

# WHITTIER FERRY TERMINAL IMPROVEMENTS PROJECT

## SEDIMENT CHARACTERIZATION REPORT

### FINAL

*Prepared for*

Alaska Department of Transportation  
and Public Facilities  
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**ACRONYMS AND ABBREVIATIONS**

AAC	Alaska Administrative Code
ACOE	U.S. Army Corps of Engineers
ADEC	Alaska Department of Environmental Conservation
ADOT&PF	Alaska Department of Transportation and Public Facilities
AMHS	Alaska Marine Highway System
ASTM	American Society for Testing and Materials
BTEX	benzene, toluene, ethylbenzene, total xylenes
CAS	Columbia Analytical Services, Inc.
COC	chain-of-custody
cy	cubic yards
DMMU	Dredge Material Management Unit
DRO	diesel range organics
EPA	U.S. Environmental Protection Agency
GC	gas chromatography
GRO	gasoline range organics
HPLC	high performance liquid chromatography
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
MDL	method detection limit
µg/kg	micrograms per kilogram
mg/kg	milligrams per kilogram
mL	milliliter
MLLW	mean lower low water
MPRSA	Marine Protection, Research, and Sanctuaries Act
MRL	method reporting limit
MS	matrix spike
MSD	matrix spike duplicate
PCB	polychlorinated biphenyl
PSEP	Puget Sound Estuary Program
QA	quality assurance
QC	quality control
RPD	relative percent difference
RRO	residual range organics
%RSD	percent relative standard deviation
VOC	volatile organic compound

## 1.0 INTRODUCTION

As part of the Whittier Ferry Terminal Improvements project, the Alaska Department of Transportation and Public Facilities (ADOT&PF) plans to deepen the existing Alaska Marine Highway System (AMHS) ferry vessel moorage area in order to provide improved service for existing and proposed vessels. The AMHS terminal facility is constructed on the alluvial fan formed by Whittier Creek and is located on the seaward side of the Alaska Railroad Company-Whittier Rail Yard. According to ADOT&PF, the existing ferry terminal moorage basin was constructed in 1988 with the removal of approximately 19,000 cubic yards of sediment to a depth of -20 feet mean lower low water (MLLW). Figure 1 shows a vicinity map of the AMHS Whittier Ferry Terminal site. ADOT&PF's ferry terminal improvements will involve dredging sediment from the existing basin to bring the current basin depth of approximately -20 feet MLLW to -30 feet MLLW. The dredge area covers approximately 1.4 acres, and the estimated volume of sediment to be dredged is 18,000 cubic yards (cy). ADOT&PF currently plans to utilize the dredge material as fill material for a culvert extension project permitted by the U.S. Army Corps of Engineers (ACOE). The remaining dredge materials will be placed at an upland site owned by the City of Whittier, or other approved location.

Ocean disposal of all or a portion of the material was initially evaluated for the project. The Marine Protection, Research, and Sanctuaries Act (MPRSA), otherwise known as the Ocean Dumping Act, specifies that prior to all proposed dumping of dredged material into ocean waters, the potential environmental impact of such activities must be determined. The ACOE and the U.S. Environmental Protection Agency (EPA) share the responsibility of regulating dredged material management activities. Additionally, the Alaska Department of Environmental Conservation (ADEC) must issue a Section 401 (Clean Water Act) certification. To obtain the necessary permits for dredging and disposal of sediments from the Whittier Ferry Terminal, ADOT&PF selected URS Corporation to perform a characterization of the dredge material that would satisfy ocean or upland disposal regulatory requirements. Because ADOT&PF plans to use the dredge material as upland fill, chemical analyses were performed to demonstrate compliance with ADEC Oil and Other Hazardous Substances Pollution Control regulations (18 Alaska Administrative Code [AAC] 75).

This Sediment Characterization Report presents findings from the characterization of sediment for both upland and ocean disposal. The report includes the following components:

- ◆ A summary of field activities, including sample locations and depths;
- ◆ Sample handling procedures;
- ◆ Quality assurance/quality control (QA/QC) summary; and
- ◆ A summary of analytical results.

## 2.0 FIELD ACTIVITIES

URS and Discovery Drilling personnel traveled to Whittier on April 2, 2003, to collect samples at the Whittier Ferry Terminal. Although the crew attempted to begin sample collection that day, the vessel *Itswoot*, provided by Dojer Ltd., was delayed in launching and the skiff that was provided to assist in anchoring the vessel had mechanical problems. As a result, no samples were collected on April 2. The next day, April 3, a different skiff was provided and sampling activities were conducted. Sampling activities were conducted in accordance with the *Dredged Material Sampling and Analysis Plan* (URS, 2003) (Work Plan). The boring depths are summarized in Table 1, and the boring logs are included as Attachment A. The boring locations are shown on Figure 2. A total of three borehole sample stations resulted in nine sediment samples from within the proposed dredge site, including one archive sample. Individual samples were identified with the abbreviation WFT (for Whittier Ferry Terminal) followed by the sample number. The archive sample was collected at the new sediment surface depth and was not analyzed. Table 2 summarizes the samples collected and the analyses performed for each sample.

**Table 1. Boring Depths**

Boring Number	Dredge Material Management Unit (DMMU)	Sample Elevation (feet mean lower low water)	Samples Collected
1	Surface Sediment	-22 to -26	WFT-1 Grab Sample
	Subsurface Sediment	-26 to -30	WFT-3 Composite & WFT-5 Grab Sample
	New Surface Sediment	-30 to -32	WFT-4 Composite Sample (Archived)
2	Surface Sediment	-23 to -27	WFT-2 Composite & WFT-6 Grab Sample
	Subsurface Sediment	-27 to -31	WFT-3 Composite & WFT-7 Grab Sample
	New Surface Sediment	-31 to -33	WFT-4 Composite Sample (Archived)
3	Surface Sediment	-21 to -25	WFT-2 Composite & WFT-8 Grab Sample
	Subsurface Sediment	-26 to -30	WFT-3 Composite & WFT-9 Grab Sample
	New Surface Sediment	-30 to -32	WFT-4 Composite Sample (Archived)

**Table 2. Summary of Samples Collected and Analyses Performed**

Dredge Material Management Unit (DMMU)	Sample Description	Sample Number	Analysis
Surface Sediment Under Existing Ferry Moorage	Discrete grab sample from boring 1	WFT-1	Grain Size, Total Volatile Solids, VOCs 8260B, GRO AK101, DRO AK102, RRO AK103, Pesticides/ PCBs, metals, ammonia, sulfides Biological – Archive
Other Surface Sediment	Composite sample from borings 2 and 3	WFT-2	Grain Size & Total Volatile Solids Chemical – Hold due to low percent fines Biological – Archive
Subsurface Sediment	Composite sample from borings 1, 2, and 3	WFT-3	Grain Size & Total Volatile Solids Chemical – Hold due to low percent fines Biological – Archive
New Sediment Surface Material (archive)	Composite sample from borings 1, 2, and 3	WFT-4	Physical – Hold Chemical – Archive Biological – Archive

Table 2. Continued

Dredge Material Management Unit (DMMU)	Sample Description	Sample Number	Analysis
Subsurface Sediment	Discrete grab sample from boring 1	WFT-5	BTEX, GRO AK101, DRO AK102, arsenic, and chromium
Surface Sediment	Discrete grab sample from boring 2	WFT-6	BTEX, GRO AK101, DRO AK102, arsenic, and chromium
Subsurface Sediment	Discrete grab sample from boring 2	WFT-7	BTEX, GRO AK101, DRO AK102, arsenic, and chromium
Surface Sediment	Discrete grab sample from boring 3	WFT-8	BTEX, GRO AK101, DRO AK102, arsenic, and chromium
Subsurface Sediment	Discrete grab sample from boring 3	WFT-9	BTEX, GRO AK101, DRO AK102, arsenic, and chromium

BTEX – Benzene, toluene, ethylbenzene, total xylenes  
 DRO AK102 – Diesel range organics by method AK102  
 GRO AK101 – Gasoline range organics by method AK101

PCBs – Polychlorinated biphenyls  
 RRO AK103 – Residual range organics by method AK103  
 VOCs 8260B – Volatile organic compounds by method 8260B

Samples were collected from the securely anchored landing craft by driving a three-inch diameter split spoon sampler through NX casing. Casing was advanced using rotary wash boring techniques. Sub-samples were collected from material that was not in direct contact with the liner or within 1 inch from either end of the core. It was necessary to drill multiple boreholes at a specific location in order to collect adequate sediment volume for the required analyses. The samples were transported back to Anchorage following the sampling event, re-packaged, and shipped to Columbia Analytical Services, Inc. in Kelso, Washington.

