PORT OF LONG BEACH
DEEP DRAFT NAVIGATION FEASIBILITY STUDY

Los Angeles County, California

Draft Integrated Feasibility Report and Environmental Impact Statement / Environmental Impact Report (EIS/EIR)

October 2019

Volume 1: Technical Appendices A to G

US Army Corps of Engineers ®

Port of LONG BEACH
The Green Port

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DRAFT INTEGRATED FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT STATEMENT / ENVIRONMENTAL IMPACT REPORT (EIS/EIR)

APPENDIX A: AGENCY COORDINATION AND PUBLIC INVOLVEMENT

PORT OF LONG BEACH
DEEP DRAFT NAVIGATION STUDY
Los Angeles County, California

October 2019

US Army Corps of Engineers ®

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1 INTRODUCTION

The environmental assessment of the Port of Long Beach Deep Draft Navigation Study is being conducted in accordance with state and federal regulations. The Port of Long Beach (POLB) is acting as lead agency for purposes of compliance with the California Environmental Quality Act (CEQA). The United States Army Corps of Engineers, Los Angeles District, (USACE) is the lead agency for purposes of compliance with the National Environmental Policy Act (NEPA). The public scoping requirements for each of these regulations differs slightly; however, the intent of each process remains the same — to initiate public scoping to assist in the preparation of the Integrated Feasibility Report (IFR) by providing information about the Proposed Project to, and solicit information that will be helpful in the environmental review process from the public.

This appendix documents the issues and concerns expressed by members of the public, government agencies, and organizations during the public scoping period. After the release of the Notice of Preparation (NOP), the POLB and the USACE held a 30-day public scoping period under CEQA. The comment period allowed the public and regulatory agencies an opportunity to comment on the scope of the environmental document, comment on the alternatives considered, and to identify issues that should be addressed in the IFR. An earlier public review and comment period was previously conducted by the USACE as part of the review process under NEPA.

The POLB and the USACE has prepared an Integrated Feasibility Report (IFR), which evaluates the potential environmental impacts associated with the Proposed Project and identifies mitigation measures to reduce these impacts to an insignificant level, where possible.

1.1 Purpose of Scoping

The process of determining the focus and content of an IFR is known as scoping. Scoping helps to identify environmental features, areas of local concern, update local conditions, and eliminate from detailed study those issues that are not pertinent to the final decision on the Proposed Project. The scoping process is not intended to resolve differences of opinion regarding the Proposed Project or evaluate its merits. Instead, the process allows all interested parties to express their concerns regarding the Proposed Project and thereby ensures that all opinions and comments are considered in the environmental analysis. Scoping is an effective way to bring together and address the concerns of the public, affected agencies, and other interested parties. Members of the public, relevant federal, state, regional, and local agencies, interests groups, community organizations, and other interested parties may participate in the scoping process by providing comments or recommendations regarding issues to be investigated in the IFR.

Comments received during the scoping process are part of the public record as documented in this scoping report. The comments and questions received during the public scoping process have been reviewed and considered by the POLB and the USACE in determining the appropriate scope of issues to be addressed in the IFR.

The purpose of the scoping for Project was to:

- Inform the public and relevant public agencies about the Project, CEQA and NEPA requirements, and the environmental impact analysis process;
- Identify potentially significant environmental resources for consideration in the IFR; and

- Compile a mailing list of public agencies and individuals interested in future Project meetings and notices.

1.2 Notice of Preparation (NOP)

As required by CEQA Guidelines §15082, the POLB issued a NOP on November 3, 2016, that summarized the Project, stated its intention to prepare a joint IFR, and requested comments from interested parties (see Attachment 1). The NOP also included notice of the public scoping meeting that was held on November 19, 2016 at 2:00 pm. The NOP was filed with the State Clearinghouse (SCH# 2016111014), which began the 30-day public scoping period. An amended NOP was filed by the POLB on January 29, 2019. The amended NOP was filed with the State Clearinghouse (SCH# 20162016111014), which began the 30-day public scoping period. The amended NOP also included notice of the public scoping meeting that was held on February 13, 2019, at 2:00 pm.

1.3 Notice of Intent (NOI)

The National Environmental Policy Act (PL 91-190), among other Federal laws and regulations, mandate public involvement. Federal planning policies, USACE practice, and regulations have consistently required and encouraged this practice. The Notice of Intent (NOI) was published in the Federal Register on January 5, 2016. The NOI summarized the Project, stated USACE's intention to prepare a joint IFR, and requested comments from interested parties (Attachment 1). The NOI also included notice of the public scoping meeting that was held on January 19, 2016 at 2:00 pm.

1.3.1 Scoping Comments

Attachment 2 contains copies of all written (and emailed) comments received from the general public, government agencies, and private companies during the scoping periods. All written and oral comments received during the public comment period, during the public scoping meetings, and through email were reviewed for the IFR.

2 ENDANGERED SPECIES ACT CONSULTATION

Preliminary consultation with the US Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) was conducted relatively early in the planning phase. A formal species list request was made to NMFS on July 31, 2014. A formal response was received on August 29, 2014. Copies of these letters are included in Appendix I of the main report. The USFWS no longer prepares species lists, but has deferred to an online system allowing federal agencies to define the study area generating an online species request via their ECOS portal. An initial species list was generated on February 18, 2015, with a follow-up request on March 10, 2015, as a result of a modification to the study area. Copies of this correspondence are also included in Appendix I of the main report.

3 FISH AND WILDLIFE COORDINATION ACT

Coordination with the USFWS, in accordance with the Fish and Wildlife Coordination Act, was also started early in the planning process. A Scope of Work was provided to USFWS in May 2015 to initiate award of a task order to USFWS to prepare a Planning Aid Report (PAR) and a Coordination Act Report (CAR). The task order was awarded on September 30, 2015. A Final PAR was submitted to the USACE on June 30, 2016. A copy of the PAR can be found in Appendix I of the main report. A Draft CAR is currently under preparation by the USFWS and will be incorporated into the Final IFR when received early in 2020.

3.1 Planning Aid Report (PAR)

The PAR included six recommendations for the study.

3.2 PAR Recommendations

1. USACE should use dredge materials, as contaminant levels in the dredge materials allow, to construct areas of shallow water fish habitats (areas of water less than -20 feet MLLW).

2. Within the center of the area of created shallow water fish habitats noted above, USACE should create a least tern/snowy plover nesting island with dredge materials. We suggest that the Outer Harbor in areas of low shipping traffic would likely be a functional location for this purpose, particularly areas adjacent to (behind) the existing Middle or Long Beach breakwaters. The middle of this island(s) should be at least several acres in size and relatively flat with the surface constructed of typical least tern nesting soil matrix materials.

3. USACE should implement a construction schedule for the project that avoids the least tern breeding season, if feasible.

4. Turbidity from dredge and fill activities in the vicinity of the shallow water habitats should not extend over an area greater than 5 acres of shallow waters (i.e., areas less than 20 feet deep) at any one time during the April-to-September breeding season of the California least tern. Monitoring of project-related turbidity, as provided for in measure 5 below, should be based on visually observed differences between ambient surface water conditions and any visible dredging turbidity plume.

5. USACE should provide a qualified least tern biologist, acceptable to the Service and Department, and approved by USACE, to help monitor and manage project activities. This program should be carried out during project activities. The biologist should coordinate with the Service and the Department and:

   a. If the areas associated with project activities (such as staging areas) would occur within upland areas of the Port that are capable of supporting sensitive species, USACE should provide an education program for construction crews, including the identity of the least tern and their nests, restricted areas and activities, and actions to be taken if least tern nesting sites are found outside the designated least tern nesting sites/within project activity areas.

b. Visually monitor and report to the dredging contractor or USACE contract manager and Service/Department any turbidity from project dredging which extends over an area greater than 5 acres of shallow waters.

6. If least tern or other protected species nests are found within the project's direct footprint in upland areas during construction, then all work in the immediate area should be halted, and the USACE biologist be notified immediately. An appropriate buffer zone around the nest for exclusion of project-related activities should be specified by the biologist in coordination with the Service and the Department.

3.3 PAR Recommendations Responses

We are not able to include any of the recommendations provided for reasons discussed below.

Recommendations 1 & 2 will be discussed together as they relate to the same thing, i.e. construction of shallow water habitat. There are no safe areas within the POLB where such a habitat could be safely constructed that would not obstruct shipping or would not erode away leading to sedimentation of the federal navigation channels. The majority of the sediments to be dredged are also considered to be too fine grained to be useful for the construction of such habitats. The Approach Channel is the only area expected to have a high sand content. Sediments from this area are proposed to be beneficially reused to fill in the borrow area for Surfside-Sunset. This would have an equivalent effect to the recommended measures. However, creation of an island in this area is not possible as it would obstruct recreational navigation and fishing in the area.

Recommendation 3 is not feasible. The least tern breeding season runs from April 15 to September 15. Avoiding this season for a multi-year effort would double the length of time required for construction. In addition, the USACE has determined that construction activities would have no effect on the species if conducted during the breeding season. This measure would not provide any protections to this species, but would result in substantial cost and time delays in completing the proposed project.

Recommendation 4 is not applicable. There are no shallow water areas close enough to proposed dredge operations where turbidity would extent over them. Monitoring of project-related turbidity would continue over the duration of the project, including outside the California least tern breeding season. This monitoring would be based on instrument packages taking measurements throughout the water column, a standard practice by the USACE. It is a better measure of turbidity than observations of ambient surface water conditions.

Recommendation 5; as discussed in Section 5.4 of the main report, the USACE has made a determination that the Proposed Project would not effect California least tern. Inclusion of a least tern biologist to monitor construction activities would be an unnecessary measure adding delays and expenses to the proposed project that are considered to be unnecessary. None of the upland areas are suitable nest sites for this, or any other species of migratory bird.

Recommendation 6; none of the upland areas within the project's direct footprint are suitable nest sites for this, or any other species of bird. They are all developed with no sandy, unvegetated areas suitable for nesting.

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Attachment 1

Notices of Preparation and Notice of Intent

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4801 Airport Plaza Drive, Long Beach, CA 90815 Tel 562.283.7000 www.polb.com

Port of
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The Green Port

NOTICE OF PREPARATION OF A DRAFT ENVIRONMENAL IMPACT REPORT

Date: November 14, 2016

To: Agencies, Organizations, and Interested Parties

Subject: **Port of Long Beach Deep Draft Navigation Study**

The Port of Long Beach (POLB) and the U.S. Army Corps of Engineers (USACE) are preparing a Port of Long Beach Deep Draft Navigation Feasibility Study and joint Environmental Impact Report/Environmental Impact Statement (EIR/EIS). The Federal lead agency responsible for implementing the National Environmental Policy Act (NEPA) is the USACE, Los Angeles District. The USACE published a Notice of Intent (NOI) for the preparation of the EIS in the January 5, 2016 Federal Register. A scoping meeting for the EIS was held at the POLB Interim Administration Building on January 19, 2016.

The Port of Long Beach (POLB), pursuant to the California Environmental Quality Act (CEQA), will act as the Lead Agency in the preparation of an Environmental Impact Report (EIR) for the subject study, which is further described below. The POLB has prepared a Notice of Preparation (NOP) under CEQA and is soliciting input from agencies, organizations, and interested parties on the scope of environmental issues to be addressed in the EIR for the subject project. Since the lead agency has determined that an EIR will be prepared for the subject project, an initial study has not been prepared and is not included as an attachment.

Project Applicant: Port of Long Beach

Project Location: The potential project area includes portions of the POLB complex as shown on Figure 1, including the channels and berths serving Pier J, Pier T/West Basin, the Southeast basin, anchorage area adjacent to the main channel, and the approach channel extending seaward from the Queen's Gate opening of the Long Beach Breakwater.

Project Description: The purpose of the Port of Long Beach Deep Draft Navigation Study is to identify and evaluate improvements to existing navigation channels within the POLB. The study will focus on improving conditions for current and future container and liquid bulk vessel operations in regards to safety, reliability, and waterborne transportation efficiencies. The study will evaluate costs, benefits, and environmental impacts of the project alternatives to confirm federal interest in dredging to deepen channels and areas in the Port of Long Beach.

Tide restrictions, light loading of container vessels and lightering of liquid bulk vessels to reduce vessel draft, and other operational inefficiencies result in economic inefficiencies that translate into increased costs for the national economy at the Nation's second busiest port. Container movements along the secondary channels serving Pier J, Pier T/West Basin, and the Southeast basin, and liquid bulk vessel movements along the main channel, have been identified as constrained by current conditions.

Navigation improvements for liquid bulk vessels include deepening the Approach Channel (extending seaward from the Queen's Gate opening of the Long Beach Breakwater) up to -82 feet Mean Lower Low Water (MLLW) and constructing an anchorage area for ultra-large liquid bulk vessels adjacent to the Main Channel to a depth of up to -75 ft. MLLW. Navigation improvements for container vessels include deepening the Pier J approach channel, berths, and constructing a turning basin to Pier J up to a depth of -57 ft. MLLW; deepening the Southeast Basin and associated berths up to -57 ft. MLLW, and deepening the Pier T/West Basin and berths up to -57 ft. MLLW. The exact depths of dredging will be determined based on an economic analysis of costs and benefits, but are not expected to exceed the depths given above.

An estimated total volume of up to 10 million cubic yards (cy) of material would be dredged. Dredging would be performed by clamshell, hydraulic, or hopper dredge barges. Potential disposal locations for the dredged material may include, but are not limited to, designated U.S. EPA ocean disposal sites LA-2 (offshore of Los Angeles/Long Beach) and LA-3 (offshore of Newport Beach), surfside borrow pits off Huntington Beach/Seal Beach, and Port fill sites.

In addition to the dredging, improvements/modifications may need to be performed to several of the berths within the project areas to accommodate the proposed dredge depths. Types of modifications may include installation of steel bulkheads and other structural modifications to reinforce the wharf design. A new dredge electrical substation may be constructed landside within the Harbor District to provide electricity to the dredge equipment that is not able to access the existing dredge electrical substation on Pier T.

Potential Impacts: It is anticipated that the following environmental resource areas may be affected by the project and therefore will be addressed in the EIR: topography, geology and geography, oceanographic characteristics and coastal processes, water and sediment quality, biological resources, cultural resources, air quality, greenhouse gases, noise, socioeconomics and environmental justice, transportation, land use, recreation, aesthetics, public safety, and public utilities.

Document Availability: A copy of this draft NOP is available for public review at the locations listed below:

- Online on the POLB's website at: www.polb.com/ceqa.
- Port of Long Beach Interim Administration Building, 4801 Airport Drive, Long Beach
- Long Beach City Clerk, 333 W. Ocean Boulevard, Long Beach
- Long Beach Main Library, 101 Pacific Avenue, Long Beach
- San Pedro Regional Branch Library, 931 S. Gaffey Street, San Pedro
- Wilmington Branch Library, 1300 N. Avalon Boulevard, Wilmington

Comments: The POLB is seeking comments on the proposed project. Accordingly, please provide comments at your earliest convenience but no later than **Tuesday, December 20, 2016.**

Comments should be mailed **or** emailed to the POLB. Please list a contact person for your agency or organization, include a valid U.S. mail or email address, and send your comments to:

Heather A. Tomley
Director of Environmental Planning
Port of Long Beach
4801 Airport Plaza Drive
Long Beach, CA 90815
heather.tomley@polb.com

Scoping Meeting: A scoping meeting will be held to receive comments (Spanish and sign language translation services provided) on the proposed project on November 16, 2016, starting at 5:30 p.m. in the Board Room at the Port Interim Administration Building, 4801 Airport Plaza Drive, Long Beach, California 90815. Oral or written comments may be submitted at that time.

For additional information, please contact Janna Watanabe at 562-283-7100 or janna.watanabe@polb.com.

Sincerely,

Heather A. Tomley
Director of Environmental Planning

JW

Attachment: Figure 1

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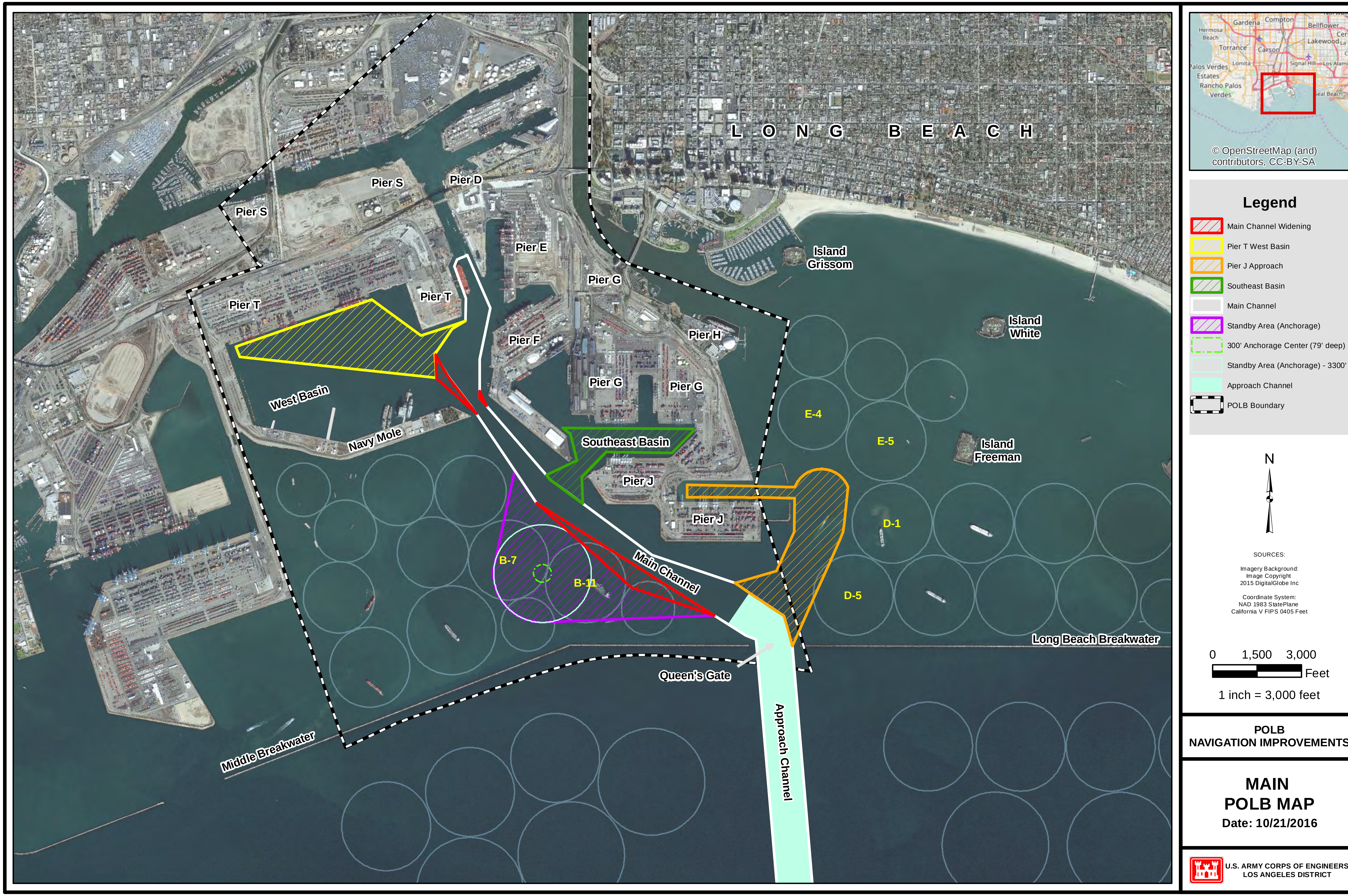
FIGURE 1



L O N G B E A C H
Pier S
Pier S
Pier D
Pier E
Pier T
Pier T
Pier G
Pier F
Pier H
Pier G
Pier G
West Basin
Navy Mole
Southeast Basin
Pier J
Pier J
Island Grissom
Island White
Island Freeman
E-4
E-5
D-1
D-5
B-7
B-11
Main Channel
Long Beach Breakwater
Queen's Gate
Approach Channel
Middle Breakwater
© OpenStreetMap (and) contributors, CC-BY-SA
Legend
Main Channel Widening
Pier T West Basin
Pier J Approach
Southeast Basin
Main Channel
Standby Area (Anchorage)
300' Anchorage Center (79' deep)
Standby Area (Anchorage) - 3300'
Approach Channel
POLB Boundary
N
SOURCES:
Imagery Background:
Image Copyright
2015 DigitalGlobe Inc
Coordinate System:
NAD 1983 StatePlane
California V FIPS 0405 Feet
0 1,500 3,000
Feet
1 inch = 3,000 feet
POLB
NAVIGATION IMPROVEMENTS
MAIN
POLB MAP
Date: 10/21/2016
U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

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4801 Airport Plaza Drive, Long Beach, CA 90815 Tel 562.283.7000 www.polb.com

Port of
LONG BEACH
The Green Port

AMENDED NOTICE OF PREPARATION OF AN ENVIRONMENAL IMPACT REPORT FOR THE PORT OF LONG BEACH DEEP DRAFT NAVIGATION FEASIBILITY STUDY AND CHANNEL DEEPENING PROJECT

Date: January 29, 2019

To: All Interested Agencies, Organizations, and Persons

-AND-

County of Los Angeles
Registrar-Recorder County Clerk
Business Filings and Registration
12400 Imperial Highway, Room 1201
Norwalk, California 90650

Office of Planning and Research
State Clearinghouse
1400 Tenth Street
Sacramento, California 95814

From: City of Long Beach Harbor Department
Port of Long Beach
4801 Airport Plaza
Long Beach, California 90815

Subject:	**Amended Notice of Preparation of a Draft Joint Environmental Impact Report/Environmental Impact Statement; SCH# 2016111014**
Project Title:	Port of Long Beach Deep Draft Navigation Feasibility Study and Channel Deepening Project
Lead Agency:	City of Long Beach Harbor Department Port of Long Beach
Project Location:	Port of Long Beach channels and berths serving Pier J, Pier T/West Basin, anchorage area adjacent to the main channel, the main channel, and the approach channel extending seaward from the Queen's Gate opening of the Long Beach Breakwater. The project is located in the City of Long Beach.
County:	Los Angeles

The Port is issuing this Amended Notice of Preparation (NOP) to notify agencies and interested parties that the City of Long Beach Harbor Department (Port of Long Beach [Port or POLB]) and the U.S Army Corps of Engineers (USACE) are preparing a joint Environmental Impact Report/Environmental Impact Statement (EIR/EIS) for the proposed Deep Draft Navigation Feasibility Study and Channel Deepening Project (Proposed Project). The Port will be the Lead Agency for the preparation of the EIR/EIS in accordance with the California Environmental Quality Act (CEQA). The Federal lead agency responsible for implementing the National Environmental Policy Act (NEPA) is the USACE, Los Angeles District.

On November 4, 2016, the Port of Long Beach issued the original NOP for the Port of Long Beach Deep Draft Navigation Feasibility Study and joint EIR/EIS. A scoping meeting for the EIS was held at the POLB Interim Administration Offices on January 19, 2016. The Port and USACE are now proposing to alter the original project title from "Port of Long Beach Deep Draft Navigation Feasibility Study" to "Port of Long Beach Deep Draft Navigation Feasibility Study and Channel Deepening Project." The update to the Project Title clarifies that in addition to the feasibility study, channel deepening and related activities will occur as well. In addition, the scope of the project has been updated – dredging in the Southeast Basin is no longer being considered as part of the Proposed Project. The Port is issuing this Amended NOP to notify public agencies and the public of these updates and to request input regarding the scope and content of the Draft EIR in light of this modification of the Proposed Project.

