Sampling and Analysis Plan

Humboldt Bay Harbor, Recreation and Conservation District and City of Eureka
Sediment Characterization for 2016-2021 Maintenance Dredging

Prepared for

Humboldt Bay Harbor, Recreation, and Conservation District
PO Box 1030
601 Startare Drive
Eureka, CA 95502

City of Eureka
531 K Street
Eureka, CA 95501

Prepared by

Northern Hydrology & Engineering

PO Box 2515
1225 Central Avenue
McKinleyville, CA 95519

December 2015

Sampling and Analysis Plan

Humboldt Bay Harbor, Recreation and Conservation District and City of Eureka
Sediment Characterization for 2016-2021 Maintenance Dredging

Prepared for

Humboldt Bay Harbor, Recreation, and Conservation District

City of Eureka

Prepared by

Northern Hydrology & Engineering

December 2015

TABLE OF CONTENTS

List of Tables

List of Figures

Acronyms and Abbreviations

ADC-#-C	Adorni Center Dock sampling station
AET	Apparent effects threshold
BISC	Boating Instruction Safety Center
BISC-#-C	BISC Dock sampling station
BON-#-C	Bonnie Gool Guest Dock sampling station
CCC	California Coastal Commission
CDP	Coastal development permit
CDFW	California Department of Fish and Wildlife
COMM-#-G	Commercial Street Dock sampling station
CST-#-E	C Street Dock sampling station
DKB-#-K	Dock B sampling station
DU	Dredging unit
ERL	Effects Range Low
ERM	Effects Range Median
FISH-#-F	Fisherman's Terminal sampling station
FL-#-A	Fields Landing Boat Yard sampling station
FST-#-D	F Street Floating Dock sampling station
IST-#-C	I Street Dock sampling station
ITM	Inland Testing Manual
ITRC	Interstate Technology and Regulatory Council
ISM	Incremental Sampling Methodology
LC10	Lethal concentration to 10 percent of a population
LC50	Lethal concentration to 50 percent of a population
µg/kg	Microgram per kilogram
µg/L	Microgram per liter
mg/kg	Milligram per kilogram
mg/L	Milligram per liter
pg/g	Picogram per gram
MLLW	Mean lower low water
N/A	Not applicable
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OEHHA	California Office of Environmental Health Hazard Assessment
PAH	Polycyclic Aromatic Hydrocarbon
PEL	Probable Effects Level
QA	Quality Assurance
QC	Quality Control
RT1-#-A	Redwood Terminal Berth 1 sampling station
RT2-#-A	Redwood Terminal Berth 2 sampling station
RWQCB	Regional Water Quality Control Board
SBB-#-H	Small Boat Basin sampling station
SAM-#-C	Samoa Bridge Launch Ramp sampling station
SAP	Sampling and Analysis Plan
SQuiRTs	Screening Quick Reference Tables
T20	20 percent toxicity probability
T50	50 percent toxicity probability
TEF	Toxic Equivalency Factor
TEL	Threshold Effects Level

Acronyms and Abbreviations

TEQ	Toxic Equivalent
USFWS	United States Fish and Wildlife Service
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
WHO	World Health Organization
WIM-#-A	Woodley Island Marina sampling station
WQO	Water Quality Objective

1. INTRODUCTION

The Humboldt Bay Harbor, Recreation, and Conservation District (District) will be applying for permits from regulating agencies to perform maintenance dredging at the District's and the City of Eureka's (City) docks and marinas in Humboldt Bay, California (Figure 1). The agencies to permit the dredging project include the US Army Corps of Engineers (USACE), North Coast Regional Water Quality Control Board (RWQCB), California Coastal Commission (CCC), California Department of Fish and Wildlife (CDFW), and the District. Approval of these permits is predicated on the physical and chemical characterization of the dredge material to determine suitable reuse or disposal options. The agencies that will approve this sampling and analysis plan include the USACE, North Coast RWQCB, and CCC.

This sampling and analysis plan (SAP) was developed following the *Sampling and Analysis Plan (Quality Assurance Project Plan) Guidance for Dredging Projects within the USACE San Francisco District* (USACE, 1999), with reference to the *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations* (USEPA QA/R-5) External Review Draft Final (USEPA, 1998a), which has since been finalized as *EPA Requirements for Quality Assurance Project Plans* (USEPA QA/R-5; USEPA, 2001) and *EPA Guidance for Quality Assurance Project Plans* (USEPA QA/G-5; USEPA, 1998b), which has since been updated (USEPA, 2002), and the *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. - Testing Manual* (Inland Testing Manual; USEPA/USACE, 1998). In addition to the standard sampling methods described in these guidance documents, the project proposes the use of *Incremental Sampling Methodology* (ITRC, 2012).

All elevations are in feet and reference Mean Lower Low Water (MLLW) vertical datum. Bathymetry was surveyed in 2014 by SHN Consulting Engineers & Geologists, Inc., included in Appendix A.

2. PROJECT OVERVIEW

2.1 Purpose of the Sampling and Analysis Plan

The District plans to conduct regular maintenance dredging in Humboldt Bay; this plan is to pursue permits for dredging events that occur from 2016 through 2021. To confirm the sediment to be dredged from Humboldt Bay is suitable for use in either beneficial reuse at a tidal wetland restoration project at the Humboldt Bay National Wildlife Refuge's White Slough Unit or to be stored temporarily at a sediment processing facility for future use or disposal, an evaluation of the material according to the Inland Testing Manual (ITM) will be completed (USEPA/USACE, 1998). The proposed SAP describes the sample collection, handling, and analysis procedures for the evaluation of dredge material.

2.2 Project Background

Federal, District, and private navigation channels are dredged within Humboldt Bay to maintain adequate channel depth for deep-draft vessels. The USACE performs the deep channel dredging, which accounts for approximately 1.2 million cubic yards annually. The District partners with other entities to dredge the interior, non-federal channels, which has accounted for approximately 200,000 cubic yards per event, on an 8- to 10- year cycle, for an estimated 20-25,000 cubic yards per year.

The District recently purchased a cutter-head suction dredge and now has the capability to maintain some of the small docks and marinas in Humboldt Bay annually. The cutter-head dredge produces slurry of sediment-laden water that can be pumped through pipes to a dewatering/settling area. Dewatering/settling areas are planned to be either a permitted sediment processing facility or a beneficial reuse project site where the material can be dewatered and processed, as needed. Another option is to pump the dredged

material to a beach to be washed to the ocean during high tides. The latter option was implemented during the past three dredging cycles.

2.3 Project Description

The purpose of the dredging project is to restore and maintain adequate berth depths for safe vessel ingress and egress to 15 docks and marinas owned by the District and City in Humboldt Bay (Figure 2). The areas, depths, over-dredge depths, and estimated volumes of dredge material for the District and City's docks and marinas are detailed in Table 1. A 1-foot over-dredge depth was used for all sites. Volume estimates were calculated by comparing existing bathymetry to project design dredging surfaces with AutoCAD software and do not account for daylighting side slopes between the edge of the dredge area and existing bathymetry. Over-dredge volumes were estimated from a 1-foot depth below the surface area, excluding daylighting side slopes. Existing bathymetry is depicted in Appendix A.

Table 1. Dredging Project Quantities

Dredging Unit	Dredging Location	Project Elevation (ft, MLLW)	Dredging Surface Area (acres)	Estimated Over-dredge Volume (cy)	Estimated Project Dredge Volume (cy)	Estimated Total Volume (cy)
DU-1	Fields Landing Boat Yard	-12	0.24	380	3,870	4,250
DU-2	Woodley Island Marina	-8, -12, and -15	19	30,670	130,050	160,728
	Samoa Bridge Launch Ramp	-12	0.086	140	1,110	1,250
	Bonnie Gool Guest Dock	-12 and -18	0.38	610	1,620	2,230
	Adorni Center Dock	-10	0.044	70	3,130	3,930
	BISC Dock	-10	0.045	70		
	I Street Dock	-15	0.41	660		
	F Street Floating Dock	-12	0.092	150	590	740
	Fisherman's Terminal	-18	0.87	1,400	5,340	6,740
	C Street Dock	-12				
	Commercial Street Dock	-18	0.28	460	69,110	82,157
	Small Boat Basin	-6, -10, and -18	7.8	12,590		
	Dock B	-12	0.25	400	1,510	1,910
DU-3	Redwood Terminal Berth 1	-25	0.90	1,450	6,780	8,230
DU-4	Redwood Terminal Berth 2	-38	2.5	4,060	14,030	18,090

Due to relative proximity, estimated dredging volumes were grouped for the Adorni Center, BISC Dock and I Street Dock; Fisherman's Terminal and C Street Dock; and Small Boat Basin and Commercial Street Dock. Fisherman's Terminal and C Street Dock were grouped to estimate dredging area, because of the continuity between the two dredging sites, which accounted for the internal transition of the

dredging depths differences, which was assumed to be 2 feet horizontal to 1-foot vertical (2:1). Woodley Island Marina, Bonnie Gool Guest Dock and Small Boat Basin all have internal transition slopes between varying dredging depths which were assumed to be 2:1. Daylighting side slopes to existing bathymetry were not included in the area and volume calculations for all dredging locations; however, all dredging locations daylight into the corresponding access channels at the project dredging depths.

2.3.1 Dredging Unit 1

Dredging Unit 1 (DU-1) includes the District's Fields Landing Boat Yard, which is proposed for dredging to an elevation of 12 feet below MLLW. Material at DU-1 is will be evaluated for suitable fill at the Humboldt Bay National Wildlife Refuge White Slough Unit tidal wetland restoration project.

The RWQCB's 401 Certification permit for the White Slough tidal wetland restoration project requires that the material placed as fill be evaluated with a sampling design that follows the ISM protocol to characterize source material soil quality (Appendix B). This SAP proposes a sampling design at DU-1 that follows a sampling methodology to fulfill all agency requirements and the specifications of the White Slough project's 401 Certification from the RWQCB.

The Fields Landing Boat Yard dock was constructed in 1981. There is no fueling station or industry on the land mass associated with this dock. Historically, a larger dock was located approximately 70 feet west of the existing dock structures, extending from the land mass approximately 150 feet into the bay in a northward direction. Historic photos show that the dock spanned the shoreline approximately 1000 feet from north to south beyond Depot Road servicing a lumber mill and yard, where a historic railway extended further south (Figure 3; Laird, 2007). The historic dock structures were completely dismantled by 2010. Existing dock pilings remain. None of the historic dock area is within the Fields Landing Boat Yard dredging area.

2.3.2 Dredging Unit 2

Dredging Unit 2 (DU-2) includes the District's Woodley Island Marina and the City's docks listed in Table 1. Most of the docks and marinas in DU-2 were dredged in the last two dredging cycles. Material proposed for dredging in DU-2 is assumed to have accumulated by settling since the last dredging event in 2007, and sourced from sediment produced in Freshwater Creek via Eureka Slough, North Bay and Entrance Bay, transported within the same currents and tidal circulation patterns. Proposed dredge locations within DU-2 will be dredged during one or two dredging events and transported to a processing facility. Dredging elevations vary from 6 to 18 feet below MLLW.

2.3.3 Dredging Unit 3

Dredging Unit 3 (DU-3) includes Redwood Terminal Berth 1, located off of the Samoa Turning Basin. Design dredging elevation is 25 feet below MLLW.

2.3.4 Dredging Unit 4

Dredging Unit 4 (DU-4) includes Redwood Terminal Berth 2, located off of the Samoa Channel. Design dredging elevation is 38 feet below MLLW.

2.3.5 Material Processing Facilities

The District plans to establish up to three dredged material processing facilities for staging, dewatering, and temporary storage, located at Samoa and Fields Landing (Figure 4). In North Bay, there is an opportunity for two processing facilities in Samoa. One is located near the intersection of Highway 255 and Samoa Boulevard on approximately 30 acres, consists of two dewatering and storage cells (approximately 13 acres) that are currently filled with dredged sediments from historical dredging events. These sediments will need to be characterized prior to relocating the fill to a permanent site. The second

site is located at the former Louisiana Pacific pulp mill recently purchased by the District that can accommodate storage and potentially an ocean or bay outfall for the dredged sediment elutriate. In South Bay, the District owns property in Fields Landing, south of the boat yard, which offers approximately 4.5 acres of flat, potentially useable area with no containment. However, for the Fields Landing site, the goal is to pump directly to the White Slough restoration project. The temporary construction of a dewatering and processing area may require the use of Geotube® dewatering technology to separate sediment from elutriate. Additional characterization may be conducted at the processing sites to determine suitability for beneficial reuse or disposal at a permanent receiving site.

2.4 Permitting

Previous maintenance dredging of the District's Woodley Island Marina required the following permits and documentation:

- Humboldt County Coastal Development Permit (CDP) No. CDP-04-38, approved January 23, 1997 and Conditional Use Permit No. CUP-04-14 approved January 20, 2005;
- Humboldt Bay Harbor, Recreation, and Conservation District Permit for District's dredging approved October 14, 2004;
- CEQA Negative Declaration approved October 14, 2004;
- State Lands Commission Approval;
- RWQCB FCWA Section 401 Water Quality Certification No. 1A04140WNHU, issued August 26, 2005;
- USACE FCWA Section 404 Individual Permit No. 22216N, issued December 10, 1997 and expired March 15, 2008;
- USACE Letter of Modification to FCWA Section 404 Individual Permit No. 22216N, issued October 25, 2006;
- California Department of Fish and Game CESA Consistency Determination or Incidental Take Permit;
- CDP No. 1-87- 172, issued March 2, 1988;
- CDP Application No. 1-96-060, issued November 25, 1997;
- CDP Application No. 1-05-039, issued August 22, 2006;
- CDP Amendment No. 1-05-039-A1, approved February 16, 2007;
- NMFS FESA Section 7 Consultation and Biological Opinion, issued December 6, 2005;
- Sampling Results Report for Dioxin/Furans, PCP, and PCB Testing, Pacific Affiliates, Inc., December 2005.

Previous maintenance dredging of the City's small docks and marinas along the Inner and Outer Eureka Channel required the following permits and documentation:

- Humboldt County Coastal Development Permit No. CDP-04-37, approved January 20, 2005 and Conditional Use Permit No. CUP-04-13 approved January 20, 2005;
- Humboldt Bay Harbor, Recreation, and Conservation District Permit for City of Eureka dredging approved October 14, 2004;
- CEQA Negative Declaration approved October 14, 2004;
- State Lands Commission Approval;
- RWQCB FCWA Section 401 Water Quality Certification No. 1A04140WNHU, issued August 26, 2005;
- USACE FCWA Section 404 Individual Permit No. 22215N, issued December 10, 1997 and expired March 15, 2008;

- USACE Letter of Modification to FCWA Section 404 Individual Permit No. 22216N;
- California Department of Fish and Game CESA Consistency Determination or Incidental Take Permit.
- CDP Application No. 1-87-172, issued March 2, 1988;
- CDP Application No. 1-96-060, issued November 25, 1997;
- CDP Application No. 1-05-040, issued February 9, 2006;
- NMFS FESA Section 7 Consultation and Biological Opinion, issued December 6, 2005;
- Sampling Results Report for Dioxin/Furans, PCP, and PCB Testing, Pacific Affiliates, Inc., December 2005.

The District is currently reapplying for all governing agency permits to perform maintenance dredging for both the District and the City. Copies of all permits will be distributed to all governing agencies as they are acquired.

3. HISTORICAL DREDGING RECORD AND 2007 ESTIMATED VOLUMES

3.1 Site History

Maintenance dredging of the District and City docks and marinas has not occurred since 2007. The areas beneath these docks and marinas have been accumulating sediment and in many locations the vessels that use the facilities are grounding during low tides. Table 2 lists the location and date of the past two dredging events, total event volume removed, and disposal site used. Note that when comparing historic to current data, the J Street Dock was rebuilt in 2011 and is currently referred to as the Boating Instruction Safety Center (BISC) Dock.

Table 2. Proposed Dredge Locations, History and Estimated Volumes

Dredge Location		**Historic Dredging**	
		2007	**1996**
1	Fields Landing Boat Yard	N/A	N/A
2	Woodley Island Marina	✓	✓
3	Redwood Terminal Berth 1	N/A	N/A
4	Redwood Terminal Berth 2	N/A	N/A
5	Samoa Bridge Launch Ramp	✓	N/A
6	Bonnie Gool Guest Dock	✓	✓
7	Adorni Center	✓	N/A
8	J Street Dock (current location of the BISC Dock)	✓	✓
9	I Street Dock	✓	N/A
10	F Street Floating Dock	✓	✓
11	Eureka Fisherman's Terminal (location of Landing Dock in 1996)	✓	✓
12	C Street Dock	N/A	N/A
13	Commercial Street Dock	✓	✓
14	Small Boat Basin	✓	✓
15	Dock B	✓	✓
Total Dredging Event Volume		216,590 (MRB, 2004)	226,240 (Pacific Affiliates, 2005)
Disposal Site		Sand Beach at Samoa Peninsula	Sand Beach at Samoa Peninsula

3.2 Existing Studies

Sediment samples were collected prior to each dredging event to evaluate the physical, chemical and biological character of the material. In addition, biological monitoring of the Samoa Beach disposal site was conducted for a series of years prior to the last dredging event.

In 2005, the District contracted a study to characterize the in-place quality of the sediment proposed for the 2007 dredging event to facilitate permitting (Pacific Affiliates, 2005a and 2005b). The physical and chemical characteristics of the material sampled at the project study locations are summarized in a series of tables in the 2005 report that include both the 2005 and 1996 sampling results (Appendix C).

Biological monitoring of the Samoa Beach disposal site from 1998 through 2002 is summarized in the report *Eureka Upper Channel: Sediment Data Summary* submitted by Mad River Biologists to Pacific Affiliates in 2004.

Sediment chemical characterization and toxicity of the Eureka Slough Channel was performed in 1999 and results were tabled in a report prepared by Toxscan, Inc. and Kinnetic Laboratories, Inc. Samples were evaluated for three composites of 4 samples.

Pacific Affiliates prepared a report of sediment sampling analysis for the District and City in 1996 with results that are summarized in the 2005 report (Pacific Affiliates, 2005a).

Toxscan, Inc. and Kinnetic Laboratories, Inc. prepared *Chemical Analysis, Toxicity Evaluation and Bioaccumulation of Sediments in Humboldt Bay: Baseline Survey I, II and III*, Fiscal Years 1993, 1994 and 1995, respectively. These studies included grain size, sediment chemistry bioassay and bioaccumulation results for composites throughout Humboldt Bay, including the Fields Landing Channel, Eureka Slough Channel, and Samoa Channel.

3.3 Summary of 2005 Eureka Slough Channel Results

Pacific Affiliates prepared and implemented the Sampling and Analysis Plan for the most recent dredging event within the inner and outer channels of Eureka Slough (Pacific Affiliates, 2005a and 2005b). Laboratory analysis results for the past two sediment sampling events in 2005 and 1996 are summarized in the 2005 report, included in Appendix C.

2005 laboratory analysis results for texture, metal, semi-volatile organics, and 2,3,7,8-TCDD toxic equivalents are discussed briefly in the following sub-section of this report. Figures are provided to demonstrate the variation in results between samples. Non-detects were not estimated at any limit and therefore have a value of zero. Toxicity screening thresholds for marine sediment, listed in the National Oceanic and Atmospheric Administration (NOAA) screening quick reference tables (SQuirTs) were included. Unless noted otherwise, the following screening thresholds were used for comparison:

> **T20 and T50:** Chemical concentrations corresponding to 20 and 50 percent probability of observing toxicity calculated from individual chemical logistic regression models based on 10-day survival results from marine amphipod tests (*Ampelisca a.* and *Rhepoxynius a.*).
> **Threshold Effects Levels (TELs) and Probable Effects Levels (PELs):** Geometric mean of a database of synoptic contaminant concentrations and sediment toxicity bioassays or benthic community metrics. Different from the ERLs/ERMs, these benchmarks use the entire database, including non-toxic data results.

Effects Range Low (ERLs) and Effects Range Median (ERMs): 10th and 50th percentiles from samples categorized as toxic for a given analyte, of a database primarily of synoptic marine sediment chemistry and sediment toxicity bioassay data. As such, these benchmarks are not analogous to LC10s or LC50s (lethal concentrations to 10 or 50 percent of the sample population).

Due to the range between the data and toxicity screening thresholds, a logarithmic scale of the concentrations was used.

3.3.1 Texture

Soil texture is illustrated in Figure 5. The sites texture fractions ranged from 3.1 to 36.8 percent sand, 38 to 59.5 percent silt, and 20.8 to 44.5 percent clay.

3.3.2 Metals

Reported results for metals levels were split by relative order of magnitude for presentation in Figure 6 and Figure 7. Dry weight concentrations of chromium, nickel, zinc, arsenic, copper, and lead were reported and presented in Figure 6. Elevated nickel levels were consistent with "background" concentrations recorded in the lower Humboldt Bay watershed at the White Slough and Salmon Creek Units of the Humboldt Bay National Wildlife Refuge (Patenaude, 2015).

Dry weight concentrations of cadmium, selenium, silver and total mercury were reported and presented in Figure 7. The NOAA SQuirTs do not list a T20/T50, TEL/PEL, or ERL/ERM for selenium; however the apparent effects threshold (AET) for an amphipod bioassay endpoint is reported to be 1000 µg/Kg, which is well above the data results at all sites.

3.3.3 Polycyclic Aromatic Hydrocarbons

Results for reported Polycyclic Aromatic Hydrocarbons (PAHs) are illustrated in Figure 8. Levels of 2-Chloronaphthalene were non-detect at all sites. In general, sediment sampled at Fisherman's Dock Terminal showed the highest concentrations of PAHs among the sampled sites.

3.3.4 2,3,7,8-TCDD Toxic Equivalents

Results for 2,3,7,8-TCDD toxic equivalents (TEQs) are illustrated in Figure 9. These values were calculated from the reported data using the 2005 World Health Organization toxic equivalency factors (TEFs). The AET for a neanthes bioassay is included for comparison with the TEL and PEL.

4. SAMPLING DESIGN

The dredging project sampling design was split into four sampling design areas, referred to as dredging units (DU) based on their location in Humboldt Bay and their dredging schedule. The docks and marinas included in each DU and their sampling design strategies are summarized in Table 3. Two sampling strategies are proposed for evaluating sediment characteristics: Incremental Sampling Methodology at DU-1, which includes the Fields Landing Boat Yard and the ITM at DU-2, DU-3 and DU-4.

Table 3. Sampling Dredging Units Schedules and Field Methods

Dredging Unit	Location	Docks/Marinas	Dredging Schedule	Guidelines for Sampling Design Strategies
DU-1	Fields Landing along Fields Landing Channel in South Bay	Fields Landing Boat Yard	August – October, 2016-2020	Incremental Sampling Methodology (ITRC, 2012) and Inland Testing Manual (USEPA/USACE, 1998)
DU-2	Eureka and Woodley Island along Eureka Slough Inner and Outer Reach Channels in North Bay	Woodley Island Marina, Samoa Bridge Boat Ramp, Bonnie Gool Guest Dock, I Street Dock, BISC Dock, Adorni Center, F Street Dock, Fisherman's Terminal, C Street Dock, Commercial Street Dock, Small Boat Basin, and Dock B	August – October, 2016-2020	Inland Testing Manual (USEPA/USACE, 1998)
DU-3	Samoa along Samoa Turning Basin in North Bay	Redwood Terminal Berth 1	August – October, 2016-2020	Inland Testing Manual (USEPA/USACE, 1998)
DU-4	Samoa along Samoa Channel in North Bay	Redwood Terminal Berth 2	August – October, 2016-2020	Inland Testing Manual (USEPA/USACE, 1998)

4.1 DU-1 Incremental Sampling Methodology Design

Incremental Sampling Methodology (ISM) was developed by the Interstate Technology and Regulatory Council (ITRC) and is a structured composite sampling and processing protocol designed to reduce data variability for representative soil samples (ITRC, 2012). This methodology is consistent with sampling strategies described in the ITM. This methodology was developed to provide reasonably unbiased, reproducible estimates of the mean concentration of analytes and will be applied at DU-1 for comparative analysis to the background physical and chemical conditions at the Humboldt Bay National Wildlife Refuge White Slough Unit tidal wetland restoration project.

The sampling plan developed for DU-1 requires the collection of three composite samples, each consisting of a minimum of 30 individual samples using random sampling on a grid, or equivalent sampling distribution, per ISM requirements. Figure 11 illustrates the proposed ISM field sampling design at DU-1. Table 4 summarizes the boring locations, including the bay sediment elevation, and estimated core length, based on the boring depth.

4.2 DU-2, DU-3, and DU-4 Sampling Design

Figure 12 and Figure 13 illustrate the proposed field sampling designs at DU-2. Figure 14 and Figure 15 illustrate the proposed field sampling designs at DU-3 and DU-4, respectively. Table 5 summarizes the boring locations, including the bay sediment elevation, and estimated core length, based on the boring depth.

Table 4. Proposed DU-1 Sampling Boring Station Locations and Details

Dredging Unit	Sampling Core Station ID: Composite 1	Latitude (degrees decimal minutes, N)	Longitude (degrees decimal minutes, W)	Bay Sediment Elevation (ft, MLLW)	Project Depth plus Over-depth (ft, MLLW)	Project Depth to Z Layer (ft, MLLW)	Estimated Core Length (ft)
DU-1	FL-01-A	40° 43.44824'	-124° 13.37929'	-8.4	-13	-13.5	5.1
	FL-02-A	40° 43.44698'	-124° 13.37555'	-2.2	-13	-13.5	11.3
	FL-03-A	40° 43.44392'	-124° 13.37586'	-1.4	-13	-13.5	12.1
	FL-04-A	40° 43.44243'	-124° 13.37413'	-2.3	-13	-13.5	11.2
	FL-05-A	40° 43.43988'	-124° 13.37020'	0.1	-13	-13.5	13.6
	FL-06-A	40° 43.43597'	-124° 13.36772'	-0.4	-13	-13.5	13.1
	FL-07-A	40° 43.43533'	-124° 13.36771'	-1.5	-13	-13.5	12
	FL-08-A	40° 43.43344'	-124° 13.36544'	-1	-13	-13.5	12.5
	FL-09-A	40° 43.43134'	-124° 13.36336'	-0.3	-13	-13.5	13.2
	FL-10-A	40° 43.43052'	-124° 13.36197'	-0.1	-13	-13.5	13.4
	FL-11-A	40° 43.44745'	-124° 13.38121'	-10.3	-13	-13.5	3.2
	FL-12-A	40° 43.44446'	-124° 13.37882'	-5.4	-13	-13.5	8.1
	FL-13-A	40° 43.44212'	-124° 13.37693'	-1.3	-13	-13.5	12.2
	FL-14-A	40° 43.43864'	-124° 13.37582'	-2.5	-13	-13.5	11
	FL-15-A	40° 43.43751'	-124° 13.37392'	-1.6	-13	-13.5	11.9
	FL-16-A	40° 43.43608'	-124° 13.37017'	-0.9	-13	-13.5	12.6
	FL-17-A	40° 43.44172'	-124° 13.38337'	-9	-13	-13.5	4.5
	FL-18-A	40° 43.43994'	-124° 13.38432'	-9.3	-13	-13.5	4.2
	FL-19-A	40° 43.43694'	-124° 13.38088'	-3.1	-13	-13.5	10.4
	FL-20-A	40° 43.43768'	-124° 13.37887'	-5.4	-13	-13.5	8.1
	FL-21-A	40° 43.43596'	-124° 13.37679'	-3	-13	-13.5	10.5
	FL-22-A	40° 43.43330'	-124° 13.37624'	-2.6	-13	-13.5	10.9
	FL-23-A	40° 43.43115'	-124° 13.37380'	-4.1	-13	-13.5	9.4
	FL-24-A	40° 43.43081'	-124° 13.37083'	-2.4	-13	-13.5	11.1
	FL-25-A	40° 43.42889'	-124° 13.36791'	-2	-13	-13.5	11.5
	FL-26-A	40° 43.42620'	-124° 13.36751'	-2.5	-13	-13.5	11
	FL-27-A	40° 43.42334'	-124° 13.36774'	-2.2	-13	-13.5	11.3
	FL-28-A	40° 43.42205'	-124° 13.36509'	-0.2	-13	-13.5	13.3
	FL-29-A	40° 43.4219'	-124° 13.36240'	-0.4	-13	-13.5	13.1
	FL-30-A	40° 43.42045'	-124° 13.36270'	0.4	-13	-13.5	13.9

Dredging Unit	Sampling Core Station ID: Composite 2	Latitude (degrees decimal minutes, N)	Longitude (degrees decimal minutes, W)	Bay Sediment Elevation (ft, MLLW)	Project Depth plus Over-depth (ft, MLLW)	Project Depth to Z Layer (ft, MLLW)	Estimated Core Length (ft)
DU-1	FL-01-B	40° 43.45072'	-124° 13.38051'	-11.6	-13	-13.5	1.9
	FL-02-B	40° 43.44846'	-124° 13.37803'	-4.6	-13	-13.5	8.9
	FL-03-B	40° 43.44525'	-124° 13.37625'	-3.0	-13	-13.5	10.5
	FL-04-B	40° 43.44307'	-124° 13.37378'	-2.3	-13	-13.5	11.2
	FL-05-B	40° 43.43900'	-124° 13.36903'	-1.8	-13	-13.5	11.7
	FL-06-B	40° 43.43713'	-124° 13.36760'	-0.7	-13	-13.5	12.8
	FL-07-B	40° 43.43509'	-124° 13.36672'	-0.8	-13	-13.5	12.7
	FL-08-B	40° 43.43335'	-124° 13.36289'	-0.2	-13	-13.5	13.3
	FL-09-B	40° 43.43178'	-124° 13.36544'	-1.1	-13	-13.5	12.4
	FL-10-B	40° 43.42944'	-124° 13.36326'	-0.7	-13	-13.5	12.8
	FL-11-B	40° 43.44620'	-124° 13.38226'	-10.3	-13	-13.5	3.2
	FL-12-B	40° 43.44389'	-124° 13.37841'	-5.4	-13	-13.5	8.1
	FL-13-B	40° 43.44186'	-124° 13.37775'	-1.9	-13	-13.5	11.6
	FL-14-B	40° 43.44039'	-124° 13.37596'	-0.4	-13	-13.5	13.1
	FL-15-B	40° 43.43805'	-124° 13.37462'	-1.7	-13	-13.5	11.8
	FL-16-B	40° 43.43675'	-124° 13.37162'	-1.1	-13	-13.5	12.4
	FL-17-B	40° 43.44431'	-124° 13.38275'	-10.3	-13	-13.5	3.2
	FL-18-B	40° 43.44171'	-124° 13.38194'	-8.5	-13	-13.5	5.0
	FL-19-B	40° 43.44041'	-124° 13.37902'	-5.0	-13	-13.5	8.5
	FL-20-B	40° 43.43731'	-124° 13.37723'	-3.2	-13	-13.5	10.3
	FL-21-B	40° 43.43382'	-124° 13.37732'	-3.5	-13	-13.5	10.0
	FL-22-B	40° 43.43193'	-124° 13.37480'	-2.0	-13	-13.5	11.5
	FL-23-B	40° 43.43230'	-124° 13.37357'	-4.4	-13	-13.5	9.1
	FL-24-B	40° 43.42808'	-124° 13.37305'	-2.6	-13	-13.5	10.9
	FL-25-B	40° 43.42977'	-124° 13.36900'	-2.1	-13	-13.5	11.4
	FL-26-B	40° 43.42673'	-124° 13.36916'	-3.7	-13	-13.5	9.8
	FL-27-B	40° 43.42359'	-124° 13.36850'	-2.4	-13	-13.5	11.1
	FL-28-B	40° 43.42440'	-124° 13.36358'	-1.1	-13	-13.5	12.4
	FL-29-B	40° 43.41970'	-124° 13.36469'	-1.2	-13	-13.5	12.3
	FL-30-B	40° 43.41978'	-124° 13.36081'	0.5	-13	-13.5	14.0

Dredging Unit	Sampling Core Station ID: Composite 3	Latitude (degrees decimal minutes, N)	Longitude (degrees decimal minutes, W)	Bay Sediment Elevation (ft, MLLW)	Project Depth plus Over-depth (ft, MLLW)	Project Depth to Z Layer (ft, MLLW)	Estimated Core Length (ft)
DU-1	FL-01-C	40° 43.45152'	-124° 13.37995'	-11.5	-13	-13.5	2.0
	FL-02-C	40° 43.44817'	-124° 13.37863'	-6.7	-13	-13.5	6.8
	FL-03-C	40° 43.44509'	-124° 13.37398'	-1.3	-13	-13.5	12.2
	FL-04-C	40° 43.44220'	-124° 13.37369'	-1.6	-13	-13.5	11.9
	FL-05-C	40° 43.44022'	-124° 13.37295'	-0.8	-13	-13.5	12.7
	FL-06-C	40° 43.43891'	-124° 13.36807'	-1.5	-13	-13.5	12.0
	FL-07-C	40° 43.43445'	-124° 13.36780'	-1.4	-13	-13.5	12.1
	FL-08-C	40° 43.43348'	-124° 13.36401'	0.2	-13	-13.5	13.7
	FL-09-C	40° 43.43102'	-124° 13.36484'	-1.5	-13	-13.5	12.0
	FL-10-C	40° 43.42892'	-124° 13.36283'	0.0	-13	-13.5	13.5
	FL-11-C	40° 43.44607'	-124° 13.38052'	-8.8	-13	-13.5	4.7
	FL-12-C	40° 43.44376'	-124° 13.37811'	-4.3	-13	-13.5	9.2
	FL-13-C	40° 43.44348'	-124° 13.37702'	-2.4	-13	-13.5	11.1
	FL-14-C	40° 43.43832'	-124° 13.37670'	-2.3	-13	-13.5	11.2
	FL-15-C	40° 43.43788'	-124° 13.37384'	-1.6	-13	-13.5	11.9
	FL-16-C	40° 43.43530'	-124° 13.36955'	-0.5	-13	-13.5	13.0
	FL-17-C	40° 43.44346'	-124° 13.38235'	-9.5	-13	-13.5	4.0
	FL-18-C	40° 43.44035'	-124° 13.37967'	-6.1	-13	-13.5	7.4
	FL-19-C	40° 43.43921'	-124° 13.37942'	-5.6	-13	-13.5	7.9
	FL-20-C	40° 43.43662'	-124° 13.38031'	-3.7	-13	-13.5	9.8
	FL-21-C	40° 43.43288'	-124° 13.37794'	-2.5	-13	-13.5	11.0
	FL-22-C	40° 43.43220'	-124° 13.37661'	-3.1	-13	-13.5	10.4
	FL-23-C	40° 43.43243'	-124° 13.37191'	-3.1	-13	-13.5	10.4
	FL-24-C	40° 43.42882'	-124° 13.37156'	-3.3	-13	-13.5	10.2
	FL-25-C	40° 43.42844'	-124° 13.37085'	-3.4	-13	-13.5	10.1
	FL-26-C	40° 43.42653'	-124° 13.36855'	-3.8	-13	-13.5	9.7
	FL-27-C	40° 43.42388'	-124° 13.36922'	-2.1	-13	-13.5	11.4
	FL-28-C	40° 43.42325'	-124° 13.36430'	-1.4	-13	-13.5	12.1
	FL-29-C	40° 43.42150'	-124° 13.36326'	0.4	-13	-13.5	13.9
	FL-30-C	40° 43.41991'	-124° 13.36273'	0.6	-13	-13.5	14.1

Table 5. Proposed Sampling Boring Station Locations and Details for DU-2, DU-3 and DU-4

Dredging Unit	Sampling Core Station ID	Latitude (degrees decimal minutes, N)	Longitude (degrees decimal minutes, W)	Bay Sediment Elevation (ft, MLLW)	Project Depth plus Over-depth (ft, MLLW)	Project Depth to Z Layer (ft, MLLW)	Estimated Core Length (ft)
DU-2	WIM-01-A	40° 48.44155'	-124° 10.0052'	-12.6	-16	-16.5	-3.9
	WIM-02-A	40° 48.44695'	-124° 9.87263'	-11.3	-16	-16.5	-5.2
	WIM-03-A	40° 48.44661'	-124° 9.77360'	-9.1	-16	-16.5	-7.4
	WIM-04-A	40° 48.45334'	-124° 9.66324'	-6.0	-16	-16.5	-10.5
	WIM-01-B	40° 48.47935'	-124° 9.63466'	-8.1	-16	-16.5	-8.4
	WIM-02-B	40° 48.47108'	-124° 9.60906'	-6.0	-16	-16.5	-10.5
	WIM-03-B	40° 48.46195'	-124° 9.57364'	-10.8	-16	-16.5	-5.7
	WIM-04-B	40° 48.49244'	-124° 9.56614'	-5.8	-16	-16.5	-10.7
	SAM-01-C	40° 48.50497'	-124° 9.26626'	-5.2	-13	-13.5	-8.3
	SAM-02-C	40° 48.50333'	-124° 9.26934'	-3.9	-13	-13.5	-9.6
	BON-01-C	40° 48.40021'	-124° 9.57367'	-11.0	-13	-13.5	-2.5
	BON-02-C	40° 48.41164'	-124° 9.54208'	-14.4	-19	-19.5	-5.1
	ADC-01-C	40° 48.37855'	-124° 9.67046'	-3.7	-11	-11.5	-7.8
	ADC-02-C	40° 48.37897'	-124° 9.66474'	-2.9	-11	-11.5	-8.6
	BISC-01-C	40° 48.37983'	-124° 9.71023'	-8.6	-11	-11.5	-2.9
	BISC-02-C	40° 48.38019'	-124° 9.69434'	-6.4	-11	-11.5	-5.1
	IST-01-C	40° 48.37128'	-124° 9.80283'	-8.8	-16	-16.5	-7.7
	IST-02-C	40° 48.37205'	-124° 9.78129'	-6.2	-16	-16.5	-10.3
	FST-02-D	40° 48.36699'	-124° 10.03441'	-8.5	-13	-13.5	-5.0
	FST-01-D	40° 48.36414'	-124° 10.05085'	-5.2	-13	-13.5	-8.3
	CST-01-E	40° 48.34445'	-124° 10.20865'	-9.5	-13	-13.5	-4.0
	CST-02-E	40° 48.34556'	-124° 10.19532'	-6.4	-13	-13.5	-7.1
	FISH-01-F	40° 48.33389'	-124° 10.27995'	-12.4	-19	-19.5	-7.1
	FISH-02-F	40° 48.33643'	-124° 10.26428'	-12.3	-19	-19.5	-7.2
	FISH-03-F	40° 48.33896'	-124° 10.24815'	-12.7	-19	-19.5	-6.8
	FISH-04-F	40° 48.34184'	-124° 10.22897'	-12.3	-19	-19.5	-7.2
	COM-01-G	40° 48.28208'	-124° 10.49133'	-15.8	-19	-19.5	-3.7
	COM-02-G	40° 48.28853'	-124° 10.46986'	-15.8	-19	-19.5	-3.7
	COM-03-G	40° 48.29591'	-124° 10.44228'	-14.3	-19	-19.5	-5.2
	COM-04-G	40° 48.30046'	-124° 10.42125'	-7.9	-19	-19.5	-11.6

Dredging Unit	Sampling Core Station ID	Latitude (degrees decimal minutes, N)	Longitude (degrees decimal minutes, W)	Bay Sediment Elevation (ft, MLLW)	Project Depth plus Over-depth (ft, MLLW)	Project Depth to Z Layer (ft, MLLW)	Estimated Core Length (ft)
DU-2	SBB-01-H	40° 48.16818'	-124° 10.73586'	-5.7	-11	-11.5	-5.8
	SBB-02-H	40° 48.19149'	-124° 10.72325'	-5.4	-11	-11.5	-6.1
	SBB-03-H	40° 48.20576'	-124° 10.69445'	-1.5	-11	-11.5	-10.0
	SBB-04-H	40° 48.17618'	-124° 10.67578'	-4.0	-11	-11.5	-7.5
	SBB-01-J	40° 48.22698'	-124° 10.63227'	-3.6	-11	-11.5	-7.9
	SBB-02-J	40° 48.22047'	-124° 10.61326'	-2.1	-11	-11.5	-9.4
	SBB-03-J	40° 48.23666'	-124° 10.59934'	-4.7	-11	-11.5	-6.8
	SBB-04-J	40° 48.24651'	-124° 10.58665'	-6.4	-11	-11.5	-5.1
	DKB-01-K	40° 48.07236'	-124° 10.97973'	-5.2	-13	-13.5	-8.3
	DKB-02-K	40° 48.07921'	-124° 10.97309'	-5.2	-13	-13.5	-8.3
	DKB-03-K	40° 48.08565'	-124° 10.96680'	-6.4	-13	-13.5	-7.1
	DKB-04-K	40° 48.09208'	-124° 10.96080'	-7.4	-13	-13.5	-6.1
DU-3	RT1-01-A	40° 48.92389'	-124° 10.94459'	-20.7	-26	-26.5	-5.8
	RT1-02-A	40° 48.96264'	-124° 10.90460'	-23.3	-26	-26.5	-3.2
	RT1-01-B	40° 49.00254'	-124° 10.86344'	-22.4	-26	-26.5	-4.1
	RT1-02-B	40° 49.04626'	-124° 10.81428'	-22.6	-26	-26.5	-3.9
DU-4	RT2-01-A	40° 48.12928'	-124° 11.34047'	-34.0	-39	-39.5	-5.5
	RT2-02-A	40° 48.17061'	-124° 11.31503'	-36.7	-39	-39.5	-2.8
	RT2-01-B	40° 48.21830'	-124° 11.28897'	-38.3	-39	-39.5	-1.2
	RT2-02-B	40° 48.26414'	-124° 11.26668'	-31.4	-39	-39.5	-8.1

5. SAMPLING METHODOLOGY

Field sampling will consist of collecting sediment at each station location within each DU. Sediment cores will be collected at each location to project depth plus 1-foot of over-depth plus 0.5-foot to accommodate collection of a "Z" layer or to depth of refusal (fewer than 2 inches of penetration per minute), whichever is encountered sooner.

5.1 Sample Collection

The contractor will determine the most efficient and effective manner in which samples are collected (e.g., vibracore or drill) based on site conditions. Vibracore tubes will consist of pre-cleaned disposable polyethylene liners inside a 4-inch outer diameter aluminum core barrel with a stainless-steel catcher to retain the sediment. To eliminate the possibility of cross-contamination, a new liner will be inserted into the core tube prior to sampling at each station. The vibracore will be deployed from a vessel using a winch. The vibracore will be energized as it nears the bottom and supported upright with the winch line during penetration into the sediment. Upon completion of penetration at a station location, the vibracore will be shut down, the position recorded, and the sampler recovered. If other collection methods are employed, sample core collection will be implemented to avoid cross-contamination.

