	14	9.3	6.4	9.2
	NS03-GC-20	1 - 2	2.45														
	NS03-GC-30	2 - 3	1.55														
	NS03-GC-40	3 - 4	2.45														
	NS03-GC-45	4 - 4.5	7.85														
NS04	NS04-GC-10	0 - 1	83.81	69	6.8	12.3	20.3	20.1	9.5	4.5	2.9	5.4	3.9	4.2	3.1	2.7	4.3
	NS04-GC-20	1 - 2	3.56	4.4	0.4	0.8	1.2	1.1	0.9	1.5	4.6	16.7	19.7	17.1	11.8	9.4	14.8
NS05	NS05-GC-10	0 - 1	29.48														
	NS05-GC-20	1 - 2	30.32														
	NS05-GC-30	2 - 3	13.03														
	NS05-GC-40	3 - 4	14.55														
	NS05-GC-50	4 - 5	NA														
NS06	NS06-GC-10	0 - 1	58.67	65.2	3.5	7.2	11.1	21.1	22.3	8.8	5.4	2.1	6.9	4.9	2.7	1.8	2.1
	NS06-GC-20	1 - 2	61.74														
NS07	NS07-GC-10	0 - 1	2.38	8.2	0.8	1.9	1.2	1.3	2.9	6.3	11.8	13.8	10.6	16.2	9.7	8.2	15.2
	NS07-GC-20	1 - 2	2.20														
	NS07-GC-30	2 - 3	0.36	4.2	0.3	2.8	0.5	0.3	0.3	1	0.5	7.3	16.8	17.2	25.1	12.5	15.3
	NS07-GC-40	3 - 4	1.61														
NS08	NS08-GC-10	0 - 1	2.57	3.1	0.1	1.1	1.2	0.5	0.3	1.5	4.8	13.2	16.8	18.6	13.2	11.2	17.6
	NS08-GC-20	1 - 2	5.58														
	NS08-GC-30	2 - 3	2.91														
	NS08-GC-40	3 - 4	1.05														
	NS08-GC-50	4 - 5	0.00														
NS09	NS09-GC-02	0 - 0.2	NA														
	NS09-GC-10	0 - 1	3.41	2.1	0.1	0.6	0.6	0.4	0.5	0.7	3.5	8.7	19.4	21	14.5	11.9	18.3
	NS09-GC-20	1 - 2	0.66														
	NS09-GC-30	2 - 3	2.68														
NS10	NS10-GC-10	0 - 1	1.82	1.4	0.2	0.2	0.4	0.5	0.2	0.2	3	11.2	17	21.6	13.9	12.7	19.1
	NS10-GC-20	1 - 2	2.19														
	NS10-GC-30	2 - 3	0.35														
	NS10-GC-40	3 - 4	1.36														
	NS10-GC-50	4 - 5	0.09														
NS11	NS11-GC-10	0 - 1	4.32	6	0.1	2.4	2	1	0.7	0.8	3.3	10.1	18.9	14.5	15.7	11.8	18.8
	NS11-GC-20	1 - 2	0.23														
	NS11-GC-30	2 - 3	0.58														
NS12	NS12-GC-10	0 - 1	4.20														
	NS12-GC-20	1 - 2	1.01														
	NS12-GC-30	2 - 3	1.81														
	NS12-GC-40	3 - 4	1.66														
	NS12-GC-50	4 - 5	7.65														
NS13	NS13-GC-10	0 - 1	5.37	4.6	0.1	0.2	0.3	0.5	3.7	9.6	6.4	14	24.7	17.3	7	6.5	10
	NS13-GC-20	1 - 2	7.73	5.8	0.1	1.3	1.3	1.3	1.9	8.8	13.7	19.8	13.7	13.1	9.3	6.6	9.3
	NS13-GC-30	2 - 3	2.29														
	NS13-GC-40	3 - 4	6.71														
NS14	NS14-GC-10	0 - 1	2.82	6.5	0.1	2.8	1.6	0.8	1.2	1.7	3.5	11	16.2	19.5	14.8	10.1	16.6
	NS14-GC-20	1 - 2	1.87														
	NS14-GC-30	2 - 3	2.95														
	NS14-GC-40	3 - 4	2.20														
NS15	NS15-GC-10	0 - 1	0.43														
	NS15-GC-20	1 - 2	2.33														
	NS15-GC-30	2 - 3	2.91														
	NS15-GC-40	3 - 4	0.58														

Table 7-2. Grain Size Field Screening and Laboratory Analytical Results

Core Location ID	Sample ID	Depth Interval (feet below top of core)	Field Screening Weight % >125 um DW	PSEP Grain Size (weight % DW)													
				Sum Phi <-1 to 3 (> 125 um)	Phi < -1 (>2000 um)	Phi -1 to 0 (2000 - 1000 um)	Phi 0 to 1 (1000 - 500 um)	Phi 1 to 2 (500 - 250 um)	Phi 2 to 3 (250 - 125 um)	Phi 3 to 4 (125 - 62.5 um)	Phi 4 to 5 (62.5 - 31 um)	Phi 5 to 6 (31 - 15.6 um)	Phi 6 to 7 (15.6 - 7.8 um)	Phi 7 to 8 (7.8 - 3.9 um)	Phi 8 to 9 (3.9 - 2.0 um)	Phi 9 to 10 (2.0 - 1.0 um)	Phi >10 (<1.0 um)
				Fine Sand and Coarser	Gravel	Very Coarse Sand	Coarse Sand	Medium Sand	Fine Sand	Very Fine Sand	Coarse Silt	Medium Silt	Fine Silt	Very Fine Silt	Clay	Clay	Clay
NS16	NS16-GC-10	0 - 1	1.84	3.7	0.1	0.7	0.3	0.7	2	2.5	3.6	10.7	16.1	21.3	13.8	10	18.4
	NS16-GC-20	1 - 2	1.54														
	NS16-GC-30	2 - 3	0.67														
	NS16-GC-40	3 - 4	2.95														
	NS16-GC-50	4 - 5	2.00														
NS17	NS17-GC-10	0 - 1	2.49	2.1	0.1	0.1	0.1	0.6	1.2	2	24	8.9	11.7	13.7	10.8	8	18.9
	NS17-GC-20	1 - 2	1.26														
	NS17-GC-30	2 - 3	3.27														
	NS17-GC-40	3 - 4	2.04														
NS18	NS18-GC-10	0 - 1	4.10														
	NS18-GC-20	1 - 2	0.43														
	NS18-GC-30	2 - 3	2.91														
	NS18-GC-40	3 - 4	5.66														
NS19	NS19-GC-10	0 - 1	NA	3.4	0.1	0.1	0.2	0.7	2.4	5.1	7	12.2	16.1	18.7	11.7	9	16.6
	NS19-GC-20	1 - 2	NA	4.8	0.5	2	1.3	0.4	0.5	2.7	8.6	10.2	15.5	16	12.9	10.4	19
	NS19-GC-30	2 - 3	NA														
NS20	NS20-GC-10	0 - 1	20.81	20.8	0.3	0.5	1.1	5.4	13.6	10.1	6.6	9.6	13.2	13.9	9.5	5	11.1
	NS20-GC-20	1 - 2	36.77														
	NS20-GC-30	2 - 3	NA														
NS21	NS21-GC-10	0 - 1	30.44														
NS23	NS23-GC-10	0 - 1	0.42														
	NS23-GC-20	1 - 2	2.88														
	NS23-GC-30	2 - 3	1.55														
NS24	NS24-GC-10	0 - 1	2.42														
	NS24-GC-20	1 - 2	5.76														
	NS24-GC-30	2 - 3	10.78														
NS26	NS26-GC-10	0 - 1	3.73														
	NS26-GC-20	1 - 2	0.00														
	NS26-GC-30	2 - 3	6.66														
NS27	NS27-GC-10	0 - 1	9.56														
	NS27-GC-20	1 - 2	NA														
	NS27-GC-30	2 - 3	32.08														
NS28	NS28-GC-02	0 - 0.2	NA														
	NS28-GC-10	0 - 1	6.85														
	NS28-GC-20	1 - 2	4.72														
	NS28-GC-30	2 - 3	0.65														
NS29	NS29-GC-10	0 - 1	2.93														
	NS29-GC-20	1 - 2	1.30														
	NS29-GC-30	2 - 3	5.40														
NS33	NS33-GC-10	0 - 1	3.50														
	NS33-GC-20	1 - 2	0.60														
	NS33-GC-30	2 - 3	0.90														
NS34	NS34-GC-02	0 - 0.2	NA														
	NS34-GC-10	0 - 1	2.38														
	NS34-GC-20	1 - 2	0.54														
	NS34-GC-30	2 - 3	3.80														
NS35	NS35-GC-10	0 - 1	96.75														

Key:
DW = Dry weight
ft = Feet
ID = Identification
NA = Not analyzed
PSEP = Puget Sound Estuary Program
um = Micrometer

