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# Memorandum

**To:** Anne Summers and Marcel Hermans – Port of Portland

**From:** Mike Palermo – Palermo Consulting, Inc.; Ben Hung and Todd Thornburg – Anchor Environmental, L.L.C.

**CC:** Krista Koehl – Port of Portland; Tom Schadt, John Verduin, PE, and Elizabeth Appy – Anchor Environmental, L.L.C.

**Date:** May 25, 2007

**Re:** Proposed Sampling and Analysis Plan for Additional Modified Elutriate Testing
Port of Portland—Terminal 4 Early Action

This memorandum presents the proposed sampling and analysis plan (SAP) to conduct additional modified elutriate testing (MET) on sediments collected in Slip 3 and Berth 414. Based on discussions with the U.S. Environmental Protection Agency (EPA), Mike Palermo Consulting, Inc. and Anchor Environmental L.L.C. (Anchor) have reviewed the previously completed MET results and methodology as reported in the 2004 *Terminal 4 Early Action Characterization Report* (Blasland, Bouck & Lee, Inc.; BBL 2005; sample T4-CM2-Met) and have recommended that an additional MET be performed with material collected from representative areas within the Slip 3 and Berth 414 dredge prism. These recommendations were based in part on the fact that the source material used in the first analysis was a composite that included sediments outside of the proposed dredge prism, including portions of Wheeler Bay and Berth 414. The composite was prepared in advance of the selection of the remedial alternative and before the areas specified for dredging had been finalized.

The MET will be completed in accordance with the procedure developed by the U.S. Army Corps of Engineers Waterways Experiment Station, as described in Appendix B of the Upland Testing Manual (USACE 2003). Other sample handling and analysis procedures will follow previously approved procedures specified in the 2004 *Terminal 4 Early Action Engineering Evaluation/Cost Analysis Work Plan* (BBL 2004), Appendix A, Field Sampling Plan and Quality Assurance Project Plan. Analytical Resources Inc. (ARI) will perform the elutriate testing and laboratory analysis; analytical parameters will include target metals, semivolatile organics, pesticides, and polychlorinated biphenyls (PCBs).

## Sampling and Processing Procedures

**Bulk Sediment Compositing**. One bulk sediment composite sample will be prepared from archived sediment core intervals representative of the dredge prism. The archived intervals were taken during pre-construction sampling in July 2006 and sampling for the sheetpile wall during January 2007. Figure 1 depicts the locations of the cores from which sample intervals are available for preparing a bulk sediment composite sample for the MET. Intervals from these cores were archived in a freezer at ARI; thus, holding times were suspended.

Aliquots from each sample interval will be combined based on the approximate volume of the dredge prism that each aliquot represents. The volume assigned to each sample is a function of the total depth of the sampling interval and the area of the Thiessen polygon associated with each core. This volume-weighted compositing scheme will ensure a statistically based bulk sediment sample is created that is representative of the bulk sediment characteristics of the dredge prism. Table 1 1ists each sample interval and the amount of material from that sample interval that will be used in the preparation of the bulk sediment composite.

The volume-weighted average dredge prism concentrations based on all available Engineering Evaluation/Cost Analysis (EE/CA) and remedial design (RD) samples are presented in Table 2 and Appendix B. Figure 2 depicts the locations of the cores used to develop these statistics. The chemistry of the bulk sediment sample used to prepare the MET is expected to be comparable to the mean concentrations in the Terminal 4 dredge prism. The bulk sediment sample used to prepare the MET will also be analyzed directly, as described in the next section.

The ARI Sample Processing Standard Operating Procedure (SOP; ARI SOP 1128) is presented in Appendix A. Each of the archived sample intervals were thoroughly homogenized in the field prior to placing the sediments in the sample jars. Thus, sample aliquots can be taken directly from the jars without splitting. However, once all aliquots have been combined, the bulk sediment composite sample will be thoroughly homogenized for the MET according to the procedures in Appendix A.

**Site Water Collection**. Site water will be collected from Slip 3 to be used in the MET analysis. Approximately 5 gallons of river water will be collected from the water column in Slip 3. This

volume will be sufficient to supply both the MET test and analysis of the river water itself. The river water will be collected from a few feet below the surface of the water column using a peristaltic or purge pump. As the sample is collected, field notes of the sampling activities and observations will be maintained in a project notebook. Included in this documentation will be the following:

- Positioning information, including coordinates and/or locations relative to shoreline landmarks
- Date and time of sampling
- Chronological occurrence of events during sampling operations
- Deviations, if any, from the specifications of this SAP

The river water will be prepared for shipping to the laboratory. Containers containing river water will be transported to the laboratory under proper chain-of-custody procedures. The shipping container will be clearly labeled with sufficient information (name of project, time and date container was sealed, person sealing the container, and consultant's office address) to enable positive identification.

### Laboratory Analysis

ARI in Tukwila Washington will perform the MET, as well as the analysis of the bulk sediment composite, site water, and elutriate water. The sediment composite will be homogenized manually or mechanically by ARI until both color and texture are uniform per the attached Sample Processing SOP. Excess sediment from the MET composite will be archived for future analysis if needed.

**Modified Elutriate Test.** The MET will be completed in general accordance with the procedure developed by the U.S. Army Corps of Engineers Waterways Experiment Station, as described in Appendix B of the Upland Testing Manual (USACE 2003). A water-to-sediment ratio of 4-to-1 will be used to prepare the MET slurry, consistent with both the anticipated characteristics of the hydraulic dredge inflow to the CDF, as well as the slurry concentration recommended in the MET test procedure.

All constituents in the MET elutriate will be analyzed on both total and dissolved bases. Metals will be filtered through a 0.45 micron filter. To avoid adsorption onto the filter surface,

dissolved organics will not be filtered but instead will be prepared by centrifugation, consistent with recommended MET test procedures. Centrifugation procedures are described in ARI SOP 1114, which is a modification of the SOP for porewater extraction (see Appendix A).

**Bulk Sediment Testing.** ARI will perform the following analyses on the composite bulk sediment sample:

- Total organic carbon
- Moisture content
- Metals
- Semivolatile organics
- Pesticides
- PCBs

The specific analytes, methods, reporting limits, and detection limits for bulk sediment are provided in Table 3.

**Site Water and MET Elutriate Water.** ARI will perform the following analyses on the site water and the elutriate samples:

- Total suspended solids
- Metals
- Semivolatile organics
- Pesticides
- PCBs

The specific analytes, methods, reporting limits and detection limits for water are provided in Table 4. The site water will be analyzed for total and dissolved metals, and total organics only. Both total and dissolved fractions of the MET elutriate will be analyzed for all constituents, as discussed previously.

## Use of the Data

The MET is intended to simulate the quality of water discharged as effluent from a CDF during active filling operations. The results will be used to inform short-term groundwater modeling

of the Confined Disposal Facility (CDF), as well as to evaluate potential impacts to surface water from any discharge over the weir from the CDF.

## References

BBL. 2005. *Terminal 4 Early Action Engineering Evaluation/Cost Analysis, Public Review Draft.* Report prepared for Port of Portland, Portland, Oregon.

BBL. 2004. *Work Plan, Terminal 4 Early Action Engineering Evaluation/Cost Analysis.* Report prepared for Port of Portland, Portland, Oregon. February 23.

USACE. 2003. *Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore, or Upland Confined Disposal Facilities – Testing Manual.* US Army Corps of Engineers. January 2003.

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**Table 1**
**Sediment Compositng Plan**

| Sample Location | Sample Interval | Sample Volume (Cubic Feet) | Mass of Sample in Composite (g) [1] |
|---|---|---|---|
| T4-B414-01 | A | 17,276 | 100 |
| | B | 17,276 | 100 |
| T4-B414-02 | A | 10,842 | 100 |
| | B | 10,842 | 100 |
| T4-S3-01 | A | 12,141 | 100 |
| | B | 12,141 | 100 |
| | C | 12,141 | 100 |
| | D | 12,141 | 100 |
| | E | 12,141 | 100 |
| | F | 12,141 | 100 |
| | G | 12,141 | 100 |
| | H | 12,141 | 100 |
| | J | 12,141 | 100 |
| | K | 12,141 | 100 |
| T4-S3-02 | A | 21,328 | 150 |
| | B | 21,328 | 150 |
| | C | 21,328 | 150 |
| | D | 21,328 | 150 |
| | E | 21,328 | 150 |
| | F | 21,328 | 150 |
| | G | 21,328 | 150 |
| | H | 21,328 | 150 |
| | J | 21,328 | 150 |
| T4-S3-03 | A | 25,672 | 150 |
| | B | 25,672 | 150 |
| | C | 25,672 | 150 |
| | D | 25,672 | 150 |
| | E | 25,672 | 150 |
| | F | 25,672 | 150 |
| | G | 25,672 | 150 |
| T4-S3-04 | A | 16,096 | 100 |
| | B | 16,096 | 100 |
| | C | 16,096 | 100 |
| | D | 16,096 | 100 |
| | E | 16,096 | 100 |
| T4-S3-05 | A | 32,676 | 200 |
| | B | 32,676 | 200 |
| | C | 32,676 | 200 |
| | D | 32,676 | 200 |
| | E | 32,676 | 200 |
| | F | 32,676 | 200 |
| | G | 32,676 | 200 |
| | H | 32,676 | 200 |
| | J | 32,676 | 200 |
| T4-S3-06 | A | 55,121 | 250 |
| | B | 55,121 | 250 |
| T4-S3-07 | A | 58,004 | 250 |
| | B | 58,004 | 250 |
| | C | 58,004 | 250 |
| | D | 58,004 | 250 |
| | E | 58,004 | 250 |

**Table 1**
**Sediment Compositng Plan**

| Sample Location | Sample Interval | Sample Volume (Cubic Feet) | Mass of Sample in Composite (g) [1] |
|---|---|---|---|
| T4-S3-08 | A | 14,248 | 100 |
| | B | 14,248 | 100 |
| | C | 14,248 | 100 |
| T4-B411-01 | -43 to -44 | 9,368 | 50 |
| | -44 to -45 | 9,368 | 50 |
| T4-B411-02 | -42 to -43 | 5,675 | 50 |
| | -43 to -44 | 5,675 | 50 |
| T4-B411-06 | A | 24,970 | 150 |
| | B | 24,970 | 150 |
| | C | 24,970 | 150 |
| **Total Mass of Composite** | | | **8800** |

Notes:

1. Volume-Weighted Compositing Scheme

| Cubic Feet | Aliquot Mass (g) |
|---|---|
| < 10,000 | 50 g |
| 10,000 to 20,000 | 100 g |
| 20,000 to 30,000 | 150 g |
| 30,000 to 40,000 | 200 g |
| > 50,000 | 250 g |

