US Army Corps of Engineers®

OAKLAND HARBOR TURNING BASINS WIDENING, CA

NAVIGATION STUDY

DRAFT INTEGRATED FEASIBILITY REPORT & ENVIRONMENTAL ASSESSMENT

APPENDIX B2:

Geotechnical

1. Introduction

This draft appendix was developed as part of the Oakland Harbor Turning Basin Widening Navigation feasibility study. This appendix summarizes exiting geotechnical conditions at the site and presents the findings of the engineering analysis conducted to support the development of recommend improvements to the Inner and Outer Harbor Turning Basins.

This Appendix is based on review of over one hundred documents including plans and design documents from previous projects, consultant and agency geotechnical reports, and published geologic reports.

1.1. Project Description

The Port of Oakland Outer Harbor Turning Basin (OHTB) is located in the outer harbor channel near berths 25 through 30. The OHTB has a diameter of 1,650 feet; the bottom elevation of -50 feet (NAVD88) is maintained by annual dredging.

The Inner Harbor Turning Basin (IHTB) is located approximately 18,000 feet to the east of the Oakland Harbor entrance near the Howard Terminal. The IHTB basin had a diameter of 1,500 feet; the bottom elevation of -50 feet is maintained by annual dredging.

This study considered several alternative geometries for both the OHTB and the IHTB. The Tentatively Selected Plan consists of widening both the Inner and Outer Harbor Turning Basins to 1,834 feet and 1,965 feet, respectively. The Turning Basin bottom elevations would remain at Elevation -50 feet. The OHTB Variation 2 would not require impacts to the land. The IHTB Variation 3 would require excavation into the Howard Terminal on the north side of the channel and private property on the south side of the channel. The proposed footprints for the IHTB and OHTB are shown on Sheets 1 and 2, respectively. Refer to the Channel Design Appendix B1 for descriptions of the variations that were considered during the alternative analysis process.

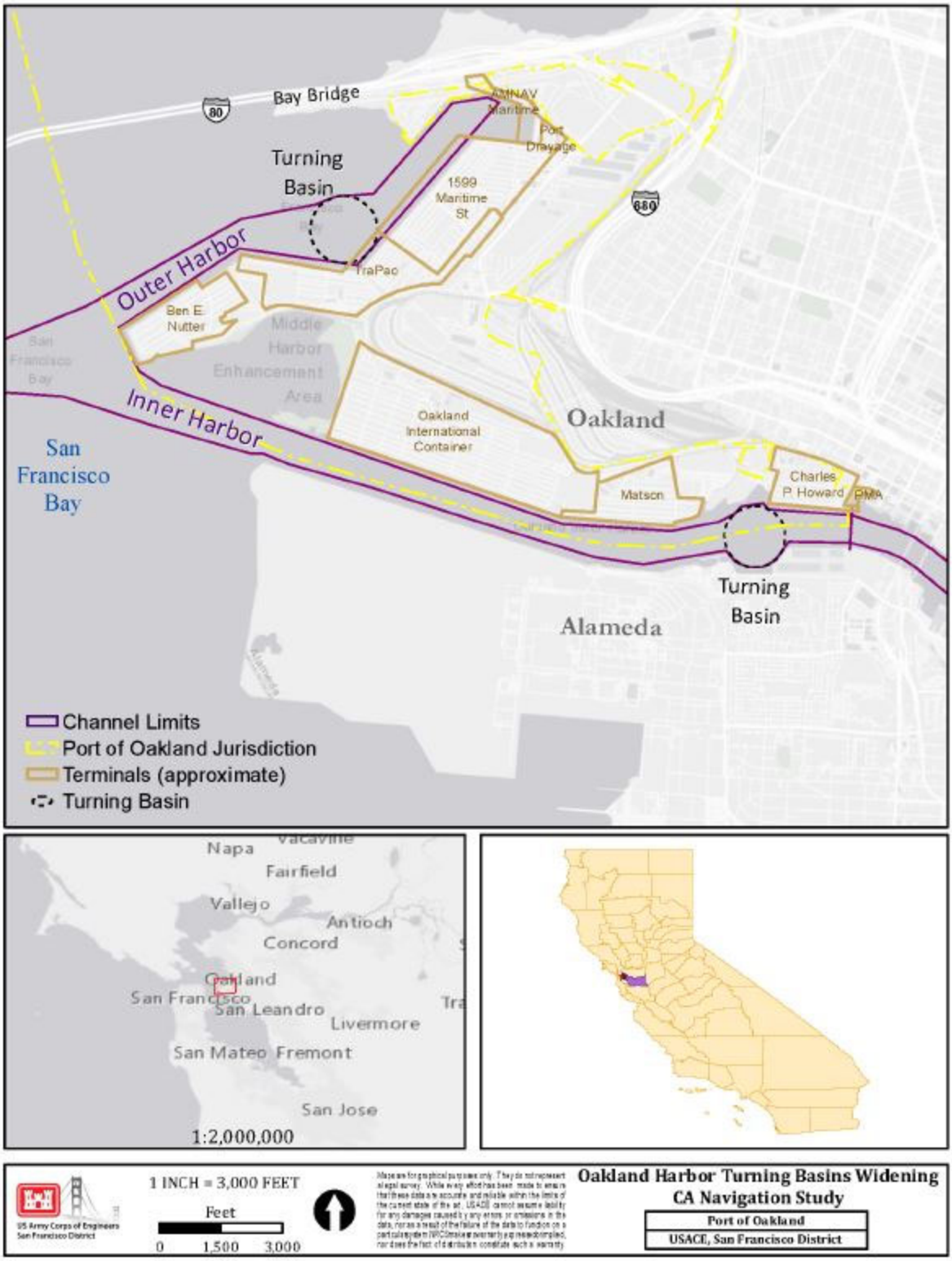


Figure 1: Study Area Location

1.2. Datums

This Appendix relies on existing subsurface information taken from various consultant and agency reports, and as-built plans for existing facilities. The conversion factors presented in Table 1 were used to convert the reported elevations to NAVD88. All Elevations in this Appendix are reported relative to NAVD88 unless otherwise noted. Mean Low Low Water is approximately equal to NAVD88. These conversions are considered accurate enough for interpretation of subsurface data.