Table 9-1. Grit Identification and Characterization Results Summary

Core Location ID	Sample ID	Depth Interval (feet below top of core)	Description	Depth of Lowest Light Gray Clay or Brownish Gray Fines Immediately Overlying Brown Organic Silt/Clay (inches)	Arsenic		Copper		Lead		Zinc		% >125 um	
					XRF (ppm)	Lab (mg/kg DW)	XRF (ppm)	Lab (mg/kg DW)	XRF (ppm)	Lab (mg/kg DW)	XRF (ppm)	Lab (mg/kg DW)	Field	Lab
NS01	NS01-GC-10	0 - 1	**0 - 7": Sand, fine to very coarse with est. 20% dark brown fines. Sand is angular, greenish black and black (apparently sandblast grit). Includes red and blue paint chips**. Wood fragments to 1.5" and several pebbles. Petroleum odor and sheen. 7 - 18": Dark brown organic silt/clay with minor fine sand and small wood debris.		4,501	2680	2,667	2600	3,507	2440	9,699	7050	76.37	74.8
	NS01-GC-15	1 - 1.5	7 - 18": Dark brown organic silt/clay with minor fine sand and small wood debris.	Not observed	127		89		185		352		12.48	
NS02	NS02-GC-10	0 - 1	**0 - 5": Dark brown to black organic silt/clay, very wet and soft. Bivalve shell and wood debris to 1". Petroleum odor.** 5 - 12": Grayish brown clay with minor sand and silt, very soft.	Gray clay at 5 - 12" underlain by sand	331	398	356	605	343	417	860	1330	20.05	12.6
	NS02-GC-20	1 - 2	12 - 20": Sand, very fine to coarse, with minor brown fines. Sand contains quartz and black mineral grains and green lithics. Overall color is greenish, brownish gray. 20 - 29": Brown organic silt/clay, very soft.		29	17.6	29	42.2	11	15.3	83	69.4	80.75	80.1
	NS02-GC-30	2 - 3	20 - 29": Brown organic silt/clay, very soft. 29 - 35": Sand, very fine to coarse, with minor brown fines. Sand contains quartz and black mineral grains and green lithics. Overall color is greenish, brownish gray. 35 - 48": Brown organic silt/clay, very soft.		9		ND		ND		32		43.88	
	NS02-GC-40	3 - 4	35 - 48": Brown organic silt/clay, very soft.		ND		ND		ND		34		60.72	
NS03	NS03-GC-10	0 - 1	**0 - 4": Dark gray to black soupy mixture of fines with some sand, wood fragments, and bivalve shell. Petroleum odor and sheen.** 4 - 29": Brownish gray organic silt and clay, very soft, wet. Petroleum odor.	Between 4 and 29	559	1180	485	1070	599	1210	1,426	3680	25.17	20.7
	NS03-GC-20	1 - 2	4 - 29": Brownish gray organic silt and clay, very soft, wet. Petroleum odor.		31		60		63		197		2.45	
	NS03-GC-30	2 - 3	4 - 29": Brownish gray organic silt and clay, very soft, wet. Petroleum odor. 29 - 60": Brown organic silt/clay with trace very fine sand, very soft. Petroleum odor.		42		43		45		139		1.55	
	NS03-GC-40	3 - 4	29 - 60": Brown organic silt/clay with trace very fine sand, very soft. Petroleum odor.		ND		36		105		46		2.45	
	NS03-GC-45	4 - 4.5	29 - 60": Brown organic silt/clay with trace very fine sand, very soft. Petroleum odor.		ND		ND		ND		21		7.85	
NS04	NS04-GC-10	0 - 1	**0 - 6": Sand, black, angular, fine to very coarse (apparently sandblast grit) with some black fines. Sand occurs as loose particles and cemented layers. Petroleum odor and sheen. 6 - 8": Well-cemented layer of black sand (apparently sandblast grit) and paint chips. 8 - 10": Grayish brown to brownish gray silt and clay with some black sand (possibly sandblast grit), very soft, wet.** 10 - 18": Finely interlayered (1/4 - 2" layers) brown and grayish brown organic silt/clay and light gray clay, very soft, wet. Petroleum odor.		4,503	4070	2,085	2240	3,551	3400	10,519	10600	83.81	69
	NS04-GC-20	1 - 2	10 - 18": Finely interlayered (1/4 - 2" layers) brown and grayish brown organic silt/clay and light gray clay, very soft, wet. Petroleum odor. 18 - 23": Brownish gray organic silt/clay, soft. 23 - 28": Brown organic silt/clay, very soft.	18 - 23	69	151	86	157	135	205	291	582	3.56	4.4
NS05	NS05-GC-10	0 - 1	**0 - 12": Black silt and clay and fine or very fine sand, very soupy, with mussel shells. Petroleum staining and odor. Sieved fraction includes some fine black sand (possible sandblast grit).**		1,968	1830	3,353	3580	2,438	2360	6,348	6040	29.48	
	NS05-GC-20	1 - 2	**12 - 24": Black and dark brown organic silt and clay with heavy black hydrocarbon stain and odor, very soft. Sieved fraction includes coarse black sand (possible sandblast grit).**		1,043	838	2,250	2110	1,800	1580	3,940	3420	30.32	
	NS05-GC-30	2 - 3	24 - 36": Mottled black and dark brown organic silt/clay with abundant fibrous plant matter, very soft. Brown material appears as isolated blobs to 1/2" in overall black matrix. Black material appears hydrocarbon stained. Hydrocarbon and naphthalene odor.		84		307		413		622		13.03	
	NS05-GC-40	3 - 4	36 - 45": Mottled black and dark brown organic silt/clay with abundant fibrous plant matter, very soft. Brown material appears as isolated blobs to 1/2" in overall black matrix. Black material appears hydrocarbon stained. Hydrocarbon and naphthalene odor. Includes piece of tar-like material 1/4 - 1/2" thick, 4" wide, and 7" long. 45 - 48": Grayish brown organic silt/clay, very soft.		37		224		282		552		14.55	
	NS05-GC-50	4 - 5	48 - 52": Brownish gray silt and clay, very soft, naphthalene odor. 52 - 58": Brown organic silt/clay, very soft. Also noted in core cutting shoe below sand catcher (probably dragged down from higher interval), the following debris: piece of coal to 1" and two black briquettes (probably coke) measuring 2.5" by 2" by 1.5".	48 - 52	NA		NA		NA		NA		NA	
NS06	NS06-GC-10	0 - 1	**0 - 24": Dark brown to black soupy fines with sand, to very coarse, and debris, including glass jar, brick fragments and wood. Sand is black, angular (apparently sandblast grit).**		907	1030	1,614	1850	1,150	1200	4,095	3650	58.67	65.2
	NS06-GC-20	1 - 2	**0 - 24": Dark brown to black soupy fines with sand, to very coarse, and debris, including glass jar, brick fragments and wood. Sand is black, angular (apparently sandblast grit).**	Not encountered	266	284	706	647	729	702	1,734	1500	61.74	
NS07	NS07-GC-10	0 - 1	0 - 4": Brownish gray to black silt and clay with fine sand and bivalve shell, very soft. Petroleum odor. 4 - 52": Brown organic silt/clay with decomposed wood fragments to 1/4", very soft, gelatinous.	Not present	27	34.3	48	91	30	66.5	115	223	2.38	8.2
	NS07-GC-20	1 - 2	4 - 52": Brown organic silt/clay with decomposed wood fragments to 1/4", very soft, gelatinous.		26		24		ND		40		2.20	
	NS07-GC-30	2 - 3	4 - 52": Brown organic silt/clay with decomposed wood fragments to 1/4", very soft, gelatinous.		21	12.5	17	24.8	ND	3.27	25	60.2	0.36	4.2
	NS07-GC-40	3 - 4	4 - 52": Brown organic silt/clay with decomposed wood fragments to 1/4", very soft, gelatinous.		19		ND		ND		21		1.61	
NS08	NS08-GC-10	0 - 1	0 - 4": Light gray to black fines with minor sand, very soft and wet. Petroleum odor. 4 - 12": Brown organic silt/clay with minor plant material to 1/4", wet, very soft, gelatinous.	0 - 4	24	19	59	67.4	45	126	133	800	2.57	3.1
	NS08-GC-20	1 - 2	12 - 65": Brown organic silt/clay with minor plant material to 1/4", wet, very soft, gelatinous. Naphthalene odor.		26		23		ND		55		5.58	
	NS08-GC-30	2 - 3	12 - 65": Brown organic silt/clay with minor plant material to 1/4", wet, very soft, gelatinous. Naphthalene odor.		21		17		ND		52		2.91	
	NS08-GC-40	3 - 4	12 - 65": Brown organic silt/clay with minor plant material to 1/4", wet, very soft, gelatinous. Naphthalene odor.		22		ND		ND		29		1.05	
	NS08-GC-50	4 - 5	12 - 65": Brown organic silt/clay with minor plant material to 1/4", wet, very soft, gelatinous. Naphthalene odor.		24		ND		ND		24		0.00	