### 3.0 SAMPLE HANDLING

All samples were collected using either disposable or decontaminated tools. The split spoon was decontaminated between soil borings, and composite samples were placed into separate clean containers for mixing. Disposable sampling spoons were used to transfer soil from the split spoon or composite container to the sample jar. Disposable nitrile gloves were worn and changed between sample intervals. Analytical samples were collected using procedures outlined in the following subsections.

#### 3.1 VOLATILES SUB-SAMPLING PROCEDURES

Sample material for volatile organic compound (VOC) analysis, including gasoline range organics (GRO) and benzene, toluene, ethylbenzene, and total xylenes (BTEX), was collected first from the soil core. Each discreet surface and subsurface interval was sampled individually for VOCs; VOC samples were not composited. Grab samples for GRO and BTEX were placed into a pre-weighed 4-ounce container with septum, filled approximately one-third to one-half full; the sample was covered with 25 milliliters (mL) of methanol. Additionally, one 4-ounce unpreserved container with septum was completely filled with sediment for the full VOC suite by method 8260B; the jar was filled so that no headspace was remaining in the container.

#### 3.2 COMPOSITING PROCEDURES

Following the collection of soil samples for VOCs, the remaining portion of the sample core was transferred to a large container and securely covered with aluminum foil. Aliquots of approximately the same volume of sediment from each appropriate sample location were added to the appropriate container for homogenization before being placed into sample jars for the remaining analyses. Sample material was thoroughly homogenized prior to splitting into separate sample containers.

#### 3.3 FIELD DECONTAMINATION PROCEDURES

Split spoons were decontaminated in the field. The sampling spoons and gloves were disposable, and the compositing containers were only used one time. The split spoons were decontaminated between each boring using the following decontamination sequence:

- ◆ Scrub with wire brush to remove large soil particles,
- ◆ Wash with Alconox<sup>®</sup> solution,
- ◆ Rinse twice with potable water,
- ◆ Rinse with de-ionized water, and
- ◆ Air dry in a hydrocarbon-free environment.

#### 3.4 SAMPLE TRANSPORT AND CHAIN-OF-CUSTODY PROCEDURES

Sample transport and chain-of-custody (COC) procedures were followed as outlined in the Work Plan. See Section 4.1 for additional chain-of-custody details.

**3.5 FIELD DOCUMENTATION**

Documentation was performed in accordance with the Work Plan. Field notes were maintained and boring logs were prepared to document field activities. The boring logs are included as Attachment A.

## 4.0 QA/QC SUMMARY

The QA/QC Summary in this section presents the evaluation of analytical data for sediment samples collected on April 3, 2003, for the ADOT&PF Whittier Ferry Terminal Improvements project. A total of three borehole sample stations resulted in nine sediment samples and one archive sample. Non-conformance of data is identified, discussed, and qualified in this summary. The analytical results are presented in Attachment B

The results of the QA/QC data associated with the analysis of the following parameters are summarized in this report:

- ◆ Particle size determination by American Society for Testing and Materials (ASTM) D422 (Modified);
- ◆ Total solids by EPA Method E160.3 (Modified);
- ◆ Total volatile solids by EPA Method E160.4 (Modified);
- ◆ Total sulfides by Puget Sound Estuary Program (PSEP) Method;
- ◆ Ammonia by Plumb Method for sediments;
- ◆ Total metals by inductively coupled plasma mass spectroscopy, EPA Method 200.8;
- ◆ Total mercury by cold vapor atomic absorption, EPA Method SW7471A;
- ◆ GRO by gas chromatography (GC), Alaska State Method AK101;
- ◆ BTEX by GC, EPA Method SW8021B;
- ◆ VOCs (full list) by GC/mass spectroscopy, EPA Method SW8260B;
- ◆ Diesel range organics (DRO) by GC, Alaska State Method AK102;
- ◆ Residual range organics (RRO) by GC, Alaska State Method AK103;
- ◆ Organochlorine pesticides by GC, EPA Method SW8081A; and
- ◆ Polychlorinated biphenyls (PCBs) by GC, EPA Method SW8082.

Samples were analyzed by Columbia Analytical Services, Inc. (CAS) at their Kelso, Washington, laboratory. Refer to Table I for a summary of the samples submitted for analysis. In addition, one trip blank was submitted to the laboratory for analysis of GRO/BTEX by AK101/8021B.

Samples were analyzed in accordance with *Test Methods for Evaluating Solid Waste Physical/Chemical Methods, SW-846*, Third Edition (USEPA, 1999); *EPA Methods for Chemical Analysis for Water and Wastes* (USEPA, 1983); *Annual Book of American Society for Testing and Materials (ASTM) Standards, Water*, Volume 11.01 (ASTM, 1993); *Procedures for Handling and Chemical Analysis of Sediment and Water Samples* (Plumb, 1981); and *Recommended Protocols for Measuring Conventional Sediment Variables in Puget Sound* (USEPA, 1986).

The laboratory provided a hard-copy deliverable, including method- and project-specific QC, and a digital deliverable in a Microsoft EXCEL flat file format. Standard laboratory data qualifiers (flags) were included in the deliverables. Flags applied by URS as a result of this data review are preceded with a

“V.” A list of the laboratory and validator qualifiers applied to the samples for this project is presented in Table 3.

**Table 3. Data Qualifiers**

Qualifier Symbol	Definition
i	The MRL/MDL has been elevated due to a chromatographic interference.
J	The result is an estimated concentration that is less than the MRL but greater than or equal to the MDL.
N	The MS and/or MSD sample recovery is not within control limits. See case narrative.
P	The GC or high performance liquid chromatography (HPLC) confirmation criterion was exceeded. The relative percent difference is greater than 40% between the two analytical results (25% for pesticides).
VJ	The sample result should be considered an estimate.
VLL	The LCS recovery was below control limits. The qualified result may be biased low.
VML	The MS recovery was below control limits. The qualified result may be biased low.
VSL	The surrogate recovery was below control limits. The qualified result may be biased low.

The data review focuses on criteria for the following QA/QC parameters and their overall effect on the data:

- ◆ Sample handling (chain-of-custody);
- ◆ Holding time compliance;
- ◆ Field QA/QC (trip blanks);
- ◆ Laboratory QA/QC (calibration verification, laboratory control samples, matrix spike samples, laboratory duplicate samples, and laboratory triplicate samples);
- ◆ Method reporting limits;
- ◆ Method blanks;
- ◆ Surrogates;
- ◆ Analytical methods;
- ◆ Precision and accuracy; and
- ◆ Completeness.

#### 4.1 SAMPLE HANDLING (CHAIN-OF-CUSTODY)

URS field personnel shipped all samples via FedEx to CAS in Kelso, Washington. Hard copy COC forms were included in the coolers with the shipment. Cooler receipt forms documenting sample condition and temperature were completed upon receipt at the laboratory. COCs, cooler receipt forms, and laboratory case narratives were provided in the final report and were reviewed to determine if any sample handling procedures may have affected the integrity of the samples and the quality of the resulting data.

The samples were received at the laboratory in good condition, and the three coolers shipped to the laboratory had temperatures of 3.1, 3.3, and 3.8 °C, within the acceptable  $4 \pm 2$  °C temperature range. All

of the COCs were signed and dated as relinquished by the field personnel and as received by the laboratory.

The original COC form was received by CAS on April 5, 2003. On April 9 and April 15, URS requested additional analyses by sending revised COC forms to CAS via e-mail. The revised COC form was included in the final report.

## **4.2 HOLDING TIME COMPLIANCE**

Holding time for samples is defined as the required time frame from the date of collection within which the laboratory must perform extraction and analysis. Recommended holding times are based on EPA guidance. All samples were extracted and/or analyzed within the recommended hold time for the analytical procedures.

## **4.3 FIELD QA/QC**

Field QA/QC protocol is designed to monitor possible contamination during sample collection and transport. For this project, trip blanks were submitted in conjunction with the samples collected for GRO/BTEX. Trip blanks are used to monitor volatile contamination of glassware and samples as they travel to and from the field. They are prepared by the laboratory using volatile-free sand covered with 25 mL of methanol in a 4-ounce pre-weighed sample container with septum. One trip blank was carried in the cooler during the sampling event with the sample containers for GRO/BTEX, and the blank was then shipped to the laboratory with the samples. The trip blank results were below the method reporting limit (MRL) for GRO/BTEX.