Project Description: The purpose of the Port of Long Beach Deep Draft Navigation Feasibility Study and Channel Deepening Project is to identify, evaluate, and improve existing navigation channels within the POLB. The Proposed Project will focus on improving conditions for current and future container and liquid bulk vessel operations in regards to safety, reliability, and waterborne transportation efficiencies. The Proposed Project will evaluate costs, benefits, and environmental impacts of the project alternatives to confirm federal interest in dredging to deepen channels and areas in the Port of Long Beach as shown in the attached figure 'Proposed Dredge Locations.'

Tide restrictions, light loading of container vessels and lightering of liquid bulk vessels to reduce vessel draft, and other operational inefficiencies result in economic inefficiencies that translate into increased costs for the national economy at the nation's second busiest port. Container movements along the secondary channels serving Pier J and Pier T/West Basin and liquid bulk vessel movements along the main channel have been identified as constrained by current conditions. Navigation improvements for liquid bulk vessels include deepening the Approach Channel (extending seaward from the Queen's Gate opening of the Long Beach Breakwater) up to 80 feet below mean lower low water (MLLW) and constructing an anchorage area for very-large liquid bulk vessels adjacent to the Main Channel to a depth of up to -76 ft MLLW. Navigation improvements for container vessels include deepening the Pier J approach channel, berths, and constructing a turning basin to Pier J up to a depth of -57 ft MLLW. Navigational improvements for container vessels will also include deepening the Pier T/West Basin and berths up to -57 ft MLLW. The exact depths of dredging will be determined based on an economic analysis of costs and benefits, but are not expected to exceed the depths given above.

An estimated total volume of up to 8.3 million cubic yards (cy) of material would be dredged. The expected volume of dredge material has decreased by approximately 1.6 million cy since the 2016 NOP was issued. Dredging would be performed by clamshell, hydraulic, or hopper dredge barges. Potential disposal locations for the dredged material may include, but are not limited to, designated U.S. EPA ocean disposal sites LA-2 (offshore of Los Angeles/Long Beach) and LA-3 (offshore of Newport Beach), surfside borrow pits off Huntington Beach/Seal Beach, and Port fill sites.

In addition to the dredging, improvements/modifications may need to be performed to several of the berths within the project areas to accommodate the proposed dredge depths. Types of modifications may include installation of pilings, steel bulkheads, rock toes, and other structural modifications to reinforce the wharf design. A new dredge electrical substation may be constructed landside within the Harbor District to provide electricity to the dredge equipment that is not able to access the existing dredge electrical substation on Pier T.

Environmental Factors Potentially Affected: The potential environmental effects of the Proposed Project to be addressed in the EIR/EIS will include, but may not be limited to the following: topography, geology and geography, oceanographic characteristics and coastal processes, water and sediment quality, biological resources, cultural resources, air quality, greenhouse gas emissions, noise, socioeconomics and environmental justice, transportation, land use, recreation, aesthetics, public safety, public utilities, and cumulative effects. The Draft EIR/EIS will also address other CEQA and NEPA mandated topics, including alternatives, energy consumption, and growth inducement.

Public Review and Comment Period: The Amended NOP is available for public review at the following locations:

- Online at the Port's website at www.polb.com/ceqa
- Port of Long Beach Interim Administration Offices, 4801 Airport Plaza Drive, Long Beach
- Long Beach City Clerk, 333 W. Ocean Boulevard., Long Beach
- San Pedro Regional Branch Library, 931 S. Gaffey Street, San Pedro
- Wilmington Branch Library, 1300 N. Avalon Boulevard, Wilmington

Written comments on the Amended NOP can be submitted anytime during the 30-day public review and comment period beginning on January 30, 2019 and ending on March 1, 2019 at 4 p.m. Please identify a contact person for your agency or organization and include a valid mailing address. Comments submitted via email should also include the project title in the subject line of the email message. Please submit comments via mail or email to:

Mail: **Director of Environmental Planning**
Port of Long Beach
4801 Airport Plaza Drive
Long Beach, California 90815

E-mail: **CEQA@polb.com**

Public Information and Scoping Meeting: A public scoping meeting will be held to present updated information on the Proposed Project and to solicit input and comments on the scope and content of the EIR/EIS. Spanish and sign language translation services will be provided. Written comments may be submitted at the Scoping Meeting or at any time during the review and comment period.

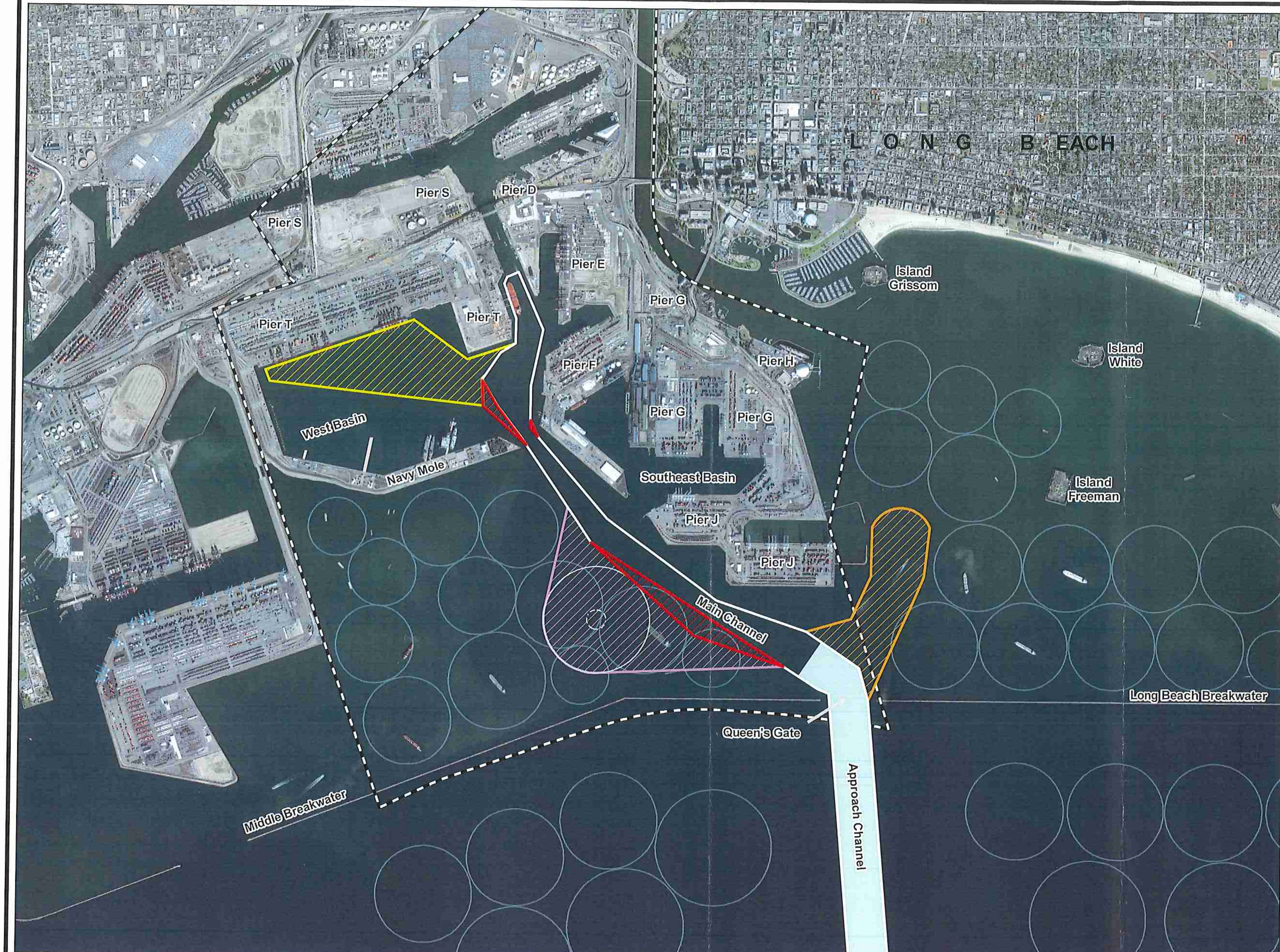
Date:	**Wednesday, February 13, 2019**
Time:	**6:00 p.m.**
Location:	**Port of Long Beach Interim Administrative Offices – Board Room** **4801 Airport Plaza Drive** **Long Beach, California 90815**

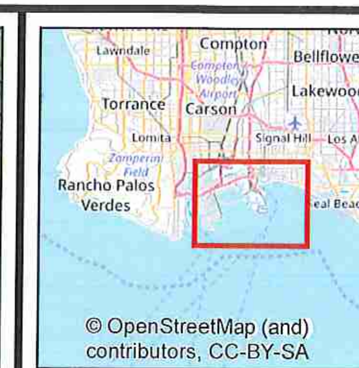
Project Contact: Please direct any project-related questions to the Project Manager:

Baron Barrera, Environmental Specialist Associate
Phone: (562) 283-7137
E-mail: baron.barrera@polb.com

Signature: Matthew Arms **Title:** Acting Director of Environmental Planning

Attachments Figure - Proposed Dredge Locations, Deep Draft Navigation Feasibility Study and Deepening Project





Legend

AreaType

- Main Channel Widening
- Pier T West Basin
- Pier J Approach/Basin
- Standby Area
- Main Channel
- Standby Area Circle
- Standby Area Center
- Approach Channel
- POLB Boundary

N

SOURCES:

Imagery Background:
Image Copyright
2015 DigitalGlobe Inc

Coordinate System:
NAD 1983 StatePlane
California V FIPS 0405 Feet

0 1,500 3,000
Feet

1 inch = 3,000 feet

POLB
NAVIGATION IMPROVEMENTS

MAIN POLB MAP

Date: 1/22/2019

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

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Print Form

Appendix C

Notice of Completion & Environmental Document Transmittal

Mail to: State Clearinghouse, P.O. Box 3044, Sacramento, CA 95812-3044 (916) 445-0613
For Hand Delivery/Street Address: 1400 Tenth Street, Sacramento, CA 95814

SCH # 2016111014

Project Title: Port of Long Beach Deep Draft Navigation Feasibility Study and Channel Deepening Project

Lead Agency: Port of Long Beach
Contact Person: Baron Barrera
Mailing Address: 4801 Airport Plaza Drive
Phone: (562) 283-7100
City: Long Beach
Zip: 90815
County: Los Angeles

Project Location: County: Los Angeles
City/Nearest Community: Long Beach
Cross Streets: N/A
Zip Code: 90802
Longitude/Latitude (degrees, minutes and seconds): ____° ____′ ____″ N / ____° ____′ ____″ W Total Acres: ____
Assessor's Parcel No.: ____ Section: ____ Twp.: ____ Range: ____ Base: ____
Within 2 Miles: State Hwy #: SR-47, I-710
Waterways: San Pedro Bay, Long Beach Harbor
Airports: Long Beach
Railways: UPRR, BNSF
Schools: ____

Document Type:

CEQA: [X] NOP [ ] Early Cons [ ] Neg Dec [ ] Mit Neg Dec [ ] Draft EIR [ ] Supplement/Subsequent EIR (Prior SCH No.) ____ Other: ____
NEPA: [ ] NOI [ ] EA [ ] Draft EIS [ ] FONSI
Other: [ ] Joint Document [ ] Final Document [ ] Other: ____

Local Action Type:

[ ] General Plan Update
[ ] General Plan Amendment
[ ] General Plan Element
[ ] Community Plan
[ ] Specific Plan
[ ] Master Plan
[ ] Planned Unit Development
[ ] Site Plan
[ ] Rezone
[ ] Prezone
[ ] Use Permit
[ ] Land Division (Subdivision, etc.)
[ ] Annexation
[ ] Redevelopment
[X] Coastal Permit
[ ] Other: ____

Development Type:

[ ] Residential: Units ____ Acres ____
[ ] Office: Sq.ft. ____ Acres ____ Employees ____
[ ] Commercial: Sq.ft. ____ Acres ____ Employees ____
[ ] Industrial: Sq.ft. ____ Acres ____ Employees ____
[ ] Educational: ____
[ ] Recreational: ____
[ ] Water Facilities: Type ____ MGD ____
[ ] Transportation: Type ____
[ ] Mining: Mineral ____
[ ] Power: Type ____ MW ____
[ ] Waste Treatment: Type ____ MGD ____
[ ] Hazardous Waste: Type ____
[X] Other: Dredging

Project Issues Discussed in Document:

[X] Aesthetic/Visual
[ ] Agricultural Land
[X] Air Quality
[X] Archeological/Historical
[X] Biological Resources
[X] Coastal Zone
[ ] Drainage/Absorption
[X] Economic/Jobs
[ ] Fiscal
[ ] Flood Plain/Flooding
[ ] Forest Land/Fire Hazard
[X] Geologic/Seismic
[ ] Minerals
[X] Noise
[ ] Population/Housing Balance
[X] Public Services/Facilities
[X] Recreation/Parks
[ ] Schools/Universities
[ ] Septic Systems
[ ] Sewer Capacity
[ ] Soil Erosion/Compaction/Grading
[ ] Solid Waste
[ ] Toxic/Hazardous
[X] Traffic/Circulation
[ ] Vegetation
[X] Water Quality
[ ] Water Supply/Groundwater
[ ] Wetland/Riparian
[ ] Growth Inducement
[X] Land Use
[ ] Cumulative Effects
[ ] Other: ____

Present Land Use/Zoning/General Plan Designation:

IP - Port industrial; Port Master Plan Harbor Districts 4,6,7,8, and 10

Project Description: *(please use a separate page if necessary)*

The Port of Long Beach Deep Draft Navigation Feasibility Study and Channel Deepening Project will evaluate dredging to deepen several channels, basins, and standby areas within the Port to improve waterborne transportation efficiencies and navigational safety for current and future container and liquid bulk vessel operations. Project areas include the approach channel extending seaward from the Queen's Gate opening of the Long Beach Breakwater; approach channel, berths, and turning basin to Pier J; and associated berths; and the Pier T/West Basin and berths. Additionally, structural improvements may need to be performed to several of the berths within the project areas to reinforce the wharf design to accommodate the proposed dredging. A new electrical substation may be constructed landside to provide electricity to the dredge equipment.

Note: The State Clearinghouse will assign identification numbers for all new projects. If a SCH number already exists for a project (e.g. Notice of Preparation or previous draft document) please fill in.

Reviewing Agencies Checklist

Lead Agencies may recommend State Clearinghouse distribution by marking agencies below with and "**X**".
If you have already sent your document to the agency please denote that with an "**S**".

S Air Resources Board
___ Boating & Waterways, Department of
___ California Emergency Management Agency
___ California Highway Patrol
S Caltrans District #7
___ Caltrans Division of Aeronautics
___ Caltrans Planning
___ Central Valley Flood Protection Board
___ Coachella Valley Mtns. Conservancy
S Coastal Commission
___ Colorado River Board
___ Conservation, Department of
___ Corrections, Department of
___ Delta Protection Commission
___ Education, Department of
___ Energy Commission
S Fish & Game Region #5
___ Food & Agriculture, Department of
___ Forestry and Fire Protection, Department of
___ General Services, Department of
___ Health Services, Department of
___ Housing & Community Development
S Native American Heritage Commission
S Office of Historic Preservation
___ Office of Public School Construction
___ Parks & Recreation, Department of
___ Pesticide Regulation, Department of
S Public Utilities Commission
S Regional WQCB #4
___ Resources Agency
___ Resources Recycling and Recovery, Department of
___ S.F. Bay Conservation & Development Comm.
___ San Gabriel & Lower L.A. Rivers & Mtns. Conservancy
___ San Joaquin River Conservancy
___ Santa Monica Mtns. Conservancy
S State Lands Commission
___ SWRCB: Clean Water Grants
___ SWRCB: Water Quality
___ SWRCB: Water Rights
___ Tahoe Regional Planning Agency
S Toxic Substances Control, Department of
___ Water Resources, Department of

___ Other: ___
___ Other: ___

Local Public Review Period (to be filled in by lead agency)

Starting Date January 30, 2019 Ending Date March 1, 2019

Lead Agency (Complete if applicable):

Consulting Firm: ICF
Address: 49 Discovery, Suite 250
City/State/Zip: Irvine, CA 92618
Contact: Chad Beckstrom
Phone: 949-929-3576

Applicant: Port of Long Beach
Address: 4081 Airport Plaza Drive
City/State/Zip: Long Beach, CA 90815
Phone: 562-283-7100

Signature of Lead Agency Representative: [signature] **Date:** 1-28-19

Authority cited: Section 21083, Public Resources Code. Reference: Section 21161, Public Resources Code.

4801 Airport Plaza Drive, Long Beach, CA 90815 Tel 562.283.7000 www.polb.com

Port of
LONG BEACH
The Green Port

January 29, 2019

Office of Planning and Research
State Clearinghouse
1400 Tenth Street, Room 121
Sacramento, California 95814

Subject: Amended Notice of Preparation of an Environmental Impact Report for the Port of Long Beach Deep Draft Navigation Feasibility Study and Channel Deepening Project; SCH Number 2016111014

In accordance with the California Environmental Quality Act (CEQA), the Port of Long Beach, as the Lead Agency, has prepared an amended Notice of Preparation (NOP) for the Port of Long Beach Deep Draft Navigation Feasibility Study and Channel Deepening Project. The NOP was originally submitted to the State Clearinghouse on November 4, 2016, under assigned SCH Number 2016111014.

The Port is updating the original project title from "Port of Long Beach Deep Draft Navigation Feasibility Study" to "Port of Long Beach Deep Draft Navigation Feasibility Study and Channel Deepening Project." The update to the Project Title clarifies that in addition to the feasibility study, channel deepening and related activities will occur as well. The scope of the project has also been modified to no longer consider dredging activities in the Southeast Basin as part of the Proposed Project. The public review and comment period will begin on January 30, 2019 and end on March 1, 2019.

The Notice of Completion & Environmental Document Transmittal Form has been revised to reflect the project changes and ensuing public review period and is included herein as an attachment to this letter.

For additional information, or if there are any questions, please contact Baron Barrera of my staff at (562) 283-7137 or baron.barrera@polb.com.

Sincerely,

Matthew Arms
Acting Director of Environmental Planning

Attachment: Notice of Completion & Environmental Document Transmittal Form
Amended Notice of Preparation, SCH #2016111014

Print Form

Appendix C

Notice of Completion & Environmental Document Transmittal

Mail to: State Clearinghouse, P.O. Box 3044, Sacramento, CA 95812-3044 (916) 445-0613
For Hand Delivery/Street Address: 1400 Tenth Street, Sacramento, CA 95814

SCH #

Project Title: Port of Long Beach Deep Draft Navigation Study

Lead Agency: Port of Long Beach — Contact Person: Heather A. Tomley
Mailing Address: 4801 Airport Plaza Drive — Phone: (562) 283-7100
City: Long Beach — Zip: 90815 — County: Los Angeles

Project Location: County: Los Angeles — City/Nearest Community: Long Beach
Cross Streets: N/A — Zip Code: 90802
Longitude/Latitude (degrees, minutes and seconds): ____° ____′ ____″ N / ____° ____′ ____″ W Total Acres: ____
Assessor's Parcel No.: ____ Section: ____ Twp.: ____ Range: ____ Base: ____
Within 2 Miles: State Hwy #: SR-47, I-710 — Waterways: San Pedro Bay, Long Beach Harbor
Airports: Long Beach — Railways: UPRR, BNSF — Schools: ____

Document Type:

CEQA: [X] NOP [ ] Early Cons [ ] Neg Dec [ ] Mit Neg Dec [ ] Draft EIR [ ] Supplement/Subsequent EIR (Prior SCH No.) ____ Other: ____
NEPA: [ ] NOI [ ] EA [ ] Draft EIS [ ] FONSI
Other: [ ] Joint Document [ ] Final Document [ ] Other: ____

Local Action Type:

[ ] General Plan Update [ ] General Plan Amendment [ ] General Plan Element [ ] Community Plan
[ ] Specific Plan [ ] Master Plan [ ] Planned Unit Development [ ] Site Plan
[ ] Rezone [ ] Prezone [ ] Use Permit [ ] Land Division (Subdivision, etc.)
[ ] Annexation [ ] Redevelopment [X] Coastal Permit [ ] Other: ____

Development Type:

[ ] Residential: Units ____ Acres ____
[ ] Office: Sq.ft. ____ Acres ____ Employees ____
[ ] Commercial: Sq.ft. ____ Acres ____ Employees ____
[ ] Industrial: Sq.ft. ____ Acres ____ Employees ____
[ ] Educational: ____
[ ] Recreational: ____
[ ] Water Facilities: Type ____ MGD ____
[ ] Transportation: Type ____
[ ] Mining: Mineral ____
[ ] Power: Type ____ MW ____
[ ] Waste Treatment: Type ____ MGD ____
[ ] Hazardous Waste: Type ____
[X] Other: Dredging

Project Issues Discussed in Document:

[X] Aesthetic/Visual
[ ] Agricultural Land
[X] Air Quality
[X] Archeological/Historical
[X] Biological Resources
[X] Coastal Zone
[ ] Drainage/Absorption
[X] Economic/Jobs
[ ] Fiscal
[ ] Flood Plain/Flooding
[ ] Forest Land/Fire Hazard
[X] Geologic/Seismic
[ ] Minerals
[X] Noise
[ ] Population/Housing Balance
[X] Public Services/Facilities
[X] Recreation/Parks
[ ] Schools/Universities
[ ] Septic Systems
[ ] Sewer Capacity
[ ] Soil Erosion/Compaction/Grading
[ ] Solid Waste
[ ] Toxic/Hazardous
[X] Traffic/Circulation
[ ] Vegetation
[X] Water Quality
[ ] Water Supply/Groundwater
[ ] Wetland/Riparian
[ ] Growth Inducement
[X] Land Use
[ ] Cumulative Effects
[ ] Other: ____

Present Land Use/Zoning/General Plan Designation:

IP - Port industrial; Port Master Plan Harbor Districts 4,6,7,8, and 10

Project Description: *(please use a separate page if necessary)*

The Port of Long Beach Deep Draft Navigation Study will evaluate dredging to deepen several channels, basins, and standby areas within the Port to improve waterborne transportation efficiencies and navigational safety for current and future container and liquid bulk vessel operations. Study areas include the approach channel extending seaward from the Queen's Gate opening of the Long Beach Breakwater; approach channel, berths, and turning basin to Pier J; the Southeast Basin and associated berths; and the Pier T/West Basin and berths. Additionally, structural improvements may need to be performed to several of the berths within the project areas to reinforce the wharf design to accommodate the proposed dredging. A new electrical substation may be constructed landside to provide electricity to the dredge equipment.

Note: The State Clearinghouse will assign identification numbers for all new projects. If a SCH number already exists for a project (e.g. Notice of Preparation or previous draft document) please fill in.

Reviewing Agencies Checklist

Lead Agencies may recommend State Clearinghouse distribution by marking agencies below with and "X".
If you have already sent your document to the agency please denote that with an "S".

S	Air Resources Board	S	Office of Historic Preservation
	Boating & Waterways, Department of		Office of Public School Construction
	California Emergency Management Agency		Parks & Recreation, Department of
	California Highway Patrol		Pesticide Regulation, Department of
S	Caltrans District # 7	S	Public Utilities Commission
	Caltrans Division of Aeronautics	S	Regional WQCB # 4
	Caltrans Planning		Resources Agency
	Central Valley Flood Protection Board		Resources Recycling and Recovery, Department of
	Coachella Valley Mtns. Conservancy		S.F. Bay Conservation & Development Comm.
S	Coastal Commission		San Gabriel & Lower L.A. Rivers & Mtns. Conservancy
	Colorado River Board		San Joaquin River Conservancy
	Conservation, Department of		Santa Monica Mtns. Conservancy
	Corrections, Department of	S	State Lands Commission
	Delta Protection Commission		SWRCB: Clean Water Grants
	Education, Department of		SWRCB: Water Quality
	Energy Commission		SWRCB: Water Rights
S	Fish & Game Region # 5		Tahoe Regional Planning Agency
	Food & Agriculture, Department of	S	Toxic Substances Control, Department of
	Forestry and Fire Protection, Department of		Water Resources, Department of
	General Services, Department of		
	Health Services, Department of		Other:
	Housing & Community Development		Other:
S	Native American Heritage Commission		

Local Public Review Period (to be filled in by lead agency)

Starting Date November 3, 2016   Ending Date December 9, 2016

Lead Agency (Complete if applicable):

Consulting Firm:
Address:
City/State/Zip:
Contact:
Phone:

Applicant:
Address:
City/State/Zip:
Phone:

Signature of Lead Agency Representative: [signature]   **Date:** 11/2/16

Authority cited: Section 21083, Public Resources Code. Reference: Section 21161, Public Resources Code.

