FINAL INTEGRATED GENERAL REEVALUATION REPORT AND ENVIRONMENTAL IMPACT STATEMENT

SAN FRANCISCO BAY TO STOCKTON, CALIFORNIA NAVIGATION STUDY

APPENDIX J: Dredge Material Capacity Analysis

JANUARY 2020

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1 INTRODUCTION

In accordance with Engineer Regulation (ER) 1105-2-100, "[d]redged material management planning for all federal harbor projects is conducted by the Corps to ensure that maintenance dredging activities are performed in an environmentally acceptable manner, use sound engineering techniques, are economically warranted, and that sufficient confined disposal facilities are available for at least the next 20 years. These plans address dredging needs, disposal capabilities, capacities of disposal areas, environmental compliance requirements, potential for beneficial usage of dredged material, and indicators of continued economic justification. The Dredged Material Management Plans shall be updated periodically to identify any potentially changed conditions."

Appendix E of ER 1105-2-100 pertains to this study and states "[f]easibility reports recommending Congressional authorization of new navigation projects or modifications of existing projects shall include a plan for management of dredged material associated with the construction and maintenance of the new project or project modification, consistent with the requirements for Management Plans for existing projects. This plan shall satisfy all identified dredged material management requirements associated with the project, to include construction dredging, projected maintenance dredging for the established project economic life, and other dredged material disposal requirements (for example dredging of berthing areas) needed to realize project benefits."

This appendix serves as the plan for management of dredged material and contains project specific information for this feasibility study in terms of operations and maintenance dredging quantities and capacity for a 20 year planning horizon. This appendix concludes that there is sufficient capacity at the current Federal Standard disposal sites for the recommended plan proposed in this feasibility study for the 20 year horizon.

2 REGIONAL DREDGED MATERIAL MANAGEMENT PLAN

2.1 BACKGROUND

In the early 2000s, the San Francisco District began preparation of a regional Dredged Material Management Plan (DMMP) for ten authorized federal navigation channels in the San Francisco Bay region. In 2011, a draft regional DMMP was completed; however, since then, development of the regional DMMP was halted due to lack of funding. As of this writing, the

San Francisco District DMMP is underway; however, a timeline for approval is not known. As such, the project development team coordinated with the Deep Draft Navigation Center of Expertise to develop a strategy for complying with Appendix E of ER 1105-2-100. The strategy for compliance was to include an analysis of the maintenance material capacity of the federal standard and base plan dredged material placement sites over a period of 20 years.

3 PROJECT INFORMATION

Reference the main report for details regarding the proposed project. The main report provides an analysis of the placement capacity at the beneficial use sites for the deepening project. It also provides an economic analysis of deepening and maintaining the project over a period of 50 years. Finally, it provides a detailed analysis of the environmental impacts resulting from deepening the project and on-going maintenance dredging.

3.1 EXISTING FEDERAL PROJECT OPERATIONS AND MAINTENANCE

Operations and maintenance material from the existing federal project within Pinole Shoal is typically placed at the project's federal standard placement site, SF-10. However, at times SF-11; and SF-9 are also used. Maintenance material from Suisun Bay, including Bulls Head Reach, is placed at the project's federal standard placement site SF-16. At times, sediment from Bulls Head Reach is placed at SF-9. Each project's federal standard dredge type and placement site is discussed below.

The four main sites are discussed below (SF-16, SF-10, SF-11 and SF-9) and each have a site specific capacity. In addition, there is an overall in-bay capacity, which is set by the current water quality permit for the O&M dredging program. The water quality permit issued to USACE for O&M dredging permits the USACE to use a 3.5 MCY capacity of in-bay disposal over a 5 year period (2015 to 2019). Per this permit and as verified with the San Francisco Bay Regional Dredging Technical Specialist, the water quality permit for the regional O&M program is currently in the process of being re-negotiated for the next 5 year period. Coordination between the study team and San Francisco Bay Regional Dredge Technical Specialist will continue to ensure the revised permit includes O&M estimates for this project.