Table 1. Datum Conversions

Datum	Elevation (NAVD88)	Elevation (P.O.D.)
NAVD88/MLLW	0	+0.5
NAVD 29	+ 2.7	+3.2
Port of Oakland Datum	-0.5	0
City of Oakland Datum	+5.7	+6.2

2. Project History

The first federal improvement of the Oakland harbor was authorized by the Rivers and Harbors Act adopted June 23, 1874. These improvements consisted of constructing two jetties to act as training walls to confine the flow of the San Antonio Estuary to scour a channel, the jetties were completed in 1894. The jetties no longer serve a navigational purpose and segments have been removed during subsequent improvements to the harbor. Significant change in the federally authorized channel have taken place in 1931, 1942, 1974-1975, and 2001-2010. In 1931, the Outer Harbor entrance was widened. The Outer Harbor was deepened to -35 feet and the turning basin was expanded in 1942. The deepening of the Inner Harbor to -35 feet was authorized in the Act of 1962 and completed in 1974. The authorized project for deepening the Entrance Channel, Outer Harbor and Inner Harbor channels to -42 feet was completed in 1998 and authorized by Section 202 of the Water Resources Development Act of 1986. The Inner and Outer Harbor were deepened to Elevation -50 feet between 2001 and 2010.

3. Subsurface Conditions

Oakland Harbor was constructed in a natural drainage channel, San Antonio Creek, which is located within the broad low-lying plain that borders the eastern shore of San Francisco Bay. Materials beneath the bay plain consist of relatively thick deposits of unconsolidated marine sediments deposited during the Pleistocene and Holocene geologic time.

The Port of Oakland is constructed entirely on artificial fill beyond the historic shoreline. Witter et al (2006) map the surface geology of the Port as artificial fill over estuarine mud (afem). The soils immediately underlying the fill consist of soft, compressible clays, known locally as Young Bay Mud, and/or Merritt Sands. Both units are exposed in the existing channel side slopes.

The Alameda Formation consists of interbedded Pleistocene sands and clays. The Alameda Formation was dissected and eroded prior to deposition of the Yerba Buena Formation, also known as Old Bay Mud or Old Bay Clay. The two units are often mapped together as layered sediments and have a combined thickness of several hundred feet. The proposed excavations are not anticipated to penetrate these formations.

The Merritt Sand (or San Antonio Formation) are dune sands that overly the Yerba Buena Formation. The Merritt Sands are generally uniformly graded and medium dense to dense.

Young Bay Mud (YBM) is a highly compressible marine clay that underlies much of the Port of Oakland. The YBM varies in the thickness across the site and may be deeper locally where is has filled eroded channels in the Merritt Sands. The Geotechnical Site Plans (Sheets 1 and 2) present the locations of existing borings and "Top of San Antonio Formation Elevation" in the Inner and Outer Harbors, respectively.

3.1. Inner Harbor

Table B-1 tabulates the thickness of fill and YBM encountered in each exploration, as well as the Top of San Antonio Formation Elevation. The Top of San Antonio Formation Elevation is also shown next to each exploration on Sheet 1. Approximately ¾ of the explorations shown on Sheet 1 were performed before the -50 Foot Deepening Project; the reported elevations represent the geologic contact between the YBM and San Antonio Formation at the time of drilling. Generally, the YBM/San Antonio contact in the IHTB is above Elevation -50 feet. All of the YBM within the existing channel and turning basin has been removed.

There are existing rock buttresses beneath the Howard Terminal Wharf and in front of the Fisc Property bulkhead wall.

3.2. Outer Harbor

Table B-2 summarizes the materials encountered in explorations in the vicinity of the OHTB. The Top of San Antonio Formation Elevation is also shown next to each exploration on Sheet 2.

Only four borings are located within the proposed OHTB. The contact between the YBM and San Antonio Formation is generally between Elevations -45 and -50 feet; the YBM within the existing channel was removed during the -50 Foot Project. YBM should be expected to be encountered in the excavation for the OHTB Variation 2 to the northwest of the existing turning basin.

4. Design Considerations

4.1. Slope Stability

Slope stability analyses were based on 1) review of existing as-built plans, 2) review of published case studies of slopes excavated in YBM, and 3) review of previous stability analyses for the -50 foot deepening project.

4.1.1. Inner Harbor

The IHTB Variation 3 may require slopes to be excavated in the northwestern portion of the proposed turning basin. The existing turning basin slopes are inclined at 3:1 (H:V). Analysis performed by SCI (1999 and 2000) indicates that the slopes would have a long-term, static factor of safety of approximately 3. The slopes are surveyed and dredged annually; no slope failures have been observed.

The conditions in the area to be excavated are expected to be similar to the existing; therefore, 3:1 (H:V) slopes are recommended for preliminary design. There may be a potential for steepening slopes in the denser materials in the lower portion of the slope. Detailed analysis of different slope configurations, as well as seismic stability and deformation analyses should be performed during design development.

4.1.2. Outer Harbor

As shown on Sheet 2, OHTB Variation 2 will require excavating additional material to the northwest of the existing turning basin. The existing turning basin slopes are inclined at 3:1 (H:V). Analysis performed by SCI (1999 and 2000) indicates that the slopes would have a long-term, static factor of safety of approximately 3. The slopes are surveyed and dredged annually; no slope failures have been observed.

The conditions in the area to be excavated are expected to be similar to the existing; therefore, 3:1 (H:V) slopes are recommended for preliminary design.

4.2. Bulkhead Wall Design

IHTB Variation 3 would require construction of a bulkhead wall at the Howard Terminal to the northeast of the turning basing and on the Fisc Property to the southeast of the turning basin. A bulkhead wall may be required adjacent to the Schnitzer Property to the northwest of the turning basin. No new bulkhead walls will be required for the OTHB Variation 2.

The calculations for the existing bulkhead wall the Fisc Property were reviewed. The design

parameters were judged to be appropriate for preliminary design. The design parameters and preliminary calculations are provided in the Structural Engineering Appendix. The existing rock buttress along the shoreline at the Howard Terminal and rubble near the Fisc Property may cause constructability issues for sheet pile walls and/or driven or drilled piles.