**Table 2**
**Bulk Sediment Quality, Terminal 4 Dredge Prism**

| Parameter | PEC | TEC | EECA Bulk Sediment Composite (T4-CM2) | | T4 Dredge Prism Mean[1] |
|---|---|---|---|---|---|
| **Metals** | | | **(mg/kg)** | | **(mg/kg)** |
| Arsenic | 33.0 | 9.79 | 2.5 | | 6.1[2] |
| Cadmium | 4.98 | 0.99 | 0.3 | | 1.6[2] |
| Chromium | 111 | 43.4 | 17 | | 20[2] |
| Copper | 149 | 31.6 | 23 | | 43[2] |
| Lead | 128 | 35.8 | 23 | J | 184 |
| Mercury | 1.06 | 0.18 | 0.06 | | 0.07[2] |
| Nickel | 48.6 | 22.7 | 18 | J | 21[2] |
| Silver | --[3] | -- | 0.13 | U | 0.4[2] |
| Zinc | 459 | 121 | 79 | J | 250 |
| **Semivolatile Organics** | | | **(µg/kg)** | | **(µg/kg)** |
| Naphthalene | 561 | 176 | 97 | | 312 |
| Acenaphthylene | -- | -- | 10 | | 61 |
| Acenaphthene | -- | -- | 170 | | 1,025 |
| Fluorene | 536 | 77.4 | 110 | | 566 |
| Phenanthrene | 1170 | 204 | 590 | | 4,259 |
| Anthracene | 845 | 57.2 | 130 | | 931 |
| Fluoranthene | 2230 | 423 | 910 | | 8,352 |
| Pyrene | 1520 | 195 | 1,100 | | 7,454 |
| Benz(a)anthracene | 1050 | 108 | 580 | | 4,948 |
| Chrysene | 1290 | 166 | 690 | | 5,656 |
| Benzo(b)fluoranthene | -- | -- | 700 | | 6,000 |
| Benzo(k)fluoranthene | -- | -- | 600 | | 5,191 |
| Benzo(a)pyrene | 1450 | 150 | 750 | | 6,148 |
| Total PAHs | 22800 | 1610 | 6,437 | | 50,851 |
| **Pesticides** | | | **(µg/kg)** | | **(µg/kg)** |
| 4,4' DDD | -- | -- | 1.9 | | 6.8[2] |
| 4,4' DDE | -- | -- | 2.1 | | 3.7[2] |
| 4,4' DDT | -- | -- | 2.5 | | 9.8[2] |
| Total DDTs | 572 | 5.28 | 6.5 | | 16.3[2] |
| **PCBs** | | | **(µg/kg)** | | **(µg/kg)** |
| Total PCBs | 676 | 59.8 | 25 | | 92[2] |

Notes:

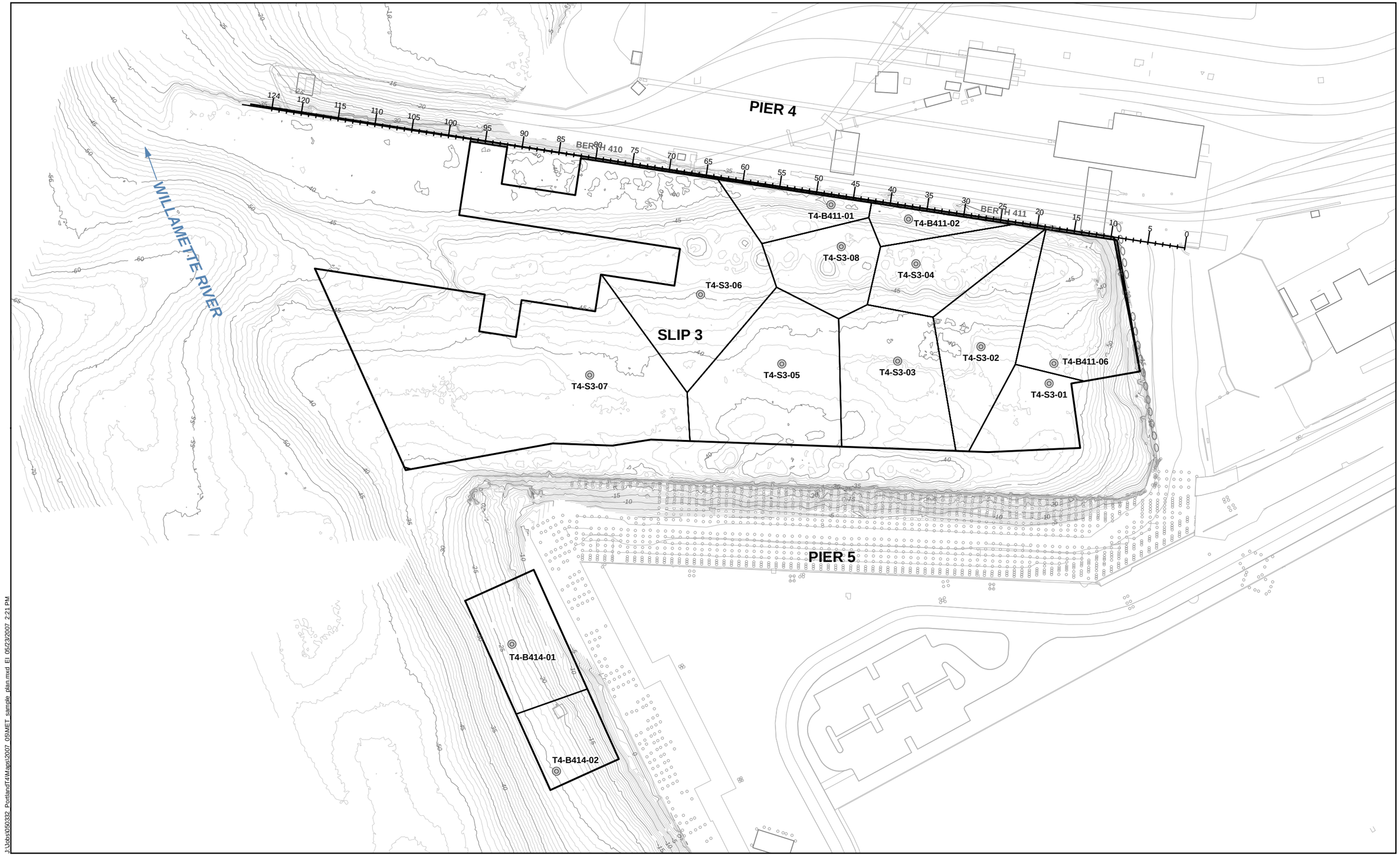
1. Volume-weighted mean based on core interval length and Thiessen polygon area, unless otherwise noted
2. Unweighted mean value; these constituents were analyzed on a smaller subset of EE/CA and RD data
3. "--" indicates there is no PEC or TEC for the parameter

**Table 3**
**Bulk Sediment Analytical Parameters, Methods, Method Reporting Limits, and Method Detection Limits**

| Parameter | Analytical Method | Method Detection Limit | Method Reporting Limit |
|---|---|---|---|
| **Conventionals** | | **Percent** | **Percent** |
| Total organic carbon | Plumb, 1981 | 41 | 200 |
| Moisture Content | Method 160.3 | -- | -- |
| **Metals** | | **(mg/kg)** | **(mg/kg)** |
| Arsenic | 6020 | 0.04 | 0.2 |
| Cadmium | 6020 | 0.02 | 0.2 |
| Chromium | 6020 | 0.12 | 0.5 |
| Copper | 6020 | 0.21 | 0.5 |
| Lead | 6020 | 0.36 | 1 |
| Mercury | 7471 | 0.005 | 0.05 |
| Nickel | 6020 | 0.16 | 0.5 |
| Silver | 6020 | 0.01 | 0.2 |
| Zinc | 6020 | 3.57 | 4 |
| **Semivolatile Organics** | | **(µg/kg)** | **(µg/kg)** |
| Naphthalene | 8270-SIM | 2.74 | 6.7 |
| 2-Methylnaphthalene | 8270-SIM | 3.34 | 6.7 |
| Acenaphthylene | 8270-SIM | 2.47 | 6.7 |
| Acenaphthene | 8270-SIM | 4.29 | 6.7 |
| Fluorene | 8270-SIM | 3.58 | 6.7 |
| Phenanthrene | 8270-SIM | 4.47 | 6.7 |
| Anthracene | 8270-SIM | 3.25 | 6.7 |
| Fluoranthene | 8270-SIM | 3.4 | 6.7 |
| Pyrene | 8270-SIM | 3.46 | 6.7 |
| Benz(a)anthracene | 8270-SIM | 6.18 | 6.7 |
| Chrysene | 8270-SIM | 2.74 | 6.7 |
| Benzo(b)fluoranthene | 8270-SIM | 6.02 | 6.7 |
| Benzo(k)fluoranthene | 8270-SIM | 5.88 | 6.7 |
| Benzo(a)pyrene | 8270-SIM | 2.39 | 6.7 |
| Indeno(1,2,3-cd)pyrene | 8270-SIM | 3.39 | 6.7 |
| Dibenz(a,h)anthracene | 8270-SIM | 5.59 | 6.7 |
| Benzo(g,h,i)perylene | 8270-SIM | 3.45 | 6.7 |
| Dimethyl phthalate | 8270-SIM | 1.59 | 13.4 |
| Diethyl phthalate | 8270-SIM | 4.255 | 13.4 |
| Di-n-butyl phthalate | 8270-SIM | 2.95 | 13.4 |
| Butylbenzyl phthalate | 8270-SIM | 0.885 | 13.4 |
| Bis(2-ethylhexyl) phthalate | 8270-SIM | 11.9 | 13.4 |
| Di-n-octyl phthalate | 8270-SIM | 3.4 | 13.4 |
| **Pesticides** | | **(µg/kg)** | **(µg/kg)** |
| 4,4'-DDE | 8081A | 0.548 | 2 |
| 4,4'-DDD | 8081A | 0.417 | 2 |
| 4,4'-DDT | 8081A | 0.646 | 2 |
| 2,4'-DDE | 8081A | 0.917 | 2 |
| 2,4'-DDD | 8081A | 0.921 | 2 |
| 2,4'-DDT | 8081A | 1.261 | 2 |
| **PCBs** | | **(µg/kg)** | **(µg/kg)** |
| Aroclor 1016 | 8082 | 1.12 | 4 |
| Aroclor 1221 | 8082 | - | 4 |
| Aroclor 1232 | 8082 | - | 4 |
| Aroclor 1242 | 8082 | - | 4 |
| Aroclor 1248 | 8082 | - | 4 |
| Aroclor 1254 | 8082 | - | 4 |
| Aroclor 1260 | 8082 | 1.33 | 4 |
| Aroclor 1262 | 8082 | - | 4 |
| Aroclor 1268 | 8082 | - | 4 |

**Table 4**
**Site Water and Elutriate Analytical Parameters, Methods, Method Reporting Limits, and Method Detection Limits**

| Parameter | Analytical Method | Method Detection Limit | Method Reporting Limit |
|---|---|---|---|
| **Conventionals (mg/L)** | | | |
| Total Suspended Solids | EPA 160.2 | - | 1 |
| **Metals (µg/L)** | | | |
| Arsenic | EPA 200.8 | 0.05 | 0.2 |
| Cadmium | EPA 200.8 | 0.02 | 0.2 |
| Chromium | EPA 200.8 | 0.03 | 0.5 |
| Copper | EPA 200.8 | 0.12 | 0.5 |
| Lead | EPA 200.8 | 0.15 | 1 |
| Mercury | EPA 7470-LL | 0.001 | 0.02 |
| Nickel | EPA 200.8 | 0.15 | 0.5 |
| Silver | EPA 200.8 | 0 | 0.2 |
| Zinc | EPA 200.8 | 1.05 | 4.0 |
| **Semivolatile Organics (µg/L)** | | | |
| Naphthalene | 8270-SIM | 0.029 | 0.1 |
| 2-Methylnaphthalene | 8270-SIM | 0.024 | 0.1 |
| Acenaphthylene | 8270-SIM | 0.022 | 0.1 |
| Acenaphthene | 8270-SIM | 0.024 | 0.1 |
| Fluorene | 8270-SIM | 0.026 | 0.1 |
| Phenanthrene | 8270-SIM | 0.025 | 0.1 |
| Anthracene | 8270-SIM | 0.023 | 0.1 |
| Fluoranthene | 8270-SIM | 0.02 | 0.1 |
| Pyrene | 8270-SIM | 0.036 | 0.1 |
| Benz(a)anthracene | 8270-SIM | 0.024 | 0.1 |
| Chrysene | 8270-SIM | 0.039 | 0.1 |
| Benzo(b)fluoranthene | 8270-SIM | 0.044 | 0.1 |
| Benzo(k)fluoranthene | 8270-SIM | 0.056 | 0.1 |
| Benzo(a)pyrene | 8270-SIM | 0.041 | 0.1 |
| Indeno(1,2,3-cd)pyrene | 8270-SIM | 0.48 | 0.1 |
| Dibenz(a,h)anthracene | 8270-SIM | 0.046 | 0.1 |
| Benzo(g,h,i)perylene | 8270-SIM | 0.52 | 0.1 |
| Dimethyl phthalate | 8270-SIM | 0.023 | 0.1 |
| Diethyl phthalate | 8270-SIM | 0.083 | 0.1 |
| Di-n-butyl phthalate | 8270-SIM | 0.112 | 0.2 |
| Butylbenzyl phthalate | 8270-SIM | 0.022 | 0.1 |
| Bis(2-ethylhexyl) phthalate | 8270-SIM | 0.194 | 0.2 |
| Di-n-octyl phthalate | 8270-SIM | 0.046 | 0.1 |
| **Pesticides (µg/L)** | | | |
| 4,4'-DDE | 8081A-LL | 0.000337 | 0.0005 |
| 4,4'-DDD | 8081A-LL | 0.000305 | 0.0005 |
| 4,4'-DDT | 8081A-LL | 0.000357 | 0.0005 |
| 2,4'-DDE | 8081A-LL | - | 0.0005 |
| 2,4'-DDD | 8081A-LL | - | 0.0005 |
| 2,4'-DDT | 8081A-LL | - | 0.0005 |
| **PCBs (µg/L)** | | | |
| Aroclor 1016 | 8082-LL | 0.002 | 0.01 |
| Aroclor 1221 | 8082-LL | - | 0.01 |
| Aroclor 1232 | 8082-LL | - | 0.01 |
| Aroclor 1242 | 8082-LL | - | 0.01 |
| Aroclor 1248 | 8082-LL | - | 0.01 |
| Aroclor 1254 | 8082-LL | - | 0.01 |
| Aroclor 1260 | 8082-LL | 0.0014 | 0.01 |
| Aroclor 1262 | 8082-LL | - | 0.01 |
| Aroclor 1268 | 8082-LL | - | 0.01 |