Pinole Shoal Channel: The Pinole Shoal Channel was typically dredged annually; however, maintenance dredging was recently changed to a 2-year (biennial) schedule to comply with the current Clean Water Act section 401 water quality certification for the federal maintenance dredging projects in San Francisco Bay over a period of 5 years (2014-2018). The water quality

certification only allows for hopper dredging of one in-bay channel each year. A hopper dredge is the federal standard dredge type for both the Pinole Shoal Channel, as well as the Richmond Outer Harbor; therefore, only one channel is dredged each year and the other channel is deferred. As such, this analysis assumes that maintenance dredging Pinole Shoal Channel would occur on a biennial schedule (every other year). Pinole Shoal's federal standard site is SF-10, with both SF-11 and SF-9 be used as a backup placement site.

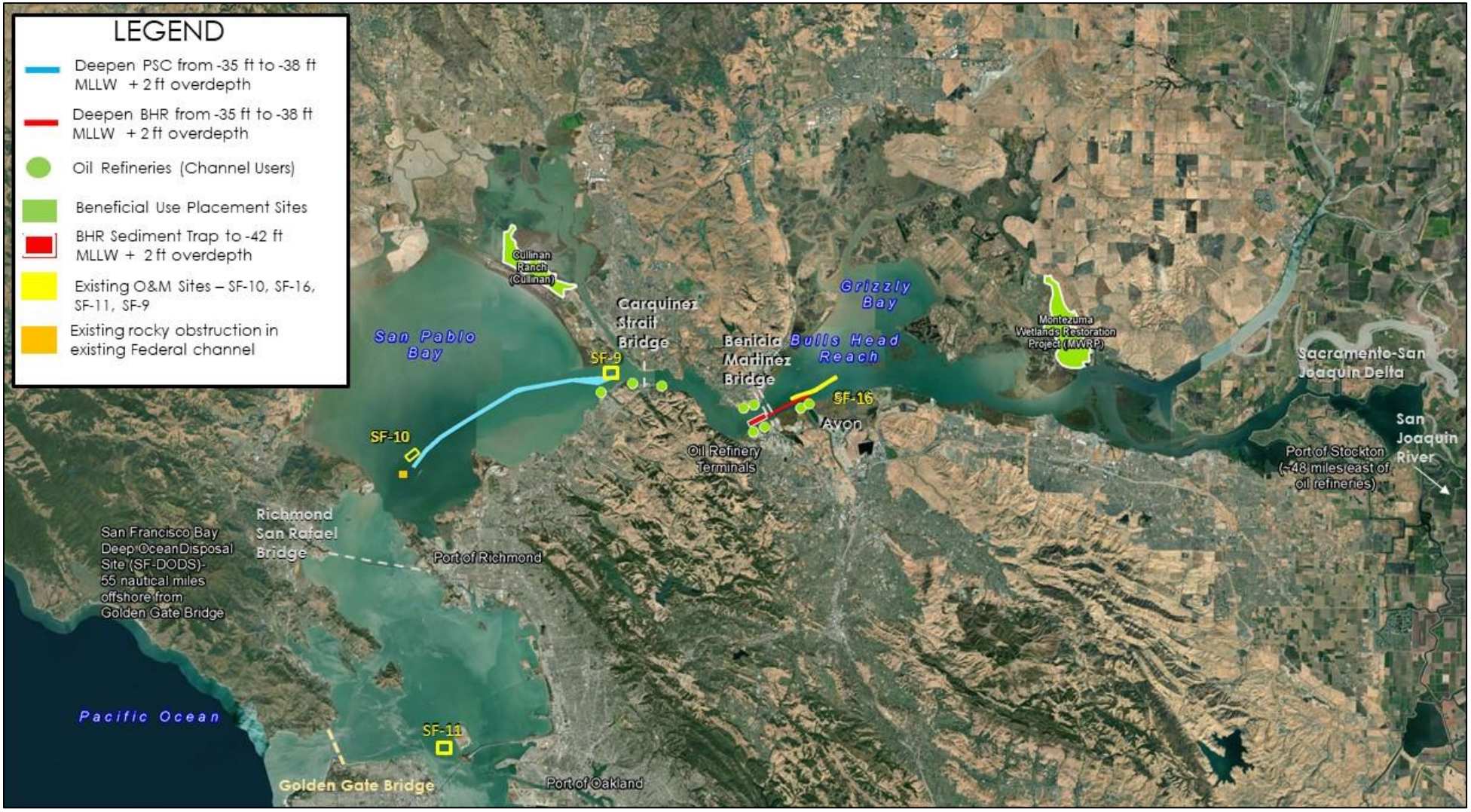
Suisun Bay Channel (which includes Bulls Head Reach): Maintenance dredging of Bulls Head Reach is typically included with the Suisun Bay Channel and dredged material is placed at the federal standard site, SF-16. At Bulls Head Reach, past maintenance has included dredging up to 4 feet of advance maintenance material to accommodate rapid shoaling. Because of the variable shoaling rate at this location, this practice is reviewed annually to determine if it remains effective. In the case of Bulls Head Reach Shoal, USACE typically elects to perform advance maintenance every year because that area shoals faster than the annual dredging cycle, and it is essential for USACE to maintain the utility of the channel as long as possible before needing to address any shoaling issues outside of the work window. In recent years, advance maintenance at Bulls Head Reach has reduced USACE's critical dredging episodes outside of the work window. It is expected that constructing a sediment basin in Bulls Head Reach will alleviate the need for yearly advance maintenance and emergency dredging.