Sample cores will be logged in the field by qualified personnel according to Unified Soil Classification System guidelines. Sample core collection forms will include station location and depth, penetration, final core length, soil classification and a description of material layers, including texture, color, odors, or debris present, noting the extent of detrital material. Sample cores will be homogenized using the following methods (USACE, 2015):

> Each sample will be individually homogenized in a stainless-steel bowl or high-density polyethylene bucket, by stirring with either stainless-steel utensils or by using an electric drill attached to a stainless steel stirring paddle. Composites will be made by sub-sampling the homogenized individual samples proportionally according to the length of each core section and mixing the sub-samples together to create the uniform composite. The same method used for thoroughly mixing the individual samples will be used to homogenize each composite. Between homogenizing different samples or composites, the homogenizing equipment will be scrubbed and rinsed with tap water until no more material remains. It will then be cleaned with biodegradable non-phosphate detergent, rinsed again with copious amounts of tap water, and then rinsed with distilled water.

Samples will be transferred to appropriate laboratory containers and placed on ice in a cooler. The amount of sediment collected from each station will be of sufficient mass and volume to analyze for physical parameters, and the full suite of chemical analytes, and biological analyses.

5.2 Sample Archiving

A representative portion of the homogenized core at each sampling station shall be preserved and archived. The amount of sediment archived from each sample station will be of sufficient mass and volume to reanalyze a single sample for the full suite of chemical analytes, and biological analysis. Archived samples will be kept at a temperature of 4 ± 2° C in the dark until they are sent to the laboratory, not to exceed the maximum holding times.

5.3 Custody Requirements

5.3.1 Field Custody

Field conditions and sampling procedures will be recorded in a field logbook. Samples collected or archived at each site will be labeled with a unique sample identification number, sample location, date and time of collection, initials of the person collecting the sample, laboratory analysis, preservation, and all other pertinent information. The final report will include an inventory of all samples collected and delivered, including their identification numbers.

5.3.2 Shipping

Sediment samples will be transported to the laboratories for analysis as soon as possible after sample collection. The sample containers will be placed on ice or equivalent cooling medium in a cooler, sealed with the chain of custody (COC) forms, and shipped to the laboratory. Original COC records will be sealed in a plastic bag and taped to the inside lid of the cooler. A temperature blank will be included in each cooler to record the arrival temperature at the laboratory.

5.3.3 Laboratory Custody

Samples received at the laboratory will checked for clear label identification, and accurate COC documentation. Temperature blanks will be measured and recorded immediately after coolers are opened. Laboratories will contact the District if there are discrepancies between the samples and the COC. Sample condition, and arrival temperature will be recorded on the COC form with any additional questions or comments. A copy of the COC form will be included in the final report.

5.3.4 Quality Assurance and Quality Control (QA/QC) Requirements

Laboratories shall maintain proper certifications (National Environmental Laboratory Accreditation Program and State) for analyses performed. Laboratories must provide evidence of performing standard QA/QC procedures.

An analytical batch (a set of samples extracted or analyzed concurrently or sequentially) will be 20 samples or less. Temporal gaps in the analytical sequence that are greater than two hours will result in the termination of the previous sequence and the initiation of a new analytical sequence. The practice of "holding a batch open" and performing a single set of batch QC samples for all analyses performed during that period is unacceptable. The following quality control measurements will be performed and reported with each batch of samples analyzed, as applicable to the method (USEPA, 2007):

- One method blank, consisting of reagents specific to the method and carried through the complete sample preparation and analytical procedure, will be analyzed for each analytical batch (or as described in the specific analytical procedure).
- Laboratory control samples (LCS), which are spiked blank samples, will be carried through the entire analysis procedure. They will be introduced into an analytical batch immediately before extractions. LCS will be performed for both inorganic and organic laboratory methods. If results are not within established control limits, all samples associated with the batch will be reanalyzed. The matrix used for LCS analyses will be reagent grade sand for soil/sediment matrices.
- Second column confirmation for all Gas Chromatography (GC) sample analyses involving identification of discrete peaks with detected concentrations will be required, for methods where it is appropriate.

- A Matrix Spike, Matrix Spike Duplicate, and Matrix Duplicate will be required for each organic and metals method per analytical batch. A test sediment sample will be spiked rather than a reference sample to best determine the matrix effects of the project material.
- Surrogate Spikes will be added to samples requiring GC or GC/Mass Spectroscopy (MS) analysis as a means of assessing matrix effects.

The final report will include a QA/QC report, which will present the results of the laboratory QA/QC.

6. ANALYTICAL METHODS

Physical, chemical and biological characteristics of the dredge material will be characterized by laboratory analysis of collected sediment samples. Physical parameters to be analyzed include grain size, total solids, and specific gravity. Chemical leachability will be analyzed by modified Waste Extraction Test (WET) using deionized water for a single replicate at DU-1 and all samples for DU-2, DU-3, and DU-4. A detailed list of analytes and methods for physical and chemical analyses are included in Tables 6-8.

Biological analysis will include a 10-day benthic (sediment) acute toxicity test on marine species representing three life strategies, including filter feeding, deposit feeding and burrowing organisms.

6.1 Physical and Chemical Analysis

Table 6 summarizes the proposed laboratory methods for physical analysis.

Table 6. Physical and General Analysis

Physical Analyte	Method	Reporting Limit	Units
Grain Size	ASTM D422	0.1	% Retained
Total Solids	USEPA 160.3	0.1	% Wet weight
Specific Gravity	ASTM D1429-08	N/A	N/A
Total Organic Carbon	USEPA 9060	0.1	%

Table 7 summarizes the proposed laboratory methods for chemical leachability and includes the State Water Resources Control Board's water quality objectives (WQO) for bays and estuaries (SWRCB, 2015). Table 8 summarizes the proposed laboratory methods and reporting limits to characterize soil concentrations of chemicals of concern.

Table 7. Leachability Analysis for Soluble Constituents

Chemical Analyte	Method	Reporting Limit	WQO for Bays and Estuaries	Units
Heavy Metals Extraction				
Silver	DI-WET Title 22 CCR	0.2	1.9	µg/L
Arsenic		0.1	0.14	µg/L
Barium		0.2	--[1]	µg/L
Beryllium		0.2	--	µg/L
Cadmium		0.1	9.3	µg/L
Cobalt		0.2	--	µg/L
Chromium (Total)		0.5	--	µg/L
Chromium (VI)		0.5	50	µg/L
Copper		0.2	3.1	µg/L
Nickel		0.3	8	µg/L
Lead		0.1	8.1	µg/L
Molybdenum		0.2	--	µg/L
Selenium		0.5	71	µg/L
Thallium		0.1	6.3	µg/L
Antimony		0.2	4,300	µg/L
Vanadium		0.2	--	µg/L
Zinc		10	81	µg/L
Mercury		0.5	0.94	µg/L
Polycyclic Aromatic Hydrocarbons (PAHs) Extraction				
Naphthalene	DI-WET Title 22 CCR	0.1	1	µg/L
Acenapthylene		0.1	10	µg/L
Acenaphthene		0.1	0.1	µg/L
Fluorene		0.1	0.1	µg/L
Phenanthrene		0.1	0.05	µg/L
Anthracene		0.1	0.1	µg/L
Fluoranthene		0.1	0.1	µg/L
Pyrene		0.1	0.1	µg/L
Benzo(a)anthracene		0.1	0.05	µg/L
Chrysene		0.1	0.05	µg/L
Benzofluoranthene		0.1	0.05	µg/L
Benzo(a)pyrene		0.1	0.05	µg/L
Indeno(1,2,3-cd)pyrene		0.1	0.05	µg/L
Dibenz(a,h)anth-racene		0.1	0.05	µg/L
Benzo(g,h,i)pery-lene		0.1	10	µg/L

1. --: no value

Table 8. Chemical Analysis for Chemical Solubility

Chemical Analyte	Method	Reporting Limit (dry weight)	Units
Metals			
Silver	USEPA 6010 B	0.20	mg/kg
Arsenic		1.0	mg/kg
Barium		1.0	mg/kg
Beryllium		0.20	mg/kg
Cadmium		0.20	mg/kg
Cobalt		0.50	mg/kg
Chromium		0.50	mg/kg
Copper		1.0	mg/kg
Nickel		1.0	mg/kg
Lead		1.0	mg/kg
Molybdenum		2.0	mg/kg
Selenium		0.10	mg/kg
Thallium		2.0	mg/kg
Antimony		2.0	mg/kg
Vanadium		0.50	mg/kg
Zinc		1.0	mg/kg
Total Mercury	USEPA 7471 A	0.02	mg/kg
PCBs			
PCB 1016	USEPA 8082A	0.5	mg/kg
PCB 1221		2.0	mg/kg
PCB 1232		1.0	mg/kg
PCB 1242		0.2	mg/kg
PCB 1248		0.2	mg/kg
PCB 1254		0.5	mg/kg
PCB 1260		0.5	mg/kg
Organotins			
Monobutyltin	Krone et al., 1989	10.0	µg/kg
Dibutyltin		10.0	µg/kg
Tributyltin		10.0	µg/kg
Tetrabutytin		10.0	µg/kg
Total Butylins		10.0	µg/kg
Polycyclic Aromatic Hydrocarbons (PAHs)			
Naphthalene	USEPA 8270 D SIM	10.0	µg/kg
Acenapthylene		10.0	µg/kg
Acenaphthene		10.0	µg/kg
Fluorene		10.0	µg/kg
Phenanthrene		10.0	µg/kg
Anthracene		10.0	µg/kg
Fluoranthene		10.0	µg/kg
Pyrene		10.0	µg/kg
Benzo(a)anthracene		10.0	µg/kg
Chrysene		10.0	µg/kg
Benzofluoranthene		10.0	µg/kg
Benzo(a)pyrene		10.0	µg/kg
Indeno(1,2,3-cd)pyrene		10.0	µg/kg
Dibenz(a,h)anth-racene		10.0	µg/kg
Benzo(g,h,i)pery-lene		10.0	µg/kg

Chemical Analyte	Method	Reporting Limit (dry weight)	Units
Organochlorine Pesticides			
2,4-DDD	USEPA 8081 B	1.0	µg/kg
4,4-DDD		1.0	µg/kg
2,4-DDE		1.0	µg/kg
4,4-DDE		1.0	µg/kg
2,4-DDT		1.0	µg/kg
4,4-DDT		1.0	µg/kg
Total DDT		1.0	µg/kg
Aldrin		1.0	µg/kg
Alpha-BHC		1.0	µg/kg
Alpha-Chlordane		1.0	µg/kg
Beta-BHC		1.0	µg/kg
Delta-BHC		1.0	µg/kg
Dieldrin		1.0	µg/kg
Endosulfan-I		1.0	µg/kg
Endosulfan-II		1.0	µg/kg
Endosulfan sulfate		1.0	µg/kg
Endrin		1.0	µg/kg
Endrin aldehyde		1.0	µg/kg
Endrin ketone		1.0	µg/kg
Gamma-BHC (Lindane)		1.0	µg/kg
Gamma-Chlordane		1.0	µg/kg
Heptochlor		1.0	µg/kg
Heptochlor epoxide		1.0	µg/kg
Methoxychlor		1.0	µg/kg
Toxaphene		20	µg/kg
Herbicides			
Pentachlorophenol	USEPA 8151 A	32	µg/kg
Dioxins and Furans			
2,3,7,8-TCDD TEQ	WHO 2005/ OEHHA Public Health Goal	N/A	pg/g
2,3,7,8-TCDD	USEPA 1613 B	1.0	pg/g
2,3,7,8-TCDF		1.0	pg/g
1,2,3,7,8-PeCDD		5.0	pg/g
1,2,3,7,8-PeCDF		5.0	pg/g
2,3,4,7,8-PeCDF		5.0	pg/g
1,2,3,4,7,8-HxCDD		5.0	pg/g
1,2,3,6,7,8-HxCDD		5.0	pg/g
1,2,3,7,8,9-HxCDD		5.0	pg/g
1,2,3,4,7,8-HxCDF		5.0	pg/g
1,2,3,6,7,8-HxCDF		5.0	pg/g
1,2,3,7,8,9-HxCDF		5.0	pg/g
2,3,4,6,7,8-HxCDF		5.0	pg/g
1,2,3,4,6,7,8-HpCDD		5.0	pg/g
1,2,3,4,6,7,8-HpCDF		5.0	pg/g
1,2,3,4,7,8,9-HpCDF		5.0	pg/g
OCDD		10	pg/g
OCDF		10	pg/g

6.2 Biological Analysis: Benthic Acute Toxicity Testing

DU-1 has been identified for potential beneficial reuse in tidal wetlands and may require biological analysis if the sediment chemical concentrations are above background levels. If the material meets this condition, a ten-day acute toxicity testing will be used to determine potential benthic impacts of dredged material based on the ITM guidelines. Species must represent three life history stages, including filter feeder, deposit feeder, and burrowing organisms, and include at least one sensitive recommended (benchmark) amphipod species will be tested at all sites (USEPA/USACE, 1998). For beneficial reuse in tidal wetlands the test will specifically require species that meet the estuarine salinity criteria (1-25%).

Specific bioassay protocols shall be provided by the toxicology laboratory prior to SAP implementation, including but not limited to:

- Species proposed for testing
- Substrate sensitivities of proposed species
- Quality control measures
- Number of laboratory replicates
- Reference toxicants
- Performance standards for control and reference samples
- Performance standards for reference toxicant testing
- Proposed bioassay sediment interstitial water monitoring parameters, including measurement procedures and frequency.

7. REFERENCES

Laird, Aldaron. 2007. Historical Atlas of Humboldt Bay and Eel River Delta. Prepared for Humboldt Bay Harbor, Recreation and Conservation District and the California Department of Fish and Game. Prepared by Trinity Associates, Arcata, CA.

Interstate Technology and Regulatory Council. 2012. "Incremental Sampling Methodology." ISM-1. Washington, D.C.: ITRC, Incremental Sampling Methodology Team. Accessed at: www.itrcweb.org.

Mad River Biologists. 2004. *Eureka Upper Channel: Sediment Data Summary*. Submitted to Pacific Affiliates. September 20, 2004. McKinleyville, CA.

Pacific Affiliates, Inc. 2005a. *Sediment Sampling Analysis*. City of Eureka and Humboldt Bay Harbor Recreation and Conservation District Cooperative Eureka Waterfront Facilities Maintenance Dredging Project. April 1, 2005. Eureka, CA.

Pacific Affiliates, Inc. 2005b. *Sampling Results Report for Dioxin/Furans, PCP and PCB Testing*. City of Eureka and Humboldt Bay Harbor Recreation and Conservation District Cooperative Eureka Waterfront Facilities Maintenance Dredging Project. December 2005. Eureka, CA.

Patenaude, J. R. 2015. *Feasibility Study: Beneficial Reuse of Dredged Materials for Tidal Marsh Restoration and Sea Level Rise Adaptation in Humboldt Bay*. Prepared for Humboldt Bay Harbor, Recreation and Conservation District by SHN Consulting Engineers & Geologists, Eureka, CA.

State Water Resources Control Board. Accessed October 15, 2015. *Water Quality-Based Assessment Thresholds Table*, current to August 21, 2014. http://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/docs/wq_assessment_thresholds.xlsx. California Environmental Protection Agency.

United States Army Corps of Engineers. 1999. *Sampling and Analysis Plan (Quality Assurance Project Plan) Guidance for Dredging Projects within the USACE San Francisco District.*

United States Army Corps of Engineers. 2015. *Humboldt Harbor and Bay Tier I Evaluation for 2015 and Sampling and Analysis Plan (SAP): Grain Size Verification & Tier III Evaluation.*

United States Environmental Protection Agency. 1998a. *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations*

United States Environmental Protection Agency, 1998b. *EPA Guidance for Quality Assurance Project Plans*

United States Environmental Protection Agency. 2002. *Guidance for Quality Assurance Project Plans: EPA QA/G-5*. EPA/240/R-02/009. Office of Environmental Information, Washington DC

.

United States Environmental Protection Agency. 2007. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846), Revision 6*, USEPA Office of Solid Waste. http://www.epa.gov/osw/hazard/testmethods/sw846/online/index.htm

United States Environmental Protection Agency/United States Army Corps of Engineers. 1998. *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. - Testing Manual*. EPA-23-B-98-O04, Washington, DC.

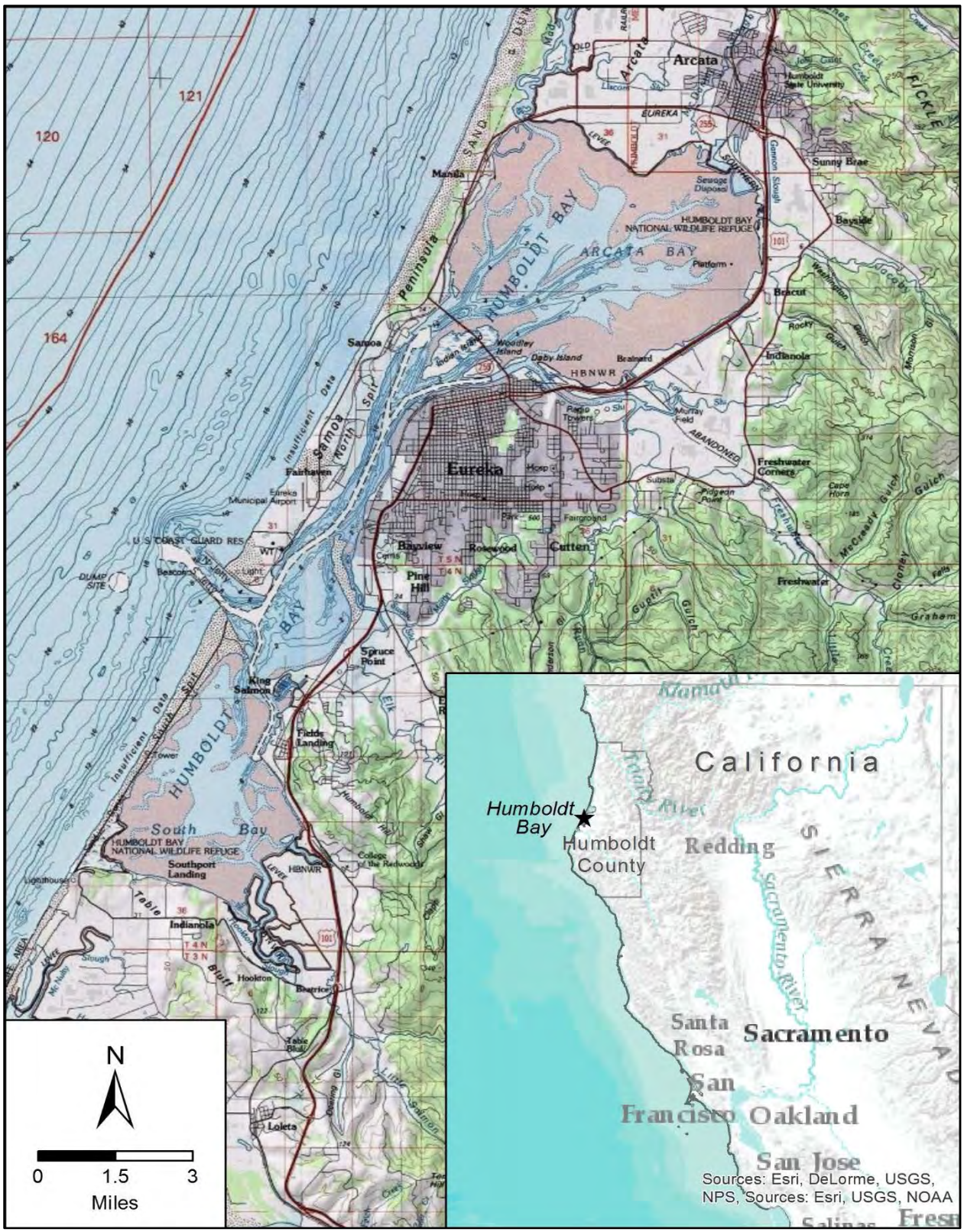


Figure 1. Site Location Map

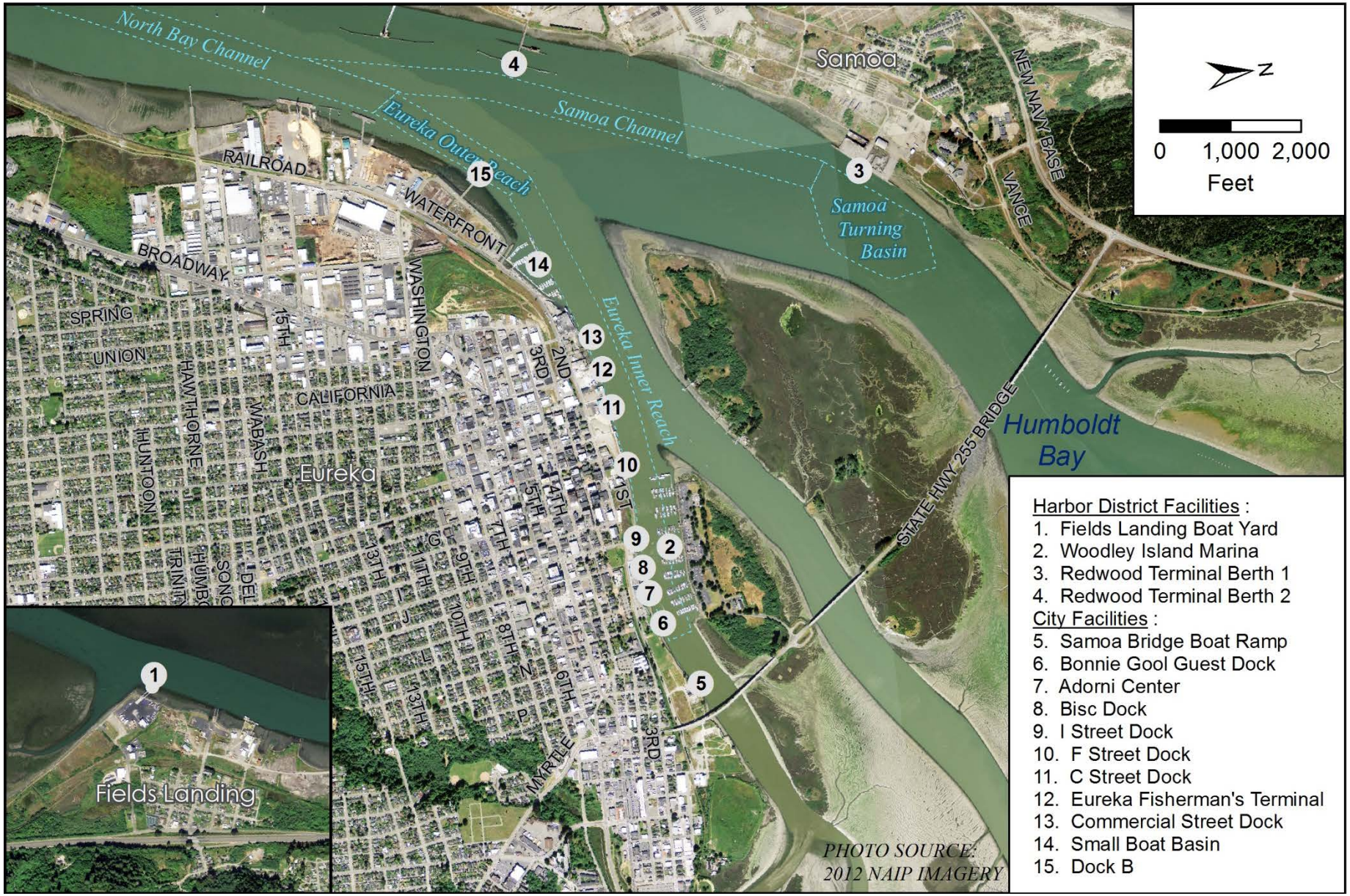


Figure 2. Proposed Dredging Site Location Map

Figure 3. Fields Landing Boat Yard Dock and Vicinity in 1948 (Laird, 2007) and present

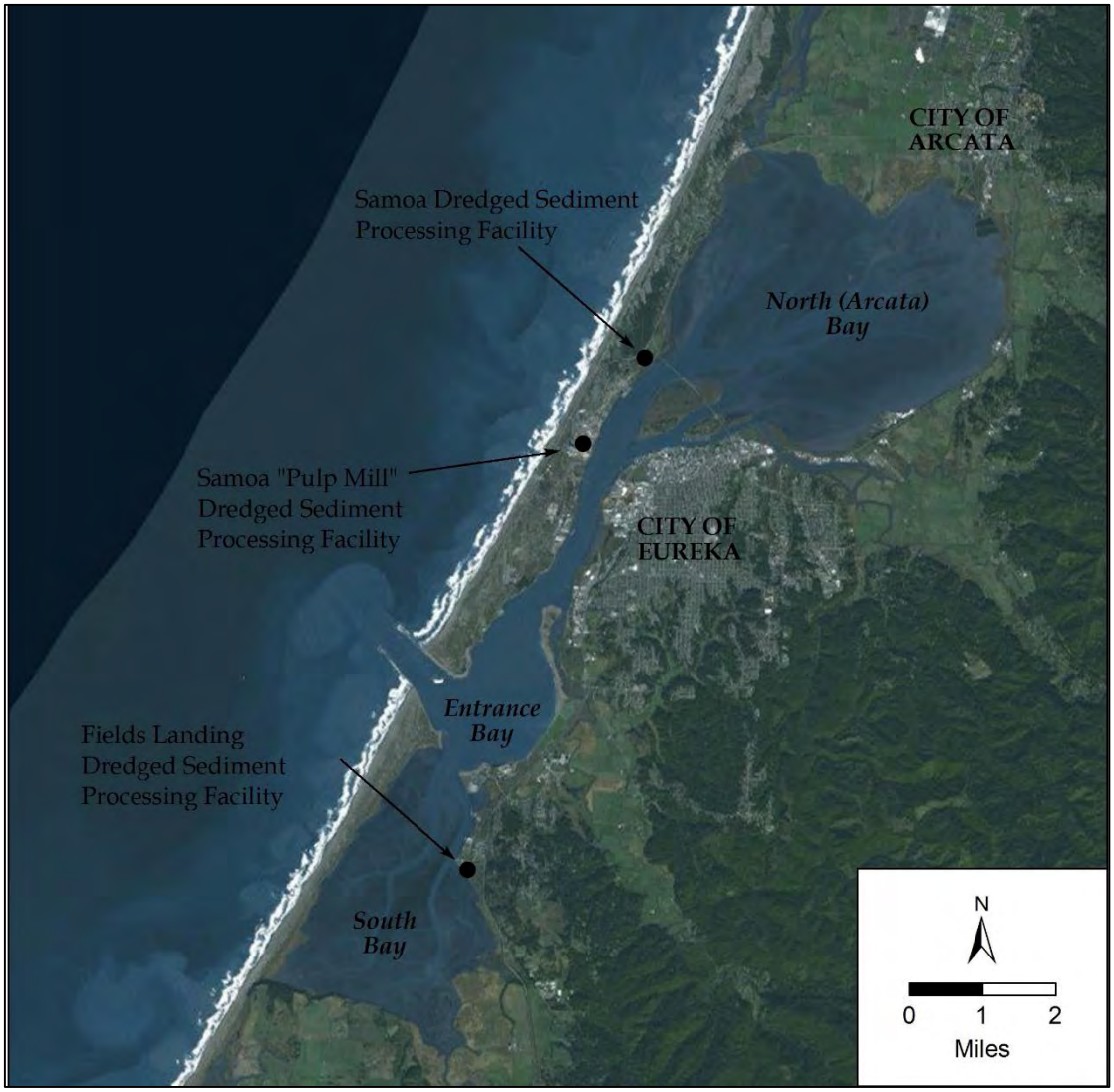


Figure 4. Proposed Processing Facilities

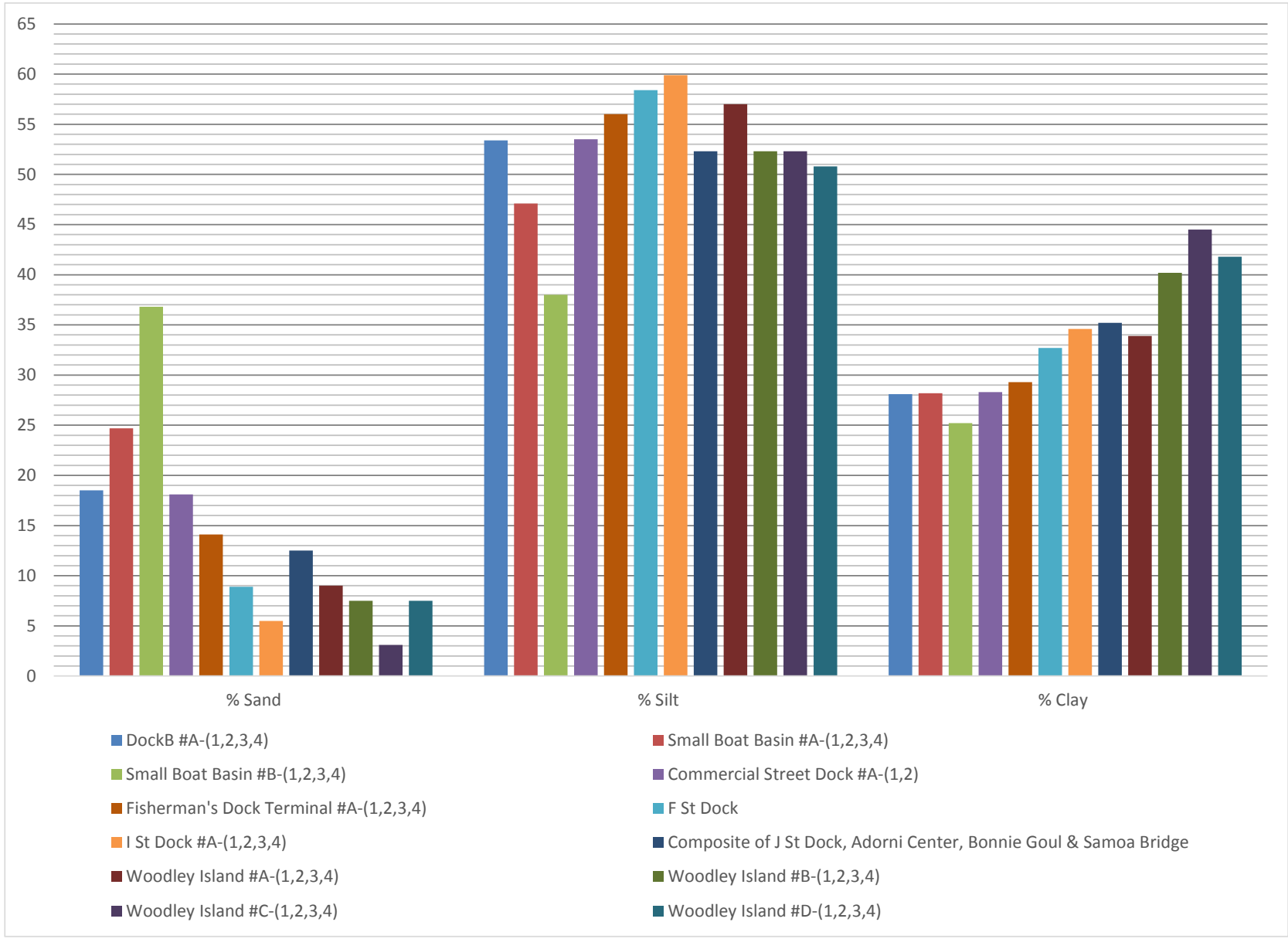


Figure 5. Summary of 2005 Laboratory Results for Texture

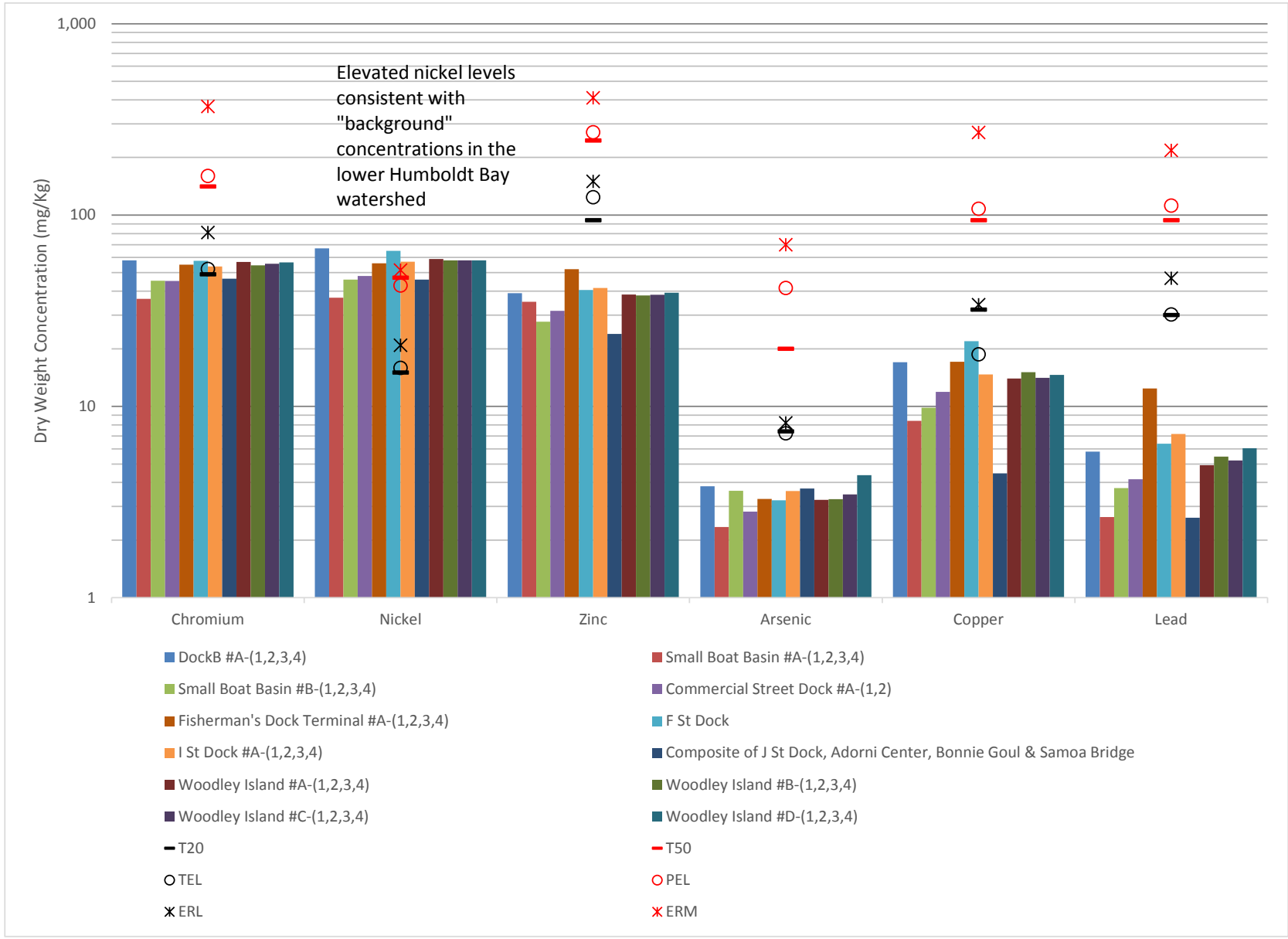


Figure 6. Summary of 2005 Laboratory Results for Metals (Ch, Ni, Zn, Ar, Cu, Pb)

Figure 7. Summary of 2005 Laboratory Results for Metals (Cd, Se, Ag, Hg)

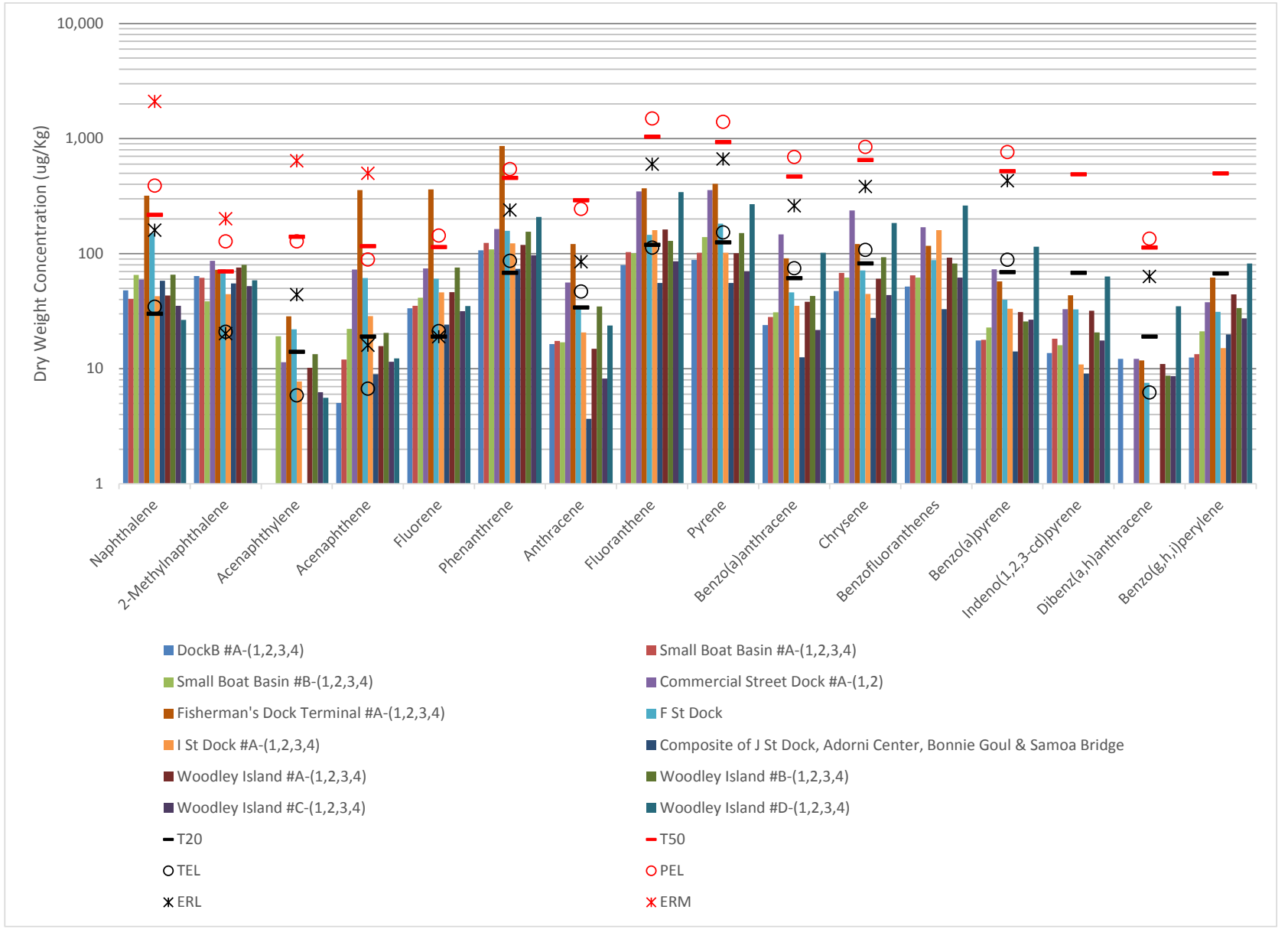


Figure 8. Summary of 2005 Laboratory Results for Polycyclic Aromatic Hydrocarbons