4.3. Disposal

Assumptions for disposal of the various materials are discussed in the Channel Design (Appendix B1).

5. Further Analysis and Design Development Needs

The preliminary findings presented in this appendix is based largely on review of previous analyses. Design will be further developed during the prior to the Agency Decision Milestone. The TSP for the Inner Harbor requires excavation at Howard Terminal and on private property on the Alameda side of the channel. Assumptions about the existing conditions and configuration of the slopes, wharf structures, and bulkhead walls in these areas were based on review of as-built plans and limited site reconnaissance. Existing conditions should be verified during the PED phase. Depending on the type of structural analysis required for design of the bulkhead walls, site-specific seismic hazard and site response analyses may be required.

Limited sampling and testing may be appropriate in areas with sparse geotechnical information, such as the northwestern portion of the proposed OHTB excavation and the northwestern portion of the IHTB (near Schnitzer Steel).

Chemical sampling of the soil in some areas may be required for disposal purposes. Disposal assumptions are discussed in the Channel Design Appendix.

6. References

Engeo, Inc., 2007, Geotechnical Field Services Report, Oakland Inner Harbor Turning Basin, Alameda, California [Report #OAK_073]

Engeo, Inc., 2019, Preliminary Geotechnical Exploration Report, Oakland Athletics Ballpark Development, Howard Terminal, Oakland, California [Report #OAK_087]

Fugro West, Inc., 2003, Geotechnical Study, Oakland Inner Harbor Turning Basin Widening Project, Phase 1B/2, Alameda, California [Report #OAK_059]

Geo/Resource Consultants, 1986, Report of Field Activities, Oakland Inner Harbor Overwater Sediment Sampling and Explorations [Report #OAK_028]

Subsurface Consultants, Inc., 1999, Geotechnical Investigation, Oakland Harbor Navigation Improvement (-50 foot) Project, Port of Oakland, Oakland and Alameda, California [Report #OAK_042]

Subsurface Consultants, Inc., 2000, Geotechnical Evaluation, -50 Foot Slope Optimization, Port of Oakland, Oakland and Alameda, California [Report #OAK_045]

Subsurface Consultants, Inc., 2003, Supplemental Design Documentation Report, Inner Harbor Turning Basin, Phase 1B, Appendix D, Oakland Harbor Navigation Improvement (-50 foot) Project, Port of Oakland, Oakland and Alameda, California [Report #OAK_060]

USACE, 2007, Oakland Harbor Navigation Improvement 50 Foot Project, Inner Harbor Turning Basin Wings, Cone Penetrometer Testing Survey Results [Report #OAK_074]

Woodward-Clyde Consultants, 1979, Geotechnical Investigation, Charles P. Howard Container Terminal, Inner Harbor, Oakland, California [Report #OAK_016]

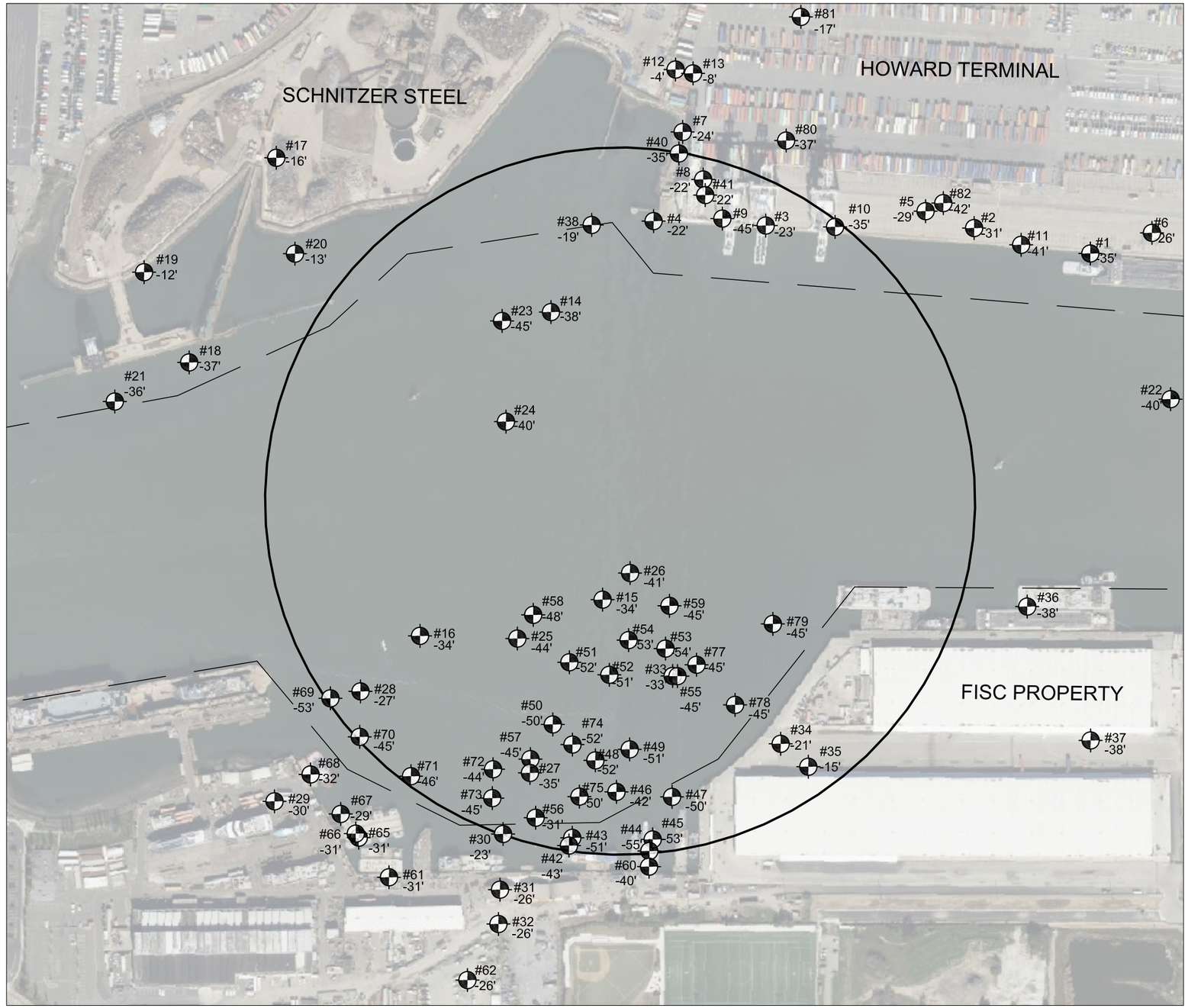
7. Subsurface Data

Pertinent information for the boring logs that were reviewed for this study are tabulated in Tables B-1 and B-2.