The channel was historically dredged with a federal hopper dredge and material was placed at the project's federal standard site, SF-16. However, Endangered Species Act coordination with the United States Fish and Wildlife Service (USFWS) has resulted in an agreement to dredge the Suisun Bay Channel with a clamshell dredge to reduce the risk of delta smelt entrainment in hydraulic hopper dredges.

3.1.1 FEDERAL STANDARD PLACEMENT SITES

The deep draft navigation channels included in the proposed project each have one identified federal standard placement site, with SF-10 being the federal standard site for Pinole Shoal and SF-16 being the federal standard site for Bulls Head Reach. Both are shown, along with the tentatively selected plan, in **Figure 1.**

Figure 1. Recommended Plan Showing Existing O&M Disposal Sites



SF-10 San Pablo Bay: The SF-10 placement site is a 1,500- by 3,000-foot rectangle, approximately 30 to 45 feet deep, located 3.0 miles northeast of Point San Pedro in southern San Pablo Bay in Marin County. Site specific capacity is limited to 500,000 cubic yards of dredged material per year. SF-10 is a multi-user disposal site that is also used by two other federal projects and other non-federal projects. Over the past 6 years, only ten non-federal projects have used this site.

SF-16 Suisun Bay: The SF-16 placement site is a single-user in-bay unconfined disposal site reserved for sand dredged from the Suisun Channel and New York Slough projects only. SF-16 is a 500-foot by 11,200-foot rectangle adjacent to the northern side of Suisun Bay Channel, approximately 1 mile upstream of the Interstate 680 Bridge. The depth at this site is approximately 30 feet MLLW. Currently, the site specific capacity is 200,000 cubic yards of dredged sand per year.

3.1.2 OTHER PLACEMENT SITES INCLUDED IN THE BASE PLAN

Pinole Shoal and Bulls Head Reach have used two other in-bay sites for placement of dredged material, including SF-9 and SF-11, discussed below. These sites are included in the project's base plan.

SF-9 Carquinez Strait: The SF-9 placement site is a 1,000-foot by 2,000-foot rectangle, approximately 10 to 55 feet deep, located 0.9 miles west of the entrance to Mare Island Strait in eastern San Pablo Bay in Solano County. The site is a multi-user site. In recently years, three Federal projects have use the site and eleven non-Federal projects have used the site. Site specific capacity is as follows:

- 1.0 million cubic yards of dredged material per month.
- 2.0 million cubic yards per year during wet years.[1]
- 1.0 million cubic yards per year during dry years.

SF-11 Alcatraz: The SF-11 placement site is a 1,000-foot-radius circular area, approximately 40 to 70 feet deep, located approximately 0.3 mile south of Alcatraz Island in the Central Bay. SF-11 is a multi-user site and is the most heavily used disposal site in the Bay. Site specific capacity is as follows:

[1] Stated capacities in wet and dry years are in lieu of 1.0 MCY per month, rather than in addition to it.

- 400,000 cubic yards per month from October to April.
- 300,000 cubic yards per month from May to September.