## **4.4 LABORATORY QA/QC**

### **4.4.1 Calibration Verification**

Initial and continuing calibration verification standards were analyzed to monitor laboratory instrument performance prior to, during, and concluding sample analysis. Laboratory standard operating procedures specify these ranges of standards in accordance with the associated EPA method used for the analysis. The laboratory is required to report any discrepancies if they occur and the effect on project samples. According to the laboratory case narrative, the primary evaluation criteria were not met for calibration verification standards for several pesticide compounds, and for initial calibration standards for several VOC compounds. In all cases, alternative evaluation criteria were met and data quality has not been impacted.

### **4.4.2 Laboratory Control Samples**

Laboratory control samples (LCS) and laboratory control sample duplicates (LCSD) are prepared in the laboratory by spiking a clean matrix (i.e., Ottawa sand) with a known concentration of target analyte. These samples are processed with a batch of 20 or fewer field samples. LCS/LCSD sample results are calculated for accuracy by percent recovery, and for precision by relative percent difference (RPD). LCS/LCSD percent recovery and RPD are evaluated against laboratory-determined acceptance ranges to

monitor if the analytical method was in control. The following sample had an associated LCS recovery that was outside of the specified acceptance range:

- ◆ Sample WFT-1 is qualified with a “VLL” flag for the VOC 2-butanone (MEK) by method SW8260B, indicating that the LCS recovery for the analytical batch was below the acceptance range. The qualifier was added to indicate that the sample result may be biased low based on the LCS recovery.

#### 4.4.3 Matrix Spike Samples

Matrix spike (MS) and matrix spike duplicate (MSD) samples are prepared in the laboratory by spiking an aliquot of a submitted field sample with a known concentration of target analyte. These samples are processed with a batch of 20 or fewer field samples. MS/MSD samples are calculated for accuracy by percent recovery, and for precision by RPD. MS/MSD percent recovery and RPD are evaluated against laboratory-specified acceptance ranges to monitor the accuracy and precision of the analytical method for the submitted matrix. URS did not request that MS/MSD analyses be performed on specific samples. The following laboratory-selected MS/MSD samples had recoveries that were outside of the specified acceptance ranges:

- ◆ Sample WFT-1 is qualified by the laboratory with an “N” flag for antimony, indicating that the MS and MSD recoveries for the analytical batch were below the acceptance range. Antimony results are generally low for sediment samples when extraction method SW3050 is used. The qualifier was added to indicate that the sample result may be biased low based on the MS/MSD recoveries, and the result should be used as an estimate for antimony concentrations.
- ◆ Sample WFT-1 is qualified with a “VML” flag for total sulfide, indicating that the MS recovery for the analytical batch was below the acceptance range. The qualifier was added to indicate that the sample result may be biased low based on the MS recovery.

#### 4.4.4 Laboratory Duplicate Samples

Laboratory duplicate samples are repeated, independent determinations of the same sample, by the same analyst, at essentially the same time, and under the same conditions. The sample is split in the laboratory and each fraction is carried through all stages of sample preparation and analysis. Duplicate analyses measure the precision of each analytical method. Laboratory duplicate analyses are performed for 10% of samples analyzed, or at least one per day for analytical methods not requiring MS/MSDs. Laboratory duplicates were reported for the following inorganic analyses: ammonia, total solids, and total volatile solids. All RPDs for laboratory duplicate samples were within acceptance ranges.

#### 4.4.5 Laboratory Triplicate Samples

Laboratory triplicate analysis is conducted in the same manner and for the same purpose as laboratory duplicates. For triplicate analysis, however, the selected samples are divided into three fractions instead of two. A laboratory will perform triplicate analysis instead of duplicate analysis when required by the method. Laboratory triplicate analyses are performed for 5% of samples analyzed, or at least one per batch, for PSEP analytical methods. Laboratory triplicates were reported for sulfide and particle size determination.

No laboratory-specified acceptance ranges exist for triplicate analysis of sulfide and particle size determination. Percent relative standard deviation (%RSD) is used to indicate variability in sample results. In general, for inorganic methods a %RSD of 20 is used as the acceptance criterion. The sulfide triplicate has an acceptable %RSD. The %RSD for coarse gravel in the particle size determination is 21.6, slightly above the acceptance criterion of 20. The coarse gravel result for this sample was qualified with a "VJ" flag to indicate that the value should be considered an estimate based on the %RSD exceedence. The remaining particle fractions were below the %RSD acceptance criterion of 20.

#### 4.5 METHOD REPORTING LIMITS

For this project, methods were selected that could provide project-specific detection limits, and results are reported to the laboratory method detection limit (MDL). MRLs were adjusted by the laboratory for sample weight/volume, percent solids, dilutions, and matrix interference. Reported results that are greater than the MDL but less than the MRL are qualified by the laboratory with a "J" flag and should be considered estimates.

MRLs for several pesticide results in sample WFT-1 are elevated due to the presence of non-target background components. These results are qualified by the laboratory with an "i" flag to indicate the matrix interference. The quality of the data has not been impacted and the results are useable for the purpose of this project.

#### 4.6 METHOD BLANKS

Method blanks are samples that are prepared in the laboratory using a clean sample matrix, such as Ottawa sand. The method blanks are extracted and analyzed concurrent with a batch of 20 or fewer samples for each of the analytical procedures performed for this project. These samples undergo all of the extraction and analysis steps that the project samples follow to monitor for potential contamination during the analytical procedure. A result that is detected above the MRL in a method blank indicates a laboratory method control problem that can affect data quality. For this project, method blanks were tested at the required frequency. All method blank results were below the corresponding MRL for the analyte; therefore, no data quality issues were identified.

#### 4.7 SURROGATES

Surrogate solutions are added to a sample prior to the extraction step of the analytical procedure. The solutions contain known amounts of specific compounds that are similar to the target analytes and are specified for organic chromatographic analytical procedures. Percent recoveries of surrogate compounds indicate overall method performance for each sample by providing a measure of accuracy for the analytical procedures. Surrogates are evaluated against laboratory-specified acceptance ranges for organic methods SW8081A, SW8082, SW8260B, SW8021B, AK101, AK102, and AK103. The following samples had surrogate recoveries that were outside of the specified acceptance ranges:

- ◆ Samples WFT-5, WFT-7, WFT-8, and WFT-9 are qualified with a "VSL" flag for GRO by AK101, and sample WFT-9 is qualified with a "VSL" flag for BTEX by SW8021B, indicating that the 4-bromofluorobenzene surrogate recoveries for the samples were below the acceptance

range. According to the laboratory case narrative, the soil to methanol ratio was higher than the ratio prescribed in the analytical procedure for field preservation. The qualifier was added to indicate that the sample results may be biased low based on the surrogate recoveries.

#### 4.8 ANALYTICAL METHODS

URS used the appropriate EPA- and ADEC-approved methods for analysis of sediment samples and achieved the required detection limits as specified in the project work plan. QA/QC criteria were met for the listed methods, except as noted in previous sections or as follows:

- ◆ The confirmation criterion of 40% difference for the pesticides endrin and endrin ketone was exceeded in sample WFT-1. The higher of the two values is reported because no evidence of matrix interference was observed. The results have been qualified by the laboratory with a “P” flag.
- ◆ The laboratory did not provide LCS/LCSD results for the PCB analytical batch. According to the case narrative, the LCS extract was spilled, and the samples were re-extracted to confirm the LCS recoveries. MS/MSD results from the analytical batch had acceptable recoveries and the re-extraction analysis successfully confirmed the presence of Aroclor 1242 and 1260; therefore, no qualifiers were applied to the data.
- ◆ The laboratory analyzed samples WFT-1, WFT-2, and WFT-3 for particle size on April 7, 2003, and provided URS with preliminary results on April 9, 2003. The preliminary particle size results were used to determine whether additional testing was required before sample holding times were compromised. Based on the particle size results, sample WFT-1 was analyzed for additional parameters. The laboratory did not use the correct sieve sizes to determine the preliminary particle size results, and they re-analyzed the samples on May 12, 2003, using the correct sieve sizes. The final particle size results are presented in this report.

#### 4.9 PRECISION AND ACCURACY

Accuracy criteria monitor agreement of measured results with “true values,” as determined by the analytical spike recoveries. Accuracy was measured for this project by the analysis of LCS/LCSD (Section 4.4.2) and MS/MSD (Section 4.4.3) analyses. The data are qualified appropriately for results outside of the acceptance ranges. Overall, the data quality for the project was not impacted, and the data are useable.

