Dakota Creek Industries
Shipyard Facility

Sediment Sampling Data Report

Prepared for

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1.0 Introduction

This report has been prepared on behalf of the Port of Anacortes (Port) to present the results of recent sediment quality sampling at the Dakota Creek Industries Shipyard Facility (DCI Basin) in Anacortes, Washington (Figure 1.1). Sediment samples were collected and chemically analyzed to determine the nature and extent of dioxin/furans in the surface sediments of the DCI Basin. This document is consistent with the guidelines provided by the Washington State Department of Ecology (Ecology) in the Sediment Sampling and Analysis Plan Appendix (Ecology 2003) and the Puget Sound Estuary Program (PSEP) guidelines (PSEP 1997). The sediment investigation was performed in accordance with a Sediment Sampling and Analysis Plan (SAP), which was approved by the Ecology in May 2006. The purpose of this investigation was to determine the nature and extent of potential sediment contamination in the DCI Basin resulting from historical uses of the site. Data presented in this report supplements the existing sediment quality data collected at the site as summarized in the *Sediment Quality Analysis Report* (Landau 2003).

The results of the sampling and analysis performed show that concentrations of dioxin/furan compounds in the surface sediments of the DCI Basin are greater than those at representative background locations. Detected dioxin/furan concentrations in all of the samples analyzed showed similar concentration ratios, thus suggesting a common source. Select samples were identified to exceed toxicity based dredged material disposal criteria however none of the samples collected and analyzed exceed the sediment dioxin/furan screening level used for the Former Scott Paper Mill Marine Area.

This report in organized as follows:

- Section 1.0 provides the project background and document organization.
- Section 2.0 provides an overview of the sampling and analysis program, including a description of deviations from the Sediment SAP.
- Section 3.0 summarizes the results of the laboratory testing performed and the results of dioxin/furan data comparisons to applicable data and criteria.
- Section 4.0 summarizes existing surface and subsurface sediment data compared to both Sediment Management Standards (SMS) criteria and Dredge Material Management Program (DMMP) criteria where appropriate.
- Section 5.0 provides references for this document.

Tables and Figures are grouped together following the text and prior to appendices. The appendices include copies of the sample collection forms, background report figures, a sediment sample rationale memorandum, chains of custody, and analytical laboratory reports.

1.1 PROJECT BACKGROUND

The DCI Basin is currently an active shipyard, primarily used for the construction and repair of vessels. The general history and existing conditions of the DCI Basin are described in detail in the following reports:

- *Sediment Quality Analysis*, Dakota Creek Industries Shipyard Facility, Anacortes, Washington (Landau Associates 2003).
- *Dredge Material Characterization*, Dakota Creek Shipyards, Anacortes, Washington (Hart Crowser 2000).

The Port and tenant, Dakota Creek Industries, are currently preparing for redevelopment to both the uplands and offshore areas of the shipyard. The proposed offshore redevelopment construction activities include installation of a new bulkhead and dredging to approximately –35 feet mean lower low water (MLLW). Redevelopment construction is anticipated to begin in July of 2007.

A number of sediment surface and subsurface sediment quality samples have been collected from within the DCI Basin since 1985 (Landau 2003). The data from these investigations are useful in evaluating sources of potential contamination. Ecology has identified a data gap regarding sediment dioxin/furan concentrations because the previous investigations did not evaluate this contaminant since they were focused on the contaminant of concern listings of the Sediment management Standards or the Dredged Material Management Program. Concern has been raised that the Former Scott Paper Mill outfall, that discharged into Guemes Channel, adjacent to the DCI Basin, may have adversely impacted sediment quality with respect to dioxin/furans and therefore, evaluation of dioxin/furans is required by Ecology along with the other Sediment Management Standards contaminants of concern to complete a comprehensive sediment quality evaluation at the site relative to all potential sources. Partial dioxin/furan characterization at the site was completed by Kimberly Clark (Anchor 2004b) to determine the suitability of planned dredged material for open water disposal. Ecology has documented concerns that the existing sediment dioxin/furan analyses may not be representative of the sediment that was potentially directly impacted by the Former Scott Paper Mill outfall discharge. The existing dioxin/furan data are the results of analysis of composite samples collected over an approximately 5-foot subsurface interval. Ecology is concerned that the historical dioxin/furan deposits may have been diluted by mixing of sediments not representative of the Former Scott Paper Mill discharge period during the sample compositing process. To address the Ecology concerns, sediment dioxin/furan characterization was performed on the sample interval determined to be representative of the former outfall discharge period.

1.1.1 Target Sediment Sampling Interval

The actual sedimentation rate of the DCI Basin is unknown, but is evidenced to be low because significant infilling is not observed and routine maintenance dredging is not required. Based on a review of available literature, the Puget Sound typical low sedimentation rate of 0.1 cm/year was assumed for the DCI Basin (Appendix A). Using this assumed rate and the time period during which the Former Scott Paper Mill outfall discharged (approximately 1952 to 1978) (Anchor 2004a) the sediments that would have been directly affected by the outfall discharges are present at 2.7 to 5.3 cm below the mudline. Therefore, Ecology agreed that the upper 10 cm would be the most appropriate sample interval for evaluating potential historical impacts from the outfall discharges and this sampling interval is also compliant with the SMS surface sediment sampling interval. To account for potentially deeper contamination within the basin the 10 to 20 cm interval was also sampled where possible.

2.0 Sediment Sampling and Analysis

Surface sediment samples were collected at nine locations within and adjacent to the DCI Basin as shown in Figure 1.1. Sediment samples were collected in general accordance with the procedures described in the Ecology approved SAP (Floyd|Snider 2006). Deviations from the SAP are described in the following section.

Sediment samples were collected using either a 7-inch or a 14-inch diver-assisted hand corer. If cobbles, gravel, and/or debris were present at the sediment surface that prevented penetration of the 14-inch sampler the 7-inch sampler was used by the diver. The 7-inch sampler collects the surface 0 to 10 cm of sediment and the 14-inch sampler collects the 0 to 20 cm sediment surface interval.

The diver-assisted hand corer was inserted into the upper 10 or 20 cm of the sediment column and brought to the surface for sample processing. The sediment sample was visually classified in accordance with ASTM D 2488. The sediment descriptions, along with the sampling time, sampling coordinates and diver notes were recorded on a sediment sampling collection form (Appendix B). Sediment sample descriptions are summarized in Table 2.1. The sediment was placed in a decontaminated stainless steel bowl and homogenized until the sediment was uniform in color and texture. Appropriate sediment sampling containers were filled with the homogenized sediment, the sample labels completely filled out, and the containers stored on ice.

Sediment samples were stored in an iced cooler and submitted to ARI Laboratory under a chain-of-custody for the following analyses:

- Total Organic Carbon (PSEP)
- Total Solids (USEPA Method 160.3)
- Grain Size (PSEP)
- Dioxin/furan (USEPA Method 8290)

Copies of the chain-of-custody records are included as part of the laboratory reports provided in Appendix C.

Sediment samples were collected from sampling locations DCI06-1 through DCI06-3 and DCI06-5 through DCI06-8 as proposed. The diver was not able to collect a sample at proposed sampling location DCI06-4, located west of the Synchrolift. The diver could not safely reach the proposed location due to lack of visibility, the steep sediment surface drop off under the Synchrolift, and the risk of tangling air supply lines with dock pilling. Therefore, sampling location DCI06-4 was relocated to approximately 35 feet west of the eastern facing front of the "L Dock" (Figure 1.1). An additional surface sediment sample was collected at location designation DCI06-9, as shown on Figure 1.1, to aid in characterizing the surface sediment west of the Former Scott Paper Mill outfall. Sample location coordinates are presented in Table 2.2.

2.1 DEVIATIONS FROM THE SAP

- The diver was not able to collect a sample at proposed sampling location DCI06-4. The diver could not safely reach the proposed location due to lack of visibility, the steep sediment surface drop off under the Synchrolift, and the risk of tangling air supply lines with dock pilling. Therefore, sampling location DCI06-4 was relocated to approximately 35 feet west of the eastern facing front of the "L Dock" as shown in Figure 1.1.
- An additional surface sediment sample was collected at location designation DCI06-9, as shown on Figure 1.1 to compensate for relocation of DCI06-4.
- Due to adverse weather conditions (e.g. strong winds and currents, and rough water conditions) the proposed reference locations within Fidalgo Bay and Padilla Bay could not safely be reached with the diver boat. Therefore, sediment samples were not collected from the reference locations as proposed in the Sediment SAP (Floyd|Snider 2006).
- The sediment samples were not photographed during processing because the necessary equipment was not available at the time of sampling. In lieu of photographs, detailed sediment sample descriptions were prepared as summarized in Table 2.1.