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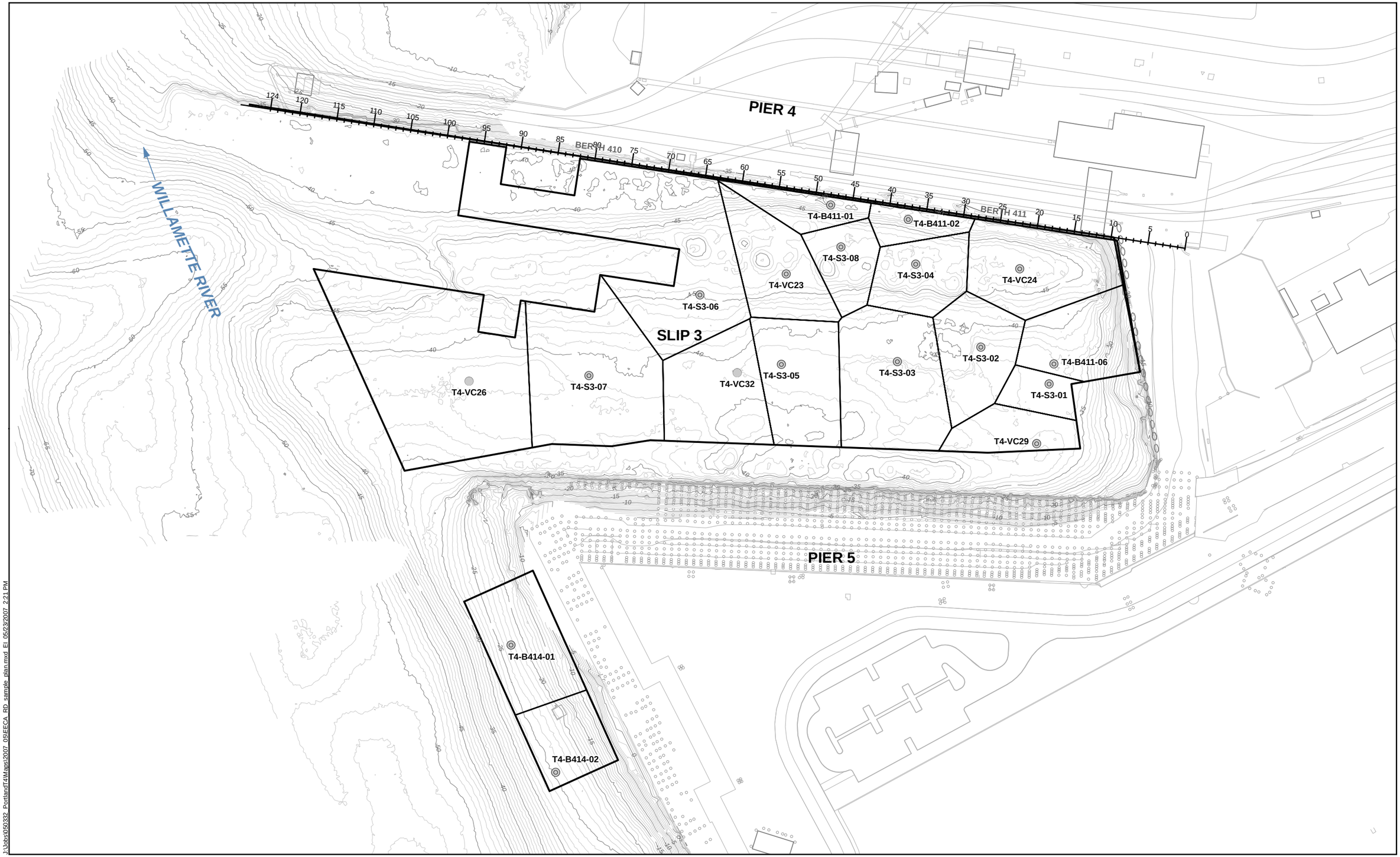
ANCHOR ENVIRONMENTAL, L.L.C.

0 120
Scale in Feet
1 inch equals 120 feet

Bathymetry and base map from Port of Portland, 2006.
Bathymetric elevations in feet NGVD.

**Figure 1**
MET Sample Locations
Terminal 4 Early Action MET Sampling and Analysis Plan
Portland, Oregon

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ANCHOR ENVIRONMENTAL, L.L.C.

0 120
Scale in Feet
1 inch equals 120 feet

Bathymetry and base map from Port of Portland, 2006.
Bathymetric elevations in feet NGVD.

**Figure 2**
EE/CA and RD Sample Locations
Terminal 4 Early Action MET Sampling and Analysis Plan
Portland, Oregon

# Standard Operating Procedure

## Sample Processing
## ASTM

## SOP 1128
## Revision 001

## Revision Date: 5/21/07
## Effective Date: 5/21/07

Prepared By:

_____

Approvals:

_____
Laboratory / Section Manager

_____
Quality Assurance

# Annual Review

| | |
|---|---|
| SOP Number: | 1128S |
| Title: | Sample Preparation |
| Revision: | 001 |
| Revision Date: | 5/21/07 |
| Effective date: | 5/22/07 |

The ARI employee named below certifies that this SOP is accurate, complete and requires no revisions.

| Reviewer's Name | Reviewer's Signature | Date |
|---|---|---|
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## 1.0 Scope and Application

This procedure describes methods, materials, equipment, and special conditions required to prepare samples for testing. The procedure applies to sample preparation for all testing in the Geotechnical laboratory.

## 2.0 Materials and Equipment

2.1 RIFFLE SAMPLERS -- A device with at least 12 chutes to divide a sample into two parts. It usually includes at least two pans to catch the soil and a soil pan from which the soil is poured over the chutes. The sampler may have fixed width chutes, such as ¾ inch or 1 inch, or it may have adjustable width chutes.

2.2 STAINLESS STEEL OR HDPE BOWLS AND BINS – Large containers in which to mix a sample. Depending on the job, these may be cleaned containers or not.

2.3 SHOVEL – A blunt nosed or flat shovel used for scooping soil of a flat surface.

2.4 SPOONS, SCOOPS AND TROWELS – Hand tools to mix and transfer soil.

2.5 LABORATORY HOODS – Exhaust hoods for working with dusty or hazardous soils.

2.6 LABORATORY MIXER – This can be either a bench top “Kitchen Aide” type mixer or a mixer paddle on a motor, used to mix samples.

2.7 MOTAR and RUBBER TIPPED PESTLE

2.13 DEIONIZED WATER

## 3.0 Procedure

3.1 AIR DRYING A SAMPLE

3.1.1 Remove samples from storage and verify ID numbers. Notify supervisor of any ID discrepancies. Label and weigh a tare pan for each sample..

3.1.2 Homogenize each sample incorporating any freestanding liquid. Remove the entire sample from its container and place in a bowl or bin. Take an aliquot of the sample for as-received moisture content, according to SOP 1103. Spread the reduced sample in the pan to air dry at room temperature. The sample can be mixed periodically during this period to facilitate drying, or placed in a laboratory hood so that the air flow will speed the process.

3.2 SAMPLE SIZE REDUCTION USING A RIFFLE SAMPLER

3.2.1 Remove sample from refrigerator and check ID numbers. Notify supervisor of any ID discrepancies.

3.2.2 Homogenize sample incorporating any freestanding liquid. This may be done using bowls and spoons or a mechanical mixer, depending on the sample size and end use of the sample.

3.2.3 A wet sample (more than damp), can’t be used in a riffle splitter. Air dry the sample before using the riffle sampler.

3.2.4 Select a sampler based on the largest particle in the sample. The sampler should have chutes that are larger than the largest particle present. If the sampler will fit, set up the riffle sampler in a hood, with two pans underneath and in position to receive the sample splits.

3.2.5 Slowly pour the sample into the hopper of the sampler and let the soil fall through the chutes and into the receiving pans. Continue with another portion until the entire sample has passed through the sampler at least once. Randomly select one receiving pan to continue with, and set the soil in the other pan aside. Pour the soil through the sampler as many times as necessary to reduce the sample volume to the desired size.

3.3 SAMPLE SIZE REDUCTION BY QUARTERING

3.3.1 Place the sample on a clean, smooth and flat surface such as the floor for large sample or on a bench top or in a bin.

3.3.2 Mix the soil by scooping it into a conical pile. Using the shovel, flatten the top of the pile down and scoop from the edges toward the middle and rebuild the pile. Continue until the material is thoroughly mixed. If the soil is too dry, segregation may occur during this process. If allowed by the test parameters, add DI water to moisten the soil and reduce dust and segregation.

3.3.3 Flatten the pile as before, and scribe two lines at 90 degrees in the soil. Using great care, remove the soil from opposite quadrants and set aside. Remix the remaining soil and repeat the process until the remaining soil volume is appropriate for the testing requested.

3.4 SAMPLE COMPOSITING

3.4.1 When multiple samples must be combined into a single larger sample, they must be adequately mixed together. Usually a compositing scheme is prepared by the client that describes the amount of each sample to be used in preparing the composite sample. It is preferred that the compositing be on a volume basis, as this does not require taking moisture contents on each individual sample. Verify that adequate sample volumes are available before beginning the process.

3.4.2 Each individual sample must be adequately homogenized prior to beginning. This may require adding DI water to prevent excessive dust or segregation of particles. It may also require the removal of oversize particles. Record the type (wood, rock, shell, etc.) and amount of oversized material that is removed. Mix the sample using either a spoon or mechanical mixer. A minimum of 50 spoon strokes or 30 sec of mechanical mixing is required.

3.4.3 Once the individual samples are ready to go, select an adequately sized bowl or bin for the composite. Place each individual aliquot in the compositing bowl. Thoroughly mix the composite using either a spoon or mechanical mixer. After the composite looks thoroughly mixed, mix it for an additional 200 spoon strokes or 2 minutes with a mechanical mixer. Once the mixing is complete, take an aliquot of soil for moisture content, per SOP 1103. Spoon the composite sample into either the test apparatus or into storage jars.

3.4.4 If the sample is to be used for chemical tests, the composite may need to be prepared in an anaerobic chamber to prevent oxidation of the sediment and chemical species. Prepare the chamber as described in SOP 1114.

## 4.0 CALCULATIONS

The only calculations for this SOP are related to compositing schemes and are project specific. Sample calculations will be provided with the final report.