Table 9-1. Grit Identification and Characterization Results Summary

Core Location ID	Sample ID	Depth Interval (feet below top of core)	Description	Depth of Lowest Light Gray Clay or Brownish Gray Fines Immediately Overlying Brown Organic Silt/Clay (inches)	Arsenic		Copper		Lead		Zinc		% >125 um	
					XRF (ppm)	Lab (mg/kg DW)	XRF (ppm)	Lab (mg/kg DW)	XRF (ppm)	Lab (mg/kg DW)	XRF (ppm)	Lab (mg/kg DW)	Field	Lab
NS09	NS09-GC-02	0 - 0.2	**0 - 4": Very dark grayish brown organic silt/clay with trace fine or very fine sand, soupy, hydrocarbon odor**		180		336		494		848		NA	
	NS09-GC-10	0 - 1	**0 - 4": Very dark grayish brown organic silt/clay with trace fine or very fine sand, soupy, hydrocarbon odor.** 4 - 6.5": Organic silt/clay, mostly brown with thin (1/4 - 1/2") reddish brown and dark grayish brown layers, very soft. 6.5 - 8": Light gray clay, soft, with thin brown layers at 6.75" and 7.75". 8 - 10": Brownish gray organic silt/clay with fibrous plant matter. 10 - 12": Organic silt/clay, very soft, grading down from brownish gray to brown.	6.5 - 8	41	41.2	104	124	235	194	316	309	3.41	2.1
	NS09-GC-20	1 - 2	12 - 38": Brown organic silt/clay, very soft, gelatinous.		25		ND		18		68		0.66	
	NS09-GC-30	2 - 3	12 - 38": Brown organic silt/clay, very soft, gelatinous.		17		ND		ND		26		2.68	
NS10	NS10-GC-10	0 - 1	0 - 5": Light gray clay and silt with minor sand, very soft, wet. Slight petroleum odor. Thin (1/4") dark gray layer at 2". 5 - 8": Light gray clay and silt, very soft, grading down to brownish gray then grayish brown organic silt/clay. Slight petroleum odor. 8 - 65": Brown organic silt/clay with minor plant matter, very soft, gelatinous.	0 - 8	29	20.5	41	61.3	47	59.1	144	164	1.82	1.4
	NS10-GC-20	1 - 2	8 - 65": Brown organic silt/clay with minor plant matter, very soft, gelatinous.		24		20		15		71		2.19	
	NS10-GC-30	2 - 3	8 - 65": Brown organic silt/clay with minor plant matter, very soft, gelatinous.		19		ND		ND		32		0.35	
	NS10-GC-40	3 - 4	8 - 65": Brown organic silt/clay with minor plant matter, very soft, gelatinous.		20		ND		ND		31		1.36	
	NS10-GC-50	4 - 5	8 - 65": Brown organic silt/clay with minor plant matter, very soft, gelatinous.		24		ND		ND		38		0.09	
NS11	NS11-GC-10	0 - 1	0 - 5": Light gray clay and silt, very soft, wet. Thin (1/4") dark gray clay layer at 2". Slight petroleum odor. 5 - 7": Light gray clay and silt grading downward to grayish brown organic clay and silt, very soft, wet. 7 - 37": Brown organic silt/clay, minor clastic material, very soft, gelatinous.	0 - 7	77	83.1	78	142	104	134	283	333	4.32	6
	NS11-GC-20	1 - 2	7 - 37": Brown organic silt/clay, minor clastic material, very soft, gelatinous.		33		21		ND		65		0.23	
	NS11-GC-30	2 - 3	7 - 37": Brown organic silt/clay, minor clastic material, very soft, gelatinous.		18		ND		ND		35		0.58	
NS12	NS12-GC-10	0 - 1	**0 - 6": Dark gray to black silt, clay, and sand, fine and very fine, soupy. Petroleum odor.** 6 - 9": Light gray clay, very soft, with interlayers of grayish brown to brownish gray very soft, gelatinous organic silt/clay. 9 - 19": Grayish brown organic silt/clay with abundant fibrous plant material, very soft.		181	180	613	627	715	653	1,090	1010	4.20	
	NS12-GC-20	1 - 2	9 - 19": Grayish brown organic silt/clay with abundant fibrous plant material, very soft. 19 - 22": Light gray clay, very soft. 22 - 28": Organic silt/clay, very soft, gelatinous, grading down from brownish gray to grayish brown.	19 - 22	29	18.9	84	96.3	107	121	224	226	1.01	
	NS12-GC-30	2 - 3	22 - 28": Organic silt/clay, very soft, gelatinous, grading down from brownish gray to grayish brown. 28 - 68": Brown organic silt/clay, very soft, gelatinous.		26		64		58		158		1.81	
	NS12-GC-40	3 - 4	28 - 68": Brown organic silt/clay, very soft, gelatinous.		25		39		19		73		1.66	
	NS12-GC-50	4 - 5	28 - 68": Brown organic silt/clay, very soft, gelatinous.		23		ND		ND		ND		7.65	
NS13	NS13-GC-10	0 - 1	**0 - 11": Black silt and clay, soupy**. 11 - 22": Grayish brown organic silt/clay with some very fine sand, very soft.		380	422	1,087	1610	769	1010	1,651	2130	5.37	4.6
	NS13-GC-20	1 - 2	11 - 22": Grayish brown organic silt/clay with some very fine sand, very soft. 22 - 30": Interlayered light gray clay and brownish gray organic silt/clay, very soft.	22 - 30	30	33	99	141	177	164	364	300	7.73	5.8
	NS13-GC-30	2 - 3	22 - 30": Interlayered light gray clay and brownish gray organic silt/clay, very soft. 30 - 33": Brownish gray organic silt/clay, very soft. 30 - 62": Brown organic silt/clay, very soft, gelatinous.		23		51		46		135		2.29	
	NS13-GC-40	3 - 4	30 - 62": Brown organic silt/clay, very soft, gelatinous.		18		22		13		57		6.71	
NS14	NS14-GC-10	0 - 1	**0 - 11": Brownish gray organic silt/clay with minor very fine sand, soupy (0 - 4") to very soft (4 - 11").** 11 - 13": Light gray clay, very soft.	11 - 13	44	99.3	181	344	301	312	391	530	2.82	6.5
	NS14-GC-20	1 - 2	11 - 13": Light gray clay, very soft. 13 - 17": Brownish gray organic silt/clay, very soft. 17 - 20": Organic silt/clay, very soft, grading down from brownish gray to brown. 20 - 62": Brown organic silt/clay, very soft, gelatinous.		25		49		50		130		1.87	
	NS14-GC-30	2 - 3	20 - 62": Brown organic silt/clay, very soft, gelatinous.		22		21		ND		48		2.95	
	NS14-GC-40	3 - 4	20 - 62": Brown organic silt/clay, very soft, gelatinous.		17		18		13		46		2.20	
NS15	NS15-GC-10	0 - 1	0 - 2": Dark gray fines, soupy. 2 - 3": Light gray clay, very soft. 3 - 6": Grayish brown fines, very soft. 6 - 9": Grayish brown organic silt/clay, very soft. 9 - 56": Brown organic silt/clay, very soft, gelatinous.	2 - 3	46		91		76		205		0.43	
	NS15-GC-20	1 - 2	9 - 56": Brown organic silt/clay, very soft, gelatinous.		16		16		9		48		2.33	
	NS15-GC-30	2 - 3	9 - 56": Brown organic silt/clay, very soft, gelatinous.		17		15		ND		33		2.91	
	NS15-GC-40	3 - 4	9 - 56": Brown organic silt/clay, very soft, gelatinous.		18		17		ND		52		0.58	
NS16	NS16-GC-10	0 - 1	0 - 14": Organic silt and clay, ranging in color from dark brown (0 - 5") to dark grayish brown (5 - 8") to reddish brown (8 - 11") to brownish gray (11 - 14"). Very soft, wet. Petroleum odor. Thin (1/4") gray clay layer at 3".		46	65.2	153	234	306	312	397	491	1.84	3.7
	NS16-GC-20	1 - 2	0 - 14": Organic silt and clay, ranging in color from dark brown (0 - 5") to dark grayish brown (5 - 8") to reddish brown (8 - 11") to brownish gray (11 - 14"). Very soft, wet. Petroleum odor. 14 - 16": Light gray clay, very soft. 16 - 17": Light gray organic silt/clay, very soft. 17 - 19": Organic silt/clay, brownish gray, very soft. 19 - 63": Organic silt/clay, very soft, gelatinous, grading down from grayish brown (19 - 24") to brown (24 - 63").	16 - 17	16		58		71		155		1.54	
	NS16-GC-30	2 - 3	24 - 63": Brown organic silt/clay, very soft, gelatinous.		25		14		16		65		0.67	
	NS16-GC-40	3 - 4	24 - 63": Brown organic silt/clay, very soft, gelatinous.		19		ND		ND		31		2.95	
	NS16-GC-50	4 - 5	24 - 63": Brown organic silt/clay, very soft, gelatinous.		20		17		ND		33		2.00	

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Core Location ID	Sample ID	Depth Interval (feet below top of core)	Description	Depth of Lowest Light Gray Clay or Brownish Gray Fines Immediately Overlying Brown Organic Silt/Clay (inches)	Arsenic		Copper		Lead		Zinc		% >125 um	
					XRF (ppm)	Lab (mg/kg DW)	XRF (ppm)	Lab (mg/kg DW)	XRF (ppm)	Lab (mg/kg DW)	XRF (ppm)	Lab (mg/kg DW)	Field	Lab
NS17	NS17-GC-10	0 - 1	**0 - 3": Dark brownish gray organic silt/clay with trace very fine sand, very soft. Petroleum odor.** 3 - 3.5": Light gray clay layer, very soft. 3.5 - 12": Dark grayish brown organic silt/clay and trace very fine sand, with several very thin (<1/4") gray clay layers, very soft. Petroleum odor.		37	49.1	137	1020	281	327	393	554	2.49	2.1
	NS17-GC-20	1 - 2	12 - 12.5": Light gray clay, soft. 12.5 - 13": Brownish gray organic silt/clay with blobs of brown liquid (NAPL?). 13 - 13.5" Light gray clay, soft. 13.5 - 16": Brownish gray organic silt/clay, very soft. 16 - 16.5": Light gray clay. 16.5 - 18": Grayish brown organic silt/clay, very soft. 18" - 56": Brown organic silt/clay, very soft.	16 - 16.5	28		53		44		170		1.26	
	NS17-GC-30	2 - 3	18" - 56": Brown organic silt/clay, very soft.		21		16		ND		44		3.27	
	NS17-GC-40	3 - 4	18" - 56": Brown organic silt/clay, very soft.		23		16		ND		51		2.04	
NS18	NS18-GC-10	0 - 1	**0 - 6": Dark grayish brown organic silt/clay with trace sand, very soupy.** Petroleum odor. 6 - 6.25" Light gray clay. 6.25 - 13": Dark grayish brown organic silt/clay and trace very fine sand, very soft. Petroleum odor. At 7.25" thin layer with brown liquid (NAPL?).		89	71.6	290	323	465	427	596	580	4.10	
	NS18-GC-20	1 - 2	6.25 - 13": Dark grayish brown organic silt/clay and trace very fine sand, very soft. Petroleum odor. 13 - 15": Reddish brown organic silt/clay with abundant fibrous plant material, very soft. 15 - 18.5": Finely interlayered thin (<1/4") gray clay layers and grayish brown organic silt/clay layers, very soft. Petroleum odor. 18.5 - 19": Light gray clay layer (lowermost in core). 19 - 22": Organic silt/clay, very soft, grading down from brownish gray to brown. 22 - 68": Brown organic silt/clay, very soft, gelatinous	18.5 - 19	29		88		108		243		0.43	
	NS18-GC-30	2 - 3	22 - 68": Brown organic silt/clay, very soft, gelatinous		35		52		58		155		2.91	
	NS18-GC-40	3 - 4	22 - 68": Brown organic silt/clay, very soft, gelatinous		24		ND		ND		43		5.66	
NS19	NS19-GC-10	0 - 1	**0 - 4": Dark brown to black fines with trace sand, soupy.** 4 - 4.25": Light gray clay. 4.25 - 7": Dark grayish brown organic silt/clay with trace sand and brown NAPL. 7 - 9.5": Reddish brown organic silt/clay, very soft, with brown NAPL. 9.5 - 13": Dark brownish gray organic silt/clay, very soft, with NAPL and strong naphthalene odor.		69	66.8	209	328	312	344	520	579	NA	3.4
	NS19-GC-20	1 - 2	9.5 - 13": Dark brownish gray organic silt/clay, very soft, with NAPL and strong naphthalene odor. 13 - 13.5": Light gray clay. 13.5 - 16.5": Brownish gray organic silt/clay, very soft, with blobs of brown NAPL concentrated immediately below gray clay (13 - 13.5"). Strong naphthalene odor. 16.5 - 17": Light gray clay. 17 - 24": Organic silt/clay, very soft, grading down from grayish brown to brown. Brown NAPL at 17 - 17.5", immediately below gray clay layer (16.5 - 17").	16.5 - 17	18	14.8	55	55.9	52	59.6	146	144	NA	4.8
	NS19-GC-30	2 - 3	24 - 57": Brown organic silt/clay, very soft.		28		17		ND		65		NA	
NS20	NS20-GC-10	0 - 1	**0 - 11": Dark brown to black fines with minor very fine or fine sand, very soft. Petroleum odor.** 11 - 11.5": Light gray clay, soft. 11.5 - 26": Organic silt/clay with minor fine or very fine sand and abundant fibrous plant material, very soft. Dark brown hydrocarbon staining, sheen, and strong naphthalene odor (not observed in interval above 11").	Gray clay at 11 - 11.5" underlain by heavily stained organic silt/clay.	89	98.2	500	612	491	601	1,232	1360	20.81	20.8
	NS20-GC-20	1 - 2	11.5 - 26": Organic silt/clay with minor fine or very fine sand and abundant fibrous plant material, very soft. Dark brown hydrocarbon staining, sheen, and strong naphthalene odor (not observed in interval above 11").		27		221		321		486		36.77	
	NS20-GC-30	2 - 3	11.5 - 26": Organic silt/clay with minor fine or very fine sand and abundant fibrous plant material, very soft. Dark brown hydrocarbon staining, sheen, and strong naphthalene odor (not observed in interval above 11"). 26 - 32": Organic silt/clay, very soft, brown, with patchy dark brown hydrocarbon stain, with sheen and strong naphthalene odor. Abundant fibrous plant matter and piece of bark to 3".		ND		165		811		757		NA	
NS21	NS21-GC-10	0 - 1	0 - 16": Sand, very fine to coarse, with some fines, overall color dark brownish gray. Includes white flecks (possibly paint) to 2mm, wood debris, piece of tar-like material to 1.5", and minor sub-rounded gravel to 0.75". Strong hydrocarbon odor.	Not encountered	20		50		44		128		30.44	
NS23	NS23-GC-10	0 - 1	**0 - 5": Dark brown to black silt/clay with trace fine or very fine sand, soupy. Petroleum odor.** 5 - 9": Dark grayish brown organic silt/clay with trace very fine sand, very soft. Thin (<1/4") gray clay at 6.5". 9 - 13.5": Brown organic silt/clay, very soft, with thin (<1/4") gray clay layers at 11" and 12.5".		37	33.1	192	222	268	266	387	387	0.42	
	NS23-GC-20	1 - 2	9 - 13.5": Brown organic silt/clay, very soft, with thin (<1/4") gray clay layers at 11" and 12.5". 13.5 - 14": Light gray clay, soft. 14 - 14.5": Brown organic silt/clay, very soft. 14.5 - 15": Light gray clay, very soft. 15 - 16": Gray organic silt/clay, very soft. 16 - 16.5": Light gray clay, soft (lowermost layer in core). 16.5 - 21": Organic silt/clay, very soft, grading down from brownish gray to brown. 21 - 24": Brown organic silt/clay, very soft.	16 - 16.5	24		66		57		173		2.88	
	NS23-GC-30	2 - 3	24 - 66": Brown organic silt/clay, very soft.		30		16		ND		64		1.55	
NS24	NS24-GC-10	0 - 1	**0 - 3": Dark grayish brown to black silt/clay with trace fine or very fine sand, soupy.** 3 - 3.25": Gray clay. 3.25 - 6": Dark grayish brown organic silt/clay with fibrous plant material, very soft. 6 - 8": Reddish brown organic silt/clay, very soft. 8 - 10": Brown organic silt/clay, very soft. 10 - 11": Light gray clay with thin brown layer in middle. 11 - 14": Organic silt/clay, very soft, grading down from grayish brown to brown.		35	27	125	141	225	299	337	311	2.42	
	NS24-GC-20	1 - 2	11 - 14": Organic silt/clay, very soft, grading down from grayish brown to brown. 14 - 42": Brown organic silt/clay, very soft		36		36		44		129		5.76	
	NS24-GC-30	2 - 3	14 - 42": Brown organic silt/clay, very soft.		24		ND		ND		33		10.78	
NS26	NS26-GC-10	0 - 1	**0 - 4": Dark grayish brown fines and trace fine to very fine sand, soupy. Petroleum odor.** 4 - 10": Organic silt/clay, very soft, grayish brown (4 - 7"), reddish brown (7 - 8"), brownish gray (8 - 9") and reddish brown (9 - 10"). Thin gray clay layer at 5". 10 - 11": Light gray clay, very soft. 11 - 13": Brownish gray organic silt/clay, very soft.	10 - 11	36		126		192		302		3.73	
	NS26-GC-20	1 - 2	11 - 13": Brownish gray organic silt/clay, very soft. 13 - 46": Brown organic silt/clay, very soft.		25		ND		ND		48		0.00	
	NS26-GC-30	2 - 3	13 - 46": Brown organic silt/clay, very soft.		25		ND		ND		41		6.66	