EDMUND G. BROWN JR.
GOVERNOR

STATE OF CALIFORNIA
GOVERNOR'S OFFICE *of* PLANNING AND RESEARCH
STATE CLEARINGHOUSE AND PLANNING UNIT

KEN ALEX
DIRECTOR

Memorandum

Date: November 14, 2016

To: All Reviewing Agencies

From: Scott Morgan, Director

Re: SCH # **2016111014**

Port of Long Beach Deep Draft Navigation Study

Pursuant to the attached letter, the Lead Agency has *extended* the review period for the above referenced project to **December 20, 2016** to accommodate the review process. All other project information remains the same.

cc: Heather A. Tomley
Port of Long Beach
4801 Airport Plaza Drive
Long Beach, CA 90815

1400 10th Street P.O. Box 3044 Sacramento, California 95812-3044
(916) 445-0613 FAX (916) 323-3018 www.opr.ca.gov

RECEIVED NOV 17 2016

4801 Airport Plaza Drive, Long Beach, CA 90815 Tel 562.283.7000 www.polb.com

Port of
LONG BEACH
The Green Port

November 14, 2016

Office of Planning and Research
State Clearinghouse
1400 Tenth Street, Room 121
Sacramento, CA 95814

Subject: **Notice of Time Extension of Public Comment Period for the Port of Long Beach Deep Draft Navigation Study Notice of Preparation (SCH# 2016111014)**

In accordance with the California Environmental Quality Act (CEQA), the Port of Long Beach (Port), as the CEQA Lead Agency, prepared a Notice of Preparation (NOP) for the Port Deep Draft Navigation Study. The NOP was previously provided to the State Clearinghouse on November 3, 2016, and has been assigned number SCH# 2016111014. This notice is to announce that the comment period, which was set to end on December 9, 2016, **has been extended to December 20, 2016.** The Notice of Completion and Environmental Document Transmittal form has been revised with the new public comment period and is included as an attachment to this letter.

For additional information, please contact Janna Watanabe at 562-283-7100 or janna.watanabe@polb.com.

Sincerely,

Heather A. Tomley
Director of Environmental Planning

JW

Attached: Revised Notice of Completion and Environmental Document Transmittal Form

Print Form

Appendix C

Notice of Completion & Environmental Document Transmittal

Mail to: State Clearinghouse, P.O. Box 3044, Sacramento, CA 95812-3044 (916) 445-0613
For Hand Delivery/Street Address: 1400 Tenth Street, Sacramento, CA 95814

SCH # 2016111014

Project Title: Port of Long Beach Deep Draft Navigation Study

Lead Agency: Port of Long Beach
Contact Person: Heather A. Tomley
Mailing Address: 4801 Airport Plaza Drive
Phone: (562) 283-7100
City: Long Beach
Zip: 90815
County: Los Angeles

Project Location: County: Los Angeles
City/Nearest Community: Long Beach
Cross Streets: N/A
Zip Code: 90802
Longitude/Latitude (degrees, minutes and seconds): ___° ___′ ___″ N / ___° ___′ ___″ W Total Acres: ___
Assessor's Parcel No.: ___
Section: ___ Twp.: ___ Range: ___ Base: ___
Within 2 Miles: State Hwy #: SR-47, I-710
Waterways: San Pedro Bay, Long Beach Harbor
Airports: Long Beach
Railways: UPRR, BNSF
Schools: ___

Document Type:

CEQA:
- [x] NOP
- [ ] Early Cons
- [ ] Neg Dec
- [ ] Mit Neg Dec
- [ ] Draft EIR
- [ ] Supplement/Subsequent EIR
- (Prior SCH No.) ___
- Other: ___

NEPA:
- [ ] NOI
- [ ] EA
- [ ] Draft EIS
- [ ] FONSI

Other:
- [ ] Joint Document
- [ ] Final Document
- [ ] Other: ___

Governor's Office of Planning & Research
NOV 14 2016
STATE CLEARINGHOUSE

Local Action Type:

- [ ] General Plan Update
- [ ] General Plan Amendment
- [ ] General Plan Element
- [ ] Community Plan
- [ ] Specific Plan
- [ ] Master Plan
- [ ] Planned Unit Development
- [ ] Site Plan
- [ ] Rezone
- [ ] Prezone
- [ ] Use Permit
- [ ] Land Division (Subdivision, etc.)
- [ ] Annexation
- [ ] Redevelopment
- [x] Coastal Permit
- [ ] Other: ___

Development Type:

- [ ] Residential: Units ___ Acres ___
- [ ] Office: Sq.ft. ___ Acres ___ Employees ___
- [ ] Commercial: Sq.ft. ___ Acres ___ Employees ___
- [ ] Industrial: Sq.ft. ___ Acres ___ Employees ___
- [ ] Educational: ___
- [ ] Recreational: ___
- [ ] Water Facilities: Type ___ MGD ___
- [ ] Transportation: Type ___
- [ ] Mining: Mineral ___
- [ ] Power: Type ___ MW ___
- [ ] Waste Treatment: Type ___ MGD ___
- [ ] Hazardous Waste: Type ___
- [x] Other: Dredging

Project Issues Discussed in Document:

- [x] Aesthetic/Visual
- [ ] Agricultural Land
- [x] Air Quality
- [x] Archeological/Historical
- [x] Biological Resources
- [x] Coastal Zone
- [ ] Drainage/Absorption
- [x] Economic/Jobs
- [ ] Fiscal
- [ ] Flood Plain/Flooding
- [ ] Forest Land/Fire Hazard
- [x] Geologic/Seismic
- [ ] Minerals
- [x] Noise
- [ ] Population/Housing Balance
- [x] Public Services/Facilities
- [x] Recreation/Parks
- [ ] Schools/Universities
- [ ] Septic Systems
- [ ] Sewer Capacity
- [ ] Soil Erosion/Compaction/Grading
- [ ] Solid Waste
- [ ] Toxic/Hazardous
- [x] Traffic/Circulation
- [ ] Vegetation
- [x] Water Quality
- [ ] Water Supply/Groundwater
- [ ] Wetland/Riparian
- [ ] Growth Inducement
- [x] Land Use
- [ ] Cumulative Effects
- [ ] Other: ___

Present Land Use/Zoning/General Plan Designation:

IP - Port industrial; Port Master Plan Harbor Districts 4,6,7,8, and 10

Project Description: *(please use a separate page if necessary)*

The Port of Long Beach Deep Draft Navigation Study will evaluate dredging to deepen several channels, basins, and standby areas within the Port to improve waterborne transportation efficiencies and navigational safety for current and future container and liquid bulk vessel operations. Study areas include the approach channel extending seaward from the Queen's Gate opening of the Long Beach Breakwater; approach channel, berths, and turning basin to Pier J; the Southeast Basin and associated berths; and the Pier T/West Basin and berths. Additionally, structural improvements may need to be performed to several of the berths within the project areas to reinforce the wharf design to accommodate the proposed dredging. A new electrical substation may be constructed landside to provide electricity to the dredge equipment.

Note: The State Clearinghouse will assign identification numbers for all new projects. If a SCH number already exists for a project (e.g. Notice of Preparation or previous draft document) please fill in.

Revised 2010

Reviewing Agencies Checklist

Lead Agencies may recommend State Clearinghouse distribution by marking agencies below with and "X".
If you have already sent your document to the agency please denote that with an "S".

S Air Resources Board
___ Boating & Waterways, Department of
___ California Emergency Management Agency
___ California Highway Patrol
S Caltrans District #7
___ Caltrans Division of Aeronautics
___ Caltrans Planning
___ Central Valley Flood Protection Board
___ Coachella Valley Mtns. Conservancy
S Coastal Commission
___ Colorado River Board
___ Conservation, Department of
___ Corrections, Department of
___ Delta Protection Commission
___ Education, Department of
___ Energy Commission
S Fish & Game Region #5
___ Food & Agriculture, Department of
___ Forestry and Fire Protection, Department of
___ General Services, Department of
___ Health Services, Department of
___ Housing & Community Development
S Native American Heritage Commission
S Office of Historic Preservation
___ Office of Public School Construction
___ Parks & Recreation, Department of
___ Pesticide Regulation, Department of
S Public Utilities Commission
S Regional WQCB #4
___ Resources Agency
___ Resources Recycling and Recovery, Department of
___ S.F. Bay Conservation & Development Comm.
___ San Gabriel & Lower L.A. Rivers & Mtns. Conservancy
___ San Joaquin River Conservancy
___ Santa Monica Mtns. Conservancy
S State Lands Commission
___ SWRCB: Clean Water Grants
___ SWRCB: Water Quality
___ SWRCB: Water Rights
___ Tahoe Regional Planning Agency
S Toxic Substances Control, Department of
___ Water Resources, Department of

___ Other: ___
___ Other: ___

Local Public Review Period (to be filled in by lead agency)

Starting Date November 14, 2016 Ending Date December 20, 2016

Lead Agency (Complete if applicable):

Consulting Firm: ___
Address: ___
City/State/Zip: ___
Contact: ___
Phone: ___

Applicant: ___
Address: ___
City/State/Zip: ___
Phone: ___

Signature of Lead Agency Representative: [signature] **Date:** 11/11/16

Authority cited: Section 21083, Public Resources Code. Reference: Section 21161, Public Resources Code.

NOP Distribution List [handwritten initials] County: Los Angeles SCH# 2016111014

Resources Agency

- [x] **Resources Agency**
  Nadell Gayou
  - [ ] **Dept. of Boating & Waterways**
    Denise Peterson
  - [x] **California Coastal Commission**
    Elizabeth A. Fuchs
  - [ ] **Colorado River Board**
    Lisa Johansen
  - [ ] **Dept. of Conservation**
    Elizabeth Carpenter
  - [ ] **California Energy Commission**
    Eric Knight
  - [ ] **Cal Fire**
    Dan Foster
  - [ ] **Central Valley Flood Protection Board**
    James Herota
  - [ ] **Office of Historic Preservation**
    Ron Parsons
- [x] **Dept of Parks & Recreation**
  Environmental Stewardship Section
  - [ ] **California Department of Resources, Recycling & Recovery**
    Sue O'Leary
  - [ ] **S.F. Bay Conservation & Dev't. Comm.**
    Steve Goldbeck
  - [x] **Dept. of Water Resources**
    Resources Agency
    Nadell Gayou

Fish and Game

- [ ] **Depart. of Fish & Wildlife**
  Scott Flint
  Environmental Services Division
- [ ] **Fish & Wildlife Region 1**
  Curt Babcock
- [ ] **Fish & Wildlife Region 1E**
  Laurie Harnsberger
- [ ] **Fish & Wildlife Region 2**
  Jeff Drongesen
- [ ] **Fish & Wildlife Region 3**
  Craig Weightman
- [ ] **Fish & Wildlife Region 4**
  Julie Vance
- [x] **Fish & Wildlife Region 5**
  Leslie Newton-Reed
  Habitat Conservation Program
- [ ] **Fish & Wildlife Region 6**
  Tiffany Ellis
  Habitat Conservation Program
- [ ] **Fish & Wildlife Region 6 I/M**
  Heidi Calvert
  Inyo/Mono, Habitat Conservation Program
- [ ] **Dept. of Fish & Wildlife M**
  William Paznokas
  Marine Region

Other Departments

- [ ] **Food & Agriculture**
  Sandra Schubert
  Dept. of Food and Agriculture
- [ ] **Depart. of General Services**
  Public School Construction
- [ ] **Dept. of General Services**
  Cathy Buck/George Carollo
  Environmental Services Section
- [ ] **Delta Stewardship Council**
  Kevan Samsam
- [ ] **Housing & Comm. Dev.**
  CEQA Coordinator
  Housing Policy Division

Independent Commissions,Boards

- [ ] **Delta Protection Commission**
  Erik Vink
- [ ] **OES (Office of Emergency Services)**
  Monique Wilber
- [x] **Native American Heritage Comm.**
  Debbie Treadway
- [x] **Public Utilities Commission**
  Supervisor
- [ ] **Santa Monica Bay Restoration**
  Guangyu Wang
- [x] **State Lands Commission**
  Jennifer Deleong
- [ ] **Tahoe Regional Planning Agency (TRPA)**
  Cherry Jacques

Cal State Transportation Agency CalSTA

- [ ] **Caltrans - Division of Aeronautics**
  Philip Crimmins
- [ ] **Caltrans – Planning HQ LD-IGR**
  Terri Pencovic
- [x] **California Highway Patrol**
  Suzann Ikeuchi
  Office of Special Projects

Dept. of Transportation

- [ ] **Caltrans, District 1**
  Rex Jackman
- [ ] **Caltrans, District 2**
  Marcelino Gonzalez
- [ ] **Caltrans, District 3**
  Eric Federicks – South
  Susan Zanchi - North
- [ ] **Caltrans, District 4**
  Patricia Maurice
- [ ] **Caltrans, District 5**
  Larry Newland
- [ ] **Caltrans, District 6**
  Michael Navarro
- [x] **Caltrans, District 7**
  Dianna Watson
- [ ] **Caltrans, District 8**
  Mark Roberts
- [ ] **Caltrans, District 9**
  Gayle Rosander
- [ ] **Caltrans, District 10**
  Tom Dumas
- [ ] **Caltrans, District 11**
  Jacob Armstrong
- [ ] **Caltrans, District 12**
  Maureen El Harake

Cal EPA

Air Resources Board

- [ ] Airport & Freight
  Cathi Slaminski
  - [ ] Transportation Projects
    Nesamani Kalandiyur
  - [ ] Industrial/Energy Projects
    Mike Tollstrup
- [ ] **State Water Resources Control Board**
  Regional Programs Unit
  Division of Financial Assistance
- [ ] **State Water Resources Control Board**
  Cindy Forbes – Asst Deputy
  Division of Drinking Water
- [ ] **State Water Resources Control Board**
  Div. Drinking Water #________
- [ ] **State Water Resources Control Board**
  Student Intern, 401 Water Quality Certification Unit
  Division of Water Quality
- [ ] **State Water Resouces Control Board**
  Phil Crader
  Division of Water Rights
- [ ] **Dept. of Toxic Substances Control**
  CEQA Tracking Center
- [ ] **Department of Pesticide Regulation**
  CEQA Coordinator

Regional Water Quality Control Board (RWQCB)

- [ ] **RWQCB 1**
  Cathleen Hudson
  North Coast Region (1)
- [ ] **RWQCB 2**
  Environmental Document Coordinator
  San Francisco Bay Region (2)
- [ ] **RWQCB 3**
  Central Coast Region (3)
- [x] **RWQCB 4**
  Teresa Rodgers
  Los Angeles Region (4)
- [ ] **RWQCB 5S**
  Central Valley Region (5)
  - [ ] **RWQCB 5F**
    Central Valley Region (5)
    Fresno Branch Office
  - [ ] **RWQCB 5R**
    Central Valley Region (5)
    Redding Branch Office
- [ ] **RWQCB 6**
  Lahontan Region (6)
  - [ ] **RWQCB 6V**
    Lahontan Region (6)
    Victorville Branch Office
- [ ] **RWQCB 7**
  Colorado River Basin Region (7)
- [ ] **RWQCB 8**
  Santa Ana Region (8)
- [ ] **RWQCB 9**
  San Diego Region (9)

- [ ] Other ________________
  ____
  ____
- [ ] ________________
  Conservancy

Last Updated 7/19/2016

STATE OF CALIFORNIA
GOVERNOR'S OFFICE *of* PLANNING AND RESEARCH
STATE CLEARINGHOUSE AND PLANNING UNIT

EDMUND G. BROWN JR.
GOVERNOR

KEN ALEX
DIRECTOR

Notice of Preparation

November 3, 2016

To: Reviewing Agencies

Re: Port of Long Beach Deep Draft Navigation Study
SCH# 2016111014

Attached for your review and comment is the Notice of Preparation (NOP) for the Port of Long Beach Deep Draft Navigation Study draft Environmental Impact Report (EIR).

Responsible agencies must transmit their comments on the scope and content of the NOP, focusing on specific information related to their own statutory responsibility, within 30 days of receipt of the NOP from the Lead Agency. This is a courtesy notice provided by the State Clearinghouse with a reminder for you to comment in a timely manner. We encourage other agencies to also respond to this notice and express their concerns early in the environmental review process.

Please direct your comments to:

Heather A. Tomley
Port of Long Beach
4801 Airport Plaza Dr
Long Beach, CA 90815

with a copy to the State Clearinghouse in the Office of Planning and Research. Please refer to the SCH number noted above in all correspondence concerning this project.

If you have any questions about the environmental document review process, please call the State Clearinghouse at (916) 445-0613.

Sincerely,

Scott Morgan
Director, State Clearinghouse

Attachments
cc: Lead Agency

RECEIVED NOV - 7 2016

Document Details Report
State Clearinghouse Data Base

SCH# **2016111014**
Project Title Port of Long Beach Deep Draft Navigation Study
Lead Agency Long Beach, Port of

Type **NOP** Notice of Preparation

Description Note: Review Per Lead

The Port of Long Beach Deep Draft Navigation Study will evaluate dredging to deepen several channels, basins, and standby areas within the Port to improve waterborne transportation efficiencies and navigational safety for current and future container and liquid bulk vessel operations. Study areas include the approach channel extending seaward from the Queen's Gate opening of the Long Beach Breakwater; approach channel, berths, and turning basin to Pier J; the Southeast Basin and associated berths; and the Pier T/West Basin and berths. Additionally, structural improvements may need to be performed to several of the berths within the project areas to reinforce the wharf design to accommodate the proposed dredging. A new electrical substation may be constructed landside to provide electricity to the dredge equipment.

Lead Agency Contact

Name Heather A. Tomley
Agency Port of Long Beach
Phone 562-283-7100 ***Fax***
email
Address 4801 Airport Plaza Dr
City Long Beach ***State*** CA ***Zip*** 90815

Project Location

County Los Angeles
City Long Beach
Region
Cross Streets
Lat / Long
Parcel No.
Township ***Range*** ***Section*** ***Base***

Proximity to:

Highways SR 47, I 710
Airports Long Beach
Railways UPRR, BNSF
Waterways San Pedro Bay, Long Beach Harbor
Schools
Land Use IP- Port Industrial; port master plan harbor districts 4,6,7,8, 10

Project Issues Aesthetic/Visual; Air Quality; Archaeologic-Historic; Biological Resources; Coastal Zone; Economics/Jobs; Geologic/Seismic; Noise; Public Services; Recreation/Parks; Traffic/Circulation; Water Quality; Landuse

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Reviewing Agencies Resources Agency; California Coastal Commission; Department of Parks and Recreation; Department of Water Resources; Department of Fish and Wildlife, Region 5; Native American Heritage Commission; Public Utilities Commission; State Lands Commission; California Highway Patrol; Caltrans, District 7; Regional Water Quality Control Board, Region 4

Date Received 11/03/2016 ***Start of Review*** 11/03/2016 ***End of Review*** 12/09/2016

Print Form

Appendix C

20161110 14

Notice of Completion & Environmental Document Transmittal

Mail to: State Clearinghouse, P.O. Box 3044, Sacramento, CA 95812-3044 (916) 445-0613
For Hand Delivery/Street Address: 1400 Tenth Street, Sacramento, CA 95814

SCH #

Project Title: Port of Long Beach Deep Draft Navigation Study

Lead Agency: Port of Long Beach | Contact Person: Heather A. Tomley
Mailing Address: 4801 Airport Plaza Drive | Phone: (562) 283-7100
City: Long Beach | Zip: 90815 | County: Los Angeles

Project Location: County: Los Angeles | City/Nearest Community: Long Beach
Cross Streets: N/A | Zip Code: 90802
Longitude/Latitude (degrees, minutes and seconds): ____° ____′ ____″ N / ____° ____′ ____″ W Total Acres: ______
Assessor's Parcel No.: ______ Section: ______ Twp.: ______ Range: ______ Base: ______
Within 2 Miles: State Hwy #: SR-47, I-710 | Waterways: San Pedro Bay, Long Beach Harbor
Airports: Long Beach | Railways: UPRR, BNSF | Schools: ______

Document Type:

CEQA: [X] NOP [ ] Early Cons [ ] Neg Dec [ ] Mit Neg Dec [ ] Draft EIR [ ] Supplement/Subsequent EIR (Prior SCH No.) ______ Other: ______

NEPA: [ ] NOI [ ] EA [ ] Draft EIS [ ] FONSI

Other: [ ] Joint Document [ ] Final Document [ ] Other: ______

Governor's Office of Planning & Research
NOV 03 2016
STATE CLEARINGHOUSE

Local Action Type:

[ ] General Plan Update
[ ] General Plan Amendment
[ ] General Plan Element
[ ] Community Plan
[ ] Specific Plan
[ ] Master Plan
[ ] Planned Unit Development
[ ] Site Plan
[ ] Rezone
[ ] Prezone
[ ] Use Permit
[ ] Land Division (Subdivision, etc.)
[ ] Annexation
[ ] Redevelopment
[X] Coastal Permit
[ ] Other: ______

Development Type:

[ ] Residential: Units ____ Acres ____
[ ] Office: Sq.ft. ____ Acres ____ Employees ____
[ ] Commercial: Sq.ft. ____ Acres ____ Employees ____
[ ] Industrial: Sq.ft. ____ Acres ____ Employees ____
[ ] Educational: ______
[ ] Recreational: ______
[ ] Water Facilities: Type ____ MGD ____
[ ] Transportation: Type ______
[ ] Mining: Mineral ______
[ ] Power: Type ____ MW ____
[ ] Waste Treatment: Type ____ MGD ____
[ ] Hazardous Waste: Type ______
[X] Other: Dredging

Project Issues Discussed in Document:

[X] Aesthetic/Visual
[ ] Agricultural Land
[X] Air Quality
[X] Archeological/Historical
[X] Biological Resources
[X] Coastal Zone
[ ] Drainage/Absorption
[X] Economic/Jobs
[ ] Fiscal
[ ] Flood Plain/Flooding
[ ] Forest Land/Fire Hazard
[X] Geologic/Seismic
[ ] Minerals
[X] Noise
[ ] Population/Housing Balance
[X] Public Services/Facilities
[X] Recreation/Parks
[ ] Schools/Universities
[ ] Septic Systems
[ ] Sewer Capacity
[ ] Soil Erosion/Compaction/Grading
[ ] Solid Waste
[ ] Toxic/Hazardous
[X] Traffic/Circulation
[ ] Vegetation
[X] Water Quality
[ ] Water Supply/Groundwater
[ ] Wetland/Riparian
[ ] Growth Inducement
[X] Land Use
[ ] Cumulative Effects
[ ] Other: ______

Present Land Use/Zoning/General Plan Designation:
IP - Port industrial; Port Master Plan Harbor Districts 4,6,7,8, and 10

Project Description: *(please use a separate page if necessary)*
The Port of Long Beach Deep Draft Navigation Study will evaluate dredging to deepen several channels, basins, and standby areas within the Port to improve waterborne transportation efficiencies and navigational safety for current and future container and liquid bulk vessel operations. Study areas include the approach channel extending seaward from the Queen's Gate opening of the Long Beach Breakwater; approach channel, berths, and turning basin to Pier J; the Southeast Basin and associated berths; and the Pier T/West Basin and berths. Additionally, structural improvements may need to be performed to several of the berths within the project areas to reinforce the wharf design to accommodate the proposed dredging. A new electrical substation may be constructed landside to provide electricity to the dredge equipment.