Precision criteria monitor analytical reproducibility. Precision was measured by the analysis of laboratory duplicate and triplicate samples, LCS/LCSD RPDs, and/or MS/MSD RPDs. The data are qualified appropriately for results outside of the acceptance ranges. Overall, the data quality for the project was not impacted, and the data are useable.

#### 4.10 COMPLETENESS

Completeness is based on two factors: whether or not all of the planned samples were collected (field completeness), and whether or not all of the planned analyses were acceptable (laboratory completeness). The percentage of valid results is reported as completeness. Laboratory completeness is calculated after the QC data have been evaluated and applied to the measurement data. In addition to results identified as being outside of the QC limits established for a method, broken or spilled samples, or samples that could

not be analyzed for any other reason, are included in the assessment of completeness. Only sample results totally rejected are considered invalid for the calculation of completeness. Since URS collected all of the planned samples, field completeness is considered to be 100%. There were no rejected sample results for the project, so the laboratory completeness is calculated at 100%. Since both factors of completeness were achieved, the completeness goals for the project were met.

## 5.0 SUMMARY OF ANALYTICAL RESULTS

Analyses were performed in accordance with the *Dredged Material Evaluation Framework, Lower Columbia River Management Area* document for disposal of dredged material into marine waters (ACOE et al., 1998). Samples WFT-1, WFT-2, and WFT-3 were initially analyzed for particle size and total volatile solids. According to protocols and procedures described in the *Dredged Material Evaluation Framework*, samples that consist of less than 20% fine-grained material (passes through a 230 sieve) and less than 5% total volatile solids require no further evaluation for ocean dumping. The percent fines and total volatile solids for the three samples are presented in Table 4.

**Table 4. Particle Size and Total Volatile Solids Results**

Sample ID	Particle Size Percent Fines (passes through 230 sieve)	Total Volatile Solids (percent)	Further Evaluation Required?
WFT-1	9	2.83	No
WFT-2	3	2.58	No
WFT-3	6	2.35	No

In order that holding times would be met for all of the analytes, the preliminary particle size results were used to determine whether further testing was required. Preliminary particle size results indicated that sample WFT-1 contained 23% fines, above the 20% limit. The laboratory, however, used the incorrect sieve sizes for the preliminary analyses and re-analyzed the samples before issuing the final report (see Section 4.8). Only the final results are presented in Table 4.

Based on the preliminary particle size results, sample WFT-1 was further characterized for ocean dumping. Additionally, because ADOT&PF plans to dispose a large portion of the dredge material at an upland location, chemical analyses were also performed to demonstrate compliance with ADEC Oil and Other Hazardous Substances Pollution Control regulations (18 AAC 75). Based on the sample results from WFT-1, grab samples WFT-5, WFT-6, WFT-7, WFT-8, and WFT-9 were analyzed additionally for BTEX, GRO, DRO, arsenic, and chromium. Refer to Table 2 for a summary of analyses performed for the samples.

Analytical results are summarized in Table 5. All of the analytical results, including MDLs and MRLs, are included as Attachment B. The limits for both the *Dredged Material Evaluation Framework* screening levels and the ADEC 18 AAC 75 Method 2 cleanup levels are also presented in Table 5.

**Table 5. Analytical Results Summary**

	WFT-1	WFT-2	WFT-3	WFT-4	WFT-5	WFT-6	WFT-7	WFT-8	WFT-9	Screening Levels <sup>1</sup>	Method 2 Limits <sup>2</sup>
<b>General Chemistry</b>											
Ammonia (mg/kg)	ND	nt	--	--							
Total Sulfides (mg/kg)	363 <sup>a</sup>	nt	--	--							
Total Solids (percent)	78.9	86.9	82.8	nt	87.2	90.3	87.5	83.1	82.4	--	--

Table 5. Continued

	WFT-1	WFT-2	WFT-3	WFT-4	WFT-5	WFT-6	WFT-7	WFT-8	WFT-9	Screening Levels <sup>1</sup>	Method 2 Limits <sup>2</sup>
<b>Metals (mg/kg)</b>											
Antimony	0.09	nt	nt	nt	nt	nt	nt	nt	nt	150	3
<b>Arsenic</b>	<b>9.89</b>	nt	nt	nt	<b>6.69</b>	<b>8.78</b>	<b>10.2</b>	<b>10.5</b>	<b>6.67</b>	57	1.8
Cadmium	0.07	nt	nt	nt	nt	nt	nt	nt	nt	5.1	4.5
<b>Chromium (total)</b>	<b>44.1</b>	nt	nt	nt	<b>32.8</b>	<b>28.9</b>	<b>32.6</b>	<b>40.2</b>	<b>35.9</b>	--	23
Copper	43.6	nt	nt	nt	nt	nt	nt	nt	nt	390	--
Lead	18.1	nt	nt	nt	nt	nt	nt	nt	nt	450	1,000
Mercury	0.03	nt	nt	nt	nt	nt	nt	nt	nt	0.41	1.24
Silver	0.08	nt	nt	nt	nt	nt	nt	nt	nt	6.1	19
Zinc	77.1	nt	nt	nt	nt	nt	nt	nt	nt	410	8,100
<b>Volatile Organic Compounds (mg/kg)<sup>3</sup></b>											
Benzene	ND	nt	nt	nt	ND	ND	ND	ND	ND <sup>d</sup>	--	0.02
Ethylbenzene	ND	nt	nt	nt	ND	ND	ND	ND	ND <sup>d</sup>	--	5
Toluene	ND	nt	nt	nt	ND	ND	ND	ND	ND <sup>d</sup>	--	4.8
Total Xylenes	ND	nt	nt	nt	ND	ND	ND	ND	ND <sup>d</sup>	--	69
<b>Petroleum Hydrocarbons (mg/kg)</b>											
<b>Gasoline range organics</b>	<b>ND</b>	nt	nt	nt	ND <sup>d</sup>	ND	ND <sup>d</sup>	ND <sup>d</sup>	ND <sup>d</sup>	--	260
<b>Distillate range organics</b>	<b>37<sup>b</sup></b>	nt	nt	nt	ND	ND	ND	ND	ND	--	230
<b>Residual range organics</b>	<b>81<sup>b</sup></b>	nt	nt	nt	nt	nt	nt	nt	nt	--	9,700
<b>Pesticides and Polychlorinated Biphenyls (µg/kg)<sup>4</sup></b>											
Endrin	1.1 <sup>c</sup>	nt	nt	nt	nt	nt	nt	nt	nt	--	300
Endrin Ketone	3.3 <sup>c</sup>	nt	nt	nt	nt	nt	nt	nt	nt	--	--
γ-BHC (Lindane)	0.64 <sup>b</sup>	nt	nt	nt	nt	nt	nt	nt	nt	10	3
Total PCBs	62	nt	nt	nt	nt	nt	nt	nt	nt	130	1,000

<sup>1</sup> Screening levels from the ACOE *Dredged Material Evaluation Framework, Lower Columbia River Management Area (1998)*.

<sup>2</sup> ADEC 18 AAC 75 Method 2 cleanup levels are for migration to groundwater in the over 40 inches of precipitation per year zone. Migration to groundwater limits are likely over-conservative due to the probable lack of potable groundwater beneath the site due to the close proximity to seawater. The lead limit applied is for commercial/industrial land use.

<sup>3</sup> Sample WFT-1 was analyzed for the full VOC list by method SW8260B, with only acetone, methylene chloride, and naphthalene being detected. Acetone and methylene chloride are common laboratory contaminants, and the naphthalene concentration of 1.4 µg/kg was significantly below the ADEC Method 2 cleanup level of 38 mg/kg. Due to the lack of any significant VOC detections in WFT-1, successive laboratory tests were performed only for BTEX.

<sup>4</sup> Only the pesticides that were reported above the method detection limit are shown; the remaining pesticides compounds were not detected.

<sup>a</sup> VML – Validator Qualifier: The matrix spike recovery was below control limits. The qualified result may be biased low.

<sup>b</sup> J – Laboratory Qualifier: The result is an estimated concentration that is less than the MRL but greater than or equal to the MDL.

<sup>c</sup> P – Laboratory Qualifier: The confirmation criterion was exceeded. The relative percent difference is greater than 40% between the two analytical results.

<sup>d</sup> VSL – Validator Qualifier: The surrogate recovery was below control limits. The qualified result may be biased low.