3.1.3 OTHER PROJECTS USING THE FEDERAL STANDARD AND BASE PLAN PLACEMENT SITES AND VOLUMES PLACED ANNUALLY

More than 100 non-federal projects maintain navigation channels in San Francisco Bay, with some projects dredging annual and most projects dredging infrequently. The number of projects dredging each year varies, as do the specific projects. With the exception of many of the deep draft federal navigation channels, it is difficult to state with certainty which projects will dredge and what the volume of dredged material will be. Over the past 6 years (2012-2017), the dredged material placement sites have had one to several projects using the sites, including:

- SF-10: Three (3) federal and ten (10) non-federal have used SF-10.
- SF-16: Only the Suisun Bay / New York Slough federal project have used SF-16.
- SF-11: Four (4) federal and 22 non-federal projects have used SF-11.
- SF-9: Three (3) federal and 11 non-federal projects have used SF-9.

Table 1 summarizes the total federal and non-federal volume of material placed at each site. As shown, the only dredged material placement exceedance was at SF-10 in 2015 when 108,000 cubic yards above the 500,000 cubic yard annual limitation was placed at the site.

Table 1. Federal and Non-federal Maintenance Dredged Material Volume Placed at Disposal Sites SF-10, SF-16, SF-11 and SF-9.

SITE	YEAR	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	TOTAL
								SF-10 Limits	**500,000 cy**
SF-10	2017	346,878	39,808	0	0	0	103,498	0	490,179
	2016	2,770	8,797	10,737	71,612	60,783	9,221	399	164,259
	2015	7,196	44,980	41,100	117,952	357,990	29,847	8,962	608,027 **
	2014	0	137,775	11,741	0	0	117,355	66,353	333,224
	2013	0	0	94,420	219,838	94,420	4,403	0	413,081
	2012	0	0	202,302	8,792	4,821	11,397	14,819	242,131
								SF-16 Limits (sandy material only)	**200,000 cy**
SF-16	2017	0	0	0	0	195,130	0	0	195,130
	2016	0	0	0	0	0	0	0	0
	2015	0	0	0	0	13,212	69,581	0	82,793
	2014	0	0	130,415	0	0	0	0	130,415
	2013	0	0	132,566	0	0	0	0	132,566
	2012	0	0	141,223	0	0	0	0	141,223
SF- 11 Limits		**300,000 cy per month**				**400,000 cy per month**			**No annual limit**
SF-11	2017	7,203	17,651	35,081	296,806	22,346	106,498	4,642	490,227
	2016	189,249	27,217	25,548	83,659	96,490	164,170	42,261	628,594
	2015	256,075	111,439	23,589	19,405	19,149	24,147	15,472	469,276
	2014	10,449	163,413	63,904	42,450	91,470	294,629	5,541	671,856

SITE	YEAR	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	TOTAL
	2013	7,121	730	49,065	74,372	113,493	98,165	0	342,946
	2012	2,033	30,290	122,602	108,651	13,819	29,880	29,129	336,404
SF-9 Limits		**1,000,000 cy per month**							**1.0M dry year 2.0M wet year**
SF-9	2017	5,541	0	0	6,991	19,253	9,597	2,809	44,191
	2016	0	0	19,407	13,960	6,504	17,688	1,637	59,196
	2015	0	0	8,829	0	2,610	0	0	11,439
	2014	0	0	23,104	29,854	21,035	0	3,843	77,836
	2013	0	0	56,176	24,398	4,045	14,056	0	98,675
	2012	15,631	0	0	0	19,432	53,208	924	89,195
** Indicates timeframes in which dredged material placement capacity was exceeded.									

3.1.4 EXISTING FEDERAL PROJECT VOLUMES/ PLACED AT SF-10 AND SF-16 (FEDERAL STANDARD SITES) AND SF-9 AND SF-11 (OTHER PLACEMENT SITES ROUTINELY USED)

Over the past 6 years, five federal navigation projects have used the one or more of the dredged material placement sites used by Pinole Shoal Channel or Bulls Head Reach. **Table 2** provides the federal operations and maintenance dredged material volumes placed at the federal standard or other base plan sites used by Pinole Shoal Channel and Bulls Head Reach over the past 6 years.

Table 2. Placement of Material Dredged from Federal Navigation Channels at Pinole Shoal Channel and Bulls Head Reach Federal Standard and Base Plan Placement Sites (cubic yards).