Table 9-1. Grit Identification and Characterization Results Summary

Core Location ID	Sample ID	Depth Interval (feet below top of core)	Description	Depth of Lowest Light Gray Clay or Brownish Gray Fines Immediately Overlying Brown Organic Silt/Clay (inches)	Arsenic		Copper		Lead		Zinc		% >125 um	
					XRF (ppm)	Lab (mg/kg DW)	XRF (ppm)	Lab (mg/kg DW)	XRF (ppm)	Lab (mg/kg DW)	XRF (ppm)	Lab (mg/kg DW)	Field	Lab
NS27	NS27-GC-10	0 - 1	0 - 2": Dark grayish brown silt/clay with trace fine or very fine sand, soupy. 2 - 2.25": Gray clay. 2.25 - 6": Thinly interlaminated reddish brown, brown, and gray organic silt/clay, very soft. 6 - 7.5": Light gray clay with thin layer of brown material at 6.5" and dark gray material at 6.75". 7.5 - 8.5": Gray clay with fibrous plant matter. 8.5 - 14": Organic silt/clay, very soft, grading down from brownish gray to grayish brown.	6 - 8.5	30		116		139		247		9.56	
	NS27-GC-20	1 - 2	8.5 - 14": Organic silt/clay, very soft, grading down from brownish gray to grayish brown. 14 - 48": Brown organic silt/clay, very soft		25		29		22		68		NA	
	NS27-GC-30	2 - 3	14 - 48": Brown organic silt/clay, very soft.		15		21		12		46		32.08	
NS28	NS28-GC-02	0 - 0.2	0 - 1.5": Dark grayish brown silt/clay, soupy. 1.5 - 1.75": Gray clay. 1.75 - 3": Reddish brown organic silt/clay, very soft.		ND		137		390		413		NA	
	NS28-GC-10	0 - 1	0 - 1.5": Dark grayish brown silt/clay, soupy. 1.5 - 1.75": Gray clay. 1.75 - 3": Reddish brown organic silt/clay, very soft. 3 - 6": Finely interlaminated brown, reddish brown, and grayish brown organic silt/clay and thin (<1/4") gray clay layers at 3.5", 4.25", 4.75", and 5.5". 6 - 8": Light gray clay with thin brown and dark gray layers. 8 - 8.5": Light gray clay. 8.5 - 13": Organic silt/clay, grading down from brownish gray to grayish brown, very soft.	6 - 8.5	23		88		120		225		6.85	
	NS28-GC-20	1 - 2	8.5 - 13": Organic silt/clay, grading down from brownish gray to grayish brown, very soft. 13 - 54": Brown organic silt/clay, very soft		23		24		18		71		4.72	
	NS28-GC-30	2 - 3	13 - 54": Brown organic silt/clay, very soft.		23		ND		ND		37		0.65	
NS29	NS29-GC-10	0 - 1	0 - 4": Dark grayish brown fines, soupy. 4 - 4.5": Light gray clay, very soft. 4.5 - 10": Dark grayish brown organic silt/clay, very soft. 10 - 11": Reddish brown organic silt/clay, very soft. 11 - 12": Dark grayish brown organic silt/clay, very soft.		57		220		300		423		2.93	
	NS29-GC-20	1 - 2	12 - 12.5": Light gray clay, very soft. 12.5 - 14": Interlayered reddish brown organic silt/clay and light gray clay, very soft. 14 - 19": Brownish gray organic silt/clay, very soft. 19 - 23": Organic silt/clay, grading down from grayish brown to brown. 23 - 54": Brown organic silt/clay, very soft, gelatinous.	12 - 14	25		61		71		175		1.30	
	NS29-GC-30	2 - 3	23 - 54": Brown organic silt/clay, very soft, gelatinous.		12		18		45		86		5.40	
NS33	NS33-GC-10	0 - 1	**0 - 6": Dark brown to black fines with trace fine to very fine sand, soupy. Petroleum odor.** 6 - 8.5": Brown organic silt/clay, very soft. 8.5 - 14.5": Interlayered gray clay and reddish brown and dark grayish brown organic silt/clay layers with fibrous plant matter, very soft.	8.5 - 14.5	85		216		338		440		3.50	
	NS33-GC-20	1 - 2	8.5 - 14.5": Interlayered gray clay and reddish brown and dark grayish brown organic silt/clay layers with fibrous plant matter, very soft. 14.5 - 18": Organic silt/clay, very soft, grading down from brownish gray to brown. 18 - 35": Brown organic silt/clay, very soft.		16		46		51		121		0.60	
	NS33-GC-30	2 - 3	18 - 35": Brown organic silt/clay, very soft.		24		ND		ND		53		0.90	
NS34	NS34-GC-02	0 - 0.2	**0 - 6": Dark grayish brown organic silt/clay with some fine to very fine sand and fibrous plant matter. Petroleum odor.**		163		388		661		785		NA	
	NS34-GC-10	0 - 1	**0 - 6": Dark grayish brown organic silt/clay with some fine to very fine sand and fibrous plant matter. Petroleum odor.** 6 - 13": Organic silt/clay, very soft, dark grayish brown (6 - 10"), reddish brown (10 - 11"), dark brownish gray (11 - 12.5"), and reddish brown (12.5 - 13"). Thin (<1/4") gray clay at 10".		74		249		490		559		2.38	
	NS34-GC-20	1 - 2	6 - 13": Organic silt/clay, very soft, dark grayish brown (6 - 10"), reddish brown (10 - 11"), dark brownish gray (11 - 12.5"), and reddish brown (12.5 - 13"). 13 - 14.5": Light gray clay with thin layer of brown material in middle. 14.5 - 17": Gray organic silt/clay, very soft. 17 - 23": Organic silt/clay, very soft, grading down from grayish brown to brown. 23 - 44": Brown organic silt/clay, very soft.	13 - 17	22		63		62		140		0.54	
	NS34-GC-30	2 - 3	23 - 44": Brown organic silt/clay, very soft.		35		24		ND		72		3.80	
NS35	NS35-GC-10	0 - 1	**0 - 11": Black fines and black sand (apparently sandblast grit).** Hydrocarbon odor.	Not encountered	1,546		2,222		963		3,923		96.75	

Notes:
Red Highlight = Denotes metal concentration at or above SMS CSL value. Arsenic: 93 mg/kg. Copper: 390 mg/kg. Lead: 530 mg/kg. Zinc: 960 mg/kg.
Yellow Highlight = Denotes metal concentration at or above SMS SQS value. Arsenic: 57 mg/kg. Copper: 390 mg/kg. Lead: 450 mg/kg. Zinc: 410 mg/kg.
Green Highlight = Denotes visual observation of sandblast grit in sample.
Gray Highlight = Denotes visual observation of basal gray clay layer of Recent Uper Deposits (Rdu) unit.