3.0 Dioxin/furan Analysis Results

Results of the dioxin/furan analysis are presented in Figure 3.1.

3.1 DATA QUALITY REVIEW

All data packages were verified at a Level 1 review (also known as a Tier II, or basic review). Analytical data was validated in accordance with:

- EPA CLP National Functional Guidelines for Inorganic Data Review (1994)
- EPA CLP National Functional Guidelines for Organic Data Review (1999)

No qualifiers were added to the analytical results based on the results of the data validation. The dioxin compound OCDD was detected in one of the method blank samples, however, the OCDD concentrations detected in sediment samples were greater than five times the blank concentration, therefore in accordance with the EPA CLP National Functional Guidelines for Organic Data Review the compound results do not require qualification. Data was determined to be of acceptable quality for use as qualified.

3.2 DATA COMPARISON TO BACKGROUND LOCATIONS

As part of this field event sediment samples were not collected from reference locations due to adverse weather. However, the proposed background sampling locations were the same as those sampled by Anchor Environmental, L.L.C. (Anchor) in 2004 as part of the Supplemental Sediment Characterization performed at DCI (Anchor 2004b). Therefore, comparison of the results of dioxin/furan testing performed in this investigation to the dioxin/furan concentrations detected in sediment samples collected from the 2004 reference locations in Fidalgo Bay and Padilla Bay is considered applicable. For this evaluation the results of the dioxin/furan analysis in sediment samples collected from and adjacent to the DCI Basin were directly compared to the 2004 reference location concentrations.

Each of the DCI sediment samples had at least one dioxin/furan congener detected at a concentration greater than that of the reference samples. The most frequently detected congeners and those detected at the highest concentrations were HpCDD, HpCDF, OCDD, and OCDF. HpCDD and OCDD were also previously detected in the 2004 reference location samples (Table 3.2).

3.3 DATA COMPARISON TO TOXICITY EQUIVALENCY FACTORS CRITERION

Complex environmental mixtures such as dioxins and furans are composed of multiple chemical components. The toxicity equivalency methodology can be used to evaluate the toxicity and assess the risks of these complex chemical mixtures that have similar structure-activity relationships. The toxicity equivalency methodology uses toxicity equivalency factors (TEFs) to estimate the potency of congeners in the mixture relative to the index chemical which is the most potent chemical. For dioxin/furan mixtures this chemical is 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). The toxicity equivalency methodology is used to calculate the total toxicity equivalency (TEQ) of the dioxin/furan mixture. This value can then be compared to criteria. To determine the TEQ, first the concentration of each congener in the media is multiplied by the applicable TEF to obtain a toxicity equivalent concentration (TEC). Then the calculated TECs are summed to obtain the TEQ.

Dioxin/furan TEFs, as presented in MTCA (WAC 173-340-708(8)) and DMMP (PSDDA 2000) are based on scientific judgment and supported by empirical data (Table 3.1). Ecology has initiated a rulemaking process to amend the MTCA Cleanup Regulation, which includes amendments to the procedures for establishing cleanup levels for mixtures of polychlorinated dibenzo-p-dioxins/ polychlorinated dibenzo-p-furans and applicable TEFs. Because the rule amendments are still draft, the dioxin/furan data presented in this report were evaluated using the current MTCA and DMMP TEFs. However, the dioxin/furan data were also evaluated using the proposed TEFs for completeness (MTCA SAB 2006; Ecology 2006).

3.3.1 Data Comparison to DMMP Criteria

The DMMP provides guidance for the evaluation and determination of the suitability of dredged material for unconfined, open-water disposal. Included in this approach is chemical testing. DMMP provides criteria to evaluate the results of chemical testing for chemicals of concern (COC) and to determine if biological testing is necessary. The chemicals identified as COCs and those that have criteria generally have the characteristics including; a demonstrated or suspected effect on ecology or human health, one or more present or historical sources, a potential for remaining in a toxic form for long periods in the environment, and a potential for entering the food web. Therefore, although the objective of this investigation was not to determine the suitability of dredge material for disposal, comparison of the dioxin/furan data to DMMP criteria is appropriate as the criteria were derived to assess the potential for sediment toxicity.

DMMP guidance provides two criteria to evaluate dioxin/furan sediment data. Those criteria include the following:

- A bulk sediment 2,3,7,8-TCDD concentration of 5 ng/kg.
- A dioxin/furan TEQ concentration of 15 ng/kg.

To evaluate the results of the dioxin/furan testing, the current MTCA TEFs were used to calculate the congener TECs and the TECs were summed to obtain the dioxin/furan TEQ using the methods described above. If the dioxin/furan congener was not detected one-half of the reporting limit was used to calculate the TEC, in accordance with the requirements outlined in the DMMP guidance for dioxin/furan data evaluation (PSDDA 2000).

The DMMP criterion for 2,3,7,8-TCDD concentration of 5 ng/kg was not exceeded in any of the sediment samples collected (Table 3.3). A total of two sediment samples had TEQ concentrations that exceeded the DMMP criterion of 15 ng/kg. Both samples were 0 to 10 cm surface samples, collected from locations DCI06-4 and DCI06-6. These sample locations are along the “L Dock”, east of the Former Scott Paper Mill outfall. Using the proposed MTCA TEFs to evaluate the dioxin/furan data, the same two sediment samples would exceed the DMMP TEQ criterion.

3.3.2 Data Comparison to Criteria Used at the Former Scott Paper Mill Marine Area

The sediment dioxin/furan screening level that has been identified for the Former Scott Paper Mill Site is called the total 2,3,7,8-TCDD Equivalants. This screening level is equal to a concentration of 3,600 ng/kg (Anchor 2004a). The results of the dioxin/furan testing performed for this investigation were also compared to this sediment screening level. The calculated TEQ values for DCI sediment samples were well below the Former Scott Paper Mill sediment screening level.

4.0 Summary of Existing Data

This section provides an overview of surface sediment quality in the DCI Basin as determined from previous sediment investigations. A total of five sediment quality investigations have been conducted in the DCI Basin for the purposes of dredged material characterization as well as environmental assessments (Hart Crowser 1985, Otten Engineering 1997, Hart Crowser 2000, Weston 2002, and Anchor 2004b). Data from the investigations completed prior to 2004 have been compiled in the *Sediment Quality Analysis* report (Landau 2003).

Surface sediment metals have previously been detected at concentrations that exceed the Sediment Quality Standards (SQS) criteria in only two samples collected in 1997 and 2001 (Otten Engineering 1997; Weston 2002). In two locations, DC-SED-03 and IT004, both copper and zinc exceeded SQS criteria. Additionally, at location DC-SED-03, arsenic and mercury also exceeded SQS criteria. Metal concentrations detected in previous investigations are summarized in Figures presented in the Landau *Sediment Quality Analysis* report and are included in Appendix D.

Semivolatile organic compounds (SVOCs) were detected at concentrations that exceed the SQS criteria in two surface sediment samples located near the former Marine Railway (IT004, DC-SED-03) and in one location situated between the “East Dock” and the “L Dock” (DC-SED-08). High molecular weight polycyclic aromatic hydrocarbons (HPAHs) exceeded SQS in all three of these sampling locations and low molecular weight polycyclic aromatic hydrocarbons (LPAHs) in two locations (IT004 and DC-SED-08). Bis(2-ethylhexyl)phthalate and dibenzofuran were detected at concentrations greater than SQS in one sediment sample location (IT004). SVOC concentrations detected in previous investigations are summarized in Figures presented in the Landau *Sediment Quality Analysis* report and are included in Appendix D.

In 2000 two composite core sediment samples were collected as part of further characterization for dredge material management (Hart Crowser 2000). The DCI Basin was divided into two Dredge Material Management Units (DMMUs), DMMU 1 and DMMU 2. Sediment core samples were collected and composited into one sample for each DMMU (D1-Comp-(A) and D2-Comp-(A)). Core samples from approximately 0 to 4 ft below the surface in DMMU 1 and from approximately 0 to 5 ft below the surface in DMMU 2 were used for the composite sediment core samples. Composite samples were analyzed for all SMS contaminants as well as TBT, pesticides, ammonia, and sulfides. The samples were not analyzed for dioxin/furans. The concentrations of all detected contaminants in DMMU 1 were below SQS criteria. In composite sample D2-Comp-(A), collected from DMMU 2, detected concentrations of several HPAH compounds and the Total HPAH concentration exceeded SQS criteria, but were below CSL criteria. All other detected contaminant concentrations were below SQS criteria. There are no SMS criteria for VOCs or Pesticides; however, VOCs were not detected in either of the composite core samples. Pesticides were either not detected or at low concentrations, slightly above the reporting limits. DMMU 1 was approved for open-water disposal. The sediments below the contact with native till in DMMU 2 were also approved for open-water disposal.