Boring Identification Table

Boring #	Boring ID	Source
1	OAK016_1	WCC (1979)
2	OAK016_5	WCC (1979)
3	OAK016_6	WCC (1979)
4	OAK016_7	WCC (1979)
5	OAK016_8	WCC (1979)
6	OAK016_9	WCC (1979)
7	OAK016_11	WCC (1979)
8	OAK016_12	WCC (1979)
9	OAK016_13	WCC (1979)
10	OAK016_14	WCC (1979)
11	OAK016_15	WCC (1979)
12	OAK016_16	WCC (1979)
13	OAK016_17	WCC (1979)
14	OAK028_0I86-1	GeoSource (1986)
15	OAK028_0I86-2	GeoSource (1986)
16	OAK028_0I86-3	GeoSource (1986)
17	OAK042_128.1	SCI (1999)
18	OAK042_128.3	SCI (1999)
19	OAK042_175.1	SCI (1999)
20	OAK042_175.3	SCI (1999)
21	OAK042_175.6	SCI (1999)
22	OAK042_266.IC-344	SCI (1999)
23	OAK042_266.TC-366	SCI (1999)
24	OAK042_266.TC-368	SCI (1999)
25	OAK042_266.TC-394	SCI (1999)
26	OAK042_266.TC-396	SCI (1999)
27	OAK042_266.TW-378	SCI (1999)
28	OAK042_285.GB17	SCI (1999)
29	OAK042_285.GB18	SCI (1999)
30	OAK042_285.GB19	SCI (1999)
31	OAK042_285.GB20	SCI (1999)
32	OAK042_285.GB21	SCI (1999)
33	OAK042_285.GB22	SCI (1999)
34	OAK042_285.GB23	SCI (1999)
35	OAK042_285.GB24	SCI (1999)
36	OAK042_285.GB25	SCI (1999)
37	OAK042_285.GB26	SCI (1999)
38	OAK042_285.GB27	SCI (1999)
39	OAK042_298.10	SCI (1999)
40	OAK042_298.11	SCI (1999)
41	OAK042_298.12	SCI (1999)
42	OAK059_CPT-01	Fugro (2003)
43	OAK059_CPT-02	Fugro (2003)
44	OAK059_CPT-03	Fugro (2003)
45	OAK059_CPT-04	Fugro (2003)
46	OAK059_CPT-05	Fugro (2003)
47	OAK059_CPT-06	Fugro (2003)
48	OAK059_CPT-07	Fugro (2003)
49	OAK059_CPT-08	Fugro (2003)
50	OAK059_CPT-09	Fugro (2003)
51	OAK059_CPT-10	Fugro (2003)
52	OAK059_CPT-11	Fugro (2003)
53	OAK059_CPT-12	Fugro (2003)
54	OAK059_CPT-13	Fugro (2003)
55	OAK059_CPT-14	Fugro (2003)
56	OAK059_CPT-15	Fugro (2003)
57	OAK059_CPT-16	Fugro (2003)
58	OAK059_CPT-17	Fugro (2003)
59	OAK059_CPT-18	Fugro (2003)
60	OAK059_CPT-19	Fugro (2003)
61	OAK059_B-1	Fugro (2003)
62	OAK059_B-2	Fugro (2003)
63	OAK059_B-3	Fugro (2003)
64	OAK059_B-4	Fugro (2003)
65	OAK059_B-6	Fugro (2003)
66	OAK059_B-7	Fugro (2003)
67	OAK059_B-8	Fugro (2003)
68	OAK059_B-9	Fugro (2003)
69	OAK073_CPT-01	Engeo (2007)
70	OAK073_CPT-02	Engeo (2007)
71	OAK073_CPT-03	Engeo (2007)
72	OAK073_CPT-04	Engeo (2007)
73	OAK073_CPT-05	Engeo (2007)
74	OAK073_CPT-06	Engeo (2007)
75	OAK073_CPT-07	Engeo (2007)
76	OAK073_CPT-08	Engeo (2007)
77	OAK073_CPT-10	Engeo (2007)
78	OAK073_CPT-11	Engeo (2007)
79	OAK073_CPT-12	Engeo (2007)
80	OAK087_1-CPT-05	Engeo (2019)
81	OAK087_1-CPT-06	Engeo (2019)
82	OAK087_1-B3	Engeo (2019)

See Table B-2 for complete details.



LEGEND

PREVIOUS BORING BY OTHERS; SEE TABLE B-1
TOP OF SAN ANTONIO FORMATION ELEVATION (FEET, NAVD88) SHOWN NEXT TO BORINGS

EXISTING CHANNEL

VARIATION 3 FOOTPRINT

NOTE: REPORTED "TOP OF SAN ANTONIO FORMATION ELEVATION" BASED ON RECORDED VALUES AT TIME OF DRILLING; MATERIAL WITHIN THE EXISTING CHANNEL EXCAVATED DURING THE -50 FOOT DEEPENING PROJECT.