**Bold** values indicate that one or both of the cleanup/screening limits have been exceeded.

µg/kg – Micrograms per kilogram

mg/kg – Milligrams per kilogram

ND – Not detected above MDL

nt – Not tested

Arsenic and chromium were detected at concentrations above the ADEC Method 2 cleanup levels in all samples analyzed. The reported concentrations of arsenic (6.67 to 10.5 milligrams per kilogram [mg/kg]) and chromium (28.9 to 44.1 mg/kg) did not vary substantially with depth or between sample locations. Additionally, dredging of the ferry terminal moorage basin in 1988 would have effectively removed any sediment impacted by historic military activities, which would be the only known potential source of metals contamination. It is believed that the reported concentrations of arsenic and chromium reflect naturally occurring conditions and are not indicative of the presence of contamination. None of the

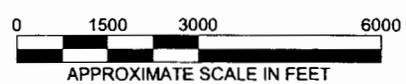
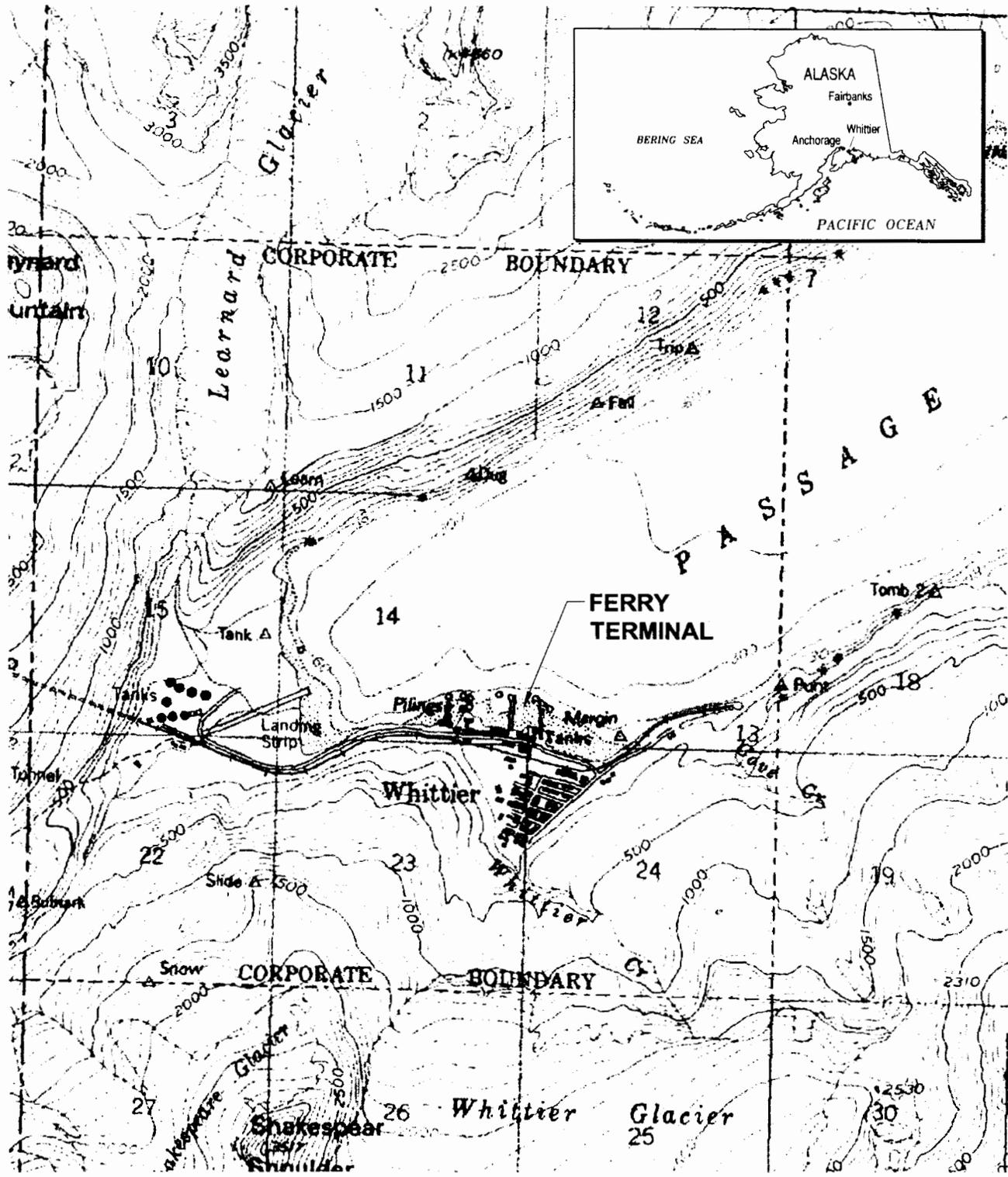
remaining analytes exceeded the *Dredged Material Evaluation Framework* screening levels or the ADEC 18 AAC 75 Method 2 cleanup levels.

## 6.0 REFERENCES

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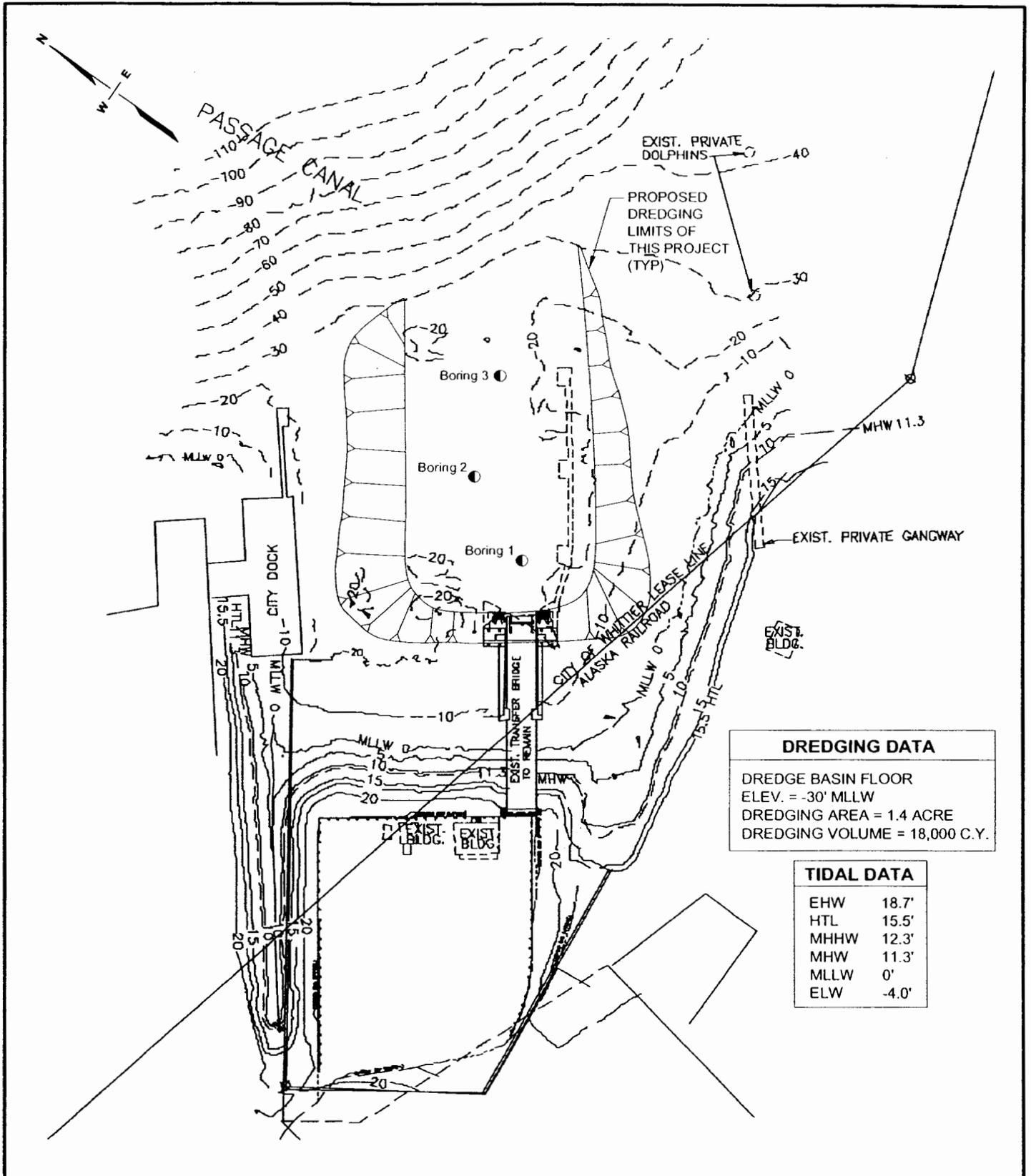
**FIGURES**

G:\PROJECTS\26219510\WHITTIER\_FERRY\_TERM.DWG; Revised Thu, 05 Dec 2002 - 9:39am; Printed Thu, 05 Dec 2002 - 9:47am



<b>DEPARTMENT OF TRANSPORTATION &amp; PUBLIC FACILITIES WHITTIER FERRY TERMINAL IMPROVEMENTS</b>	
<b>SITE LOCATION</b>	<b>URS</b>
<b>WHITTIER, ALASKA</b>	
JOB NO: 26219510 DATE: 27 NOVEMBER 2002	DRAWN: SRJ FILE: WHITTIER_FERRY_TERM.DWG
<b>FIGURE 1</b>	

G:\PROJECTS\26219510\WHITTIER\_FERRY\_TERM.DWG; Revised Thu, 22 May 2003 - 3:21pm; Printed Fri, 08 Aug 2003 - 10:27am



DREDGING DATA	
DREDGE BASIN FLOOR	ELEV. = -30' MLLW
DREDGING AREA	= 1.4 ACRE
DREDGING VOLUME	= 18,000 C.Y.