## 5.0 SAFETY

5.1 LAB WEAR – Lab wear including a lab coat, safety glasses or goggles, dust masks, and gloves should be worn at all times.

5.2 FINE DUST – Care should be taken not to inhale fine dust while processing a sample, use a dust mask if necessary. If samples are known to be hazardous, sample handling shall be done under a hood or in a chamber.

## 6.0 CORRECTIVE ACTION

6.1 Note any sample inconsistencies, excluded material or anomalous findings on the project data sheets or a “green sheet.”

## 7.0 REPORT

The report shall include the following:

7.1 Maximum size of particles encountered.
7.2 Description of samples including any excluded material.
7.3 The type mixer used, hand or mechanical and the approximate total mixing time.
7.4 The type of sample reduction used (riffle sampler or quartering).
7.5 The use of any water to reduce dust or segregation of particles.

## 8.0 REFERENCES

ASTM C-702, “Standard Practice for Reducing Samples of Aggregate to Testing Size,” Annual Book of ASTM Standards, American Society for Testing and Materials, West Conshohocken, Pennsylvania.

ASTM C-75, “Practice for Sampling Aggregates,” Annual Book of ASTM Standards, American Society for Testing and Materials, West Conshohocken, Pennsylvania.

# Pore water extraction for TBT

## 1.0 PURPOSE AND SCOPE

This procedure describes the method, materials, equipment, and special conditions required to extract interstitial water from sediments, for the analysis of TriButyl Tin species. This procedure is specifically for extraction for the analysis of Butyl Tin species, but may be modified for other analytes, provided such modifications are noted on the extraction data sheet.

## 2.0 EQUIPMENT

2.1 Refrigerated Centrifuge, and Polycarbonate bottles
2.2 Balance for balancing the centrifuge bottles
2.3 Nitrogen chamber, with Oxygen meter
2.4 Miscellaneous spoons, pipettes, etc.

## 3.0 DEFINITIONS

3.1 Interstitial Water

3.1.1 Interstitial water is the water that fills the pore spaces of sediment. The water is assumed to be in chemical equilibrium with the sediment. Only a portion of the water will be extracted using centrifugation. Other methods of extraction produce larger yields, (i.e., pressing) but are prone to shift the chemical equilibrium and are not recommended.

## 4.0 DOCUMENTATION

4.1 Pore Water Extraction Data Form, 1114F

## 5.0 PROCEDURE

5.1 Decontamination

At a minimum, decontamination of equipment shall include the following steps:

- wash the equipment with a detergent and rinse with tap water to remove any residue;
- rinse with a 5% nitric acid solution
- rinse with DI water
- air dry
- rinse with solvent, hexane for polycarbonate bottles and methylene chloride for all other equipment.

5.2 Centrifuge Settings

The process of centrifugation separates the solids and liquid phases based on their specific gravity. During the spinning process, the denser materials move to the bottom of the tube while the lighter materials float on top. In order to be extracted, there must be a significant difference between the specific gravity of the matrix and the material to be separated. Some organic materials may not be significantly denser than the pore water and may not separate. An example of this is seed pods which generally will float on top of the water layer.

The rate of separation in a centrifuge is based on the difference in specific gravity of the materials, particle size, temperature, and speed and radius of the rotor. Also, the design of the centrifuge rotor will effect the calculation, as the angle of the rotor, and thus the effective radius, will change the centrifugal force.

Based on project specific information, the time of spin may be calculated from the temperature, the size of the particles to be separated, and the constants associated with each centrifuge and rotor, the time of each spin cycle may be calculated from the following equation:

$$t = \frac{(6.3E09)\ \eta \log_{10} R/S}{N^2 D^2\ \Delta s}$$

Where:

- t is the time of spin in minutes
- η is the viscosity of the fluid phase, in poises
- R is the radius of rotation of the top of the sediment in the bottle, cm
- S is the radius of rotation of the surface of the suspension in the bottle, cm
- N is the speed of the rotor, rpm
- D is the particle diameter, microns
- Δs is the difference in specific gravity between the solids and the suspending liquid

In general for pore water extraction of sediments, a time of 2-3 minutes is all that is required. However, to account for highly organic sediments, a time of 30 minutes has been assumed by the U.S. Army Corps of Engineers. The speed necessary for the first extraction step has been calculated at 3,000 rpm for the IEC centrifuge and the speed for the second clean up spin in the Beckman centrifuge is 7,000 rpm.

3.3 Extraction

The amount of pore water required will be determined based on project specific detection limits. Appropriate centrifuge bottles shall be selected based on the analytes of interest, the amount of pore water required and the weight and speed limits of the rotor / centrifuge.

Sediment samples will be maintained at 4°C prior to centrifuging. Care must be taken at each step to ensure that the temperature of the sample is maintained at or below 10°C during processing. Proper set up and planning are required to keep each step as short as possible and keep the samples and pore waters in the proper temperature environment.

The centrifuges should be turned on at the same time as the nitrogen in the anaerobic chamber is turned on. The temperature of each centrifuge should be set to 4°C, and they should be allowed come to this temperature prior to use.

The sample to be extracted shall be examined. The sample identification and any other pertinent information shall be recorded on the data sheet. The sediment for pore water extraction shall be placed in the nitrogen chamber along with centrifuge jars, spoons, a balance, etc. and the chamber sealed and filled with nitrogen. After about 30 minutes the oxygen level shall be checked using the hand held oxygen meter. Allow about 5 minutes for the instrument reading to stabilize. Because sulfides which are often present in marine sediments interfere with the instrument, subsequent oxygen readings may be erroneous. The centrifuge jars should be opened to allow them to come to equilibrium with the chamber. The oxygen level in the chamber shall be less than 1% before any work in the chamber is started.

Once the chamber is ready, the sediment jars may be opened and the sediment spooned into labeled centrifuge bottles. Any free liquid on the top of the sediment may be poured into the centrifuge bottle. The bottles will be balanced to within 0.1 g. Once a set of four

bottles is ready, they are removed from the chamber via the air lock and placed in the pre-cooled centrifuge. All samples for TBT analysis are centrifuged at 3,000 rpm for 30 minutes. They are then placed back in the nitrogen chamber, decanted into another PC bottle, balanced with another bottle containing DI water, and were placed in another pre-cooled centrifuge (4°C) and spun at 7,000 rpm for 30 minutes.

Following the second "clean up" spin, the bottles are replaced in the nitrogen chamber and the water is poured into pre-preserved PC bottles. For TBT analysis, the preservative will be a few drops of HCl. The pore water samples are then placed in the refrigerator until they are transferred to the Organic Extractions lab or Sample receiving.

## 4.0 SAFETY

4.1 Keep all laboratory areas clean and follow all safety requirements.

## 5.0 REFERENCE

5.1 Clarification paper for the TBT-interstitial water extraction protocol, USA Corps of Engineers web site, http://www.nps.usace.army.mil/dmmo/smarm98/papers.htm.