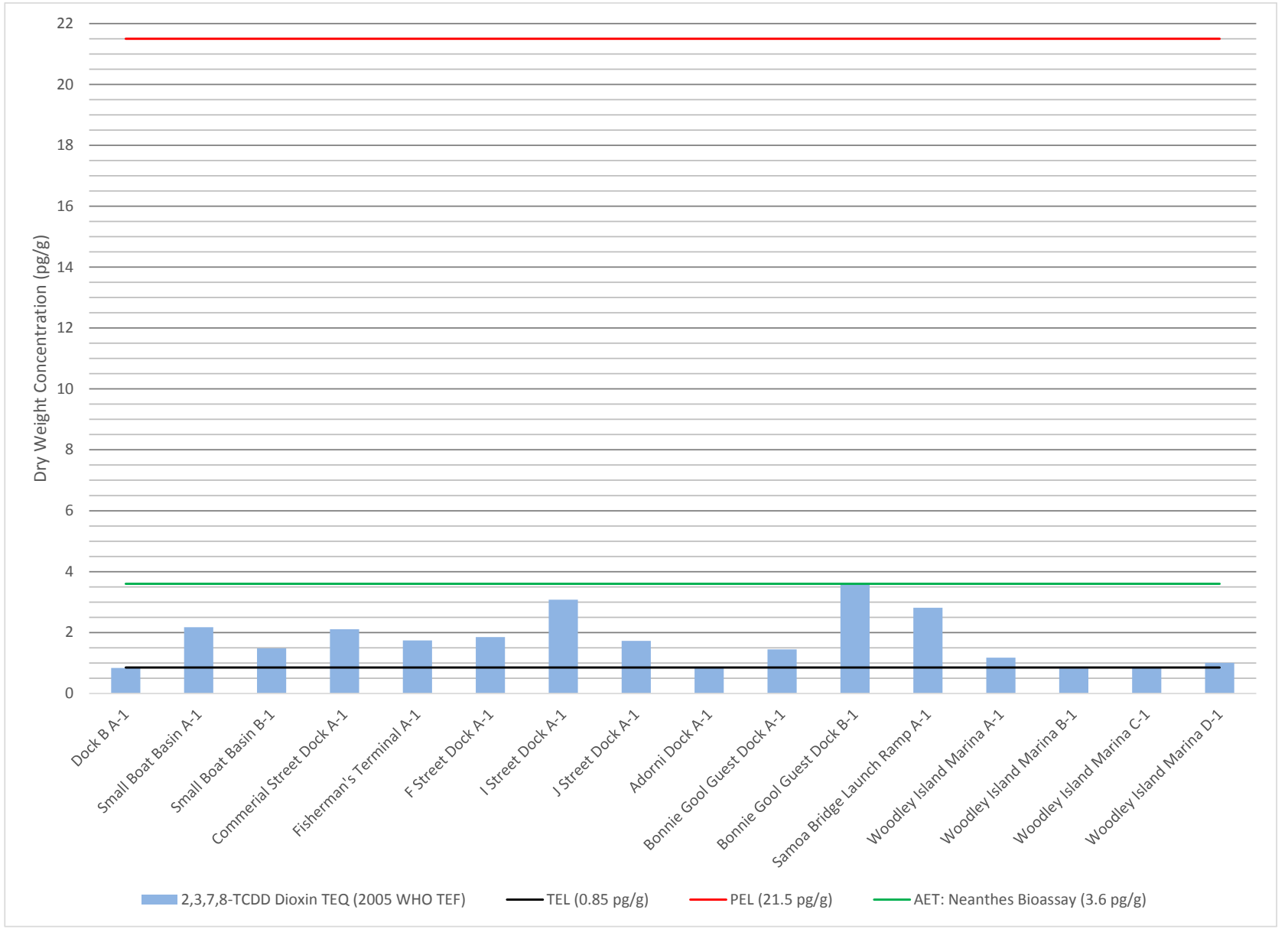


Figure 9. Summary of 2005 Laboratory Results for 2,3,7,8-TCDD Dioxin TEQ

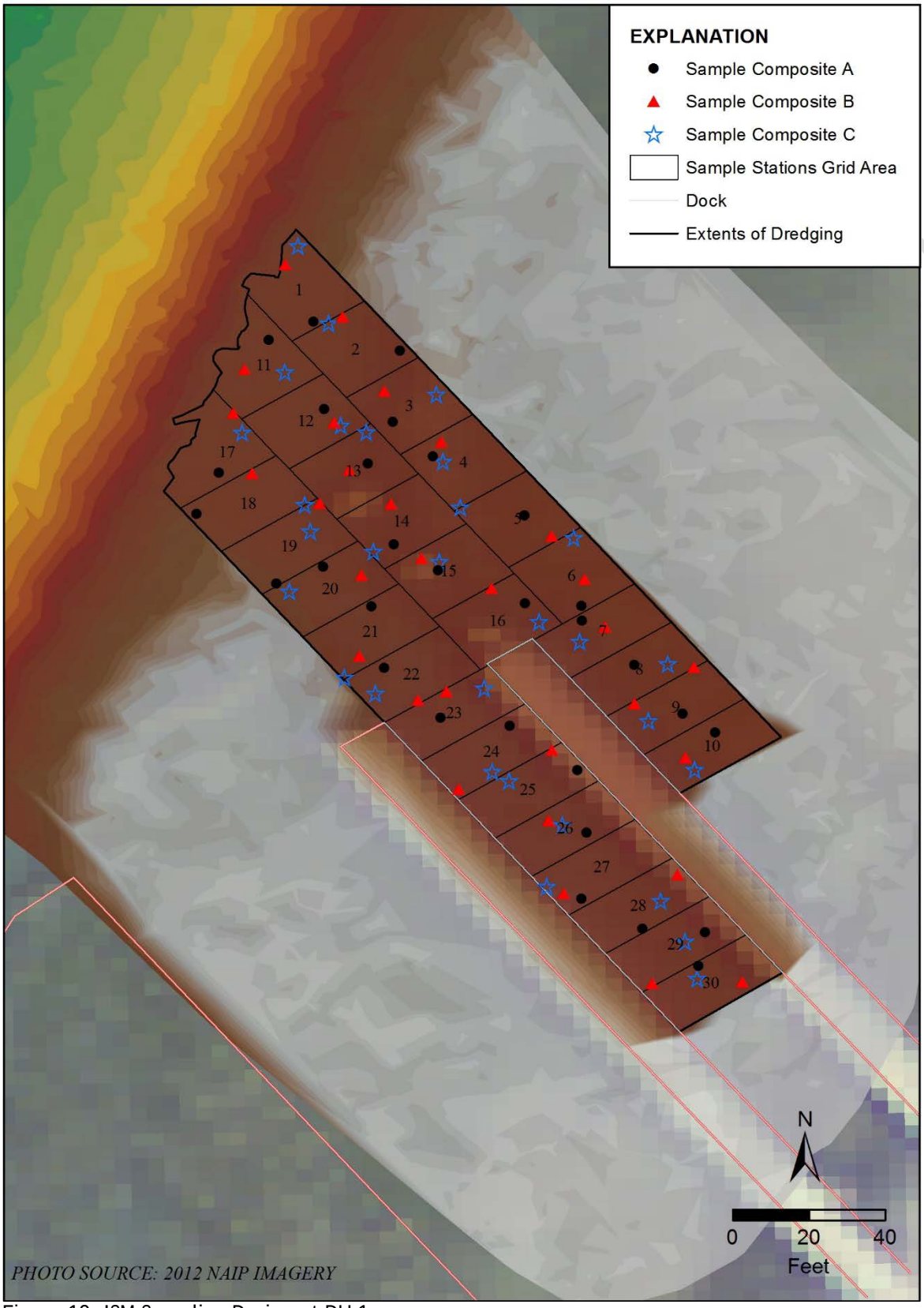


Figure 10. ISM Sampling Design at DU 1

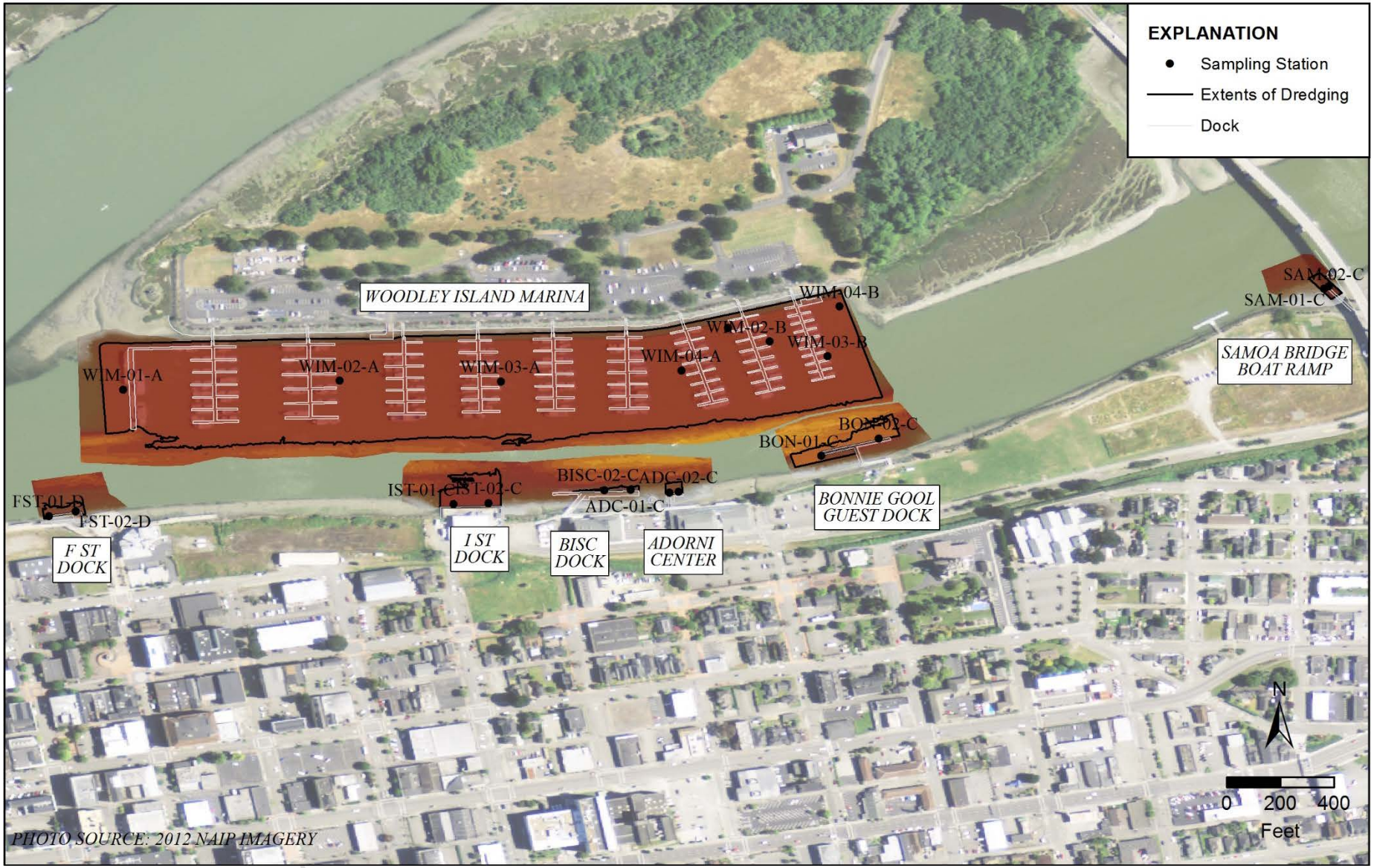


Figure 11. Sampling Designs at DU-2: F Street Dock to Samoa Boat Launch

Figure 12. Sampling Designs at DU-2: Dock B to C Street Dock

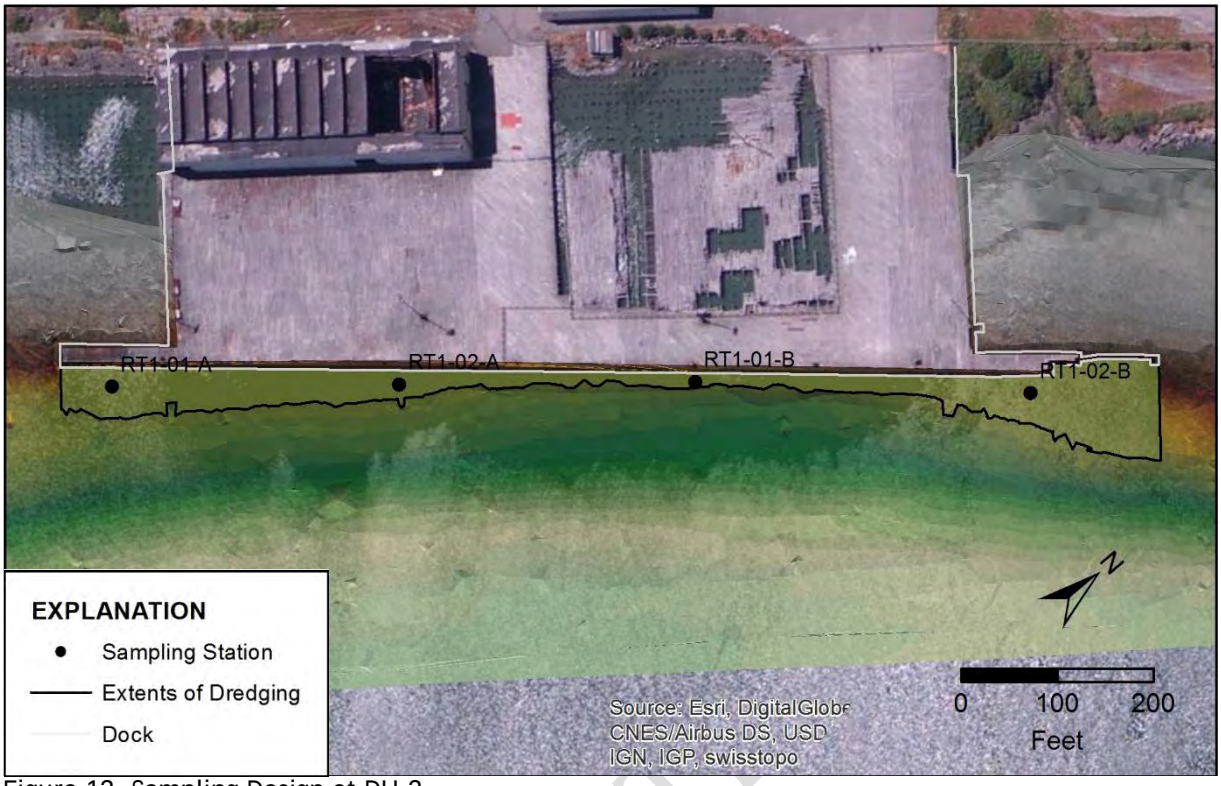


Figure 13. Sampling Design at DU-3

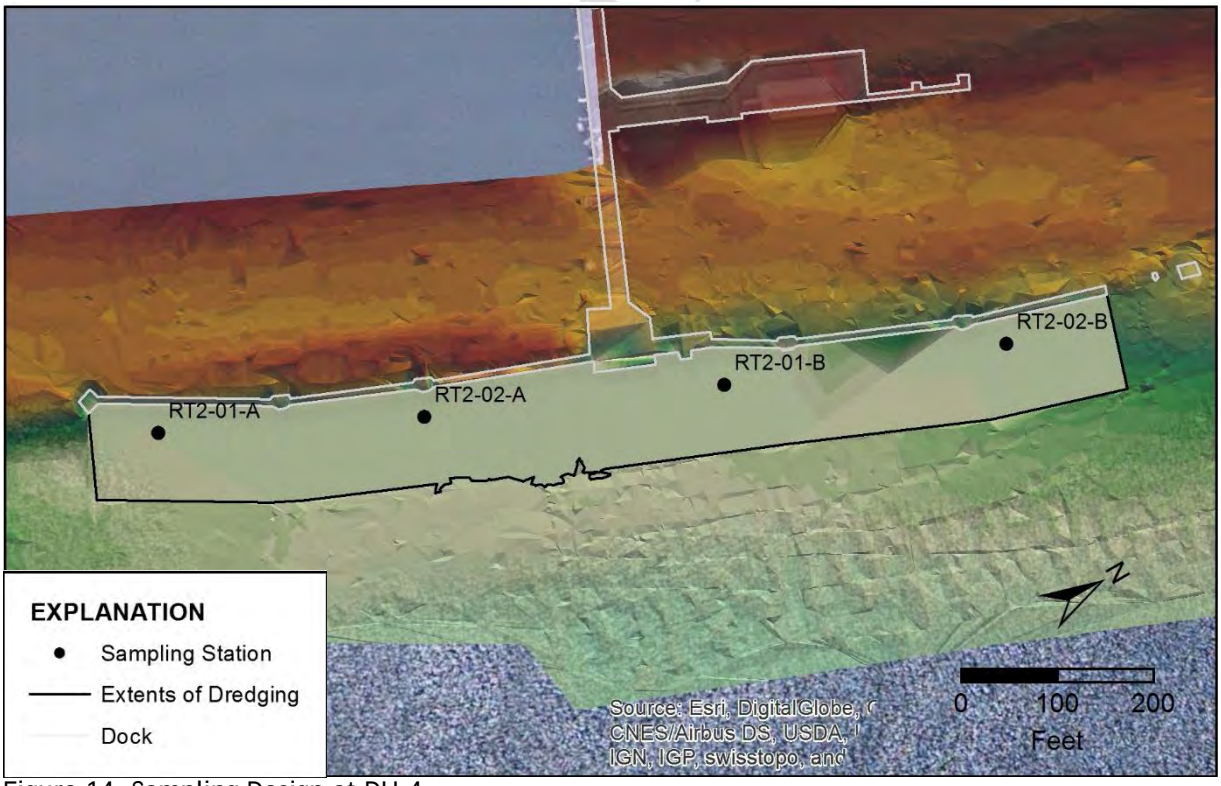
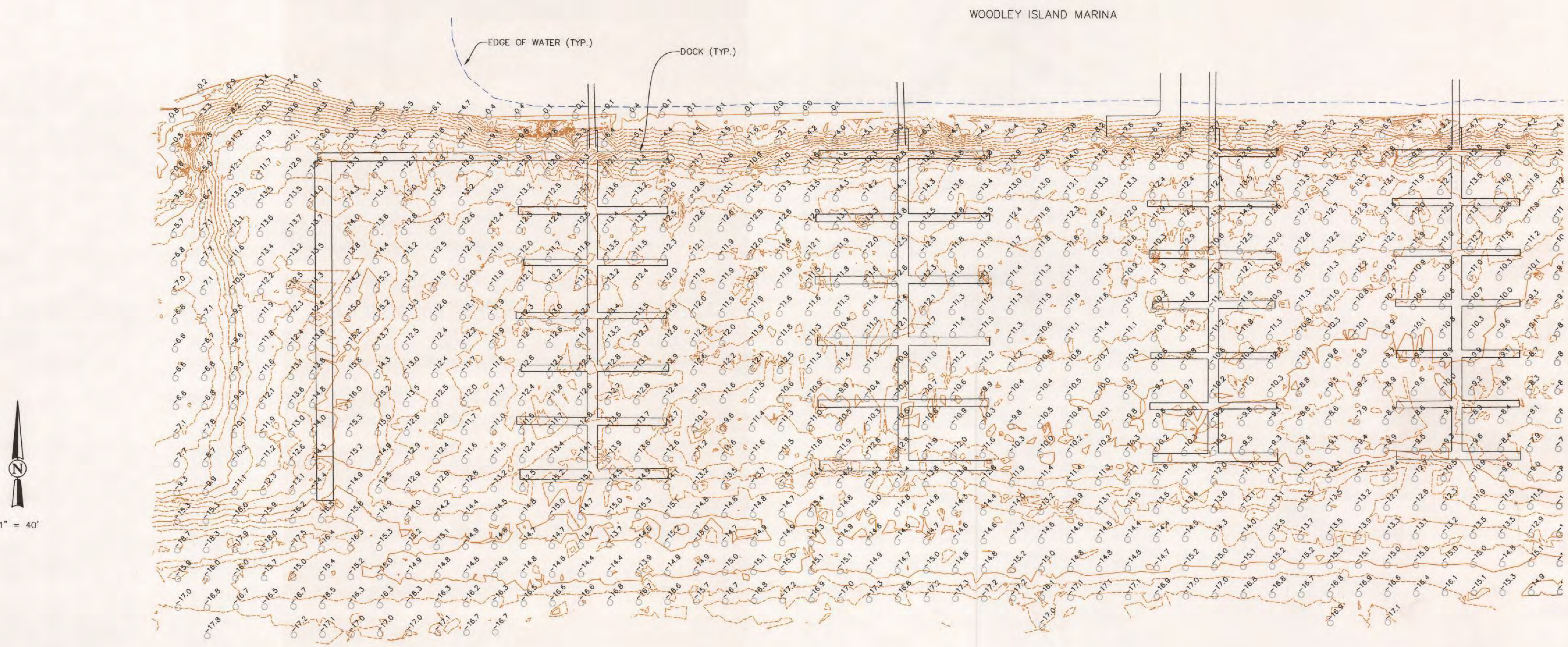


Figure 14. Sampling Design at DU-4

Appendix A: Bathymetric Survey



VERIFY SCALES

BAR IS ONE INCH ON ORIGINAL DRAWING

0 1"

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SHN CONSULTING ENGINEERS & GEOLOGISTS, INC.
275 Market Ave. Coos Bay, OR 97420
(541)266-9890 FAX (541)266-9496

NO.	DATE	REVISION	BY

DSGN

DRFT CDT

CHK EWW

APVD

HBHD & City of Eureka
Pre-Dredge Bathymetric Survey
Eureka, Humboldt County, California

Woodley Island Marina – West

SHEET 1 OF 14

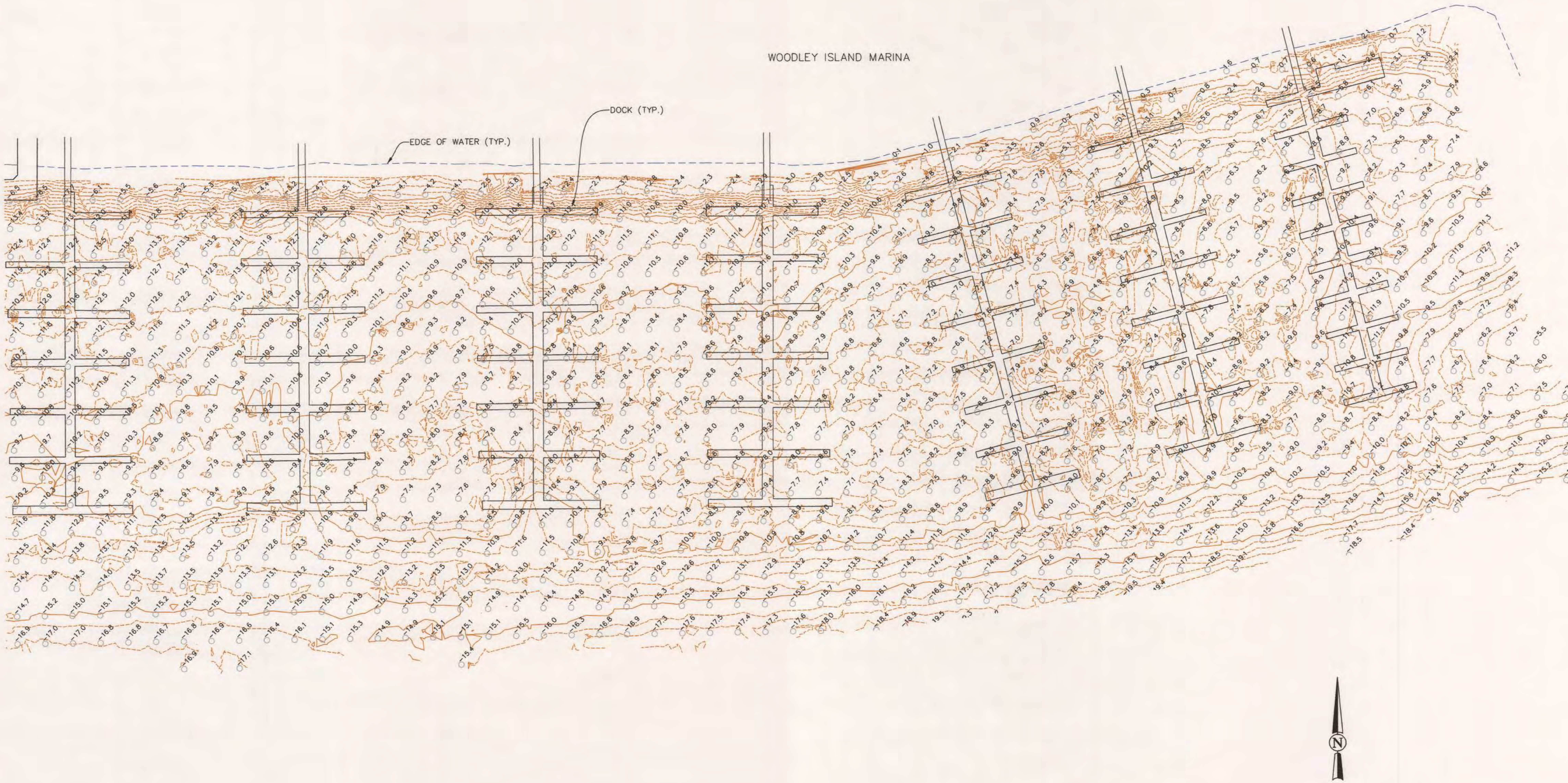
DATE 11/2014

PROJ. NO. 014188

LICENSED LAND SURVEYOR
Curt D. Traina
No. 8683
STATE OF CALIFORNIA

1/8/15

SAVED: 12/16/2014 3:24 PM CTRAINA, PLOTTED: 1/8/2015 2:46 PM CURT TRAINA
C:\USERS\CTRAINA\DESKTOP\014188.DWG



1" = 40'

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SHN
CONSULTING ENGINEERS & GEOLOGISTS, INC.
275 Market Ave. Coos Bay, OR 97420
(541)266-9890 FAX (541)266-9496

NO.	DATE	REVISION	BY

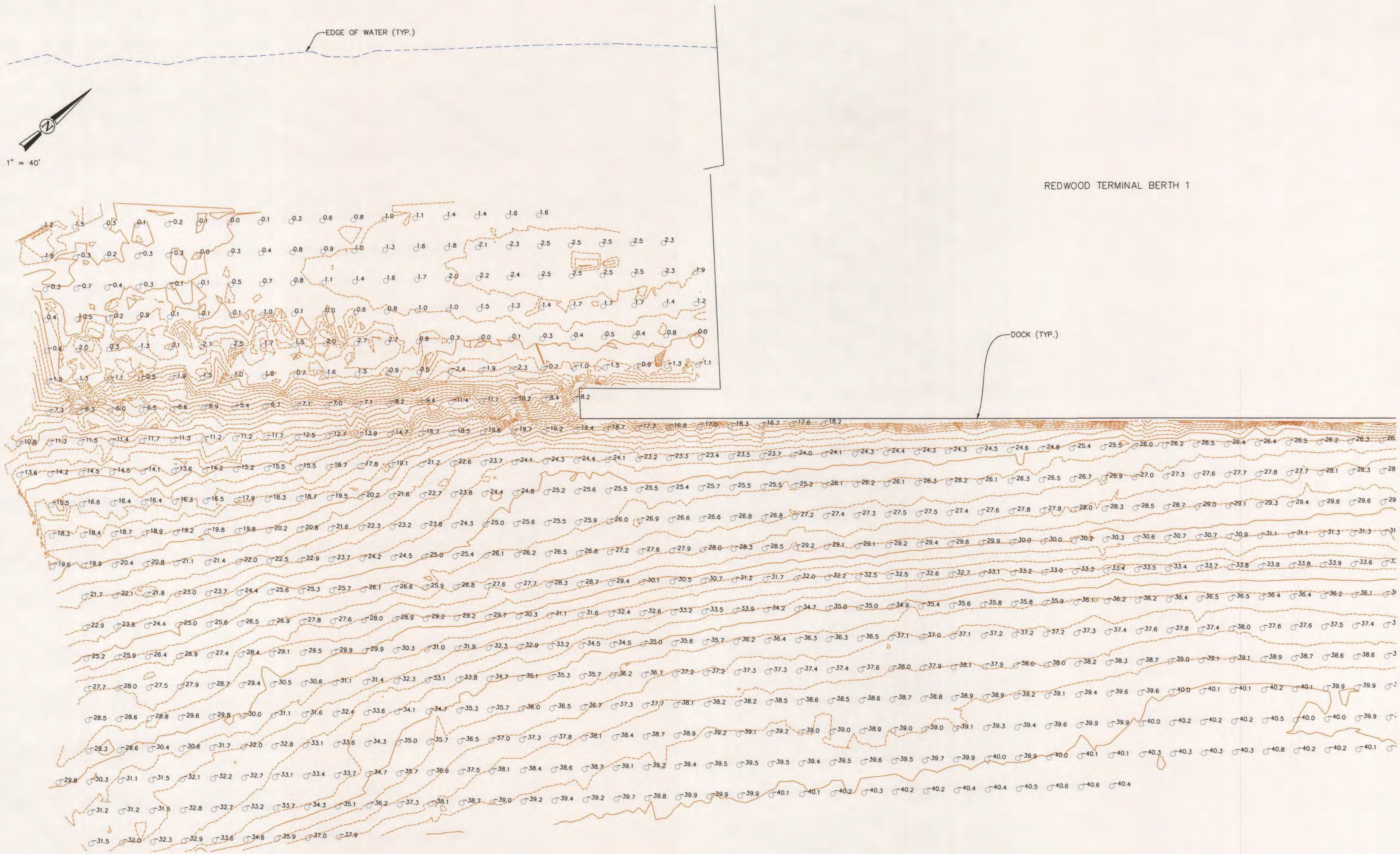
DSGN	
DRFT	CDT
CHK	EWW
APVD	

HBHD & City of Eureka
Pre–Dredge Bathymetric Survey
Eureka, Humboldt County, California

Woodley Island Marina – East

SHEET 2 OF 14
DATE 11/2014
PROJ. NO. 014188

SAVED: 12/16/2014 3:24 PM CTRAINA, PLOTTED: 1/8/2015 1:39 PM CURT TRAINA
C:\USERS\CTRAINA\DESKTOP\014188.DWG



VERIFY SCALES

BAR IS ONE INCH ON ORIGINAL DRAWING

0 1"

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

CONSULTING ENGINEERS & GEOLOGISTS, INC.

275 Market Ave. Coos Bay, OR 97420

(541)266-9890 FAX (541)266-9496

NO.	DATE	REVISION	BY

DSGN	
DRFT	CDT
CHK	EWW
APVD	

HBHD & City of Eureka
Pre-Dredge Bathymetric Survey
Eureka, Humboldt County, California

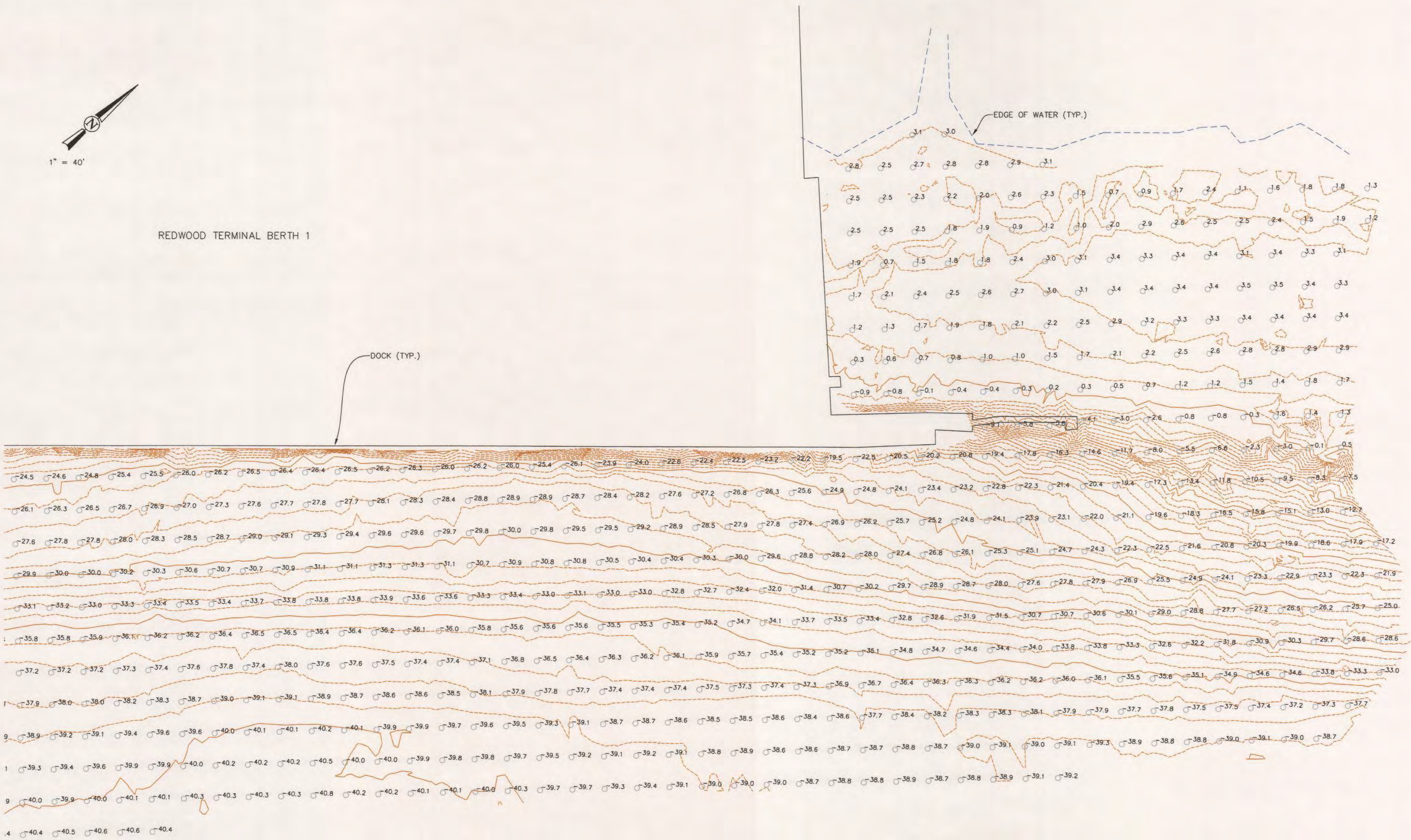
Redwood Terminal Berth 1 - West

SHEET 3 OF 14

DATE 11/2014

PROJ. NO. 014188

SAVED: 12/16/2014 3:24 PM CTRAINA, PLOTTED: 1/8/2015 2:31 PM CURT TRAINA
C:\USERS\CTRAINA\DESKTOP\014188.DWG



SAVED: 12/16/2014 3:24 PM CTRAINA, PLOTTED: 1/8/2015 1:43 PM CURT TRAINA
C:\USERS\CTRAINA\DESKTOP\014188.DWG

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SHN CONSULTING ENGINEERS & GEOLOGISTS, INC.
275 Market Ave. Coos Bay, OR 97420
(541)266-9890 FAX (541)266-9496

NO.	DATE	REVISION	BY

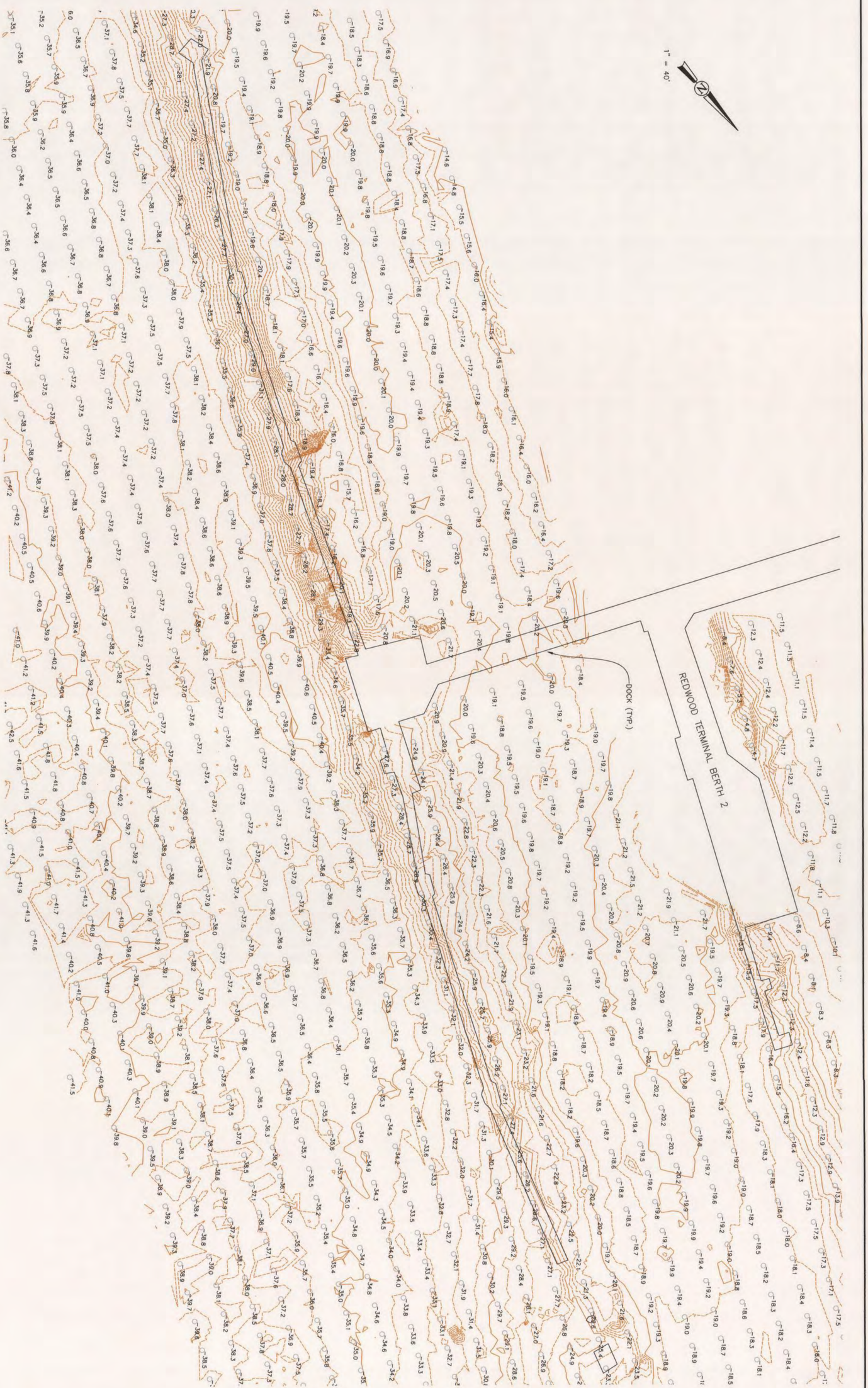
DSGN
DRFT CDT
CHK EWW
APVD

HBHD & City of Eureka
Pre-Dredge Bathymetric Survey
Eureka, Humboldt County, California

Redwood Terminal Berth 1 – East

SHEET 4 OF 14
DATE 11/2014
PROJ. NO. 014188

SAVED: 12/16/2014 3:24 PM CTRAINA, PLOTTED: 1/8/2015 1:43 PM CURT TRAINA
C:\USERS\CTRAINA\DESKTOP\014188.DWG



HBHD & City of Eureka
Pre-Dredge Bathymetric Survey
Eureka, Humboldt County, California

Redwood Terminal Berth 2

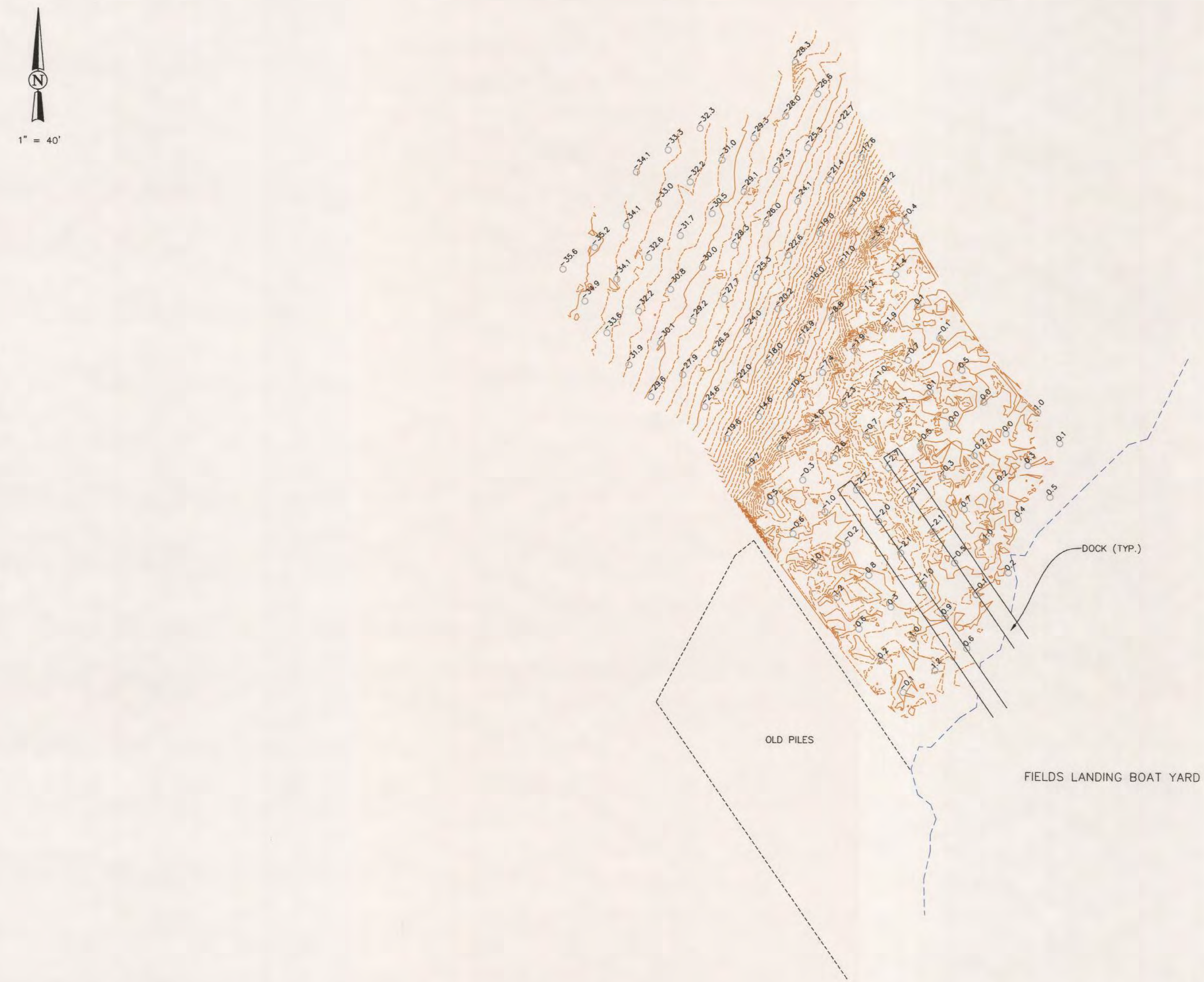
DSGN	
DRFT	CDT
CHK	EWW
APVD	

NO.	DATE	REVISION	BY

SHN CONSULTING ENGINEERS & GEOLOGISTS, INC.
275 Market Ave. Coos Bay, OR 97420
(541)266-9890 FAX (541)266-9496

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SHEET 5 OF 14
DATE 11/2014
PROJ. NO. 014188



SAVED: 12/16/2014 3:24 PM CTRAINA, PLOTTED: 1/8/2015 1:43 PM CURT TRAINA
C:\USERS\CTRAINA\DESKTOP\014188.DWG

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SHN CONSULTING ENGINEERS & GEOLOGISTS, INC.
275 Market Ave. Coos Bay, OR 97420
(541)266-9890
FAX (541)266-9496

NO.	DATE	REVISION	BY

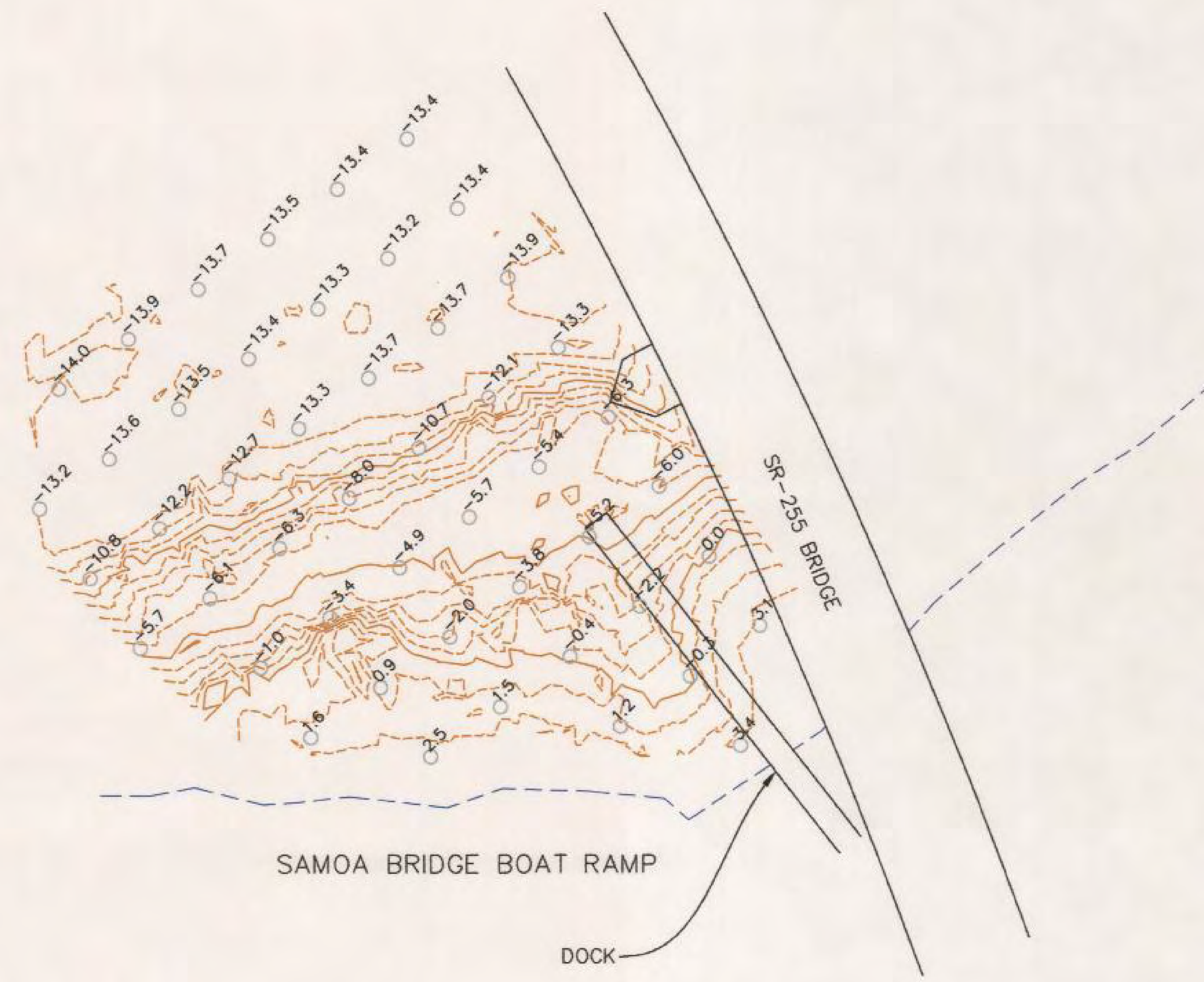
DSGN
DRFT CDT
CHK EWW
APVD

HBHD & City of Eureka
Pre-Dredge Bathymetric Survey
Eureka, Humboldt County, California

Fields Landing Boat Yard

SHEET 6 OF 14
DATE 11/2014
PROJ. NO. 014188

1" = 40'



VERIFY SCALES

BAR IS ONE INCH ON ORIGINAL DRAWING

0 1"

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SHN CONSULTING ENGINEERS & GEOLOGISTS, INC.