TIDAL DATA	
EHW	18.7'
HTL	15.5'
MHHW	12.3'
MHW	11.3'
MLLW	0'
ELW	-4.0'

**LEGEND**

● Approximate Boring Location



<b>DEPARTMENT OF TRANSPORTATION &amp; PUBLIC FACILITIES WHITTIER FERRY TERMINAL IMPROVEMENTS</b>	
<b>SEDIMENT BORING LOCATIONS</b>	
<b>WHITTIER, ALASKA</b>	
JOB NO. 26219510	DRAWN SRJ
DATE MAY 2003	FILE WHITTIER_FERRY_TERM.DWG



**FIGURE 2**

**ATTACHMENT A**

**BORING LOGS**

**Project: Whittier Ferry Terminal Improvements**

**Project Location: Whittier, Alaska**

**Project Number: 26219510**

**Log of Boring WFT-1**

Sheet 1 of 1

Date(s) Drilled	4/3/03	Logged By	M. Gray	Checked By	B. Craig
Drilling Method	Rotary Wash	Drill Bit Size/Type	2" Rock	Total Depth of Borehole	10.0 feet
Drill Rig Type	CME-75	Drilling Contractor	Discovery Drilling	Approximate Surface Elevation	-22.0 MLLW
Groundwater Level and Date Measured	N/A	Sampling Method(s)	Split Spoon	Hammer Data	340 lb, 30" drop
Borehole Completion	N/A	Comments	Elevation relative to mean lower low water (MLLW)		

Elevation feet	Depth, feet	SAMPLES				Graphic Log	MATERIAL DESCRIPTION	REMARKS AND WELL DETAILS
		Type	Number	Recovery				
0			WFT-1	48/48		(GP) POORLY GRADED SANDY GRAVEL, 10B 3/1 dark gray to black, fine- to coarse-grained sand, angular to subangular gravel to 1" size, shaly lithology, organic odor.	Fine sediment at surface	
2								
-25			WFT-3	24/18		Same as above; medium- to coarse-grained sand, less organic odor.	Composite sample collected	
4								
6				24/18		(SP) POORLY GRADED SAND with gravel, 10B 3/1 dark gray, fine- to coarse-grained sand, angular to subangular gravel to 1" size.		
-30			WFT-4	24/18		(GP) POORLY GRADED SANDY GRAVEL, 10B 3/1 dark gray to black, fine- to coarse-grained sand, angular to subangular gravel to 1.5" size.	Composite sample collected	
8								
10							Boring completed to -32' MLLW	
12								
-35								
14								
16								
-40								
18								
20								

Report: ENV\_125W\_ANCHORAGE; File: WHITTIER.GPJ; 4/10/2003 WFT-1



**Project: Whittier Ferry Terminal Improvements**

**Project Location: Whittier, Alaska**

**Project Number: 26219510**

**Log of Boring WFT-2**

Sheet 1 of 1

Date(s) Drilled	4/3/03	Logged By	M. Gray	Checked By	B. Craig
Drilling Method	Rotary Wash	Drill Bit Size/Type	2" Rock	Total Depth of Borehole	10.0 feet
Drill Rig Type	CME-75	Drilling Contractor	Discovery Drilling	Approximate Surface Elevation	-23.0 MLLW
Groundwater Level and Date Measured	N/A	Sampling Method(s)	Split Spoon	Hammer Data	340 lb, 30" drop
Borehole Completion	N/A	Comments	Elevation relative to mean lower low water (MLLW)		

Elevation feet	Depth, feet	SAMPLES			Graphic Log	MATERIAL DESCRIPTION	REMARKS AND WELL DETAILS
		Type	Number	Recovery			
0	0		WFT-2	48/48		(GP) POORLY GRADED SANDY GRAVEL, 10B 3/1 dark gray to black, medium- to coarse-grained sand, angular to subangular gravel to 1.5" size, shaly lithology, thin fine-grained sand lenses.	Kelp at surface
-25	2						Composite sample collected
	4		WFT-3	24/18		Same as above; gravel to 1" size.	Composite sample collected
	6			24/18		(SP) POORLY GRADED SAND with rare gravel, 10B 3/1 dark gray, fine- to medium-grained sand, angular to subangular gravel to 0.5" size.	
-30	8		WFT-4	24/12		(GP) POORLY GRADED SANDY GRAVEL, 10B 3/1 dark gray to black, very fine- to coarse-grained sand, angular to subangular gravel to 1" size.	Composite sample collected
	10						
	12						Boring completed to -33' MLLW
-35	14						
	16						
-40	18						
	20						

Report: ENV\_12SW\_ANCHORAGE; File: WHITTIER.GPJ; 4/10/2003 WFT-2



**Project: Whittier Ferry Terminal Improvements**

**Project Location: Whittier, Alaska**

**Project Number: 26219510**

**Log of Boring WFT-3**

Sheet 1 of 1

Date(s) Drilled	4/3/03	Logged By	M. Gray	Checked By	B. Craig
Drilling Method	Rotary Wash	Drill Bit Size/Type	2" Rock	Total Depth of Borehole	11.0 feet
Drill Rig Type	CME-75	Drilling Contractor	Discovery Drilling	Approximate Surface Elevation	-21.0 MLLW
Groundwater Level and Date Measured	N/A	Sampling Method(s)	Split Spoon	Hammer Data	340 lb, 30" drop
Borehole Completion	N/A	Comments	Elevation relative to mean lower low water (MLLW)		

Elevation feet	SAMPLES				Graphic Log	MATERIAL DESCRIPTION	REMARKS AND WELL DETAILS
	Depth, feet	Type	Number	Recovery			
0							
			WFT-2	48/36		(SP) POORLY GRADED GRAVELLY SAND, 10B 3/1 dark gray to black, fine- to coarse-grained sand, angular to subangular gravel to 0.75" size.	Very thin sediment layer with roots at surface Composite sample collected
2							
-25			WFT-3	24/18		(GP) POORLY GRADED SANDY GRAVEL, 10B 3/1 dark gray to black, fine- to coarse-grained sand, angular to subangular gravel to 1" size.	Composite sample collected
				24/18		(SP) POORLY GRADED SAND, 10B 3/1 dark gray, angular, very fine- to medium-grained.	
-30			WFT-4	24/24		Same as above; slightly coarser grained.	Composite sample collected
10							
12							Boring completed to -32' MLLW
-35							
14							
16							
18							
-40							
20							