Key:
CSL = Washington Sediment Management Standards Cleanup Screening Levels.
DW = Dry weight
ID = Identification
mg/kg = Milligrams per kilogram
NA = Not applicable or not available.
NAPL = Non-aqueous phase liquid.
ND = Not detected
ppm = Parts per million
SMS = Washington State Sediment Management Standards
SQS = Washington Sediment Management Standards Sediment Quality Standards.
um = Micrometer
XRF = X-ray fluorescence

Figures

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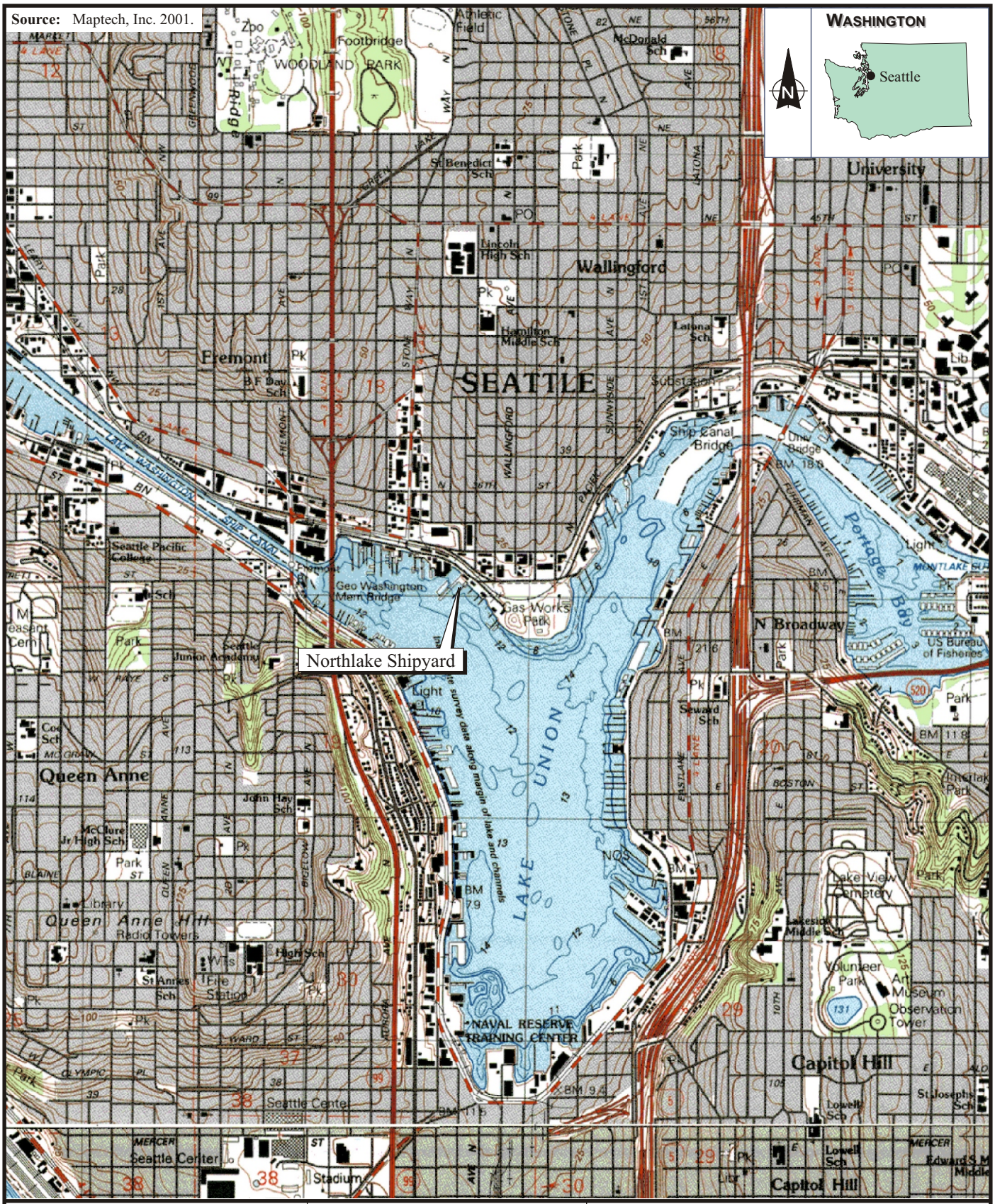

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NORTHLAKE SHIPYARD
SANDBLAST GRIT STUDY
Seattle, Washington

Figure 1-1

SITE VICINITY MAP

0 1000 2000
Approximate Scale in Feet

Date:	Drawn by:	
6-17-09	AES	10:002330WD1005\fig 1-1

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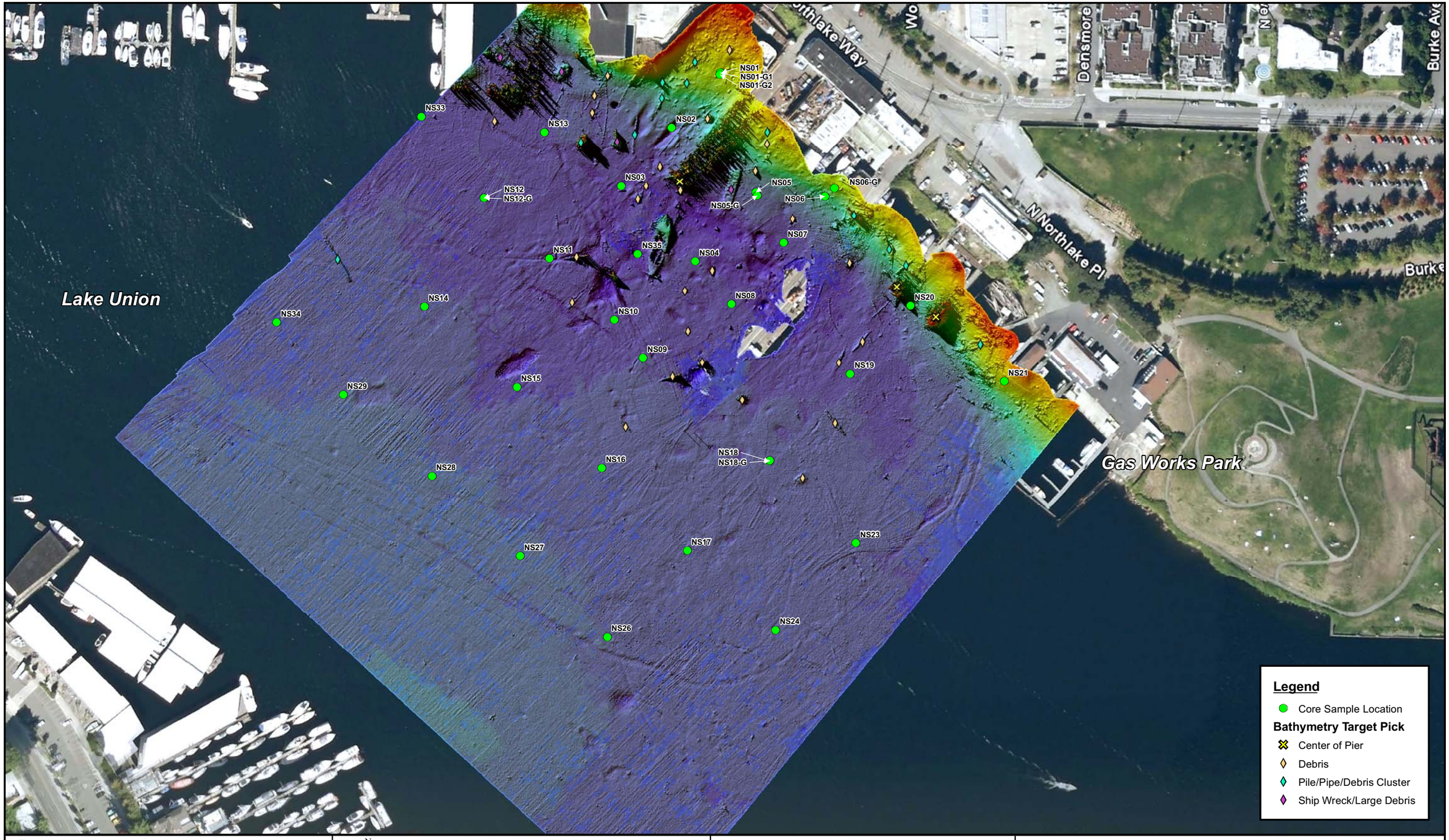
NORTHLAKE SHIPYARD
SANDBLAST GRIT STUDY
Seattle, Washington

Figure 1-2
SITE MAP

Source: USA Photo Map 2006.

Date:	Drawn by:	
6/17/09	AES	10:002330WD1005\fig 1-2



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N W E S

0 50 100 200 300 400 500
Feet
Scale 1:1,900

Map Source Information: King County GIS Data, June 2003.