275 Market Ave. Coos Bay, OR 97420

(541)266-9890 FAX (541)266-9486

NO.	DATE	REVISION	BY

DSGN	
DRFT	CDT
CHK	EWW
APVD	

HBHD & City of Eureka
Pre-Dredge Bathymetric Survey
Eureka, Humboldt County, California

Samoa Bridge Boat Ramp

SHEET 7 OF 14

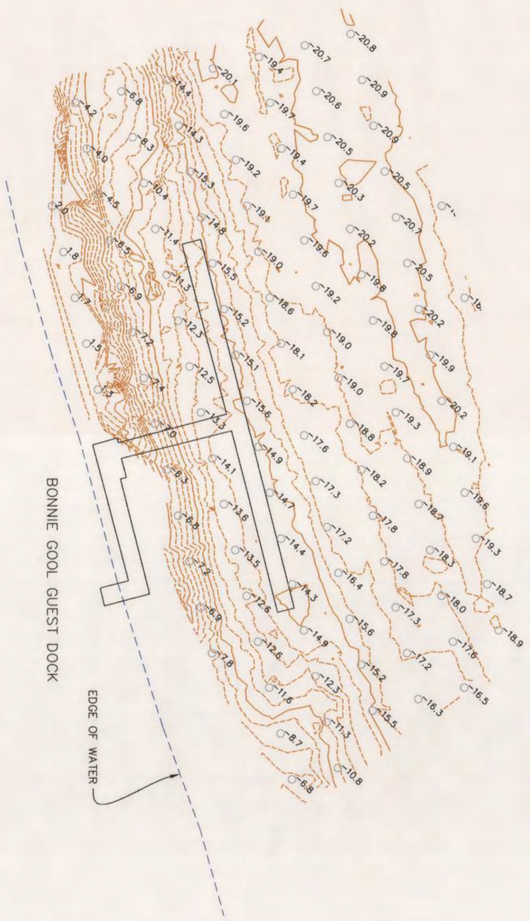
DATE 11/2014

PROJ. NO. 014188

SAVED: 12/16/2014 3:24 PM CTRAINA, PLOTTED: 1/8/2015 1:44 PM CURT TRAINA
C:\USERS\CTRAINA\DESKTOP\014188.DWG

SAVED: 12/16/2014 3:24 PM CTRAINA, PLOTTED: 1/8/2015 1:44 PM CURT TRAINA
C:\USERS\CTRAINA\DESKTOP\014188.DWG

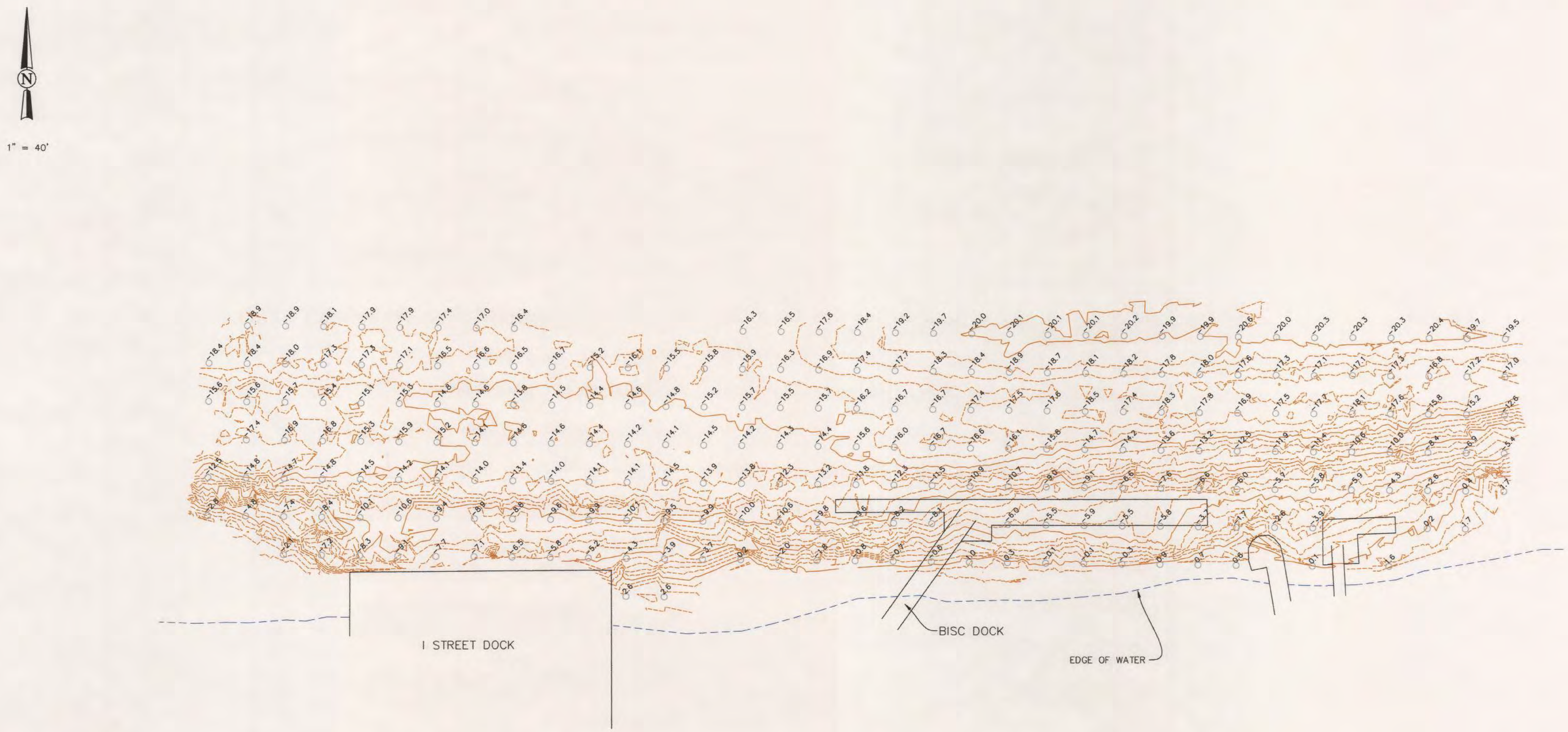
1" = 40'



PROJ. NO. 014188	DATE 11/2014	SHEET 8 OF 14	HBHD & City of Eureka Pre-Dredge Bathymetric Survey Eureka, Humboldt County, California **Bonnie Gool Guest Dock**	DSGN DRFT CDT CHK EWW APVD	NO.	DATE	REVISION	BY

SHN CONSULTING ENGINEERS & GEOLOGISTS, INC.
275 Market Ave. Coos Bay, OR 97420 (541)266-9890 FAX (541)266-9496

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY



VERIFY SCALES

BAR IS ONE INCH ON ORIGINAL DRAWING

0 1"

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SHN CONSULTING ENGINEERS & GEOLOGISTS, INC.

275 Market Ave. Coos Bay, OR 97420

(541)266-9890 FAX (541)266-9486

NO.	DATE	REVISION	BY

DSGN	
DRFT	CDT
CHK	EWW
APVD	

HBHD & City of Eureka
Pre-Dredge Bathymetric Survey
Eureka, Humboldt County, California

I Street Dock & Vicinity

SHEET 9 OF 14

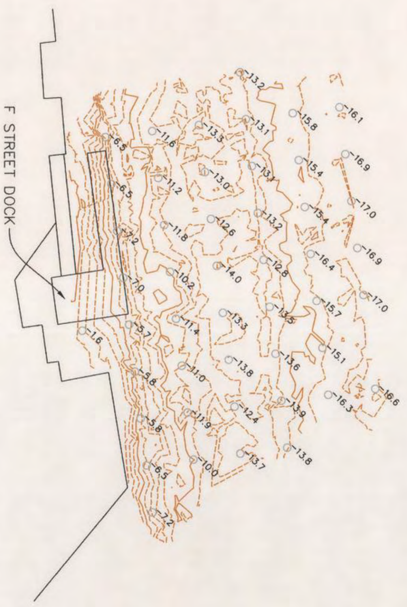
DATE 11/2014

PROJ. NO. 014188

SAVED: 12/16/2014 3:24 PM CTRAINA, PLOTTED: 1/8/2015 1:44 PM CURT TRAINA
C:\USERS\CTRAINA\DESKTOP\014188.DWG

SAVED: 12/16/2014 3:24 PM CTRAINA, PLOTTED: 1/8/2015 1:44 PM CURT TRAINA
C:\USERS\CTRAINA\DESKTOP\014188.DWG

1" = 40'



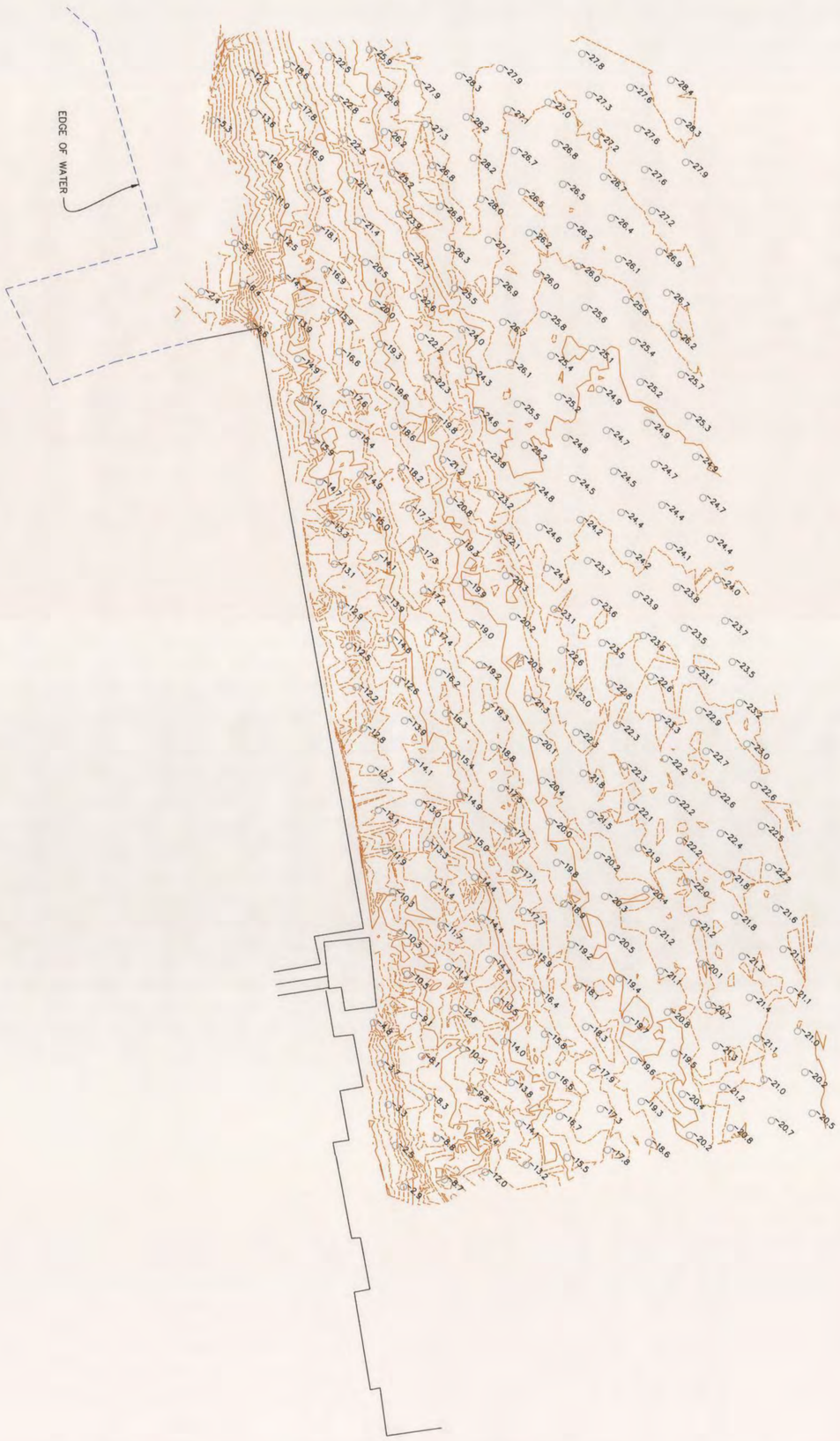
PROJ. NO. 014188	DATE 11/2014	SHEET 10 OF 14	HBHD & City of Eureka Pre-Dredge Bathymetric Survey Eureka, Humboldt County, California F Street Dock	DSGN DRFT CDT CHK EWW APVD	NO.	DATE	REVISION / BY

SHN CONSULTING ENGINEERS & GEOLOGISTS, INC.
275 Market Ave. Coos Bay, OR 97420 (541)266-9890 FAX (541)266-9496

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SAVED: 12/16/2014 3:24 PM CTRAINA, PLOTTED: 1/8/2015 1:45 PM CURT TRAINA
C:\USERS\CTRAINA\DESKTOP\014188.DWG

1" = 40'

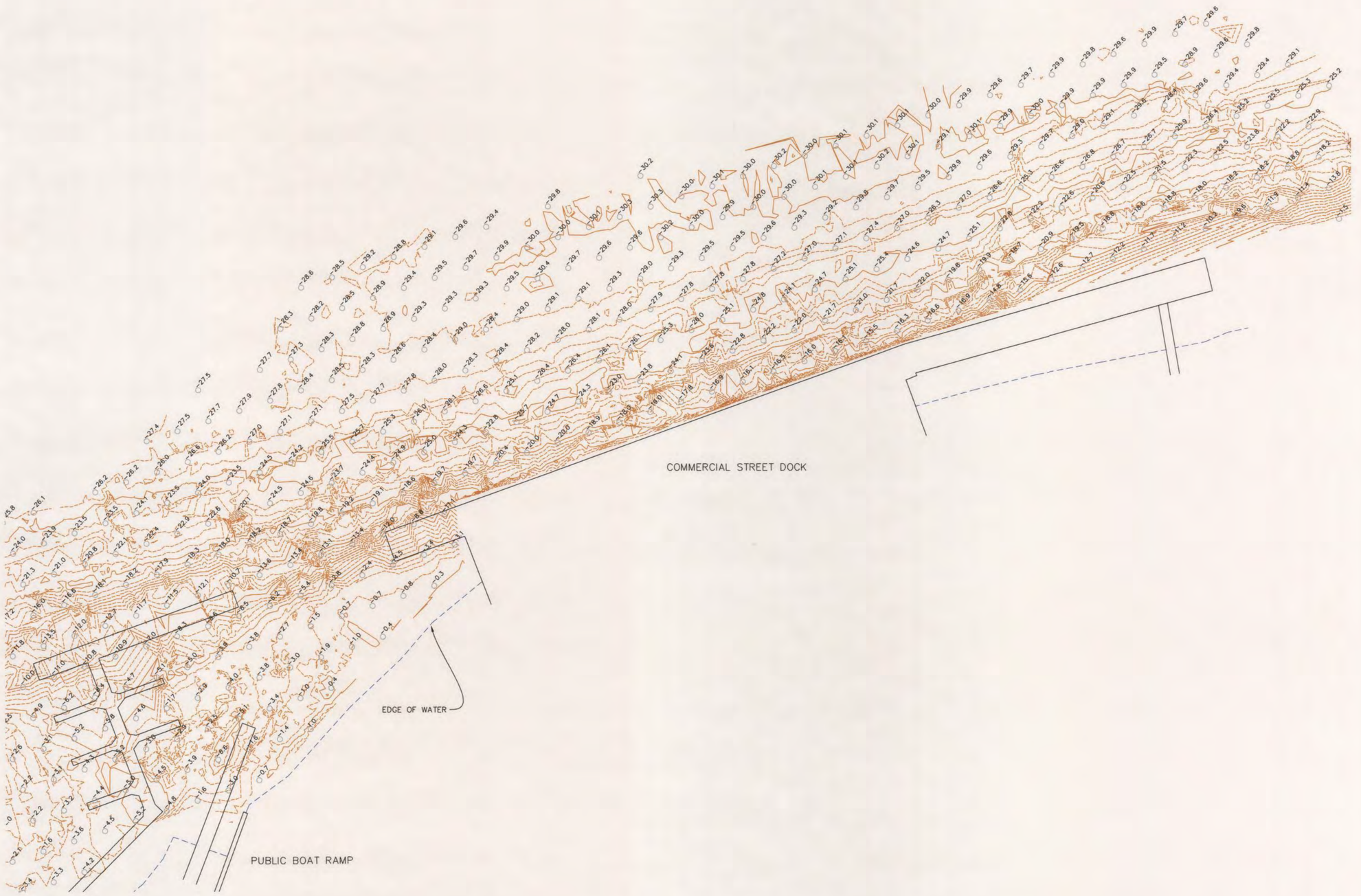


PROJ. NO. 014188	DATE 11/2014	SHEET 11 OF 14	HBHD & City of Eureka Pre-Dredge Bathymetric Survey Eureka, Humboldt County, California **Fisherman's Terminal & C Street Dock**	DSGN DRFT CDT CHK EWW APVD	NO.	DATE	REVISION / BY

SHN CONSULTING ENGINEERS & GEOLOGISTS, INC.
275 Market Ave. Coos Bay, OR 97420 (541)266-9890 FAX (541)266-9496

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

1" = 40'



SAVED: 12/16/2014 3:24 PM CTRAINA, PLOTTED: 1/8/2015 1:45 PM CURT TRAINA
C:\USERS\CTRAINA\DESKTOP\014188.DWG

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SHN
CONSULTING ENGINEERS & GEOLOGISTS, INC.
275 Market Ave. Coos Bay, OR 97420
(541)266-0890 FAX (541)266-8486

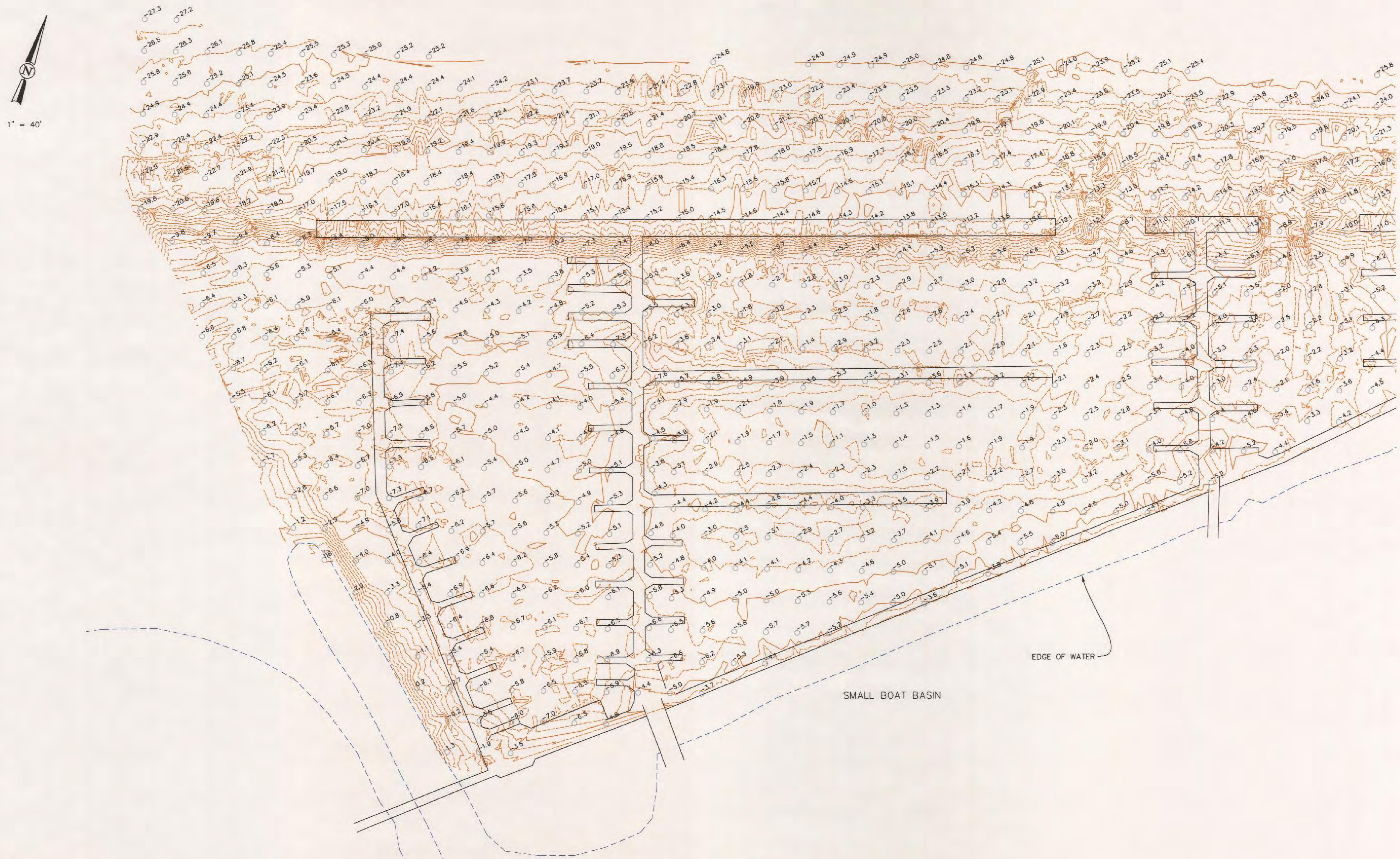
NO.	REVISION	BY	DATE

DSGN
DRFT CDT
CHK EWW
APVD

HBHD & City of Eureka
Pre-Dredge Bathymetric Survey
Eureka, Humboldt County, California

Commercial Street Dock & Small Boat Basin - East

SHEET 12 OF 14
DATE 11/2014
PROJ. NO. 014188



VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SHN CONSULTING ENGINEERS & GEOLOGISTS, INC.
275 Market Ave. Coos Bay, OR 97420
(541)266-9890 FAX (541)266-9496

NO.	DATE	REVISION	BY

DSGN
DRFT CDT
CHK EWW
APVD

HBHD & City of Eureka
Pre-Dredge Bathymetric Survey
Eureka, Humboldt County, California

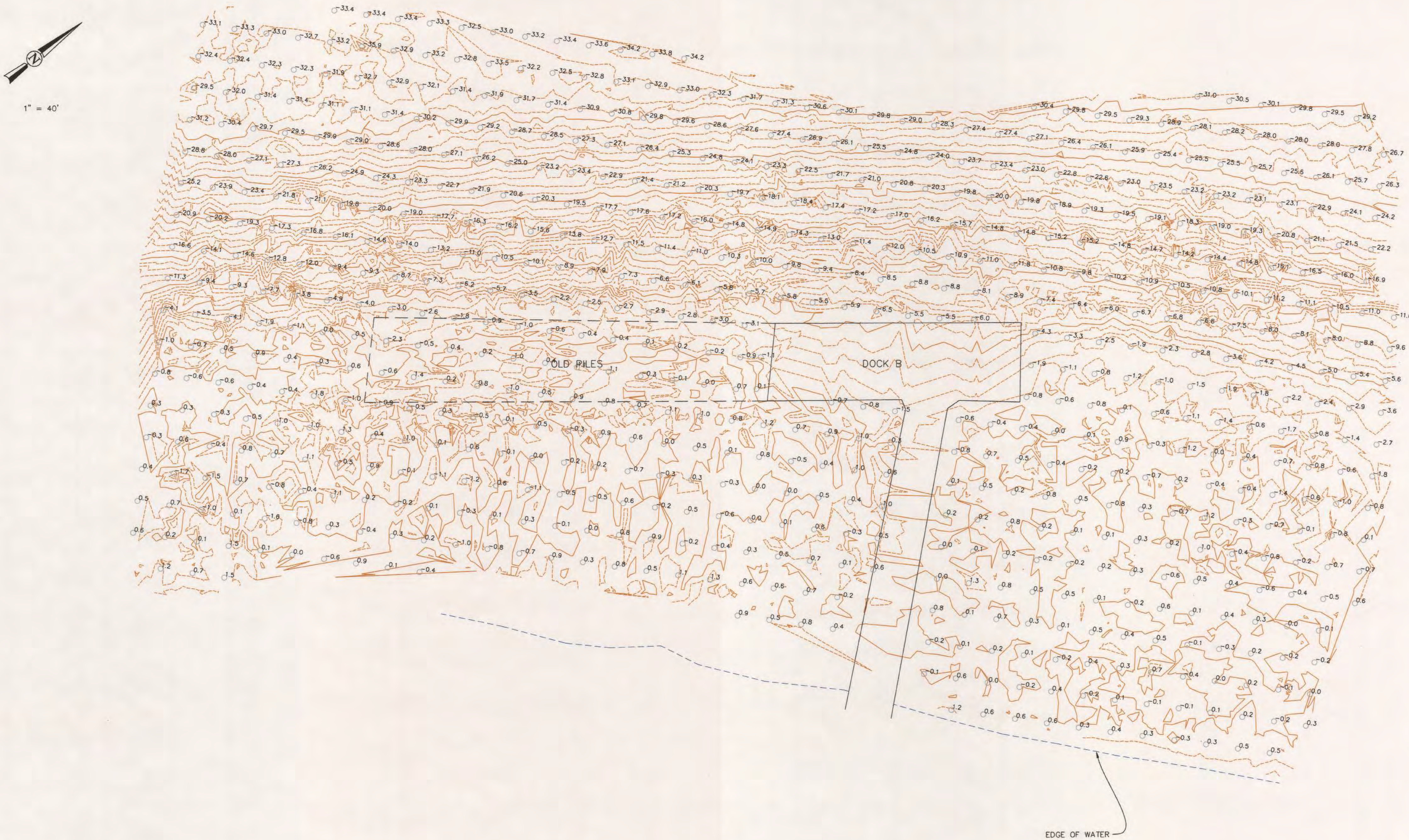
Small Boat Basin – West

SHEET 13 OF 14

DATE 11/2014

PROJ. NO. 014188

SAVED: 12/16/2014 3:24 PM CTRAINA, PLOTTED: 1/8/2015 1:45 PM CURT TRAINA
C:\USERS\CTRAINA\DESKTOP\014188.DWG



VERIFY SCALES

BAR IS ONE INCH ON ORIGINAL DRAWING

0 1"

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SHN CONSULTING ENGINEERS & GEOLOGISTS, INC.
275 Market Ave. Coos Bay, OR 97420
(541)266-9890 FAX (541)266-9496

NO.	DATE	REVISION	BY

DSGN	
DRFT	CDT
CHK	EWW
APVD	

HBHD & City of Eureka
Pre-Dredge Bathymetric Survey
Eureka, Humboldt County, California

Dock B

SHEET 14 OF 14

DATE 11/2014

PROJ. NO. 014188

SAVED: 12/16/2014 3:24 PM CTRAINA, PLOTTED: 1/8/2015 1:45 PM CURT TRAINA
C:\USERS\CTRAINA\DESKTOP\014188.DWG

Appendix B: White Slough 401 Certification

July 28, 2015

In the Matter of

Water Quality Certification

for

White Slough Tidal Wetlands Restoration Project
WDID No. 1B15030WNHU

APPLICANT:	Humboldt Bay National Wildlife Refuge
RECEIVING WATER:	White Slough
HYDROLOGIC UNIT:	Eureka Plain Hydrologic Unit, 110.00
COUNTY:	Humboldt
FILE:	White Slough Tidal Wetlands Restoration Project, WDID No. 1B15030WNHU, ECM PIN CW-813925

BY THE EXECUTIVE OFFICER:

1. On March 17, 2015, the Humboldt Bay National Wildlife Refuge, Eric Nelson (Applicant) filed an application for water quality certification (certification) under section 401 of the Clean Water Act (33 U.S.C. § 1341) with the California Regional Water Quality Control Board, North Coast Region (Regional Water Board) for activities associated with the White Slough Tidal Wetlands Restoration Project (Project). Information describing the Project was noticed for public comment on the Regional Water Board's website on June 10, 2015. We received no comments. The proposed Project will cause disturbances to waters of the United States associated with the White Slough within the Eureka Plain Hydrologic Unit No. 110.00. The Project is located within the Humboldt Bay National Wildlife Refuge White Slough Unit, Loleta, Humboldt County, at latitude 40.7049°N, and longitude 124.211°W. No permanent impacts to waters of the U.S. and the State are proposed. Temporary

impacts to waters of the U.S. and the State include approximately 37.5 acres of diked subsided former tidelands. Project activities are proposed to restore or enhance approximately 37.5 acres of waters of the U.S. and State.

2. The primary objective of the federal Clean Water Act is to *restore* and maintain the chemical, physical, and biological integrity of the Nation's waters (Clean Water Act section 101(a)). To achieve the objectives of the Clean Water Act and the Porter-Cologne Water Quality Control Act, the Regional Water Board must take an active role in promoting the implementation of restoration projects that are expected to help restore the chemical, physical, and biological integrity of the waters within the region. (From the *Policy in Support of Restoration in the North Coast Region* Resolution No. R1-2015-0001 as adopted by the Regional Water Board on January 29, 2015).

3. The primary purpose of the Project is to restore salt marsh habitat on diked subsided former tidelands and to enhance existing brackish and freshwater wetlands. The applicant proposes to restore tidal wetlands and other habitats to be higher ecological function than existing resources as well as be self-sustaining systems adaptive to sea level rise. The proposed Project would include creating construction access and building three earthen tidal ridges to divide the project area into tidal basins. The tidal ridges will be used as access roads. Existing vegetation will be removed as necessary and clean imported fill will be graded to restore tidal wetland elevations. Dewatering of channels will occur when necessary and flow will be restored upon completion of grading and shaping of the restored area. The Applicant has submitted plans for dewatering to avoid and minimize impacts to aquatic resources. Additionally, to restore functions to the tidelands, tide gates will be removed and dikes breached to create higher functioning brackish and salt marshes as well as a mosaic of other aquatic habitats.

   The proposed Project includes a plan to revegetate disturbed areas with a combination of plantings at higher elevations and natural recruitment from the native seed bank within the Humboldt Bay tidal system and surrounding aquatic systems. The Project proposes to employ best management practices to prevent or reduce any discharges during and after construction.

4. The Project is planned to begin in the summer of 2015. Due to the size and scope the project is proposed to be conducted through 2020 with construction work at various locations planned to last approximately 5 years.

5. The Project will have only temporary impacts to waters of the US, no mitigation is necessary. The restoration project design and implementation shall restore and enhance currently degraded ecological functions of areas temporarily impacted as well as adjacent aquatic resources for a net gain in wetland functions and area. The applicant has submitted a revegetation plan for restoration of temporarily disturbed

areas. The Applicant proposes to employ best management practices to prevent or reduce any discharges during and after construction.

6. The Applicant has applied for authorization from the United States Army Corps of Engineers for a Clean Water Act, section 404 permit. The Applicant has applied to the California Department of Fish and Wildlife to obtain a Streambed Alteration Agreement.

7. On March 26, 2015, the California Coastal Conservancy, as lead California Environmental Quality Act (CEQA) agency, has produced an Initial Study and Proposed Mitigated Negative Declaration and filed with the State Clearinghouse (SCH No. 2015022040), pursuant to CEQA guidelines.

8. Pursuant to Regional Water Board Resolution R1-2004-0087, Total Maximum Daily Load Implementation Policy Statement for Sediment-Impaired Receiving Waters within the North Coast Region (Sediment TMDL Implementation Policy), the Executive Officer is directed to "rely on the use of all available authorities, including existing regulatory standards, and permitting and enforcement tools to more effectively and efficaciously pursue compliance with sediment-related standards by all dischargers of sediment waste."

9. Section 131.12 of the U.S. EPA's Water Quality Standards regulations includes the "federal antidegradation policy" which emphasizes protection of instream beneficial uses, especially protection of aquatic organisms. As required by the federal antidegradation policy (40 C.F.R. §131.6(d)), each state's water quality standards must include a policy consistent with the federal antidegradation policy. The State Water Board established California's antidegradation policy in State Water Board Resolution No. 68-16 incorporates the federal antidegradation policy where the federal policy applies under federal law. Resolution No. 68-16 requires that existing quality of waters be maintained unless degradation is justified based on specific findings. The Regional Water Board's Basin Plan implements, and incorporates by reference, both the State and federal antidegradation policies. Restoration projects must conform to the state and federal antidegradation policies. This Order is consistent with applicable federal and State antidegradation policies. Restoration projects are intended for the purpose of correcting a water quality problem or condition, which is causing, or threatens to cause, a detrimental effect on an aquatic ecosystem and beneficial uses. Although a restoration project may result in a discharge of waste to a water of the State, or a water of the United States, or both, the impacts are intended to be temporary in nature with the purpose of providing a net benefit to water quality.

10. This discharge is also regulated under State Water Resources Control Board Order No. 2003-0017-DWQ, "General Waste Discharge Requirements for Dredge and Fill Discharges That Have Received State Water Quality Certification," which requires

compliance with all conditions of this water quality certification. (Weblink attached below).

Receiving Water:	White Slough, Eureka Plain Hydrologic Unit, 110.00
Filled or Excavated Area:	Permanent impact to waters of the State: None Temporary impact to waters of the State: 37.5 acres of wetlands
Imported Fill material:	Approximately 240,000 cubic yards
Latitude/Longitude:	40.7049°N / 124.211°W
Expiration:	July 28, 2020

Accordingly, based on its independent review of the record, the Regional Water Board certifies that the White Slough Tidal Wetlands Restoration Project (WDID No. 1B15030WNHU), as described in the application, will comply with sections 301, 302, 303, 306 and 307 of the Clean Water Act, and with applicable provisions of state law, provided that the Applicant complies with the following terms and conditions:

All conditions of this order apply to the Applicant (and all their employees) and all contractors (and their employees), sub-contractors (and their employees), and any other entity or agency that performs activities or work on the project as related to this Water Quality Certification.

1. This certification action is subject to modification or revocation upon administrative or judicial review, including review and amendment pursuant to Water Code section 13330 and title 23, California Code of Regulations, section 3867.

2. This certification action is not intended and shall not be construed to apply to any discharge from any activity involving a hydroelectric facility requiring a Federal Energy Regulatory Commission (FERC) license or an amendment to a FERC license unless the pertinent certification application was filed pursuant to title 23, California Code of Regulations, section 3855, subdivision (b) and the application specifically identified that a FERC license or amendment to a FERC license for a hydroelectric facility was being sought.

3. The validity of this certification is conditioned upon total payment of any fee required under title 23, California Code of Regulations, section 3833, and owed by the Applicant.

4. A fee of $200 was received for this project on March 17, 2015. This certification will be subject to annual billing during the construction phase ("Annual Active Discharge Fee") and during the monitoring phase of the project ("Annual Post Discharge Monitoring Fee"), per the current fee schedule, which can be found on our website: http://www.swrcb.ca.gov/northcoast/water_issues/programs/water_quality_certification.shtml These fees will be automatically invoiced to the applicant.

   The applicant must notify the Regional Water Board of the end of the construction phase of the project in order to request the Regional Water Board to terminate annual construction period billing and to receive a "Notice of Completion of Discharges Letter". If the project is subject to annual monitoring fees, the applicant must also notify the Regional Water Board at the end of the monitoring period in order to request to terminate annual monitoring period billing and receive a "Notice of Project Complete Letter". Completion reports may be necessary to be submitted by applicant at the end of each of these phases. Regional Water Board staff may request site visits at the end of each phase of the project to confirm status of project and compliance with this Order.

5. The Project will have only temporary impacts to waters of the US, no mitigation is necessary. The Project includes a plan to revegetate disturbed areas with a combination of plantings at higher elevations and natural recruitment from the native seed bank within the Humboldt Bay tidal system and surrounding aquatic systems.

   Results of annual monitoring of the construction and restoration areas will be reported to the Regional Water Board annually by December 31st beginning in 2015 for at least five years. Reports shall summarize restoration progress, data collected, annual performance, any remedial action necessary and whether success criteria are met for restoration habitat goals identified in the project description. Reports shall also include documentation of appropriate CEQA mitigation measure BMPs implemented to avoid direct impacts and reduce turbidity on site. Photo documentation of BMP installation and performance during rain events at the construction site shall be included in annual reports. Monitoring reports shall be sent electronically to the following email address: NorthCoast@waterboards.ca.gov

6. Only wildlife-friendly, 100 percent biodegradable erosion and sediment control products that will not entrap or harm wildlife shall be used. Erosion and sediment control products shall not contain synthetic (e.g., plastic or nylon) netting. Photodegradable synthetic products are not considered biodegradable. The applicant shall request approval from the Regional Water Board if an exception from this requirement is needed for a specific location.

7. BMPs shall be implemented as proposed in the application materials. BMPs for erosion, sediment and turbidity control shall be implemented and in place at commencement of, during and after any ground clearing activities or any other

Project activities that could result in erosion or sediment discharges to surface water. Severe and unseasonal rain events are becoming more frequent due to the effects of climate change. Therefore, BMPs shall be immediately available for deployment at all times to prevent discharges to waters of the State.

8. Ground disturbing activities of greater than one acre are located within jurisdictional waters of the US and these require a Clean Water Act section 404 permit from the US Army Corps of Engineers. Finding No. 23 of the NPDES General Permit for Storm Water Discharges Associate With Construction and Land Disturbance Activities Order No. 2012-0006-DWQ, NPDES No. CAS000002 states that, 'Regional Water Boards may make a determination of whether it applies to the site when construction sites that intend to disturb one or more acres of land within jurisdictional boundaries of a Clean Water Act section 404 permit'. The North Coast Regional Water Quality Control Board staff have reviewed the project description and CEQA mitigation measures (incorporated as conditions of this Order) and have determined that the issuance of this Clean Water Act section 401 water quality certification and associated WDRs State Water Resources Control Board Order No. 2003-0017-DWQ will be sufficient to avoid and minimize and discharges of storm water to surface waters, and that the enrollment under NPDES No.CAS000002 is not applicable.

   Mitigation measures identified in the Initial Study and Proposed Mitigated Negative Declaration and filed with the State Clearinghouse (SCH No. 2015022040) are hereby incorporated as conditions of this water quality certification. Annual reporting of installation and performance of mitigation measures shall be included in annual reporting identified in condition #5.

9. The applicant shall submit for review and approval to Regional Water Board Staff a dredge liquid management plan if they pursue the use of liquid fraction dredged imported fill material at the project site. This plan should include at a minimum, engineering designs, BMPs, additional sampling and analysis of dredged elutriate (if applicable), dredged liquid management and any discharge proposal and be protective of beneficial uses identified in the Water Quality Control Plan for the North Coast.

10. As a condition of this water quality certification, the Applicant shall comply with Attachment 1, *Restoration project imported fill suitability assessment criteria*.

11. No debris, soil, silt, sand, bark, slash, sawdust, rubbish, cement or concrete washings, oil or petroleum products, or other organic or earthen material from any construction or associated activity of whatever nature, other than that authorized by this Order, shall be allowed to enter into or be placed where it may be washed by rainfall into waters of the State. When operations are completed, any excess material or debris shall be removed from the work area.

12. The Applicant shall provide Regional Water Board staff access to the Project site to document compliance with this certification.

13. If, at any time, an unauthorized discharge to surface water (including wetlands, lakes, rivers or streams) occurs, or any water quality problem arises, the associated Project activities shall cease immediately until adequate BMPs are implemented including stopping work. The Regional Water Board shall be notified promptly and in no case more than 24 hours after the unauthorized discharge or water quality problem arises.

14. Prior to implementing any change to the Project that may have a significant or material effect on the findings, conclusions, or conditions of this Order, the Applicant shall obtain the written approval of the Regional Water Board Executive Officer. If the Regional Water Board is not notified of a significant alteration to the Project, it will be considered a violation of this Order, and the Applicant may be subject to Regional Water Board enforcement action(s).

15. All Project work shall be conducted as described in this Order and in the application submitted by the Applicant, and shall comply with all applicable water quality standards as detailed in the Basin Plan. If the Regional Water Board is not notified of a significant alteration to the Project, it will be considered a violation of this Order, and the Applicant may be subject to Regional Water Board enforcement actions.

16. The Applicant shall provide a copy of this Order and State Water Resources Control Board (SWRCB) Order No. 2003-0017-DWQ to any contractor(s), subcontractor(s), and utility company(ies) conducting work on the Project, and shall require that copies remain in their possession at the work site. The Applicant shall be responsible for ensuring that all work conducted by its contractor(s), subcontractor(s), and utility companies is performed in accordance with the information provided by the Applicant to the Regional Water Board.

17. Disturbance or removal of existing vegetation shall not exceed the minimum necessary to complete the Project.

18. Fueling, lubrication, maintenance, storage, and staging of vehicles and equipment shall not result in a discharge or threatened discharge to any waters of the State including dry portions of the shoreline. At no time shall the Applicant or its contractors allow use of any vehicle or equipment, which leaks any substance that may impact water quality.