**Appendix B-1 - Summary Statistics for Terminal 4 Dredge Prism (SVOCs, Pb, and Zn)**

| Sample ID | Sample Date | Sample Depth (feet) | Sample Interval (feet) | Sample Area (sq. ft.) | Sample Volume (cubic ft.) | Volume Weight | MET Interval | 2-Methylnaphthalene (ug/kg) | Q | Acenaphthene (ug/kg) | Q | Acenaphthylene (ug/kg) | Q | Anthracene (ug/kg) | Q | Benzo(a)anthracene (ug/kg) | Q | Benzo(a)pyrene (ug/kg) | Q | Benzo(b)fluoranthene (ug/kg) | Q | Benzo(e)pyrene (ug/kg) | Q | Benzo(g,h,i)perylene (ug/kg) | Q | Benzo(k)fluoranthene (ug/kg) | Q | Chrysene (ug/kg) | Q | Dibenzo(a,h)anthracene (ug/kg) | Q | Fluoranthene (ug/kg) | Q |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T4-B411-01(-43 to -44) | 1/8/07 | 43-44 | 1 | 6,761 | 6,761 | 0.0049 | X | 59 | UJ | 580 | | 59 | U | 480 | | 2,900 | | 3,400 | | 3,600 | | 2,200 | | 2,200 | | 2,700 | | 2,800 | | 1,100 | | 3,700 | |
| T4-B411-01(-44 to -45) | 1/8/07 | 44-45 | 1 | 6,761 | 6,761 | 0.0049 | X | 230 | J | 2,700 | | 59 | U | 1,300 | | 8,700 | | 11,000 | | 11,000 | | 6,700 | | 7,400 | | 3,800 | | 8,000 | | 2,700 | | 10,000 | |
| T4-B411-02(-42 to -43) | 1/8/07 | 42-43 | 1 | 5,193 | 5,193 | 0.0037 | X | 500 | J | 4,200 | J | 59 | U | 3,600 | | 34,000 | | 38,000 | | 43,000 | | 24,000 | | 24,000 | | 24,000 | | 33,000 | | 9,300 | | 43,000 | |
| T4-B411-02(-43 to -44) | 1/8/07 | 43-44 | 1 | 5,193 | 5,193 | 0.0037 | X | 20 | UJ | 240 | | 20 | U | 200 | | 1,400 | | 1,500 | | 1,800 | | 1,000 | | 640 | | 1,100 | | 1,300 | | 330 | | 1,800 | |
| T4-B411-06-A | 1/3/07 | - | 1 | 14,818 | 14,818 | 0.0106 | X | 570 | | 5,500 | | 66 | J | 4,900 | | 34,000 | | 38,000 | | 36,000 | | 23,000 | | 24,000 | | 30,000 | | 34,000 | | 6,300 | | 47,000 | |
| T4-B411-06-B | 1/3/07 | - | 1 | 14,818 | 14,818 | 0.0106 | X | 56 | J | 190 | | 60 | U | 130 | | 700 | | 830 | | 720 | | 520 | | 540 | | 580 | | 760 | | 190 | | 1,200 | |
| T4-B411-06-C | 1/3/07 | - | 1 | 14,818 | 14,818 | 0.0106 | X | 350 | J | 3,000 | | 60 | U | 2,400 | | 17,000 | | 20,000 | | 22,000 | | 13,000 | | 13,000 | | 13,000 | | 17,000 | | 4,300 | | 23,000 | |
| T4-B414-01-A | 7/20/06 | 0-1 | 1 | 17,260 | 17,260 | 0.0124 | X | 3,200 | | 12,000 | | 98 | U | 11,000 | | 46,000 | | 54,000 | | 63,000 | | 37,000 | | 38,000 | | 52,000 | | 60,000 | | 15,000 | | 97,000 | |
| T4-B414-01-B | 7/20/06 | 1-2 | 1 | 17,260 | 17,260 | 0.0124 | X | 89 | | 410 | | 50 | U | 350 | | 2,100 | | 2,600 | | 3,000 | | 1,800 | | 1,900 | | 2,300 | | 2,800 | | 540 | | 3,900 | |
| T4-B414-02-A | 7/19/06 | 0-1 | 1 | 10,842 | 10,842 | 0.0078 | X | 89 | | 540 | | 50 | U | 310 | | 1,800 | | 2,400 | | 2,800 | | 1,600 | | 1,700 | | 2,200 | | 2,600 | | 510 | | 3,900 | |
| T4-B414-02-B | 7/19/06 | 1-2 | 1 | 10,842 | 10,842 | 0.0078 | X | 15 | | 40 | | 9 | | 27 | | 85 | | 100 | | 110 | | 74 | | 76 | | 96 | | 120 | | 23 | | 220 | |
| T4-S3-01-D | 7/18/06 | 3-4 | 1 | 5,242 | 5,242 | 0.0038 | X | 240 | | 2,100 | | 74 | | 2,000 | | 11,000 | | 16,000 | | 15,000 | | 9,500 | | 7,300 | | 14,000 | | 14,000 | | 2,800 | | 19,000 | |
| T4-S3-01-E | 7/18/06 | 4-5 | 1 | 5,242 | 5,242 | 0.0038 | X | 420 | | 4,700 | | 73 | | 4,300 | | 25,000 | | 34,000 | | 34,000 | | 19,000 | | 16,000 | | 27,000 | | 28,000 | | 4,300 | | 38,000 | |
| T4-S3-01-F | 7/18/06 | 5-6 | 1 | 5,242 | 5,242 | 0.0038 | X | 590 | J | 6,200 | | 990 | U | 5,700 | | 34,000 | | 45,000 | | 44,000 | | 26,000 | | 20,000 | | 38,000 | | 39,000 | | 8,100 | | 53,000 | |
| T4-S3-01-G | 7/18/06 | 6-7 | 1 | 5,242 | 5,242 | 0.0038 | X | 360 | J | 4,200 | | 450 | U | 3,500 | | 19,000 | | 26,000 | | 26,000 | | 15,000 | | 12,000 | | 22,000 | | 22,000 | | 4,300 | | 31,000 | |
| T4-S3-01-H | 7/18/06 | 7-8 | 1 | 5,242 | 5,242 | 0.0038 | X | 1,000 | | 8,700 | | 910 | U | 6,900 | | 42,000 | | 57,000 | | 51,000 | | 32,000 | | 29,000 | | 50,000 | | 49,000 | | 9,900 | | 64,000 | |
| T4-S3-01-J | 7/18/06 | 8-9 | 1 | 5,242 | 5,242 | 0.0038 | X | 160 | | 2,100 | | 25 | | 1,900 | | 9,400 | | 12,000 | | 11,000 | | 6,800 | | 8,000 | | 10,000 | | 11,000 | | 1,400 | | 15,000 | |
| T4-S3-01-K | 7/18/06 | 9-10 | 1 | 5,242 | 5,242 | 0.0038 | X | 5 | U | 13 | | 5 | U | 9 | | 51 | | 61 | | 62 | | 38 | | 43 | | 53 | | 63 | | 13 | | 76 | |
| T4-S3-02-C | 7/18/06 | 2-3 | 1 | 14,421 | 14,421 | 0.0104 | X | 99 | U | 890 | | 99 | U | 880 | | 5,500 | | 7,600 | | 7,100 | | 4,500 | | 5,600 | | 6,400 | | 6,700 | | 1,700 | | 8,900 | |
| T4-S3-02-D | 7/18/06 | 3-4 | 1 | 14,421 | 14,421 | 0.0104 | X | 220 | | 2,400 | | 220 | U | 1,900 | | 13,000 | | 17,000 | | 16,000 | | 9,800 | | 12,000 | | 13,000 | | 15,000 | | 3,800 | | 20,000 | |
| T4-S3-02-E | 7/18/06 | 4-5 | 1 | 14,421 | 14,421 | 0.0104 | X | 220 | | 2,400 | | 200 | U | 1,900 | | 12,000 | | 15,000 | | 15,000 | | 9,000 | | 11,000 | | 12,000 | | 14,000 | | 3,100 | | 19,000 | |
| T4-S3-02-F | 7/18/06 | 5-6 | 1 | 14,421 | 14,421 | 0.0104 | X | 260 | U | 720 | | 260 | U | 620 | | 3,700 | | 5,100 | | 4,900 | | 3,000 | | 3,700 | | 4,200 | | 4,700 | | 1,200 | | 6,600 | |
| T4-S3-02-G | 7/18/06 | 6-7 | 1 | 14,421 | 14,421 | 0.0104 | X | 25 | | 150 | | 36 | | 120 | | 500 | | 590 | | 560 | | 390 | | 410 | | 520 | | 680 | | 98 | | 1,100 | |
| T4-S3-02-H | 7/18/06 | 7-8 | 1 | 14,421 | 14,421 | 0.0104 | X | 37 | | 96 | | 37 | U | 110 | | 460 | | 550 | | 590 | | 380 | | 210 | | 610 | | 650 | | 77 | | 930 | |
| T4-S3-02-J | 7/18/06 | 8-9 | 1 | 14,421 | 14,421 | 0.0104 | X | 10 | | 45 | | 17 | | 40 | | 110 | | 140 | | 120 | | 88 | | 46 | | 130 | | 160 | | 11 | | 270 | |
| T4-S3-03-B | 7/19/06 | 1-2 | 1 | 25,311 | 25,311 | 0.0182 | X | 200 | U | 870 | | 200 | U | 630 | | 4,600 | | 5,900 | | 6,300 | | 3,800 | | 4,300 | | 5,100 | | 6,300 | | 1,300 | | 9,000 | |
| T4-S3-03-C | 7/19/06 | 2-3 | 1 | 25,311 | 25,311 | 0.0182 | X | 50 | U | 170 | | 50 | U | 110 | | 570 | | 790 | | 730 | | 510 | | 640 | | 690 | | 830 | | 150 | | 1,300 | |
| T4-S3-03-D | 7/19/06 | 3-4 | 1 | 25,311 | 25,311 | 0.0182 | X | 50 | U | 140 | | 50 | U | 94 | | 420 | | 520 | | 480 | | 320 | | 390 | | 420 | | 600 | | 99 | | 1,000 | |
| T4-S3-03-E | 7/19/06 | 4-5 | 1 | 25,311 | 25,311 | 0.0182 | X | 51 | | 94 | | 27 | | 100 | | 340 | | 440 | | 310 | | 280 | | 210 | | 380 | | 460 | | 53 | | 810 | |
| T4-S3-03-F | 7/19/06 | 5-6 | 1 | 25,311 | 25,311 | 0.0182 | X | 15 | | 31 | | 9 | | 34 | | 100 | | 120 | | 100 | | 78 | | 58 | | 100 | | 140 | | 18 | | 260 | |
| T4-S3-03-G | 7/19/06 | 6-7 | 1 | 25,311 | 25,311 | 0.0182 | X | 23 | | 44 | | 12 | | 46 | | 120 | | 120 | | 90 | | 78 | | 58 | | 110 | | 170 | | 11 | | 380 | |
| T4-S3-04-A | 7/20/06 | 0-1 | 1 | 11,663 | 11,663 | 0.0084 | X | 460 | | 4,600 | | 380 | U | 4,000 | | 25,000 | | 33,000 | | 31,000 | | 19,000 | | 23,000 | | 27,000 | | 31,000 | | 6,700 | | 42,000 | |
| T4-S3-04-B | 7/20/06 | 1-2 | 1 | 11,663 | 11,663 | 0.0084 | X | 6 | | 48 | | 3 | J | 44 | | 300 | | 400 | | 380 | | 240 | | 230 | | 340 | | 380 | | 75 | | 500 | |
| T4-S3-04-C | 7/20/06 | 2-3 | 1 | 11,663 | 11,663 | 0.0084 | X | 42 | | 370 | | 28 | U | 320 | | 2,200 | | 2,800 | | 2,500 | | 1,700 | | 1,600 | | 2,400 | | 2,600 | | 560 | | 3,400 | |
| T4-S3-04-D | 7/20/06 | 3-4 | 1 | 11,663 | 11,663 | 0.0084 | X | 4 | J | 29 | | 5 | U | 25 | | 160 | | 200 | | 180 | | 130 | | 140 | | 190 | | 200 | | 48 | | 250 | |
| T4-S3-04-E | 7/20/06 | 4-5 | 1 | 11,663 | 11,663 | 0.0084 | X | 5 | U | 5 | U | 5 | U | 5 | U | 9 | | 10 | | 13 | | 8 | | 5 | | 8 | | 11 | | 5 | U | 14 | |
| T4-S3-05-E | 7/19/06 | 4-5 | 1 | 17,643 | 17,643 | 0.0127 | X | 98 | U | 710 | | 98 | U | 650 | | 3,800 | | 5,200 | | 5,000 | | 3,000 | | 3,800 | | 3,900 | | 4,500 | | 1,100 | | 6,400 | |
| T4-S3-05-F | 7/19/06 | 5-6 | 1 | 17,643 | 17,643 | 0.0127 | X | 210 | | 1,900 | | 180 | U | 1,700 | | 11,000 | | 15,000 | | 14,000 | | 9,200 | | 6,600 | | 14,000 | | 13,000 | | 2,600 | | 18,000 | |
| T4-S3-05-G | 7/19/06 | 6-7 | 1 | 17,643 | 17,643 | 0.0127 | X | 430 | U | 3,900 | | 430 | U | 3,300 | | 21,000 | | 28,000 | | 24,000 | | 17,000 | | 20,000 | | 26,000 | | 25,000 | | 6,500 | | 33,000 | |
| T4-S3-05-H | 7/19/06 | 7-8 | 1 | 17,643 | 17,643 | 0.0127 | X | 190 | U | 1,700 | | 190 | U | 1,500 | | 9,500 | | 13,000 | | 11,000 | | 7,500 | | 6,700 | | 12,000 | | 11,000 | | 2,600 | | 15,000 | |
| T4-S3-05-J | 7/19/06 | 8-9 | 1 | 17,643 | 17,643 | 0.0127 | X | 10 | U | 62 | | 10 | U | 57 | | 330 | | 430 | | 400 | | 250 | | 310 | | 350 | | 390 | | 100 | | 510 | |
| T4-S3-06-A | 7/20/06 | 0-1 | 1 | 46,891 | 46,891 | 0.0337 | X | 49 | U | 350 | | 49 | U | 350 | | 2,000 | | 2,700 | | 2,600 | | 1,600 | | 1,400 | | 2,400 | | 2,600 | | 520 | | 3,800 | |
| T4-S3-06-B | 7/20/06 | 1-2 | 1 | 46,891 | 46,891 | 0.0337 | X | 5 | U | 5 | U | 5 | U | 5 | U | 22 | | 27 | | 31 | | 18 | | 16 | | 26 | | 29 | | 6 | | 40 | |
| T4-S3-07-B | 7/20/06 | 1-2 | 1 | 32,141 | 32,141 | 0.0231 | X | 45 | J | 300 | | 79 | | 410 | | 2,200 | | 3,100 | | 2,800 | | 1,900 | | 2,400 | | 2,600 | | 2,800 | | 620 | | 4,500 | |
| T4-S3-07-C | 7/20/06 | 2-3 | 1 | 32,141 | 32,141 | 0.0231 | X | 49 | U | 200 | | 49 | U | 190 | | 1,200 | | 1,500 | | 1,400 | | 940 | | 1,200 | | 1,300 | | 1,400 | | 370 | | 1,800 | |