Note: The State Clearinghouse will assign identification numbers for all new projects. If a SCH number already exists for a project (e.g. Notice of Preparation or previous draft document) please fill in.

NOP Distribution List

County: Los Angeles

SCH# 2016111014

Resources Agency

- [x] **Resources Agency**
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- [ ] **Fish & Wildlife Region 4**
  Julie Vance
- [x] **Fish & Wildlife Region 5**
  Leslie Newton-Reed
  Habitat Conservation Program
- [ ] **Fish & Wildlife Region 6**
  Tiffany Ellis
  Habitat Conservation Program
- [ ] **Fish & Wildlife Region 6 I/M**
  Heidi Calvert
  Inyo/Mono, Habitat Conservation Program
- [ ] **Dept. of Fish & Wildlife M**
  William Paznokas
  Marine Region

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  Sandra Schubert
  Dept. of Food and Agriculture
- [ ] **Depart. of General Services**
  Public School Construction
- [ ] **Dept. of General Services**
  Cathy Buck/George Carollo
  Environmental Services Section
- [ ] **Delta Stewardship Council**
  Kevan Samsam
- [ ] **Housing & Comm. Dev.**
  CEQA Coordinator
  Housing Policy Division

Independent Commissions,Boards

- [ ] **Delta Protection Commission**
  Erik Vink
- [ ] **OES (Office of Emergency Services)**
  Monique Wilber
- [x] **Native American Heritage Comm.**
  Debbie Treadway
  - [x] **Public Utilities Commission**
    Supervisor
  - [ ] **Santa Monica Bay Restoration**
    Guangyu Wang
  - [x] **State Lands Commission**
    Jennifer Deleong
  - [ ] **Tahoe Regional Planning Agency (TRPA)**
    Cherry Jacques

Cal State Transportation Agency CalSTA

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  Philip Crimmins
- [ ] **Caltrans – Planning HQ LD-IGR**
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  Office of Special Projects

Dept. of Transportation

- [ ] **Caltrans, District 1**
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- [ ] **Caltrans, District 2**
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- [ ] **Caltrans, District 12**
  Maureen El Harake

Cal EPA

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- [ ] Airport & Freight
  Cathi Slaminski
  - [ ] Transportation Projects
    Nesamani Kalandiyur
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  Cindy Forbes – Asst Deputy
  Division of Drinking Water
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  Div. Drinking Water #________
- [ ] **State Water Resources Control Board**
  Student Intern, 401 Water Quality Certification Unit
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- [ ] **State Water Resouces Control Board**
  Phil Crader
  Division of Water Rights
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- [ ] **Department of Pesticide Regulation**
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Regional Water Quality Control Board (RWQCB)

- [ ] **RWQCB 1**
  Cathleen Hudson
  North Coast Region (1)
- [ ] **RWQCB 2**
  Environmental Document Coordinator
  San Francisco Bay Region (2)
- [ ] **RWQCB 3**
  Central Coast Region (3)
- [x] **RWQCB 4**
  Teresa Rodgers
  Los Angeles Region (4)
- [ ] **RWQCB 5S**
  Central Valley Region (5)
  - [ ] **RWQCB 5F**
    Central Valley Region (5)
    Fresno Branch Office
  - [ ] **RWQCB 5R**
    Central Valley Region (5)
    Redding Branch Office
- [ ] **RWQCB 6**
  Lahontan Region (6)
  - [ ] **RWQCB 6V**
    Lahontan Region (6)
    Victorville Branch Office
- [ ] **RWQCB 7**
  Colorado River Basin Region (7)
- [ ] **RWQCB 8**
  Santa Ana Region (8)
- [ ] **RWQCB 9**
  San Diego Region (9)

- [ ] Other ____________________
- [ ] ____________________
  Conservancy

Last Updated 7/19/2016

Attachment 2

Comment Letters Received in Response to NOPs/NOI

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

February 25, 2016

Larry Smith
U.S. Army Corps of Engineers
Los Angeles District, Project Management Division
915 Wilshire Boulevard, Suite 930
Los Angeles, CA 90017-3401

Subject: Notice of Intent to Prepare an Environmental Impact Statement for the Port of Long Beach Deep Draft Navigation Project, Los Angeles County, CA

Dear Mr. Smith:

The U.S. Environmental Protection Agency has received the above referenced Notice of Intent (NOI). We appreciate the opportunity to provide our recommendations on the scope of the upcoming Draft Environmental Impact Statement (DEIS). Our comments are provided pursuant to the National Environmental Policy Act, the Council on Environmental Quality NEPA Implementation Regulations at 40 CFR 1500-1508, and our NEPA review authority under Section 309 of the Clean Air Act.

According to the NOI, the U.S. Army Corps of Engineers (Corps) proposes to support a cost-shared feasibility study with the Port of Long Beach (Port) for navigation improvements to existing navigation channels within the Port. The primary problem stated in the NOI is the inefficient operation of deep draft vessels in secondary channels, and consequent inefficiencies to container movements and loading of vessels. The NOI further states that newer and larger vessels are anticipated, which will result in even greater delays, and that navigation improvements are needed to improve existing inefficiencies to container movements. The project is proposed in the South Coast Air Basin, which has some of the worst air quality in the nation, and is adjacent to communities that have a long history of experiencing adverse effects of goods movement. As such, it is critical that the Draft EIS for the proposed project include a robust analysis of the possible health and environmental impacts associated with the project, as well as measures to reduce those impacts. We encourage the Corps, and the Port of Long Beach, to include the neighboring communities in a transparent decision-making process and provide opportunities for the community to inform meaningful mitigation.

Please consider the following comments and recommendations while preparing the Draft EIS.

Analysis and Disclosure of Air Quality Impacts

The proposed project has the potential to result in increased air pollutants from dredging, operation of larger cargo vessels, and the rail and truck transport of the increased freight that a deeper channel will allow. EPA recommends that emissions from all of these sources be analyzed, disclosed, and mitigated to the extent feasible.

Emissions from Dredging
The DEIS should discuss the projected air pollutant emissions from the operation of dredging equipment for each alternative. The DEIS should discuss methods of improving dredging efficiency and measures to reduce emissions including, but not limited to, utilizing more efficient drive trains and dredge pumps, using new excavation tools, implementing strategies to recover waste heat, using alternative energy sources or energy management systems, and utilizing after-treatment technologies.

Emissions from Cargo Vessels
The DEIS should discuss the projected air pollutant emissions from vessels expected to call at the Port, under each alternative, including the No Action Alternative. The DEIS should also discuss the Port's Green Ship Incentive Program that provides incentives for cleaner ships.

Emissions from Rail Transport
EPA supports the maximum use of on-dock rail lines at the Port of Long Beach. We recommend that the DEIS identify the relative percentage of containers passing through the terminal that will use off-dock, near-dock and on-dock rail facilities, and provide air emissions projections associated with the use of these facilities under each alternative, including the No Action Alternative.

Emissions from Truck Transport
The DEIS should discuss the projected air pollutant emissions from truck transport of freight, and whether the proposed project is expected to increase operational air pollutant emissions. The DEIS should discuss programs that the Port has in place to minimize emissions from trucks (including zero emissions vehicles), systems that reduce drayage truck turn-around times and emissions, and idling reduction measures for drayage trucks. The DEIS should also provide information on the Port's Clean Trucks Program.

When a truck carrier cannot arrange for both an inbound and outbound shipment to a destination, the resulting empty truck trip increases traffic, fuel use, air pollutant emissions, and transportation costs. Reducing the percentage of empty export freight containers may represent a potentially fruitful opportunity for increasing dual transactions. The DEIS should estimate the number of trucks arriving at the Port that would involve single transactions, dual transactions, empty chassis, and any other categories of truck transactions and explain how dual transactions could be further increased in the future.

Mobile and Stationary Source Controls
EPA recommends that the proposed project include the following measures and that the DEIS identify all such measures that the Port and its partners would commit to for this project:

- Minimize use, trips, and unnecessary idling of heavy equipment.
- Maintain and tune engines per manufacturer's specifications to perform at EPA certification levels, where applicable, and to perform at verified standards applicable to retrofit technologies.
- Employ periodic, unscheduled inspections to limit unnecessary idling and to ensure that construction equipment is properly maintained, tuned, and modified consistent with established specifications. The California Air Resources Board (CARB) has a number of mobile source anti-idling requirements which should be employed (http://www.arb.ca.gov/msprog/truck-idling/truck-idling.htm).

- Prohibit any tampering with engines and require continuing adherence to manufacturer's recommendations.
- To the extent possible, construction activities should utilize grid-based electricity and/or onsite renewable electricity generation rather than diesel and/or gasoline powered generators.
- In general, commit to the best available emissions control technologies for project equipment.
    - *On-Highway Vehicles* - On-highway vehicles used for this project should meet, or exceed the EPA exhaust emissions standards for model year 2010 and newer heavy-duty on-highway compression-ignition engines (e.g., long-haul trucks, refuse haulers, shuttle buses, etc.).[1]
    - *Nonroad Vehicles & Equipment* - Nonroad vehicles & equipment used for this project should meet, or exceed the EPA Tier 4 exhaust emissions standards for heavy-duty nonroad compression-ignition engines (e.g., construction equipment, nonroad trucks, etc.).[2]
    - *Low Emission Equipment Exemptions* – The equipment specifications outlined above should be met unless: (1) a piece of specialized equipment is not available for purchase or lease within the United States; or (2) the relevant project contractor has been awarded funds to retrofit existing equipment, or purchase/lease new equipment, but the funds are not yet available.
    - *Advanced Technology Demonstration & Deployment* – To the extent feasible, the Port is encouraged to demonstrate and deploy technologies that exceed the latest emission performance standards for the equipment categories that are relevant for this project (e.g., plug-in hybrid-electric vehicles-PHEVs, battery-electric vehicles-BEVs, fuel cell electric vehicles-FCEVs, advanced technology locomotives and marine vessels, etc.).
- Utilize EPA or CARB verified emission control devices where suitable to reduce emissions of diesel particulate matter and other pollutants at the construction site.

Health Impacts and Environmental Justice Considerations

The DEIS should identify communities with potential environmental justice concerns that could be affected by the proposed project and assess potential health impacts and impact avoidance measures. Because the proposed project could result in increased mobile source air toxics (MSAT) and criteria pollutant emissions and increased traffic at the Port of Long Beach, there is potential to disproportionately impact low income and minority communities that may occur in and around the project area. Disproportionate impacts to communities with potential environmental justice concerns should be avoided and mitigated to the fullest extent practicable. In addition, the Corps should work with affected communities to identify appropriate mitigation measures.

The increased volume of freight traffic that will likely occur in conjunction with the navigation improvements may result in additional conventional truck traffic along the freight corridor, which would contribute to increases in roadway-related MSAT and criteria pollutant emissions impacting already heavily burdened, low income and minority communities along the I-710 Corridor and other freight corridors. Near roadway exposure to air pollution is linked to a variety of adverse health outcomes

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[1] http://www.epa.gov/otaq/standards/heavy-duty/hdci-exhaust.htm

[2] http://www.epa.gov/otaq/standards/nonroad/nonroadci.htm

including asthma and adverse birth and childhood outcomes.[3] In addition, there is a growing volume of evidence that low income and minority communities are more vulnerable to pollution impacts than other communities. The DEIS should disclose the amount of additional conventional truck traffic that this project will generate and discuss the potential health impacts on vulnerable populations, including children and communities with potential environmental justice concerns. The DEIS should evaluate near roadway health impacts on neighboring communities, and work with the affected community to develop mitigation measures to reduce emissions, reduce exposure to emissions, and compensate for near-roadway health impacts. EPA recently published a guidance document titled "Best Practices for Mitigating Near Roadway Pollution at Schools" (November 2015) which could serve as a useful resource for mitigating impacts.

The Corps should also consider conducting a corridor level EJ analysis of near roadway impacts, as recommended in the Draft 2016-2040 Southern California Association of Governments Regional Transportation Plan/Sustainable Communities Strategy.[4]

Children's Health

Executive Order 13045 on Children's Health and Safety directs that each Federal agency shall make it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children, and shall ensure that its policies, programs, activities, and standards address these risks. To meet this priority, we recommend that the DEIS consider data on existing asthma rates, or indicators, and asthma severity among children and the general community near the project site; identify impacts of the project on asthma rates or indicators and quantify associated costs, to the extent feasible; and, consider impacts from noise on health and learning, especially near schools and daycare centers along the freight corridors and close to any construction work.

Mitigation of Health Impacts

The DEIS should discuss the Port Mitigation Grant Programs and the work that has been done to improve community health by reducing the impacts of Port-related air pollution and to decrease greenhouse gas emissions. The DEIS should describe whether the action alternatives will provide additional funding for community projects or grants. We also encourage the Port of Long Beach to describe programs intended to benefit the local community (e.g., job training and local hiring requirements).

<u>Climate Change Impacts</u>

The DEIS should identify the cumulative contributions to greenhouse gas emissions that will result from implementation of the proposed project, and discuss the potential impacts of climate change on the project. The DEIS should also identify any specific mitigation measures needed to: (1) protect the project from the effects of climate change (e.g., changes to storm surge, magnitude, or frequency), (2) reduce the project's adverse air quality effects, and/or (3) promote pollution prevention and environmental stewardship.

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[3] Padmanabhan, N. & Glenn, B. August 2009, EPA Research Focus on Health Effects of Near-Roadway Air Pollution. Air and Waste Management Association, EM Magazine. Available at: http://pubs.awma.org/gsearch/em/2009/8/padmanabhan.pdf
[4] http://scagrtpscs.net/Pages/DRAFT2016RTPSCS.aspx

Any sustainable design and operation measures that can be identified as reducing greenhouse gases should be identified in the DEIS with an estimate of the greenhouse gas emissions reductions that would result if such measures were implemented, and the DEIS should indicate whether these measures would be required. Attention should be paid to explaining the quality of each greenhouse gas mitigation measure – including its permanence, verifiability and enforceability.

Dredged Material Management

The NOI does not provide an estimate of the volume of dredged material associated with each action alternative. The DEIS should estimate dredged material volumes in as much detail as possible for each action alternative. Placement site capacity, impacts of dredging and placement, and degree of any benefits all relate directly to the volume of material at issue.

The DEIS should also estimate as specifically as possible the subsequent (post-construction) maintenance dredging needs for each action alternative and address whether modifications in channel configuration or depth may result in greater volumes needing to be maintenance-dredged in comparison to current (No Action) volumes. The DEIS should provide estimates for funding increases that may be needed to support these activities.

Comprehensive physical, chemical, and biological testing of sediment should be conducted and the results presented in the DEIS. Sediment testing and evaluation is required to determine suitability for ocean disposal. The DEIS should discuss the criteria associated with management and disposal of dredged material, including sediment characterization results (e.g. grain size, contaminant concentrations, and toxicity) or plans for sediment characterization sampling and analysis, and disposal options for sediment that cannot be beneficially reused. Sampling and analysis plans and sediment testing results must be reviewed by the Southern California Dredged Material Management Team (SC-DMMT), a Federal-State interagency review group, to ensure that that sediments proposed for dredging are adequately characterized in order to determine suitable placement options.

Absent sediment suitability determinations in advance from the appropriate agencies, the DEIS should presume that a percentage of the material to be dredged will not be suitable for all placement options, and the DEIS should identify how any toxic or contaminated material that does not meet placement criteria would be handled.

To the maximum extent practicable, alternatives to ocean disposal should be evaluated for all feasible beneficial reuse options, including but not limited to beach nourishment, marsh restoration, and construction fill. The Corps and the Port should target 100% of the material to be dredged for beneficial reuse, and not limit the evaluation of possible reuse options to the immediate Port vicinity. EPA will not concur on ocean disposal of any material that can practicably be reused.

Storm surge and subsidence are common along the coastal areas, and beneficial reuse of dredged material may provide protection to shore-side infrastructure endangered by coastal erosion, or be used to extend the area of recreational beaches where sand has been eroded by storm surge. Coastal marshes are also subject to erosion and subsidence, and these areas can be restored using suitable dredged material. We recommend that the Corps coordinate with EPA and other resource agencies on the relative merits of specific reuse opportunities to ensure that maximum benefits are realized and ancillary adverse impacts on existing habitats are avoided.

Aquatic Resource and Habitat Impacts

Clean Water Act Section 404(b)(1) Analysis

Section 404 of the Clean Water Act regulates the discharge of dredged or fill materials to waters of the United States. Compliance with the 404(b)(1) Guidelines (40 CFR 230) requires that permits be issued only for the Least Environmentally Damaging Practicable Alternative (LEDPA). The CWA Section 404(b)(1) alternatives analysis for this project will be used to determine the LEDPA and demonstrating project compliance with Federal Guidelines for Specification of Disposal Sites for Dredged or Fill Materials ("Guidelines"). Page 29 of the Corps South Pacific Division February 8, 2013 Regulatory Program Standard Operating Procedure for Preparing and Coordinating EISs (12509-SPD) states:

> Districts will make all reasonable efforts to ensure the NEPA alternatives analysis is thorough and robust enough to provide the information needed for the evaluation of alternatives under the section 404(b)(1) Guidelines and the public interest review. The goal of integrating the NEPA alternatives analysis and the CWA section 404(b)(1) alternatives analysis is to gain efficiencies, facilitate agency decision-making and avoid unnecessary duplication.

The practice of deferring, until later in the NEPA process, the disclosure of information needed for findings of compliance with the Guidelines makes it difficult for agencies and the public to provide timely and substantive input on the evaluation of alternatives, which could inform the Corps' decision-making process. Integrating the section 404(b)(1) alternatives analysis into the DEIS alternatives analysis would afford agencies and the public a more meaningful opportunity to evaluate impacts and provide relevant and timely feedback to inform these analyses and the Corps' decision. We recommend that the DEIS identify the LEDPA and include the CWA Section 404(b)(1) alternatives analysis within the document.

Benthic Habitat

Any alternative involving deepening or reconfiguring the existing channel(s) must address potential short-term and long-term impacts to benthic habitat, and discuss the need for mitigation of those impacts. We note that mitigation or otherwise offsetting measures could be required under either or both the Essential Fish Habitat and Endangered Species Act processes, as well as under Section 404 of the Clean Water Act, depending on the alternative selected.

Ocean Discharges from Ocean Going Vessels

The DEIS should discuss compliance with EPA's Final 2013 Vessel General Permit for discharges incidental to the normal operation of commercial vessels greater than 79 feet in length. We encourage the Port to raise awareness of the requirements of the General Permit among mariners.

Inefficiencies in Container Movements and Loading of Vessels

The NOI states that existing container vessels cannot load to their maximum draft, which is causing light-loading of vessels at the point of origin and delays to an increasing number of containerships. The DEIS should provide more detailed information on these issues including how many ships are currently affected by depth limitations in the channels, the degree that ships are light-loaded, estimates for the amount of freight which cannot be loaded, whether the freight is loaded onto the ship elsewhere, and the extent of delays. The DEIS should discuss how ship traffic and loading of container ships is anticipated to change in conjunction with each alternative, including anticipated increases of container freight and improvements in logistics.

Recreation Opportunities

The NOI presents three problem statements that summarize inefficiencies associated with operation of deep draft vessels in secondary channels. The third item mentions diminished recreation opportunities and environmental degradation in coastal areas outside of the study area. The DEIS should clarify what specific "diminished recreation opportunities" might be addressed by the proposed navigation deepening project.

We appreciate the opportunity to review this scoping notice and look forward to working with you on this project. Please send a hard copy of the DEIS to this office when it is officially filed via *e-NEPA*. If you have any questions, please contact me at 415-972-3545 or mcpherson.ann@epa.gov or Jeanne Geselbracht at 415-972-3853 or Geselbracht.jeanne@epa.gov.

Sincerely,

Ann McPherson
Environmental Review Section

CC (via email): Richard D. Cameron, Port of Long Beach
Christopher Cannon, City of Los Angeles Harbor Department
Cynthia Marvin, California Air Resources Board
Philip Fine, South Coast Air Quality Management District
Courtney Aguirre, Southern California Association of Governments

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LOS ANGELES WATERKEEPER®

February 3, 2016

Mr. Lawrence Smith
Project Environmental Coordinator
U.S. Army Corps of Engineers
Los Angeles District
915 Wilshire Boulevard, Suite 390
Los Angeles CA 90017-3401

Via e-mail to: Lawrence.J.Smith@usace.army.mil
RE: Port of Long Beach Deep Draft Navigation Project

Dear Mr. Smith:

Thank you for the opportunity to comment on the proposed Port of Long Beach Deep Draft Navigation Project (Proposed Project). Founded in 1993, Los Angeles Waterkeeper (LAW) has approximately 3,000 members who live and/or recreate in and around the Los Angeles area. LAW is dedicated to the preservation, protection, and defense of the rivers, creeks, wetlands, tidelands, coastal waters and groundwater of Los Angeles County from all sources of pollution and degradation. For more than two decades, LAW has pursued these goals through a combination of education, advocacy, and impact litigation.

LAW would like to take this opportunity early in the stage of the Proposed Project to ask that the U.S. Army Corps of Engineers (USACE) evaluates the following in the Environmental Impact Statement (EIS):

1. The EIS should include an analysis of how the disposal sites for the dredged sediment will be chosen, and that analysis should assess the appropriate grain size of the sediment being disposed of as well as the impacts from potentially contaminated sediment.
2. The EIS' assessment of the water quality impacts from dredging and sediment disposal should evaluate impacts from an increased turbidity and suspended solids, particularly in sensitive habitat areas near the Proposed Project site.
3. The EIS' assessment of impacts on habitat/biota should focus on the Proposed Project's impacts on sensitive nearshore coastal and estuarine habitats; impacts on fisheries; the potential loss of benthic habitat; potential harm to species, particularly endangered species; and the newly dredged substrate's susceptibility to colonization by opportunistic and non-native, invasive species.
4. The EIS should also evaluate the Propose Project's impact on waterborne vessel traffic in the port. If the Proposed Project increases shipping efficiency as intended, will vessel traffic in the Port of Long Beach increase and what will be the environmental impacts of the increased traffic?

Thank you for the opportunity to comment, and we look forward to reviewing the EIS.

Sincerely,

Melissa Kelly
Law Fellow

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DEPARTMENT OF TRANSPORTATION
DISTRICT 7 – Office of Regional Planning
100 S. MAIN STREET, MS 16
LOS ANGELES, CA 90012
PHONE (213) 897-9140
FAX (213) 897-1337
TTY 711
www.dot.ca.gov

Making Conservation a California Way of Life.

February 26, 2019

Matthew Arms
Acting Director of Environmental Planning
Port of Long Beach
4801 Airport Plaza Drive
Long Beach, CA 90815

RE: Long Beach Deep Draft Navigation Feasibility Study and Channel Deepening Project – Notice of Preparation (NOP)
SCH # 2016111014
GTS # 07-LA-2016-02241
Vic. LA-710/PM: 3.869

Dear Mr. Arms:

Thank you for including the California Department of Transportation (Caltrans) in the environmental review process for the above referenced project's Notice of Preparation (NOP). The Port of Long Beach Deep Draft Navigation Study will evaluate dredging to deepen several channels, basins, and standby areas within the Port to improve waterborne transportation efficiencies and navigational safety for current and future container and liquid bulk vessel operations. Study areas include the approach channel extending seaward from the Queen's Gate opening of the Long Beach Breakwater; approach channel, berths, and turning basin to Pier J; the Southeast Basin and associated berths; and the Pier T/West Basin and berths. Additionally, structural improvements may need to be performed to several of the berths within the project areas to reinforce the wharf design to accommodate the proposed dredging. A new electrical substation may be constructed landside to provide electricity to the dredge equipment.