19. The Regional Water Board may add to or modify the conditions of this Order, as appropriate, to implement any new or revised water quality standards and implementation plans adopted and approved pursuant to the Porter-Cologne Water Quality Control Act or section 303 of the Clean Water Act.

20. In the event of any violation or threatened violation of the conditions of this Order, the violation or threatened violation shall be subject to any remedies, penalties, process or sanctions as provided for under applicable state or federal law. For the purposes of section 401(d) of the Clean Water Act, the applicability of any state law authorizing remedies, penalties, process or sanctions for the violation or threatened violation constitutes a limitation necessary to assure compliance with the water quality standards and other pertinent requirements incorporated into this Order. In response to a suspected violation of any condition of this certification, the State Water Board may require the holder of any federal permit or license subject to this Order to furnish, under penalty of perjury, any technical or monitoring reports the State Water Board deems appropriate, provided that the burden, including costs, of the reports shall bear a reasonable relationship to the need for the reports and the benefits to be obtained from the reports. In response to any violation of the conditions of this Order, the Regional Water Board may add to or modify the conditions of this Order as appropriate to ensure compliance.

21. In the event of any change in control of ownership of land presently owned or controlled by the Applicant, the Applicant shall notify the successor-in-interest of the existence of this Order by letter and shall email a copy of the letter to the following email address: NorthCoast@waterboards.ca.gov

    To discharge dredged or fill material under this Order, the successor-in-interest must email the Regional Water Board Executive Officer at: NorthCoast@waterboards.ca.gov a written request for transfer of the Order. The request must contain the requesting entity's full legal name, the state of incorporation if a corporation, and the address and telephone number of the person(s) responsible for contact with the Regional Water Board.

    The request must also describe any changes to the Project proposed by the successor-in-interest or confirm that the successor-in-interest intends to implement the Project as described in this Order. Except as may be modified by any preceding conditions, all certification actions are contingent on: a) the discharge being limited to and all proposed mitigation being completed in strict compliance with the Applicant's Project description, and b) compliance with all applicable requirements of the Water Quality Control Plan for the North Coast Region (Basin Plan).

22. The authorization of this certification for any dredge and fill activities expires on July 28, 2020. Conditions and monitoring requirements outlined in this Order are not subject to the expiration date outlined above, and remain in full effect and are enforceable.

If you have any questions or comments, please call Gil Falcone at (707) 576-2830 or Stephen Bargsten at (707) 576-2653.

_____

Matthias St. John
Executive Officer

150728_GBF_dp_WhiteSlough_401

Enclosure: Attachment 1

Weblink: State Water Resources Control Board Order No. 2003-0017 -DWQ, General Waste Discharge Requirements for Dredge and Fill Discharges That Have Received State Water Quality Certification can be found at: http://www.waterboards.ca.gov/board_decisions/adopted_orders/water_quality/2003/wqo/wqo2003-0017.pdf

Original to: Mr. Eric Nelson, Refuge Manager, Humboldt Bay National Wildlife Refuge, P.O. Box 576, Loleta, CA 95551

Copy to: Holly Costa, US Army Corps of Engineers holly.n.costa@usace.army.mil

Aldaron Laird, Trinity Associates, riverplanner@gmail.com

Rose Patenaude, Northern Hydrology, rose@northernhydrology.com

Cammy Purchio, US Army Corps of Engineers Cameron.R.Purchio@usace.army.mil

Rebecca Garwood, CA Fish and Wildlife Rebecca.Garwood@wildlife.ca.gov

Jennifer Siu, US EPA, Siu.Jennifer@epa.gov

Attachment 1

Date: July 28, 2015

File: Humboldt Bay National Wildlife Refuge - White Slough Restoration Project, ECM PIN CW-813925, WDID No. 1B15030WNHU

SUBJECT: Restoration project imported fill suitability assessment criteria

On March 17, 2015, the Regional Water Board staff received an application for Clean Water Act 401 water quality certification for the Humboldt Bay National Wildlife Refuge - White Slough Restoration Project. The project description states that restoration activities at White Slough will restore and re-establish approximately 37 acres of subsided tidal wetlands, enhancing ecological function of waters of the US and state. To re-establish the diked former tidelands the Applicant proposes to use imported fill material to raise the ground elevation to a level suitable for recruitment of tidal wetland vegetation and to maintain self-sustaining wetland conditions. Approximately 240,000 cubic yards of imported fill material is proposed to be used to re-establish and restore the tidal wetlands.

This attachment accompanies the water quality certification and describes requirements for sampling and analysis to determine suitability of matching imported fill for placement at the receiving site. Prior to discharging imported fill material at the project site the Applicant shall submit an *Imported Fill Suitability Assessment* (Report) for review and approval by Regional Water Board staff. This Report will identify constituents and characteristics of imported fill compared to the receiving site soils and numeric water quality objectives for bays and estuaries, and if necessary, conform to exposure toxicology thresholds for sensitive aquatic species that may be present in the re-established bay and estuary habitat.

Beneficial Reuse: Re-establishment of tidal wetlands

Dredged and excavated material from harbors, marinas, rivers, industrial, and agricultural sites may be considered a waste due to the likelihood of the accumulation of pollutants while residing in these environments. On the North Coast, these waste materials typically have measured levels of various organic compounds, metals and other constituents that are, or may be, higher than those naturally occurring at ambient levels in local soils. Depending on the nature and location of placement/disposal/reuse of waste materials,

pollutants within these materials may pose a threat to surface and/or ground water quality. These pollutants may also pose a threat to human health and sensitive ecological receptors. Accordingly, these materials are typically considered a non-hazardous or designated waste. Placement of these waste materials at sites to be re-established as waters of the state are subject to regulations of land disposal under California Code of Regulations, the Clean Water Act and the Water Quality Control Plan for the North Coast Region (Basin Plan).

The Report is a waste reuse evaluation tool to determine whether waste constituents are present in concentrations that could cause numeric water quality objectives to be exceeded and beneficial uses to be impaired, and to demonstrate that the proposed reuse is indeed a beneficial reuse and not simply disposal.

We understand that dredged and excavated imported fill material from harbors, marinas, rivers, industrial, and agricultural sites may be contemplated for reuse at the White Slough receiving site, to serve as fill to re-establish appropriate elevation for a self-sustaining tidal wetland. The beneficial uses identified in the Basin Plan for the restored receiving site will include but are not limited to Estuarine Habitat, Wildlife Habitat and Wetland Habitat.

If imported fill constituent levels exceed receiving site levels for specific chemicals, exposure toxicology may need to be further assessed, to ensure fine grained imported fill material is suitable for these beneficial uses and is compatible with species associated with the re-established aquatic habitats. The routes of exposure to sensitive aquatic species in these habitats considered by these guidelines are direct exposure to fill sediments and exposure to leachate after fill sediment placement.

Sampling and Analysis

Receiving Site

As part of the *Beneficial Reuse of Dredged Materials for Tidal Marsh Restoration and Sea Level Rise Adaptation in Humboldt Bay Feasibility Study*, the Applicant has conducted sampling and analysis of the White Slough Wildlife Refuge as a receiving site using the Incremental Sampling Method (ISM) to determine physical characteristics and chemical constituents at the White Slough receiving site.

Imported Fill Material

If previously collected data for imported fill exists it should be made available to Regional Water Board staff. Similar chemical constituent data for proposed imported fill material will need to be sampled using ISM and compared to ISM data obtained from the receiving site and numeric water quality objectives. Sampling analysis results shall be submitted to Regional Water Board staff showing comparison to the receiving site. If all levels of fill constituents are below those of the receiving site, the fill material will meet suitability requirements set by Regional Water Board staff. If some fill constituent levels are elevated

above receiving site, these constituent levels will be evaluated for risks associated with mobility, toxicity, and exposure to determine suitability.

Preliminary Sampling, Testing, and Analysis

1. Sample imported fill material using ISM
2. Analyze for total concentration levels of Cam 17 metals, PAHs, PCBs, Pesticides, Dioxins/Furans, TPH and values for pH, TOC, and sediment texture.
3. Conduct modified Deionized Water Waste Extraction Test (Di-WET) test on soluble and mobile constituents that are elevated above receiving site, analyze for soluble concentrations.

Supplemental Toxicological Testing and Analysis

If some fill constituent levels are elevated above receiving site and numeric water quality objectives, further testing and analysis may be deemed necessary by Regional Water Board staff to show exposure toxicological suitability.

1. Compare elevated import fill results with NOAA Screening Quick Reference Tables (SQuiRT) for preliminary screening for potential risks levels.
2. If imported fill constituent levels exceed receiving site values, conduct sediment exposure toxicology assessment with 10-day acute bioassay using appropriate sensitive organism representative of three life history stages (filter-feeding, burrowing, and deposit feeding) of appropriate benthic aquatic species, using imported fill sediment. (US Army Corps Inland Testing Manual protocol).

Imported Fill Suitability Assessment (Report)

The Report shall include tabulated data from imported fill sampling and analysis including analytes, test methods, reporting limits, measurement units, and results compared to receiving site and numeric water quality objectives for bays and estuaries. Additionally, the report may include results of preliminary SQuiRTs screening results and or aquatic toxicology testing of fill sediment if deemed necessary.

Suitability Determination

Imported fill material may be determined suitable by the Regional Water Board staff, for beneficial reuse and placement at the receiving site, if constituent results do not exceed receiving site sample results and if imported fill material results do not exceed water quality objectives for bays and estuaries. Imported fill may be suitable for reuse if some fill constituent levels are slightly elevated above receiving site or water quality objectives and the threat to water quality and beneficial uses is not significant. The Applicant may show, through additional testing/analysis or mitigation measures that constituent levels for risks associated with mobility, toxicity, and exposure for imported fill material are not significant.

Appendix C: 2005 Sediment Analysis Results Report

CITY OF EUREKA and HUMBOLDT BAY HARBOR, RECREATION AND CONSERVATION DISTRICT

SEDIMENT SAMPLING ANALYSIS

PREPARED BY:

PACIFIC AFFILIATES, INC.

A CONSULTING ENGINEERING GROUP
990 W. WATERFRONT DRIVE
Eureka, CA 95501

(707) 445 3001

April 1, 2005

TABLE OF CONTENTS

TABLE OF TABLES

INTRODUCTION

The Woodley Island Marina (Humboldt Bay Harbor, Recreation and Conservation District, 'HBHR&CD'), and various City of Eureka waterfront moorage facilities require maintenance dredging to restore adequate depth to their moorage facilities. It has been proposed to pump the dredge spoils directly to a site on the Samoa Peninsula for dispersion in the surf zone of the Pacific Ocean. This method was previously employed for maintenance dredging of Humboldt Bay sites in 1988 and 1996. Pursuant to requisite permits for such disposition, sediments of the proposed dredge sites have been sampled and submitted for analytical characterization as required by the EPA, California Regional Quality Control Board and the Army Corps of Engineers.

On behalf of the City of Eureka and the HBHR&CD, Pacific Affiliates, Inc., A Consulting Engineering Group, submitted a sampling plan that was approved by the EPA and the Army Corps of Engineers on December 7th, 2004.

Between January 19th and February 7th, 2005 core samples were collected from Woodley Island Marina, 11 sites along the Eureka waterfront, and from the beach disposal site. Representative samples were collected at the proposed dredge project depths for each site. Samples were submitted to ToxScan Labs (Watsonville, CA) for the required analysis. The analysis included testing for grain size, percent solids, total mercury, total organic carbon (TOC), total petroleum hydrocarbons (TPH), total volatile solids (TVS), metals, semivolatile organics, polychlorinated biphenyls (PCBs) and speciated butyltins in sediment. The results from the 2005 testing were compared to the testing results conducted between August 6th and August 13th, 1996 in order to determine changes in the quality of the sediment over time.

Seven core samples from four of the Eureka waterfront sites were combined in the 2005 testing to form one composite sample, while in 1996 two of the sites were tested individually (J Street and Bonnie Gool Guest Dock) and the remaining two sites were not tested (Adorni Dock and the Samoa Bridge Launch Ramp). The data from the testing results is listed in the report. I street Dock and Coast Seafoods Dock were only tested in 2005.

Five sampling sites along the Eureka waterfront and Woodley Island Marina were identical in sampling locations in 1996 and 2005. Therefore, these sites were chosen for comparison (see details in report). The result indicated that most sampled compound concentrations have decreased over time in those locations. Mercury concentrations decreased at all sampling locations. Metal and TVS concentrations also decreased at all sampling locations except at F Street Dock where no change was noted. TPH concentration decreased at four of the sites. Testing results for TOC showed decrease or no change in concentrations since 1996. At all sampling sites except for Commercial Dock, the concentrations of most semivolatile organic compounds decreased. PCBs were not detected at any site except at Landing Dock.

Arcolor 1254 and 1260 of the speciated butyltins group were detected at Coast Seafoods Dock, I Street Dock and at the Small Boat Basin. Based upon the testing results, no significant change was noticed in the quality of the sediment at the above locations.

The report includes summaries of the lab results from 1998 and 2005 on a site specific basis.

METHODOLGY

Samples were composited in the field for laboratory analysis at ratios of 4:1 or 2:1 as prescribed in the Sampling and Analysis Plan Dated December 10, 2004. Each representative sample was collected via an AMS Multi-Stage Core Sampler. Samples from the length of each core were hand split with a knife along the longitudinal axis of the entire core length and diverted and packed into a 1- liter sample jar, labeled and stored cold in an ice chest. The samples were shipped to ToxScan Labs along with Chain of Custody documentation. A second composite sample was made for each target sample, refrigerated and archived for possible later analysis.

SEDIMENT TESTING RESULTS AND ANALYSIS – CITY OF EUREKA SITES

Site #1 - Dock 'B'

Four locations were sampled at Dock 'B' (see attached location map). The core, and the date/time of core retrieval were as follows:

Table 1: Dock 'B' core sampling characteristics

Sample I.D	Collection Date	Collection Time	Core* Depth (Feet)	Shipping Date
#A-1	01/19/2005	13:00	2.2	02/14/2005
#A-2	01/19/2005	13:00	5.4	02/15/2005
#A-3	01/19/2005	13:00	6.8	02/16/2005
#A-4	01/19/2005	13:00	7.6	02/17/2005

* Core depth is the depth below the mud line

Prior to analysis the samples were composited 4:1 into one sample, as designated below. Analytical results are summarized, and the final report data is appended.

#A-(1,2,3,4)

Results

Dock B was sampled at the same locations in 1996 and 2005 (see attached sample location map). The amount of TPH almost doubled since 1996, which is not a significant change considering the low levels of concentration (Table 2). The percent of sand for this test was less by 5.4%, yet this site has the highest percent of sand. In addition, TOC increased by 0.5 percent. Mercury and TVS concentrations decreased by 0.16 and 0.7 mg/Kg respectively. Metal concentrations in the sediment also decreased since 1996. For example, silver, cadmium and selenium concentrations decreased to non detectable limits. In addition, excluding benzofluoranthenes all semivolatile organic compound concentrations decreased. PCBs and speciated butyltins concentrations were undetectable. Overall the sample tested very similar to the 1996 test.

Notes for table 2:

[A] The test results from 1996 were reported based upon wet weight and dry weight respectively. For example, 41/25 refers to wet weight/dry weight results.

[B] Benzofluoranthenes were tested as one compound in 2005, while in 1996 Benzo(b)fluoranthene and Benzo(k)fluoranthene were sampled individually.

[C] N.A means that the constitute was not sampled.

Table 2: Dock 'B' sediment testing results.

City of Eureka	Dock B	
Year	Feb, 2005	Aug, 1996
Percent Solids, % dry wt.	55	61
Total Mercury, mg/Kg ,dry wt.	0.1	0.26
Total Organic Carbon, % dry wt.	2.2	1.7
Total Petroleum Hydrocarbons, mg/Kg, dry wt.	710	360
Total Volatile Solids, mg/Kg, dry wt	4.7	5.4
% Sand	18.5	23.9
% Silt	53.4	52.3
% Clay	28.1	23.8
Silver, mg/Kg	ND	0.17
Arsenic, mg/Kg	3.82	8
Cadmium, mg/Kg	ND	0.23
Chromium, mg/Kg	57.9	140
Copper, mg/Kg	17	35
Nickel, mg/Kg	67	110
Lead, mg/Kg	5.8	19
Selenium, mg/Kg	ND	0.29
Zinc, mg/Kg	39.1	88
Semivolatile Organics		
Naphthalene, (µg/Kg)	47.9	86/53
2-Methylnaphthalene, (µg/Kg)	63.9	N.A[C]
2-Chloronaphthalene, (µg/Kg)	ND	N.A
Acenapthylene, (µg/Kg)	ND	ND/ND
Acenaphthene, (µg/Kg)	5.05	41/25[A]
Fluorene, (µg/Kg)	33.5	75/46
Phenanthrene, (µg/Kg)	107	200/120
Anthracene, (µg/Kg)	16.4	52/32
Fluoranthene, (µg/Kg)	79.6	240/150
Pyrene, (µg/Kg)	88.4	230/140
Benzo(a)anthracene, (µg/Kg)	24	70/43
Chrysene, (µg/Kg)	47.4	130/79
Benzofluoranthenes, (µg/Kg)	51.7	(b)72/44[B] (k)46/28
Benzo(a)pyrene, (µg/Kg)	17.6	46/28
Indeno(1,2,3-cd)pyrene, (µg/Kg)	13.7	29/18
Dibenz(a,h)anthracene, (µg/Kg)	12.2	ND/ND
Benzo(g,h,i)perylene, (µg/Kg)	12.5	21/13
PCBs		
Arcolor 1016, 1221, 1232, 1242, 1248, 1254, 1260 (mg/Kg)	ND	ND/ND
Speciated Butyltins in Sediment		
Monobutyltin, (µg/Kg)	ND	ND
Dibutyltin, (µg/Kg)	ND	2
Tributyltin, (µg/Kg)	ND	8
Tetrabutyltin, (µg/Kg)	ND	ND

Site #2 - Small Boat Basin

Eight locations in the Small Boat Basin were sampled (See attached location map). The core lengths, and the date/time of core retrieval were as follows:

Table 3: Small Boat Basin core sampling characteristics

Sample I.D	Collection Date	Collection Time	Core Depth (ft)	Shipping Date
#A-1	01/19/2005	14:45	3.8	02/17/2005
#A-2	01/19/2005	14:45	3.1	02/17/2005
#A-3	01/19/2005	14:45	4.3	02/17/2005
#A-4	01/19/2005	14:45	5.5	02/17/2005
#B-1	01/20/2005	14:00	4	02/17/2005
#B-2	01/20/2005	14:00	4.4	02/17/2005
#B-3	01/20/2005	14:00	5.9	02/17/2005
#B-4	01/20/2005	14:00	5	02/17/2005

Prior to analysis the samples were composited 4:1 into two samples, as designated below. Analytical results are summarized, and the final report data is appended.

#A-(1,2,3,4)
#B-(1,2,3,4)

Results

Two composite samples were made in 1996 and 2005 at the Small Boat Basin (see attached sample location map). In 1996, two composite samples were made from sampling eight locations at the east side of Small Boat Basin. In 2005, the dock to the west was added and the samples were distributed over a larger area than in 1996 (see sampling location map). Mercury was not detected in the 2005 test (Table 4). The percentage of sand for this test did not show any significant change. TPH and TVS concentrations decreased, and TOC concentrations did not change significantly since 1996. The results indicate that the concentration of metals in the sediment, such as, lead, nickel and copper decreased since 1996. Semivolatile organic compound concentrations have increased, except for fluoranthene, pyrene and benzo(a)anthracene concentrations which decreased since 1996. PCBs were undetectable, yet speciated butyltins were detected in one core sample, A-(1,2,3,4). Overall the sample tested very similar to the 1996 test.

Table 4: Small Boat Basin testing results.

City of Eureka, 2005	05-Feb		Aug-96	
Small Boat Basin	Sample #A-(1,2,3,4)	Sample #B- (1,2,3,4)	Sample #1-(A,B,C,D)	Sample #1- (E,F,G,H)
Percent Solids, % dry wt.	52	75	62	62
Total Mercury, mg/Kg ,dry wt.	ND	ND	0.32	0.19
Total Organic Carbon, % dry wt.	1.9	0.82	1.3	1.4
Total Petroleum Hydrocarbons, mg/Kg, dry wt.	270	170	540	400
Total Volatile Solids, mg/Kg, dry wt	4.4	2.3	5	4.2
% Sand	24.7	36.8	31.9	33.3
% Silt	47.1	38	47.3	45.4
% Clay	28.2	25.2	20.8	21.3
Metals				
Silver, mg/Kg	ND	ND	0.17	0.16
Arsenic, mg/Kg	2.34	3.62	8.4	6.3
Cadmium, mg/Kg	0.23	ND	0.27	0.24
Chromium, mg/Kg	36.5	45.4	140	140
Copper, mg/Kg	8.41	9.83	38	36
Nickel, mg/Kg	37	46	110	110
Lead, mg/Kg	2.64	3.74	15	19
Selenium, mg/Kg	ND	0.294	0.29	0.27
Zinc, mg/Kg	35.2	27.7	100	99
Semivolatile Organics				
Naphthalene, (µg/Kg)	40.4	65.3	36/22	41/25
2-Methylnaphthalene, (µg/Kg)	61.6	38.5	N.A	N.A
2-Chloronaphthalene, (µg/Kg)	ND	ND	N.A	N.A
Acenapthylene, (µg/Kg)	ND	19.2	N/D	N/D
Acenaphthene, (µg/Kg)	12	22.2	ND/ND	14/8.4
Fluorene, (µg/Kg)	35.3	41.4	34/21	44/27
Phenanthrene, (µg/Kg)	124	109	120/57	160/100
Anthracene, (µg/Kg)	17.4	17	23/14	24/15
Fluoranthene, (µg/Kg)	103	101	82/51	260/160
Pyrene, (µg/Kg)	102	139	130/82	240/150
Benzo(a)anthracene, (µg/Kg)	28.1	30.9	29/18	50/31
Chrysene, (µg/Kg)	67.9	61.9	58/36	120/71
Benzofluoranthenes, (µg/Kg)	64.7	61.9	(b)45/28 (k)26/16	(b)70/43 (k)46/28
Benzo(a)pyrene, (µg/Kg)	17.8	22.8	27/17	45/21
Indeno(1,2,3-cd)pyrene, (µg/Kg)	18.2	16	26/16	33/20
Dibenz(a,h)anthracene, (µg/Kg)	ND	ND	ND/ND	ND/ND
Benzo(g,h,i)perylene, (µg/Kg)	13.4	21.1	ND/ND	36/22
PCBs				
Arcolor 1016, 1221, 1232, 1242, 1248, 1254, 1260 (mg/Kg)	ND	ND	ND/ND	ND/ND
Monobutyltin, (µg/Kg)	4.75	ND	ND	ND
Dibutyltin, (µg/Kg)	5.52	ND	ND	3
Tributyltin, (µg/Kg)	2.51	ND	3	ND
Tetrabutyltin, (µg/Kg)	ND	ND	ND	ND

Site #3 - Commercial Street Dock

Two locations were sampled at Commercial Street Dock (see attached location map). The core, and the date/time of core retrieval were as follows:

Table 5: Commercial Street Dock core sampling characteristics

Sample I.D.	Collection Date	Collection Time	Core Depth (ft)	Shipping Date
#A-1	01/20/2005	15:00	1.5	02/17/2005
#A-2	01/20/2005	15:00	5.9	02/17/2005

Prior to analysis the samples were composited 2:1 into one sample, as designated below. Analytical results are summarized, and the final report data is appended.

#A-(1,2)

Results

Commercial Street Dock was sampled in 2005 at two locations (see attached sample location map). In 1996, Acushent Dock, former name of Commercial Dock, was sampled at four locations. In 2005, a composite sample of a 2:1 ratio was used and in 2005 a 4:1 composite sample was used (Table 6). The results indicate that mercury and TPH concentrations decreased at this site. The percent of TOC for this test was less by 0.03 percent, while TVS concentrations decreased by 0.5 mg/Kg. Sand concentrations decreased by 50 percent. All tested metal concentrations decreased since 1996. In the semivolatile organic group, four of the 12 tested compound concentrations, phenanthrene, chrysene, acenaphthene and fluorine, increased. PCBs and speciated butyltins were undetectable. Overall the sample tested very similar to the 1996 test.

Table 6: Commercial Street Dock sediment testing results.

City of Eureka	Feb, 2005	Aug, 1996
Commercial Street Dock	Sample #A-(1,2)	Sample #3-(A,B,C,D)
Percent Solids, % dry wt.	62	67
Total Mercury, mg/Kg ,dry wt.	0.083	0.19
Total Organic Carbon, % dry wt.	1.6	1.3
Total Petroleum Hydrocarbons, mg/Kg, dry wt.	260	430
Total Volatile Solids, mg/Kg, dry wt	5.2	4.7
% Sand	18.1	37.7
% Silt	53.5	42.9
% Clay	28.3	19.4
Metals		
Silver, mg/Kg	ND	0.13
Arsenic, mg/Kg	2.82	5.9
Cadmium, mg/Kg	ND	0.16
Chromium, mg/Kg	45.3	110
Copper, mg/Kg	11.9	91
Nickel, mg/Kg	48	93
Lead, mg/Kg	4.16	20
Selenium, mg/Kg	0.173	0.21
Zinc, mg/Kg	31.6	120
Semivolatile Organics		
Naphthalene, (µg/Kg)	59.4	80/54
2-Methylnaphthalene, (µg/Kg)	86.6	N.A
2-Chloronaphthalene, (µg/Kg)	ND	N.A
Acenapthylene, (µg/Kg)	11.4	ND/ND
Acenaphthene, (µg/Kg)	72.9	190/130
Fluorene, (µg/Kg)	74.4	180/120
Phenanthrene, (µg/Kg)	164	420/280
Anthracene, (µg/Kg)	56.1	80/54
Fluoranthene, (µg/Kg)	347	270/180
Pyrene, (µg/Kg)	357	400/270
Benzo(a)anthracene, (µg/Kg)	147	190/130
Chrysene, (µg/Kg)	237	480/320
Benzofluoranthenes, (µg/Kg)	170	(b)130/88 (k)130/87
Benzo(a)pyrene, (µg/Kg)	73.1	97/65
Indeno(1,2,3-cd)pyrene, (µg/Kg)	33	46/31
Dibenz(a,h)anthracene, (µg/Kg)	12.2	ND/ND
Benzo(g,h,i)perylene, (µg/Kg)	37.8	24/16
PCBs		
Arcolor 1016, 1221, 1232, 1242, 1248, 1254, 1260 (mg/Kg)	ND	ND/ND
Speciated Butyltins in Sediment		
Monobutyltin, (µg/Kg)	ND	ND/ND
Dibutyltin, (µg/Kg)	ND	ND/ND
Tributyltin, (µg/Kg)	ND	ND/ND
Tetrabutyltin, (µg/Kg)	ND	ND/ND

Site #4 - Fisherman's Terminal/Landing Dock

Four locations were sampled at Fishermen's Terminal/Landing Dock (see attached location map). The core, and the date/time of core retrieval were as follows:

Table 7: Fishermen's Terminal core sampling characteristics.

Sample I.D	Collection Date	Collection Time	Core Depth (Feet)	Shipping Date
#A-1	01/20/2005	16:00	6.8	02/17/2005
#A-2	01/20/2005	16:00	5.5	02/17/2005
#A-3	01/20/2005	16:00	2.2	02/17/2005
#A-4	01/20/2005	16:00	7.3	02/17/2005

Prior to analysis the samples were composited 4:1 into one sample, as designated below. Analytic results are summarized, and the final report data is appended.

#A-(1,2,3,4)

Results

Landing Dock was sampled at the same locations and 4:1 composite sampled were made in 1996 and 2005 (see attached sample location map). The percent of sand for this test did not change significantly (Table 8). Although TOC concentrations have increased by 0.6 mg/Kg, the concentration of TPH has decreased by more than 50 percent since 1996 and mercury concentrations have decreased by 0.07 mg/Kg. In addition, percent of solids has not changed. Thus, the "quality" of the material on this site has not been degraded. In addition, metal concentrations have decreased at the site since 1996. Zinc, lead and nickel concentrations have decreased by approximately 50 percent. An increase is noticed in semivolatile organics concentrations and PCBs (Arcolor 1254 and 1260 were detected). In the speciated butyltins group dibutyltin concentrations decreased from 3 μg/Kg to non-detectable. Overall the sample tested very similar to the 1996 test.

Table 8: Fishermen's/ Landing Dock sediment testing results.

City of Eureka – Fishermen's/ Landing Dock		
	Feb, 2005	Aug, 1996
Percent Solids, % dry wt.	64	64
Total Mercury, mg/Kg ,dry wt.	0.18	0.25
Total Organic Carbon, % dry wt.	2.1	1.5
Total Petroleum Hydrocarbons, mg/Kg, dry wt.	490	780
Total Volatile Solids, mg/Kg, dry wt	5.1	5.8
% Sand	14.1	13.8
% Silt	56	58.6
% Clay	29.3	27.6
Metals		
Silver, mg/Kg	ND	0.21
Arsenic, mg/Kg	3.28	9.2
Cadmium, mg/Kg	0.129	0.23
Chromium, mg/Kg	55.1	150
Copper, mg/Kg	17.1	40
Nickel, mg/Kg	56	120
Lead, mg/Kg	12.4	23
Selenium, mg/Kg	0.307	0.29
Zinc, mg/Kg	52.2	110
Semivolatile Organics		
Naphthalene, (µg/Kg)	319	50/32
2-Methylnaphthalene, (µg/Kg)	72.5	N.A
2-Chloronaphthalene, (µg/Kg)	ND	N.A
Acenapthylene, (µg/Kg)	28.6	20/13
Acenaphthene, (µg/Kg)	357	33/21
Fluorene, (µg/Kg)	361	70/45
Phenanthrene, (µg/Kg)	861	250/160
Anthracene, (µg/Kg)	121	48/31
Fluoranthene, (µg/Kg)	370	200/130
Pyrene, (µg/Kg)	404	170/110
Benzo(a)anthracene, (µg/Kg)	91.2	70/45
Chrysene, (µg/Kg)	121	100/65
Benzofluoranthenes, (µg/Kg)	117	(b)72/46 (k)50/32
Benzo(a)pyrene, (µg/Kg)	57.4	58/37
Indeno(1,2,3-cd)pyrene, (µg/Kg)	43.4	45/29
Dibenz(a,h)anthracene, (µg/Kg)	11.8	ND/ND
Benzo(g,h,i)perylene, (µg/Kg)	61.9	45/29
PCBs		
Arcolor 1016, 1221, 1232, 1242, 1248 (mg/Kg)	ND	ND
Arcolor 1254	0.0166	0.050/0.032
Arcolor 1260	0.017	ND/ND
Speciated Butyltins in Sediment		
Monobutyltin, (µg/Kg)	ND	ND
Dibutyltin, (µg/Kg)	ND	3
Tributyltin, (µg/Kg)	ND	ND
Tetrabutyltin, (µg/Kg)	ND	ND

Site #5 - F Street Floating Dock

Two locations were sampled (see attached location map). The core, and the date/time of core retrieval were as follows:

Table 9: F Street Floating Dock core sampling characteristics.

Sample I.D	Collection Date	Collection Time	Core Depth (ft)	Shipping Date
#A-1	01/21/2005	14:40	3.7	02/17/2005
#A-2	01/21/2005	14:40	1.2	02/17/2005

Prior to analysis the samples were composited 2:1 into one sample, as designated below. Analytical results are summarized, and the final report data is appended.

#A-(1,2)

Results

F Street Floating Dock was sampled at two locations in 2005 and at four locations in 1996 and composite samples of ratios 2:1 and 4:1 were made respectively (see attached sample location map). The percentage of sand for this test was less by 2.9 percent. Since 1996, TPH concentrations decreased by 410 mg/Kg. Mercury, TOC and TVS concentrations did not change significantly. All tested metal concentrations decreased at this site. All semivolatile organic compound concentrations increased except for Chrysene. PCBs and speciated butyltins were not detected in the 2005 test. Overall the sample tested very similar to the 1996 test.

Table 10: F Street Floating Dock sediment testing results.

City of Eureka – Landing Dock		
	Feb, 2005	Aug, 1996
Percent Solids, % dry wt.	61	60
Total Mercury, mg/Kg ,dry wt.	0.12	0.2
Total Organic Carbon, % dry wt.	1.9	1.3
Total Petroleum Hydrocarbons, mg/Kg, dry wt.	230	640
Total Volatile Solids, mg/Kg, dry wt	5.1	5
% Sand	8.9	11.8
% Silt	58.4	56.9
% Clay	32.7	31.3
Metals		
Silver, mg/Kg	ND	0.16
Arsenic, mg/Kg	3.23	9.9
Cadmium, mg/Kg	ND	0.18
Chromium, mg/Kg	57.6	140
Copper, mg/Kg	21.9	35
Nickel, mg/Kg	65	110
Lead, mg/Kg	6.38	17
Selenium, mg/Kg	0.182	0.31
Zinc, mg/Kg	40.6	97
Semivolatile Organics		
Naphthalene, (µg/Kg)	150	1100/650
2-Methylnaphthalene, (µg/Kg)	73.1	N.A
2-Chloronaphthalene, (µg/Kg)	ND	N.A
Acenapthylene, (µg/Kg)	22	ND/ND
Acenaphthene, (µg/Kg)	61.5	15/8.7
Fluorene, (µg/Kg)	60.6	44/26
Phenanthrene, (µg/Kg)	158	170/100
Anthracene, (µg/Kg)	32.7	54/32
Fluoranthene, (µg/Kg)	146	140/86
Pyrene, (µg/Kg)	182	140/85
Benzo(a)anthracene, (µg/Kg)	46.1	65/39
Chrysene, (µg/Kg)	71.6	170/100
Benzofluoranthenes, (µg/Kg)	87.9	(b)67/40 (k)55/33
Benzo(a)pyrene, (µg/Kg)	39.8	52/31
Indeno(1,2,3-cd)pyrene, (µg/Kg)	32.8	35/21
Dibenz(a,h)anthracene, (µg/Kg)	7.54	ND/ND
Benzo(g,h,i)perylene, (µg/Kg)	31.2	39/23
PCBs		
Arcolor 1016, 1221, 1232, 1242, 1248, 1254 ,1260 (mg/Kg)	ND	ND/ND
Arcolor -1254	ND	30/18
Speciated Butyltins in Sediment		
Monobutyltin, (µg/Kg)	ND	ND
Dibutyltin, (µg/Kg)	ND	ND
Tributyltin, (µg/Kg)	ND	ND
Tetrabutyltin, (✪g/Kg)	ND	ND

Site #6 - I Street Dock

Two locations were sampled (see attached location map). The core, and the date/time of core retrieval were as follows:

Table 11: I Street Dock core sampling characteristics.

Sample I.D	Collection Date	Collection Time	Core Depth (Feet)	Shipping Date
#A-1	01/21/2005	15:10	7.6	02/17/2005
#A-2	01/21/2005	15:10	5.1	02/17/2005
#A-3	01/21/2005	15:10	4.3	02/17/2005
#A-4	01/21/2005	15:10	7.1	02/17/2005

Prior to analysis the samples were composited 4:1 into one sample, as designated below. Analytical results are summarized, and the final report data is appended.

#A-(1,2,3,4)

Results

I Street Floating Dock was sampled at four locations in 2005 and was not sampled in 1996 (see attached sample location map). The percent of sand from this core sample is low compared to the other docks (Table 12). Note that mono, di, and tributyltin were detected at this location. PCBs were not detected at this site.

Table 12: I Street Dock sediment testing results.

I Street Dock, 2005	
City of Eureka	Sample #A-(1,2,3,4)
Percent Solids, % dry wt.	59
Total Mercury, mg/Kg ,dry wt.	0.1
Total Organic Carbon, % dry wt.	1.9
Total Petroleum Hydrocarbons, mg/Kg, dry wt.	270
Total Volatile Solids, mg/Kg, dry wt	5.3
% Sand	5.5
% Silt	59.9
% Clay	34.6
Silver, mg/Kg	ND
Metals	
Arsenic, mg/Kg	3.61
Cadmium, mg/Kg	0.113
Chromium, mg/Kg	53.9
Copper, mg/Kg	14.7
Nickel, mg/Kg	57
Lead, mg/Kg	7.17
Selenium, mg/Kg	0.328
Zinc, mg/Kg	41.6
Semivolatile Organics	
Naphthalene, (µg/Kg)	42.8
2-Methylnaphthalene, (µg/Kg)	44.4
2-Chloronaphthalene, (µg/Kg)	ND
Acenapthylene, (µg/Kg)	7.75
Acenaphthene, (µg/Kg)	28.7
Fluorene, (µg/Kg)	46
Phenanthrene, (µg/Kg)	123
Anthracene, (µg/Kg)	20.7
Fluoranthene, (µg/Kg)	160
Pyrene, (µg/Kg)	102
Benzo(a)anthracene, (µg/Kg)	35.3
Chrysene, (µg/Kg)	44.6
Benzofluoranthenes, (µg/Kg)	60
Benzo(a)pyrene, (µg/Kg)	33.3
Indeno(1,2,3-cd)pyrene, (µg/Kg)	10.9
Dibenz(a,h)anthracene, (µg/Kg)	ND
Benzo(g,h,i)perylene, (µg/Kg)	15.1
PCBs	
Arcolor 1016, 1221, 1232, 1242, 1248, 1254, 1260 (mg/Kg)	ND
Speciated Butyltins in Sediment	
Monobutyltin, (µg/Kg)	9.23
Dibutyltin, (µg/Kg)	9.46
Tributyltin, (µg/Kg)	6.18
Tetrabutyltin, (µg/Kg)	ND

City of Eureka

Seven core samples from J street Dock, Adorni Dock, Bonnie Gool Guest Dock and Samoa Bridge Launch Ramp were combined to form one composite sample. The combined composite sample was named #10.

Site #7 - J Street Dock

Two locations were sampled at J street Dock (see attached location map). The core, and the date/time of core retrieval were as follows:

Table 13: J Street Dock core sampling characteristics.

Sample I.D	Collection Date	Collection Time	Core Depth (ft)	Shipping Date
#A-1	01/21/2005	16:00	8	02/17/2005
#A-2	01/21/2005	16:00	6.9	02/17/2005

Site #8 - Adorni Dock

Two locations were sampled at Adorni Dock (see attached location map). The core, and the date/time of core retrieval were as follows:

Table 14: Adorni Dock core sampling characteristics.

Sample I.D	Collection Date	Collection Time	Core Depth (ft)	Shipping Date
#A-1	01/212005	16:00	2.8	02/17/2005
#A-2	01/212005	16:00	3.9	02/17/2005

Site #9 - Bonnie Gool Guest Dock

Two locations were sampled at Bonnie Gool Guest Dock (see attached location map). The core, and the date/time of core retrieval were as follows:

Table 15: Bonnie Gool Guest Dock core sampling characteristics.

Sample I.D	Collection Date	Collection Time	Core Depth (ft)	Shipping Date
#A-1	01/212005	16:00	1.6	02/17/2005
#A-2	01/212005	16:00	3.7	02/17/2005

Site #10 - Samoa Bridge Launch Ramp

One location was sampled at the Samoa Bridge Launch Ramp (see attached location map). The core, and the date/time of core retrieval were as follows:

Table 16: Samoa Bridge Launch Ramp core sampling characteristics.

Sample I.D	Collection Date	Collection Time	Core Depth (ft)	Shipping Date
#A-1	01/20/2005	16:00	3	02/17/2005

Prior to analysis seven samples from the four different sites were combined to form one composite sample. Analytic results are summarized below, and the final report data is appended.

Results

The results from the composite testing and the 1996 testing of J Street Dock and Bonnie Gool Dock are shown in Table 17 (Adorni dock and Samoa Bridge Launch Ramp were not tested in 1996). The percent sand for this test decreased, while TOC and TVS concentrations increased. All metal and mercury concentrations decreased since 1996; Nickel and zinc concentrations, for example, decreased 65 and 76 percent respectively. Yet, all semivolatile organic compound concentrations increased except for Dibenz(a,h)anthracene. Although dibutyltin was detected in 1996, speciated butyltins and PCBs were undetectable in 2005. Overall the sample tested very similar to the 1996 test.

Table 17: Testing results of composite sample from seven sampling locations at four sites.

	Feb, 2005	Aug, 1996			
City of Eureka	Sample I.D #10	J Street Dock	Adorni Dock	Bonnie Gool Guest Dock	Samoa Bridge Launch Ramp
Percent Solids, % dry wt.	59	62	N.A.	66	N.A.
Total Mercury, mg/Kg ,dry wt.	0.1	0.22	N.A.	0.32	N.A.
Total Organic Carbon, % dry wt.	2.1	1.2	N.A.	1	N.A.
Total Petroleum Hydrocarbons, dry wt. (mg/Kg)	420	640	N.A.	360	N.A.
Total Volatile Solids, mg/Kg, dry wt	5.4	4.4	N.A.	4.2	N.A.
% Sand	12.5	22.3	N.A.	33	N.A.
% Silt	52.3	49.6	N.A.	45	N.A.
% Clay	35.2	28.1	N.A.	22	N.A.
Metals					
Silver, mg/Kg	ND	0.16	N.A.	0.18	N.A.
Arsenic, mg/Kg	3.72	8.8	N.A.	8.1	N.A.
Cadmium, mg/Kg	ND	0.19	N.A.	0.14	N.A.
Chromium, mg/Kg	46.5	160	N.A.	120	N.A.
Copper, mg/Kg	4.46	41	N.A.	27	N.A.
Nickel, mg/Kg	46	130	N.A.	96	N.A.
Lead, mg/Kg	2.62	14	N.A.	19	N.A.
Selenium, mg/Kg	ND	0.28	N.A.	0.23	N.A.
Zinc, mg/Kg	23.9	100	N.A.	80	N.A.
Semivolatile Organics					
Naphthalene, (µg/Kg)	58.1	21/17	N.A.	21/14	N.A.
2-Methylnaphthalene, (µg/Kg)	55.2	N.A	N.A.	N.A	N.A.
2-Chloronaphthalene, (µg/Kg)	ND	N.A	N.A.	N.A	N.A.
Acenapthylene, (µg/Kg)	ND	16/19.9	N.A.	ND/ND	N.A.
Acenaphthene, (µg/Kg)	8.96	15/9.0	N.A.	ND/ND	N.A.
Fluorene, (µg/Kg)	24.2	48/30	N.A.	13/8.5	N.A.
Phenanthrene, (µg/Kg)	73.9	140/85	N.A.	76/50	N.A.
Anthracene, (µg/Kg)	3.67	40/25	N.A.	ND/ND	N.A.
Fluoranthene, (µg/Kg)	55.6	520/320	N.A.	47/31	N.A.
Pyrene, (µg/Kg)	55.7	450/280	N.A.	53/35	N.A.
Benzo(a)anthracene, (µg/Kg)	12.6	82/51	N.A.	15/10	N.A.
Chrysene, (µg/Kg)	27.6	190/120	N.A.	26/17	N.A.
Benzofluoranthenes, (µg/Kg)	32.9	(b)68/110 (k)74/46	N.A.	(a)23/15 (k)ND/ND	N.A.
Benzo(a)pyrene, (µg/Kg)	14.1	58/36	N.A.	14/9.1	N.A.
Indeno(1,2,3-cd)pyrene, (µg/Kg)	9.08	39/24	N.A.	ND/ND	N.A.
Dibenz(a,h)anthracene, (µg/Kg)	ND	ND/ND	N.A.	ND/ND	N.A.
Benzo(g,h,i)perylene, (µg/Kg)	19.9	ND/ND	N.A.	21/14	N.A.
PCBs					
Arcolor 1016, 1221, 1232, 1242, 1248, 1254, 1260 (mg/Kg)	ND	ND/ND	N.A.	ND/ND	N.A.
Speciated Butyltins in Sediment					
Monobutyltin, (µg/Kg)	ND	ND	N.A.	ND	N.A.
Dibutyltin, (µg/Kg)	ND	3	N.A.	ND	N.A.
Tributyltin, (µg/Kg)	ND	ND	N.A.	ND	N.A.
Tetrabutyltin, (µg/Kg)	ND	ND	N.A.	ND	N.A.