**Appendix B-1 - Summary Statistics for Terminal 4 Dredge Prism (SVOCs, Pb, and Zn)**

| Sample ID | Sample Date | Sample Depth (feet) | Sample Interval (feet) | Sample Area (sq. ft.) | Sample Volume (cubic ft.) | Volume Weight | MET Interval | 2-Methylnaphthalene (ug/kg) | Q | Acenaphthene (ug/kg) | Q | Acenaphthylene (ug/kg) | Q | Anthracene (ug/kg) | Q | Benzo(a)anthracene (ug/kg) | Q | Benzo(a)pyrene (ug/kg) | Q | Benzo(b)fluoranthene (ug/kg) | Q | Benzo(e)pyrene (ug/kg) | Q | Benzo(g,h,i)perylene (ug/kg) | Q | Benzo(k)fluoranthene (ug/kg) | Q | Chrysene (ug/kg) | Q | Dibenzo(a,h)anthracene (ug/kg) | Q | Fluoranthene (ug/kg) | Q |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T4-S3-07-D | 7/20/06 | 3-4 | 1 | 32,141 | 32,141 | 0.0231 | X | 63 | | 520 | | 29 | J | 430 | | 2,600 | | 3,400 | | 3,400 | | 2,100 | | 2,400 | | 2,800 | | 3,200 | | 700 | | 4,500 | |
| T4-S3-07-E | 7/20/06 | 4-5 | 1 | 32,141 | 32,141 | 0.0231 | X | 3 | J | 21 | | 3 | J | 26 | | 140 | | 190 | | 160 | | 120 | | 140 | | 160 | | 170 | | 39 | | 250 | |
| T4-S3-08-B | 7/19/06 | 1-2 | 1 | 8,580 | 8,580 | 0.0062 | X | 49 | | 550 | | 49 | U | 500 | | 3,100 | | 4,400 | | 4,000 | | 2,600 | | 2,000 | | 4,100 | | 3,800 | | 700 | | 4,900 | |
| T4-S3-08-C | 7/19/06 | 2-3 | 1 | 8,580 | 8,580 | 0.0062 | X | 5 | U | 26 | | 5 | U | 26 | | 170 | | 230 | | 240 | | 140 | | 120 | | 180 | J | 210 | | 40 | | 280 | |
| T4-VC23-0-1 | 3/3/04 | 0-1 | 1 | 15,660 | 15,660 | 0.0113 | | 19 | | 200 | | 6 | | 210 | | 1,100 | | 1,600 | | 1,500 | | 1,100 | | 1,200 | | 1,300 | | 1,300 | | 270 | | 1,600 | |
| T4-VC23-1-3 | 3/3/04 | 1-3 | 2 | 15,660 | 31,320 | 0.0225 | | 5 | U | 1 | J | 5 | U | 2 | J | 14 | | 18 | | 17 | | 15 | | 14 | | 16 | | 17 | | 2 | J | 21 | |
| T4-VC24-0-1 | 3/3/04 | 0-1 | 1 | 20,429 | 20,429 | 0.0147 | | 2,900 | | 16,000 | | 53 | J | 15,000 | | 56,000 | | 55,000 | | 55,000 | | 36,000 | | 26,000 | | 53,000 | | 56,000 | | 8,400 | | 110,000 | |
| T4-VC24-1-3 | 3/3/04 | 1-3 | 2 | 20,429 | 40,858 | 0.0294 | | 76 | | 960 | | 7 | J | 930 | | 4,500 | | 6,500 | | 5,500 | | 4,500 | | 4,600 | | 5,300 | | 5,100 | | 970 | | 6,600 | |
| T4-VC24-3-5 | 3/3/04 | 3-5 | 2 | 20,429 | 40,858 | 0.0294 | | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 0 | J | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U |
| T4-VC26-0-1 | 3/4/04 | 0-1 | 1 | 50,126 | 50,126 | 0.0360 | | 19 | | 98 | | 20 | | 140 | | 750 | | 1,100 | | 1,000 | | 820 | | 870 | | 870 | | 930 | | 160 | | 1,300 | |
| T4-VC26-1-3 | 3/4/04 | 1-3 | 2 | 50,126 | 100,252 | 0.0720 | | 24 | | 270 | | 8 | | 280 | | 1,800 | | 2,600 | | 2,400 | | 1,800 | | 1,900 | | 1,900 | | 2,000 | | 430 | | 2,400 | |
| T4-VC26-3-5 | 3/5/04 | 3-5 | 2 | 50,126 | 100,252 | 0.0720 | | 22 | | 74 | | 7 | | 59 | | 410 | | 570 | | 580 | | 430 | | 460 | | 450 | | 530 | | 110 | | 680 | |
| T4-VC29-0-1 | 3/5/04 | 0-1 | 1 | 8,797 | 8,797 | 0.0063 | | 82 | | 600 | | 57 | | 720 | | 3,800 | | 5,600 | | 4,900 | | 3,800 | | 4,100 | | 4,100 | | 4,300 | | 880 | | 6,000 | |
| T4-VC29-1-3 | 3/5/04 | 1-3 | 2 | 8,797 | 17,594 | 0.0126 | | 140 | | 840 | | 150 | | 1,200 | | 6,600 | | 9,500 | | 8,600 | | 6,500 | | 7,100 | | 6,600 | | 7,400 | | 1,400 | | 9,600 | |
| T4-VC29-3-5 | 3/5/04 | 3-5 | 2 | 8,797 | 17,594 | 0.0126 | | 48 | | 400 | | 27 | | 370 | | 2,600 | | 3,600 | | 3,200 | | 2,500 | | 2,600 | | 2,900 | | 3,000 | | 550 | | 4,000 | |
| T4-VC29-5-7 | 3/5/04 | 5-7 | 2 | 8,797 | 17,594 | 0.0126 | | 5 | U | 0 | J | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 1 | J |
| T4-VC32-0-1 | 3/4/04 | 0-1 | 1 | 18,640 | 18,640 | 0.0134 | | 84 | | 340 | | 130 | | 660 | | 2,500 | | 3,500 | | 3,000 | | 2,900 | | 3,100 | | 3,000 | | 3,400 | | 630 | | 5,100 | |
| T4-VC32-1-3 | 3/4/04 | 1-3 | 2 | 18,640 | 37,280 | 0.0268 | | 74 | | 390 | | 54 | | 410 | | 2,800 | | 3,900 | | 3,700 | | 2,800 | | 3,000 | | 2,500 | | 3,400 | | 690 | | 4,300 | |
| T4-VC32-3-5 | 3/4/04 | 3-5 | 2 | 18,640 | 37,280 | 0.0268 | | 82 | | 1,000 | | 23 | J | 1,000 | | 5,600 | | 8,000 | | 6,900 | | 5,500 | | 5,900 | | 6,200 | | 6,200 | | 1,400 | | 7,900 | |
| T4-VC32-5-7 | 3/4/04 | 5-7 | 2 | 18,640 | 37,280 | 0.0268 | | 5 | U | 0 | J | 5 | U | 0 | J | 2 | J | 2 | J | 2 | J | 2 | J | 2 | J | 2 | J | 3 | J | 5 | U | 4 | J |
| TOTAL: | | | 76 | | 1,391,923 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **T4 Dredge Prism Volume-weighted Mean** | | | | | | | | 162 | | 1,025 | | 61 | | 931 | | 4,948 | | 6,148 | | 6,000 | | 3,896 | | 3,885 | | 5,191 | | 5,656 | | 1,197 | | 8,352 | |

**Appendix B-1 - Summary Statistics for Terminal 4 Dredge Prism (SVOCs, Pb, and Zn)**

| Sample ID | Fluorene (ug/kg) | Q | Indeno(1,2,3-cd)pyrene (ug/kg) | Q | Naphthalene (ug/kg) | Q | Phenanthrene (ug/kg) | Q | Pyrene (ug/kg) | Q | Total T4 13 PAH | bis(2-Ethylhexyl)phthalate (ug/kg) | Q | Butylbenzylphthalate (ug/kg) | Q | Diethylphthalate (ug/kg) | Q | Dimethylphthalate (ug/kg) | Q | Di-n-butylphthalate (ug/kg) | Q | Di-n-octylphthalate (ug/kg) | Q | Lead (mg/kg) | Q | Zinc (mg/kg) | Q |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T4-B411-01(-43 to -44) | 180 | | 2,200 | | 58 | J | 1,800 | | 3,400 | | 25,598 | 59 | UJ | 59 | U | 59 | U | 59 | U | 59 | U | 59 | U | 551 | J | 300 | |
| T4-B411-01(-44 to -45) | 650 | | 7,100 | | 470 | J | 4,500 | | 9,800 | | 71,920 | 59 | UJ | 59 | U | 59 | U | 59 | U | 59 | U | 59 | U | 440 | J | 225 | |
| T4-B411-02(-42 to -43) | 1,600 | | 22,000 | | 830 | J | 18,000 | | 40,000 | | 283,230 | 59 | UJ | 59 | U | 59 | U | 59 | U | 59 | U | 59 | U | 320 | J | 505 | |
| T4-B411-02(-43 to -44) | 77 | | 740 | | 28 | J | 730 | | 1,500 | | 11,675 | 20 | UJ | 20 | U | 20 | U | 20 | U | 20 | U | 20 | U | 173 | J | 313 | |
| T4-B411-06-A | 2,400 | | 24,000 | | 960 | | 24,000 | | 35,000 | | 291,826 | 240 | | 120 | U | 120 | U | 120 | U | 120 | U | 120 | U | 645 | J | 712 | |
| T4-B411-06-B | 65 | | 500 | | 75 | J | 690 | | 1,200 | | 7,140 | 60 | UJ | 60 | U | 60 | U | 60 | U | 60 | U | 60 | U | 730 | | 724 | |
| T4-B411-06-C | 1,500 | | 12,000 | | 540 | J | 12,000 | | 20,000 | | 151,440 | 97 | J | 60 | U | 60 | U | 60 | U | 60 | U | 60 | U | 522 | | 605 | |
| T4-B414-01-A | 9,800 | | 35,000 | | 1,100 | | 60,000 | B | 67,000 | | 532,900 | 100 | U | 100 | U | 100 | U | 100 | U | 100 | U | 100 | U | 26 | | 126 | |
| T4-B414-01-B | 260 | | 1,700 | | 74 | | 2,000 | B | 3,000 | | 22,794 | 56 | U | 20 | U | 20 | U | 20 | U | 38 | U | 20 | U | 26 | | 128 | |
| T4-B414-02-A | 220 | | 1,500 | | 180 | | 1,900 | B | 3,000 | | 21,850 | 68 | U | 20 | U | 20 | U | 20 | U | 20 | U | 20 | U | 18 | | 104 | |
| T4-B414-02-B | 25 | | 62 | | 34 | | 150 | B | 200 | | 1,216 | 33 | U | 20 | U | 20 | U | 20 | U | 60 | U | 20 | U | 14 | | 94 | |
| T4-S3-01-D | 1,100 | | 6,900 | | 440 | | 8,700 | B | 16,000 | | 119,414 | 99 | U | 99 | U | 99 | U | 99 | U | 99 | U | 99 | U | 258 | | 381 | |
| T4-S3-01-E | 2,000 | | 15,000 | | 720 | | 16,000 | B | 33,000 | | 246,793 | 180 | UJ | 99 | U | 99 | U | 99 | U | 99 | U | 99 | U | 432 | | 546 | |
| T4-S3-01-F | 2,800 | | 19,000 | | 990 | | 24,000 | B | 47,000 | | 339,690 | 300 | U | 300 | U | 300 | U | 300 | U | 300 | U | 300 | U | 559 | | 827 | |
| T4-S3-01-G | 2,000 | | 11,000 | | 620 | | 15,000 | B | 27,000 | | 198,320 | 370 | U | 250 | U | 250 | U | 250 | U | 250 | U | 250 | UJ | 455 | | 656 | |
| T4-S3-01-H | 3,400 | | 28,000 | | 1,700 | | 29,000 | B | 56,000 | | 418,700 | 360 | U | 260 | U | 260 | U | 260 | U | 260 | U | 260 | U | 527 | | 609 | |
| T4-S3-01-J | 810 | | 6,800 | | 280 | | 7,700 | | 14,000 | | 95,215 | 99 | U | 99 | U | 99 | U | 99 | U | 99 | U | 99 | U | 238 | J | 333 | J |
| T4-S3-01-K | 7 | | 36 | | 5 | U | 49 | | 77 | | 521 | 20 | U | 20 | U | 20 | U | 20 | U | 20 | U | 20 | U | 42 | J | 69 | J |
| T4-S3-02-C | 480 | | 4,600 | | 160 | | 4,000 | | 8,200 | | 56,810 | 60 | U | 60 | U | 60 | U | 60 | U | 60 | U | 60 | U | 212 | | 328 | J |
| T4-S3-02-D | 1,100 | | 10,000 | | 410 | | 9,000 | | 18,000 | | 126,810 | 120 | U | 120 | U | 120 | U | 120 | U | 120 | U | 120 | U | 496 | | 633 | J |
| T4-S3-02-E | 1,000 | | 9,300 | | 530 | | 8,300 | | 16,000 | | 117,130 | 110 | U | 110 | U | 110 | U | 110 | U | 110 | U | 110 | U | 452 | | 573 | J |
| T4-S3-02-F | 410 | | 3,200 | | 260 | U | 3,000 | | 6,200 | | 40,150 | 210 | U | 150 | U | 150 | U | 150 | U | 150 | U | 150 | U | 721 | | 705 | J |
| T4-S3-02-G | 76 | | 340 | | 48 | | 660 | | 1,400 | | 6,440 | 110 | U | 20 | U | 20 | U | 20 | U | 20 | U | 20 | U | 901 | J | 878 | J |
| T4-S3-02-H | 59 | | 180 | | 55 | | 560 | | 1,200 | | 5,870 | 32 | U | 29 | U | 29 | U | 29 | U | 29 | U | 29 | U | 723 | J | 701 | J |
| T4-S3-02-J | 19 | | 42 | | 24 | | 210 | | 410 | | 1,695 | 20 | U | 20 | U | 20 | U | 20 | U | 20 | U | 20 | U | 127 | J | 164 | J |
| T4-S3-03-B | 670 | | 3,600 | | 240 | | 4,100 | | 7,600 | | 51,310 | 140 | U | 110 | U | 110 | U | 110 | U | 110 | U | 110 | U | 266 | | 418 | J |
| T4-S3-03-C | 120 | | 490 | | 69 | | 610 | | 1,300 | | 7,289 | 160 | U | 59 | U | 59 | U | 59 | U | 59 | U | 59 | U | 417 | | 546 | J |
| T4-S3-03-D | 99 | | 310 | | 50 | | 620 | | 1,200 | | 5,643 | 59 | U | 59 | U | 59 | U | 59 | U | 59 | U | 59 | U | 580 | | 583 | J |
| T4-S3-03-E | 50 | | 180 | | 90 | | 520 | | 940 | | 4,561 | 22 | | 20 | U | 20 | U | 20 | U | 20 | U | 20 | U | 217 | J | 280 | J |
| T4-S3-03-F | 19 | | 57 | | 24 | | 160 | | 260 | | 1,357 | 20 | U | 20 | U | 20 | U | 20 | U | 20 | U | 20 | U | 66 | J | 111 | J |
| T4-S3-03-G | 25 | | 50 | | 26 | | 270 | | 400 | | 1,813 | 20 | U | 20 | U | 20 | U | 20 | U | 20 | U | 20 | U | 131 | J | 178 | J |
| T4-S3-04-A | 1,900 | | 20,000 | | 720 | | 18,000 | | 35,000 | | 253,220 | 110 | U | 110 | U | 110 | U | 110 | U | 110 | U | 110 | U | 435 | | 460 | |
| T4-S3-04-B | 21 | | 210 | | 13 | | 200 | | 450 | | 3,079 | 16 | J | 20 | U | 20 | U | 20 | U | 30 | U | 20 | U | 206 | | 252 | |
| T4-S3-04-C | 160 | | 1,500 | | 76 | | 1,400 | | 3,000 | | 21,226 | 34 | | 28 | U | 28 | U | 28 | U | 38 | U | 28 | U | 276 | | 343 | |
| T4-S3-04-D | 18 | | 120 | | 6 | | 130 | | 220 | | 1,608 | 20 | U | 20 | U | 20 | U | 20 | U | 26 | U | 20 | U | 111 | | 141 | |
| T4-S3-04-E | 5 | U | 5 | | 5 | U | 5 | | 12 | | 82 | 20 | U | 20 | U | 20 | U | 20 | U | 20 | U | 20 | U | 17 | | 60 | |
| T4-S3-05-E | 340 | | 3,200 | | 150 | | 2,900 | | 6,200 | | 39,750 | 60 | U | 60 | U | 60 | U | 60 | U | 60 | U | 60 | U | 142 | | 303 | J |
| T4-S3-05-F | 810 | | 6,600 | | 390 | | 7,500 | | 14,000 | | 111,300 | 120 | U | 110 | U | 110 | U | 110 | U | 110 | U | 110 | U | 267 | | 479 | J |
| T4-S3-05-G | 1,700 | | 17,000 | | 650 | | 14,000 | | 30,000 | | 210,550 | 160 | U | 120 | U | 120 | U | 120 | U | 120 | U | 120 | U | 264 | | 454 | J |
| T4-S3-05-H | 730 | | 6,400 | | 310 | | 6,500 | | 14,000 | | 96,240 | 150 | U | 110 | U | 110 | U | 110 | U | 110 | U | 110 | U | 311 | | 465 | J |
| T4-S3-05-J | 26 | | 270 | | 14 | | 230 | | 490 | | 3,289 | 20 | U | 20 | U | 20 | U | 20 | U | 20 | U | 20 | U | 6 | | 54 | J |
| T4-S3-06-A | 200 | | 1,300 | | 83 | | 1,600 | | 3,200 | | 21,883 | 46 | U | 20 | U | 20 | U | 20 | U | 20 | U | 20 | U | 104 | | 188 | J |
| T4-S3-06-B | 5 | U | 16 | | 5 | U | 16 | | 38 | | 229 | 20 | U | 20 | U | 20 | U | 20 | U | 20 | U | 20 | U | 10 | | 54 | J |
| T4-S3-07-B | 200 | | 2,000 | | 120 | | 1,800 | | 4,300 | | 25,209 | 40 | | 20 | U | 20 | U | 20 | U | 35 | U | 20 | U | 57 | | 212 | |
| T4-S3-07-C | 110 | | 990 | | 54 | | 860 | | 1,700 | | 11,714 | 24 | | 20 | U | 20 | U | 20 | U | 32 | U | 20 | U | 53 | | 156 | |