Sediment investigations conducted prior to the Supplemental Dredged Material Characterization conducted by Anchor in 2004, did not analyze for contaminants that could potentially be associated with pulp mill effluent (i.e., dioxin/furans) discharged from the Former Scott Paper

Mill outfall. In 2004, five subsurface sediment cores, each approximately 5 feet in length, were collected to characterize materials in proposed dredging areas by Anchor. As part of the characterization, sediment core samples were analyzed for dioxin/furans. In each sediment core, sediment samples were collected from the 1- to 3-foot or 2- to 3-foot interval. However, the sample interval used did not focus on the sediment sample interval of interest that is representative of the outfall period of discharge. The dioxin/furan concentrations in the sediment cores collected from the DCI and Pier 1 Dredge Material Management Units (DMMUs) were less than both the DMMP criterion for 2,3,7,8-TCDD (5 ng/kg) and the TEQ (15 ng/kg). The complete results of the sediment characterization are provided in the *Sampling and Analysis Data Report* (Anchor 2004b), which is included in Appendix E.

5.0 References

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Tables

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Table 2.1
Sediment Sample Descriptions

Sample	Depth Interval (cm)	Sample Description	Sample Collection Notes
DCI06-1A	0-10	Soft, dark gray gravelly sand with rounded gravel up to 1 inch in diameter. Approx. 80% shells and shell fragments. Small sheen in sediment, less than 1" wide.	Surface cobbles present and removed by Diver to penetrate with corer. Not able to collect 10 to 20 cm sample due to hard substrate.
DCI06-2A	0-10	Hard, olive gray sandy gravel with rounded gravel and rocks up to 3 inches in diameter with barnacles and algae. Abundant shell fragments.	Gravel and cobbles present. Not able to collect 10 to 20 cm sample due to hard substrate.
DCI06-2D	0-10	Hard, dark gray/olive, gravelly sand with angular and rounded gravel up to 2 inches in diameter. Abundant shell fragments, large 3 inch clam.	Gravel and cobbles present. Not able to collect 10 to 20 cm sample due to hard substrate.
DCI06-3A	0-10	Stiff surface greenish clay with several small polychaete worms. Beneath immediate surface (1 to 2 cm) greenish/gray coarse gravelly sand with shell fragments.	Cobbles, gravel, and debris present. Not able to collect 10 to 20 cm sample due to hard substrate.
DCI06-4A	0-10	Very soft, dark olive/gray to black clayey silt (~5% sand) with 5% angular gravel. Trace shells.	Surface drops off at synchrolift with zero visibility. Lots of water in sample, with possible mixing of intervals. Only able to go 30 to 35 feet west, under pier and synchrolift.
DCI06-4B	10-20	Soft, olive/dark gray, sandy, clayey silt with ~10% sand, small rounded gravel, and angular rock up to 3 inches in diameter. Wood debris up to 4 inches in diameter, some shell fragments.	Surface drops off at synchrolift with zero visibility. Lots of water in sample, with possible mixing of intervals. Only able to go 30 to 35 feet west, under pier and synchrolift.
DCI06-5A	0-10	Soft, olive gray silty clay with black banding (reduced sediment), increased (OL). Wood fibers ~40%. H_2S odor and small shell fragments.	None

Sample	Depth Interval (cm)	Sample Description	Sample Collection Notes
DCI06-5B	10-20	Very soft, olive gray silty clay with black banding (reduced sediment), and less than 10% wood fibers-roots. H_2S odor.	None
DCI06-6A	0-10	Soft/medium stiff black coarse sand with interbedded silty clay and rounded gravel up to 1 to 2 inches in diameter and one large 5-inch rock. Some shell fragments.	Cobbles present (100%) under L dock. Not able to collect 10-20 cm sample due to hard substrate.
DCI06-7A	0-10	Very soft, olive/gray/dark green silty clay with little shell fragments and algae (reddish and green). Faint H_2S odor.	Algae cover is 100% at sediment surface.
DCI06-7B	10-20	Soft, olive/gray/green clayey silt with less than 10% fine sand. Shell fragments. Faint H_2S odor.	Algae cover is 100% at sediment surface.
DCI06-8A	0-10	Dark gray, black gravelly coarse sand with crushed rock up to 3 inches in diameter and abundant shell fragments. Only marine odor.	Very coarse gravel present at surface. Not able to collect 10 to 20 cm sample due to hard substrate.
DCI06-9A	0-10	Dry sand-surface under building/dock adjacent to Port building.	None

Note:
Sediment samples collected using a 7-inch or a 14-inch diver-assisted hand core.

Table 2.2
Sediment Sampling Location Coordinates

Sample ID	Sample Coordinates (NAD 83 State Plane WA N)	
	Northing	Easting
DC106-1	560275	1209237
DC106-2	560230	1209652
DC106-3	560142	1209707
DC106-4	559989	1209715
DC106-5	560097	1209976
DC106-6	559852	1209708
DC106-7	559899	1209971
DC106-8	559756	1209962
DC106-9	NA	NA

Notes:
NA Not available. Sediment sample collected on-shore by hand.
All sediment samples collected on November 17, 2006.

Table 3.1
Summary of Dioxin/furan Toxic Equivalency Factors

Dioxin/Furan Congeners	TEF
1,2,3,4,6,7,8-HpCDD	0.01
1,2,3,4,6,7,8-HpCDF	0.01
1,2,3,4,7,8,9-HpCDF	0.01
1,2,3,4,7,8-HxCDD	0.1
1,2,3,4,7,8-HxCDF	0.1
1,2,3,6,7,8-HxCDD	0.1
1,2,3,6,7,8-HxCDF	0.1
1,2,3,7,8,9-HxCDD	0.1
1,2,3,7,8,9-HxCDF	0.1
1,2,3,7,8-PeCDD	0.5
1,2,3,7,8-PeCDF	0.05
2,3,4,6,7,8-HxCDF	0.1
2,3,4,7,8-PeCDF	0.5
2,3,7,8-TCDD	1
2,3,7,8-TCDF	0.1
OCDD	0.001
OCDF	0.001

Notes:
TEF Toxic Equivalency Factors

Table 3.2
Summary of Sediment Sampling Results and Comparison to 2004 Reference Samples