Caltrans has reviewed the NOP and has the following comments:

In order to assist in evaluating this project's impact on state facilities, a traffic study should be prepared to analyze the following information:

- Please analyze the traffic impact to the Main Channel, Queen's Gate, Pier T, Pier J and all potentially impacted streets, intersections/crossroads and ramps associated with this project.

  Please include:

  - Trip counts on/off Interstate 710 and State Route 47 during construction
  - LOS analysis before, during and after the construction.
  - AM and PM peak hour volumes
  - A brief traffic discussion/map indicating the turning movements and directional flow of construction/operation vehicles
  - Any/all potential mitigation traffic analysis

Further information included for your consideration:

If VMT methodology is being used The Port should refer to the traffic study consultant of the Developer to OPR's website guidelines in the evaluation of traffic impact:

http://opr.ca.gov/docs/Revised_VMT_CEQA_Guidelines_Proposal_January_20_2016.pdf

Caltrans emphasizes that safety and mobility are the most important criteria. This needs to be the main consideration. Increased congestion on local arterial and freeways contributes to an increase in the number of accidents

In case the City of Los Angeles intends to use Level of Service (LOS) and HCM methodology for TIS, we recommend the use of "Caltrans Guide for the Preparation of Traffic Impact Studies" for traffic impact on the State highways and freeways and the appurtenant facilities. Please note that these guidelines are different than those applied in the Los Angeles County Congestion Management Program (CMP). For State thresholds and guidance on preparation of acceptable traffic studies, please refer to Caltrans (State) Guide for Traffic Impact Studies:

http://www.dot.ca.gov/hq/tpp/offices/ocp/igr_ceqa_files/tisguide.pdf

Caltrans seeks to promote safe, accessible multimodal transportation. Methods to reduce pedestrian and bicyclist exposure to vehicles improve safety by lessening the time that the user is in the likely path of a motor vehicle. These methods include the construction of physically separated facilities such as sidewalks, raised medians, refuge islands, and off-road paths and trails, or a reduction in crossing distances through roadway narrowing.

Caltrans recommends the project to consider the use of methods such as, but not limited to, pedestrian and bicyclist warning signage, flashing beacons, crosswalks, signage and striping, be used to indicate to motorists that they should expect to see and yield to pedestrians and bicyclists. Visual indication from signage can be reinforced by road design features such as lane widths, landscaping, street furniture, and other design elements.

Storm water run-off is a sensitive issue for Los Angeles County. Please be mindful that projects should be designed to discharge clean run-off water. Discharge of storm water run-off is not permitted onto State Highway facilities without a storm water management plan.

As a reminder, any transportation of heavy construction equipment and/or materials which requires use of oversized-transport vehicles on State highways will need a Caltrans transportation permit. We recommend large size truck trips be limited to off-peak commute periods

If you have any questions regarding these comments, please contact project coordinator Reece Allen, at reece.allen@dot.ca.gov and refer to GTS# 07-LA-2016-02241

Sincerely,

MIYA EDMONSON
IGR/CEQA Branch Chief
cc: Scott Morgan, State Clearinghouse

STATE OF CALIFORNIA - NATURAL RESOURCES AGENCY GAVIN NEWSOM, *Governor*

CALIFORNIA COASTAL COMMISSION
South Coast Area Office
301 E Ocean Blvd, Suite 300
Long Beach, CA 90802
(562) 590-5071

March 1, 2019

Director of Environmental Planning
Port of Long Beach
4801 Airport Plaza Drive
Long Beach, California 90815

RE: **Port of Long Beach Deep Draft Navigation Feasibility Study and Channel Deepening Project Coastal Commission Staff Comments on Amended NOP of a DEIR/EIS (SCH# 2016111014)**

Director of Environmental Planning:

Thank you for the invitation to comment on the Amended Notice of Preparation (NOP) of a Draft Joint Environmental Impact Report/Environmental Impact Statement (DEIR/EIS) for the Port of Long Beach (Port) Deep Draft Navigation Feasibility Study and Channel Deepening Project (Project). The Project, as proposed, is within the Coastal Zone and involves changes to the design of the Port's water and land areas to improve existing navigation channels focusing on improvements for container and liquid bulk vessel operations. A harbor development permit for the Project from the Port of Long Beach is required. Under Section 30715 of the Coastal Act, because the development is, in part, for the transmission of liquid bulk cargo in the Port, which includes large quantities of liquefied natural gas and crude oil, it is also appealable to the Coastal Commission. This letter provides direction on topics and issues that should be addressed in the DEIR/EIS.

The following are general comments on Coastal Act issues relevant to the Project:

A. **Consistency with the Port of Long Beach certified Port Master Plan (PMP).** The DEIR/EIS should include a thorough analysis of the Project's consistency with the Port of Long Beach's certified Port Master Plan (PMP), including all certified amendments to the PMP. In addition, under Section 30711 of the Coastal Act, projects listed as appealable shall be included in the Port's PMP and shall be consistent with the Chapter 3 policies of the Coastal Act. Thus, an amendment to the Port's certified PMP is necessary to add a description of the Project to the PMP and ensure the Project's consistency with the certified PMP.

B. **Consistency with the Coastal Act.** The DEIR/EIS should also include a thorough analysis of the Project's consistency with the Chapter 3 and Chapter 8 policies of the Coastal Act. These include, but are not limited to: *Section 30705*, which prohibits the dredging of water areas unless the dredging is consistent with the PMP, falls under one of the categories where dredging can be permitted, takes advantage of existing water depths, water circulation, siltation patterns and means to reduce controllable sedimentation, minimizes disruption of fish and bird breeding and migrations, marine habitats and water circulation, and balances socioeconomic and environmental factors; *Sections30233 and 30706* relating to fill of coastal waters (including fill resulting from addition of new piles, bulkheads, rock toes, etc.) and requiring that fill only be permitted in certain circumstances where there is no feasible alternative and where mitigation measures are provided; and *Sections 30230 and 30231*, which protect and, where feasible, enhance marine resources, biological productivity, and water quality. If any mitigation credits are proposed to be used as a result of this project, the DEIR/EIS should also include information on the Port's current mitigation credit balance and proposed use of mitigation credits.

C. **Ocean Disposal Requirements.** Section 30706 of the Coastal Act requires that any disposal of dredged materials within the jurisdiction of the Port shall minimize harmful effects to coastal resources. However, the Project, as proposed, also includes potential disposal of dredged material at offshore disposal sites outside the Port and seaward of the coastal zone boundary (e.g., LA-2 and LA-3). Disposal of dredged material at these locations will require the Port to prepare and submit to the Commission a federal consistency certification. The standard of review for dredged material disposal at these sites is Section 30233 of the Coastal Act rather than Section 30706. The DEIR/EIS should analyze dredge spoil disposal alternatives with the goal of maximizing beneficial reuse of dredged sediments and minimizing disposal volumes at ocean disposal sites. The DEIR/EIS should also note that proposed dredged material disposal in ocean waters must be reviewed by the interagency Southern California Dredged Material Management Team to determine the suitability of dredged materials for disposal.

Please note that the comments provided herein are preliminary in nature. More specific comments may be appropriate as the project develops. Coastal Commission staff requests notification of any future activity associated with this project or related projects. Thank you for the opportunity to comment on the Amended NOP. Please contact me at (562) 590-5071 with any questions.

Sincerely,

Dani Ziff
Coastal Program Analyst

South Coast
Air Quality Management District
21865 Copley Drive, Diamond Bar, CA 91765-4178
(909) 396-2000 · www.aqmd.gov

SENT VIA USPS AND E-MAIL: February 21, 2019
CEQA@polb.com
Director of Environmental Planning
Port of Long Beach
4801 Airport Plaza Drive
Long Beach, CA 90815

Amended Notice of Preparation of an Environmental Impact Report for the Proposed Deep Draft Navigation Feasibility Study and Channel Deepening

South Coast Air Quality Management District (SCAQMD) staff appreciates the opportunity to comment on the above-mentioned document. SCAQMD staff's comments are recommendations regarding the analysis of potential air quality impacts from the Proposed Project that should be included in the Environmental Impact Report (EIR). Please send SCAQMD a copy of the EIR upon its completion. Note that copies of the EIR that are submitted to the State Clearinghouse are not forwarded to SCAQMD. Please forward a copy of the EIR directly to SCAQMD at the address shown in the letterhead. **In addition, please send with the EIR all appendices or technical documents related to the air quality, health risk, and greenhouse gas analyses and electronic versions of all air quality modeling and health risk assessment files[1]. These include emission calculation spreadsheets and modeling input and output files (not PDF files). Without all files and supporting documentation, SCAQMD staff will be unable to complete our review of the air quality analyses in a timely manner. Any delays in providing all supporting documentation will require additional time for review beyond the end of the comment period.**

Air Quality Analysis

SCAQMD adopted its California Environmental Quality Act (CEQA) Air Quality Handbook in 1993 to assist other public agencies with the preparation of air quality analyses. SCAQMD recommends that the Lead Agency use this Handbook as guidance when preparing its air quality analysis. Copies of the Handbook are available from SCAQMD's Subscription Services Department by calling (909) 396-3720. More guidance developed since this Handbook is also available on SCAQMD's website at: http://www.aqmd.gov/home/regulations/ceqa/air-quality-analysis-handbook/ceqa-air-quality-handbook-(1993). SCAQMD staff also recommends that the Lead Agency use the CalEEMod land use emissions software. This software has recently been updated to incorporate up-to-date state and locally approved emission factors and methodologies for estimating pollutant emissions from typical land use development. CalEEMod is the only software model maintained by the California Air Pollution Control Officers Association (CAPCOA) and replaces the now outdated URBEMIS. This model is available free of charge at: www.caleemod.com.

SCAQMD has also developed both regional and localized significance thresholds. SCAQMD staff requests that the Lead Agency quantify criteria pollutant emissions and compare the results to SCAQMD's CEQA regional pollutant emissions significance thresholds to determine air quality impacts. SCAQMD's CEQA regional pollutant emissions significance thresholds can be found here: http://www.aqmd.gov/docs/default-source/ceqa/handbook/scaqmd-air-quality-significance-thresholds.pdf. In addition to analyzing regional air

[1] Pursuant to the CEQA Guidelines Section 15174, the information contained in an EIR shall include summarized technical data, maps, plot plans, diagrams, and similar relevant information sufficient to permit full assessment of significant environmental impacts by reviewing agencies and members of the public. Placement of highly technical and specialized analysis and data in the body of an EIR should be avoided through inclusion of supporting information and analyses as appendices to the main body of the EIR. Appendices to the EIR may be prepared in volumes separate from the basic EIR document, but shall be readily available for public examination and shall be submitted to all clearinghouses which assist in public review.

quality impacts, SCAQMD staff recommends calculating localized air quality impacts and comparing the results to localized significance thresholds (LSTs). LSTs can be used in addition to the recommended regional significance thresholds as a second indication of air quality impacts when preparing a CEQA document. Therefore, when preparing the air quality analysis for the Proposed Project, it is recommended that the Lead Agency perform a localized analysis by either using the LSTs developed by SCAQMD staff or performing dispersion modeling as necessary. Guidance for performing a localized air quality analysis can be found at: http://www.aqmd.gov/home/regulations/ceqa/air-quality-analysis-handbook/localized-significance-thresholds.

The Lead Agency should identify any potential adverse air quality impacts that could occur from all phases of the Proposed Project and all air pollutant sources related to the Proposed Project. Air quality impacts from both construction (including demolition, if any) and operations should be calculated. Construction-related air quality impacts typically include, but are not limited to, emissions from the use of heavy-duty equipment from grading, earth-loading/unloading, paving, architectural coatings, off-road mobile sources (e.g., heavy-duty construction equipment) and on-road mobile sources (e.g., construction worker vehicle trips, material transport trips). Operation-related air quality impacts may include, but are not limited to, emissions from stationary sources (e.g., boilers), area sources (e.g., solvents and coatings), and vehicular trips (e.g., on- and off-road tailpipe emissions and entrained dust). Air quality impacts from indirect sources, such as sources that generate or attract vehicular trips, should be included in the analysis.

In the event that the Proposed Project generates or attracts vehicular trips, especially heavy-duty diesel-fueled vehicles, it is recommended that the Lead Agency perform a mobile source health risk assessment. Guidance for performing a mobile source health risk assessment ("*Health Risk Assessment Guidance for Analyzing Cancer Risk from Mobile Source Diesel Idling Emissions for CEQA Air Quality Analysis*") can be found at: http://www.aqmd.gov/home/regulations/ceqa/air-quality-analysis-handbook/mobile-source-toxics-analysis. An analysis of all toxic air contaminant impacts due to the use of equipment potentially generating such air pollutants should also be included.

In addition, guidance on siting incompatible land uses (such as placing homes near freeways) can be found in the California Air Resources Board's *Air Quality and Land Use Handbook: A Community Health Perspective*, which can be found at: http://www.arb.ca.gov/ch/handbook.pdf. CARB's Land Use Handbook is a general reference guide for evaluating and reducing air pollution impacts associated with new projects that go through the land use decision-making process. Guidance[2] on strategies to reduce air pollution exposure near high-volume roadways can be found at: https://www.arb.ca.gov/ch/rd_technical_advisory_final.PDF.

Mitigation Measures

In the event that the Proposed Project generates significant adverse air quality impacts, CEQA requires that all feasible mitigation measures that go beyond what is required by law be utilized during project construction and operation to minimize these impacts. Pursuant to CEQA Guidelines Section 15126.4 (a)(1)(D), any impacts resulting from mitigation measures must also be discussed. Several resources are available to assist the Lead Agency with identifying potential mitigation measures for the Proposed Project, including:

- Chapter 11 "Mitigating the Impact of a Project" of SCAQMD'S *CEQA Air Quality Handbook.* SCAQMD's CEQA web pages available here: http://www.aqmd.gov/home/regulations/ceqa/air-quality-analysis-handbook/mitigation-measures-and-control-efficiencies

[2] In April 2017, CARB published a technical advisory, *Strategies to Reduce Air Pollution Exposure Near High-Volume Roadways: Technical Advisory*, to supplement CARB's Air Quality and Land Use Handbook: A Community Health Perspective. This technical advisory is intended to provide information on strategies to reduce exposures to traffic emissions near high-volume roadways to assist land use planning and decision-making in order to protect public health and promote equity and environmental justice. The technical advisory is available at: https://www.arb.ca.gov/ch/landuse.htm.

- SCAQMD's Rule 403 – Fugitive Dust, and the Implementation Handbook for controlling construction-related emissions and Rule 1403 – Asbestos Emissions from Demolition/Renovation Activities
- SCAQMD's Mitigation Monitoring and Reporting Plan (MMRP) for the 2016 Air Quality Management Plan (2016 AQMP) available here (starting on page 86): http://www.aqmd.gov/docs/default-source/Agendas/Governing-Board/2017/2017-mar3-035.pdf
- CAPCOA's *Quantifying Greenhouse Gas Mitigation Measures* available here: http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf

Alternatives

In the event that the Proposed Project generates significant adverse air quality impacts, CEQA requires the consideration and discussion of alternatives to the project or its location which are capable of avoiding or substantially lessening any of the significant effects of the project. The discussion of a reasonable range of potentially feasible alternatives, including a "no project" alternative, is intended to foster informed decision-making and public participation. Pursuant to CEQA Guidelines Section 15126.6(d), the EIR shall include sufficient information about each alternative to allow meaningful evaluation, analysis, and comparison with the Proposed Project.

Permits and SCAQMD Rules

In the event that the Proposed Project requires a permit from SCAQMD, SCAQMD should be identified as a Responsible Agency for the Proposed Project in the EIR. The assumptions in the air quality analysis in the EIR will be the basis for permit conditions and limits. For more information on permits, please visit SCAQMD's webpage at: http://www.aqmd.gov/home/permits. Questions on permits can be directed to SCAQMD's Engineering and Permitting staff at (909) 396-3385.

General Conformity Review and Determination

In the event that the Proposed Project is subject to the General Conformity requirement of the Clean Air Act and is not exempt from General Conformity review and determination, the Lead Agency should quantify the Proposed Project's annual total emissions and compared those emissions to the de minimis thresholds in the EIR to determine if the Proposed Project's annual total emissions would exceed General Conformity de minimis thresholds. Any questions related to the SCAQMD General Conformity review process and determination can be directed to Ms. Sang-Mi Lee, Program Supervisor, at slee@aqmd.gov.

Data Sources

SCAQMD rules and relevant air quality reports and data are available by calling SCAQMD's Public Information Center at (909) 396-2039. Much of the information available through the Public Information Center is also available at SCAQMD's webpage at: http://www.aqmd.gov.

SCAQMD staff is available to work with the Lead Agency to ensure that project air quality and health risk impacts are accurately evaluated and mitigated where feasible. If you have any questions regarding this letter, please contact me at lsun@aqmd.gov or (909) 396-3308.

Sincerely,

Lijin Sun

Lijin Sun, J.D.
Program Supervisor, CEQA IGR
Planning, Rule Development & Area Sources

LS
LAC190201-09
Control Number

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DRAFT INTEGRATED FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT STATEMENT / ENVIRONMENTAL IMPACT REPORT (EIS/EIR)

APPENDIX B: COASTAL ENGINEERING

PORT OF LONG BEACH
DEEP DRAFT NAVIGATION STUDY
Los Angeles County, California

October 2019

US Army Corps of Engineers ®

Port of LONG BEACH
The Green Port

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1 Introduction

Presented herein is the Coastal Engineering Report of the Port of Long Beach (POLB) Deep Draft Navigation Study. The purpose of this appendix is to summarize existing physical conditions and present the results of the engineering investigations and analyses conducted to assist in development of the recommended project improvements for the Approach Channel, Main Channel, West Basin, and Pier J Basin Approach of the study.

1.1 Project Area Description

The Port of Long Beach is located within San Pedro Bay, Los Angeles County, California approximately 20 miles south of downtown Los Angeles. It lies between the Port of Los Angeles to the West, the Los Angeles River mouth and city of Long Beach to the East, and is protected by the Middle Breakwater (18,500 feet) and Long Beach Breakwater (13,350 feet). A map of the Los Angeles region and POLB location is shown in Figure 1-1. The current federal channel includes the entrance at Queens Gate, extending northward along the west of Pier J and east of Pier F, the Navy Mole, and Pier T, shown in Figure 1-2. Further descriptions of the various POLB improvements evaluated as part of this study are provided in the following paragraphs.

Figure 1-1 Study Area Location Map

Figure 1-2 Port of Long Beach Current Federal Channel

1.1.1 Approach Channel

The Approach Channel (teal, Figure 1-3) is currently authorized to -76 feet mean lower low water (MLLW) by 1200 feet wide, and spans from station 192+00 offshore to inside the breakwaters at station 350+00. The channel is predominantly straight, except for a single bend which occurs to the northwest at station 337+00, shortly after passing through the breakwater. The channel then widens to 1300 feet. The gap between the Middle and Long Beach Breakwaters (Queen's Gate) is 1800 feet wide and serves as the main entrance into the Long Beach Outer Harbor of San Pedro Bay. Construction to the current depth was completed by the US Army Corps of Engineers (USACE) in 2001 (USACE 1998). The Approach Channel is utilized by both container and liquid bulk vessels

1.1.2 Main Channel

The Main Channel (Figure 1-3) is the continuation of the Approach Channel from the Long Beach Outer Harbor to the Middle Harbor. It begins at station 350+00, ends at 517+50, and the channel width varies from a minimum of 400 feet at the Navy Mole/Pier F channel bender to a maximum of 1400 feet at the Pier T Turning Basin. The channel is currently authorized to a depth of -76 feet MLLW. This depth was completed by the Port of Long Beach from the start of the Main Channel to the Navy Mole/Pier F channel bender, and most recently had maintenance dredging performed by USACE in 2014. The authorized depth for the Pier T Turning Basin and Berthing area were completed in 2011 by USACE (USACE 2009). The main channel is utilized by both container and liquid bulk vessels, with liquid bulk vessels docking at Pier T.

1.1.3 West Basin

The West Basin (yellow, Figure 1-3) encompasses the approach from the Main Channel Pier T Turning Basin to the Pier T berthing area. It is bounded on the north by Pier T and the west/south by the Navy Mole. Depths currently vary from -43 feet to -80 feet MLLW. The region is not currently a federal area, and is maintained by the POLB. The deeper portions of the basin are located at a sediment borrow pit utilized by the Port of Long Beach in 2016 for slip fill and land reclamation. The West Basin is utilized by only container vessels.

1.1.4 Pier J Basin Approach

The Pier J Approach (orange, Figure 1-3) will construct a route to the northeast off of the Main and Approach Channels, north of the Queen's Gate, and provides access to the Pier J Basin. Small portions of the area have previously been dredged, near the entrance to the Pier J slip and basin, and natural water depths range from -76 feet at the Main Channel to -49 feet MLLW near the Pier J Basin entrance. The Pier J Approach will be utilized by container vessels only.

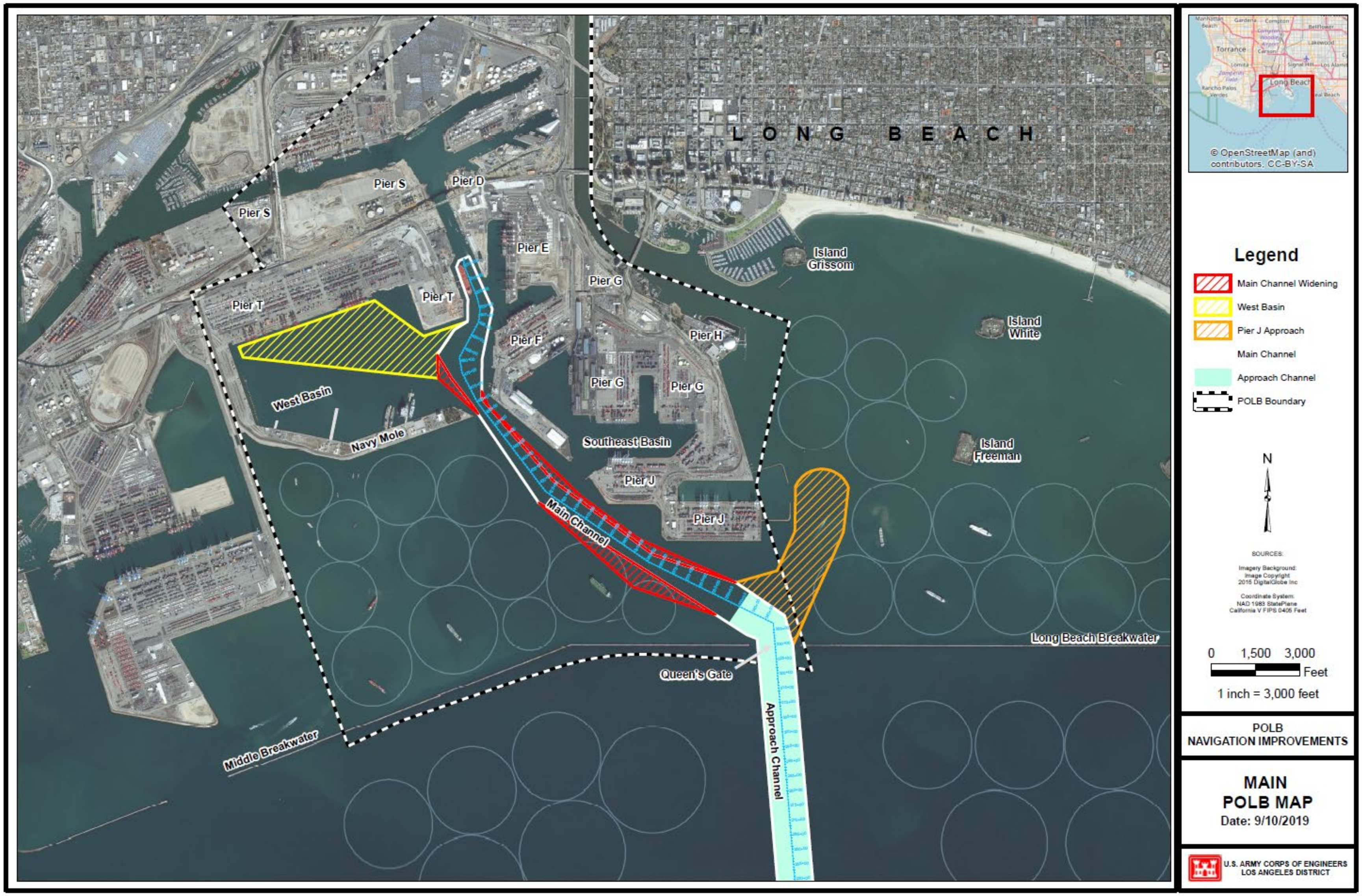

Figure 1-3 Study and Project Area

2 Physical Environment

2.1 Climate

The San Pedro Bay climate is characterized by warm, dry summers and mild winters. Due to Long Beach and San Pedro bays location directly east of the Palos Verdes Peninsula, the area experiences different weather patterns than other nearby coastal communities. Average annual high and low temperatures are 74 degrees and 55 degrees Fahrenheit, with an average temperature of 65 degrees Fahrenheit. Water temperatures in the Port range from 55 – 70 degrees Fahrenheit. Annual precipitation over the port area is 12 inches, the majority of which comes within the winter and early spring months (November to April).