**Appendix B-1 - Summary Statistics for Terminal 4 Dredge Prism (SVOCs, Pb, and Zn)**

| Sample ID | Fluorene (ug/kg) | Q | Indeno(1,2,3-cd)pyrene (ug/kg) | Q | Naphthalene (ug/kg) | Q | Phenanthrene (ug/kg) | Q | Pyrene (ug/kg) | Q | Total T4 13 PAH | bis(2-Ethylhexyl)phthalate (ug/kg) | Q | Butylbenzylphthalate (ug/kg) | Q | Diethylphthalate (ug/kg) | Q | Dimethylphthalate (ug/kg) | Q | Di-n-butylphthalate (ug/kg) | Q | Di-n-octylphthalate (ug/kg) | Q | Lead (mg/kg) | Q | Zinc (mg/kg) | Q |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T4-S3-07-D | 250 | | 2,100 | | 110 | | 2,000 | | 3,800 | | 27,039 | 60 | | 20 | U | 20 | U | 20 | U | 22 | U | 20 | U | 81 | | 217 | |
| T4-S3-07-E | 13 | | 120 | | 7 | | 90 | | 250 | | 1,480 | 20 | U | 20 | U | 20 | U | 20 | U | 36 | U | 20 | U | 14 | | 58 | |
| T4-S3-08-B | 260 | | 2,000 | | 93 | | 2,100 | | 4,500 | | 32,303 | 200 | U | 59 | U | 59 | U | 59 | U | 59 | U | 59 | U | 188 | | 297 | J |
| T4-S3-08-C | 14 | | 110 | | 5 | | 120 | | 250 | | 1,751 | 58 | U | 58 | U | 58 | U | 58 | U | 58 | U | 58 | U | 89 | | 142 | J |
| T4-VC23-0-1 | 93 | | 1,300 | | 39 | | 820 | | 1,800 | | 11,568 | 68 | | 20 | U | 20 | U | 20 | U | 20 | U | 20 | UJ | 69 | | 115 | J |
| T4-VC23-1-3 | 1 | J | 13 | | 0 | J | 10 | | 24 | | 142 | 10 | U | 10 | U | 10 | U | 10 | U | 10 | U | 10 | UJ | 3 | | 38 | J |
| T4-VC24-0-1 | 9,900 | | 36,000 | | 11,000 | | 66,000 | | 100,000 | | 602,953 | 200 | U | 180 | J | 200 | U | 200 | U | 200 | U | 200 | UJ | 681 | | 768 | J |
| T4-VC24-1-3 | 390 | | 5,000 | | 140 | | 3,500 | | 7,600 | | 47,027 | 58 | | 20 | U | 20 | U | 20 | U | 28 | | 20 | UJ | 153 | | 151 | J |
| T4-VC24-3-5 | 5 | U | 5 | U | 0 | J | 5 | U | 0 | J | 1 | 10 | U | 10 | U | 10 | U | 10 | U | 76 | | 10 | UJ | 5 | | 51 | J |
| T4-VC26-0-1 | 64 | | 900 | | 48 | | 600 | | 1,600 | | 8,520 | 40 | | 4 | J | 20 | U | 20 | U | 8 | J | 20 | UJ | 31 | | 98 | J |
| T4-VC26-1-3 | 120 | | 2,100 | | 49 | | 1,100 | | 2,700 | | 17,627 | 58 | | 13 | J | 20 | U | 20 | U | 5 | J | 20 | UJ | 109 | | 150 | J |
| T4-VC26-3-5 | 46 | | 500 | | 37 | | 340 | | 730 | | 4,513 | 86 | | 8 | J | 20 | U | 20 | U | 13 | J | 20 | UJ | 72 | | 152 | J |
| T4-VC29-0-1 | 310 | | 4,600 | | 190 | | 2,700 | | 7,000 | | 40,277 | 70 | | 19 | J | 20 | U | 20 | U | 10 | J | 20 | UJ | 338 | | 281 | J |
| T4-VC29-1-3 | 510 | | 7,900 | | 360 | | 4,500 | | 13,000 | | 68,860 | 130 | | 100 | U | 100 | U | 100 | U | 100 | U | 100 | UJ | 240 | | 263 | J |
| T4-VC29-3-5 | 190 | | 2,800 | | 120 | | 1,700 | | 4,400 | | 26,507 | 64 | J | 100 | U | 100 | U | 100 | U | 100 | U | 100 | UJ | 129 | | 155 | J |
| T4-VC29-5-7 | 5 | U | 5 | U | 5 | U | 1 | J | 1 | J | 3 | 10 | U | 10 | U | 10 | U | 10 | U | 21 | J | 10 | UJ | 3 | | 44 | J |
| T4-VC32-0-1 | 330 | | 2,400 | | 290 | | 2,600 | | 7,600 | | 32,450 | 79 | | 10 | J | 20 | U | 20 | U | 32 | | 20 | UJ | 176 | | 253 | J |
| T4-VC32-1-3 | 260 | | 3,300 | | 170 | | 1,900 | | 4,800 | | 28,584 | 130 | | 20 | U | 20 | U | 20 | U | 14 | J | 20 | UJ | 151 | | 188 | J |
| T4-VC32-3-5 | 400 | | 6,600 | | 170 | | 3,700 | | 9,200 | | 56,293 | 180 | | 20 | U | 20 | U | 20 | U | 13 | J | 20 | UJ | 161 | | 207 | J |
| T4-VC32-5-7 | 0 | J | 1 | J | 0 | J | 2 | J | 5 | | 23 | 10 | U | 10 | U | 10 | U | 10 | U | 10 | U | 10 | UJ | 3 | | 38 | J |
| TOTAL: | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **T4 Dredge Prism Volume-** | 566 | | 3,841 | | 312 | | 4,259 | | 7,454 | | 50,851 | 73 | | 41 | | 43 | | 43 | | 45 | | 43 | | 184 | | 250 | |