CHANNEL	YEAR	SF-10	SF-16	SF-11	SF-9	TOTAL DREDGE VOLUME
Pinole Shoal	2017 [a]	437,797	--	--	5,541	443,338
	2016	107,281	--	100,338	--	207,619
	2015	97,695	--	--	82,793	180,488
	2014	145,372	--	--	20,333	165,705
	2013	78,208	--	--	27,603	105,811
	2012	113,988	--	--	--	113,988
Suisun Bay (including Bulls Head Reach)	2017	--	195,130	--	--	195,130
	2016 [b]	--	--	--	--	--
	2015	--	82,793	--	--	82,793
	2014	--	130,415	--	--	130,415
	2013	--	132,566	--	--	132,566
	2012	--	141,223	--	15,631 [b]	156,854
Richmond Outer Harbor	2017	--	--		--	--
	2016	12,291	--	222,203	--	234,494
	2015	232,222	--	--	--	232,222
	2014	73,036	--	173,862	--	246,898
	2013	330,470	--	171,730	--	502,200
	2012	113,988	--	114,950	--	228,938
Redwood City	2017	--	--	249,507	--	249,507
	2016	--	--	205,356	--	205,356

CHANNEL	YEAR	SF-10	SF-16	SF-11	SF-9	TOTAL DREDGE VOLUME
	2015	--	--	271,399	--	271,399
	2014	110,672	--	283,710	--	394,382
	2013	--	--	--	--	--
	2012	--	--	10,040	--	10,040
Oakland Harbor [c]	2017	--	--	--	--	--
	2016	--	--	--	--	--
	2015	--	--	--	--	--
	2014	--	--	--	--	--
	2013	--	--	124,200	--	124,200
	2012	--	--	--	--	--

Notes:
[a] 2017 was the first year advance maintenance occurred in the Pinole Shoal Channel prior to the 2018 maintenance dredging deferment.
[b] Suisun Bay Channel was not dredged in 2016 because the clamshell dredge contract bids were too high.

3.2 PROPOSED FUTURE FEDERAL PROJECT

The recommended plan proposes the following:

- Deepen the existing maintained channel depth of the Pinole Shoal Channel and Suisun Bay Channel from -35 feet to -38 feet MLLW, with approximately 13.2 miles of new regulatory depths.
- Dredge a 2,600 foot sediment trap at Bulls Head Reach with a depth of -42 feet MLLW, plus 2 feet of overdepth.
- Level the rocky obstruction located to the west of Pinole Shoal from a peak of -39.7 feet MLLW to approximately -43 feet MLLW for navigability

The recommended plan would dredge a total of approximately 1.6 million cubic yards of material. Of that total amount, up to approximately 1,443,900 cubic yards material would be placed in the Cullinan Ranch Site and roughly 159,300 cubic yards of material would be used in Montezuma Wetlands Restoration. The breakdown of material and the classification of material

by location in the channel is shown in
Table 3. The estimated quantities shown in **Table 3** include 2 feet of over depth. Related

CHANNEL	QUANTITY (CY)	PROPOSED PLACEMENT	CLASSIFICATION
Pinole Shoal Channel (STA 0+00 to STA 547+00)	1,443,900	Cullinan Ranch	Silty Sand/Clayey Sand
Suisun Bay Channel (STA 0+00 to STA 62+00 & STA 88+00 to STA 160+00)	38,700	Montezuma Wetland	Silty Sand/Clayey Sand
Bulls Head Reach Sediment Trap (STA 62+00 to 88+00)	120,600	Montezuma Wetland	Silty Sand/Clayey Sand
Rocky Obstruction leveling	40	Sidecast	Rock
TOTAL DREDGING QUANTITIES	**1,603,200**		

operations and maintenance material and disposal is discussed in the sections below.

A brief bulking analysis has been conducted for initial placement of material in **Appendix A, Civil Site** and concludes that the effect of bulking of the material from this project is significantly low. A more detailed analysis will be performed during the pre-construction and engineering design (PED) phase to reevaluate the dredge material quantity from the new work and other factors that may impact project cost including bulking.