Northlake Shipyard Sandblast Grit Study

Seattle, Washington

Figure 3-1
Bathymetry and Core Locations

Date:	GIS:	Job Number:
6/17/2009	avh	002330.WD10.05

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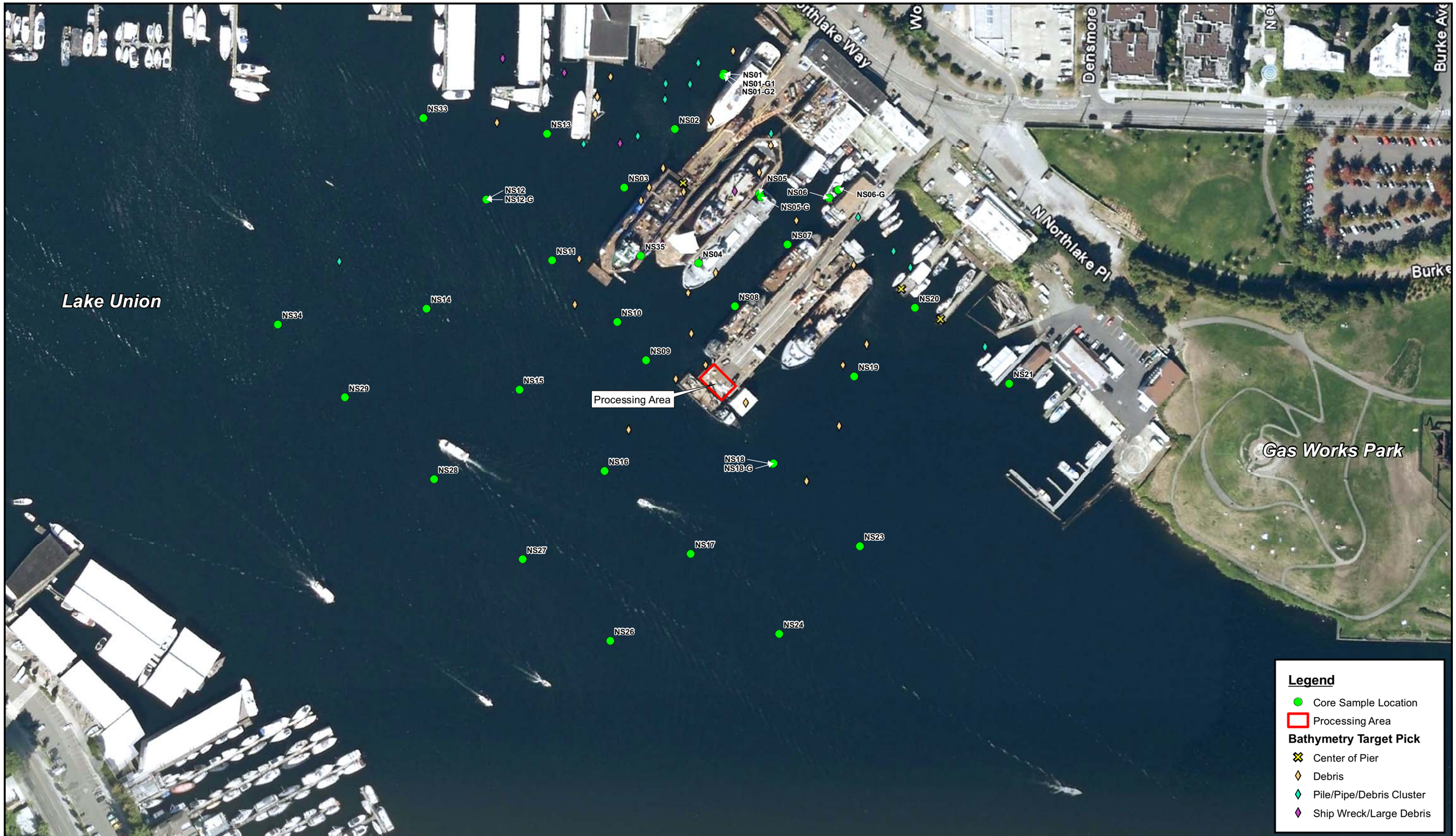

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N W E S

0 50 100 200 300 400 500
Feet
Scale 1:1,900

Map Source Information: King County GIS Data, June 2003.

Northlake Shipyard Sandblast Grit Study

Seattle, Washington

Figure 3-2
Core Locations

Date:	GIS:	Job Number:
6/17/2009	avh	002330.WD10.05

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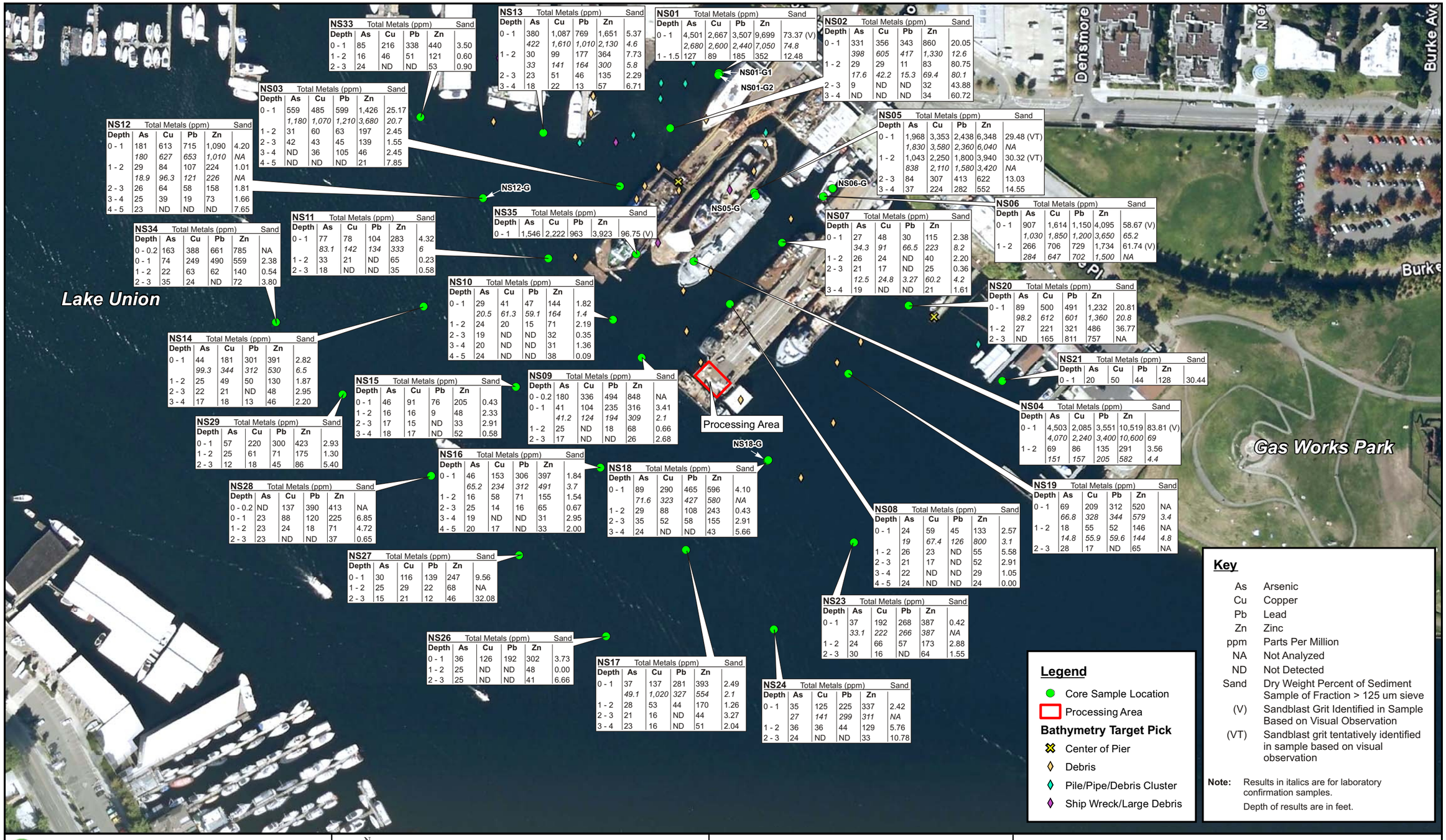

NS33 Total Metals (ppm)

Depth	As	Cu	Pb	Zn	Sand
0 - 1	85	216	338	440	3.50
1 - 2	16	46	51	121	0.60
2 - 3	24	ND	ND	53	0.90

NS03 Total Metals (ppm)

Depth	As	Cu	Pb	Zn	Sand
0 - 1	559	485	599	1,426	25.17
	1,180	*1,070*	*1,210*	*3,680*	*20.7*
1 - 2	31	60	63	197	2.45
2 - 3	42	43	45	139	1.55
3 - 4	ND	36	105	46	2.45
4 - 5	ND	ND	ND	21	7.85

NS12 Total Metals (ppm)

Depth	As	Cu	Pb	Zn	Sand
0 - 1	181	613	715	1,090	4.20
	180	*627*	*653*	*1,010*	*NA*
1 - 2	29	84	107	224	1.01
	18.9	*96.3*	*121*	*226*	*NA*
2 - 3	26	64	58	158	1.81
3 - 4	25	39	19	73	1.66
4 - 5	23	ND	ND	ND	7.65

NS34 Total Metals (ppm)

Depth	As	Cu	Pb	Zn	Sand
0 - 0.2	163	388	661	785	NA
0 - 1	74	249	490	559	2.38
1 - 2	22	63	62	140	0.54
2 - 3	35	24	ND	72	3.80

NS11 Total Metals (ppm)

Depth	As	Cu	Pb	Zn	Sand
0 - 1	77	78	104	283	4.32
	83.1	*142*	*134*	*333*	*6*
1 - 2	33	21	ND	65	0.23
2 - 3	18	ND	ND	35	0.58

NS35 Total Metals (ppm)

Depth	As	Cu	Pb	Zn	Sand
0 - 1	1,546	2,222	963	3,923	96.75 (V)

NS13 Total Metals (ppm)

Depth	As	Cu	Pb	Zn	Sand
0 - 1	380	1,087	769	1,651	5.37
	422	*1,610*	*1,010*	*2,130*	*4.6*
1 - 2	30	99	177	364	7.73
	33	*141*	*164*	*300*	*5.8*
2 - 3	23	51	46	135	2.29
3 - 4	18	22	13	57	6.71

NS01 Total Metals (ppm)

Depth	As	Cu	Pb	Zn	Sand
0 - 1	4,501	2,667	3,507	9,699	73.37 (V)
	2,680	*2,600*	*2,440*	*7,050*	*74.8*
1 - 1.5	127	89	185	352	12.48

NS02 Total Metals (ppm)

Depth	As	Cu	Pb	Zn	Sand
0 - 1	331	356	343	860	20.05
	398	*605*	*417*	*1,330*	*12.6*
1 - 2	29	29	11	83	80.75
	17.6	*42.2*	*15.3*	*69.4*	*80.1*
2 - 3	9	ND	ND	32	43.88
3 - 4	ND	ND	ND	34	60.72

NS05 Total Metals (ppm)

Depth	As	Cu	Pb	Zn	Sand
0 - 1	1,968	3,353	2,438	6,348	29.48 (VT)
	1,830	*3,580*	*2,360*	*6,040*	*NA*
1 - 2	1,043	2,250	1,800	3,940	30.32 (VT)
	838	*2,110*	*1,580*	*3,420*	*NA*
2 - 3	84	307	413	622	13.03
3 - 4	37	224	282	552	14.55

NS06 Total Metals (ppm)