Site #11 - Coast Seafoods Dock

Two locations were sampled (see attached location map). The core, and the date/time of core retrieval were as follows:

Table 18: Coast Seafoods Dock core sampling characteristics

Sample I.D	Collection Date	Collection Time	Core Depth (Feet)	Shipping Date
#1	02/02/2005	13:45	---	02/17/2005

Prior to analysis the sample was composited 4:1 into one sample, as designated below. Analytic results are summarized, and the final report data is appended.

#A-(1,2,3,4)

Results

Coast Seafoods Dock was sampled at four locations in 2005 and was not sampled in 1996. Percent sand at this site is relatively high compared to the other sites (16.6 percent). From the PCB group, arcolor 1254 and 1260 were detected at the site. In addition di and tri-butyltin were detected at the site.

Table 19: Coast Seafoods Dock sediment testing results.

Coast Seafoods Dock	
City of Eureka, 2005	Sample #A-(1,2,3,4)
Percent Solids, % dry wt.	62
Total Mercury, mg/Kg ,dry wt.	ND
Total Organic Carbon, % dry wt.	2.6
Total Petroleum Hydrocarbons, mg/Kg, dry wt.	220
Total Volatile Solids, mg/Kg, dry wt	4.4
% Sand	16.1
% Silt	51.5
% Clay	32.4
Metals	
Silver, mg/Kg	ND
Arsenic, mg/Kg	3.59
Cadmium, mg/Kg	0.315
Chromium, mg/Kg	50.1
Copper, mg/Kg	21
Nickel, mg/Kg	61
Lead, mg/Kg	7.83
Selenium, mg/Kg	0.375
Zinc, mg/Kg	83.4
Semivolatile Organics	
Naphthalene, (µg/Kg)	62.2
2-Methylnaphthalene, (µg/Kg)	72.6
2-Chloronaphthalene, (µg/Kg)	ND
Acenapthylene, (µg/Kg)	25.2
Acenaphthene, (µg/Kg)	39.6
Fluorene, (µg/Kg)	111
Phenanthrene, (µg/Kg)	657
Anthracene, (µg/Kg)	780
Fluoranthene, (µg/Kg)	1130
Pyrene, (µg/Kg)	862
Benzo(a)anthracene, (µg/Kg)	179
Chrysene, (µg/Kg)	345
Benzofluoranthenes, (µg/Kg)	331
Benzo(a)pyrene, (µg/Kg)	141
Indeno(1,2,3-cd)pyrene, (µg/Kg)	98.9
Dibenz(a,h)anthracene, (µg/Kg)	43.3
Benzo(g,h,i)perylene, (µg/Kg)	133
PCBs	
Arcolor 1016, 1221, 1232, 1242, 1248 (mg/Kg)	ND
Arcolor 1254, (mg/Kg)	0.14
Arcolor 1260, (mg/Kg)	0.0552
Speciated Butyltins in Sediment	
Monobutyltin, (µg/Kg)	ND
Dibutyltin, (µg/Kg)	4.48
Tributyltin, (µg/Kg)	2.12
Tetrabutyltin, (µg/Kg)	ND

SEDIMENT TESTING RESULTS AND ANALYSIS – HUMBOLDT BAY HARBOR, RECREATION AND CONSERVATION DISTRICT SITE

Site #12 - Woodley Island Marina

16 locations were sampled at Woodley Island Marina (see attached location map). The core, and the date/time of core retrieval were as follows.

Table 20: Woodley Island Marina core sampling characteristics.

Sample I.D	Collection Date	Collection Time	Core Depth (Feet)	Shipping Date
#A-1	02/03/2005	12:45	2.2	02/17/2005
#A-2	02/03/2005	12:45	3.9	02/17/2005
#A-3	02/03/2005	12:45	3.8	02/17/2005
#A-4	02/03/2005	12:45	4.3	02/17/2005
#B-1	02/03/2005	13:30	5.2	02/17/2005
#B-2	02/03/2005	13:30	4.4	02/17/2005
#B-3	02/03/2005	13:30	4.3	02/17/2005
#B-4	02/03/2005	13:30	6	02/17/2005
#C-1	02/04/2005	14:30	5.6	02/17/2005
#C-2	02/04/2005	14:30	6.4	02/17/2005
#C-3	02/04/2005	14:30	5.5	02/17/2005
#C-4	02/04/2005	14:30	4.2	02/17/2005
#D-1	02/04/2005	15:15	4.3	02/17/2005
#D-2	02/04/2005	15:15	4	02/17/2005
#D-3	02/04/2005	15:15	1.6	02/17/2005
#D-4	02/04/2005	15:15	4	02/17/2005

Prior to analysis the samples were composited at a ratio of 16:4 into four core samples as designated below. Analytical results are summarized, and the final report data is appended.

#A-(1,2,3,4)
#B-(1,2,3,4)
#C-(1,2,3,4)
#D-(1,2,3,4)

Results

The results indicate that no significant change has occurred to the quality of the sediment in Woodley Island Marina. In 2005, four composite samples were taken in Woodley Island Marina while in 1996, three composite samples were taken (see attached sample location map). Sample numbers A-(1,2,3,4) and D-(1,2,3,4) can be compared to samples number WI-(A,B,C,D) and WI-(I,J,K,L). The four middle moorage facilities of Woodley Island were sampled in 1996 with one core sample, WI-(E,F,G,H) and in 2005 with two core samples, C-(1,2,3,4) and D-(1,2,3,4) and are compared (Table 22).

Overall no significant changes were noticed in the test results. TPH have increased on the west side of Woodley Island Marina from non-detectable to 610 mg/Kg. In the middle area of the marina TPH concentrations ranged from 300 to 460 mg/Kg in the 2005 test and were not detected in 1996. On the east side of the Marina TPH has decreased by 340 mg/Kg. The percent of sand in the Marina has decreased from 1996 to 2005 at all locations. TOC concentration did not change significantly in all locations (maximum change of 0.3 mg/Kg). In all testing locations at Woodley Island Marina metal concentrations have remained the same or decreased since 1996, except nickel. For example, silver concentration has decreased to levels of undetectable on the west side of the Marina. Most semivolatile organic compound concentrations have increased since 1996 at all sampling locations of the marina. For example, fluoranthene concentrations have almost doubled on the east side and almost tripled on the west side of the Marina. PCBs were undetectable in 1996 and 2005. In the speciated butyltins group dibutyltin and tributyltin decreased to non-detectable levels.

Table 21: Test results from Woodley Island Marina, four core samples were analyzed in 2005.

Woodley Island Marina, February, 2005				
Humboldt Bay Harbor, Recreation and Conservation District	Sample #A-(1,2,3.4)	Sample #B-(1,2,3.4)	Sample #C-(1,2,3.4)	Sample #D-(1,2,3,4)
Percent Solids, % dry wt.	60	57	56	53
Total Mercury, mg/Kg ,dry wt.	0.095	0.096	0.099	0.1
Total Organic Carbon, % dry wt.	1.6	1.6	1.9	2.1
Total Petroleum Hydrocarbons, mg/Kg, dry wt.	610	460	300	400
Total Volatile Solids, mg/Kg, dry wt	4.5	4.7	4.8	5.3
% Sand	9	7.5	3.1	7.5
% Silt	57	52.3	52.3	50.8
% Clay	33.9	40.2	44.5	41.8
Metals				
Silver, mg/Kg	ND	ND	ND	0.113
Arsenic, mg/Kg	3.25	3.27	3.47	4.37
Cadmium, mg/Kg	ND	ND	ND	0.103
Chromium, mg/Kg	56.9	54.6	55.6	56.5
Copper, mg/Kg	14	15.1	14.1	14.6
Nickel, mg/Kg	59	58	58	58
Lead, mg/Kg	4.93	5.47	5.21	6.05
Selenium, mg/Kg	0.321	0.331	0.212	0.27
Zinc, mg/Kg	38.4	38	38.3	39.3
Semivolatile Organics				
Naphthalene, (µg/Kg)	43.3	65.7	35.3	26.6
2-Methylnaphthalene, (µg/Kg)	75.8	80.1	52.3	58.6
2-Chloronaphthalene, (µg/Kg)	ND	ND	ND	ND
Acenapthylene, (µg/Kg)	10.2	13.4	6.25	5.6
Acenaphthene, (µg/Kg)	15.7	20.5	11.5	12.3
Fluorene, (µg/Kg)	46.3	75.8	31.6	35
Phenanthrene, (µg/Kg)	119	155	96.8	208
Anthracene, (µg/Kg)	14.9	34.7	8.21	23.8
Fluoranthene, (µg/Kg)	162	129	85.8	342
Pyrene, (µg/Kg)	101	151	70.1	269
Benzo(a)anthracene, (µg/Kg)	38.2	42.9	21.7	102
Chrysene, (µg/Kg)	60.6	92.9	43.6	185
Benzofluoranthenes, (µg/Kg)	92.1	82.2	61.9	262
Benzo(a)pyrene, (µg/Kg)	31.1	25.7	26.7	115
Indeno(1,2,3-cd)pyrene, (µg/Kg)	31.9	20.7	17.6	63.3
Dibenz(a,h)anthracene, (µg/Kg)	11	8.73	8.65	34.9
Benzo(g,h,i)perylene, (µg/Kg)	44.2	33.7	27.4	82.3
PCBs				
Arcolor 1016, 1221, 1232, 1242, 1248, 1254, 1260 (mg/Kg)	ND	ND	ND	ND
Speciated Butyltins in Sediment				
Monobutyltin, (µg/Kg)	ND	ND	ND	ND
Dibutyltin, (µg/Kg)	ND	ND	ND	ND
Tributyltin, (µg/Kg)	ND	ND	ND	ND
Tetrabutyltin, (µg/Kg)	ND	ND	ND	ND

Table 22: Woodley Island Marina test results from 1996 where three core samples were analyzed.

Woodley Island Marina, August, 1996			
Humboldt Bay Harbor, Recreation and Conservation District	Sample #WI-(A,B,C,D)	Sample #WI-(E,F,G,H)	Sample #WI-(I,J,K,L)
Percent Solids, % dry wt.	59	55	5.9
Total Mercury, mg/Kg ,dry wt.	0.13	0.15	0.11
Total Organic Carbon, % dry wt.	1.5	1.8	1.8
Total Petroleum Hydrocarbons, mg/Kg, dry wt.	ND	ND	740
Total Volatile Solids, mg/Kg, dry wt	5	5	5.9
% Sand	25.8	14.1	14.4
% Silt	49.5	55.2	54.2
% Clay	24.7	30.7	31.4
Metals			
Silver, mg/Kg	0.12	0.13	0.13
Arsenic, mg/Kg	8.7	9.4	9.7
Cadmium, mg/Kg	0.18	0.2	0.2
Chromium, mg/Kg	140	150	130
Copper, mg/Kg	34	39	37
Nickel, mg/Kg	12	15	14
Lead, mg/Kg	110	120	110
Selenium, mg/Kg	0.27	0.35	0.31
Zinc, mg/Kg	94	100	99
Semivolatile Organics			
Naphthalene, (µg/Kg)	34/20	35/19	36/20
2-Methylnaphthalene, (µg/Kg)	N.A	N.A	N.A
2-Chloronaphthalene, (µg/Kg)	N.A	N.A	N.A
Acenapthylene, (µg/Kg)	ND/ND	ND/ND	ND/ND
Acenaphthene, (µg/Kg)	ND/ND	ND/ND	16/8.7
Fluorene, (µg/Kg)	34/20	31/17	42/23
Phenanthrene, (µg/Kg)	130/75	140/78	220/120
Anthracene, (µg/Kg)	15/18.7	15/8.1	20/11
Fluoranthene, (µg/Kg)	100/60	100/55	180/100
Pyrene, (µg/Kg)	120/71	93/51	150/82
Benzo(a)anthracene, (µg/Kg)	32/19	27/15	38/21
Chrysene, (µg/Kg)	88/52	55/30	48/87
Benzofluoranthenes, (µg/Kg)	(b)49/29 (k)29/17	(b)47/26 (k)26/14	(b)69/38 (k)44/24
Benzo(a)pyrene, (µg/Kg)	32/19	35/19	47/26
Indeno(1,2,3-cd)pyrene, (µg/Kg)	ND/ND	ND/ND	42/23
Dibenz(a,h)anthracene, (µg/Kg)	ND/ND	ND/ND	ND/ND
Benzo(g,h,i)perylene, (µg/Kg)	ND/ND	38/21	47/26
PCBs			
Arcolor 1016, 1221, 1232, 1242, 1248, 1254, 1260 (mg/Kg)	ND/ND	ND/ND	ND/ND
Speciated Butyltins in Sediment			
Monobutyltin, (µg/Kg)	ND	ND	ND
Dibutyltin, (µg/Kg)	7	ND	ND
Tributyltin, (µg/Kg)	ND	4	2
Tetrabutyltin, (µg/Kg)	ND	ND	ND

SEDIMENT TESTING RESULTS - HBHR&CD AND THE CITY OF EUREKA SITE

Site #13 - Samoa Beach

Using a stainless steel bottom sediment grab sampler, one grab sample was collected from the wave slope of the beach nourishment area (see attached sample location map).

Table 23: Samoa beach grab sample characteristics.

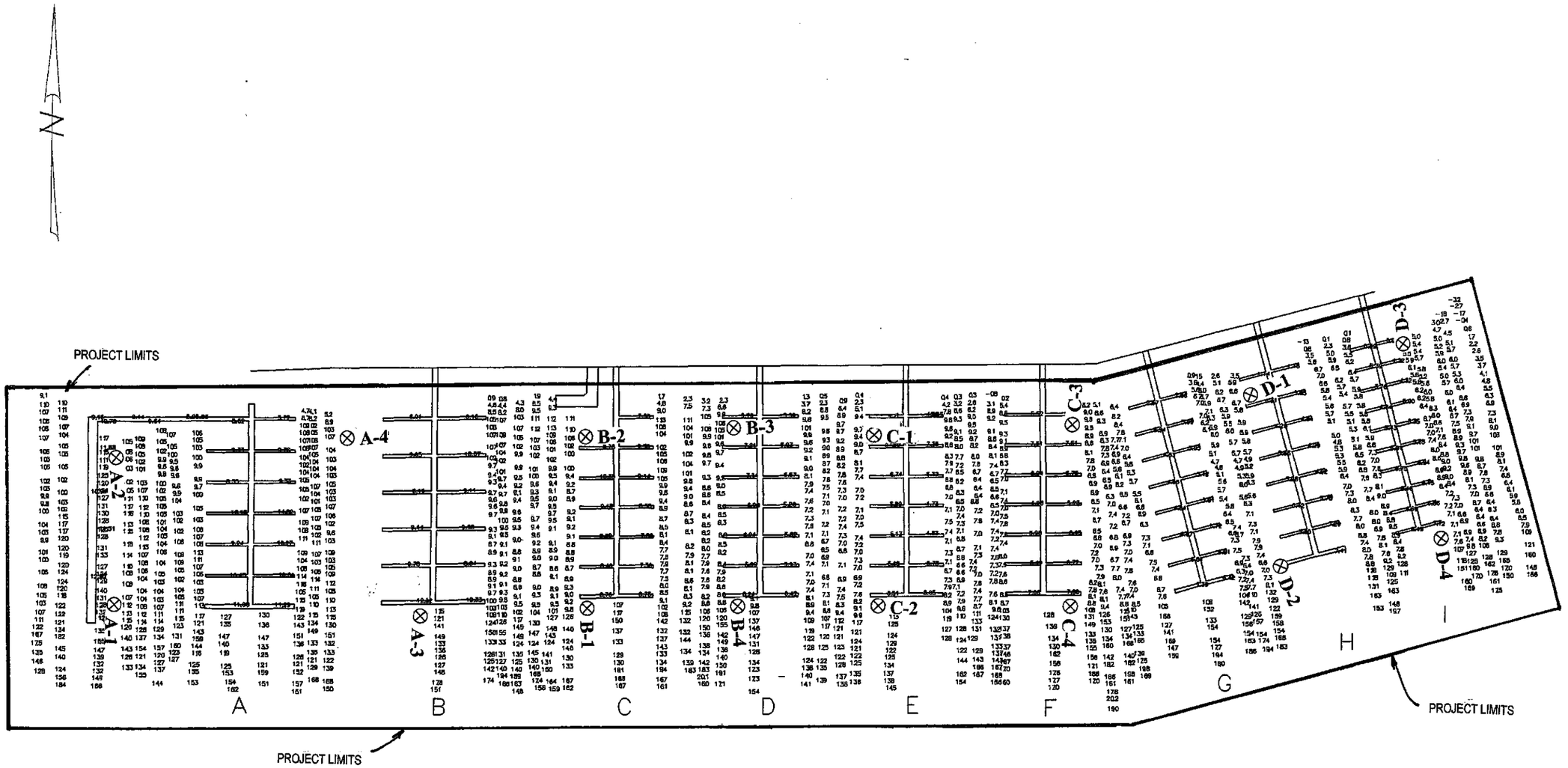
Sample I.D	Collection Date	Collection Time	Core Depth (Feet)	Shipping Date
#1	02/07/2005	16:00	---	02/17/2005

Results

The Samoa Beach was only sampled in 1996 for grain size (see attached sample location map). In 1996, 100 percent of the sample contained sand. The results from the 2005 testing are shown in Table 24.

Table 24: Samoa beach nourishment site 2005 sediment testing results.

Beach Nourishment Site	
City of Eureka, 2005	Sample #A-(1,2,3,4)
Percent Solids, % dry wt.	80
Total Mercury, mg/Kg ,dry wt.	ND
Total Organic Carbon, % dry wt.	ND
Total Petroleum Hydrocarbons, mg/Kg, dry wt.	290
Total Volatile Solids, mg/Kg, dry wt	0.85
% Sand	98
% Silt	0.3
% Clay	1.7
Metals	
Silver, mg/Kg	ND
Arsenic, mg/Kg	3.72
Cadmium, mg/Kg	ND
Chromium, mg/Kg	46.5
Copper, mg/Kg	4.46
Nickel, mg/Kg	46
Lead, mg/Kg	2.62
Selenium, mg/Kg	ND
Zinc, mg/Kg	23.9
Semivolatile Organics	
Naphthalene, (µg/Kg)	ND
2-Methylnaphthalene, (µg/Kg)	ND
2-Chloronaphthalene, (µg/Kg)	ND
Acenapthylene, (µg/Kg)	ND
Acenaphthene, (µg/Kg)	ND
Fluorene, (µg/Kg)	ND
Phenanthrene, (µg/Kg)	ND
Anthracene, (µg/Kg)	ND
Fluoranthene, (µg/Kg)	ND
Pyrene, (µg/Kg)	ND
Benzo(a)anthracene, (µg/Kg)	ND
Chrysene, (µg/Kg)	ND
Benzofluoranthenes, (µg/Kg)	ND
Benzo(a)pyrene, (µg/Kg)	ND
Indeno(1,2,3-cd)pyrene, (µg/Kg)	ND
Dibenz(a,h)anthracene, (µg/Kg)	ND
Benzo(g,h,i)perylene, (µg/Kg)	ND
PCBs	
Arcolor 1016, 1221, 1232, 1242, 1248 , 1254, 1260 (mg/Kg)	ND
Speciated Butyltins in Sediment	
Monobutyltin, (µg/Kg)	ND
Dibutyltin, (µg/Kg)	ND
Tributyltin, (µg/Kg)	ND
Tetrabutyltin, (µg/Kg)	ND



⊗ SAMPLE LOCATION

SURVEY NOTES

SURVEYED BY PACIFIC AFFILIATES CONSULTING ENGINEERS ON FEBRUARY 4,23,26, 2004. TIDE STATION FOR SURVEY PACIFIC AFFILIATES BENCHMARK AT WOODLEY ISLAND MARINA FISHERMAN'S LOADING DOCK IN EUREKA, CA. ELEV. 15.54' MLLW.

SOUNDINGS ARE SHOWN TO THE NEAREST FOOT AND TENTHS OF A FOOT. VERTICAL DATUM UTILIZED – MEAN LOWER LOW WATER (MLLW).

HORIZONTAL CONTROL REFERENCED TO NAD 27, CALIFORNIA ZONE 1, LAMBERT CONFORMAL PROJECTION. SURVEY REPRESENTS THE CONDITIONS ON THE DATE SURVEYED (FEBRUARY 4,23,26, 2004).

DRAWINGS NOT TO BE USED FOR NAVIGATION. ONLY CHANNEL CONDITION AT DATE OF SURVEY.

REVISIONS	BY

PACIFIC AFFILIATES
A CONSULTING ENGINEERING GROUP
996 WEST WATERFRONT DRIVE
EUREKA, CA 95501

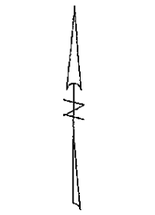
ENGINEER
DAVID L. SCHNEIDER
990 WEST WATERFRONT DRIVE
EUREKA, CA 95501
(707) 445-3001

WOODLEY ISLAND MARINA
CONDITIONAL
BATHYMETRIC SURVEY

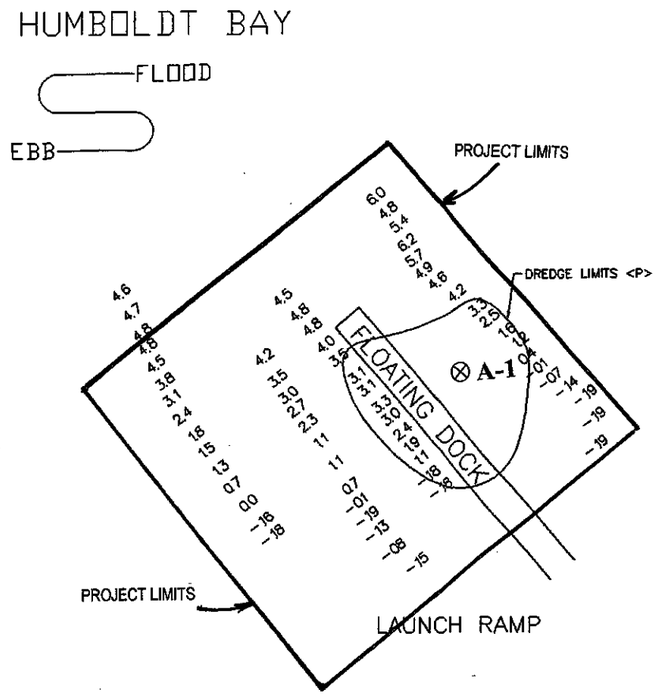
HUMBOLDT BAY HARBOR,
RECREATION AND
CONSERVATION DISTRICT
P.O. BOX 1030
EUREKA, CA 95502-1030

Date: June 14, 2004
Scale: 1"= 80' U.O.N.
Drawn by: Travis Schneider

SHEET NUMBER
C-1.1



SCALE: 1" = 40'



⊗ SAMPLING LOCATION

SURVEY NOTES

SOUNDINGS ARE SHOWN TO THE NEAREST FOOT AND TENTHS OF A FOOT.

SOUNDINGS ARE REFERENCED TO THE DATUM OF MEAN LOWER LOW WATER AT THE LOCALITY

HORIZONTAL CONTROL IS BASED UPON CALIFORNIA STATE PLANE COORDINATE SYSTEM, LAMBERT CONFORMAL PROJECTION, ZONE 1.

HYDROGRAPHIC SOUNDINGS SURVEYED JUNE 24, 2004 (HIGH TIDE).

REVISIONS	BY

PACIFIC AFFILIATES
A CONSULTING ENGINEERING GROUP
990 WEST WATERFRONT DRIVE
EUREKA, CA 95501

ENGINEER
DAVID L. SCHNEIDER
990 WEST WATERFRONT DRIVE
EUREKA, CA 95501
(707) 445-3001

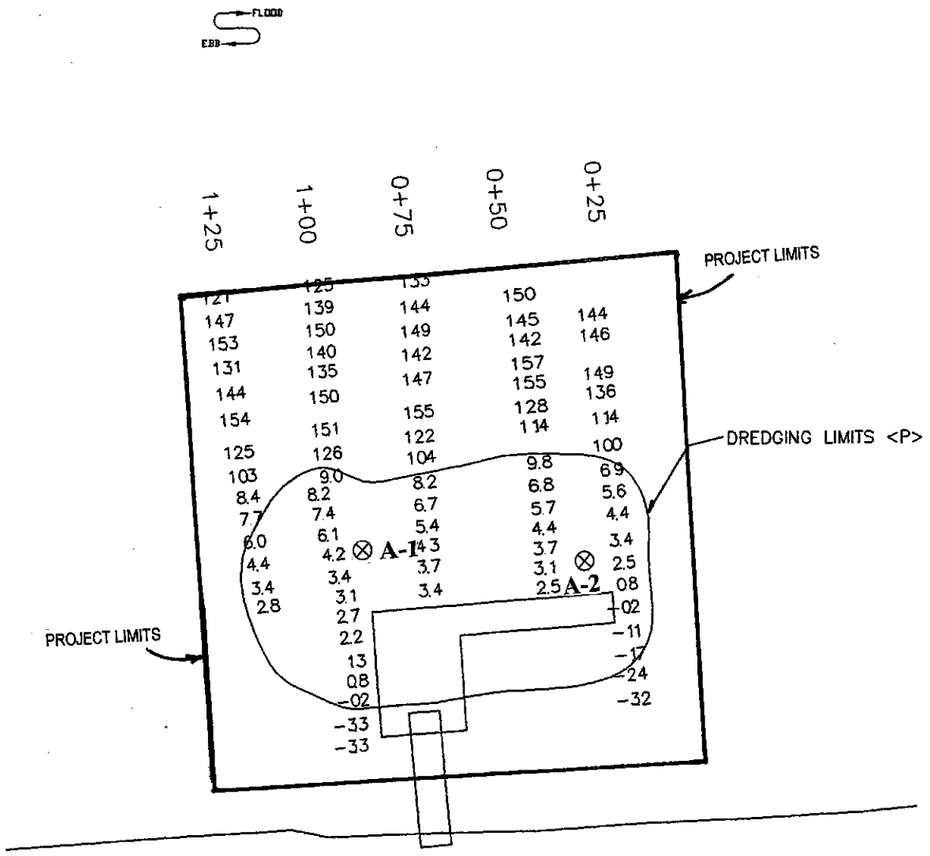
CONDITIONAL SURVEY

CITY OF EUREKA
MAINTENANCE DREDGING
SAMOA BRIDGE LAUNCH RAMP
EUREKA, CA 95501

Survey Date: June 24, 2004
Scale: 1"=40' U.O.N.
Drawn by: Travis Schneider

SHEET NUMBER
C-1.1

HUMBOLDT BAY



SCALE : 1" = 20'

ADORNI CENTER

⊗ SAMPLING LOCATION

SURVEY NOTES

SOUNDINGS ARE SHOWN TO THE NEAREST FOOT AND TENTHS OF A FOOT.

SOUNDINGS ARE REFERENCED TO THE DATUM OF MEAN LOWER LOW WATER USING PACIFIC AFFILIATES TIDAL POINT, TIED BY SURVEY TO USGS BRASS DISK "1940" LOCATED IN THE CONCRETE SEA WALL, USCG STATION HUMBOLDT BAY, ELEVATION 14.28' MLLW.

HORIZONTAL CONTROL IS BASED UPON CALIFORNIA STATE PLANE COORDINATE SYSTEM, LAMBERT CONFORMAL PROJECTION, ZONE 1.

HYDROGRAPHIC SOUNDINGS FOR STATIONS 0+25 – 1+25 SURVEYED APRIL 7, 2004 (HIGH TIDE).

REVISIONS	BY

PACIFIC AFFILIATES
A CONSULTING ENGINEERING GROUP
990 WEST WATERFRONT DRIVE
EUREKA, CA 95501

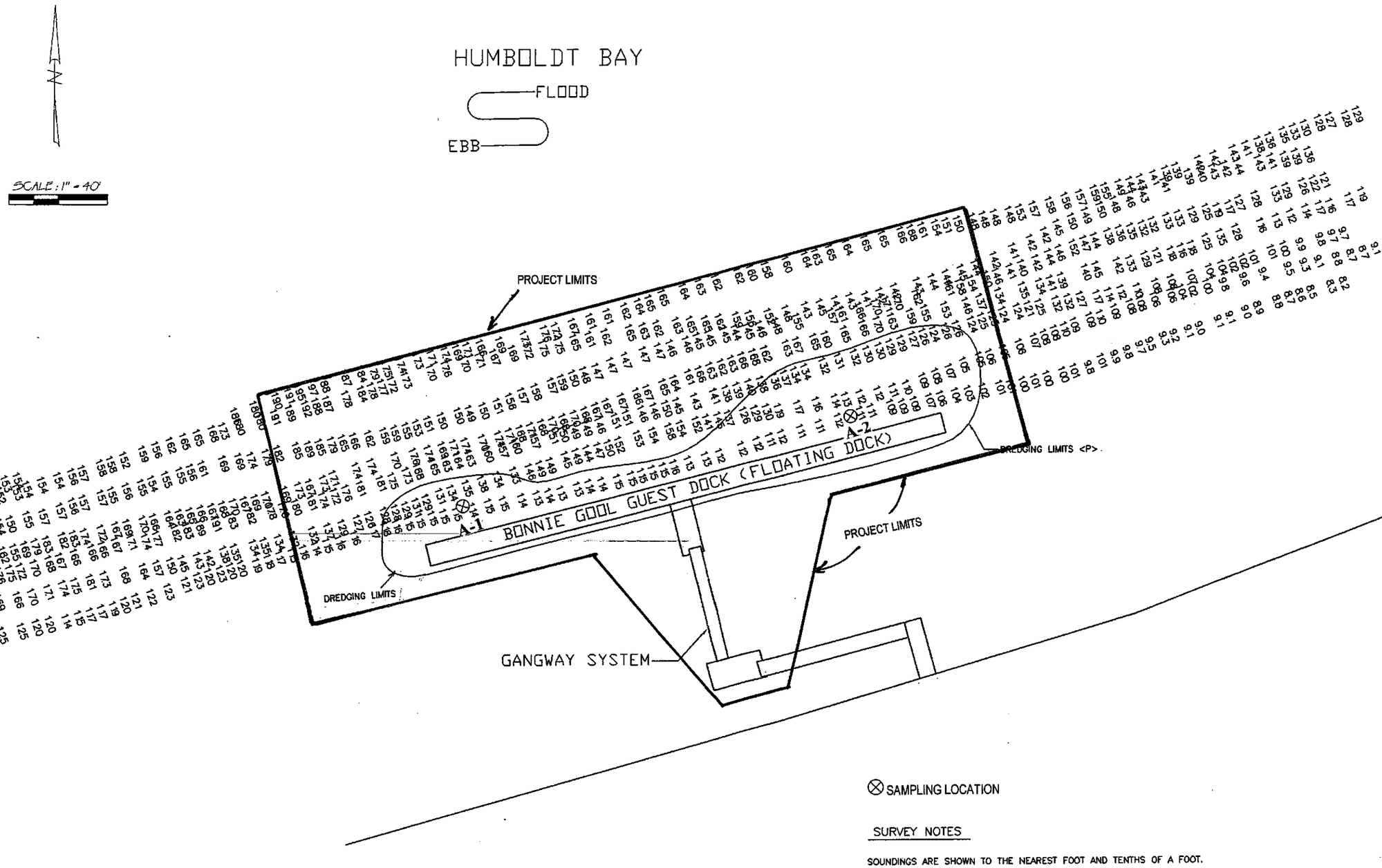
ENGINEER
DAVID L. SCHNEIDER
990 WEST WATERFRONT DRIVE
EUREKA, CA 95501
(707) 445-3001

CONDITIONAL SURVEY

CITY OF EUREKA
MAINTENANCE DREDGING
ADORNI DOCK
EUREKA, CA 95501

Survey Date: April 7, 2004
Scale: 1"=20' U.O.N.
Drawn by: Travis Schneider

SHEET NUMBER
C–1.1



⊗ SAMPLING LOCATION

SURVEY NOTES

SOUNDINGS ARE SHOWN TO THE NEAREST FOOT AND TENTHS OF A FOOT.

SOUNDINGS ARE REFERENCED TO THE DATUM OF MEAN LOWER LOW WATER AT THE LOCALITY

HORIZONTAL CONTROL IS BASED UPON CALIFORNIA STATE PLANE COORDINATE SYSTEM, LAMBERT CONFORMAL PROJECTION, ZONE 1.

HYDROGRAPHIC SOUNDINGS FOR STATIONS 0+00 – 0+60 SURVEYED APRIL 28, 2004 (HIGH TIDE).

REVISIONS	BY

PACIFIC AFFILIATES
A CONSULTING ENGINEERING GROUP
998 WEST WATERFRONT DRIVE,
EUREKA, CA 95501

ENGINEER
DAVID L. SCHNEIDER
990 WEST WATERFRONT DRIVE
EUREKA, CA 95501
(707) 445-3001

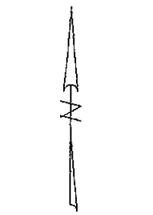
CONDITIONAL SURVEY

CITY OF EUREKA
MAINTENANCE DREDGING
BONNIE GOOL GUEST DOCK
EUREKA, CA 95501

Date: April 28, 2004
Scale: 1"=40' U.O.N.
Drawn by: Travis Schneider

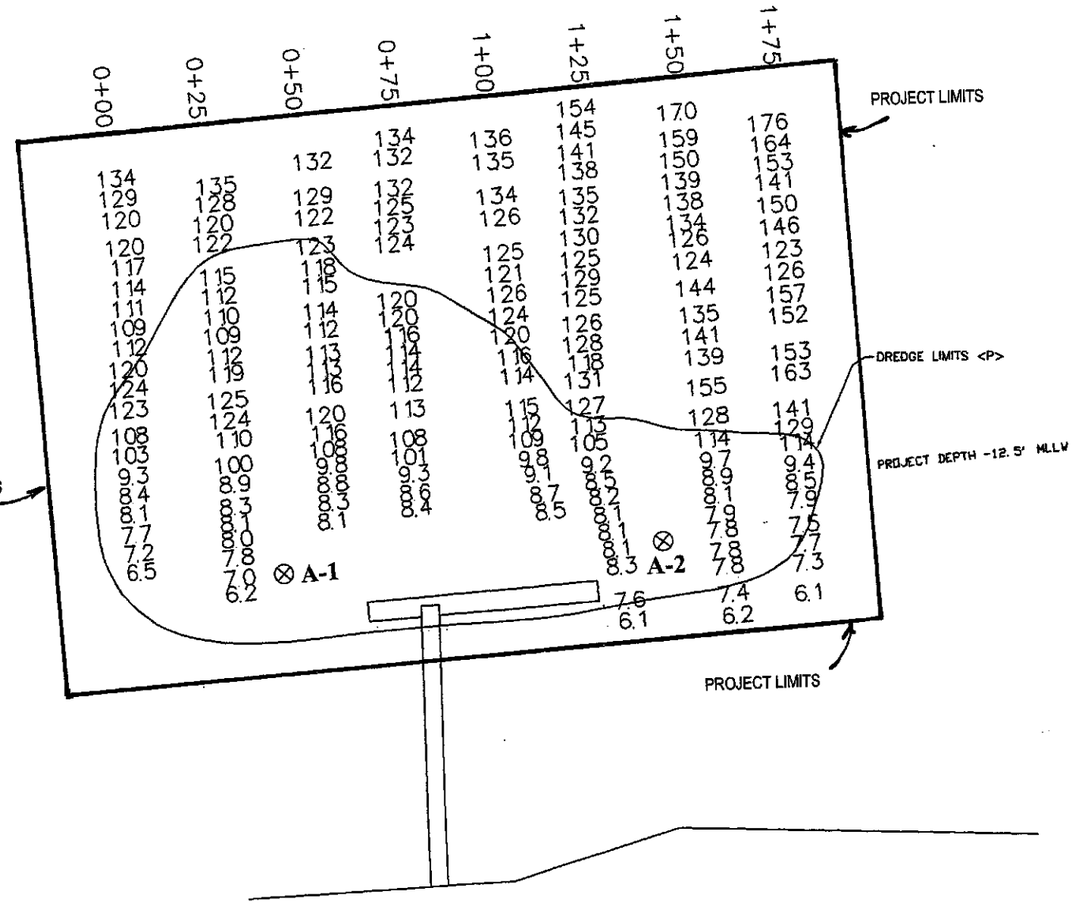
SHEET NUMBER
C-1.1

HUMBOLDT BAY



N544122.69
E1401954.05

N543989.74
E1401959.40



⊗ SAMPLING LOCATION

SURVEY NOTES

SOUNDINGS ARE SHOWN TO THE NEAREST FOOT AND TENTHS OF A FOOT.

SOUNDINGS ARE REFERENCED TO THE DATUM OF MEAN LOWER LOW WATER AT THE LOCALITY

HORIZONTAL CONTROL IS BASED UPON CALIFORNIA STATE PLANE COORDINATE SYSTEM, LAMBERT CONFORMAL PROJECTION, ZONE 1.

HYDROGRAPHIC SOUNDINGS FOR STATIONS 0+00 – 1+75 SURVEYED APRIL 7, 2004 (HIGH TIDE).

J STREET DOCK

REVISIONS	BY

PACIFIC AFFILIATES
A CONSULTING ENGINEERING GROUP
998 WEST WATERFRONT DRIVE
EUREKA, CA 95501

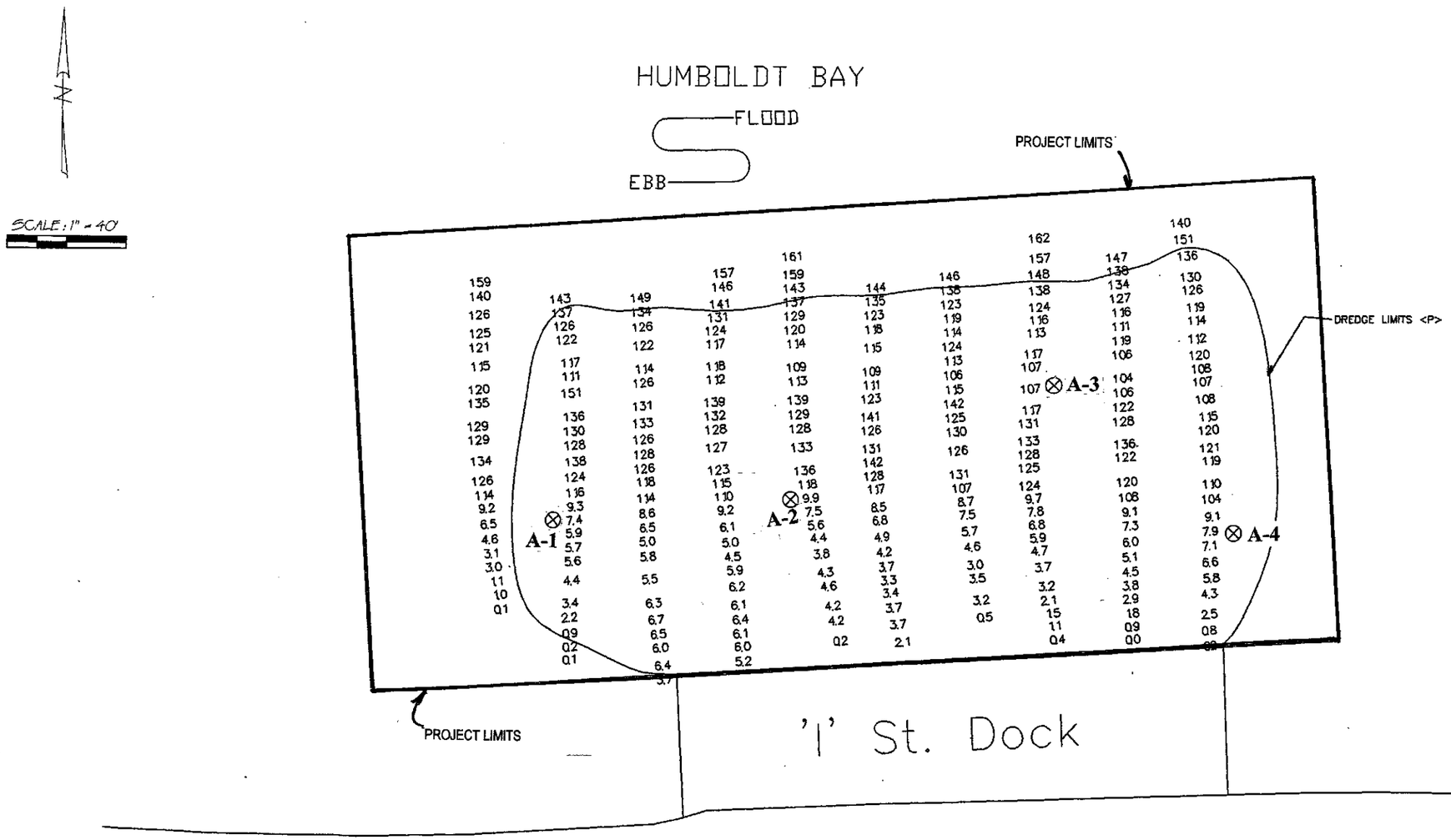
ENGINEER
DAVID L. SCHNEIDER
990 WEST WATERFRONT DRIVE
EUREKA, CA 95501
(707) 445-3001

CONDITIONAL SURVEY

CITY OF EUREKA
MAINTENANCE DREDGING
'J' STREET DOCK
EUREKA, CA 95501

Survey Date: April 7, 2004
Scale: 1"=40' U.O.N.
Drawn by: Travis Schneider

SHEET NUMBER
C-1.1



SCALE: 1" = 40'

⊗ SAMPLE LOCATION

SURVEY NOTES

SOUNDINGS ARE SHOWN TO THE NEAREST FOOT AND TENTHS OF A FOOT.