2.2 Winds

The prevailing winds in San Pedro Bay are from the south or west. These are primarily caused by differential heating of water and land, and though the shore faces southward, the onshore (prevailing) wind direction occurs due to the Pacific Ocean being oriented to the west. The most common (50% occurrence) wind speeds in the area are around 6-10 miles per hour, and during the summer onshore winds can peak at 20-25 miles per hour. Occasional strong hot winds from the Great Basin area create an offshore wind condition (Santa Ana Winds) out of the north in the fall and winter months. Winds can sometimes reach hurricane velocities during this time, especially when occurring in tandem with winter storms. Variations in wind speeds can also occur due to a funneling of winds caused by the nearby Palos Verdes peninsula, intensifying winds in the port area. A wind rose from nearby Long Beach Airport is shown in Figure 2-1.

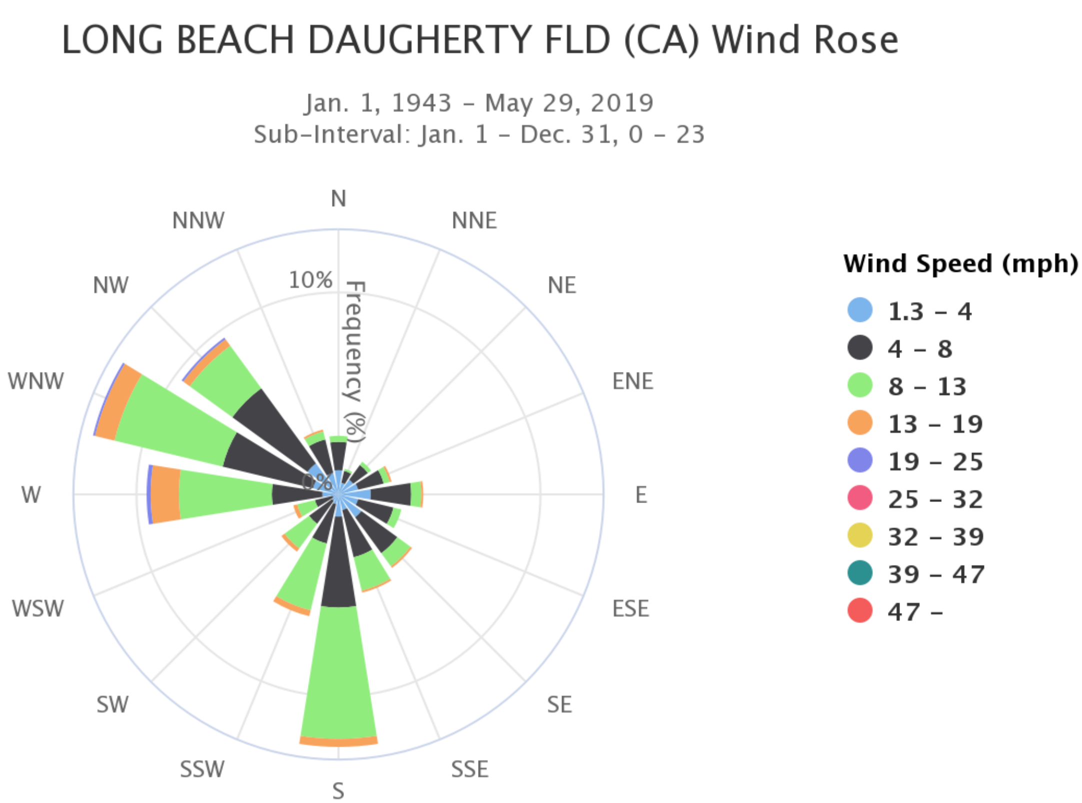

Figure 2-1 Wind Conditions, Long Beach Airport (1943-2019)

2.3 Waves

Due to the sheltering effect of Palos Verdes peninsula, Santa Catalina Island, and San Clemente Island, deepwater waves predominantly approach San Pedro Bay from the west and south. Extratropical storm waves approach from the west, while tropical and pre-frontal sea waves approach from the south. More frequent storm waves from the south occur primarily in the summer, while larger, more threatening storm waves occur less frequently in the winter, and originate from the west. The Middle and Long Beach breakwaters provide protection for the port from approaching waves. Outside the breakwaters, waves of 10-12 feet can occur. The typical swell that penetrates into the port have a period upwards of 10 seconds. When wind generated waves occur within the breakwaters they are typically small (< 1 foot wave height), but can reach up to 4 feet with 4 second periods during extreme Santa Ana Winds conditions.

2.4 Tides

Tides along the southern California coastline are of the mixed, semi-diurnal type. Typically, a lunar day (about 25 hours) consists of two unequal high and two unequal low tides. A lower low tide normally follows the higher high tide by approximately seven to eight hours while the time to return to the next higher high tide (through higher low and lower high water levels) is usually approximately 17 hours. Annual tidal peaks typically occur during the summer and winter seasons following a solstice. The increased tidal elevations during the winter season can exacerbate the coastal impacts of winter storms. Tidal datum for the San Pedro Bay are listed in Table 2-1. The mean range of the tide is 3.81 feet, while the great diurnal range is 5.49 feet.

Table 2-1 Tidal Datum at Los Angeles, CA, NOAA Station 9410660

Datum Plane	Elevation, feet, MLLW
Highest Observed Water Level	7.92
Mean Higher High Water (MHHW)	5.49
Mean High Water (MHW)	4.75
Mean Tide Level (MTL)	2.84
Mean Sea Level (MSL)	2.82
Mean Low Water (MLW)	0.94
North American Vertical Datum 1988 (NAVD88)	0.20
Mean Lower Low Water (MLLW)	0.00
Lowest Observed Water Level	-2.73

Source: https://tidesandcurrents.noaa.gov/datums.html?id=9410660

2.5 Currents

Offshore currents, including the California Current, the California Undercurrent, the Davidson Current, and the Southern California Countercurrent (also known as the Southern California Eddy), consist of major large-scale coastal currents, constituting the mean seasonal oceanic circulation with induced tidal and event specific fluctuations on a temporal scale of 3 to 10 days (Hickey, 1979).

The California Current is the equator-ward flow of water off the coast of California and is characterized as a wide, sluggish body of water that has relatively low levels of temperature and salinity. Peak currents with a mean speed of approximately 25 to 49 feet per minute occur in summer following several months of persistent northwesterly winds (Schwartzlose and Reid, 1972).

The California Undercurrent is a subsurface northward flow that occurs below the main pycnocline and seaward of the continental shelf. The mean speeds are low, on the order of 10 to 20 feet per minute (Schwartzlose and Reid, 1972).

The Davidson Current is a northward flowing nearshore current that is associated with winter wind patterns north of Point Conception. The current, which has average velocities between 30 and 60 feet per minute, is typically found off the California coast from mid-November to mid-February, when southerly winds occur along the coast (Schwartzlose and Reid, 1972).

The Southern California Countercurrent is the inshore part of a large semi-permanent eddy rotating cyclonically in the Southern California Bight south of Point Conception. Maximum velocities during the winter months have been observed to be as high as 69 to 79 feet per minute (Maloney and Chan, 1974).

Maximum flood and ebb tidal velocities occur at Queen's Gate, with surface velocities reaching up to 1.1 feet per second. Tidal circulation is generally clockwise within the port, with flows of 0.2 - 0.3 feet per second in inner channels and 0.3 – 1.1 feet per second at the entrance channel near Queen's Gate. Tidal flushing is the primary influence on water quality in the inner port areas.

2.6 Climate Change

2.6.1 Sea Level Change

Sea level change is an uncertainty, potentially increasing the frequency of extreme water levels. Planning guidance in the form of an USACE Engineering Regulation (ER), USACE ER 1100-2-8162 (USACE 2019), incorporates new information, including projections by the Intergovernmental Panel on Climate Change and National Research Council (IPCC 2007, NRC 2012). Planning studies and engineering designs are to evaluate the entire range of possible future rates of sea-level change (SLC), represented by three scenarios of "low", "intermediate", and "high" sea-level change. ER 1100-2-8162 also recommends that a National Oceanic and Atmospheric Administration (NOAA) water level station should be used with a period of record of at least 40 years. The use of sea level change scenarios as opposed to individual scenario probabilities underscores the uncertainty in how local relative sea levels will actually play out into the future. At any location, changes in local relative sea level (LRSL) reflect the integrated effects of global mean sea level (GMSL) change plus local or regional changes of geologic, oceanographic, or atmospheric origin.

- "Low" rate of sea-level change is equal to the historic rate of SLC.
- "Intermediate" rate of sea-level (ISL) change is based on the modified NRC curve I and using the current estimate of 1.7 mm/year for GMSL change, the following equation

$$E(t) = 0.0017t + bt^2$$

in which t represents years, starting in 1986, b is a constant, and $E(t)$ is the eustatic sea level change, in meters, as a function of t.

Manipulating the above equation to account for the fact that it was developed for eustatic sea level change starting in 1992, while projects will actually be constructed at some date after 1992, results in equation

$$E(t_2) - E(t_1) = 0.0017(t_2 - t_1) + b(t_2^2 - t_1^2)$$

Where t_1 is the time between the project's construction date and 1992 and t_2 is the time between a future date at which one wants an estimate for sea level change and 1992 ($t_2 = t_1$ + number of years after construction)

- "High" rate of sea-level change (HSL) is based on the modified NRC curve III and the above equations.

Using the USACE Institute of Water Resources (IWR) Sea Level Change calculator (based on the above equations) and data from Los Angeles, CA NOAA gage 9410660, provides an estimated sea level change of 0.00272 feet per year. Figure 2-2 shows the relative sea level change projections for the three SLC scenarios. As shown in Table 2-2, projecting the three rates of change to the year 2077, which corresponds to a 50 year period of analysis, provides us with predicted low level rise of 0.14 feet, intermediate of 0.67 feet, and high level rise of 2.36 feet. Any rises in sea level are a net positive for deep draft navigation due to a reduction in future dredging needs.

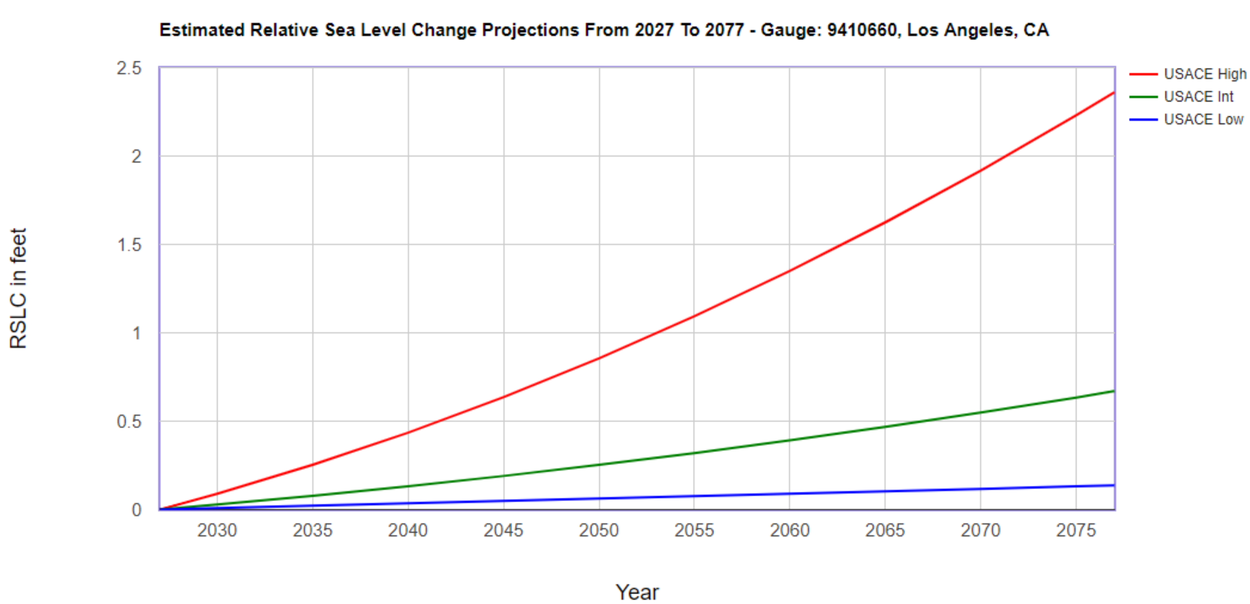

Figure 2-2 Relative Sea Level Rise Projections, Los Angeles, CA, NOAA gage 9410660

Table 2-2 Predicted Relative Sea Level Change, Los Angeles, CA, NOAA gage 9410660

Estimated Relative Sea Level Change from 2027 To 2077

9410660, Los Angeles, CA
NOAA's 2006 Published Rate: 0.00272 feet/yr
All values are expressed in feet

Year	USACE Low	USACE Int	USACE High
2027	0.00	0.00	0.00
2030	0.01	0.03	0.09
2035	0.02	0.08	0.25
2040	0.04	0.13	0.44
2045	0.05	0.19	0.64
2050	0.06	0.25	0.86
2055	0.08	0.32	1.09
2060	0.09	0.39	1.35
2065	0.10	0.47	1.63
2070	0.12	0.55	1.92
2075	0.13	0.63	2.23
2077	0.14	0.67	2.36

2.6.2 Other Factors

The Port of Long Beach has an extensive Climate Adaptation and Coastal Resiliency Plan (POLB 2016). This plan identifies strategies for adaptation to climate change impacts throughout the port. Port guidelines and policies for future planning studies are influenced by adding sea level rise analysis to all future harbor development permits. This has led to multiple infrastructure improvements to address future climate change issues.

2.7 Sediment

Sediments in the study area comprise sand, silt, and clay of varying proportions. Gravel, cobble, and debris may be encountered in limited quantities, within project depths. A thin layer of semi-floating silt and mud (clay) exists atop the ocean bottom surface, in areas of less disturbance or where recent man-made activities (e.g., dredging and harbor modifications) have not altered the surrounding natural subsurface conditions. This layer is approximately 2 to 6 inches thick and overlies a very loose unconsolidated layer of sand or silt. Underlying this shallow surface sediment are thick alternating layers of silty sand and sand with some silt, with some occasional thin layers of clay. Sandy portions of the sediment are predominantly fine grained, rounded and composed of quartz and mica minerals. Minor thin layers and localized lenses of gravel and clays are present within the sandy sediment and are found mostly within the upper 50 feet. The sediment is unconsolidated and increases in density with increasing depth. For more information on sediment characteristics see Appendix C.

2.8 Sediment Transport

The San Pedro Bay has a stable bathymetry, with very little sedimentation and sediment transport. The area is located at the beginning of the San Pedro Littoral Cell (Patsch and Griggs 2006), where sediment transport is blocked from the north and west by the Palos Verdes peninsula, and the stability created by the breakwaters limits accretion or loss of sediment. Since the Los Angeles River was diverted in 1923 to its present course, the sediment load carried by the river is diverted to areas away from the port facilities. The main sources of sedimentation within the inner port and berths is prop wash from the large propellers of commercial vessels along with the small amounts of sediment inflow from the channel through Queen's Gate. Recent surveys by USACE show that even exterior of the breakwaters is very stable, as since the deepening of the Approach Channel by USACE in 2001 there has been only a small 40,000 cubic yard shoal of sedimentation in the channel, which currently does not impact navigability. Maintenance dredging within the port harbor and berths is performed occasionally by the POLB under a Waste Discharge Requirements Authorization from the State of California Water Quality Control Board for maintenance dredging, which is renewed every five years (most recently in 2018).

3 Design Considerations

3.1 Vessel Inventory and Forecast

Vessels calling port in the Port of Long Beach include container ships and liquid bulk tankers. The port currently handles more than 7 million twenty-foot equivalent units (TEUs) in container traffic, more than 75 million tons of cargo, and has over 2,000 vessel calls. As shown on Figure 3-1, from 1995 through 2017, total container throughput at the Port increased from about 2.84 million TEUs to about 7.54 million TEUs, representing an increase of 165%, or an annual compound growth rate of 4.54%. Strong growth in throughput is projected to continue until the Port's facilities reach capacity, which is anticipated in 2035. Liquid forms of bulk cargo include gasoline, miscellaneous chemicals, and the primary liquid bulk commodity of crude oil imports. Crude oil imports have varied with no discernable trend from 2006 through 2016, and projected imports are not anticipated to be significantly different from historical volumes.

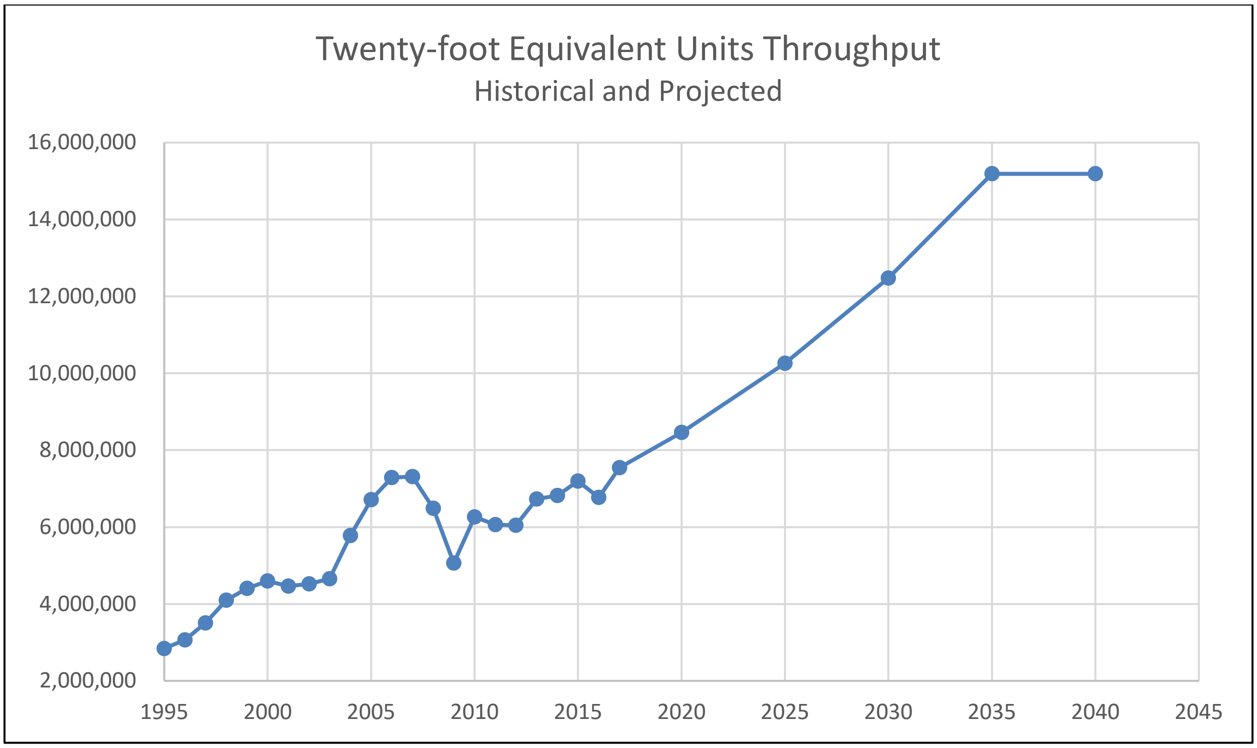

Figure 3-1 Port of Long Beach Container Unit Throughput, Historical and Projected

Vessel speeds in the approach channel are typically 10 knots, with a maximum allowable speed of 12 knots. As vessels approach the Queen's Gate they slow to 8 knots in preparation for the turn after passing through the breakwater. After, their speed exiting the turn is typically around 3 knots, which they maintain through the rest of the Main Channel area. Upon entering the Pier T Turning Basin, the West Basin, or the Pier J Approach, tugboats take over speed and maneuvering for the vessel.

3.2 Design Vessel

Vessels are progressively getting larger and future vessel fleet forecasts continue to show this trend. The container and liquid bulk design vessels were determined based on input and forecasts from the Port of Long Beach, professional judgment of Harbor Pilots, and data collection and analysis by the Planning Center of Expertise for Deep Draft Navigation supported by the Institute for Water Resources. The container design vessel characteristics are 1,300 feet long overall, summer load line of 52 feet, 193-foot beam, 188,000 deadweight tonnage (DWT), and 18,000-19,000 twenty-foot equivalent units (TEU). This is roughly the equivalent to a "Triple E" or "Post-Panamax Generation IV" containerized carrier. The liquid bulk design vessel characteristic are 1,100 feet long overall, 200-foot beam, 325,000 DWT, and 70 feet summer load line draft. This vessel is within the Very/Ultra Large Crude Carrier class also known as VLCC and ULCC.

3.3 Ship Simulation Study

A ship simulation was performed in accordance with ER 1110-2-1403 to evaluate channel navigability of the approach and main channels. A site visit to the port was performed to observe navigation conditions and take photographs for the model's visual scenes. The ship simulations were conducted in Vicksburg, Mississippi at the Coastal and Hydraulics Laboratory of the Engineer Research and Development Center. Two POLB pilots, experienced in navigating the Port of Long Beach channels, participated in the effort. Various conditions of ship size, wave, and current conditions were tested. Model vessels readily available in the ERDC library were chosen for the feasibility level testing, including the containership *Superium Maersk* (length 1,300 feet, beam 191 feet, draft 53 feet)and the VLCC *Elizabeth I. Angelicoussi* (length 1089 feet, beam 190 feet, draft 70 feet). Both of these model vessels are similar to the design vessels, and were good approximations for the simulation testing. As a result of the study, based on feedback from the harbor pilots using the larger design vessels, bend easing of portions of the Main Channel was added to the scope of the project. The pilots also concurred, based on their experience in the simulator, that the recommended design depths (as seen in the following section) were acceptable for the new design vessel sizes.

3.4 Recommended Design

The current POLB standard of operation is to allow only one-way traffic in and out of the port. The USACE Engineering Manual on deep draft navigation (EM 1110-2-1613) recommends a design channel width for one-way ship traffic of a dredged trench type channel of 3.25 times the design beam width for current speeds between 0.5 and 1.5 knots (at Queen's Gate) and 2.75 for current speeds between 0.0 and 0.5 knots (inner channels). Thus, the navigation channel will require a width of 650 feet at Queen's Gate and 550 feet for inner channels for liquid bulk design vessels moving under their own power, with container vessels requiring less. These widths are reached for all channel designs.