N

0 300 600 Feet

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

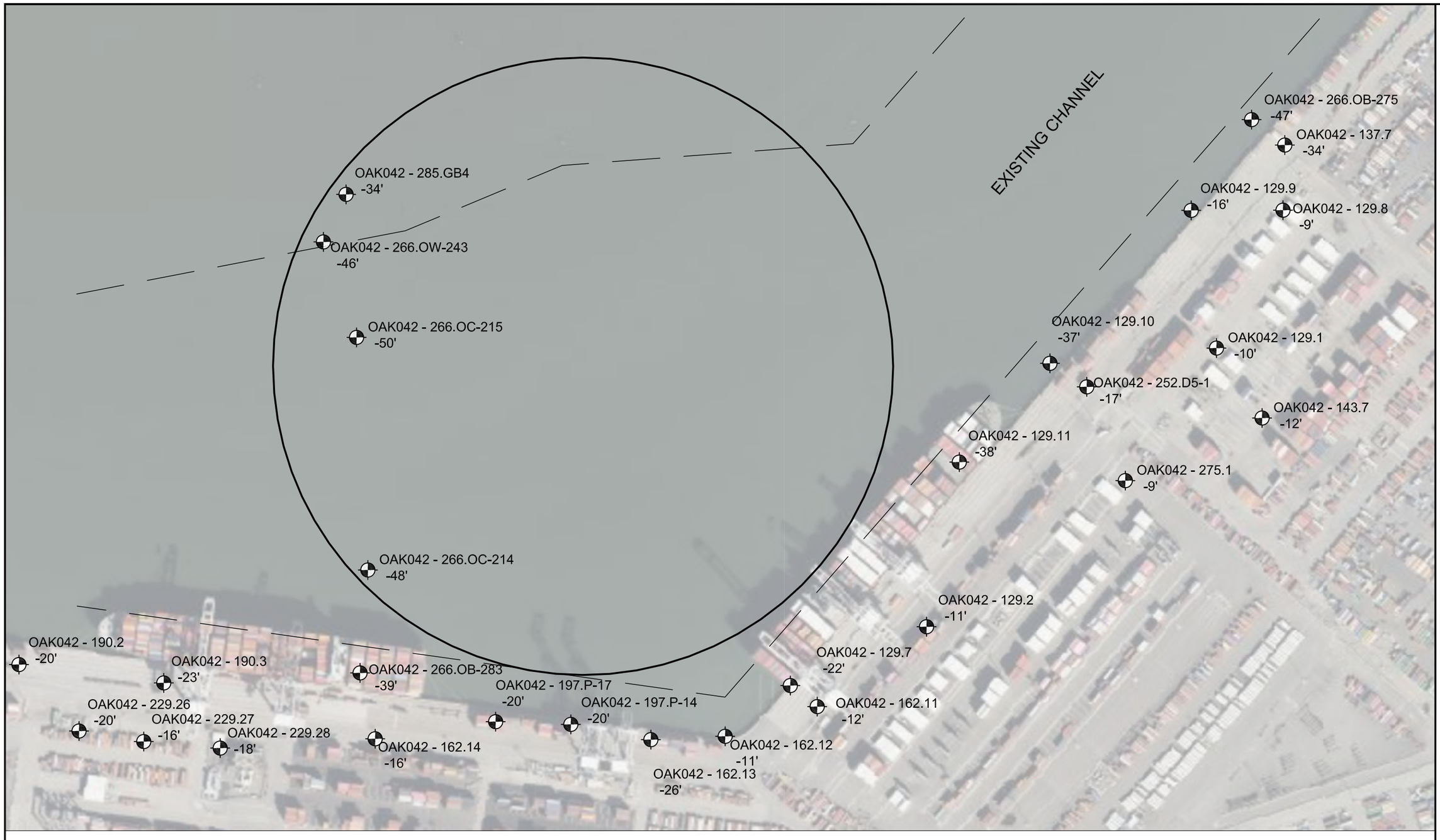
DESIGNED BY: B.WAR
DRAWN BY: J. PEHRSON
CHECKED BY: A. LAIKRAM
SUBMITTED BY: B.WAR
ISSUE DATE: NOVEMBER 2021
SOLICITATION NO:
CONTRACT NO:
PROJECT NO:
SIZE: ANSI B

U.S. ARMY CORPS OF ENGINEERS
SAN FRANCISCO DISTRICT
450 GOLDEN GATE AVE., 4TH FLOOR
SAN FRANCISCO, CA 94102-3404

ALAMEDA COUNTY, CALIFORNIA
OAKLAND TURNING BASIN WIDENING STUDY

INNER HARBOR GEOTECHNICAL SITE PLAN

SHEET ID
1



LEGEND

PREVIOUS BORING BY OTHERS; SEE TABLE B-2
TOP OF SAN ANTONIO FORMATION ELEVATION (FEET, NAVD88) SHOWN NEXT TO BORINGS

EXISTING CHANNEL

VARIATION 2 FOOTPRINT

NOTE: REPORTED "TOP OF SAN ANTONIO FORMATION ELEVATION" BASED ON RECORDED VALUES AT TIME OF DRILLING; MATERIAL WITHIN THE EXISTING CHANNEL EXCAVATED DURING THE -50 FOOT DEEPENING PROJECT.

N

0 300 600 FEET

US Army Corps of Engineers ®

MARK	DESCRIPTION	DATE

DESIGNED BY: B.WAR
DRAWN BY: J. PEHRSON
CHECKED BY: A. LAIKRAM
SUBMITTED BY: B.WAR
ISSUE DATE: NOVEMBER 2021
SOLICITATION NO:
CONTRACT NO:
PROJECT NO:
SIZE: ANSI B