SOUNDINGS ARE REFERENCED TO THE DATUM OF MEAN LOWER LOW WATER AT THE LOCALITY

HORIZONTAL CONTROL IS BASED UPON CALIFORNIA STATE PLANE COORDINATE SYSTEM, LAMBERT CONFORMAL PROJECTION, ZONE 1.

HYDROGRAPHIC SOUNDINGS SURVEYED JUNE 24, 2004 (HIGH TIDE).

REVISIONS	BY

PACIFIC AFFILIATES
A CONSULTING ENGINEERING GROUP
940 WEST WATERFRONT DRIVE
EUREKA, CA 95501

ENGINEER
DAVID L. SCHNEIDER
940 WEST WATERFRONT DRIVE
EUREKA, CA 95501
(707) 445-3001

CONDITIONAL SURVEY

CITY OF EUREKA
MAINTENANCE DREDGING
'I' St. Dock
EUREKA, CA 95501

Survey Date: June 24, 2004
Scale: 1"=40' U.O.N.
Drawn by: Travis Schneider

SHEET NUMBER
C-1.1

HUMBOLDT BAY

FLOOD
EBB

PROJECT LIMITS

PROJECT LIMITS

PROJECT LIMITS

DREDGING LIMITS <P>

A-1

A-2

FLOATING DOCK

'F' ST. PLAZA

BOARDWALK

⊗ SAMPLE LOCATION

SCALE: 1" = 40'

SURVEY NOTES

SOUNDINGS ARE SHOWN TO THE NEAREST FOOT AND TENTHS OF A FOOT.

SOUNDINGS ARE REFERENCED TO THE DATUM OF MEAN LOWER LOW WATER USING PACIFIC AFFILIATES TIDAL POINT, TIED BY SURVEY TO USGS BRASS DISK "1940" LOCATED IN THE CONCRETE SEA WALL, USCG STATION HUMBOLDT BAY, ELEVATION 14.28' MLLW.

HORIZONTAL CONTROL IS BASED UPON CALIFORNIA STATE PLANE COORDINATE SYSTEM, LAMBERT CONFORMAL PROJECTION, ZONE 1.

HYDROGRAPHIC SOUNDINGS SURVEYED JUNE 22, 2004 (HIGH TIDE).

REVISIONS	BY

PACIFIC AFFILIATES
A CONSULTING ENGINEERING GROUP
990 WEST WATERFRONT DRIVE
EUREKA, CA 95501

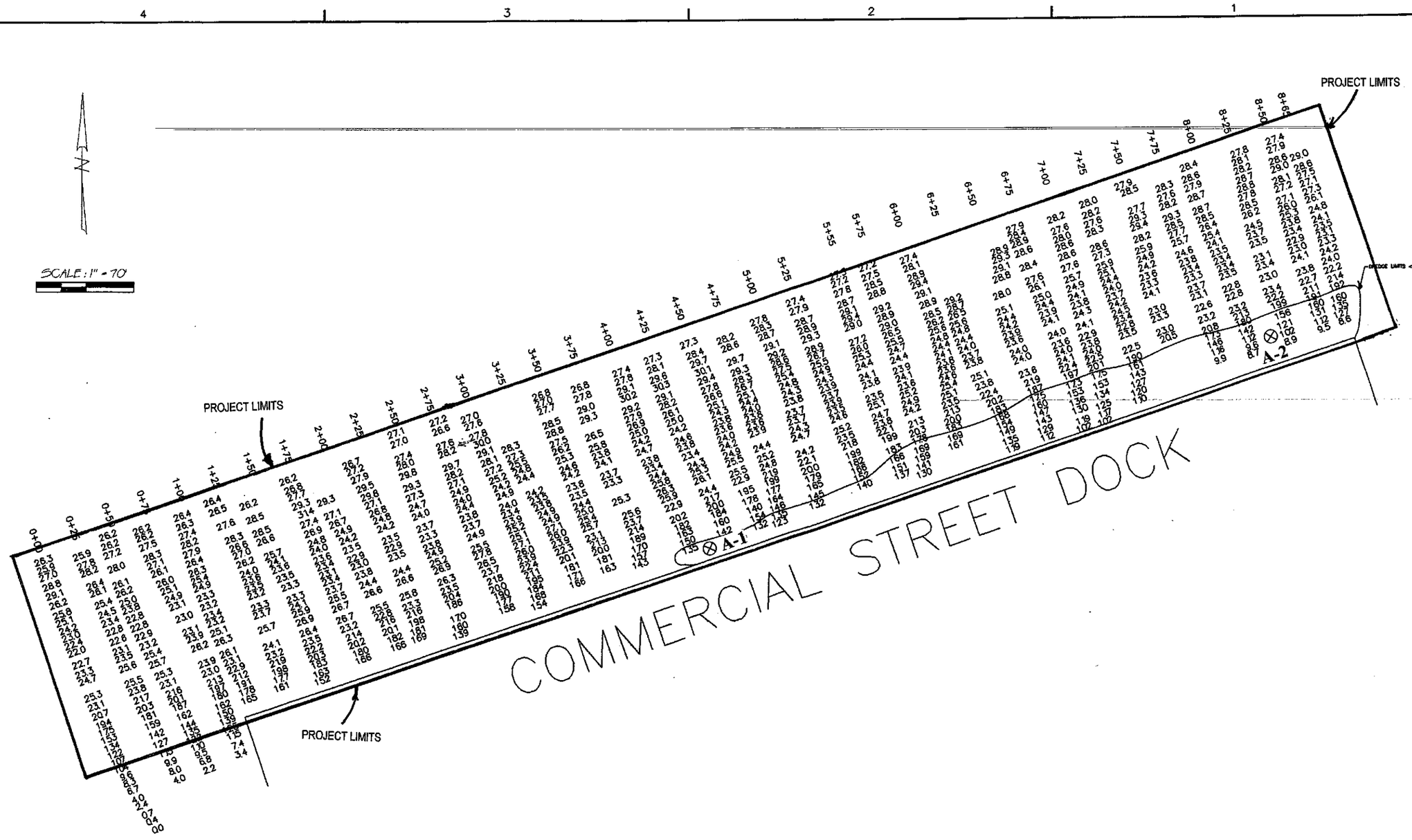
ENGINEER
DAVID L. SCHNEIDER
990 WEST WATERFRONT DRIVE
EUREKA, CA 95501
(707) 445-3001

CONDITIONAL SURVEY

CITY OF EUREKA
MAINTENANCE DREDGING
'F' St. DOCK
EUREKA, CA 95501

Survey Date: June 22, 2004
Scale: 1"=40' U.O.N.
Drawn by: Travis Schneider

SHEET NUMBER
C-1.1



SURVEY NOTES

SOUNDINGS ARE SHOWN TO THE NEAREST FOOT AND TENTHS OF A FOOT.

SOUNDINGS ARE REFERENCED TO THE DATUM OF MEAN LOWER LOW WATER AT THE LOCALITY

HORIZONTAL CONTROL IS BASED UPON CALIFORNIA STATE PLANE COORDINATE SYSTEM, LAMBERT CONFORMAL PROJECTION, ZONE 1.

HYDROGRAPHIC SOUNDINGS FOR STATIONS 0+00 – 2+25 SURVEYED APRIL 28, 2004, 2+50 – 2+75 SURVEYED APRIL 29, 2004, 3+00 – 3+50 SURVEYED APRIL 28, 2004 AND 3+75 – 8+65 SURVEYED APRIL 7, 2004.

⊗ SAMPLE LOCATION

REVISIONS	BY

PACIFIC AFFILIATES
A CONSULTING ENGINEERING GROUP
998 WEST WATERFRONT DRIVE
EUREKA, CA 95501

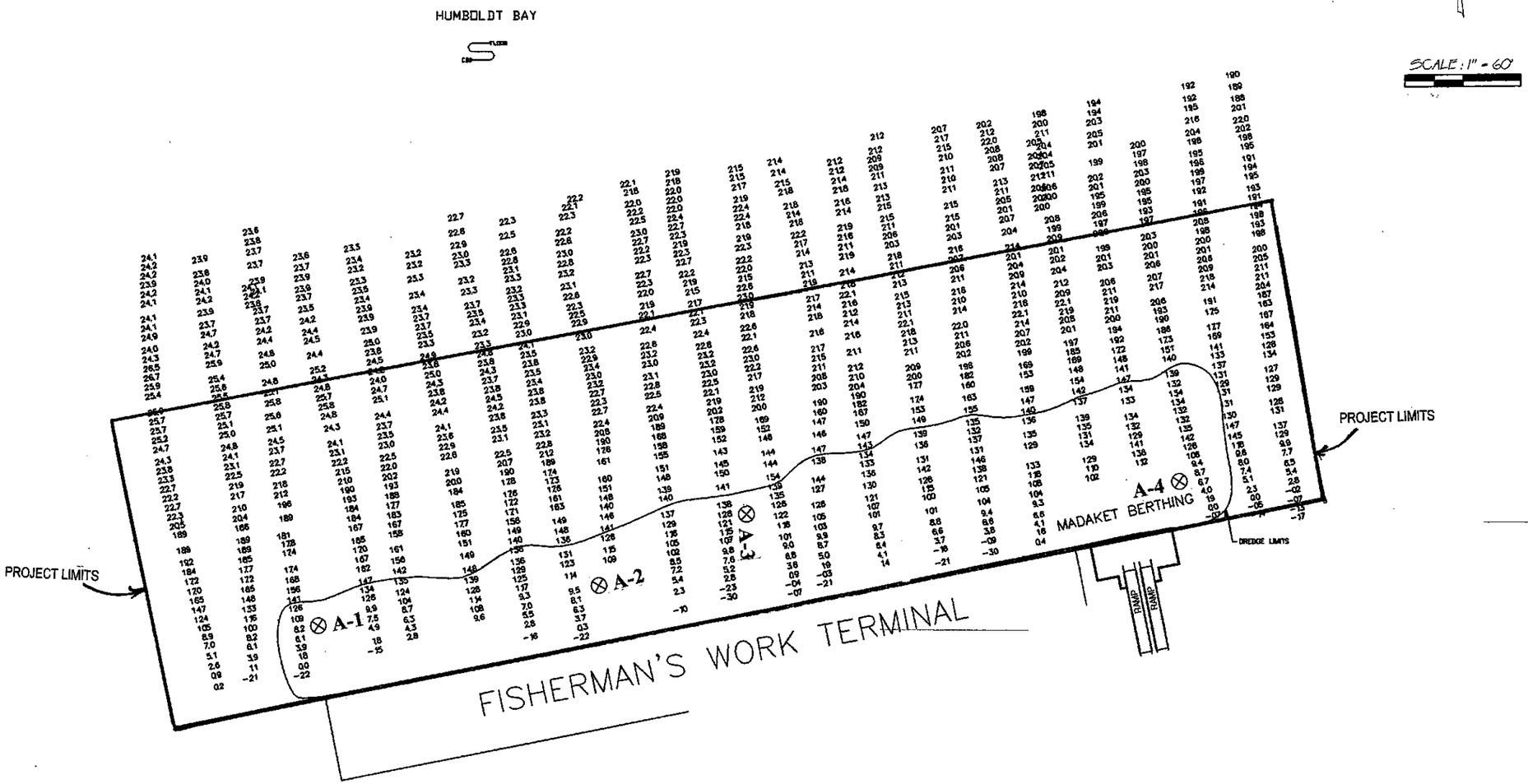
ENGINEER
DAVID L. SCHNEIDER
998 WEST WATERFRONT DRIVE
EUREKA, CA 95501
(707) 445-3001

CONDITIONAL SURVEY

CITY OF EUREKA
MAINTENANCE DREDGING
COMMERCIAL STREET DOCK
EUREKA, CA 95501

Survey Date:
April 7, 28, 29, 2004
Scale:
1"=70' U.O.N.
Drawn by:
Travis Schneider

SHEET NUMBER
C-1.1



SCALE: 1" = 60'

⊗ SAMPLE LOCATION

SURVEY NOTES

SOUNDINGS ARE SHOWN TO THE NEAREST FOOT AND TENTHS OF A FOOT.

SOUNDINGS ARE REFERENCED TO THE DATUM OF MEAN LOWER LOW WATER USING PACIFIC AFFILIATES TIDAL POINT, TIED BY SURVEY TO USGS BRASS DISK "1940" LOCATED IN THE CONCRETE SEA WALL, USCG STATION HUMBOLDT BAY, ELEVATION 14.28' MLLW.

HORIZONTAL CONTROL IS BASED UPON CALIFORNIA STATE PLANE COORDINATE SYSTEM, LAMBERT CONFORMAL PROJECTION, ZONE 1.

HYDROGRAPHIC SOUNDINGS SURVEYED JUNE 22, 2004 (HIGH TIDE).

EXACT PIER ALIGNMENT UNKNOWN. ALIGNMENT DETERMINED FROM MAPPING PROVIDED BY THE CITY OF EUREKA JULY 8, 2004

REVISIONS	BY

PACIFIC AFFILIATES
A CONSULTING ENGINEERING GROUP
998 WEST WATERFRONT DRIVE
EUREKA, CA 95501

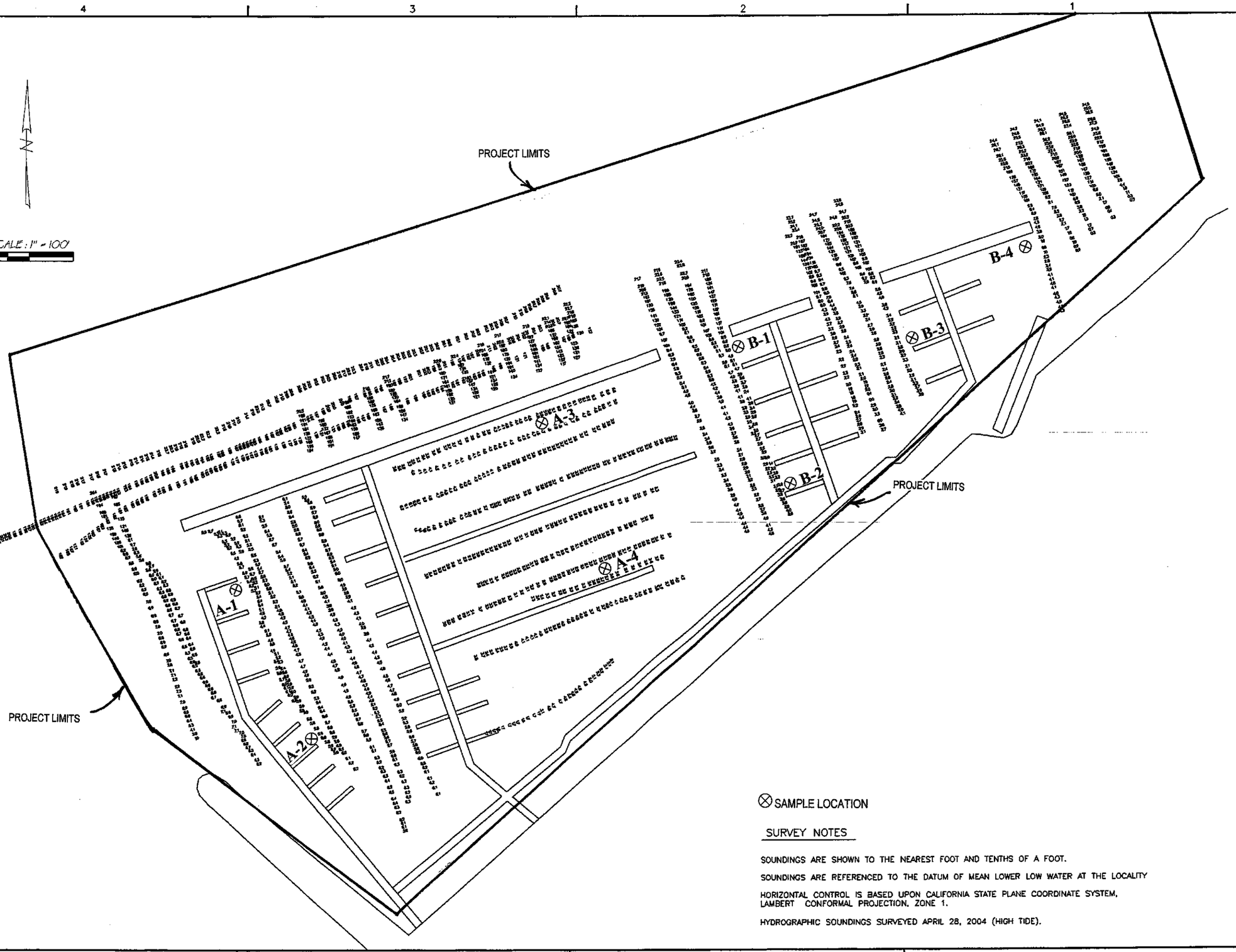
ENGINEER
DAVID L. SCHNEIDER
990 WEST WATERFRONT DRIVE
EUREKA, CA 95501
(707) 445-3001

CONDITIONAL SURVEY

CITY OF EUREKA
MAINTENANCE DREDGING
FISHERMAN'S TERMINAL
EUREKA, CA 95501

Survey Date: June 22, 2004
Scale: 1"=60' U.O.N.
Drawn by: Travis Schneider

SHEET NUMBER
C-1.1



⊗ SAMPLE LOCATION

SURVEY NOTES

SOUNDINGS ARE SHOWN TO THE NEAREST FOOT AND TENTHS OF A FOOT.

SOUNDINGS ARE REFERENCED TO THE DATUM OF MEAN LOWER LOW WATER AT THE LOCALITY

HORIZONTAL CONTROL IS BASED UPON CALIFORNIA STATE PLANE COORDINATE SYSTEM, LAMBERT CONFORMAL PROJECTION, ZONE 1.

HYDROGRAPHIC SOUNDINGS SURVEYED APRIL 28, 2004 (HIGH TIDE).

REVISIONS	BY

PACIFIC AFFILIATES
A CONSULTING ENGINEERING GROUP
990 WEST WATERFRONT DRIVE
EUREKA, CA 95501

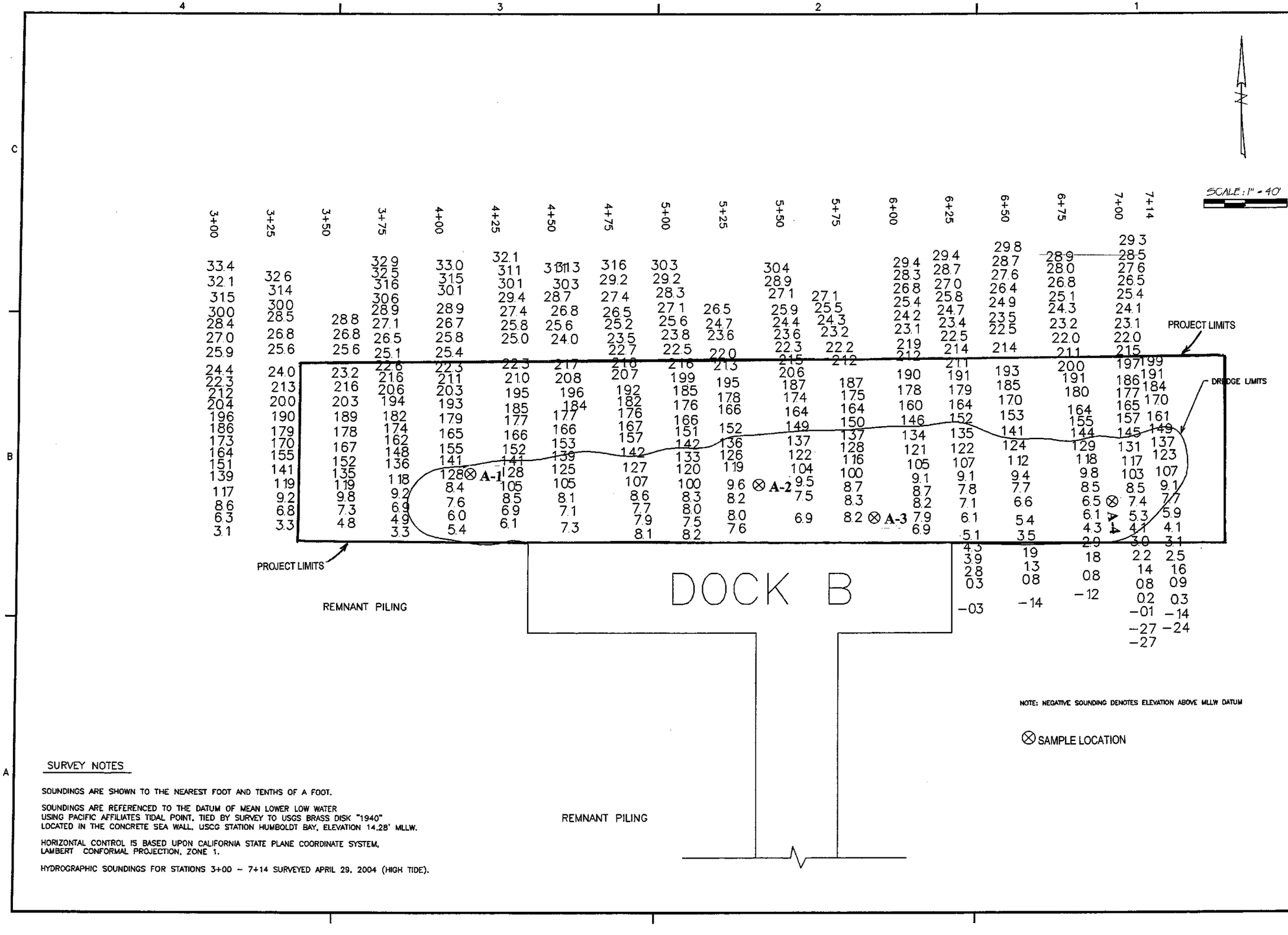
ENGINEER
DAVID L. SCHNEIDER
990 WEST WATERFRONT DRIVE
EUREKA, CA 95501
(707) 445-3001

CONDITIONAL SURVEY

CITY OF EUREKA
MAINTENANCE DREDGING
BOAT BASIN
EUREKA, CA 95501

Survey Date: April 29, 2004
Scale: 1"=100' U.O.N.
Drawn by: Travis Schneider

SHEET NUMBER
C-1.1



NOTE: NEGATIVE SOUNDING DENOTES ELEVATION ABOVE MLLW DATUM

⊗ SAMPLE LOCATION

SURVEY NOTES

SOUNDINGS ARE SHOWN TO THE NEAREST FOOT AND TENTHS OF A FOOT.

SOUNDINGS ARE REFERENCED TO THE DATUM OF MEAN LOWER LOW WATER USING PACIFIC AFFILIATES TIDAL POINT, TIED BY SURVEY TO USGS BRASS DISK "1940" LOCATED IN THE CONCRETE SEA WALL, USCG STATION HUMBOLDT BAY, ELEVATION 14.28' MLLW.

HORIZONTAL CONTROL IS BASED UPON CALIFORNIA STATE PLANE COORDINATE SYSTEM, LAMBERT CONFORMAL PROJECTION, ZONE 1.

HYDROGRAPHIC SOUNDINGS FOR STATIONS 3+00 ~ 7+14 SURVEYED APRIL 29, 2004 (HIGH TIDE).

REVISIONS | BY

PACIFIC AFFILIATES
A CONSULTING ENGINEERING GROUP
990 WEST WATERFRONT DRIVE
EUREKA, CA 95501

ENGINEER
DAVID L. SCHNEIDER
990 WEST WATERFRONT DRIVE
EUREKA, CA 95501
(707) 445-3001

CONDITIONAL
BATHYMETRIC SURVEY

CITY OF EUREKA
DOCK 'B'

Survey Date:
April 29, 2004
Scale:
1"=40' U.O.N.
Drawn by:
Travis Schneider

SHEET NUMBER
C-1.1

CITY OF EUREKA

and

HUMBOLDT BAY HARBOR, RECREATION AND CONSERVATION DISTRICT

COOPERATIVE EUREKA WATERFRONT FACILITES MAINTENANCE DREDGING PROJECT

EUREKA CHANNEL, HUMBOLDT BAY, CALIFORNIA

◆❖◆

SAMPLING RESULTS REPORT

for

DIOXIN/FURANS, PCP AND PCB TESTING

PREPARED BY:

PACIFIC AFFILIATES, INC.
A CONSULTING ENGINEERING GROUP
990 W. Waterfront Drive
Eureka, CA 95501
◆
(707) 445-3001

EXHIBIT NO. **10**
APPLICATION NO.
1-05-039 (HUMBOLDT BAY)
EXCERPTS, SAMPLING RESULTS REPORT
(Page 1 of 31)

DECEMBER, 2005

ANNUAL BIOLOGICAL MONITORING REPORT
HARBOR DISTRICT AND CITY OF EUREKA
MAINTENANCE DREDGING PROJECT
SAMOA BEACH, HUMBOLDT COUNTY, CA

1.0 EXECUTIVE SUMMARY

- Approximately 226, 238 cubic yards of dredged materials were pumped via floating pipeline across the bay to the Samoa Peninsula and discharged across the exposed sand beach between January and May, 1998. The discharge pipe was located on the beach just above the high tide line, at approximate latitude of 40° 49' 20" N, longitude 124° 11' 20' W (Figure 1).

- Three transects were established to determine the species composition and abundance of sand beach animals in the immediate area of the dredged materials discharged, at a location nearby, and at a control site some distance south of the discharge point.

- In both pre- and post-discharge periods, the beach fauna was dominated in species composition and numerically by the burrowing crustacean *Excirolana linguifrons* and the burrowing marine worm *Euzonus williamsi* .

- The abundance of burrowing isopods (*Excirolana linguifrons*) and the marine worm *Euzonus williamsi* appears to have been much less in 1988 than we collected in 1998. The abundance of other sand beach animals was comparable in 1988 and 1998.

- Dredged materials were still being discharged across the disposal site during the April sampling interval. All three sites had been affected by winter storm beach erosion. Additionally, the presence of hydrogen sulfide at the discharge transect influenced both occurrence and abundance of animals.

- In the May sampling period we noted a gradual increase in species occurrence and abundance. The severe winter storms that had caused significant erosion on the Samoa Peninsula beaches were no longer a dominant environmental factor.

- In June and July sampling, we encountered about the same number of species at the three sites, but the control site had the highest number of species (11) of the three. Many small *Euzonus williamsi* were collected and it was noted that several of the mole crabs (*Emerita analoga*) were bearing egg masses.

- By the August sampling period the three sites were approaching a level of faunal similarity approximating that found in the January pre-discharge sampling. The reappearance of mole crabs (*Emerita analoga*) in August samples at all three transects and its abundance at the discharge transect indicated that little residual biological effect of dredge spoil disposal could be detected at the discharge point.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

INTRODUCTION

On behalf of the Humboldt Bay Harbor, Recreation and Conservation District (HBHRCD) and the City of Eureka, Pacific Affiliates and MFG/Tetra Tech collected 55 sediment core samples from the 11 Eureka Waterfront moorage facilities and Woodley Island Marina slated for maintenance dredging between November 4th and November 14th, 2005. Composite samples from all 12 sites slated for dredging were tested for polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofuran (PCDF) also known as dioxins/furans and pentachlorophenol (PCP). Three of the sites, Coast Seafoods Dock, Fisherman's Terminal and 'F' Street Dock, were also tested for polychlorinated biphenyls (PCBs). The beach disposal site was tested for dioxins/furans, PCBs, PCP, and grain size distribution.

California Coastal Commission (CCC) and the U.S. Environmental Protection Agency (EPA) Sediment and Dredging Management Team staffs have requested that the sites be tested for dioxins/furans and PCPs in response to the Humboldt Baykeepers and the Surfriders Foundation concerns that were raised at the California Coastal Commission hearing, held in Eureka, California on September 14th, 2005.

Composite samples from all 13 sites, including the beach disposal site, were tested in February 2005 (see Sediment Sampling Analysis, April 1, 2005) and Coast Seafoods Dock was sampled for the second time on September 25th, 2005 for PCBs. Three sites where PCBs were detected (regardless of the levels) were tested again for PCBs in this sediment sampling event.

The Sediment Sampling and Analysis Plan (SAP) for this investigation was approved on November 3rd, 2005 by the EPA and the U.S. Army Corps of Engineers (ARCOE). The SAP was reviewed by Dr. Jack Gregg of the CCC Water Quality Unit, Clyde Davis of the ARCOE and Brian Ross of the EPA Sediment and Dredging Management Team. Changes made to the SAP are provided in Appendix A.

It has been proposed to pump the dredge spoils directly to a site on the Samoa Peninsula for dispersion in the surf zone of the Pacific Ocean. This method was previously employed for maintenance dredging of Humboldt Bay sites in 1988 and 1996. The results from this testing will be used to verify that the material slated for dredging is adequate for ocean disposal.

SAMPLING METHODOLOGY

Core samples were collected to a depth of 6" below the project depth. The core lengths collected are specified in the Sediment Testing Site Descriptions section. Any deviations from the approved core lengths specified in the SAP are also listed in the Sediment Testing Site Descriptions section. Core lengths were calculated from the 2004 hydrographic surveys shown in Appendix D.

Samples were collected from a barge, designed by Pacific Affiliates, equipped with all necessary sampling and compositing equipment. The equipment on the barge included a working bench, decontamination equipment, a winch, a 2" diameter core sampler kit, safety equipment and ice filled coolers to store the samples.

The sampling kit designed by AMS includes a 1' long steel sampling tubes of 2" diameter, 4' long extensions of 5/8" diameter, and two types of core catchers including an auger bucket with open blades and a butterfly valve core tip. In most cases the butterfly catcher was used. While the core was collected and pushed into the sampler, the butterfly core catcher was used to slice along the longitudinal axis before the sample was retrieved from within the sampler and prevented the sediment from falling out of the sampler.

A 3" PVC pipe was used to collect deeper core samples (longer than 4'). The pipe was pushed to the required core depth and remained in place until the entire core length was retrieved. The 2" sampler was then inserted into the PVC pipe and was penetrated through the sediment numerous times until the entire core length was retrieved.

MFG/TetraTech personnel composited the core samples on the sampling barge. Samples that were not taken with the butterfly core tip were sliced along the longitudinal axis. The core samples were pushed out of the sampler with a plunger into the trough located on the working bench. Representative sediment of the entire core length, excluding the bottom 6" below the project depth, was put in a decontaminated 1-gallon bucket for compositing with other core samples. When compositing was complete the sample was labeled and put in a lab supplied 4-ounce jar and placed in an iced filled cooler. Representative sediment of the other half of the core sample and sediment from 6" below the project depth were each archived separately in lab supplied 4-ounce jars for future analysis. After each core sample was collected, the sampling equipment and the working area were decontaminated.

Sampling locations were recorded with a GPS to the nearest 2'. All sampling point locations are referenced to the NAD 83 datum.

LABORATORY ANALYSIS

Severn Trent Laboratories (STL) in Sacramento conducted the testing of the composite sediment samples for dioxins/furans, PCBs and PCP. LACO Associates in Eureka tested the beach samples for grain size analysis.

Dioxins/Furans Test Methods

The purpose of the testing was to quantify for dioxins/furan concentrations in the sediment. The procedure selected for the analysis was EPA Method 8290. This method provides procedures for detection and quantitative measurements of polychlorinated dibenzo-p-dioxins (tetra through octachlorinated isomers; PCDDs), and polychlorinated dibenzofurans (tetra–through octachlorinated isomers); PCDF at part-per-trillion (ppt) to part-per-quadrillion (ppq) concentrations (EPA, Method 8290). STL reduced the final extract volume from 20 microliters (µL) to 10µL to achieve the requested quantitation limit of 2.5 ppt for the penta-hepta chlorination levels. This reduction in final extract volume resulted in quantitation limits of 0.5 ppt for tetra chlorinated levels and 5.0 ppt for OCDD/OCDF.

The Toxic Equivalents (TEQs) were calculated and reported two ways based on the chemistry results. Using the first method, a "detection" TEQ was calculated based on the quantified concentrations. The second method involved calculations of "overall" TEQs, which are based on including one-half (1/2) of the detection limit for all non-detected isomers, before applying the World Health Organization (WHO) Toxicity Equivalency Factors (TEFs) (see Appendix B for TEF values and SAP for Method 8290 Procedure).

PCB Test Methods

The purpose of this test is to determine the concentrations of polychlorinated biphenyls (PCBs) as Aroclors in extracts from a solid matrix. The procedure selected for the analysis is EPA Method 8082 by Gas Chromatography and EPA method 3550 for sample preparation (see SAP for Methods 8082 and 3550 procedures). This method allows for detection of PCBs at parts-per-billion (ppb) with a detection limit of 33 ppb (wet weight).

PCP Test

The purpose of this test is to determine concentrations of the compound pentachlorophenol (PCP) in extracts from a solid matrix. The procedure selected for analysis is EPA Method 8151A, chlorinated herbicides by gas chromatography (GC), using methylation or pentafluorobenzylation derivatization. This method allows for detection of PCP at ppb with a detection limit of 20 ppb.

Grain Size Distribution Test

Both Beach samples were analyzed for grain size distribution. The purpose of the test is to determine the grain size distribution of the material at the beach disposal site. For sediments with both fine and coarse-grained materials a combined analysis is performed using both the sieve and hydrometer procedures (ASTM D422). In the hydrometer analysis, the sediment smaller than No. 200 sieve is placed in suspension and by use of Stokes' equation the percent of grain size distribution is calculated. ASTM C136 is used to determine the grain size distribution of the sample portion greater than No. 200 sieve (sand).

Testing Results Acronyms

In the laboratory supplied testing results submitted by STL to Pacific Affiliates several acronyms are placed to the right of the result number (see Appendix B). The laboratory flags used are as follows:

a - Spiked analyte recovery is outside stated control limits.
CON – Confirmation Analysis
G – Elevated reporting limits. The reporting limit is elevated due to matrix interference.
J – Estimated result, result is less than the reporting limit.
JA – The analyte was positively identified, but the quantitation is an estimate.
ND – Non detect

QUALITY CONTROL DATA VALIDATION

Three Laboratory reports were submitted by STL to Pacific Affiliates (see Appendix B) and were validated by MFG/Tetra Tech and Pacific Affiliates staff. A copy of the Laboratory Report Evaluation Checklist can be found in the SAP. All laboratory QC batches were checked to ensure that the correct number of samples were analyzed, the holding times were not exceeded, surrogates recoveries were within stated control limits, and that Laboratory Method Blank, Matrix Spikes (MS), Matrix Spike Duplicates (MSD), Laboratory Control Samples (LCS) and Laboratory Control Sample Duplicates (LCSD) were all tested and within the acceptable limits.

Several comments were provided in the narrative section of the laboratory report including failure of the MS/MSD for the 1,2,3,7,8,9-HxCDF isomer, flagging of several isomers as "JA", OCDD recoveries in MS/MSD and Matrix interference for dioxins testing per method 8290. MS/MSD associated with two extraction batches that included 13 samples tested for dioxins/furans have recoveries outside of the established control limits for 1,2,3,7,8,9-HxCDF. Acceptable LCS data demonstrate that the analytical system is within QC limits. This anomaly is most likely matrix-related to the non-homogenous nature of the sediment

(Appendix B, STL Project Numbers G5K100136 and G5K110245). The recoveries for OCDD were not calculated in the MS/MSD associated with seven samples as the level of this compound in the parent sample is inappropriate relative to the spike concentration and non-homogeneity of the matrix. Acceptable LCS data demonstrate that the analytical system within QC limits (Appendix B, STL Project Number G5K150224). In addition, the isomers 2,3,7,8-TCDD or 2,3,7,8-TCDF have been designated with the "JA" qualifier due to the ion abundance ratios being outside of criteria (Appendix B, STL Project Number G5K100136). The isomer 1,2,3,4,6,7,8-HpCDF has also been designated with the "JA" qualifier in a separate batch (Appendix B, STL Project Number G5K110245). The isomers have been qualified as "positively identified, but at an estimated quantity" because the quantitation is based on the theoretical ratios for these samples. Several isomers have also been designated with the "JA" qualifier in three samples from the last batch (see Appendix B, STL Project Number G5K150224 - Samples 3, 4 and 5). In addition, due to matrix interference the detection limits for 2,3,7,8-TCDD in one sample from this batch were elevated.

In the PCP analysis per method 8151A, the recovery of the surrogate 2,4-dichlorophenylacetic acid is above the established control limits for the composite sample from Commercial Street Dock (see Appendix B, STL Project Number G5K110245-). As the sample is non-detect for the target analyte, PCP, there is no adverse impact upon the data. In addition, insufficient volume was available for MS/MSD in seven samples (one batch). A laboratory LCS/LCSD was prepared instead (see Appendix B, STL Project Number G5K150224). All seven samples in this batch were initially analyzed on November 29th, 2005. However, when the data was processed through technical review, matrix interference was observed in the chromatograms, which necessitated dilution of these extracts. The extracts of these samples required 10-50 times dilution. All reporting limits have been adjusted accordingly. As a result, most surrogates have recoveries outside of the established control limits.

Review of the data by MFG/Tetra Tech and Pacific Affiliates staff indicate that all of the samples were prepared and analyzed within the specified holding times in the SAP and were received in good condition by the laboratory. There were no other anomalies associated with this project.

SEDIMENT TESTING SITE DESCRIPTIONS

All sediment testing site descriptions provided in this section are accompanied by the hydrographic surveys that include the dredging limit, project limit and the sampling locations provided in Appendix D.

SITE # 1 – DOCK 'B'

Four locations were sampled at Dock 'B'. The date/time of core retrieval, core depth, and sampling locations are shown in Table 1.

Core sample A-1 was collected 10' from the dock's face instead of 27' from the dock's face, as specified in the approved SAP, due to strong tides and currents in Humboldt Bay. Core sample A-3 was taken 15' from the dock's face instead of 20' from the dock's face as approved in the SAP because the sampling team was unable to penetrate the sediment to the required core depth, 6.4' (including six inches below project depth) at the approved location. The required core depth was achieved at the reported location. Core samples A-2 and A-4 were collected at the approved locations.

The sample 1-A-1 was composited 4:1 in the field. The composite sample 1-A-1 from Dock 'B' was received by STL on November 15th, 2005 and was prepared for dioxin/furans analysis (Method 8290) on November 23rd, 2005 and for PCP analysis (Method 8151A) on November 22nd, 2005.

Table 1: Core samples collected at Dock 'B'.

Composite I.D.	Core Sample I.D.	Collection		Core Length (feet)	Location	
		Date	Time		Latitude	Longitude
1-A-1	A-1	11-10-05	23:00	4.5	40° 48' 04.29797" N	124°10' 58.75307" W
	A-2	11-10-05	23:30	5.4	40° 48' 04.91620" N	124° 10' 58.25612" W
	A-3	11-11-05	00:20	5.9	40° 48' 05.48921" N	124° 10' 57.65750" W
	A-4	11-11-05	00:45	6.5	40° 48' 06.08582" N	124° 10' 57.10060" W

SITE # 2 – SMALL BOAT BASIN

Eight locations were sampled at the Small Boat Basin. The date/time of core retrieval, core depth, and sampling locations are shown in Table 2.

Core sample A-4 was collected approximately 100' northwest of the approved sampling location. Two attempts were made to collect the core sample from the approved location; however, rocks and/or concrete piling were encountered at that location. The core length obtained was 5.5'. The current depth at the actual sampling location is -5.6' Mean Lower Low Water (MLLW), which is one foot deeper than at the approved sampling location. The core sample collected penetrated into a sand layer and a deeper sample could not be obtained. All other sampling points were taken from the approved sampling locations as designated in the SAP.

Two composite samples 2-A-1 and 2-A-2 were composited 4:1 in the field and were analyzed for dioxin/furans and PCBs. Composite sample 2-A-1 and 2-B-1 were received by STL on November 23rd and November 11th, 2005 respectively, and were prepared for dioxin/furans analysis (Method 8290) and for PCP analysis (Method 8151A) on November 22nd and November 21st, 2005 respectively.

Table 2: Core samples collected at the Small Boat Basin.

Composite I.D.	Core Sample I.D.	Collection		Core Length (feet)	Location	
		Date	Time		Latitude	Longitude
2-A-1	A-1	11-11-05	12:22	3.8	40° 48' 11.46478" N	124° 10' 44.96572" W
	A-2	11-11-05	12:44	3.1	40° 48' 9.08049" N	124° 10' 43.03373" W
	A-3	11-11-05	15:05	4.3	40° 48' 11.31827" N	124° 10' 40.24658" W
	A-4	11-11-05	14:38	5.5	40° 48' 13.59708" N	124° 10' 39.90963" W
2-B-1	B-1	11-10-05	01:30	4.0	40° 48' 14.0555" N	124° 10' 38.30124" W
	B-2	11-10-05	01:50	4.4	40° 48' 12.50898" N	124° 10' 37.44479" W
	B-3	11-9-05	13:19	5.9	40° 48' 14.04502" N	124° 10' 35.90682" W
	B-4	11-9-05	12:49	5.0	40° 48' 15.22452" N	124° 10' 34.36032" W

SITE # 3 – COMMERCIAL STREET DOCK

Three locations were sampled at Commercial Street Dock. The date/time of core retrieval, core depth, and sampling locations are shown in Table 3. All core samples were collected at the specified locations as stated in the approved SAP.

The sample 3-A-1 was composited 3:1 in the field. The composite sample 3-A-1 from Commercial Street Dock was received by STL laboratory on November 11th, 2005. The sample was prepared for dioxin/furans analysis (Method 8290) and for PCP analysis (Method 8151A) on November 21st, 2005.

Table 3: Core samples collected at Commercial Street Dock.

Composite I.D.	Core Sample I.D.	Collection		Core Length (feet)	Location	
		Date	Time		Latitude	Longitude
3-A-1	A-1	11-10-05	00:50	7.0	40° 48' 17.52595" N	124° 10' 27.56415" W
	A-2	11-10-05	00:10	9.0	40° 48' 18.03403" N	124° 10' 25.36151" W
	A-3	11-10-05	00:30	7.0	40° 48' 17.76994" N	124° 10' 26.50639" W

SITE # 4 – COAST SEAFOODS DOCK

Three locations were sampled at Coast Seafoods Dock. The date/time of core retrieval, core depth, and sampling locations are shown in Table 4. All core samples were collected at the specified locations as stated in the approved SAP.

Two composite samples were sent for analysis. Composite Sample 4-A-1 consisted of a single sample from core A-1 and was analyzed for dioxins/furans and PCP. Composite Sample 4-B-1 was composited 2:1 in the field from core samples A-2 and A-3 and was analyzed for dioxin/furans, PCBs and PCP. Composite samples 4-A-1 and 4-B-1 from Coast Seafoods Dock were received by STL laboratory on November 15th, 2005 and were prepared for dioxin/furans analysis (Method 8290) on November 23rd, 2005, for PCP analysis (Method 8151A) on November 22nd, 2005. Sample 4-B-1 was prepared for PCB analysis (Method 8082) on November 21st, 2005.