CHANNEL	QUANTITY (CY)	PROPOSED PLACEMENT	CLASSIFICATION
Pinole Shoal Channel (STA 0+00 to STA 547+00)	1,443,900	Cullinan Ranch	Silty Sand/Clayey Sand
Suisun Bay Channel (STA 0+00 to STA 62+00 & STA 88+00 to STA 160+00)	38,700	Montezuma Wetland	Silty Sand/Clayey Sand

Bulls Head Reach Sediment Trap (STA 62+00 to 88+00)	120,600	Montezuma Wetland	Silty Sand/Clayey Sand
Rocky Obstruction leveling	40	Sidecast	Rock
TOTAL DREDGING QUANTITIES	**1,603,200**		

Table 3. Deepening Material (CY), Proposed Placement Site, and Sediment Type.

3.2.1 FUTURE FEDERAL PROJECT OPERATIONS AND MAINTENANCE VOLUMES

Existing operations and maintenance dredging would increase by the amounts as shown in **Table 4**. Operations and maintenance material from Pinole Shoal and Suisun Bay are placed in the in-bay placement sites SF-10 and SF-16, respectively.

Table 4. Increases in Annual Project Operations and Maintenance Due to the Proposed Project (cubic

yard.

CHANNEL	EXISTING AVERAGE VOLUME	EXTIMATED INCREASE	FUTURE O&M VOLUME
Pinole Shoal Channel [a] (STA 0+00 to STA 547+00)	255,000 (biennial)	96,800 (biennial)	351,800 (biennial)
Bulls Head Reach [b] (STA 0+00 to STA 62+00 & STA 88+00 to STA 160+00)	25,000 (annual)	20,700 (annual)	45,700 (annual)
Sediment Trap in Bulls Head Reach [b] (STA 62+00 to 88+00)	0 [c]	8,900	8,900
TOTAL DREDGING QUANTITIES *WITHOUT* PINOLE SHOAL	**25,000**	**29,600**	**54,600**
TOTAL DREDGING QUANTITIES *WITH* PINOLE SHOAL	**280,000**	**126,400**	**406,400**

Notes:
[a] Pinole Shoal is currently on a biennial maintenance dredging schedule (i.e., dredged every two years).
[b] Bulls Head Reach is maintenance dredged annually with the Suisun Bay Channel.
[c] The sediment trap does not exist and, therefore, is currently not dredged.

3.2.2 CAPACITY OF PLACEMENT SITES USED OVER THE NEXT 20 YEARS

Over 20 years, maintaining the new regulatory depth of Pinole Shoal Channel and Bulls Head Reach will create a total of approximately 54,600 cubic yards during years where Pinole Shoal Channel is deferred and 406,400 cubic yards of material when Pinole Shoal is dredged. The following sections provide the analysis of the capacity of the Pinole Shoal Channel and Suisun Bay Channel federal standard placement sites, as well as backup sites used by the projects.

Pinole Shoal Channel: Pinole Shoal Channel will be dredged on a biennial schedule with a hopper dredge. Over 20 years, maintaining the new regulatory depth of Pinole Shoal Channel would create an additional 96,800 cubic yards of material each year dredging occurs. In total, it is expected that a total of 351,800 cubic yards would require dredging on a biennial schedule.

Pinole Shoal Channel's federal standard site is SF-10, with both SF-11 and SF-9 included in the project's base plan. As shown on **Table 1**, SF-10 has an annual capacity limitation of 500,000 cubic yards per year. SF-11 does not have annual limitations; however, this site does have monthly limitations. Between June and September, the monthly limitation is 300,000 cubic yards; between October and December, the monthly limitation is 400,000 cubic yards. SF-9 does not have monthly limitations; however, the annual limitation is 1,000,000 cubic yards during a dry year and 2,000,000 during a wet year.

SF-10 is a multi-user disposal site that is also used by two other federal projects and ten non-federal project. Over the past 6 years, placement at SF-10 has ranged from 164,300 to 608,400 cubic yards, with an average of 375,200 cubic yards. Of this quantity, approximately 78,200 to 437,800 cubic yards has come from Pinole Shoal Channel. Future maintenance dredging would be on a biennial schedule with approximately 351,800 being dredged every other year. If all this material was placed at SF-10, 148,200 cubic yards of capacity would be available for other projects to utilize SF-10. **Table 5** provides details regarding the annual placement of maintenance dredged material at SF-10, including material from the Pinole Shoal Channel, other federal channels, and non-federal channels.