	Sample ID	DCI06-1A	DCI06-2A	DCI06-2-D	DCI06-3A	DCI06-4A	DCI06-4B	DCI06-5A	DCI06-5B	DCI06-6A	DCI06-7A	DCI06-7B	DCI06-8A	DCI06-9A	AN-REF-1-01-SD	AN-REF-2-01-SD
	Sample Date	11/17/2006	11/17/2006	11/17/2006	11/17/2006	11/17/2006	11/17/2006	11/17/2006	11/17/2006	11/17/2006	11/17/2006	11/17/2006	11/17/2006	11/17/2006	7/13/2004	7/13/2004
	Sample	0 to 10 cm	0 to 10 cm	0 to 10 cm	0 to 10 cm	0 to 10 cm	10 to 20 cm	0 to 10 cm	10 to 20 cm	0 to 10 cm	0 to 10 cm	10 to 20 cm	0 to 10 cm	0 to 10 cm	0 to 15 cm	0 to 15 cm
Analytes	Units															
Conventionals (USEPA Method 160.3)																
Total Solids	%	69.5	78.3	78.2	75.5	67	59.6	34.8	42.9	81.9	55.1	57.2	71.1	95.8	58	70.6
Total Organic Carbon[1]	%	1.32	0.641	1.15	0.448	0.883	3.43	4.96	2.88	0.56	1.48	1.06	1.27	0.239	1.17	0.74
Grain Size (PSEP Method)																
Gravel	%	40.5	41.4	15.4	27.4	22	32.7	3.2	1.4	39.1	0.6	2.3	29.4	0	0.02	0.04
Sand, Very Coarse	%	9.7	8.4	10.9	11.9	5.2	4.6	3.3	2.2	10.6	1.6	0.9	6.5	0.1	0.36	0.41
Sand, Coarse	%	6.8	11.8	17.3	10.1	4.5	3.5	3.9	2.5	9.5	1.9	1.7	12.8	2.9	0.47	4.37
Sand, Medium	%	14.7	17.4	33.7	13.8	9	6.8	6	4.1	13.7	3.9	4.5	22.1	78.1	0.74	19.5
Sand, Fine	%	12.2	8.7	11.4	10.4	17.3	14.5	12.1	12.3	16.4	12.5	13.1	10.9	18.7	16.9	24.8
Sand, Very Fine	%	4.4	2.2	2.9	6.2	14.5	10.1	11.8	13	4.4	23.1	20.7	3.9	0	33	5.57
Silt	%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	34.6	30
Silt, Coarse	%	1.5	5.3	2.7	3.7	10.5	7.2	7.7	11.9	1.6	20.7	22.6	3.1	NA	NA	NA
Silt, Medium	%	1.7	0.9	1.1	3.7	4.1	5.6	16.5	12.1	1.3	11.5	12.4	2.9	NA	NA	NA
Silt, Fine	%	1.6	0.8	0.9	2.9	2.6	3.9	7.4	8.8	0.7	5.9	5.7	2	NA	NA	NA
Silt, Very Fine	%	1.3	0.6	0.8	2.3	2.4	2.6	6.2	6.7	0.5	3.8	3.2	1.2	NA	NA	NA
Clay	%	5.6	2.6	2.8	7.6	7.9	8.4	22	24.9	2.3	14.4	13.2	5.3	NA	10.8	6.23
Dioxin/Furan Congeners (USEPA Method 8290)																
1,2,3,4,6,7,8-HpCDD	ng/kg	**20**	2 J	**5**	**18**	**6100** A	**220**	**180**	**9**	**1100** A	**330**	**220**	**310** A	**17**	2.742 J	6.001
1,2,3,4,6,7,8-HpCDF	ng/kg	**3.1** J	1.1 U	0.91 U	**3.6** J	**1000** A	**54**	**29**	1.4 J	**180**	**40**	**23**	**39**	**6.8**	2.5 U	2.5 U
1,2,3,4,7,8,9-HpCDF	ng/kg	0.82 U	1.1 U	0.91 U	0.97 U	**36**	2	1.3	0.37 U	**7.2**	2.5	2 J	**2.7**	1.1 J	2.5 U	2.5 U
1,2,3,4,7,8-HxCDD	ng/kg	0.82 U	1.1 U	0.91 U	0.97 U	**28**	1.8	1.8 J	0.37 U	**8.9**	2.1	1.1 J	**2.7**	1 U	2.5 U	2.5 U
1,2,3,4,7,8-HxCDF	ng/kg	0.82 U	1.1 U	0.91 U	0.97 U	**28**	1.6	1.4 J	0.37 U	0.44 E	2.5	0.97 E	**3.1**	1 E	2.5 U	2.5 U
1,2,3,6,7,8-HxCDD	ng/kg	1.4 J	1.1 U	0.91 U	1.2 J	**330** A	**11**	**10**	0.68 J	**61** A	**14**	**8.4**	**13**	1 U	2.5 U	2.5 U
1,2,3,6,7,8-HxCDF	ng/kg	0.82 U	1.1 U	0.91 U	0.97 U	0.26 E	1.6	1.4 J	0.37 U	**3.2**	1.5 J	1 J	1.5	1 U	2.5 U	2.5 U
1,2,3,7,8,9-HxCDD	ng/kg	0.82 U	1.1 U	0.91 U	0.97 U	**49**	**3.9**	2.5 J	0.46 J	**21**	**4.8**	2.2	**6.2**	1 U	2.5 U	2.5 U
1,2,3,7,8,9-HxCDF	ng/kg	0.82 U	1.1 U	0.91 U	0.97 U	**16**	0.69 J	1 U	0.37 U	**2.8**	0.94 J	0.97 U	0.88 JA	1 U	2.5 U	2.5 U
1,2,3,7,8-PeCDD	ng/kg	0.82 U	1.1 U	0.91 U	0.97 U	**7.5**	1.1 J	1 J	0.37 U	**5.1**	1.1 J	0.97 U	1.4	1 U	2.5 U	2.5 U
1,2,3,7,8-PeCDF	ng/kg	0.82 U	1.1 U	0.91 U	0.97 U	2.5	0.27 I	1.2 J	0.37 U	0.96 JA	0.56 J	0.97 U	2.3	1 U	2.5 U	2.5 U
2,3,4,6,7,8-HxCDF	ng/kg	0.82 U	1.1 U	0.91 U	0.97 U	**49**	2.3	2 J	0.37 U	**10**	2.4	2.5 J	2.4	1 U	2.5 U	2.5 U
2,3,4,7,8-PeCDF	ng/kg	0.82 U	1.1 U	0.91 U	0.97 U	**11**	1.4	1.3 J	0.49 J	2.3	1.4 J	0.97 U	1.5	1 U	2.5 U	2.5 U
2,3,7,8-TCDD	ng/kg	0.27 AU	0.21 U	0.18 U	0.19 U	0.41 A	0.12 IA	0.25 AU	0.19 AU	0.43 JA	0.11 IA	0.19 U	0.16 JA	0.2 U	1 U	1 U
2,3,7,8-TCDF	ng/kg	0.64 J	0.21 U	0.18 U	0.19 U	0.7	0.83 A	**1.4**	0.74 A	0.43 JA	**1.3**	0.55 J	0.65 A	0.31 J	1 U	1 U
OCDD	ng/kg	**180**	14	**35**	**130**	**53000** N2	**1900**	**1800**	**78**	**10000**	**3100**	**2200**	**2500**	**160**	16.972 J	47.747 B
OCDF	ng/kg	**6.5** J	2.1 U	2.2 J	**5.6**	**1000**	**81**	**29**	2.2 J	**150**	**70**	**54**	**110**	**19**	5 U	5 U
Total HpCDD	ng/kg	**74**	**4.1** J	**20**	**48**	**10000**	**580**	**400**	**33**	**2000**	**840**	**580**	**900**	**31**	2.742	13.324
Total HpCDF	ng/kg	**9.3**	1.1 U	1.3 J	**8.4**	**4700**	**160**	**100**	**3.8**	**640**	**140**	**79**	**170**	**20**	2.5 U	2.5 U
Total HxCDD	ng/kg	**14**	1.1 U	1 J	**18**	**850**	**76**	**48**	**8.1**	**220**	**90**	**49**	**150**	**4.6** J	1.218	2.5 U
Total HxCDF	ng/kg	**5**	1.1 U	0.91 U	**3.7**	**1800**	**34**	**60**	2	**360**	**70**	**32**	**69**	**6**	2.5 U	2.5 U
Total PeCDD	ng/kg	0.96 J	1.1 U	0.91 U	**8.3**	**46**	**24**	**9.7**	**3.8**	**20**	**10**	0.97 U	**10**	1 U	2.5 U	2.5 U
Total PeCDF	ng/kg	**3.1** J	1.1 U	0.91 U	0.97 U	**120**	**20**	**16**	**3.3**	**33**	**17**	**5.4**	**12**	**5.9**	2.5 U	2.5 U
Total TCDD	ng/kg	**4.7**	0.21 U	0.18 U	**14**	**100**	**64**	**12**	**12**	**12**	**20**	**2.1**	**4.6**	0.2 U	1 U	1 U
Total TCDF	ng/kg	**6.3**	0.21 U	0.18 U	0.25	**14**	**17**	**24**	**14**	**4.5**	**11**	**2.7**	**4.7**	**5.2**	1 U	1 U

Notes:

BOLD Indicates dioxin concentration exceeds background sample concentration.
DCI06-2-D Indicates field duplicate sample.
A Detection limit based on signal-to-noise measurement
B Detected in method blank (assumed as this qualifier is from analysis conducted by a previous study)
E PCDE Interference
J Concentration detected is below the calibration range
NA Not applicable.
N2 Value obtained from additional analysis
U Not detected

Table 3.3
Summary of Sediment Dioxin Testing Results and Comparison to DMMP Criteria