Table 4: Core samples collected at Coast Seafoods Dock.

Composite Sample I.D.	Sample I.D.	Collection		Core Length (feet)	Location	
		Date	Time		Latitude	Longitude
4-A-1	A-1	11-10-05	13:20	5.0	40° 48' 18.75642" N	124° 10' 22.51553" W
4-B-1	A-2	11-10-05	12:30	9.4	40° 48' 18.94154" N	124° 10' 21.59590" W
	A-3	11-10-05	12:00	9.5	40° 48' 18.84771" N	124° 10' 22.06202" W

SITE # 5 – FISHERMAN'S TERMINAL

Four locations were sampled at the Fisherman's Terminal. The date/time of core retrieval, core depth, and sampling locations are shown in Table 5. All core samples were collected at the specified locations as stated in the approved SAP.

The sample 5-A-1 was composited 4:1 in the field. The composite sample 4-A-1 from Fisherman's Terminal was received by STL laboratory on November 15th, 2005 and was prepared for dioxin/furans analysis (Method 8290) on November 23rd, 2005, for PCP analysis (Method 8151A) on November 22nd, 2005. Sample 5-A-1 was prepared for PCB analysis (Method 8082) on November 21st, 2005.

Table 5: Core samples collected at Fisherman's Terminal Dock.

Composite Sample I.D.	Sample I.D.	Collection		Core Length (feet)	Location	
		Date	Time		Latitude	Longitude
5-A-1	A-1	11-10-05	02:15	5.6	40° 48' 19.87294" N	124° 10' 16.60154" W
	A-2	11-11-05	01:15	9.6	40° 48' 20.11417" N	124° 10' 15.47495" W
	A-3	11-11-05	02:00	9.0	40° 48' 20.36881" N	124° 10' 14.28577" W
	A-4	11-11-05	02:25	8.4	40° 48' 20.77085" N	124° 10' 12.40813" W

SITE # 6 – 'F' STREET FLOATING DOCK

Two locations were sampled at the 'F' Street Dock. The date/time of core retrieval, core depth, and sampling locations are shown in Table 6. All core samples were collected at the specified locations as stated in the approved SAP.

The sample 6-A-1 was composited 2:1 in the field. The composite sample 6-A-1 from 'F' Street Floating Dock was received by STL laboratory on November 9th, 2005. Composite sample 6-A-1 was analyzed for dioxins/furans, PCBs and PCP. The sample was prepared for dioxin/furans analysis (Method 8290) and PCB analysis (Method 8082) on November 21st, 2005 and for PCP analysis (Method 8151A) on November 15th, 2005.

Table 6: Core samples collected at 'F' Street Floating Dock.

Composite Sample I.D.	Sample I.D.	Collection		Core Length (feet)	Location	
		Date	Time		Latitude	Longitude
6-A-1	A-1	11-08-05	10:30	3.7	40° 48' 21.89385" N	124° 10' 02.87573" W
	A-2	11-08-05	09:50	1.2	40° 48' 21.96376" N	124° 10' 02.03142" W

SITE # 7 – I STREET DOCK

Four locations were sampled at the I Street Dock. The date/time of core retrieval, core depth, and sampling locations are shown in Table 7.

Core samples A-1 and A-2 were collected at locations 25' from the dock's face instead of 45' from dock's face as specified in the approved SAP due to strong tides and currents in Humboldt Bay. The current depth at the new sampling locations A-1 is -3.4' MLLW. The depth at the new sampling point A-1 is 4.0' shallower than the approved sampling location. Core sample A-2 was taken from a depth of -6.5' MLLW which is approximately one-foot shallower than the approved sampling depth. Sample A-3 was collected 50' from the dock's face instead of 90' from the dock's face as approved in the SAP where the current elevations differ by one-foot. Sample A-4 was collected at the location and depth specified in the SAP.

Composite sample 7-A-1 was composited 4:1 in the field. The composite sample 7-A-1 from I Street Dock was received by STL laboratory on November 11th, 2005. The sample was prepared for dioxin/furans analysis (Method 8290) and for PCP analysis (Method 8151A) on November 21st, 2005.

Table 7: Core samples collected at 'I' Street Dock.

Composite Sample I.D.	Sample I.D.	Collection		Core Length (feet)	Location	
		Date	Time		Latitude	Longitude
7-A-1	A-1	11-08-05	20:30	9.0	40° 48' 21.94586" N	124° 09' 48.40795" W
	A-2	11-08-05	21:40	9.2	40° 48' 22.93474" N	124° 09' 48.00033" W
	A-3	11-09-05	12:00	4.3	40°48' 22.18594" N	124° 09' 46.76234" W
	A-4	11-09-05	10:10	7.9	40° 48' 22.19992" N	124° 09' 46.47244" W

SITE # 8 – J STREET DOCK

Two locations were sampled at the J Street Dock. The date/time of core retrieval, core depth, and sampling locations are shown in Table 8. All core samples were collected at the specified locations as stated in the approved SAP.

The sample 8-A-1 was composited 2:1 in the field. The composite sample 8-A-1 from the J Street Dock was received by STL laboratory on November 9th, 2005. The sample was prepared for dioxin/furans analysis (Method 8290) on November 21st, 2005 and for PCP analysis (Method 8151A) on November 15th, 2005.

Table 8: Core samples collected at J Street Dock.

Composite Sample I.D.	Sample I.D.	Collection		Core Length (feet)	Location	
		Date	Time		Latitude	Longitude
8-A-1	A-1	11-04-05	19:45	5.2	40° 48' 22.77394" N	124° 09' 45.61189" W
	A-2	11-04-05	20:20	5.4	40° 48' 22.72642" N	124° 09' 44.28592" W

SITE # 9 – ADORNI CENTER

Two locations were sampled at the Adorni Center. The date/time of core retrieval, core depth, and sampling locations are shown in Table 9. All core samples were collected at the specified locations as stated in the approved SAP.

The composite sample 9-A-1 was composited 2:1 in the field. The composite sample 9-A-1 from Adorni Center was received by STL laboratory on November 11th, 2005. The sample was prepared for dioxin/furans analysis (Method 8290) on November 21st, 2005 and for PCP analysis (Method 8151A) on November 15th, 2005.

Table 9: Core samples collected at Adorni Center.

Composite Sample I.D.	Sample I.D.	Collection		Core Length (feet)	Location	
		Date	Time		Latitude	Longitude
9-A-1	A-1	11-04-05	18:30	2.8	40° 48' 22.76331" N	124° 09' 40.56340" W
	A-2	11-04-05	19:00	3.9	40° 48' 22.71214" N	124° 09' 39.83742" W

SITE # 10 – BONNIE GOOL GUEST DOCK

Four locations were sampled at the Bonnie Gool Guest Dock. The date/time of core retrieval, core depth, and sampling locations are shown in Table 10. Core samples A-1 and A-2 were collected on the channel side of the dock (north side). Core samples A-3 and A-4 were collected behind the dock around the gangway system. All samples were taken at the locations designated in the approved SAP.

Composite sample 10-A-1 and 10-B-1 were composited 2:1 in the field. The composite samples 10-A-1 and 10-B-1 from Bonnie Gool Guest Dock were received by STL laboratory on November 9th, 2005. The samples were prepared for dioxin/furans analysis (Method 8290) on November 21st, 2005 and for PCP analysis (Method 8151A) on November 15th, 2005.

Table 10: Core samples collected at Bonnie Gool Guest Dock.

Composite Sample I.D.	Sample I.D.	Collection		Core Length (feet)	Location	
		Date	Time		Latitude	Longitude
10-A-1	A-1	11-06-05	21:06	1.6	40° 48' 24.29428" N	124° 09' 34.17931" W
	A-2	11-06-05	20:21	3.7	40° 48' 24.66295" N	124° 09' 32.46017" W
10-B-1	A-3	11-06-05	19:30	1.0	40° 48' 23.95425" N	124° 09' 33.58165" W
	A-4	11-06-05	19:54	1.0	40° 48' 24.11623" N	124° 09' 32.84399" W

SITE # 11 – SAMOA BRIDGE LAUNCH RAMP

One core sample A-1 was collected at the Samoa Bridge Launch Ramp on November 6th, 2005. Composite sample 11-A-1 consisted of a single core. Composite sample 11-A-1 was received by STL Laboratory on November 9th, 2005. To reach project depth of -5.0' MLLW, the required core length was 1.6'. The sample was collected at the location designated in the approved SAP. The coordinates of the sample location are 40° 48' 30.09973" N and 124° 09' 15" W.

The composite sample 11-A-1 was received by STL Laboratories on November 9th, 2005 and was prepared for dioxin/furans analysis (Method 8290) on November 21st, 2005 and for PCP analysis (Method 8151A) on November 15th, 2005.

SITE # 12 – WOODLEY ISLAND MARINA

Sixteen locations were sampled at the Woodley Island Marina. The date/time of core retrieval, core depth, and sampling locations are shown in Table 11.

Core sample B-2 was collected 10' west of the approved sampling location (see Appendix D, Hydrographic Surveys). Two attempts were made to collect the core sample from the approved location; however, rocks and concrete pilings were encountered at that location. The core length obtained was 2.5' and a representative split from the entire core length was included in the composite sample and sent for analysis.

Core sample C-1 and C-3 were collected 10' west and 15' east of the approved location, respectively. Two attempts were made to collect each sample from the approved location; however, rocks and concrete pilings were encountered at those locations. The current depth at the new sampling locations is approximately the same as at the approved sampling locations. Core lengths C-1 and C-3 retrieved were 5.6' and 5.5' as indicated in the SAP (Table 11).

Core sample D-1 was collected 20' west and 10' north of the approved location. Two attempts were made to collect the sample from the approved location; however, rocks and concrete pilings were encountered at that location. The core length obtained was 3.5' long which is 0.8' shorter then the required core length. The current depth at the new sampling locations is approximately the same as at the approved sampling locations. A representative split from the entire core length was included in the composite sample and sent for analysis.

The remaining core samples were collected at the approved locations as indicated in Table 11 below. Four samples were composited 4:1 in the field and were analyzed for dioxin/furans and PCBs. Composite samples 12-A-1 and 12-B-1 were received by STL Laboratories on November 15th, 2005. The samples were prepared for dioxin/furans analysis (Method 8290) and for PCP analysis (Method 8151A) on November 21st, 2005. Composite samples 12-C-1 and 12-D-1 were received by STL on November 9th, 2005. The samples were prepared for dioxin/furans analysis (Method 8290) on November 21st, 2005 and for PCP analysis Method 8151A) on November 15th 2005.

Table 11: Core samples collected at Woodley Island Marina

Composite I.D.	Core Sample I.D.	Collection		Obtained Core Length (feet)	Location	
		Date	Time		Latitude	Longitude
12-A-1	A-1	11-08-05	23:45	2.2	40° 48' 25.27570" N	124° 09' 59.82348" W
	A-2	11-08-05	23:30	3.9	40° 48' 27.46837" N	124° 09' 59.91542" W
	A-3	11-09-05	00:10	3.8	40° 48' 25.41356" N	124° 09' 53.36709" W
	A-4	11-09-05	01:00	4.3	40° 48' 27.89311" N	124° 09' 53.54260" W
12-B-1	B-1	11-07-05	23:30	5.2	40° 48' 25.56858" N	124° 09' 50.51911" W
	B-2	11-07-05	00:00	4.4	40° 48' 27.77290" N	124° 09' 50.65381" W
	B-3	11-08-05	22:45	4.3	40° 48' 28.24361" N	124° 09' 47.86910" W
	B-4	11-07-05	23:00	6.0	40° 48' 25.64236" N	124° 09' 47.72540" W
12-C-1	C-1	11-07-05	20:50	5.6	40° 48' 28.30847" N	124° 09' 45.13980" W
	C-2	11-07-05	21:15	6.4	40° 48' 25.69076" N	124° 09' 45.06631" W
	C-3	11-07-05	20:20	5.5	40° 48" 28.40286" N	124° 09' 41.22928" W
	C-4	11-07-05	21:40	4.2	40° 48' 25.79749" N	124° 09'41.00350" W
12-D-1	D-1	11-07-05	19:40	3.5	40° 48' 29.01502" N	124° 09' 37.94514" W
	D-2	11-07-05	22:10	4.0	40° 48' 26.34060" N	124° 09' 36.98820" W
	D-3	11-06-05	22:05	1.6	40° 48' 29.63900" N	124° 09' 35.06930" W
	D-4	11-06-05	22:50	4.0	40° 48' 26.96225" N	124° 09' 34.17566" W

SITE # 13 – BEACH DISPOSAL SITE

Two grab samples were collected in the vicinity of the near shore beach disposal site. The first core sample, A-1, was collected in the intertidal zone and the second core sample A-2 was collected in the subtidal zone. The date/time of core retrieval, core depth, and sampling locations are shown in Table 12.

The composite sample 13-A-1 and 13-B-1 were received by STL laboratory on November 15th, 2005. The samples were prepared for dioxin/furans analysis (Method 8290) on and for PCP analysis Method 8151A) on November 23rd, 2005.

Table 12: Core samples collected at Samoa beach disposal site.

Composite I.D.	Core Sample I.D.	Collection		Location	
		Date	Time	Latitude	Longitude
13-A-1	A-1	11-15-05	15:20	40° 49' 37.45000" N	124° 11' 16.66841" W
13-B-1	A-2	11-15-05	15:15	40° 49' 39.76588" N	124° 11' 15.35662" W

RESULTS

Dioxins/Furans Results

Dioxin/furan concentrations based on the quantitated concentrations are shown in Table 13. The quantitated results range between 0.78 ppt (pg/g) at Woodley Island Marina and a high of 6.03 ppt at the Coast Seafoods Dock. Dioxin/furan concentrations at all sites excluding Coast Seafoods Dock were below 3.5 ppt. All TEQ calculations and data received from STL Laboratory are presented in Appendix B.

Table 13: Dioxin/Furans test results (pg/g, ppt) for 11 Eureka Waterfront Sites, Woodley Island Marina and Beach disposal site.

Sample I.D.	Site	2,3,7,8-TCDD TEQ	"Overall"[A] 2,3,7,8-TCDD TEQ
1-A-1	Dock 'B'	0.80	2.81
2-A-1	Small Boat Basin	2.04	3.74
2-B-1		1.39	2.57
3-A-1	Commercial Street Dock	2.00	3.13
4-A-1	Coast Seafoods Dock	4.94	7.70
4-B-1		6.03	6.99
5-A-1	Fisherman's Terminal	1.66	3.44
6-A-1	'F' Street Dock	1.76	2.87
7-A-1	I street Dock	2.91	3.86
8-A-1	J Street Dock	1.62	2.46
9-A-1	Adorni Dock	0.80	1.95
10-A-1	Bonnie Gool Guest Dock	1.31	2.28
10-B-1		3.49	4.57
11-A-1	Samoa Bridge Launch Ramp	2.52	4.18
12-A-1	Woodley Island Marina	1.13	2.03
12-B-1		0.78	1.78
12-C-1		0.83	1.89
12-D-1		0.96	2.16
13-A-1	Beach Disposal Site	ND	1.30
13-B-1		ND	1.54

[A] "Overall" TEQ is calculated by including one-half of the reporting limits when an isomer is non-detect and multiplying half the reporting limit by the TEF.

PCB Results

In February 2005, the 12 sediment locations described in this report were sampled and analyzed for PCB Aroclors. The results of that sampling event showed that PCBs were not detected at 9 of the 12 sediment sampling locations. In November 2005, those locations that had detectable PCBs in the February 2005 samples were resampled and analyzed for PCBs. The sample locations are listed in Table 14, with the results from both February and November 2005. The Beach Disposal Site was sampled again for PCBs to confirm that they are not detected in this location.

The November 2005 PCB testing results indicate that Aroclor 1254 was detected at the Coast Seafoods dock at 89 ppb. PCBs were not detected in sediment samples from the Fisherman's Terminal and the 'F' street dock that were sampled in November 2005. The minimum reporting limit for PCBs is 33 ppb.

Table 14: PCB concentrations (µg/kg, ppb) at three sites with detectable PCBs in the February 2005 testing episode.

PCBs (ppb)	Coast Seafoods Dock		Fisherman's Terminal		F Street Floating Dock		Beach Disposal Site	
	Feb, 2005	Nov, 2005	Feb, 2005	Nov, 2005	Feb, 2005	Nov, 2005	Feb, 2005	Nov, 2005
Aroclor 1016	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1221	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1232	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1242	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1248	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1254	140	89	16.6	ND	ND	ND	ND	ND
Aroclor 1260	55.2	ND	17	ND	46.8	ND	ND	ND
Total PCBs	195.2	89	33.6	ND	46.8	ND	ND	ND

PCP Results

Table 15 summarizes the PCP analytical results. PCP was not detected in 14 composite samples from 12 Eureka waterfront dredging sites and the Woodley Island Marina. In sediment samples from the remaining City of Eureka waterfront sites PCP concentrations were detected below the reporting limits (and therefore have a "J" flag, which indicates the concentration is estimated). These concentrations range between 8.3J at I Street Dock and 2.8J at Woodley Island Marina. PCP was detected at concentrations below the reporting limits, 1.8J and 1.9J ppb at the beach disposal site. It should be noted that some of the samples that were "non-detects" for PCP had elevated detection limits because of a matrix interference to the analytical method. Given that the TCDD TEQ results among the sample locations are within a factor of around 4 (range of overall TCDD TEQs from dock sediment locations of 1.78 to 7.7 ppt), one would expect that PCP concentrations (presuming that the dioxins were historically associated with PCP) would not vary by orders of magnitude. Therefore, it is reasonable to assume that the elevated detection limits do not mask concentrations of PCP that are significantly higher than the detected values. This is addressed further in the Discussion section.

Table 15: PCP concentrations (µg/kg, ppb) detected at the City of Eureka waterfront sites, Woodley Island Marina and the beach disposal site.

Sample I.D.	Site	PCP (ppb)	Reporting Limit (ppb)
1-A-1	Dock 'B'	ND	160
2-A-1	Small Boat Basin	ND	170
2-B-1		3.7 J[A]	17
3-A-1	Commercial Street Dock	ND	16
4-A-1	Coast Seafoods Dock	ND	850
4-B-1		ND	300
5-A-1	Fisherman's Terminal	ND	320
6-A-1	F' Street Dock	ND	16
7-A-1	I street Dock	8.3 J	16
8-A-1	J Street Dock	ND	16
9-A-1	Adorni Dock	ND	18
10-A-1	Bonnie Gool Guest Dock	ND	17
10-B-1		ND	17
11-A-1	Samoa Bridge Launch Ramp	ND	21
12-A-1	Woodley Island Marina	3.3 J	17
12-B-1		2.8 J	17
12-C-1		ND	18
12-D-1		ND	20
13-A-1	Beach Disposal Site	1.9 J	11
13-B-1		1.8 J	12

[A] J Flag – Estimated result, result is lower than the reporting limit

Grain Size Distribution

The beach disposal samples were analyzed for grain size distribution. The complete results are shown in Appendix C. Between 99.38 and 100 percent of subtidal beach sediment samples and the intertidal, respectively, have grain sizes less than 4.75 mm in diameter.

CHEMICAL CONCNETRATION LIMITS FOR DISPOSAL OF DREDGED SPOILS

2,3,7,8-TCDD

The residential Soil Preliminary Remediation Goal (PRG) from USEPA Region 9 for 2,3,7,8-TCDD TEQ of 3.9 pg/g (3.9 ppt). This value could be considered as a very conservative human health screening value when considering the risk of potential human contact with dredge spoils (short duration exposure before dispersal by tide). All samples except Coast Seafoods Dock were detected with 2,3,7,8-TCDD TEQ concentrations of less that 3.9 ppt.

PCBs

According to the 1998 Dredging Material Management Program conducted by the ARCOE the Total PCBs screening levels for open ocean disposal of dredged material is 130 ppb. The upper limit for PCB in dredge spoils is 3,100 ppb (ARCOE, 1998). In the November 2005 sampling event, PCBs were not detected in any samples except those collected near the Coast Seafoods Dock (89 ppb total PCBs).

PCP

According to the ARCOE Dredging Material Management Program the screening levels for pentachlorophenol is 420 ppb. The upper limit for PCP in dredge spoils is 690 ppb (ARCOE, 1998). Four composited samples had detectable PCP levels ranging from 2.8J to 8.3J ppb and were below the reporting limit. Both samples from the beach disposal site were also detected with levels of PCP below 2.0 ppb.

DISCUSSION

The sampling program described herein was conducted to chemically characterize the dredge materials so that a risk evaluation could be conducted of potential exposure to these constituents of interest (PCDD/F congeners, PCBs, and PCP) in the dredge materials. The proposed ocean disposal plan for Humboldt Bay dredge maintenance involves pumping the dredge material to the Samoa peninsula (i.e., the beach disposal site) for tidal dispersal to the Pacific Ocean. The dredge materials are expected to be dispersed to the ocean within a relatively short time (approximately 2-3 tidal periods according to anecdotal observations). Therefore, there is little time for ecological receptors to colonize

or contact these materials before they will be transported to the open ocean. Likewise, the exposure duration for human receptors to potentially contact dredge materials is very short. To evaluate the potential risk associated with contacting the dredge material, a preliminary screening risk evaluation was conducted. The analytical sediment core data first are compared with dredging-specific screening criteria. To evaluate the potential human health risk for direct contact of constituents of interest in dredge material, there are no standard risk-based screening criteria for sediment. However, risk-based residential soil criteria are based on long-term (30 years), frequent (350 days/year) exposure, and are therefore conservative screening criteria for the very short duration that dredge materials are available to be contacted in tidal dispersal area.

The dredge materials from the various dredge areas will be mixed in the tidal dispersal area, and maximum concentrations of constituents of interest from individual dredge areas will be combined with materials with lower concentrations, yielding lower average concentrations. Therefore, it is reasonable to calculate average concentrations of constituents of interest from all the proposed dredge material to estimate concentrations in combined dredge materials. USEPA and CalEPA agencies recommend the use of USEPA's ProUCL program for calculating summary statistics for risk assessment. This program tests the distribution of a dataset, and recommends a 95% UCLs based on use of appropriate statistical methods for the specific distribution. The latest version (ProUCL Version 3.0; USEPA, 2004a) was used to calculate mean and 95% upper confidence limit (UCL) of the mean concentrations of the sediment core data.

Preliminary Screening Risk Evaluation of Dredge Materials Disposal

This section provides a screening risk evaluation of the dredge material that would be generated from the proposed maintenance dredging.

PCDD/Fs

PCDD/Fs were detected in all of the samples except for the beach disposal site. As presented previously, TCDD TEQs were calculated for each composited sample (20 in all) using the WHO TEFs (1998). Table 16 shows a summary of the TCDD TEQ data from all locations including all non-detected congeners at ½ their respective detection limits. The range of detections of TEQs is ND (the beach disposal site) to 7.7 ppt. The mean concentration is 3.16 ppt, and the 95% UCL of the mean is 3.84 ppt. Appendix E provides the ProUCL output sheets for the summary statistics and datasets.

It should be noted that state of the art dioxin analysis can measure very low concentrations (ppt, and even parts per quadrillion (ppq). At such low detection limits, dioxins are detected ubiquitously in environmental media. The levels of TCDD TEQs measured in the samples from proposed dredge areas are within

typical background dioxin levels from across the United States and Europe. USEPA's draft dioxin reassessment (USEPA, 2003) indicates that 5.3 ppt is a typical background level of TCDD TEQs in sediments of the United States.

A number of dredge material-specific screening values have been developed for PCCD/Fs based on TCDD TEQs. These include values of 4 ppt from the Washington Department of Ecology (per Wenning et al., 2004), and less than 4.5 ppt from the New York State Department of Conservation (NYSDEC, 2004). The 4.5 ppt value from NYSDEC is defined as a level representing "No appreciable contamination (no toxicity to aquatic life)." Another dredge material-specific set of values is from the Seattle ARCOE's Puget Sound Dredged Disposal Analysis, User Guide (2000). If dredge materials have <15 ppt TCDD TEQ and <5 ppt 2,3,7,8-TCDD, then no bioaccumulation testing is needed prior to disposal. Table 17 shows the mean and 95% UCL concentrations of TCDD TEQs compared with these dredge material-specific screening values. The maximum detected concentration of 2,3,7,8-TCDD is 0.68 ppt, which is nearly an order of magnitude lower than the ARCOE value. Since the sediment core data have lower TCDD TEQs and 2,3,7,8-TCDD concentrations than the screening criteria, dredge materials from these areas are not anticipated to be of adverse risk for ocean disposal.

To evaluate the potential risk of human receptors during the short time that dredge materials are available in the tidal dispersal area, the 95% UCL of TCDD TEQs was compared with the USEPA Region 9 Preliminary Remediation Goal (PRG) for residential soil (USEPA, 2004b). The residential soil PRG is based on assumed 30 year exposure duration for nearly every day of the year (350 days/year). This degree of exposure is much higher than is possible for the short time that dredge materials are present in the beach disposal area prior to tidal dispersion. Table 17 shows the residential soil PRG as 3.9 ppt (it is listed as the equivalent 3.9E-06 mg/kg in the PRG table). The 95% UCL is just lower than the long-term risk-based screening PRG. Therefore, risks associated with actual potential exposure to the dredge materials are likely to be associated with acceptable risk.

PCBs

PCBs were only detected sporadically in bay sediment cores from proposed dredge areas. These were detected in only 3 of the 12 sampling locations in February 2005, and in only one of these areas in the November 2005 sampling round. The only detected concentration of total PCBs in November 2005 was 89 ug/kg (ppb). Summary statistics were not conducted for these limited PCB data.

According to the 1998 Dredging Material Management Program conducted by the ARCOE, the Total PCBs screening levels for open ocean disposal of dredged material is 130 ppb. The upper limit for PCB in dredge spoils is 3,100 ppb (ARCOE, 1998, 2005). The detected concentration of 89 ppb is lower than

these ARCOE dredge-specific values. Since dredge material from the areas with detected PCBs in February and November will be only a proportion of the total dredge materials, resulting PCB concentrations in combined dredge material in the tidal dispersal area are anticipated to be much lower. Given the diluting of PCB concentrations in final dredge materials and very short duration of time for potential contact, it is likely that risks associated with human health or ecological receptors contacting dredge materials will be acceptable.

PCP

PCP was detected in sediment samples from a few locations, including the beach disposal area. There are some samples with elevated detection limits (160 – 850 ppb compared with normal detection limit range of 11-21 ppb), and these appear to be a result of matrix interference. There is nothing to suggest that the elevated detection limits are masking the presence of higher concentrations of PCP. Since the dioxins in Humboldt Bay sediments are likely to have been historically associated with PCP, it is reasonable to consider the range of TCDD TEQs across the samples as an indicator of the likely relative range of PCP concentrations. The range of TCDD TEQs in the 20 composite samples is 1.3 ppt (which is from the samples with no PCDD/F congener detected) to 7.7 ppt. If the lowest TCDD TEQ from a sample with any detected congeners is considered, the range is 1.7 to 7.7 ppt. Thus, all the TCDD TEQ results are within a factor of approximately 4-6 times. If the elevated detection limits are included as suggesting detected values of ½ the DL, the range of PCP results are 1.8J to 425 ppb. This is a factor of over 200 times. Therefore, including the elevated PCP detection limits in calculating the 95% UCL likely significantly overestimates the actual PCP levels.

To address this uncertainty, the summary statistics of PCP analytical results from proposed dredge areas were calculated two ways. In the first analysis, the standard approach of including ½ the detection limit for non-detected results was used. This is shown on Table 16 with the range of data up to 425 ppb (representing half of a elevated detection limit), and mean and 95% UCL of 50.1 and 274 ppb, respectively. The second way that the 95% UCL was calculated was by using ½ of the highest normal range of detection limits as a surrogate value for each of the highly elevated detection limits. This is consistent with the approach presented in USEPA Risk Assessment Guidance for Superfund (RAGS) Part A (USEPA, 1989). Thus, the elevated detection limits of 160 – 850 ppb were replaced with ½ of 21 ppb, which is the highest of the normal detection limits. The resulting mean and 95% UCL are 7.69 and 10.7 ppb, respectively. Appendix E provides the ProUCL output sheets for the summary statistics and datasets.

According to the ARCOE Dredging Material Management Program the screening level for pentachlorophenol is 420 ppb. The upper limit for PCP in dredge spoils is 690 ppb (ARCOE, 1998, 2005). Table 17 shows the means and 95% UCLs for PCP, whether elevated detection limits are included or not, are lower than the ARCOE dredge material-specific values. Therefore, ocean disposal of dredge materials is likely to be associated with acceptable ecological risk.

The potential risk for human receptors directly contacting the dredge material while it is in the beach disposal area is evaluated by comparison of 95% UCLs to the USEPA Region 9 PRG for residential soil. Table 17 shows this comparison. The residential soil PRG is 3 mg/kg (i.e., 3,000 ug/kg or ppb). The 95% UCLs of 10.7 and 274 ppb are lower than the long-term exposure PRG. Therefore, it is likely that human health risks for direct contact with dredge materials will be acceptable.

Table 16: Statistical Summary and Recommended 95%UCLs

Medium	Constituent of Interest	Dataset Description	Number of Samples	Units	Min.	Max.	Mean	ProUCL[1] results		
								ProUCL distribution	ProUCL Recommended statistical method	ProUCL Recommended 95% UCL
Sediment	TCDD TEQs[2,3]	All Locations	20	ppt	1.3	7.7	3.16	gamma	approximate gamma	3.84
Sediment	PCP	All Locations	20	ppb	1.8J	425[4]	50.1	nonparametric	99% Chebychev UCL	274
Sediment	PCP	All locations	20	ppb	1.8J	10.5[5]	7.69	nonparametric	95% Chebychev UCL	10.7

Notes:

1 USEPA (2004). Statistical program for calculating summary statistics.

2 Congeners that were not detected were incorporated into the TEQ calculation as 1/2 the detection limit and multiplied by the respective TCDD TEF. This is consistent with WHO approach.

3 2,3,7,8-TCDD was not detected in most samples. Maximum detected concentration 0.68J ppt, which was also from location of sample with highest TCDD TEQ.

4 Maximum detected value is 8.3J ug/kg, but the maximum value in the statistical dataset is 425 ug/kg, which is 1/2 of an elevated detection limit.

5 Maximum value is 1/2 maximum detection limit without interference (still greater than maximum estimated detected value of 8.3J).

25 of 31

Table 17: Preliminary Risk Screening Evaluation of PCDD/Fs and PCP.
Risk Screening Evaluation with Dredge Material-Specific Criteria

Chemical	Units	Maximum Detected Concentration	Mean	95% UCL	Dredge Material-Specific Criteria				
					Washington Dept. of Ecology [1]	ARCOE Bioaccumulation Potential	NYSDEC[3]	ARCOE[4] Screening Level	ARCOE[4] Maximum Level
2,3,7,8-TCDD (TEQ)	ppt	7.7	3.16	3.84	4	15 [2]	<4.5	NA	NA
PCP	ppb	425	50.1	274.00	NA	504 [4]	NA	400	690
PCP[5]	ppb	10.5	7.69	10.7	NA	504 [4]	NA	400	690

Human Health Risk Screening - Direct Contact with Proposed Dredge Materials

Chemical	Units	Maximum Detected Concentration	Mean	95% UCL	PRG[6] Residential Soil
2,3,7,8-TCDD (TEQ)	ppt	7.7	3.16	3.84	3.9
PCP	ppb	425	50.1	274.00	3000
PCP[6]	ppb	10.5	7.69	10.7	3000

Notes:
1 Value presented in: Dioxin 2004, Organohalogen Compounds, Risk Management and Regulatory Aspects.
2 Puget Sound Dredged Disposal Analysis (PSDDA, 2000)- no bioaccumulation testing is necessary these dredge materials. Value for 2,3,7,8-TCDD is 5 ppt.
3 NYSDEC (2004). In-Water and Riparian Management of Sediment and Dredged Material. Value represents "No appreciable contamination (no toxicity to aquatic life)."
4 Dredge Disposal Management Program (DMMP, 2005)
5 Alternate statistics with 1/2 highest normal detection limit as surrogate value for elevated detection limits.
6 USEPA Region 9 (2004).

Conclusions

The Screening Risk Evaluation indicates that ocean disposal of the proposed dredge material is likely to be associated with acceptable risk for the low levels of PCDD/Fs, PCP, and sporadically detected PCBs measured in representative sediment core samples.

REFERENCES

Assessment of the health risk of dioxins: re-evaluation of the Tolerable Daily Intake (TDI). WHO Consultation May 25-29 1998, Geneva, Switzerland. http://www.who.int/ipcs/publications/en/exe-sum-final.pdf

California Environmental Protection Agency Office of Environmental Health Hazard Assessment/Air Resources Board (OEHHA/ARB), 2005. Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values. http://www.arb.ca.gov/toxics/healthval/contable.pdf.

Minnesota Department of Public Health
http://www.health.state.mn.us/divs/eh/risk/guidance/dioxinmemo1.html

New York State Department of Environmental Conservation (NYSDEC, 2004). Technical & Operational Guidance Series (TOGS) 5.1.9. In-Water and Riparian Management of Sediment and Dredged Material. Table 2. Division of Water. Bureau of Water Assessment and Management. November.

Pacific Affiliates. City of Eureka and Humboldt Bay Harbor, Recreation and Conservation District. Sediment Sampling Analysis Plan for Coast Seafoods Dock. August 24, 2005.

Pacific Affiliates. City of Eureka and Humboldt Bay Harbor, Recreation and Conservation District. Sediment Sampling Analysis. April 1, 2005.

US Army Corps of Engineers (ARCOE, 2000). Puget Sound Dredged Disposal Analysis, Program Dredged Material Evaluation and Disposal Procedures: A Users Manual for the Puget Sound PSDDA Program. February 2000.

US Army Corps of Engineers web site (ARCOE, 2005). Screening Level (SL), Bioaccumulation Trigger (BT), and Maximum Level (ML) DMMP Guideline Chemistry Values. Updated June 2005
http://www.nws.usace.army.mil/publicmenu/DOCUMENTS/2005_COCs.pdf

US Environmental Protection Agency (USEPA 2004a). ProUCL Version 3.00.02. Statistical software available at: http://www.epa.gov/nerlesd1/tsc/form.htm.

US Environmental Protection Agency (USEPA, 2003). Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD) and Related Compounds National Academy Sciences (NAS) Review Draft. Part I Estimating Exposures to Dioxin-Like Compounds, Volume 2

Properties, Environmental Levels, and Background Exposures, Chapter 3 Levels of CDD, CDF, and PCB Congeners in Environmental Media and Food. http://www.epa.gov/ncea/pdfs/dioxin/nas-review/

US Environmental Protection Agency (USEPA, 1989). Risk Assessment Guidance for Superfund, Human Health Evaluation Manual Part A. Office of Solid Waste and Emergency Response. 9285.701A. December.

U.S. Food and Drug Administration
http://www.cfsan.fda.gov/~lrd/dioxdata.html

US Army Corps of Engineers web site. 1998 DMMP Chemical Guidelines http://www.nws.usace.army.mil/publicmenu/Attachments/98slbtml.pdf

US Environmental Protection Agency (EPA) Region IX. Preliminary Remediation Goals (PRGs). October 2004. http://www.epa.gov/region09/waste/sfund/prg/files/04prgtable.pdf

US Food and Drug Administration. Dioxin Analysis Results/Exposure Estimates. http://www.cfsan.fda.gov/~lrd/dioxdata.html

Wenning, Richard J., Linda Martello, Timothy Ianuzzi. 2004. "Review of Approaches used to Establish Sediment Benchmarks for PCDD/Fs." Organohalogen Compounds 66: 3479-3503. Proceedings – Dioxin 2004 – 24th International Symposium on Halogenated Environmental Organic Pollutants and POPs, Berlin, September 6-10, 2004.

Appendix B

EPA Method 8290
Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurnas (PCDFs)
by High-Resolution Gas Chromatography/High Resolution Mass Spectrometry

The following testing parameters and the WHO 1997 TEF values are listed below:

		TEF
PCDDs		
2,3,7,8-TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin	1.0
1,2,3,7,8-PeCDD	1,2,3,7,8-pentachlorodibenzo-p-dioxin	1.0
1,2,3,4,7,8-HxCDD	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	0.10
1,2,3,6,7,8-HxCDD	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	0.10
1,2,3,7,8,9-HxCDD	1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	0.10
1,2,3,4,6,7,8-HpCDD	1,2,3,4,6,7,8-hepatchlorodibenzo-p-dioxin	0.01
OCDD	octachorodibenzo-p-dioxin	0.0001
PCDFs		
2,3,7,8-TCDF	2,3,7,8-tetrachlorodibenzofuran	0.1
1,2,3,7,8-PeCDF	1,2,3,7,8-tetrachlorodibenzofuran	0.05
2,3,4,7,8-PeCDF	2,3,4,7,8-pentachlorodibenzofuran	0.5
1,2,3,4,7,8-HxCDF	1,2,3,4,7,8-hexachlorodibenzofuran	0.1
1,2,3,6,7,8-HxCDF	1,2,3,6,7,8- hexachlorodibenzofuran	0.1
1,2,3,7,8,9-HxCDF	1,2,3,7,8,9-hexachlorodibenzofuran	0.1
2,3,4,6,7,8-HxCDF	2,3,4,6,7,8-hexachlorodibenzofuran	0.1
1,2,3,4,6,7,8-hpCDF	1,2,3,4,7,8,9-heptachlorodibenzofuran	0.01
1,2,3,4,7,8,9-HpCDF	1,2,3,4,7,8,9-heptachlrodibenzofuran	0.01
OCDF	octachlrodibenzofuran	0.0001

US Food and Drug Administration. Dioxin Analysis Results/Exposure Estimates.
http://www.cfsan.fda.gov/~lrd/dioxdata.html

Appendix B

City of Eureka and Humboldt Bay Harbor, Recreation and Conservation District Cooperative Maintenance Dredging Project
Dioxin/Furans Concentration (pg/g, ppt)

Site	Sample I.D.	2,3,7,8-TCDD	1,2,3,7,8-PeCDD	1,2,3,4,7,8-HxCDD	1,2,3,6,7,8-HxCDD	1,2,3,7,8,9-HxCDD	1,2,3,4,6,7,8-HpCDD	OCDD	2,3,7,8-TCDF	1,2,3,7,8-PeCDF	2,3,4,7,8-PeCDF	1,2,3,4,7,8-HxCDF	1,2,3,6,7,8-HxCDF	2,3,4,6,7,8-HxCDF	1,2,3,7,8,9-HxCDF	1,2,3,4,6,7,8-HpCDF	1,2,3,4,7,8,9-HpCDF	OCDF	2,3,7,8-TCDD TEQ	"Overall"[A] 2,3,7,8-TCDD TEQ
Dock 'B'	1-A-1	ND[B]	ND	ND	3.0 J[C]	ND	35	180	0.95 CON[D]	ND	ND	ND	ND	ND	ND	3.5 J	ND	11.0	0.80	2.81
Small Boat Basin	2-A-1	ND	ND	ND	6.8	ND	99	660	2.0 CON	ND	ND	ND	ND	ND	ND	10.0	ND	14.0	2.04	3.74
	2-B-1	ND	ND	ND	3.1 J	ND	88	440	0.72 J, CON	ND	ND	ND	ND	ND	ND	8.6	ND	21.0	1.39	2.57
Commercial Street Dock	3-A-1	ND	ND	ND	4.4	3.8 J	88	540	1.5 CON	ND	ND	ND	ND	ND	ND	9.1	ND	24.0	2.00	3.13
Coast Seafoods Dock	4-A-1	ND G[F]	ND	ND	4.3 JA[E]	ND	370	2800	0.46 J,CON	ND	ND	2.3 J	ND	ND	ND	21	3.5 J, JA	110	4.94	7.70
	4-B-1	0.68 J	ND	ND	5.9	3.3 J	110	830	3.4 CON	1.9 J, JA	3.4 J	6.1	2.9 J	ND	ND	21.0	ND	60.0	6.03	6.99
Fisherman's Terminal	5-A-1	ND	ND	ND	5.3	2.4 J, JA	71	400	0.57 J, CON	ND	ND	ND	ND	ND	ND	7.8 JA	ND	22.0	1.66	3.44
F' Street Dock	6-A-1	0.57 J	ND	ND	3.8 J	ND	54	410	1.3 CON	ND	ND	ND	ND	ND	ND	10.0	ND	21.0	1.76	2.87
I street Dock	7-A-1	0.53 J	ND	ND	4.6	3.1 J	87	810	2.0 CON	ND	ND	2.6 J	ND	ND	ND	19.0	ND	56.0	2.91	3.86
J Street Dock	8-A-1	ND	ND	ND	3.1 J	2.3 J	62	520	0.59 J, JA, CON	ND	ND	2.4 J	ND	ND	ND	11.0	ND	16.0	1.62	2.46
Adorni Dock	9-A-1	ND	ND	ND	2.5 J	ND	42	210	0.54 J, CON	ND	ND	ND	ND	ND	ND	5.6	ND	9.6	0.80	1.95
Bonnie Gool Guest Dock	10-A-1	ND	ND	ND	2.7 J	ND	83	640	0.56 J, JA, CON	ND	ND	ND	ND	ND	ND	8.9	ND	42.0	1.31	2.28
	10-B-1	0.49 J, JA	ND	ND	6.1	3.5 J	140	690	1.0 CON	ND	ND	3.0 J	ND	ND	ND	17.0	ND	34.0	3.49	4.57
Samoa Bridge Launch Ramp	11-A-1	ND	ND	ND	4.5 J	3.4 J	140	1400	0.70 J, JA, CON	ND	ND	ND	ND	ND	ND	12.0	ND	39.0	2.52	4.18
Woodley Island Marina	12-A-1	ND	ND	ND	3.0 J	2.3 J	45	230	0.71 J, CON	ND	ND	ND	ND	ND	ND	5.4 JA	ND	11.0	1.13	2.03
	12-B-1	ND	ND	ND	2.9 J	ND	30	180	1.3 CON	ND	ND	ND	ND	ND	ND	4.3 J	ND	7.2 J	0.78	1.78
	12-C-1	ND	ND	ND	2.7 J	ND	38	190	1.1 CON	ND	ND	ND	ND	ND	ND	5.5	ND	8.4 J	0.83	1.89
	12-D-1	ND	ND	ND	3.0 J	ND	52	220	0.68 J, CON	ND	ND	ND	ND	ND	ND	5.0	ND	8.0 J	0.96	2.16
Beach Disposal Site	13-A-1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.30
	13-B-1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.54

[A]"Overall" TEQ - based on including one-half (1/2) of the detection limit for all non-detected isomers, before applying the W.H.O TEFs.
[B]ND – Non detect
[C]J – Estimated result, result is less than the reporting limit
[D]CON – Confirmation Analysis
[E]JA – The analyte was positively identified, but the quantitation is an estimate
[F]G - Elevated reporting limit. The reporting limit is elevated due to matrix interference.