As discussed, per the requirements of the 5-year water quality certification, only one in-bay channel can be dredged with a hopper dredge each year. In San Francisco Bay, both Pinole Shoal Channel and Richmond Outer Harbor are dredged with a hopper dredge. As such, the USACE has elected to maintenance dredge one channel each year with a hopper dredge and defer dredging of the other channel. This has resulted in both channels maintenance dredged on a biennial schedule, with only one channel being dredged each year. Therefore, during years when Pinole Shoal is dredged, Richmond Outer Harbor would not be dredged and would not place material at SF-10. Removing the volume of material from Richmond Outer Harbor placed at SF-10, the resulting capacity of SF-10 during years in which Pinole Shoal Channel would be dredged would range from 82,600 to 462,400 cubic yards, averaging approximately 222,400 cubic yards. Adding the additional volume from Pinole Shoal Channel after deepening would add an additional 96,800 cubic yards. During years Pinole Shoal is dredged, placement at SF-10 could range from 180,000 to 560,000 cubic yards, averaging approximately 319,200 cubic yards. During years when the volume capacity at SF-10 could be exceeded, the additional volume (expected to be a maximum of 60,000 cubic yards) could be placed at SF-9 or SF-11.

Table 5. Operations and Maintenance Material Placed at SF-10.

DREDGING PROJECT(S)	2012	2013	2014	2015	2016	2017
Pinole Shoal Channel	113,988	78,208	145,372	97,659	107,281	437,797
Redwood City	--	--	110,672	--	--	--
Richmond Outer Harbor	75,551	330,470	77,150	232,222	12,291	--
Non-Federal Projects	52,772	4,403	--	278,148	44,687	52,382
Total	**242,311**	**413,081**	**333,194**	**608,029**	**164,259**	**490,179**

Suisun Bay Channel (which includes Bulls Head Reach): Maintenance dredging of Bulls Head Reach is typically included with the Suisun Bay Channel and dredged material is placed at the federal standard site, SF-16. Over the past 6 years, the volume of material dredged from the Suisun Bay Channel (including Bulls Head Reach) has ranged from approximately 83,000 to 195,000 cubic yards, with an average of 140,000 cubic yards per year (median of 133,000 cubic yards). Including the additional 56,400 cubic yards of additional maintenance dredging volume anticipated following deepening Bulls Head Reach, a total of 196,400 cubic yards would be dredged from the Suisun Bay Channel (including Bulls Head Reach). The annual capacity of SF-16 is 200,000 cubic yards per year, which is enough capacity to accept maintenance material dredged annually from the Suisun Bay Channel following deepening of Bulls Head Reach. In years where the volume dredged is above 200,000 cubic yards, additional material could be placed at SF-9, SF-11, or an upland beneficial use site, should a beneficial use site be available.

3.2.3 CONCLUSIONS

This appendix concludes that there is sufficient capacity at the current Federal Standard disposal sites for the recommended plan proposed in this feasibility study for a 20 year horizon.

It is estimated that site specific capacity in existing federal standard placement sites SF-10 and SF-16 will typically be adequate for annual operations and maintenance placement. During times when additional capacity is required, the placement sites included in the project's base plan, SF-9 and SF-11, would provide enough site specific capacity to accept additional dredged material. Based on this analysis, no new placement sites will be needed as a result of the new operations

and maintenance volumes. In addition, there is an overall in-bay capacity, which is dictated by the current water quality permit for the O&M dredging program. The water quality permit issued to USACE for O&M dredging shows that USACE is currently permitted to use a 3.5 MCY capacity of in-bay disposal over a 5 year period (2015 to 2019). Per this permit and as verified with the San Francisco Bay Regional Dredging Technical Specialist, the water quality permit for the regional O&M program is currently in the process of being re-negotiated for the next 5 year period. Coordination between the study team and San Francisco Bay Regional Dredge Technical Specialist will continue to ensure the revised permit includes O&M estimates for this project. It is estimated that Pinole Shoal Channel O&M volumes will increase from 127,500 to 175,900 cy to be dredged every other year and Bulls Head Reach O&M volumes will increase from 25,000 to 54,600 cy to be dredged annually (inclusive of the sediment trap). During the development and finalization of the San Francisco Bay Regional DMMP, this information will be included.