	Sample ID		DCI06-1A	DCI06-2A	DCI06-2-D	DCI06-3A	DCI06-4A	DCI06-4B	DCI06-5A	DCI06-5B	DCI06-6A	DCI06-7A	DCI06-7B	DCI06-8A	DCI06-9A	AN-REF-1-01-SD	AN-REF-2-01-SD
	Sample Date		11/17/2006	11/17/2006	11/17/2006	11/17/2006	11/17/2006	11/17/2006	11/17/2006	11/17/2006	11/17/2006	11/17/2006	11/17/2006	11/17/2006	11/17/2006	7/13/2004	7/13/2004
	Sample Depth		0 to 10 cm	0 to 10 cm	0 to 10 cm	0 to 10 cm	0 to 10 cm	10 to 20 cm	0 to 10 cm	10 to 20 cm	0 to 10 cm	0 to 10 cm	10 to 20 cm	0 to 10 cm	0 to 10 cm	0 to 15 cm	0 to 15 cm
Analytes	**Units**	**TEF**															
Conventionals (USEPA Method 160.3)																	
Total Solids	%	NA	69.5	78.3	78.2	75.5	67	59.6	34.8	42.9	81.9	55.1	57.2	71.1	95.8	58	70.6
Total Organic Carbon[1]	%	NA	1.32	0.641	1.15	0.448	0.883	3.43	4.96	2.88	0.56	1.48	1.06	1.27	0.239	1.17	0.74
Grain Size (PSEP Method)																	
Gravel	%	NA	40.5	41.4	15.4	27.4	22	32.7	3.2	1.4	39.1	0.6	2.3	29.4	0	0.02	0.04
Sand, Very Coarse	%	NA	9.7	8.4	10.9	11.9	5.2	4.6	3.3	2.2	10.6	1.6	0.9	6.5	0.1	0.36	0.41
Sand, Coarse	%	NA	6.8	11.8	17.3	10.1	4.5	3.5	3.9	2.5	9.5	1.9	1.7	12.8	2.9	0.47	4.37
Sand, Medium	%	NA	14.7	17.4	33.7	13.8	9	6.8	6	4.1	13.7	3.9	4.5	22.1	78.1	0.74	19.5
Sand, Fine	%	NA	12.2	8.7	11.4	10.4	17.3	14.5	12.1	12.3	16.4	12.5	13.1	10.9	18.7	16.9	24.8
Sand, Very Fine	%	NA	4.4	2.2	2.9	6.2	14.5	10.1	11.8	13	4.4	23.1	20.7	3.9	0	33	5.57
Silt	%	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	34.6	30
Silt, Coarse	%	NA	1.5	5.3	2.7	3.7	10.5	7.2	7.7	11.9	1.6	20.7	22.6	3.1	NA	NA	NA
Silt, Medium	%	NA	1.7	0.9	1.1	3.7	4.1	5.6	16.5	12.1	1.3	11.5	12.4	2.9	NA	NA	NA
Silt, Fine	%	NA	1.6	0.8	0.9	2.9	2.6	3.9	7.4	8.8	0.7	5.9	5.7	2	NA	NA	NA
Silt, Very Fine	%	NA	1.3	0.6	0.8	2.3	2.4	2.6	6.2	6.7	0.5	3.8	3.2	1.2	NA	NA	NA
Clay	%	NA	5.6	2.6	2.8	7.6	7.9	8.4	22	24.9	2.3	14.4	13.2	5.3	NA	10.8	6.23
Dioxin/Furan Congeners (USEPA Method 8290)																	
1,2,3,4,6,7,8-HpCDD	ng/kg	0.01	20	2 J	5	18	6100 A	220	180	9	1100 A	330	220	310 A	17	2.742 J	6.001
1,2,3,4,6,7,8-HpCDF	ng/kg	0.01	3.1 J	1.1 U	0.91 U	3.6 J	1000 A	54	29	1.4 J	180	40	23	39	6.8	2.5 U	2.5 U
1,2,3,4,7,8,9-HpCDF	ng/kg	0.01	0.82 U	1.1 U	0.91 U	0.97 U	36	2	1.3	0.37 U	7.2	2.5	2 J	2.7	1.1 J	2.5 U	2.5 U
1,2,3,4,7,8-HxCDD	ng/kg	0.1	0.82 U	1.1 U	0.91 U	0.97 U	28	1.8	1.8 J	0.37 U	8.9	2.1	1.1 J	2.7	1 U	2.5 U	2.5 U
1,2,3,4,7,8-HxCDF	ng/kg	0.1	0.82 U	1.1 U	0.91 U	0.97 U	28	1.6	1.4 J	0.37 U	0.44 E	2.5	0.97 E	3.1	1 E	2.5 U	2.5 U
1,2,3,6,7,8-HxCDD	ng/kg	0.1	1.4 J	1.1 U	0.91 U	1.2 J	330 A	11	10	0.68 J	61 A	14	8.4	13	1 U	2.5 U	2.5 U
1,2,3,6,7,8-HxCDF	ng/kg	0.1	0.82 U	1.1 U	0.91 U	0.97 U	0.26 E	1.6	1.4 J	0.37 U	3.2	1.5 J	1 J	1.5	1 U	2.5 U	2.5 U
1,2,3,7,8,9-HxCDD	ng/kg	0.1	0.82 U	1.1 U	0.91 U	0.97 U	49	3.9	2.5 J	0.46 J	21	4.8	2.2	6.2	1 U	2.5 U	2.5 U
1,2,3,7,8,9-HxCDF	ng/kg	0.1	0.82 U	1.1 U	0.91 U	0.97 U	16	0.69 J	1 U	0.37 U	2.8	0.94 J	0.97 U	0.88 JA	1 U	2.5 U	2.5 U
1,2,3,7,8-PeCDD	ng/kg	0.5	0.82 U	1.1 U	0.91 U	0.97 U	7.5	1.1 J	1 J	0.37 U	5.1	1.1 J	0.97 U	1.4	1 U	2.5 U	2.5 U
1,2,3,7,8-PeCDF	ng/kg	0.05	0.82 U	1.1 U	0.91 U	0.97 U	2.5	0.27 I	1.2 J	0.37 U	0.96 JA	0.56 J	0.97 U	2.3	1 U	2.5 U	2.5 U
2,3,4,6,7,8-HxCDF	ng/kg	0.1	0.82 U	1.1 U	0.91 U	0.97 U	49	2.3	2 J	0.37 U	10	2.4	2.5 J	2.4	1 U	2.5 U	2.5 U
2,3,4,7,8-PeCDF	ng/kg	0.5	0.82 U	1.1 U	0.91 U	0.97 U	11	1.4	1.3 J	0.49 J	2.3	1.4 J	0.97 U	1.5	1 U	2.5 U	2.5 U
2,3,7,8-TCDD	ng/kg	1	0.27 AU	0.21 U	0.18 U	0.19 U	0.41 A	0.12 IA	0.25 AU	0.19 AU	0.43 JA	0.11 IA	0.19 U	0.16 JA	0.2 U	1 U	1 U
2,3,7,8-TCDF	ng/kg	0.1	0.64 J	0.21 U	0.18 U	0.19 U	0.7	0.83 A	1.4	0.74 A	0.43 JA	1.3	0.55 J	0.65 A	0.31 J	1 U	1 U
OCDD	ng/kg	0.001	180	14	35	130	53000 N2	1900	1800	78	10000	3100	2200	2500	160	16.972 J	47.747 B
OCDF	ng/kg	0.001	6.5 J	2.1 U	2.2 J	5.6	1000	81	29	2.2 J	150	70	54	110	19	5 U	5 U
Total HpCDD	ng/kg	NA	74	4.1 J	20	48	10000	580	400	33	2000	840	580	900	31	2.742	13.324
Total HpCDF	ng/kg	NA	9.3	1.1 U	1.3 J	8.4	4700	160	100	3.8	640	140	79	170	20	2.5 U	2.5 U
Total HxCDD	ng/kg	NA	14	1.1 U	1 J	18	850	76	48	8.1	220	90	49	150	4.6 J	1.218	2.5 U
Total HxCDF	ng/kg	NA	5	1.1 U	0.91 U	3.7	1800	34	60	2	360	70	32	69	6	2.5 U	2.5 U
Total PeCDD	ng/kg	NA	0.96 J	1.1 U	0.91 U	8.3	46	24	9.7	3.8	20	10	0.97 U	10	1 U	2.5 U	2.5 U
Total PeCDF	ng/kg	NA	3.1 J	1.1 U	0.91 U	0.97 U	120	20	16	3.3	33	17	5.4	12	5.9	2.5 U	2.5 U
Total TCDD	ng/kg	NA	4.7	0.21 U	0.18 U	14	100	64	12	12	12	20	2.1	4.6	0.2 U	1 U	1 U
Total TCDF	ng/kg	NA	6.3	0.21 U	0.18 U	0.25	14	17	24	14	4.5	11	2.7	4.7	5.2	1 U	1 U
Calculated Dioxin/Furan TEQ	ng/kg	NA	1.44	1.12	0.99	1.38	**185.2**	8.4	7.4	0.91	**38.0**	11.2	7.03	10.9	1.48	2.81	2.87

Notes:

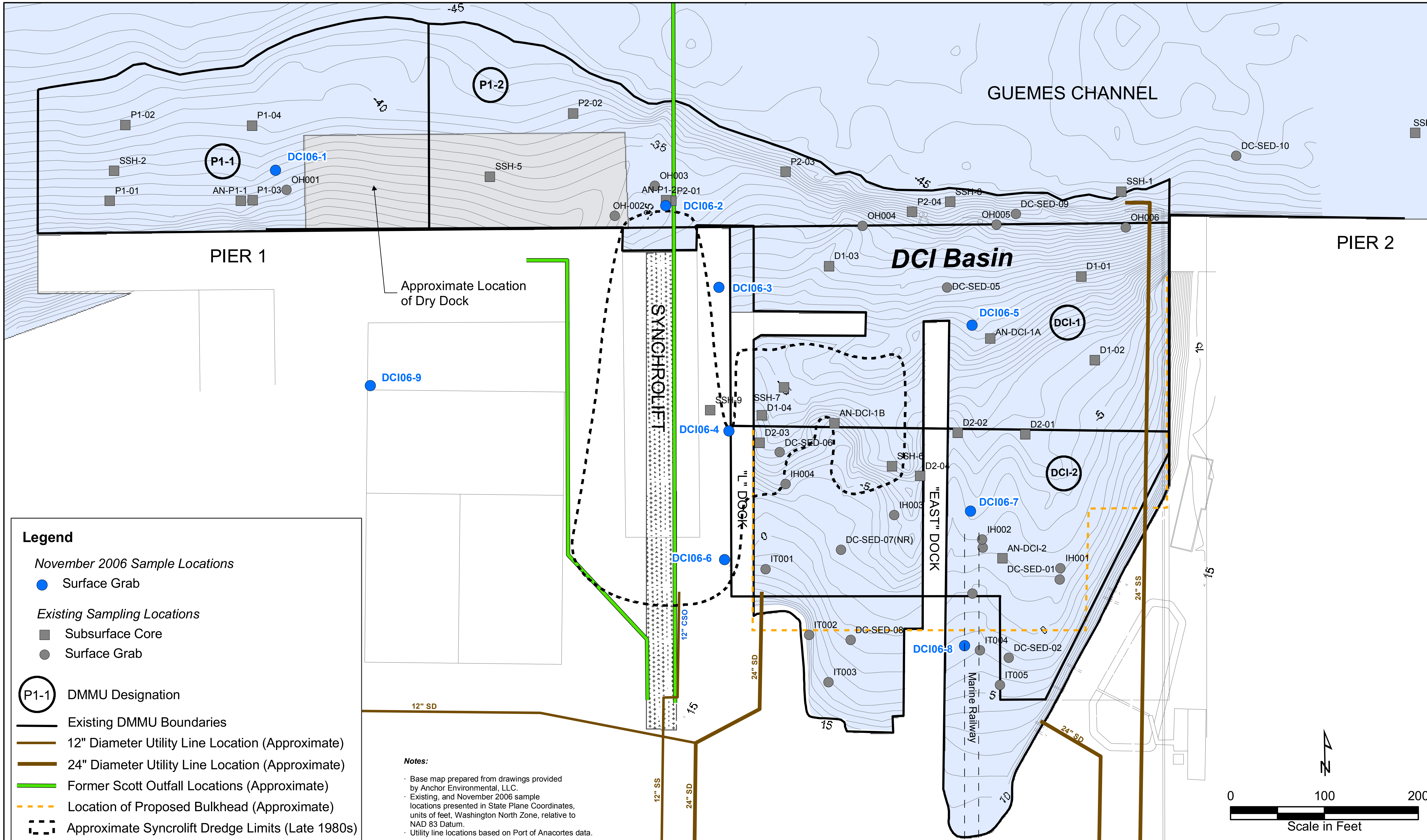
The DMMP criterion for 2,3,7,8-TCDD of 5 ng/kg was not exceeded in any of the sediment samples collected.
TEFs were obtained from the DMMP procedures document (PSDDA 2000).
1 PSEP Method (Plumb, 1981)
DCI06-2-D Indicates field duplicate sample.
BOLD TEC conentrations indicate exceedance fo the TEC DMMP criterion of 15 ng/kg.
A Detection limit based on signal-to-noise measurement.
B Detected in method blank (assumed as this qualifier is from analysis conducted by a previous study).
CDD chlorinated dibenzodioxins.
CDF chlorinated dibenzofurans.
E PCDE Interference.
J Concentration detected is below the calibration range.
NA Not applicable
N2 Value obtained from additional analysis.
TEF Toxicity Equivalency Factors.
TEQ Total Toxicity Equivalence
U Not detected.

Dakota Creek Industries
Shipyard Facility

Sediment Sampling Data Report

Figures

FINAL



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Sediment Sampling Data Report
Dakota Creek Shipyard
Port of Anacortes, Washington

Figure 1.1
Sediment Sampling Locations

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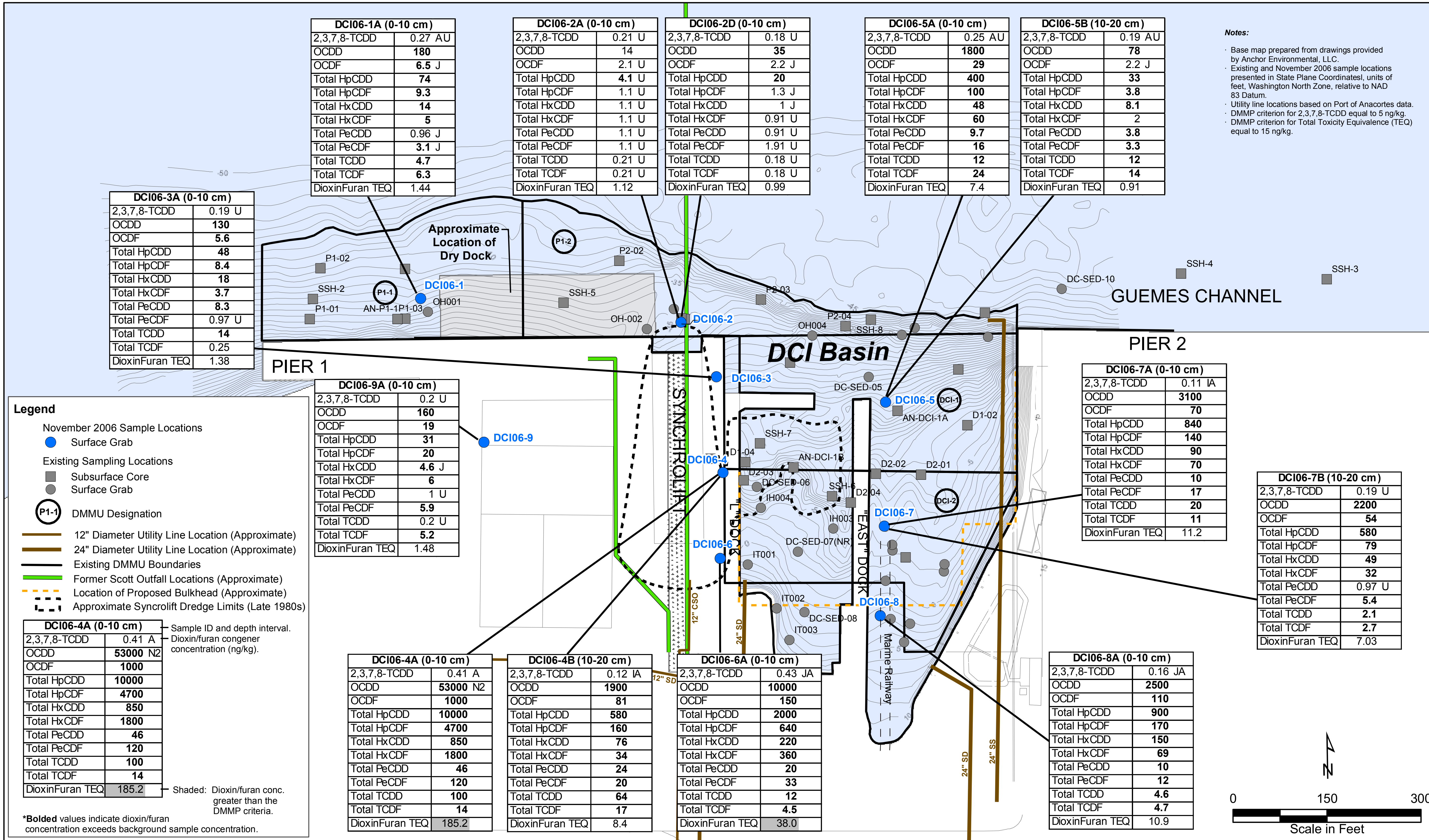

Notes:

- Base map prepared from drawings provided by Anchor Environmental, LLC.
- Existing and November 2006 sample locations presented in State Plane Coordinatesl, units of feet, Washington North Zone, relative to NAD 83 Datum.
- Utility line locations based on Port of Anacortes data.
- DMMP criterion for 2,3,7,8-TCDD equal to 5 ng/kg.
- DMMP criterion for Total Toxicity Equivalence (TEQ) equal to 15 ng/kg.