Channel depth design, as directed by EM 1110-2-1613, "is determined … by an economic analysis of the expected project benefits compared with project costs. Once the design ship and channel depth are determined [by economic analysis], the safety and adequacy of the channel depth for operational design ship transits will be determined". An adequate design channel depth is determined by the design vessel draft and a set of underkeel safety allowances, as well as needs of the local harbor pilots. A summary of the underkeel safety allowances follows, and can be seen in Figure 3-2:

- Minimum safe clearance. A minimum of two additional feet in depth is required under the keel after all other requirements for depth have been met. This is needed to avoid damage to ships propellers from sunken timbers and debris, to avoid fouling of pumps and condensers by bottom material, reduce propeller wash effects, provide allowance for spot shoals, and offset poor steerage effects caused by under keel clearance close to the seabed.
- Freshwater sinkage. Passing from seawater into a freshwater system will increase vessel displacement. However, due to high salinity in the port, fresh water sinkage is anticipated to have a negligible effect on vessel displacement.
- Trim. The difference between the vessel draft at midship and the bow or stern is termed trim. It is often complex and expensive to keep a ship at even keel and a nose down vessel does not maneuver well, so a vessel is often loaded to keep the stern lower than the bow. For the Port of Long Beach, this provision is not necessary, due to the needs and requirements of local pilots.
- Squat. A moving ship causes a drawdown of the water surface causing the vessel to ride lower relative to a fixed datum. Squat is dependent upon many variables including vessel speed through the water, water depth, and vessel to channel blockage ratio. Vessel speed controls this design value, and calculation is provided in EM 1110-2-1613.
- Tidal and wave effects. In order to eliminate tidal delays in the waterways an allowance is included for transits during low tides and effects from wave motion.

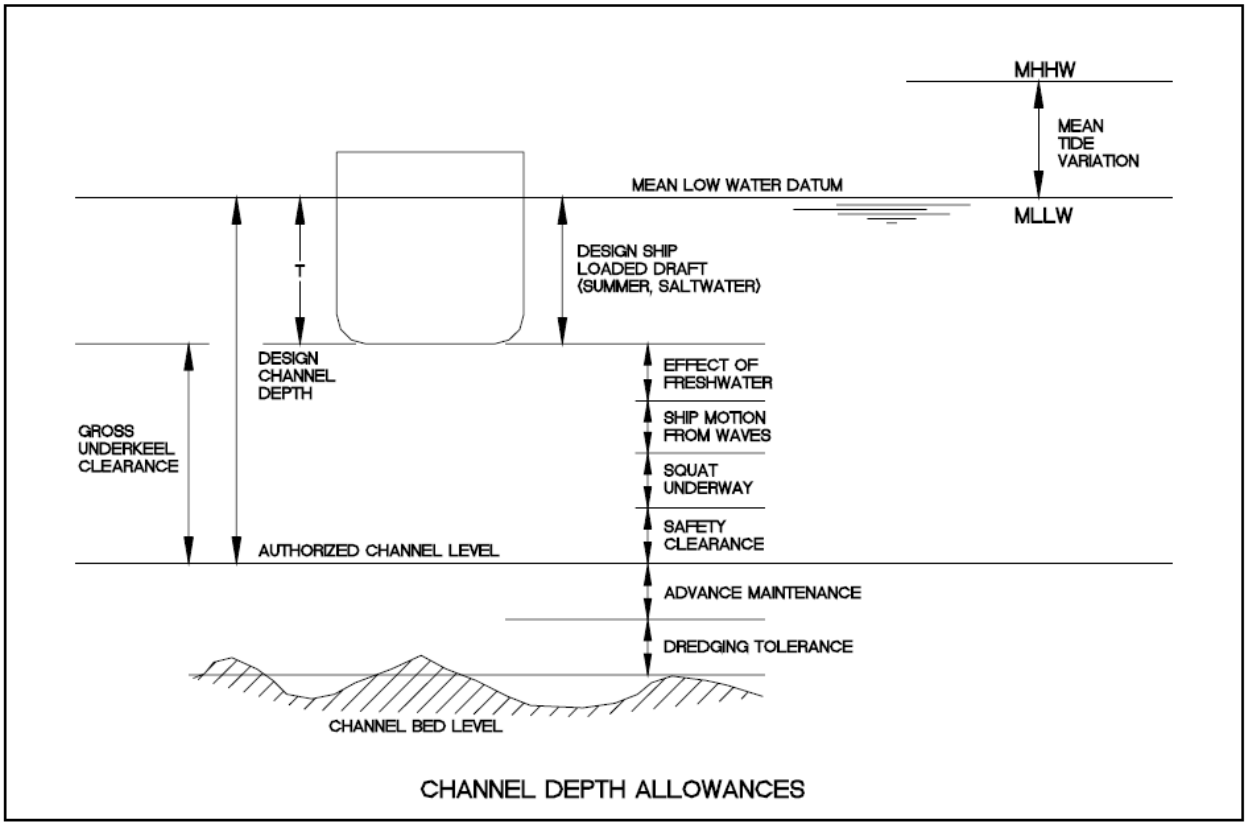

Figure 3-2 Design Channel Depth Allowances and Underkeel Clearance

3.4.1 Approach Channel

For the approach channel, depths are driven by the draft of the design liquid bulk vessel. The total underkeel clearance required by EM 1110-2-1613 is the liquid bulk vessel draft of 70 feet, plus the 2 feet of safe clearance, 2.5 feet of squat effects, and 4 feet from local tidal and wave effects, for a total of 78.5 feet. The economic analysis justifies a design depth of -80 feet MLLW, which meets minimum operational safety for navigability of both design ships in the channel.

3.4.2 Main Channel

In the main channel, the liquid bulk vessel slows down, decreasing the squat effects to 0.5 feet. Wave and tidal effects are also reduced to 2 feet due to the sheltering of the Middle and Long Beach Breakwaters. These effects, plus 2 feet of safe clearance, produce a total underkeel clearance required of 74.5 feet. The current depth of the main channel is -76 feet MLLW. Based on pilot feedback from the ship simulation study, bend easing will be done to several areas of the main channel, to accommodate the increased turning radius of the larger design liquid bulk and container vessels. EM 1110-2-1613 guidance for channel turns and bends recommends a turn width increase ranging from 0-2 times the ship beam, depending on the angle of the turn/bend in the channel. The proposed bend easing would comply with the worst case scenario of 2 times the ship beam throughout the main channel, even though that multiplier is not required for the turn angles present (note: the Navy Mole channel bender is classified as an 'angle turn', not requiring an increase in channel width). The regions where bend easing will occur are shown in Figure 1-3, which includes west and east sides of the Pier F/Navy Mole channel bender, western portion of the main channel from station 355+00 to 425+00, and the east edge of the main channel from station 350+00 to 460+00. The current design depth of -76 feet MLLW will be maintained, as justified by the economic analysis.

3.4.3 West Basin

Container vessels enter the west basin under control of tugboats at slow speeds. Due to this, squat effects can be assumed small, and the underkeel depth only needs to account for an addition of 2 feet of clearance and tidal/wave effects. The economic analysis justifies a federally authorized design depth of -55 feet MLLW in the area, which is larger than the required underkeel clearance for safe navigability. Currently, much of the west basin is already at or deeper than this design depth, and approximately 30% of the area will require dredging, located at the north and south ends of the area shown in Figure 1-3.

3.4.4 Pier J Basin Approach

The channel alignment design of this area was chiefly driven by feedback from local port pilots prior to and during the ship simulation study and was justified by the economic analysis. Container vessels will enter the Pier J Basin Approach under control of tugboats at slow speeds. Due to this, squat effects can be assumed small, and the underkeel depth only needs to account for an addition of 2 feet of clearance and tidal/wave effects. The economic analysis justifies a design depth of -55 feet MLLW in the area, which surpasses underkeel safety considerations. A transitional depth from the Approach and Main Channel design depths to the Pier J Basin Approach design depth will also be created.

Since this will be a new federal channel, design considerations from EM 1110-2-1613 need to be taken into account to ensure this locally and economically driven design meets safe navigation criteria. Pier J will only need to accommodate the design container vessel, with a beam of 193 feet, and will allow one-way ship traffic. As previously mentioned, the channel widths throughout the entire project area meet minimum safe navigability requirements for one-way traffic. The angle of the turn moving from the Approach Channel to the Pier J Approach requires an increase width factor of 1 times the ship beam, resulting in a needed width in the turn of 820 feet, which the current design meets. The turning basin at the head of the Pier J Approach needs to be 1.2 times the length of the design vessel, or 1560 feet for the project design container vessel, which the turning basin diameter surpasses. The depth for the turning basin has the same safety requirements as the channel.

3.5 Utilities

There are not any utility relocations anticipated for this project. The only utility line crossing a portion of the channel is at the border between the middle and inner port areas. This is past the liquid bulk terminal at Pier T, and outside the project area.

3.6 Slope Stability

The recommended side slope for the federal channel is 1 vertical on 3 horizontal. This has been historically used for projects within the POLB, and have proven stable for the sediment characteristics in the region. The currently proposed channel configuration for all regions of the project will not present any concerns for undercutting of structures. However, at the Queen's Gate entrance hydraulic dredging will be minimized for two reasons: most of the channel is currently at the design depth except locations away from the side slopes of the structure, as seen in Figure 3-3; and to minimize any risk of undercutting nearby structures, the Middle and Long Beach Breakwaters.

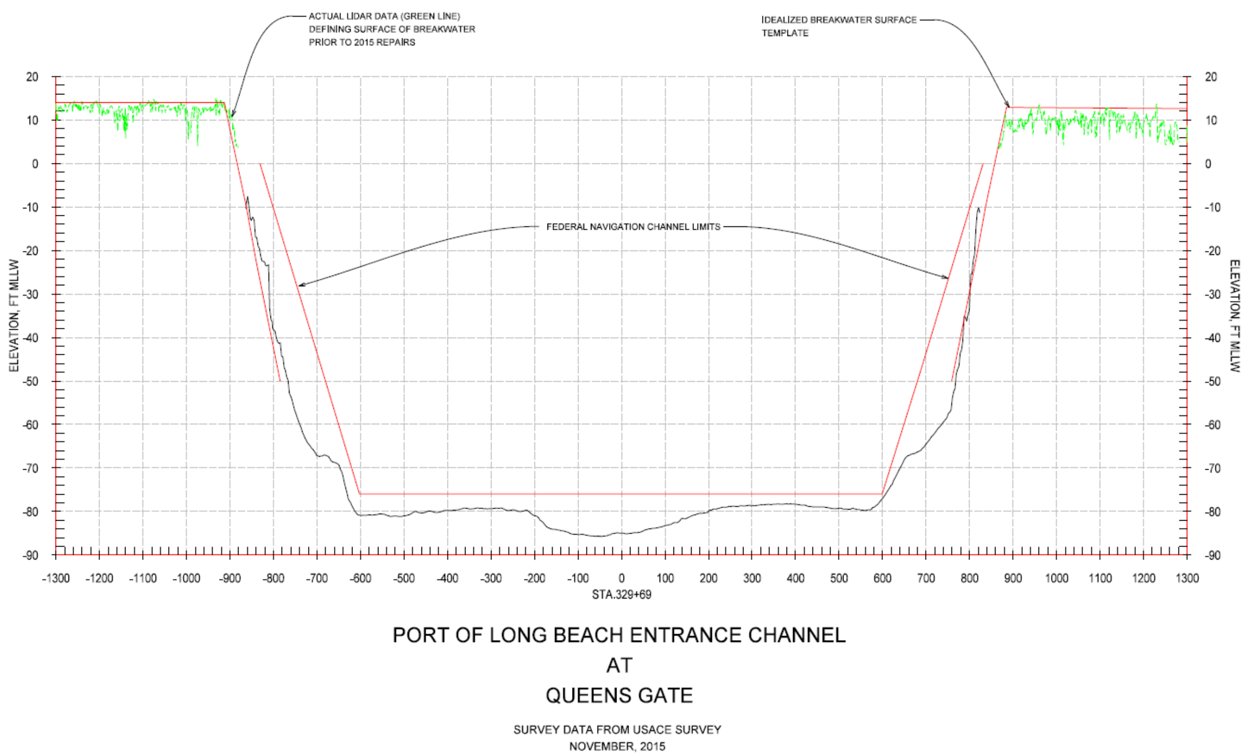

Figure 3-3 Cross-section of POLB Approach Channel and Breakwaters at Queen's Gate, with current federal navigation channel limits

3.7 Dredging

3.7.1 Dredged Material Quantities

The maximum allowable dredging depth for each alternative will include 2 feet of over dredging tolerance beyond the project design depth to account for inaccuracies during dredging operations. Table 3-1 lists the design depth, area, and dredged volume in each project area (with a reference to their footprint color from Figure 1-3). The total volume including over-depth is calculated using survey data, and is not expected to increase between current date and project construction (due to previously discussed low sedimentation of the area).

Table 3-1 Required Dredging Volumes for Recommended Design Depths

Project Area	Design Depth (feet, MLLW)	Area (square feet)	Average Cut Thickness (feet, approx.)	Total Volume Including Over-depth (cubic yards)
Approach Channel (Teal)	-80	18,780,550	3.8	2,600,000
Main Channel (Red)	-76	4,532,405	6.3	1,065,000
West Basin* (Yellow)	-55	3,010,000*	6.4	717,000
Pier J Approach (Orange)	-55	8,938,890	5.7	1,873,000
Pier J Approach, Transition (Orange)	-68	1,563,000	13.8	800,000
Total				7,055,000

*West Basin Area is approximately 30% of yellow footprint from Figure 1-3, as the majority of the area is to design depth.

3.7.2 Dredged Material Management

The USACE maintains a Dredged Material Management Plan for the Los Angeles Region which outlines strategies for management of dredged sediments from local harbors. Three locations are available for dredged material placement. A nearshore placement site near Sunset beach will be utilized. This area is a borrow pit created during USACE projects nourishing Surfside and Sunset beaches, and can contain approximately 2.5 million cubic yards of material. The Environmental Protection Agency maintained Ocean Disposal Sites LA-2 and LA-3 will also be utilized. LA-2 is located 10 miles southwest of the project site, and has an annual maximum disposal volume of 1.0 million cubic yards. LA-3 is located 25 miles southeast and has an annual maximum of 2.5 million cubic yards (EPA SMMP 2011). It is assumed the project will have access to place 0.9 million cubic yards and 2.2 million cubic yards at the locations per year. Relative placement site locations are shown in Figure 3-4. Dredged material from the Approach Channel will be placed at the nearshore site, with an extra 0.1 million cubic yards going to LA-2 after the nearshore site is full. All other dredging operations will place material at LA-2 and LA-3.

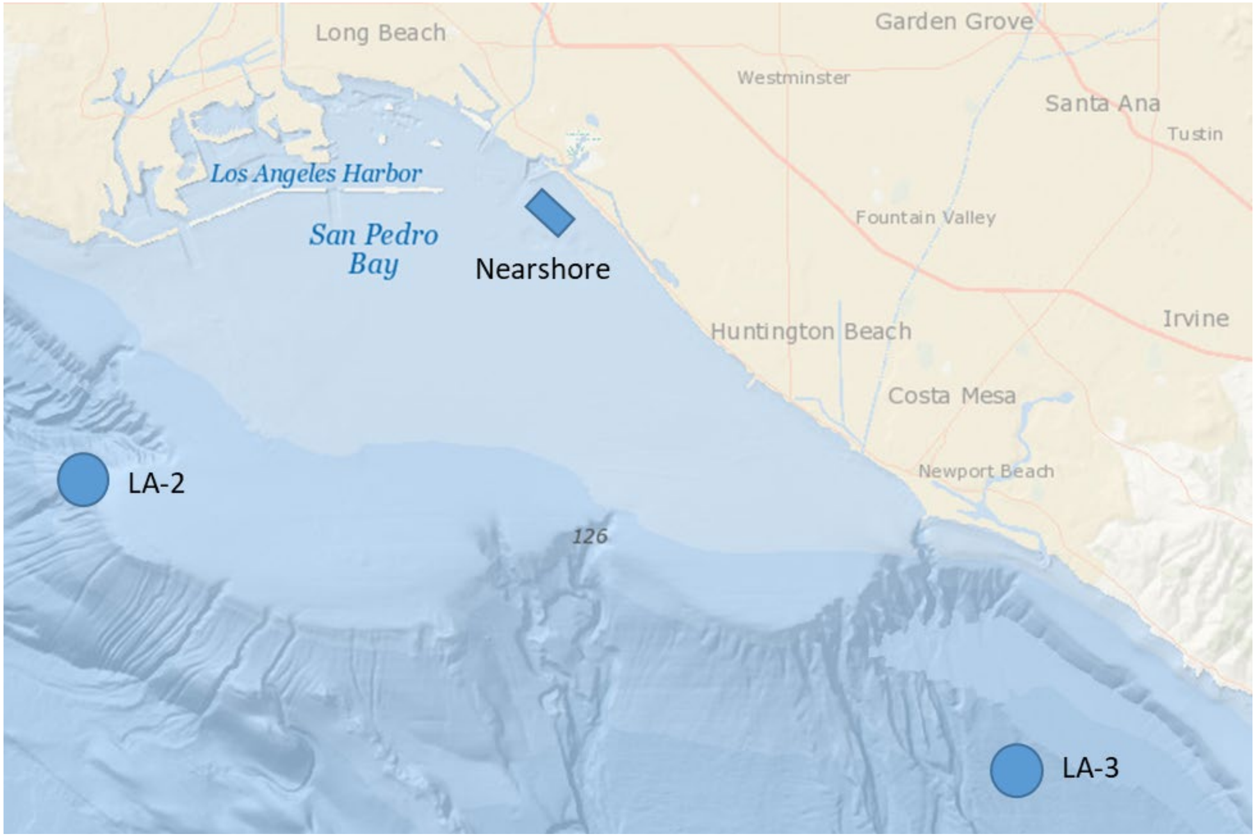

Figure 3-4 Dredging Placement Sites, Surfside/Sunset Nearshore and EPA LA-2/LA-3

3.8 Effects of Recommended Plan

The recommended design is not expected to cause a change in wave energy transmission from the exterior to inner harbor regions, as there is expected to be no decrease in wave attenuation or protection provided by the Middle and Long Beach Breakwaters. Following recent repairs by USACE in 2019 the breakwaters are currently fully performing as designed, with crest elevation of 14 feet MLLW. If the most aggressive sea level change ('USACE High' of Table 2-2) of 2.3 feet at 50 years occurs, the structures would maintain their designed performance in wave attenuation and protection for the life of the project, with no impact to project area function. The recommended design will have little to no impact on water circulation and current flow in the harbor, and will not affect tidal flushing and water quality.

4 Construction

4.1 Equipment and Production

4.1.1 Approach Channel

The Approach Channel will be dredged using a large hopper dredge. In selecting this dredging equipment, vessel traffic, disposal site restrictions, hauling distance, and cost are considered. The hopper dredge is the equipment of choice in heavy traffic and is capable of high productions resulting in a cost effective choice. The hopper dredge maneuverability is excellent and is therefore more mobile in traffic. The hopper dredge does not need scows, thus equipment footprint in the area near Queen's Gate is reduced and vessel traffic impacts are reduced. Reduction of traffic impacts near Queen's Gate is encouraged by the project requirements. The production rate of a hopper will vary between 15,000 and 17,500 cubic yards per day, depending on distance traveled to placement site, LA-2 and nearshore respectively.

4.1.2 Other Locations

All other work within the port will be performed by an electric clamshell as a mitigation measure for air quality. The clamshell dredge is economical and suitable for site conditions: selected dredge must run on electric power, a large part of the required deepening of the sea floor runs along the wharf face, and dredging depths are -55 feet and greater. There is an existing electric substation near Pier T that can serve as a power supply to the electric clamshell dredge when working on the West Basin and Main Channel Bend Easing. A new electrical substation will be built at Pier J for work in the Pier J Approach. The clamshell production rate is expected to be 6,000 cubic yards per day.

4.2 Dredging Schedule

Project construction is expected to last two and a half years, and the expected construction sequence is shown in Figure 4-1. The Approach Channel will be completed in year one, utilizing the Nearshore placement site and LA-2. The rest of the project areas, completed by the clamshell dredge, will take approximately 2.5 years. One limiting factor on production is the disposal sites LA-2 and LA-3, due to their yearly disposal capacity. Another is the production rate that the clamshell dredge can achieve.

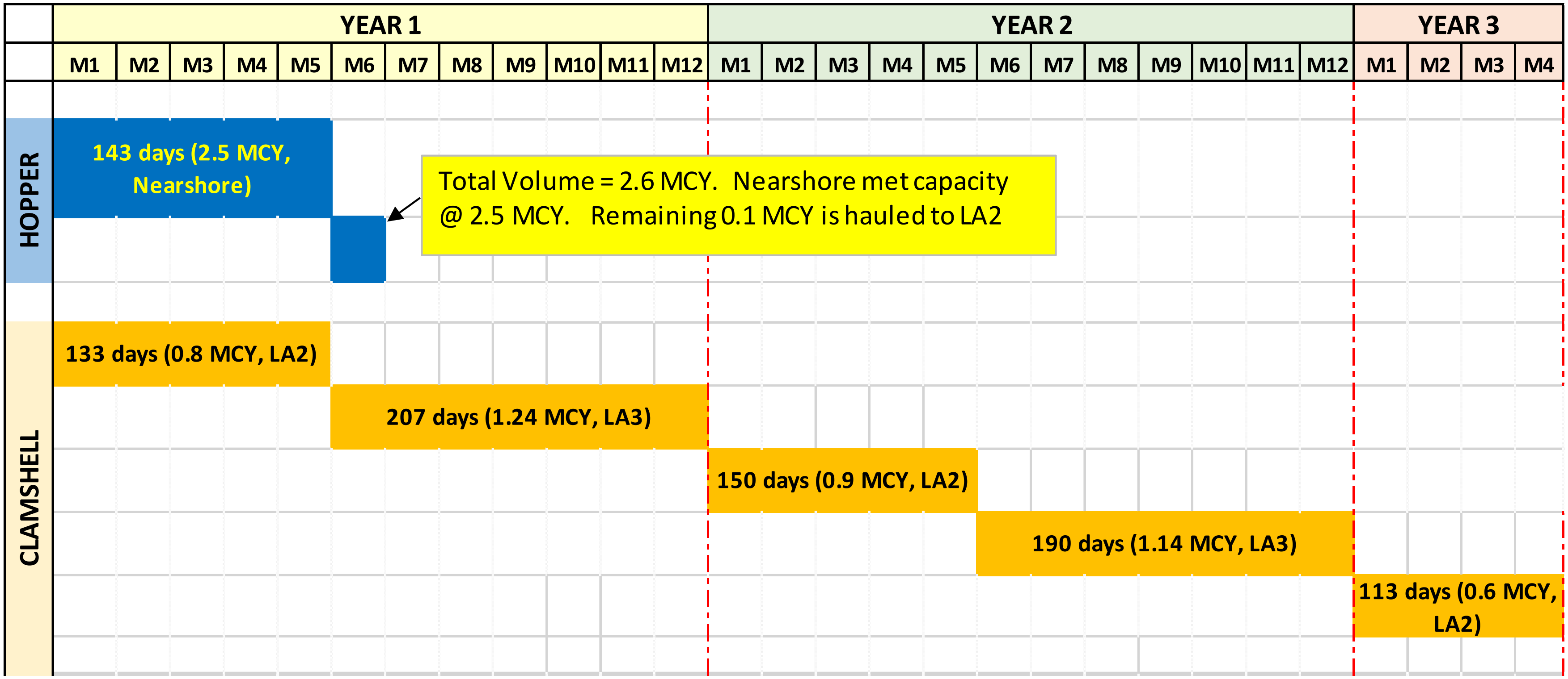

Figure 4-1 Construction Sequence, Port of Long Beach Deep Draft Navigation Study

5 Operations and Maintenance

Historically channel deepening projects result in a net increase in operation and maintenance (O&M) dredging requirements. This has been well documented over multiple historic deepening and widening projects (Rosati 2005; Vincente and Uva 1984). Sedimentation will result in the need for O&M dredging at the recommended depth over the project life. The main sources of sedimentation within the inner port and berths is prop wash from the large propellers of commercial vessels along with the small amounts of sediment inflow from the channel through Queen's Gate.