Depth	As	Cu	Pb	Zn	Sand
0 - 1	907	1,614	1,150	4,095	58.67 (V)
	1,030	*1,850*	*1,200*	*3,650*	*65.2*
1 - 2	266	706	729	1,734	61.74 (V)
	284	*647*	*702*	*1,500*	*NA*

NS07 Total Metals (ppm)

Depth	As	Cu	Pb	Zn	Sand
0 - 1	27	48	30	115	2.38
	34.3	*91*	*66.5*	*223*	*8.2*
1 - 2	26	24	ND	40	2.20
2 - 3	21	17	ND	25	0.36
	12.5	*24.8*	*3.27*	*60.2*	*4.2*
3 - 4	19	ND	ND	21	1.61

NS10 Total Metals (ppm)

Depth	As	Cu	Pb	Zn	Sand
0 - 1	29	41	47	144	1.82
	20.5	*61.3*	*59.1*	*164*	*1.4*
1 - 2	24	20	15	71	2.19
2 - 3	19	ND	ND	32	0.35
3 - 4	20	ND	ND	31	1.36
4 - 5	24	ND	ND	38	0.09

NS14 Total Metals (ppm)

Depth	As	Cu	Pb	Zn	Sand
0 - 1	44	181	301	391	2.82
	99.3	*344*	*312*	*530*	*6.5*
1 - 2	25	49	50	130	1.87
2 - 3	22	21	ND	48	2.95
3 - 4	17	18	13	46	2.20

NS15 Total Metals (ppm)

Depth	As	Cu	Pb	Zn	Sand
0 - 1	46	91	76	205	0.43
1 - 2	16	16	9	48	2.33
2 - 3	17	15	ND	33	2.91
3 - 4	18	17	ND	52	0.58

NS09 Total Metals (ppm)

Depth	As	Cu	Pb	Zn	Sand
0 - 0.2	180	336	494	848	NA
0 - 1	41	104	235	316	3.41
	41.2	*124*	*194*	*309*	*2.1*
1 - 2	25	ND	18	68	0.66
2 - 3	17	ND	ND	26	2.68

NS29 Total Metals (ppm)

Depth	As	Cu	Pb	Zn	Sand
0 - 1	57	220	300	423	2.93
1 - 2	25	61	71	175	1.30
2 - 3	12	18	45	86	5.40

NS16 Total Metals (ppm)

Depth	As	Cu	Pb	Zn	Sand
0 - 1	46	153	306	397	1.84
	65.2	*234*	*312*	*491*	*3.7*
1 - 2	16	58	71	155	1.54
2 - 3	25	14	16	65	0.67
3 - 4	19	ND	ND	31	2.95
4 - 5	20	17	ND	33	2.00

NS18 Total Metals (ppm)

Depth	As	Cu	Pb	Zn	Sand
0 - 1	89	290	465	596	4.10
	71.6	*323*	*427*	*580*	*NA*
1 - 2	29	88	108	243	0.43
2 - 3	35	52	58	155	2.91
3 - 4	24	ND	ND	43	5.66

NS28 Total Metals (ppm)

Depth	As	Cu	Pb	Zn	Sand
0 - 0.2	ND	137	390	413	NA
0 - 1	23	88	120	225	6.85
1 - 2	23	24	18	71	4.72
2 - 3	23	ND	ND	37	0.65

NS27 Total Metals (ppm)

Depth	As	Cu	Pb	Zn	Sand
0 - 1	30	116	139	247	9.56
1 - 2	25	29	22	68	NA
2 - 3	15	21	12	46	32.08

NS26 Total Metals (ppm)

Depth	As	Cu	Pb	Zn	Sand
0 - 1	36	126	192	302	3.73
1 - 2	25	ND	ND	48	0.00
2 - 3	25	ND	ND	41	6.66

NS17 Total Metals (ppm)

Depth	As	Cu	Pb	Zn	Sand
0 - 1	37	137	281	393	2.49
	49.1	*1,020*	*327*	*554*	*2.1*
1 - 2	28	53	44	170	1.26
2 - 3	21	16	ND	44	3.27
3 - 4	23	16	ND	51	2.04

NS08 Total Metals (ppm)

Depth	As	Cu	Pb	Zn	Sand
0 - 1	24	59	45	133	2.57
	19	*67.4*	*126*	*800*	*3.1*
1 - 2	26	23	ND	55	5.58
2 - 3	21	17	ND	52	2.91
3 - 4	22	ND	ND	29	1.05
4 - 5	24	ND	ND	24	0.00

NS23 Total Metals (ppm)

Depth	As	Cu	Pb	Zn	Sand
0 - 1	37	192	268	387	0.42
	33.1	*222*	*266*	*387*	*NA*
1 - 2	24	66	57	173	2.88
2 - 3	30	16	ND	64	1.55

NS24 Total Metals (ppm)

Depth	As	Cu	Pb	Zn	Sand
0 - 1	35	125	225	337	2.42
	27	*141*	*299*	*311*	*NA*
1 - 2	36	36	44	129	5.76
2 - 3	24	ND	ND	33	10.78

NS20 Total Metals (ppm)

Depth	As	Cu	Pb	Zn	Sand
0 - 1	89	500	491	1,232	20.81
	98.2	*612*	*601*	*1,360*	*20.8*
1 - 2	27	221	321	486	36.77
2 - 3	ND	165	811	757	NA

NS21 Total Metals (ppm)

Depth	As	Cu	Pb	Zn	Sand
0 - 1	20	50	44	128	30.44

NS04 Total Metals (ppm)

Depth	As	Cu	Pb	Zn	Sand
0 - 1	4,503	2,085	3,551	10,519	83.81 (V)
	4,070	*2,240*	*3,400*	*10,600*	*69*
1 - 2	69	86	135	291	3.56
	151	*157*	*205*	*582*	*4.4*

NS19 Total Metals (ppm)

Depth	As	Cu	Pb	Zn	Sand
0 - 1	69	209	312	520	NA
	66.8	*328*	*344*	*579*	*3.4*
1 - 2	18	55	52	146	NA
	14.8	*55.9*	*59.6*	*144*	*4.8*
2 - 3	28	17	ND	65	NA

Key

As	Arsenic
Cu	Copper
Pb	Lead
Zn	Zinc
ppm	Parts Per Million
NA	Not Analyzed
ND	Not Detected
Sand	Dry Weight Percent of Sediment Sample of Fraction > 125 um sieve
(V)	Sandblast Grit Identified in Sample Based on Visual Observation
(VT)	Sandblast grit tentatively identified in sample based on visual observation

Note: Results in italics are for laboratory confirmation samples.

Depth of results are in feet.

Legend

- Core Sample Location
- Processing Area

Bathymetry Target Pick

- Center of Pier
- Debris
- Pile/Pipe/Debris Cluster
- Ship Wreck/Large Debris

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N W E S

0 50 100 200 300 400 500
Feet
Scale 1:1,900

Map Source Information: King County GIS Data, June 2003.

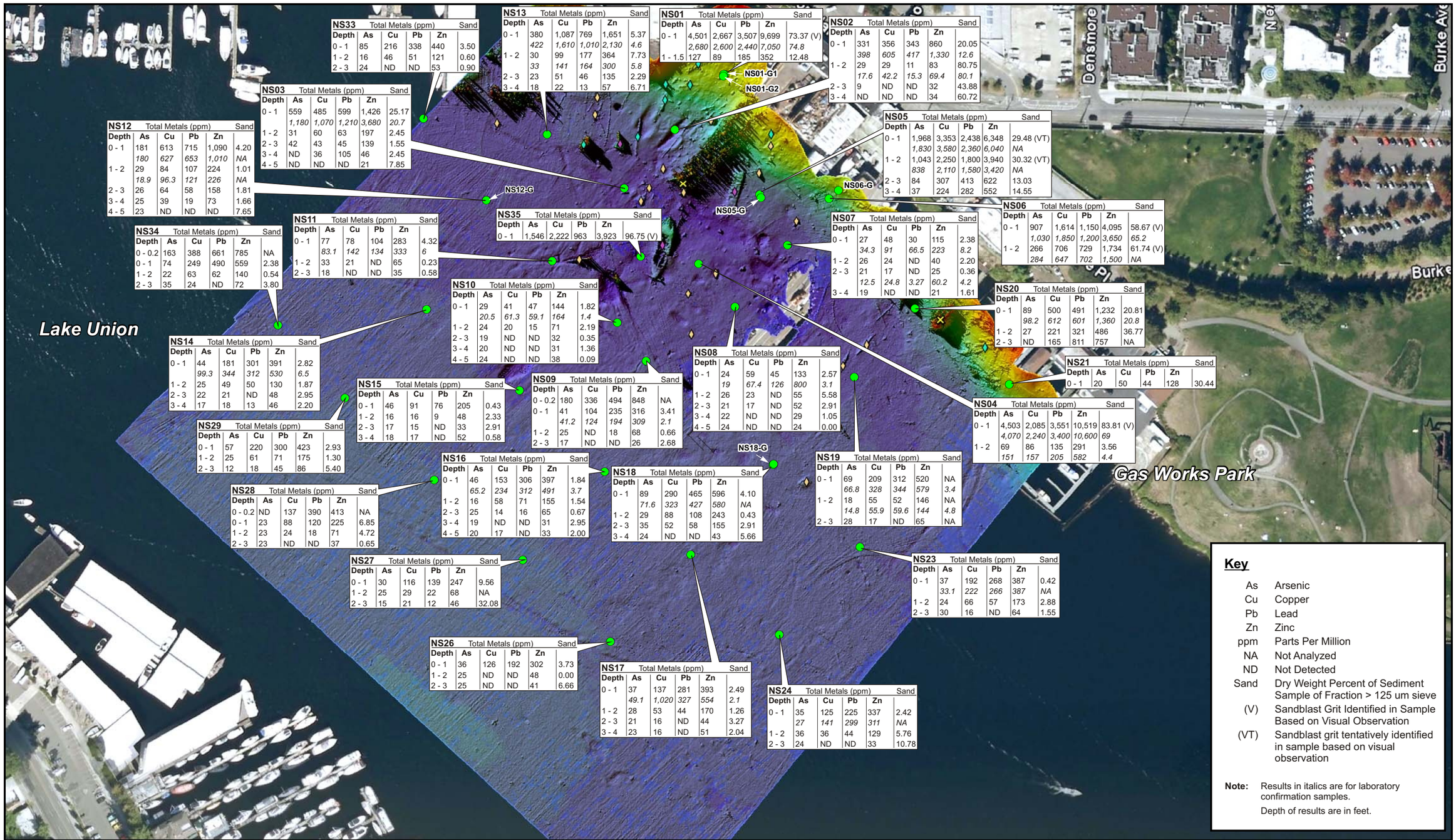
Northlake Shipyard Sandblast Grit Study

Seattle, Washington

Figure 7-1
Core Sample Results

Date:	GIS:	Job Number:
6/26/2009	avh	002330.WD10.05

\edms-projects\northlake shipyard\report figures\new figures\figure x-x core sample grid locs with aerial.mxd