Legend

November 2006 Sample Locations
- Surface Grab

Existing Sampling Locations
- Subsurface Core
- Surface Grab
- P1-1 DMMU Designation
- 12" Diameter Utility Line Location (Approximate)
- 24" Diameter Utility Line Location (Approximate)
- Existing DMMU Boundaries
- Former Scott Outfall Locations (Approximate)
- Location of Proposed Bulkhead (Approximate)
- Approximate Syncrolift Dredge Limits (Late 1980s)

DCI06-4A (0-10 cm)	
2,3,7,8-TCDD	0.41 A
OCDD	**53000 N2**
OCDF	**1000**
Total HpCDD	**10000**
Total HpCDF	**4700**
Total HxCDD	**850**
Total HxCDF	**1800**
Total PeCDD	**46**
Total PeCDF	**120**
Total TCDD	**100**
Total TCDF	**14**
DioxinFuran TEQ	185.2

Sample ID and depth interval.
Dioxin/furan congener concentration (ng/kg).
Shaded: Dioxin/furan conc. greater than the DMMP criteria.

*Bolded values indicate dioxin/furan concentration exceeds background sample concentration.

DCI06-1A (0-10 cm)	
2,3,7,8-TCDD	0.27 AU
OCDD	**180**
OCDF	**6.5 J**
Total HpCDD	**74**
Total HpCDF	**9.3**
Total HxCDD	**14**
Total HxCDF	**5**
Total PeCDD	0.96 J
Total PeCDF	**3.1 J**
Total TCDD	**4.7**
Total TCDF	**6.3**
DioxinFuran TEQ	1.44

DCI06-2A (0-10 cm)	
2,3,7,8-TCDD	0.21 U
OCDD	14
OCDF	2.1 U
Total HpCDD	**4.1** U
Total HpCDF	1.1 U
Total HxCDD	1.1 U
Total HxCDF	1.1 U
Total PeCDD	1.1 U
Total PeCDF	1.1 U
Total TCDD	0.21 U
Total TCDF	0.21 U
DioxinFuran TEQ	1.12

DCI06-2D (0-10 cm)	
2,3,7,8-TCDD	0.18 U
OCDD	**35**
OCDF	2.2 J
Total HpCDD	**20**
Total HpCDF	1.3 J
Total HxCDD	1 J
Total HxCDF	0.91 U
Total PeCDD	0.91 U
Total PeCDF	1.91 U
Total TCDD	0.18 U
Total TCDF	0.18 U
DioxinFuran TEQ	0.99

DCI06-5A (0-10 cm)	
2,3,7,8-TCDD	0.25 AU
OCDD	**1800**
OCDF	**29**
Total HpCDD	**400**
Total HpCDF	**100**
Total HxCDD	**48**
Total HxCDF	**60**
Total PeCDD	**9.7**
Total PeCDF	**16**
Total TCDD	**12**
Total TCDF	**24**
DioxinFuran TEQ	7.4

DCI06-5B (10-20 cm)	
2,3,7,8-TCDD	0.19 AU
OCDD	**78**
OCDF	2.2 J
Total HpCDD	**33**
Total HpCDF	**3.8**
Total HxCDD	**8.1**
Total HxCDF	2
Total PeCDD	**3.8**
Total PeCDF	**3.3**
Total TCDD	**12**
Total TCDF	**14**
DioxinFuran TEQ	0.91

DCI06-3A (0-10 cm)	
2,3,7,8-TCDD	0.19 U
OCDD	**130**
OCDF	**5.6**
Total HpCDD	**48**
Total HpCDF	**8.4**
Total HxCDD	**18**
Total HxCDF	**3.7**
Total PeCDD	**8.3**
Total PeCDF	0.97 U
Total TCDD	**14**
Total TCDF	0.25
DioxinFuran TEQ	1.38

DCI06-9A (0-10 cm)	
2,3,7,8-TCDD	0.2 U
OCDD	**160**
OCDF	**19**
Total HpCDD	**31**
Total HpCDF	**20**
Total HxCDD	**4.6 J**
Total HxCDF	**6**
Total PeCDD	1 U
Total PeCDF	**5.9**
Total TCDD	0.2 U
Total TCDF	**5.2**
DioxinFuran TEQ	1.48

DCI06-7A (0-10 cm)	
2,3,7,8-TCDD	0.11 IA
OCDD	**3100**
OCDF	**70**
Total HpCDD	**840**
Total HpCDF	**140**
Total HxCDD	**90**
Total HxCDF	**70**
Total PeCDD	**10**
Total PeCDF	**17**
Total TCDD	**20**
Total TCDF	**11**
DioxinFuran TEQ	11.2

DCI06-7B (10-20 cm)	
2,3,7,8-TCDD	0.19 U
OCDD	**2200**
OCDF	**54**
Total HpCDD	**580**
Total HpCDF	**79**
Total HxCDD	**49**
Total HxCDF	**32**
Total PeCDD	0.97 U
Total PeCDF	**5.4**
Total TCDD	**2.1**
Total TCDF	**2.7**
DioxinFuran TEQ	7.03

DCI06-4A (0-10 cm)	
2,3,7,8-TCDD	0.41 A
OCDD	**53000 N2**
OCDF	**1000**
Total HpCDD	**10000**
Total HpCDF	**4700**
Total HxCDD	**850**
Total HxCDF	**1800**
Total PeCDD	**46**
Total PeCDF	**120**
Total TCDD	**100**
Total TCDF	**14**
DioxinFuran TEQ	185.2

DCI06-4B (10-20 cm)	
2,3,7,8-TCDD	0.12 IA
OCDD	**1900**
OCDF	**81**
Total HpCDD	**580**
Total HpCDF	**160**
Total HxCDD	**76**
Total HxCDF	**34**
Total PeCDD	**24**
Total PeCDF	**20**
Total TCDD	**64**
Total TCDF	**17**
DioxinFuran TEQ	8.4

DCI06-6A (0-10 cm)	
2,3,7,8-TCDD	0.43 JA
OCDD	**10000**
OCDF	**150**
Total HpCDD	**2000**
Total HpCDF	**640**
Total HxCDD	**220**
Total HxCDF	**360**
Total PeCDD	**20**
Total PeCDF	**33**
Total TCDD	**12**
Total TCDF	**4.5**
DioxinFuran TEQ	38.0

DCI06-8A (0-10 cm)	
2,3,7,8-TCDD	0.16 JA
OCDD	**2500**
OCDF	**110**
Total HpCDD	**900**
Total HpCDF	**170**
Total HxCDD	**150**
Total HxCDF	**69**
Total PeCDD	**10**
Total PeCDF	**12**
Total TCDD	**4.6**
Total TCDF	**4.7**
DioxinFuran TEQ	10.9

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Sediment Sampling Data Report
Dakota Creek Shipyard
Port of Anacortes, Washington

Figure 3.1
Dioxin/furan Sediment Results

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Dakota Creek Industries
Shipyard Facility

Sediment Sampling Data Report

Appendix A
Sediment Sample Interval Memorandum

FINAL

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DAKOTA CREEK SHIPYARD BASIN SAMPLING INTERVAL

An outfall from the former Scott Mill facility existed within the Dakota Creek Shipyard basin (Basin) from approximately 1952 to 1978. Determination of potential environmental impacts to the basin resulting from the historical outfall discharges requires sampling of sediments deposited during the discharge period. The proposed sampling interval is based on assumptions regarding the sedimentation rate within the Basin.

Sedimentation within the Dakota Creek Shipyard Basin

Data on a specific sedimentation rate within the Basin does not exist. However, empirical data indicate the rate of sedimentation within Basin is low. Evidence for this conclusion is as follows:

- Materials comprising the upper several feet of the sediment column are coarse-grained gravels and sands. In northern Puget Sound, sediments of this nature are typically associated with glacial deposition when not situated near an alternate source such as a river delta. A low sedimentation rate is evidenced by the presence of these glacially derived materials near the surface of the sediment column. In a less energetic depositional environment, the glacial deposits would typically be covered by more recent, fine-grained sediments as is observed in nearby Fidalgo Bay.
- The low sedimentation rates are most likely the result of the high current velocities within Guemes Channel. Propeller wash, and movement of the synchrolift and drydock also contribute to the dynamic environment of the DCI basin resulting in a low sedimentation rate.
- Low sedimentation rates are also evidenced by the dredging history of the DCI basin. Dredging was performed as part of construction of the Synchrolift and to clear the berthing approach to Pier 2. Both historical dredging events are visually apparent in recent bathymetry surveys of the site and have not required additional maintenance dredging. These observations strongly suggest significant infilling is not occurring within or immediately outside the Basin.