U.S. ARMY CORPS OF ENGINEERS
SAN FRANCISCO DISTRICT
450 GOLDEN GATE AVE, 4TH FLOOR
SAN FRANCISCO, CA 94102-3404

ALAMEDA COUNTY, CALIFORNIA
OAKLAND TURNING BASIN WIDENING STUDY

OUTER HARBOR GEOTECHNICAL SITE PLAN

SHEET ID
2

Table B-1 - Port of Oakland Inner Harbor Borings

Boring ID	Source	Date	Northing[1]	Easting	Latitude	Longitude	Ground Surface Elevation (ft)[2]	Mudline Elevation (ft)	Top of San Antonio Elevation (ft)	Notes
OAK016_1	WCC (1979)	9/25/1978	2,116,776	6,046,204	37.794789	-122.284060	12.5	----	-35.0	Note 5
OAK016_5	WCC (1979)	9/29/1978	2,116,842	6,045,902	37.794954	-122.285108	12.5	----	-30.5	Note 5
OAK016_6	WCC (1979)	10/2/1978	2,116,848	6,045,362	37.794944	-122.286979	12.5	----	-23.0	Note 5
OAK016_7	WCC (1979)	9/27/1978	2,116,860	6,045,070	37.794960	-122.287987	12.5	----	-21.5	Note 5
OAK016_8	WCC (1979)	6/28/1979	2,116,886	6,045,776	37.795068	-122.285547	12.5	----	-28.5	Note 5
OAK016_9	WCC (1979)	6/26/1979	2,116,829	6,046,364	37.794944	-122.283510	13.5	----	-25.5	Note 5
OAK016_11	WCC (1979)	7/5/1979	2,117,091	6,045,146	37.795599	-122.287741	12.5	----	-23.5	Note 5
OAK016_12	WCC (1979)	7/6/1979	2,116,968	6,045,199	37.795263	-122.287549	12.5	----	-21.5	Note 5
OAK016_13	WCC (1979)	7/16/1979	2,116,866	6,045,249	37.794987	-122.287370	----	-28.0	-44.5	Note 5
OAK016_14	WCC (1979)	7/13/1979	2,116,845	6,045,541	37.794944	-122.286356	----	-27.0	-34.5	Note 5
OAK016_15	WCC (1979)	7/10/1979	2,116,798	6,046,024	37.794841	-122.284683	----	-35.0	-40.5	Note 5
OAK016_16	WCC (1979)	8/29/1979	2,117,253	6,045,127	37.796043	-122.287816	12.5	----	-3.5	Note 5
OAK016_17	WCC (1979)	8/29/1979	2,117,243	6,045,173	37.796018	-122.287658	12.5	----	-7.5	Note 5
OAK028_0I86-1	GeoSource (1986)	10/23/1986	2,116,624	6,044,804	37.794298	-122.288893	----	-32.8	-37.8	Note 6
OAK028_0I86-2	GeoSource (1986)	10/24/1986	2,115,878	6,044,938	37.792257	-122.288380	----	-32.7	-33.7	Note 6
OAK028_0I86-3	GeoSource (1986)	10/27/1986	2,115,784	6,044,464	37.791974	-122.290013	----	-32.7	-34.2	Note 6
OAK042_128.1	SCI (1999)[4]	7/27/1973	2,117,024	6,044,092	37.795360	-122.291385	7.0	----	-16.0	
OAK042_128.3	SCI (1999)	7/30/1973	2,116,493	6,043,865	37.793890	-122.292132	----	-22.5	-37.0	
OAK042_175.1	SCI (1999)	5/6/1986	2,116,727	6,043,748	37.794527	-122.292553	13.5	----	-12.0	
OAK042_175.3	SCI (1999)	5/15/1986	2,116,775	6,044,140	37.794679	-122.291202	----	-8.5	-13.0	
OAK042_175.6	SCI (1999)	3/23/1988	2,116,392	6,043,672	37.793602	-122.292793	----	-27.5	-36.0	Note 6
OAK042_266.IC-344	SCI (1999)	8/5/1997	2,116,398	6,046,412	37.793762	-122.283315	----	-39.1	-39.6	Note 6
OAK042_266.TC-366	SCI (1999)	7/31/1997	2,116,601	6,044,677	37.794228	-122.289330	----	-42.3	-45.3	Note 6
OAK042_266.TC-368	SCI (1999)	7/31/1997	2,116,340	6,044,687	37.793512	-122.289278	----	-39.4	-39.9	Note 6
OAK042_266.TC-394	SCI (1999)	8/4/1997	2,115,777	6,044,717	37.791968	-122.289139	----	-43.9	-44.4	Note 6
OAK042_266.TC-396	SCI (1999)	8/4/1997	2,115,947	6,045,009	37.792450	-122.288138	----	-40.2	-40.7	Note 6
OAK042_266.TW-378	SCI (1999)	9/15/1997	2,115,428	6,044,750	37.791012	-122.289002	----	-24.2	-34.7	Note 6
OAK042_285.GB17	SCI (1999)	9/15/1997	2,115,640	6,044,310	37.791571	-122.290537	----	-23.0	-27.0	Note 6
OAK042_285.GB18	SCI (1999)	9/23/1997	2,115,355	6,044,087	37.790775	-122.291290	10.3	----	-30.2	
OAK042_285.GB19	SCI (1999)	9/13/1997	2,115,270	6,044,680	37.790574	-122.289233	----	-17.7	-23.2	Note 6
OAK042_285.GB20	SCI (1999)	9/19/1997	2,115,125	6,044,672	37.790177	-122.289251	10.5	----	-26.0	
OAK042_285.GB21	SCI (1999)	9/24/1997	2,115,036	6,044,668	37.789932	-122.289259	9.6	----	-26.4	
OAK042_285.GB22	SCI (1999)	9/13/1997	2,115,680	6,045,120	37.791723	-122.287737	----	-28.5	-33.0	Note 6
OAK042_285.GB23	SCI (1999)	8/5/1997	2,115,504	6,045,400	37.791254	-122.286757	10.3	----	-21.2	
OAK042_285.GB24	SCI (1999)	8/7/1997	2,115,444	6,045,472	37.791094	-122.286505	10.4	----	-14.6	
OAK042_285.GB25	SCI (1999)	9/12/1997	2,115,860	6,046,040	37.792265	-122.284566	----	-24.3	-37.8	Note 6
OAK042_285.GB26	SCI (1999)	8/12/1997	2,115,513	6,046,205	37.791320	-122.283974	9.7	----	-37.8	
OAK042_285.GB27	SCI (1999)	9/16/1997	2,116,850	6,044,910	37.794924	-122.288541	----	-8.4	-18.9	Note 6
OAK042_298.10	SCI (1999)	7/3/1979	2,116,786	6,046,612	37.794837	-122.282646	----	-30.5	-40.0	Note 6
OAK042_298.11	SCI (1999)	7/5/1979	2,117,035	6,045,136	37.795445	-122.287771	----	-27.5	-35.0	Note 6
OAK042_298.12	SCI (1999)	7/9/1979	2,116,928	6,045,204	37.795153	-122.287528	----	-15.5	-22.0	Note 6
OAK059_CPT-01	Fugro (2003)	4/4/2003	2,115,240	6,044,851	37.790500	-122.288639	----	-25.3	-43.0	
OAK059_CPT-02	Fugro (2003)	4/4/2003	2,115,260	6,044,859	37.790556	-122.288611	----	-28.3	-51.0	