Report: ENV\_125/W\_ANCHORAGE; File: WHITTIER.GPJ; 4/10/2003 WFT-3



**ATTACHMENT B**  
**ANALYTICAL RESULTS**

**Whittier Ferry Terminal Improvements Project  
Analytical Results**

Sample ID	Analyte	Method	Result	Units	MDL	MRL	Laboratory Flags	Validator Flags
WFT-1	Ammonia as Nitrogen	Plumb NH <sub>3</sub> S1	ND	mg/kg	0.2	0.4		
	Solids, Total	160.3M	78.9	Percent				
	Solids, Total Volatile Sulfide	160.4M PSEP	2.83 363	Percent mg/kg				VML
	Antimony, Total	200.8	0.09	mg/kg	0.03	0.03	N	
	Arsenic, Total	200.8	9.89	mg/kg	0.06	0.32		
	Cadmium, Total	200.8	0.07	mg/kg	0.01	0.03		
	Chromium, Total	200.8	44.1	mg/kg	0.1	0.63		
	Copper, Total	200.8	43.6	mg/kg	0.13	0.32		
	Lead, Total	200.8	18.1	mg/kg	0.02	0.03		
	Mercury, Total	SW7471A	0.03	mg/kg	0.01	0.02		
	Silver, Total	200.8	0.08	mg/kg	0.01	0.01		
	Zinc, Total	200.8	77.1	mg/kg	0.3	1.6		
	4,4'-DDD	SW8081A	ND	ug/kg	0.65	0.65	i	
	4,4'-DDE	SW8081A	ND	ug/kg	0.13	0.65		
	4,4'-DDT	SW8081A	ND	ug/kg	2.3	2.3	i	
	Aldrin	SW8081A	ND	ug/kg	0.12	0.65		
	alpha-BHC	SW8081A	ND	ug/kg	0.14	0.65		
	alpha-Chlordane	SW8081A	ND	ug/kg	0.13	0.65		
	beta-BHC	SW8081A	ND	ug/kg	0.28	0.65		
	delta-BHC	SW8081A	ND	ug/kg	0.16	0.65		
	Dieldrin	SW8081A	ND	ug/kg	1.3	1.3	i	
	Endosulfan I	SW8081A	ND	ug/kg	0.14	0.65		
	Endosulfan II	SW8081A	ND	ug/kg	0.65	0.65	i	
	Endosulfan Sulfate	SW8081A	ND	ug/kg	0.14	0.65		
	Endrin	SW8081A	1.1	ug/kg	0.16	0.65	P	
	Endrin Aldehyde	SW8081A	ND	ug/kg	0.50	0.65	i	
	Endrin Ketone	SW8081A	3.3	ug/kg	0.11	0.65	P	
	gamma-BHC (Lindane)	SW8081A	0.64	ug/kg	0.22	0.65	J	
	gamma-Chlordane	SW8081A	ND	ug/kg	0.65	0.65	i	
	Heptachlor	SW8081A	ND	ug/kg	0.21	0.65		
	Heptachlor Epoxide	SW8081A	ND	ug/kg	0.26	0.65		
	Methoxychlor	SW8081A	ND	ug/kg	0.28	0.65		
	Toxaphene	SW8081A	ND	ug/kg	78	78	i	
Aroclor 1016	SW8082	ND	ug/kg	0.82	10			
Aroclor 1221	SW8082	ND	ug/kg	0.82	20			
Aroclor 1232	SW8082	ND	ug/kg	0.82	10			
Aroclor 1242	SW8082	35	ug/kg	0.82	10			
Aroclor 1248	SW8082	ND	ug/kg	0.82	10			
Aroclor 1254	SW8082	ND	ug/kg	0.82	10			
Aroclor 1260	SW8082	27	ug/kg	0.82	10			
1,1,1,2-Tetrachloroethane	SW8260B	ND	ug/kg	0.65	6.3			
1,1,1-Trichloroethane (TCA)	SW8260B	ND	ug/kg	0.73	6.3			
1,1,2,2-Tetrachloroethane	SW8260B	ND	ug/kg	0.93	6.3			
1,1,2-Trichloroethane	SW8260B	ND	ug/kg	0.88	6.3			
1,1-Dichloroethane (1,1-DCA)	SW8260B	ND	ug/kg	0.99	6.3			
1,1-Dichloroethene (1,1-DCE)	SW8260B	ND	ug/kg	0.88	6.3			
1,1-Dichloropropene	SW8260B	ND	ug/kg	0.93	6.3			
1,2,3-Trichlorobenzene	SW8260B	ND	ug/kg	1.2	26			
1,2,3-Trichloropropane	SW8260B	ND	ug/kg	0.78	6.3			

**Whittier Ferry Terminal Improvements Project  
Analytical Results**

Sample ID	Analyte	Method	Result	Units	MDL	MRL	Laboratory Flags	Validator Flags
WFT-1	1,2,4-Trichlorobenzene	SW8260B	ND	ug/kg	0.98	26		
	1,2,4-Trimethylbenzene	SW8260B	ND	ug/kg	1.1	26		
	1,2-Dibromo-3-chloropropane (DBCP)	SW8260B	ND	ug/kg	1.1	26		
	1,2-Dibromoethane (EDB)	SW8260B	ND	ug/kg	1.1	26		
	1,2-Dichlorobenzene	SW8260B	ND	ug/kg	0.83	6.3		
	1,2-Dichloroethane (EDC)	SW8260B	ND	ug/kg	0.85	6.3		
	1,2-Dichloropropane	SW8260B	ND	ug/kg	0.92	6.3		
	1,3,5-Trimethylbenzene	SW8260B	ND	ug/kg	4.9	26		
	1,3-Dichlorobenzene	SW8260B	ND	ug/kg	0.90	6.3		
	1,3-Dichloropropane	SW8260B	ND	ug/kg	0.66	6.3		
	1,4-Dichlorobenzene	SW8260B	ND	ug/kg	1.1	6.3		
	2,2-Dichloropropane	SW8260B	ND	ug/kg	1.1	6.3		
	2-Butanone (MEK)	SW8260B	ND	ug/kg	11	26		
	2-Chlorotoluene	SW8260B	ND	ug/kg	0.93	26		
	2-Hexanone	SW8260B	ND	ug/kg	7.8	26		
	4-Chlorotoluene	SW8260B	ND	ug/kg	0.94	26		
	4-Isopropyltoluene	SW8260B	ND	ug/kg	0.92	26		
	4-Methyl-2-pentanone (MIBK)	SW8260B	ND	ug/kg	7.0	26		
	Acetone	SW8260B	15	ug/kg	13	63		J
	Benzene	SW8260B	ND	ug/kg	1.1	6.3		
	Bromobenzene	SW8260B	ND	ug/kg	1.1	6.3		
	Bromochloromethane	SW8260B	ND	ug/kg	0.66	6.3		
	Bromodichloromethane	SW8260B	ND	ug/kg	0.68	6.3		
	Bromoform	SW8260B	ND	ug/kg	0.83	6.3		
	Bromomethane	SW8260B	ND	ug/kg	1.1	6.3		
	Carbon Disulfide	SW8260B	ND	ug/kg	2.0	6.3		
	Carbon Tetrachloride	SW8260B	ND	ug/kg	0.77	6.3		
	Chlorobenzene	SW8260B	ND	ug/kg	0.89	6.3		
	Chloroethane	SW8260B	ND	ug/kg	0.99	6.3		
	Chloroform	SW8260B	ND	ug/kg	0.73	6.3		
	Chloromethane	SW8260B	ND	ug/kg	1.3	6.3		
	cis-1,2-Dichloroethene	SW8260B	ND	ug/kg	1.1	6.3		
	cis-1,3-Dichloropropene	SW8260B	ND	ug/kg	0.97	6.3		
	Dibromochloromethane	SW8260B	ND	ug/kg	0.77	6.3		
	Dibromomethane	SW8260B	ND	ug/kg	0.92	6.3		
	Dichlorodifluoromethane (CFC 12)	SW8260B	ND	ug/kg	0.89	6.3		
	Dichloromethane (Methylene Chloride)	SW8260B	3.3	ug/kg	1.3	13		J
	Ethylbenzene	SW8260B	ND	ug/kg	0.73	6.3		
	Hexachlorobutadiene	SW8260B	ND	ug/kg	0.96	26		
	Isopropylbenzene	SW8260B	ND	ug/kg	0.87	26		
m,p-Xylenes	SW8260B	ND	ug/kg	2.0	6.3			
Naphthalene	SW8260B	1.4	ug/kg	1.2	26		J	
n-Butylbenzene	SW8260B	ND	ug/kg	0.96	26			
n-Propylbenzene	SW8260B	ND	ug/kg	0.92	26			
o-Xylene	SW8260B	ND	ug/kg	0.88	6.3			
sec-Butylbenzene	SW8260B	ND	ug/kg	0.94	26			
Styrene	SW8260B	ND	ug/kg	0.93	6.3			
tert-Butylbenzene	SW8260B	ND	ug/kg	0.94	26			
Tetrachloroethene (PCE)	SW8260B	ND	ug/kg	0.40	6.3			
Toluene	SW8260B	ND	ug/kg	1.1	6.3			