Regional Sedimentation Rates

Review of available literature indicates regional sedimentation rates are highly variable and are a function of the depositional energy within the environment sampled.

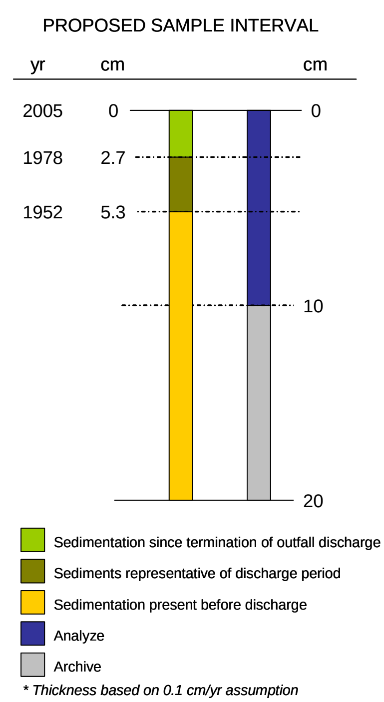
- Typical measured sedimentation rates ranged from 0.1 to 2.4 cm/yr but can be lower, and potentially negative, in high energy and erosional areas.
- Sedimentation rate data were typically collected to evaluate long-term chemical trends and therefore, were only available in lower energy depositional environments.
- No sedimentation rate data were available for shipyard or similar environments. This result was expected given sedimentation rate determination relies on evaluation of undisturbed sediment column samples.

Location	Sedimentation Rate (cm/yr)	Reference
Padilla Bay	0.36	Gwozdz, R. WWU MS Research: Sediment accretion in eelgrasses. NOAA, NERR Padilla Bay Program.
Puget Sound (typical range)	0.1 to 2.4	Carpenter, R., M. L. Peterson, and J. T. Bennett. 1985. 210 Pb-Derived sediment accumulation and mixing rates for the greater Puget Sound Region. Marine Geology. 64:291-312. Shell, W.R., and A. Nevissi. 1977. Heavy metals from waste disposal in central Puget Sound. ES and T. Vol. 11(9):887-893. Crecelius et al. 1975. Geochemistries of arsenic, antimony, mercury, and related elements in sediments in Puget Sound. ES and T. Vol. 9(4):325-333.

PROPOSED SEDIMENT SAMPLING INTERVAL

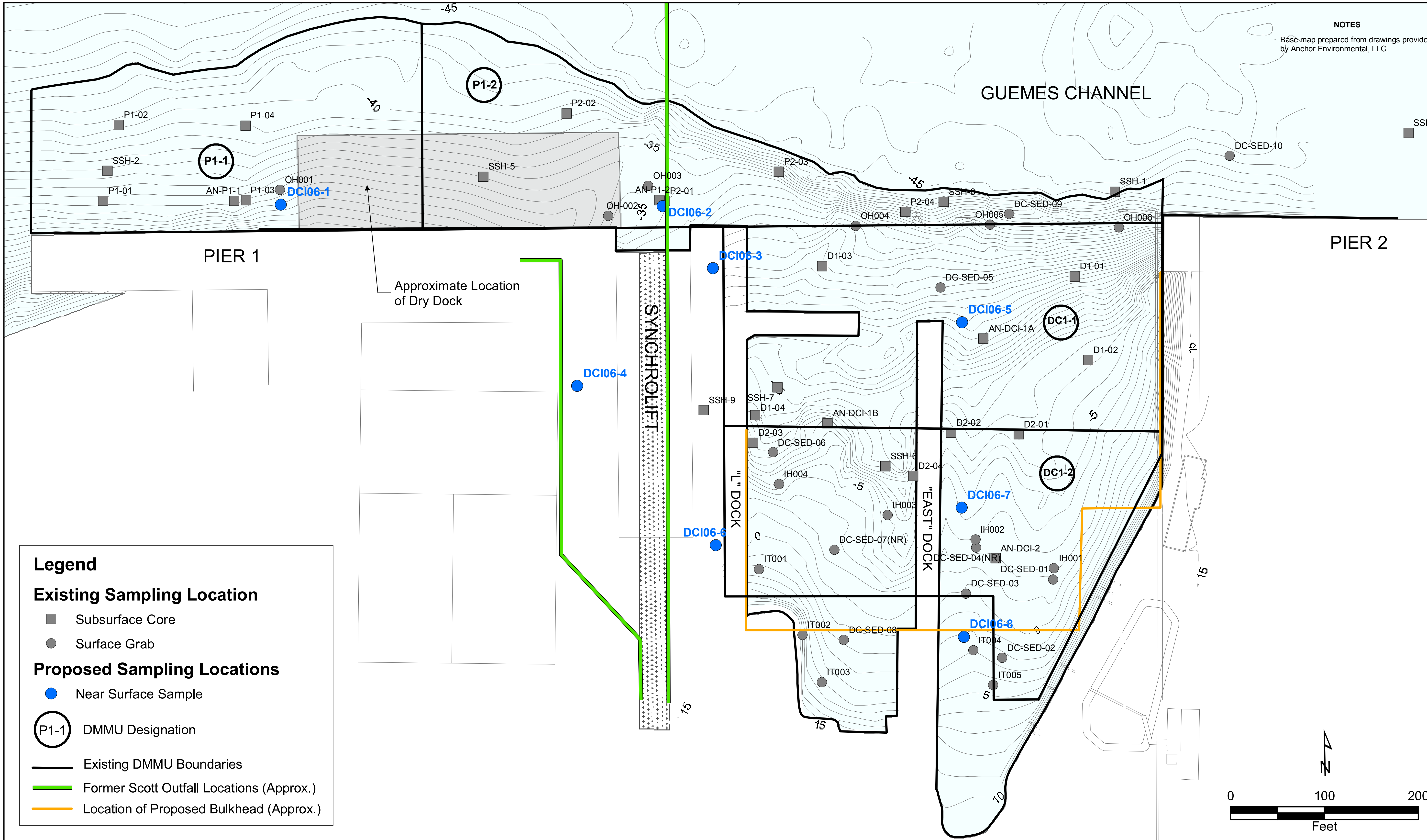
Given the actual sedimentation rate of the Basin is unknown but evidenced to be low, the Puget Sound typical-low range of 0.1 cm/yr is assumed.

- Based on this assumed sedimentation rate, the interval with the highest potential to have been impacted by the 26 years of Scott Mill outfall discharge is 2.7 to 5.3 cm below mudline.
- Sampling of the upper 10 cm is appropriate for evaluation of potential historical contamination and compliance with the Sediment Management Standards. This interval accounts for variability in sedimentation rate and potential redistribution of sediments from scour.
- To conservatively account for assumed higher sedimentation rates within the Basin, the 10 to 20-cm interval will also be sampled and archived for later analysis if necessary.
- No inner-tidal sediment samples above elevation 2 ft MLLW are proposed because the inner-tidal area is well mixed, with homogenized sediment.



PROPOSED SAMPLING LOCATIONS

Sample	Location	Rationale
DCI06-1	West of Dry Dock, DMMU (P1-1)	Confirm DMMU PSDDA Characterization Characterize area of former outfall location
DCI06-2	East of Dry Dock, DMMU (P1-2)	Confirm DMMU PSDDA Characterization Characterize area of former outfall location
DCI06-3	East of Synchrolift, under pier	Characterize area of former outfall location
DCI06-4	West of Synchrolift, bank sample	Characterize area of former outfall location
DCI06-5	DCI Basin, DMMU (DC1-1)	Confirm DMMU PSDDA Characterization
DCI06-6	East of Synchrolift, under pier	Characterize area of former outfall location
DCI06-7	DCI Basin, DMMU (DC1-2)	Confirm DMMU PSDDA Characterization
DCI06-8	DCI Basin, inner-tidal area	Characterize sediments south of the proposed bulkhead that will remain in place following redevelopment



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Port of Anacortes- Dakota Creek Shipyard
Anacortes, Washington

Existing and Proposed
Sediment Sampling Locations

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