NS33 Total Metals (ppm) — Sand

Depth	As	Cu	Pb	Zn	
0 - 1	85	216	338	440	3.50
1 - 2	16	46	51	121	0.60
2 - 3	24	ND	ND	53	0.90

NS13 Total Metals (ppm) — Sand

Depth	As	Cu	Pb	Zn	
0 - 1	380	1,087	769	1,651	5.37
	422	*1,610*	*1,010*	*2,130*	*4.6*
1 - 2	30	99	177	364	7.73
	33	*141*	*164*	*300*	*5.8*
2 - 3	23	51	46	135	2.29
3 - 4	18	22	13	57	6.71

NS01 Total Metals (ppm) — Sand

Depth	As	Cu	Pb	Zn	
0 - 1	4,501	2,667	3,507	9,699	73.37 (V)
	2,680	*2,600*	*2,440*	*7,050*	*74.8*
1 - 1.5	127	89	185	352	12.48

NS02 Total Metals (ppm) — Sand

Depth	As	Cu	Pb	Zn	
0 - 1	331	356	343	860	20.05
	398	*605*	*417*	*1,330*	*12.6*
1 - 2	29	29	11	83	80.75
	17.6	*42.2*	*15.3*	*69.4*	*80.1*
2 - 3	9	ND	ND	32	43.88
3 - 4	ND	ND	ND	34	60.72

NS03 Total Metals (ppm) — Sand

Depth	As	Cu	Pb	Zn	
0 - 1	559	485	599	1,426	25.17
	1,180	*1,070*	*1,210*	*3,680*	*20.7*
1 - 2	31	60	63	197	2.45
2 - 3	42	43	45	139	1.55
3 - 4	ND	36	105	46	2.45
4 - 5	ND	ND	ND	21	7.85

NS12 Total Metals (ppm) — Sand

Depth	As	Cu	Pb	Zn	
0 - 1	181	613	715	1,090	4.20
	180	*627*	*653*	*1,010*	*NA*
1 - 2	29	84	107	224	1.01
	18.9	*96.3*	*121*	*226*	*NA*
2 - 3	26	64	58	158	1.81
3 - 4	25	39	19	73	1.66
4 - 5	23	ND	ND	ND	7.65

NS05 Total Metals (ppm) — Sand

Depth	As	Cu	Pb	Zn	
0 - 1	1,968	3,353	2,438	6,348	29.48 (VT)
	1,830	*3,580*	*2,360*	*6,040*	*NA*
1 - 2	1,043	2,250	1,800	3,940	30.32 (VT)
	838	*2,110*	*1,580*	*3,420*	*NA*
2 - 3	84	307	413	622	13.03
3 - 4	37	224	282	552	14.55

NS34 Total Metals (ppm) — Sand

Depth	As	Cu	Pb	Zn	
0 - 0.2	163	388	661	785	NA
0 - 1	74	249	490	559	2.38
1 - 2	22	63	62	140	0.54
2 - 3	35	24	ND	72	3.80

NS11 Total Metals (ppm) — Sand

Depth	As	Cu	Pb	Zn	
0 - 1	77	78	104	283	4.32
	83.1	*142*	*134*	*333*	*6*
1 - 2	33	21	ND	65	0.23
2 - 3	18	ND	ND	35	0.58

NS35 Total Metals (ppm) — Sand

Depth	As	Cu	Pb	Zn	
0 - 1	1,546	2,222	963	3,923	96.75 (V)

NS07 Total Metals (ppm) — Sand

Depth	As	Cu	Pb	Zn	
0 - 1	27	48	30	115	2.38
	34.3	*91*	*66.5*	*223*	*8.2*
1 - 2	26	24	ND	40	2.20
2 - 3	21	17	ND	25	0.36
	12.5	*24.8*	*3.27*	*60.2*	*4.2*
3 - 4	19	ND	ND	21	1.61

NS06 Total Metals (ppm) — Sand

Depth	As	Cu	Pb	Zn	
0 - 1	907	1,614	1,150	4,095	58.67 (V)
	1,030	*1,850*	*1,200*	*3,650*	*65.2*
1 - 2	266	706	729	1,734	61.74 (V)
	284	*647*	*702*	*1,500*	*NA*

NS10 Total Metals (ppm) — Sand

Depth	As	Cu	Pb	Zn	
0 - 1	29	41	47	144	1.82
	20.5	*61.3*	*59.1*	*164*	*1.4*
1 - 2	24	20	15	71	2.19
2 - 3	19	ND	ND	32	0.35
3 - 4	20	ND	ND	31	1.36
4 - 5	24	ND	ND	38	0.09

NS20 Total Metals (ppm) — Sand

Depth	As	Cu	Pb	Zn	
0 - 1	89	500	491	1,232	20.81
	98.2	*612*	*601*	*1,360*	*20.8*
1 - 2	27	221	321	486	36.77
2 - 3	ND	165	811	757	NA

NS14 Total Metals (ppm) — Sand

Depth	As	Cu	Pb	Zn	
0 - 1	44	181	301	391	2.82
	99.3	*344*	*312*	*530*	*6.5*
1 - 2	25	49	50	130	1.87
2 - 3	22	21	ND	48	2.95
3 - 4	17	18	13	46	2.20

NS15 Total Metals (ppm) — Sand

Depth	As	Cu	Pb	Zn	
0 - 1	46	91	76	205	0.43
1 - 2	16	16	9	48	2.33
2 - 3	17	15	ND	33	2.91
3 - 4	18	17	ND	52	0.58

NS09 Total Metals (ppm) — Sand

Depth	As	Cu	Pb	Zn	
0 - 0.2	180	336	494	848	NA
0 - 1	41	104	235	316	3.41
	41.2	*124*	*194*	*309*	*2.1*
1 - 2	25	ND	18	68	0.66
2 - 3	17	ND	ND	26	2.68

NS08 Total Metals (ppm) — Sand

Depth	As	Cu	Pb	Zn	
0 - 1	24	59	45	133	2.57
	19	*67.4*	*126*	*800*	*3.1*
1 - 2	26	23	ND	55	5.58
2 - 3	21	17	ND	52	2.91
3 - 4	22	ND	ND	29	1.05
4 - 5	24	ND	ND	24	0.00

NS21 Total Metals (ppm) — Sand

Depth	As	Cu	Pb	Zn	
0 - 1	20	50	44	128	30.44

NS04 Total Metals (ppm) — Sand

Depth	As	Cu	Pb	Zn	
0 - 1	4,503	2,085	3,551	10,519	83.81 (V)
	4,070	*2,240*	*3,400*	*10,600*	*69*
1 - 2	69	86	135	291	3.56
	151	*157*	*205*	*582*	*4.4*

NS16 Total Metals (ppm) — Sand

Depth	As	Cu	Pb	Zn	
0 - 1	46	153	306	397	1.84
	65.2	*234*	*312*	*491*	*3.7*
1 - 2	16	58	71	155	1.54
2 - 3	25	14	16	65	0.67
3 - 4	19	ND	ND	31	2.95
4 - 5	20	17	ND	33	2.00

NS18 Total Metals (ppm) — Sand

Depth	As	Cu	Pb	Zn	
0 - 1	89	290	465	596	4.10
	71.6	*323*	*427*	*580*	*NA*
1 - 2	29	88	108	243	0.43
2 - 3	35	52	58	155	2.91
3 - 4	24	ND	ND	43	5.66

NS19 Total Metals (ppm) — Sand

Depth	As	Cu	Pb	Zn	
0 - 1	69	209	312	520	NA
	66.8	*328*	*344*	*579*	*3.4*
1 - 2	18	55	52	146	NA
	14.8	*55.9*	*59.6*	*144*	*4.8*
2 - 3	28	17	ND	65	NA

NS28 Total Metals (ppm) — Sand

Depth	As	Cu	Pb	Zn	
0 - 0.2	ND	137	390	413	NA
0 - 1	23	88	120	225	6.85
1 - 2	23	24	18	71	4.72
2 - 3	23	ND	ND	37	0.65

NS27 Total Metals (ppm) — Sand

Depth	As	Cu	Pb	Zn	
0 - 1	30	116	139	247	9.56
1 - 2	25	29	22	68	NA
2 - 3	15	21	12	46	32.08

NS23 Total Metals (ppm) — Sand

Depth	As	Cu	Pb	Zn	
0 - 1	37	192	268	387	0.42
	33.1	*222*	*266*	*387*	*NA*
1 - 2	24	66	57	173	2.88
2 - 3	30	16	ND	64	1.55

NS26 Total Metals (ppm) — Sand

Depth	As	Cu	Pb	Zn	
0 - 1	36	126	192	302	3.73
1 - 2	25	ND	ND	48	0.00
2 - 3	25	ND	ND	41	6.66

NS17 Total Metals (ppm) — Sand

Depth	As	Cu	Pb	Zn	
0 - 1	37	137	281	393	2.49
	49.1	*1,020*	*327*	*554*	*2.1*
1 - 2	28	53	44	170	1.26
2 - 3	21	16	ND	44	3.27
3 - 4	23	16	ND	51	2.04

NS24 Total Metals (ppm) — Sand

Depth	As	Cu	Pb	Zn	
0 - 1	35	125	225	337	2.42
	27	*141*	*299*	*311*	*NA*
1 - 2	36	36	44	129	5.76
2 - 3	24	ND	ND	33	10.78

Key

As	Arsenic
Cu	Copper
Pb	Lead
Zn	Zinc
ppm	Parts Per Million
NA	Not Analyzed
ND	Not Detected
Sand	Dry Weight Percent of Sediment Sample of Fraction > 125 um sieve
(V)	Sandblast Grit Identified in Sample Based on Visual Observation
(VT)	Sandblast grit tentatively identified in sample based on visual observation

Note: Results in italics are for laboratory confirmation samples.

Depth of results are in feet.

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N W E S

0 50 100 200 300 400 500
Feet
Scale 1:1,900

Map Source Information: King County GIS Data, June 2003.

Northlake Shipyard Sandblast Grit Study

Seattle, Washington

Figure 7-2
Bathymetry and Core Sample Results

Date:	GIS:	Job Number:
6/26/2009	avh	002330.WD10.05

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