**Appendix B-2 - Summary Statistics for Terminal 4 Dredge Prism (DDTs, PCBs, Other Metals)**

| sys_loc_code | Sample ID | Sample Date | Sample Depth (feet) | Sample Interval (feet) | MET Interval | 2,4'-DDD (ug/kg) | Q | 2,4'-DDE (ug/kg) | Q | 2,4'-DDT (ug/kg) | Q | 4,4'-DDD (ug/kg) | Q | 4,4'-DDE (ug/kg) | Q | 4,4'-DDT (ug/kg) | Q | Total DDTs (SMS) (ug/kg) | Q | Aroclor 1016 (ug/kg) | Q | Aroclor 1221 (ug/kg) | Q | Aroclor 1232 (ug/kg) | Q | Aroclor 1242 (ug/kg) | Q | Aroclor 1248 (ug/kg) | Q | Aroclor 1254 (ug/kg) | Q | Aroclor 1260 (ug/kg) | Q | Aroclor 1262 (ug/kg) | Q | Aroclor 1268 (ug/kg) | Q | Total PCBs (SMS) (ug/kg) | Q | Arsenic (mg/kg) | Q | Cadmium (mg/kg) | Q | Chromium (mg/kg) | Q | Copper (mg/kg) | Q | Mercury (mg/kg) | Q | Nickel (mg/kg) | Q | Silver (mg/kg) | Q |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T4-B411 | T4-B411-01(-43 to -44) | 08-Jan-07 | 43-44 | 1 | X | 2 | U | 2 | U | 2 | U | 2 | U | 2 | U | 2 | U | 2 | U | 19 | U | 19 | U | 19 | U | 19 | U | 19 | U | 19 | U | 19 | U | 19 | U | 19 | U | 19 | U | 7 | | 1.6 | | | | 29.7 | J | 0.06 | U | 19 | | | |
| T4-B411 | T4-B411-01(-44 to -45) | 08-Jan-07 | 44-45 | 1 | X | 1.9 | U | 1.9 | U | 1.9 | U | 1.9 | U | 1.9 | U | 4.1 | U | 4.1 | U | 19 | U | 19 | U | 19 | U | 19 | U | 19 | U | 19 | U | 19 | U | 19 | U | 19 | U | 19 | U | 6 | U | 1.2 | | | | 23.3 | J | 0.05 | U | 20 | | | |
| T4-B411 | T4-B411-02(-42 to -43) | 08-Jan-07 | 42-43 | 1 | X | 1.9 | U | 1.9 | U | 1.9 | U | 1.9 | U | 1.9 | U | 1.9 | U | 1.9 | U | 19 | U | 19 | U | 19 | U | 19 | U | 19 | U | 19 | U | 19 | U | 19 | U | 19 | U | 19 | U | 7 | | 2.9 | | | | 34.9 | J | 0.05 | U | 21 | | | |
| T4-B411 | T4-B411-02(-43 to -44) | 08-Jan-07 | 43-44 | 1 | X | 2 | U | 2 | U | 2 | U | 2 | U | 2 | U | 6.5 | U | 6.5 | U | 20 | U | 20 | U | 20 | U | 20 | U | 20 | U | 20 | U | 20 | U | 20 | U | 20 | U | 20 | U | 5 | U | 1.6 | | | | 23.7 | J | 0.05 | U | 17 | | | |
| T4-B411 | T4-B411-06-A | 03-Jan-07 | - | 1 | X | 9.9 | U | 9.9 | U | 9.9 | U | 17 | U | 9.9 | U | 9.9 | U | 17 | U | 20 | U | 20 | U | 20 | U | 20 | U | 20 | U | 48 | | 54 | | 20 | U | 20 | U | 102 | | 14 | | 3.9 | | | | 116 | | 0.12 | | 32 | | | |
| T4-B411 | T4-B411-06-B | 03-Jan-07 | - | 1 | X | 3.9 | U | 3.9 | U | 8.8 | U | 25 | U | 16 | U | 50 | U | 50 | U | 19 | U | 58 | U | 19 | U | 19 | U | 39 | U | 52 | | 130 | | 92 | U | 19 | U | 182 | | 14 | | 4.2 | | | | 82.8 | | 0.14 | | 30 | | | |
| T4-B411 | T4-B411-06-C | 03-Jan-07 | - | 1 | X | 3.9 | U | 3.9 | U | 3.9 | U | 3.9 | U | 9.9 | U | 13 | U | 13 | U | 20 | U | 79 | U | 39 | U | 20 | U | 39 | U | 48 | | 74 | | 51 | U | 20 | U | 122 | | 11 | | 3.3 | | | | 78.3 | | 0.13 | | 29 | | | |
| T4-VC23 | T4-VC23-0-1 | 03-Mar-04 | 0-1 | 1 | | 1.1 | | 0.44 | U | 1.1 | J | 2 | | 2.1 | | 1.8 | J | 5.9 | | 5 | U | 9.9 | U | 5 | U | 5 | U | 5 | U | 5 | U | 12 | | 5 | U | 5 | U | 12 | | 4.2 | | 0.61 | | 13.9 | J | 29 | J | 0.033 | J | 19.3 | J | 0.23 | |
| T4-VC23 | T4-VC23-1-3 | 03-Mar-04 | 1-3 | 2 | | 0.4 | U | 0.4 | U | 0.4 | U | 0.4 | U | 0.4 | U | 0.4 | U | 0.4 | U | 5 | U | 10 | U | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 10 | U | 2.1 | | 0.1 | | 10.1 | J | 20.6 | J | 0.019 | UJ | 15.5 | J | 0.05 | |
| T4-VC24 | T4-VC24-0-1 | 03-Mar-04 | 0-1 | 1 | | 3 | | 0.72 | U | 0.84 | U | 5.6 | | 6 | | 6.5 | | 18.1 | | 5.1 | U | 11 | U | 5.1 | U | 5.1 | U | 5.1 | U | 5.1 | U | 53 | | 5.1 | U | 5.1 | U | 53 | | 15.1 | | 4.44 | | 25.4 | J | 72.4 | J | 0.129 | | 21 | J | 1.46 | |
| T4-VC24 | T4-VC24-1-3 | 03-Mar-04 | 1-3 | 2 | | 1 | | 0.4 | U | 0.61 | J | 1.5 | | 1.2 | | 0.4 | U | 2.7 | | 5 | U | 9.9 | U | 5 | U | 5 | U | 5 | U | 11 | | 10 | J | 5 | U | 5 | U | 21 | | 5.5 | | 0.92 | | 22.8 | J | 41 | J | 0.034 | J | 23.3 | J | 0.15 | |
| T4-VC24 | T4-VC24-3-5 | 03-Mar-04 | 3-5 | 2 | | 0.4 | U | 0.4 | U | 0.4 | U | 0.4 | U | 0.4 | U | 0.4 | U | 0.4 | U | 5 | U | 9.9 | U | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 9.9 | U | 2.3 | | 0.2 | | 19.4 | J | 27.7 | J | 0.035 | J | 22.5 | J | 0.09 | |
| T4-VC26 | T4-VC26-0-1 | 04-Mar-04 | 0-1 | 1 | | 1.2 | | 0.4 | U | 0.74 | | 2.5 | | 3.5 | | 2 | J | 8 | | 5 | U | 10 | U | 5 | U | 5 | U | 6 | | 15 | U | 16 | | 5 | U | 5 | U | 22 | | 3.2 | | 0.49 | | 25.2 | | 33.4 | J | 0.074 | | 20.5 | J | 0.21 | |
| T4-VC26 | T4-VC26-1-3 | 04-Mar-04 | 1-3 | 2 | | 2.1 | | 0.62 | U | 0.93 | J | 3.1 | | 3.7 | | 1.7 | | 8.5 | | 5.1 | U | 11 | U | 5.1 | U | 5.1 | U | 13 | | 29 | U | 28 | | 5.1 | U | 5.1 | U | 41 | | 4.8 | | 0.8 | | 25 | | 43.1 | J | 0.088 | | 20.4 | J | 0.46 | |
| T4-VC26 | T4-VC26-3-5 | 05-Mar-04 | 3-5 | 2 | | 4.2 | J | 0.4 | U | 3.1 | J | 3.3 | | 4.7 | J | 13 | | 21 | | 5 | U | 10 | U | 5 | U | 5 | U | 53 | | 88 | U | 130 | | 5 | U | 5 | U | 183 | | 3.9 | | 0.8 | | 23.6 | | 35.6 | J | 0.102 | | 20.8 | J | 0.37 | |
| T4-VC29 | T4-VC29-0-1 | 05-Mar-04 | 0-1 | 1 | | 2.4 | | 0.75 | | 0.63 | U | 3.4 | | 2.2 | | 2.8 | J | 8.4 | | 5.2 | U | 11 | U | 5.2 | U | 5.2 | U | 11 | | 19 | U | 31 | | 5.2 | U | 5.2 | U | 42 | | 6.4 | | 1.9 | | 21.9 | | 44.9 | J | 0.088 | | 19 | J | 0.7 | |
| T4-VC29 | T4-VC29-1-3 | 05-Mar-04 | 1-3 | 2 | | 16 | | 0.67 | U | 24 | U | 64 | J | 4.1 | | 90 | | 158 | | 50 | U | 100 | U | 50 | U | 50 | U | 50 | U | 240 | U | 1000 | | 50 | U | 50 | U | 1000 | | 5.4 | | 1.81 | | 28 | | 43.9 | J | 0.078 | | 21.7 | J | 0.54 | |
| T4-VC29 | T4-VC29-3-5 | 05-Mar-04 | 3-5 | 2 | | 1.8 | J | 0.4 | U | 0.4 | U | 2.5 | | 1.8 | | 1.6 | | 5.9 | | 5 | U | 10 | U | 5 | U | 5 | U | 6.7 | | 22 | U | 17 | | 5 | U | 5 | U | 23.7 | | 3.8 | | 0.88 | | 15.7 | | 28.6 | J | 0.053 | | 18.7 | J | 0.28 | |
| T4-VC29 | T4-VC29-5-7 | 05-Mar-04 | 5-7 | 2 | | 0.4 | U | 0.4 | U | 0.4 | U | 0.4 | U | 0.4 | U | 0.4 | U | 0.4 | U | 5 | U | 10 | U | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 5 | U | 10 | U | 1.4 | | 0.09 | | 13.9 | | 15 | J | 0.014 | B | 17.2 | J | 0.02 | |
| T4-VC32 | T4-VC32-0-1 | 04-Mar-04 | 0-1 | 1 | | 2.8 | | 0.93 | U | 1.4 | J | 5.4 | | 2.9 | | 9.8 | | 18.1 | | 5 | U | 10 | U | 5 | U | 5 | U | 11 | J | 28 | U | 46 | | 5 | U | 5 | U | 57 | | 5.1 | | 1.69 | | 23 | | 44 | J | 0.083 | | 22.8 | J | 0.57 | |
| T4-VC32 | T4-VC32-1-3 | 04-Mar-04 | 1-3 | 2 | | 3 | | 0.79 | U | 1.3 | J | 4.5 | | 4.9 | | 4 | | 13.4 | | 5.1 | U | 11 | U | 5.1 | U | 5.1 | U | 24 | | 45 | U | 64 | | 5.1 | U | 5.1 | U | 88 | | 5.2 | | 1.19 | | 26.4 | | 53.7 | J | 0.11 | | 23.7 | J | 0.48 | |
| T4-VC32 | T4-VC32-3-5 | 04-Mar-04 | 3-5 | 2 | | 2.5 | | 0.69 | U | 0.66 | U | 3.7 | | 3.6 | | 2.8 | | 10.1 | | 5 | U | 10 | U | 5 | U | 5 | U | 22 | | 33 | U | 29 | | 5 | U | 5 | U | 51 | | 4.6 | | 1.23 | | 19.6 | | 49.7 | J | 0.086 | | 20.5 | J | 0.77 | |
| T4-VC32 | T4-VC32-5-7 | 04-Mar-04 | 5-7 | 2 | | 0.41 | U | 0.41 | U | 0.41 | U | 0.41 | U | 0.41 | U | 0.41 | U | 0.41 | U | 5.1 | U | 11 | U | 5.1 | U | 5.1 | U | 5.1 | U | 5.1 | U | 5.1 | U | 5.1 | U | 5.1 | U | 11 | U | 2.3 | | 0.1 | | 9.59 | | 13.9 | J | 0.012 | B | 14.8 | J | 0.02 | U |
| **T4 Dredge Prism Unweighted Mean** | | | | | | **3.0** | | **1.5** | | **2.9** | | **6.8** | | **3.7** | | **9.8** | | **16.3** | | **11** | **U** | **21** | **U** | **12** | **U** | **11** | **U** | **18** | | **34** | | **78** | | **16** | **U** | **11** | **U** | **92** | | **6.1** | | **1.6** | | **20** | | **43** | | **0.07** | | **21** | | **0.40** | |