**Whittier Ferry Terminal Improvements Project  
Analytical Results**

Sample ID	Analyte	Method	Result	Units	MDL	MRL	Laboratory Flags	Validator Flags
WFT-1	trans-1,2-Dichloroethene	SW8260B	ND	ug/kg	0.93	6.3		
	trans-1,3-Dichloropropene	SW8260B	ND	ug/kg	0.77	6.3		
	Trichloroethene (TCE)	SW8260B	ND	ug/kg	0.36	6.3		
	Trichlorofluoromethane (CFC 11)	SW8260B	ND	ug/kg	0.93	6.3		
	Vinyl Chloride	SW8260B	ND	ug/kg	0.79	6.3		
	C6 - C10 Gasoline Range Organics	AK 101	ND	mg/kg	2.6	25		
	C10 - C25 Diesel Range Organics	AK 102	37	mg/kg	15	50	J	
	C25 - C36 Residual Range Organics	AK 103	81	mg/kg	12	250	J	
WFT-2	Solids, Total	160.3M	86.9	Percent				
	Solids, Total Volatile	160.4M	2.58	Percent				
WFT-3	Solids, Total	160.3M	82.8	Percent				
	Solids, Total Volatile	160.4M	2.35	Percent				
WFT-5	Solids, Total	160.3M	87.2	Percent				
	Arsenic, Total	200.8	6.69	mg/kg	0.06	0.56		
	Chromium, Total	200.8	32.8	mg/kg	0.01	0.22		
	Benzene	SW8021B	ND	mg/kg	0.012	0.012		
	Ethylbenzene	SW8021B	ND	mg/kg	0.0299	0.030		
	m,p-Xylenes	SW8021B	ND	mg/kg	0.0528	0.0528		
	o-Xylene	SW8021B	ND	mg/kg	0.0287	0.030		
	Toluene	SW8021B	ND	mg/kg	0.0299	0.030		
	C6 - C10 Gasoline Range Organics	AK 101	ND	mg/kg	2.3	6.0		VSL
	C10 - C25 Diesel Range Organics	AK 102	ND	mg/kg	6.7	23		
WFT-6	Solids, Total	160.3M	90.3	Percent				
	Arsenic, Total	200.8	8.78	mg/kg	0.05	0.54		
	Chromium, Total	200.8	28.9	mg/kg	0.01	0.22		
	Benzene	SW8021B	ND	mg/kg	0.012	0.012		
	Ethylbenzene	SW8021B	ND	mg/kg	0.0288	0.0288		
	m,p-Xylenes	SW8021B	ND	mg/kg	0.0510	0.0510		
	o-Xylene	SW8021B	ND	mg/kg	0.0277	0.0277		
	Toluene	SW8021B	ND	mg/kg	0.0288	0.0288		
	C6 - C10 Gasoline Range Organics	AK 101	ND	mg/kg	2.3	4.4		
	C10 - C25 Diesel Range Organics	AK 102	ND	mg/kg	6.5	22		
WFT-7	Solids, Total	160.3M	87.5	Percent				
	Arsenic, Total	200.8	10.2	mg/kg	0.06	0.57		
	Chromium, Total	200.8	32.6	mg/kg	0.01	0.23		
	Benzene	SW8021B	ND	mg/kg	0.012	0.012		
	Ethylbenzene	SW8021B	ND	mg/kg	0.0298	0.0298		
	m,p-Xylenes	SW8021B	ND	mg/kg	0.0526	0.0526		
	o-Xylene	SW8021B	ND	mg/kg	0.0286	0.029		
	Toluene	SW8021B	ND	mg/kg	0.0298	0.0298		
	C6 - C10 Gasoline Range Organics	AK 101	ND	mg/kg	2.3	5.7		VSL
	C10 - C25 Diesel Range Organics	AK 102	ND	mg/kg	6.7	23		

**Whittier Ferry Terminal Improvements Project  
Analytical Results**

Sample ID	Analyte	Method	Result	Units	MDL	MRL	Laboratory Flags	Validator Flags
WFT-8	Solids, Total	160.3M	83.1	Percent				
	Arsenic, Total	200.8	10.5	mg/kg	0.06	0.58		
	Chromium, Total	200.8	40.2	mg/kg	0.01	0.23		
	Benzene	SW8021B	ND	mg/kg	0.013	0.013		
	Ethylbenzene	SW8021B	ND	mg/kg	0.0313	0.032		
	m,p-Xylenes	SW8021B	ND	mg/kg	0.0554	0.0554		
	o-Xylene	SW8021B	ND	mg/kg	0.0301	0.032		
	Toluene	SW8021B	ND	mg/kg	0.0313	0.032		
	C6 - C10 Gasoline Range Organics	AK 101	ND	mg/kg	2.5	6.4		VSL
C10 - C25 Diesel Range Organics	AK 102	ND	mg/kg	7.0	24			
WFT-9	Solids, Total	160.3M	82.4	Percent				
	Arsenic, Total	200.8	6.67	mg/kg	0.06	0.6		
	Chromium, Total	200.8	35.9	mg/kg	0.01	0.24		
	Benzene	SW8021B	ND	mg/kg	0.013	0.013		VSL
	Ethylbenzene	SW8021B	ND	mg/kg	0.0316	0.0316		VSL
	m,p-Xylenes	SW8021B	ND	mg/kg	0.0559	0.0559		VSL
	o-Xylene	SW8021B	ND	mg/kg	0.0304	0.031		VSL
	Toluene	SW8021B	ND	mg/kg	0.0316	0.0316		VSL
	C6 - C10 Gasoline Range Organics	AK 101	ND	mg/kg	2.5	6.2		VSL
C10 - C25 Diesel Range Organics	AK 102	ND	mg/kg	7.1	25			
Trip Blank	Benzene	SW8021B	ND	mg/kg	0.0115	0.023		
	Ethylbenzene	SW8021B	ND	mg/kg	0.030	0.12		
	m,p-Xylenes	SW8021B	ND	mg/kg	0.053	0.12		
	o-Xylene	SW8021B	ND	mg/kg	0.029	0.12		
	Toluene	SW8021B	ND	mg/kg	0.030	0.12		
	C6 - C10 Gasoline Range Organics	AK 101	ND	mg/kg	2.0	20		

MDL - Method detection limit

mg/kg - Milligrams per kilogram

MRL - Method reporting limit

ND - Not detected above the MDL

ug/kg - Micrograms per kilogram

i - The MDL/MRL has been elevated due to a chromatographic interference

J - The result is an estimated concentration that is less than the MRL but greater than or equal to the MDL

N - The matrix spike and/or matrix spike duplicate sample recovery is not within control limits.

P - The confirmation criterion was exceeded; relative percent difference is greater than 40%

VLL - The laboratory control sample recovery was below control limits; the result may be biased low

VML - The matrix spike recovery was below control limits; the result may be biased low

VSL - The surrogate recovery was below control limits; the result may be biased low

**Whittier Ferry Terminal Improvements Project  
Particle Size Results**

Sample ID	Sample Description	Depth	Grain Size	Sieve/Particle Size (mm)	Sieve Number	Percent	Validator Flags
WFT-1	Discrete grab sample from boring 1	0 to 4 feet below mudline	Gravel, Coarse	4.00	5	27.7	VJ
			Gravel	2.00	10	10.8	
			Sand, Very Coarse	1.00	18	12.9	
			Sand, Coarse	0.500	35	12.1	
			Sand, Medium	0.250	60	10.2	
			Sand, Fine	0.125	120	10.2	
			Sand, Very Fine	0.0625	230	7.41	
			Silt	0.0625-0.0039	NA	8.44	
			Clay	<0.0039	NA	1.63	
WFT-2	Composite sample from borings 2 and 3	0 to 4 feet below mudline	Gravel, Coarse	4.00	5	30.0	
			Gravel	2.00	10	12.4	
			Sand, Very Coarse	1.00	18	13.1	
			Sand, Coarse	0.500	35	15.6	
			Sand, Medium	0.250	60	14.5	
			Sand, Fine	0.125	120	8.66	
			Sand, Very Fine	0.0625	230	3.11	
			Silt	0.0625-0.0039	NA	3.37	
			Clay	<0.0039	NA	1.68	
WFT-3	Composite sample from borings 1, 2 and 3	4 feet below mudline to -30 feet mean lower low water (MLLW)	Gravel, Coarse	4.00	5	16.2	
			Gravel	2.00	10	13.2	
			Sand, Very Coarse	1.00	18	16.3	
			Sand, Coarse	0.500	35	17.7	
			Sand, Medium	0.250	60	16.5	
			Sand, Fine	0.125	120	10.7	
			Sand, Very Fine	0.0625	230	3.72	
			Silt	0.0625-0.0039	NA	4.35	
			Clay	<0.0039	NA	2.09	

mm - Millimeters

NA - Not applicable

VJ - The sample result should be considered an estimate