Table B-1 - Port of OaklandInner Harbor Borings, continued

Boring ID	Source	Date	Northing[1]	Easting	Latitude	Longitude	Ground Surface Elevation (ft)[2]	Mudline Elevation (ft)	Top of San Antonio Elevation (ft)	Notes
OAK059_CPT-03	Fugro (2003)	7/1/2003	2,115,226	6,045,059	37.790472	-122.287917	----	-29.4	-55.0	
OAK059_CPT-04	Fugro (2003)	7/1/2003	2,115,256	6,045,068	37.790556	-122.287889	----	-28.7	-53.0	
OAK059_CPT-05	Fugro (2003)	4/7/2003	2,115,379	6,044,974	37.790889	-122.288222	----	-30.5	-42.0	
OAK059_CPT-06	Fugro (2003)	4/7/2003	2,115,366	6,045,118	37.790861	-122.287722	----	-27.1	-50.0	
OAK059_CPT-07	Fugro (2003)	4/7/2003	2,115,461	6,044,919	37.791111	-122.288417	----	-41.8	-52.0	
OAK059_CPT-08	Fugro (2003)	4/8/2003	2,115,490	6,045,008	37.791194	-122.288111	----	-39.8	-51.0	
OAK059_CPT-09	Fugro (2003)	4/8/2003	2,115,554	6,044,809	37.791361	-122.288806	----	-42.9	-50.0	
OAK059_CPT-10	Fugro (2003)	4/8/2003	2,115,715	6,044,852	37.791806	-122.288667	----	-44.5	-52.0	
OAK059_CPT-11	Fugro (2003)	4/8/2003	2,115,683	6,044,956	37.791722	-122.288306	----	-45.0	-51.0	
OAK059_CPT-12	Fugro (2003)	4/8/2003	2,115,751	6,045,102	37.791917	-122.287806	----	-42.6	-54.0	
OAK059_CPT-13	Fugro (2003)	4/9/2003	2,115,773	6,045,006	37.791972	-122.288139	----	-45.6	-53.0	
OAK059_CPT-14	Fugro (2003)	4/10/2003	2,115,679	6,045,133	37.791722	-122.287694	----	-42.7	-45.0	
OAK059_CPT-15	Fugro (2003)	4/7/2003	2,115,312	6,044,764	37.790694	-122.288944	----	-20.6	-31.0	
OAK059_CPT-16	Fugro (2003)	4/4/2003	2,115,464	6,044,751	37.791111	-122.289000	----	-43.4	-45.0	
OAK059_CPT-17	Fugro (2003)	4/9/2003	2,115,838	6,044,758	37.792139	-122.289000	----	-44.1	-48.0	
OAK059_CPT-18	Fugro (2003)	4/9/2003	2,115,862	6,045,112	37.792222	-122.287778	----	-42.9	-45.0	
OAK059_CPT-19	Fugro (2003)	7/1/2003	2,115,185	6,045,059	37.790361	-122.287917	----	-24.1	-40.0	
OAK059_B-1	Fugro (2003)	4/2/2003	2,115,158	6,044,384	37.790250	-122.290250	----	-16.2	-30.5	
OAK059_B-2	Fugro (2003)	3/31/2003	2,114,891	6,044,587	37.789528	-122.289528	----	-20.8	-26.0	
OAK059_B-3	Fugro (2003)	4/1/2003	2,114,685	6,044,744	37.788972	-122.288972	----	-18.8	-28.0	
OAK059_B-4	Fugro (2003)	4/1/2003	2,114,480	6,044,901	37.788417	-122.288417	----	-25.0	-38.5	
OAK059_B-6	Fugro (2003)	4/2/2003	2,115,260	6,044,305	37.790528	-122.290528	----	-16.5	-30.5	
OAK059_B-7	Fugro (2003)	4/3/2003	2,115,271	6,044,298	37.790556	-122.290556	----	-19.0	-31.0	
OAK059_B-8	Fugro (2003)	4/2/2003	2,115,322	6,044,259	37.790694	-122.290694	----	-14.8	-28.5	
OAK059_B-9	Fugro (2003)	4/3/2003	2,115,425	6,044,180	37.790972	-122.290972	----	-11.3	-32.4	
OAK073_CPT-01	Engeo (2007)	3/20/2007	2,115,622	6,044,232	37.791517	-122.290800	----	-47.4	-53.3	
OAK073_CPT-02	Engeo (2007)	3/20/2007	2,115,522	6,044,308	37.791250	-122.290533	----	-43.4	-45.2	
OAK073_CPT-03	Engeo (2007)	3/20/2007	2,115,420	6,044,441	37.790967	-122.290533	----	-44.9	-45.5	
OAK073_CPT-04	Engeo (2007)	3/20/2007	2,115,438	6,044,654	37.791033	-122.289333	----	-42.0	-44.0	
OAK073_CPT-05	Engeo (2007)	3/22/2007	2,115,363	6,044,652	37.790833	-122.289333	----	-43.8	-44.6	
OAK073_CPT-06	Engeo (2007)	3/22/2007	2,115,502	6,044,860	37.791217	-122.288633	----	-41.0	-52.4	
OAK073_CPT-07	Engeo (2007)	3/22/2007	2,115,367	6,044,878	37.790850	-122.288550	----	-48.0	-49.9	
OAK073_CPT-08	Engeo (2007)	3/22/2007	2,115,578	6,045,039	37.791433	-122.288017	----	-39.8	-53.4	
OAK073_CPT-10	Engeo (2007)	3/21/2007	2,115,709	6,045,182	37.791800	-122.287517	----	-41.8	-45.3	
OAK073_CPT-11	Engeo (2007)	3/21/2007	2,115,605	6,045,282	37.791533	-122.287167	----	-39.6	-45.1	
OAK073_CPT-12	Engeo (2007)	3/21/2007	2,115,815	6,045,380	37.792100	-122.286850	----	-38.9	-45.3	
OAK087_1-CPT-05	Engeo (2019)	1/15/2019	2,117,069	6,045,415	37.795552	-122.286810	7.0	----	-37.0	
OAK087_1-CPT-06	Engeo (2019)	1/15/2019	2,117,390	6,045,453	37.796435	-122.286700	7.0	----	-17.0	
OAK087_1-B3	Engeo (2019)	10/30/2019	2,116,907	6,045,822	37.795128	-122.285389	7.0	----	-41.5	

Notes

1) California State Plane Coordinate System (1983) Zone 3, feet.
2) Elevations reported in NAV88
3) Top of San Antonio Formation corresponds to Bottom of Young Bay Mud Elevation
4) Boring data reported by SCI (1999); actual boring logs not reviewed. Refer to SCI report for further details.
5) Boring performed prior to construction of Howard Terminal
6) Boring within federal navigation channel and performed before -50 Foot Deepening Project

Table B-2 - Port of Oakland Outer Harbor Borings

Boring ID	Source	Date	Northing[1]	Easting	Latitude	Longitude	Ground Surface Elevation (ft)[2]	Mudline Elevation (ft)	Top of San Antonio Elevation (ft)	Notes
OAK042_129.1	SCI (1999)[4]	1974	2,123,796	6,036,578	37.813555	-122.317839	15.5	----	-9.5	
OAK042_129.2	SCI (1999)	1974	2,122,919	6,035,666	37.811100	-122.320937	11.5	----	-10.5	
OAK042_129.7	SCI (1999)	1974	2,122,734	6,035,237	37.810569	-122.322408	----	-18.5	-21.5	
OAK042_129.8	SCI (1999)	1974	2,124,230	6,036,787	37.814758	-122.317144	15.5	----	-8.5	
OAK042_129.9	SCI (1999)	1974	2,124,229	6,036,499	37.814741	-122.318143	----	-14.5	-15.5	
OAK042_129.10	SCI (1999)	1974	2,123,748	6,036,054	37.813396	-122.319649	----	-22.5	-37.0	
OAK042_129.11	SCI (1999)	1974	2,123,437	6,035,769	37.812528	-122.320616	----	-31.5	-38.0	
OAK042_137.7	SCI (1999)	7/5/1978	2,124,435	6,036,793	37.815321	-122.317138	----	-31.5	-33.5	
OAK042_143.7	SCI (1999)	2/6/1979	2,123,576	6,036,721	37.812959	-122.317328	12.5	----	-11.5	
OAK042_162.11	SCI (1999)	8/20/1985	2,122,668	6,035,322	37.810392	-122.322111	----	-0.5	-11.5	
OAK042_162.12	SCI (1999)	8/28/1985	2,122,575	6,035,032	37.810120	-122.323107	12.5	----	-10.5	
OAK042_162.13	SCI (1999)	8/29/1985	2,122,564	6,034,798	37.810079	-122.323915	15.5	----	-25.5	
OAK042_162.14	SCI (1999)	8/21/1985	2,122,567	6,033,931	37.810041	-122.326917	13.5	----	-15.5	
OAK042_190.2	SCI (1999)	7/28/1990	2,122,801	6,032,811	37.810622	-122.330810	14.5	----	-20.0	
OAK042_190.3	SCI (1999)	7/28/1990	2,122,743	6,033,266	37.810487	-122.329230	14.5	----	-22.5	
OAK042_197.P-14	SCI (1999)	12/31/1990	2,122,612	6,034,547	37.810197	-122.324790	10.0	----	-20.0	
OAK042_197.P-17	SCI (1999)	1/3/1991	2,122,621	6,034,310	37.810208	-122.325609	8.0	----	-20.0	
OAK042_229.26	SCI (1999)		2,122,592	6,033,000	37.810058	-122.330142	11.3	----	-19.7	
OAK042_229.27	SCI (1999)		2,122,559	6,033,203	37.809978	-122.329436	10.9	----	-16.1	
OAK042_229.28	SCI (1999)		2,122,538	6,033,444	37.809934	-122.328602	10.3	----	-17.7	
OAK042_252.D5-1	SCI (1999)	5/1958	2,123,674	6,036,170	37.813199	-122.319243	5.5	----	-16.5	
OAK042_266.OB-275	SCI (1999)	8/13/1997	2,124,515	6,036,689	37.815535	-122.317504	----	-47.0	-47.0	
OAK042_266.OB-283	SCI (1999)	8/12/1997	2,122,774	6,033,884	37.810607	-122.327095	----	-39.4	-39.4	
OAK042_266.OC-214	SCI (1999)	8/15/1997	2,123,098	6,033,908	37.811497	-122.327032	----	-44.5	-48.3	Note 5
OAK042_266.OC-215	SCI (1999)	8/15/1997	2,123,830	6,033,873	37.813505	-122.327203	----	-45.1	-49.5	Note 5
OAK042_266.OW-243	SCI (1999)	8/5/1997	2,124,130	6,033,769	37.814324	-122.327585	----	-29.0	-45.6	Note 5
OAK042_275.1	SCI (1999)	12/10/1990	2,123,379	6,036,291	37.812396	-122.318804	12.5	----	-8.5	
OAK042_285.GB4	SCI (1999)	9/23/1997	2,124,280	6,033,840	37.814739	-122.327348	----	-4.3	-34.3	Note 5

Notes

1) California State Plane Coordinate System (1983) Zone 3, feet.

2) Elevations reported in NAV88

3) Top of San Antonio Formation corresponds to Bottom of Young Bay Mud Elevation

4) Boring data reported by SCI (1999); actual boring logs not reviewed. Refer to SCI report for further details.

5) Boring within federal navigation channel and performed before -50 Foot Deepening Project