O&M within the harbor and berth areas of the port are maintained by the Port of Long Beach Authority under a Waste Discharge Requirements Authorization from the State of California Water Quality Control Board for maintenance dredging, which is renewed every five years (most recently in 2018). From 2014-2018 POLB authority dredging amounted to only 170,000 cubic yards, the majority of which was placed in LA-2. O&M for the Approach Channel is maintained by the USACE, while the Main Channel has been maintained through collaboration of POLB and USACE. The USACE maintains a Dredged Material Management Plan for the Los Angeles region, which outlines strategies for management of dredged sediments, which includes offshore disposal (LA-2). Since navigation improvement dredging of the Main Channel in 2014 (5 years), there has been no sedimentation within the channel requiring maintenance. For the Approach Channel, since navigation improvements completed in 2001 (18 years), there is presently only a small 40,000 cubic yard shoal within authorized channel limits, which does not presently impact navigability. Currently, O&M dredging of the federal channels at the POLB is anticipated to occur every 10 years. An increase in the frequency of O&M dredging is not anticipated within the harbor and berths, current federal channels, or the new Pier J Approach due to the implementation of the Tentatively Selected Plan.

6 References

Eryuzlu NE, (1994). “Underkeel requirements for large vessels in shallow waterways.” 28th International Navigation Congress, PIANC, Paper; 2:17-25.

Environmental Protection Agency, (2011). “Site Management & Monitoring Plan for Three Southern California Ocean Dredged Material Disposal Sites: LA-2, LA-3, and LA-5.” US EPA Region IX and USACE. January 2011.

Hickey BM, (1979). "The California current system—hypotheses and facts." Progress in Oceanography 8.4: 191-279.

Intergovernmental Panel on Climate Change, (2007). “Climate Change 2007: The Physical Science Basis, Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K. B. Averyt, M. Tignor, and H. L. Miller, eds.).” Cambridge, United Kingdom, and New York, NY: Cambridge University Press.

Maloney NJ, and Chan KM, (1974). “Physical oceanography. A summary of knowledge of the southern California coastal zone and offshore areas.”

National Research Council, (2012). “Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future.” Committee on Sea Level Rise on California, Oregon, and Washington, Board on Earth Sciences and Resources and Ocean Studies Board. Washington, DC: National Academy Press.

Patsch K, and Griggs G, (2006). “Littoral Cells, Sand Budgets, and Beaches: Understanding California’s Shoreline.” Institute of Marine Sciences, University of California, Santa Cruz.

Port of Long Beach, (2016). “Climate Adaptation and Coastal Resiliency Plan (CRP).” Fall 2016. http://www.polb.com/civica/filebank/blobdload.asp?BlobID=13799

Rosati, JD, (2005). “Coastal Inlet Navigation Channel Shoaling with Deepening and Widening.” U.S. Army Corps of Engineers, Coastal Hydraulics Laboratory. ERDC/CHL CHETN-IV-64.

Schwartzlose RA, and Reid, JL, (1972). “Near-shore circulation in the California Current.”

U.S. Army Corps of Engineers, (1998). “Port of Long Beach Main Channel Deepening.” Specification No. DACW09-9B-0024, June 20.

U.S. Army Corps of Engineers, (2006). “Engineering and Design – Hydraulic design of deep draft navigation projects.” Engineering Manual No. 1110-2-1613. 31 May 2006.

U.S. Army Corps of Engineers, (2009). “Recovery Port of Long Beach (Deepening) and Other Long Beach Projects.” Specification No. W912PL-09-B-0009.

U.S. Army Corps of Engineers, (2013). “Recovery Port of Long Beach (Deepening) and Other Long Beach Projects, Supplemental.” Specification No. W912PL-09-C-0033.

U.S. Army Corps of Engineers, (2019). “Incorporating sea level change in Civil Works Programs –Engineering Regulation.” Engineering Regulation No. 1100-2-8162.

Vincente CM, and Uva LP, (1984). “Sedimentation in dredged channels and basins -- prediction of shoaling rates.” Proceedings 19th International Conference on Coastal Engineering, ASCE. 1863-1878.

DRAFT INTEGRATED FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT STATEMENT / ENVIRONMENTAL IMPACT REPORT (EIS/EIR)

APPENDIX C: GEOTECHNICAL ENGINEERING

PORT OF LONG BEACH
DEEP DRAFT NAVIGATION STUDY
Los Angeles County, California

October 2019

US Army Corps of Engineers®

Port of LONG BEACH
The Green Port

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LIST OF ACRONYMS/ABBREVIATIONS

ACRONYMS/ABBREVIATIONS	MEANING
ANSS	Advanced National Seismic System
CCC	Criterion Continuous Concentration (chronic)
CISN	California Integrated Seismic Network
CLE	Contingency Level Earthquake
CCM	Criterion Maximum Concentration (acute)
4,4"-DDT	DDT
DE	Code-Level Design Earthquake
ERL	Effect Range Low
ERM	Effects Range Medium
EMI	Eath Mechanics, Inc.
H:V	horizontal on vertical
MLLW	mean lower low water
NOAA	National Oceanic and Atmospheric Administration
OLE	Operational Level Earthquake
PGA	peak ground acceleration
POLB	Port of Long Beach
S_1	1-second spectral acceleration
SAP	Sampling and Analysis Plan
SAPR	Sampling and Analysis Plan Report
SC-DMMT	Southern California Dredge Mtrl Mgmt Team
USACE	United States Army Corps of Engineers
USEPA	United Sates Environmental Protection Agency
USGS	United States Geologic Survey

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1 INTRODUCTION

Presented herein is the Geotechnical Study Report prepared in support of the Port of Long Beach (POLB) Deep Draft Navigation Feasibility Study. The overall objective of this report is to summarize existing geotechnical conditions, considerations, and constraints, as well as present recommendations and conclusions for the proposed dredging activities within the POLB and associated federal waterway channels.

1.1 Study Area

The Study Area is located on the coast of southern California in San Pedro Bay at the POLB, which is approximately 20 miles south of downtown Los Angeles, California. To the west and northwest of San Pedro Bay are the communities of San Pedro and Wilmington, respectively, to the north is the City of Long Beach, and to the east is the community of Seal Beach. The study area includes the waters in the immediate vicinity (and shoreward) of the breakwaters in the POLB including the main channel, west basin, southeast basin, and other areas. The federal channel includes the entrance at Queens Gate (the gap between the Long Beach Breakwater and the Middle Breakwater) extending northward along the west of Pier J and east of Pier F, the Navy Mole, and Pier T. This study does not include any land areas within the harbor. The study area is shown as Plate A1 in Attachment A.

1.2 Port Operations

The POLB handles domestic and international shipping trade that utilizes the San Pedro Bay water ways for berthing of shipping containers and liquid bulk vessels. The port handles 2,000 vessel calls and 82.3 million metric tons of cargo annually. Presently, access to the main channel, Pier J, West Basin, and the Southeast Basin is limited by depth. The proposed improvements will provide increased transportation efficiency and safety for port navigation. The design vessels for this project are cargo ships with 52-foot draft and oil tankers with 70-foot draft.

1.3 Proposed Improvements

The scope of this feasibility study is dredging to widen the Main Channel to the authorized depth of -76 feet MLLW, deepen the Approach Channel from -76 feet MLLW to depths ranging from -78 feet to -83 feet MLLW, deepen portions of the West Basin with depths ranging from -53 feet to -57 feet MLLW, create a Pier J approach channel and basin, and a standby area.

1.4 Geotechnical Scope of Work

The objective of this geotechnical report is to evaluate the proposed dredging elevations and lateral limits based on available data and provide conclusions and recommendations to meet the safety, cost, and navigational requirements of the project. There are two geotechnical aspects of the project:

A. The effects of dredging on the stability of adjacent structures
B. Dredgability of the sediments and the suitability of the dredged for disposal

The USACE portion of the geotechnical evaluation for this feasibility study was:

A. The stability effects of dredging within the federal channel at the Queens Gate entry through the Long Beach Breakwater.
B. The dredgability of the sediments and compatibility of the dredged material with proposed beach disposal sites. This will be addressed under a separate cover.

Within the POLB harbor, stability analysis of the proposed dredge locations were performed by POLB's consultant, AECOM, and geotechnical sub consultant Earth Mechanics Inc. (EMI). The results of POLB's geotechnical analysis are included in this report as Attachment B.

USACE geotechnical tasks for this report included:

A. Review and summarize existing geotechnical data.
B. Peer review the geotechnical analyses completed by POLB's consultants and evaluate how they impact the federal channel.
C. Conduct slope stability analyses of the Long Beach Breakwater and Middle Breakwater with the proposed dredge cuts.

2 AVAILABLE INFORMATION

Characterization of baseline geotechnical and geologic conditions for the study area included acquisition, compilation, and review of existing, available data sources. The present conditions and design parameters are based primarily on the existing data the POLB provided, which includes previous geotechnical studies and investigations dating back to 1942. As-built plans and design manuals available in United States Army Corps of Engineers (USACE) Los Angeles District files were also reviewed. Available information is listed in Section 2.1.1 of this report and cited in Section 8.

2.1 Summary of Existing Reports and Studies

This section presents existing reports and studies prepared for previous projects at the POLB, design guidance, and criteria. These documents assisted in providing the history of previous conditions and parameters within the POLB. References for the reports and studies are provided in Section 8.

2.1.1 Existing Reports and Studies

- Report of Foundation Investigation Proposed Wharf, Berths 245, 246, and 247 Pier J (Dames and Moore 1967)
- Report – Foundation Investigation Berths 243 and 244, Pier J (Dames and Moore 1970)
- Report of Soil and Foundation Investigation: Proposed Sea-Land Container Terminal Pier G expansion, Berths 226 – 230 (Dames and Moore 1972)
- Comprehensive Condition Survey Los Angeles – Long Beach Breakwaters: Geotechnical Appendix, (USACE 1987).
- Queens Gate Dredging – Geotechnical and Chemical Investigation (Sea Surveyor 1994)
- Final Report of Geotechnical Investigation Volume 1 – Soil Data Report: Pier G Terminal Development Project (Kleinfelder 2000)
- Final Report of Geotechnical Investigation: Proposed New Container Wharf Pier J, Berths 235 and 236 (Kleinfelder 1996)
- Comprehensive Condition Assessment of the Middle Breakwaters (USACE 2014)
- Port Wide Ground Motion Study: Final Addendum No. 3 (Earth Mechanics 2015)
- Wharf Design Criteria, Version 4.0 (POLB 2015)
- Port-Wide Dredge Plan and Federal Channel Expansion Study (AECOM 2016)
- Geotechnical Input for Berth and Channel Deepening (Earth Mechanics 2017)

2.2 Summary of Existing Drawings and As-built Plans

From the design and record drawings database, POLB provided available drawings and details of various port structures along the channels and waterways. These drawings included critical data such as the design water depths of existing port structures, current water depths and distances to the proposed/existing channels and waterways from the toe of the existing port structures. POLB's consultants (AECOM and EMI) used the data and drawings to develop potential wharf improvement solutions and to assess setback distances.

2.2.1 Existing Drawings and As-built Plans

The POLB supplied the design team with cross-sections and as-built plans that were the basis of evaluation for the constructed conditions used in the assumptions and analysis. Plans are itemized below and referenced in Section 8.

- General Plan of Breakwater & Dredging, West Arm
- Pier A Berth 201, Quay Wall
- Pier E Berths 122-124, Wharf
- Pier F and Pier G, Diking, Dredging and Filling
- Pier E Berths 125-127, Cast-In-Place Wharf
- Pier F Berths 204-205, Wharf
- Pier J and Pier F Extension, Rock Dike – Hydraulic Fill
- Pier E Berth 121, Tanker Terminal Offshore facilities
- Pier J Expansion, Rock Dike and Hydraulic Fill
- Pier J Berths 245-247, Wharf Modification
- Pier J Breakwater
- Pier J Expansion, Berths 266-270, Wharf
- Pier T Marine Terminal, Dredging and Wharf Construction
- Pier T Marine Terminal, Berths 134-136, Dredging and Wharf Extension
- Pier S Berths 102-110, Dike Realignment
- Pier T Marine Terminal, Berths 132-134, Dredging and Wharf Extension, Volume 2
- Pier G Berths 232-236, Terminal Redevelopment, Berth 236 Wharf, Landfill and Back Area
- Pier G Berths 232-236, Terminal Redevelopment, Berth 232 Wharf and Backlands

3 BACKGROUND AND EXISTING CONDITIONS

The development of the San Pedro Bay began at the end of the 19th century with the initial construction of the breakwater. After approximately 12 years of construction and dredging the POLB was officially dedicated on June 24, 1911. Over the past 100 years the POLB has undergone several expansion and redevelopment projects since the original development. Construction and composition of the port structures presented below are based upon design cross-sections and as-built plans referenced in Section 2.

While the geology of the port remains relatively unchanged, the POLB has had an impact on surficial sedimentation due to port activities and dredging operations. Present conditions of the basin floor are based upon bathymetry data recently collected in the port as well as the National Oceanic and Atmospheric Administration (NOAA) Nautical Chart of the Los Angeles and Long Beach Harbors (Chart No. 18571) which provides sounding depths from the MLLW datum. The bathymetry map and Chart No. 18571 are included in Attachment C.

The following sections provide a brief summary of the project's basins' sedimentation and existing conditions of the adjacent piers and wharfs.

3.1 West Basin

The West Basin is located within the north-central region of the port and is bounded on the north by Pier T, to the west and south by the Navy Base Mole, and the Middle Harbor/Long Beach Channel to the east. Basin elevations are generally around -50 feet MLLW with shallower regions within the prohibited anchorage region of the Navy Base Mole. Dredging in winter 2016 was performed along a majority of Pier T and widening of the channel at the east end of the mole. Based on previous explorations in the West Basin, soils there generally consist of soft or loose sediments grading to medium stiff and medium dense sands to stiff silts in the surficial 20 feet before transitioning into dense to very dense sands and silty sands.

3.1.1 Pier T (Pier Echo/ US Naval Shipyard)

Located at the north end of the West Basin, at Pier T (formerly part of the U.S. Naval Shipyard) the depth immediately adjacent to the wharf structures varies from -36 to -54 feet MLLW, with an average depth of -50 feet MLLW in the vicinity of Berths 130 to 140, and an average depth of -40 feet MLLW for Berths 122 to 126. In winter 2016 this area was dredged to a depth of -55 feet MLLW to facilitate docking of larger vessels at Pier T. The wharf is supported by timber piles, sheet piles, and tiebacks with deadman anchors (POLB 1956; POLB 2002_A; POLB 2002_B).

3.1.2 Navy Base Mole (Pier W/ US Naval Shipyard)

Bordering the south perimeter of the West Basin is the 17 acre Navy Base Mole which was constructed in the 1940's as part of a new naval station and included 100 acres of Terminal Island. The design cross sections indicate the mole is comprised of hydraulic fill with quarry rock dikes and rock armoring (Naval Operating Base 1944).

3.2 Southeast Basin

Subsurface soils in the Southeast Basin are similar in composition to those in the West Basin. The basin ranges in depth from -35 to -64 feet MLLW with an original design depth of -55 MLLW. Previous explorations indicate soils in the Southeast Basin generally consist of soft clay grading to stiff clay around a depth of 10 feet below bottom of basin before transitioning into the underlying dense to very dense sands and silty sands.

3.2.1 Pier F (Pier A)

The westward expansion of the Southeast Basin included the construction of Pier F, designated Pier A prior to 1993. In the 1960s, wharfs were expanded to accommodate Berths 203 through 208 with repairs to the rock dike being performed in the 1970s. The pier consists of typical hydraulic fill, rock dikes and 18-inch diameter precast concrete piles. The region adjacent to Pier F has the greatest depths to the mudline with elevations in the Southeast Basin averaging at approximately -65 MLLW (POLB 1952; POLB 1961; POLB 1966; POLB 1967).

3.2.2 Pier G

Providing berthing access to the north central region of the Southeast Basin, Pier G was originally constructed with hydraulic fill and a series of rock dikes with stone armoring. Recent redevelopment of the region included the installation of 18- and 24-inch-diameter prestressed concrete piles in the 1990s, creating Berths 227 through 230. The depth immediately adjacent to the wharf structures at Pier G varies from -45 to -59 feet MLLW, with an average depth of -54 feet MLLW (POLB 1966; POLB 1967).

3.2.3 Pier J

The southernmost expansion of the Port of Long Beach, Pier J, provides access to the northeastern, east, and southern regions of the Southeast Basin. Similar to the construction sequence as Pier G, Pier J construction and development of the wharfs and pier included hydraulic fill and a series of rock dikes with stone armoring as well as 18- and 24-inch-diameter concrete piles. The east portion of Pier J has a shallow mudline elevation of nearly -55 MLLW that transitions to -65 MLLW at the west end near the entrance to the Southeast Basin (POLB 1967; POLB 1991; POLB 1994; POLB 1995).

3.3 Pier J East Approach and Pier J Breakwaters

For cargo and shipping vessels that will berth along the eastern region of Pier J, ships are conveyed through the Middle and Long Beach Breakwater at the Queens Gate Entry before entering the Pier J east approach. Several expansion projects were completed during the last three decades of the 20th century. The south most expansion created an inlet for Berths 260 through 270 which are now protected by two breakwaters comprised of quarry run cores with armoring focused upon the seaward side. The south most sections of the breakwaters are constructed at 1.75 horizontal on 1 vertical (H:V) along the seaward side with an armored reinforced toe and 1.5H:1V along the landward side. The top of the breakwaters were designed with a top elevation of 12 to 18 feet MLLW that extends to the harbor seabed at -35 to -48 feet MLLW (POLB 1991; POLB 1994; POLB 1995).

3.4 Queens Gate Entrance and Main Breakwaters

The Queens Gate is the main entrance through the Middle and Long Beach Breakwaters into the Long Beach Outer Harbor of San Pedro Bay. The approach and main channel are, on average, at an elevation of -78 to -80 MLLW as indicated by bathymetry data and sounding depths (see Attachment B). In 2001, the channel through Queens Gate was dredged to a maximum over-depth elevation of -78 feet MLLW with dredged side slopes in soil constructed at 3H:1V (Sea Surveyor 1994).

As shown in Figure 3-1, the composition of both the Middle and Long Beach Breakwaters is comparable in the design cross-section (Coastal 1986). At the crest of the breakwaters, the stone class is significantly denser, Class A, than the underlying course, Class B, with clay cores and sand cores chiefly constructed from locally dredged sediments in San Pedro Bay. Based on condition surveys of the Middle and Long Beach Breakwaters, the thickness of the layers may vary by few feet (UACE 1987, 2014).

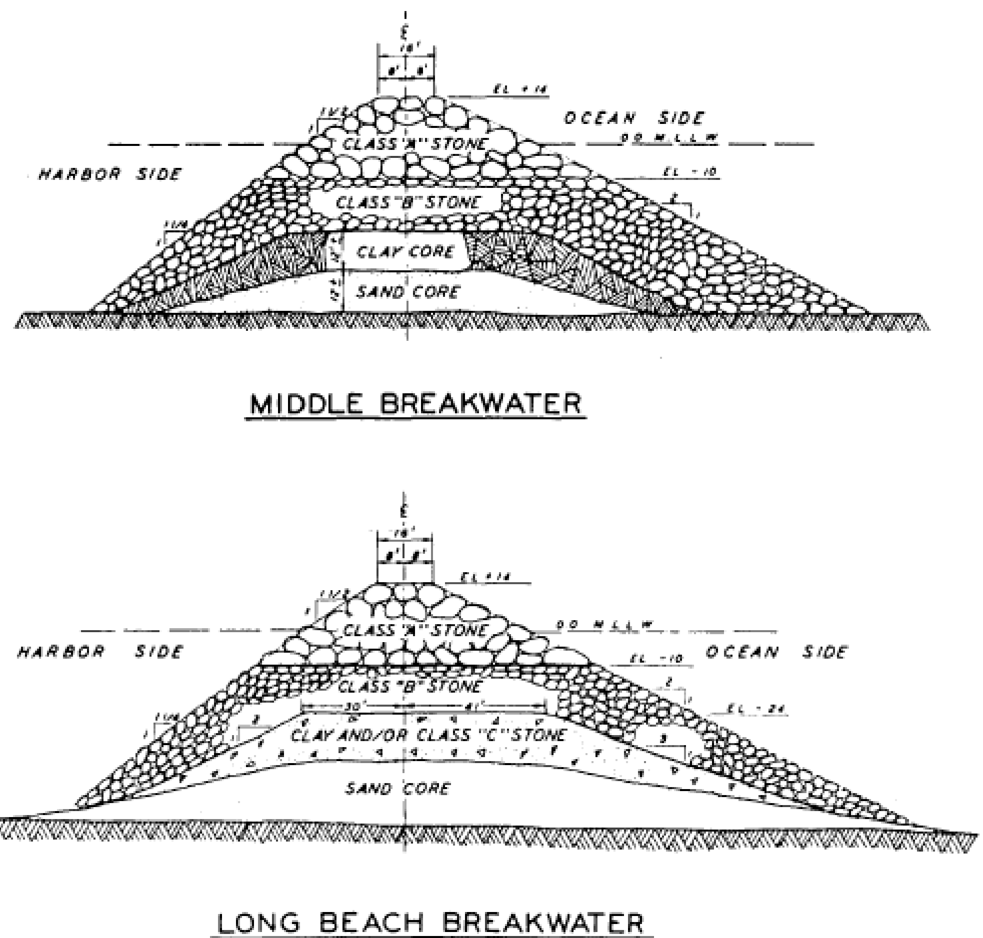

Figure 3-1 Middle and Long Beach Breakwater Cross Sections

3.5 Local Marine Geology

The POLB study area is located entirely within the San Pedro Shelf, which is a relatively flat, isolated and narrow projection of the continental shelf. The bathymetry of the ocean surface at the shelf mimics this flat surface and slopes to the south at a rate of 10 feet per mile. The natural water depth of the Bay ranges from 20 to 50 feet. These depths have been increased from 50 to 70 feet locally due to dredging along the man-made channels and harbors and basins, as part of the creation of the marine infrastructure in the study area.

Based on background information, the uppermost 20 to 100 feet of material beneath the bay is unconsolidated Quaternary-aged marine sediments. These sediments consist primarily of alternating layers of sand and silt, with very minor amounts of clay, gravel and sea-shells. The shelf sediment is consistently found across the study area and all of the man-made features in the study area are founded upon it. The thickness of the sand and silt layer vary in thickness 5 to 50 feet and increases in density with depth. Clay, gravel and sea-shells are relegated to the uppermost 50 feet of the sediment and are found as thin localized lenses mixed within the thicker layers of sand and silt. The very top of the ocean bottom sediment consists of a semi-floating, light layer of mud (suspended clay and silt) atop a very loose layer of sand to silt. The thickness of the floating layer is approximately 2 to 6 inches.

The Long Beach harbor and marina infrastructure in the Bay is composed of Anthropogenic (man-made) fill (map symbol af). The fill consists of loose sand, silty sand and silt that was placed as a result of sediments dredged from the Bay since the 1930s. The marine sediment geology is shown on the map Local Marine Geology (Plate Attachment).

3.5.1 Liquefaction

Soil liquefaction is the partial loss of strength in sandy soils beneath the water table that occurs due to temporary increases in pore water pressure during intense earthquake shaking. As previously mentioned, much of the unconsolidated natural marine sediments in the study are composed of coarse sandy to fine silty materials that become denser with depth. Because of the increasing density with depth, the liquefaction potential of such sediments is low, except for shallower deposits of small natural isolated lenses of loose coarse sandy and silty sandy sediment. The liquefaction potential is higher for loose to less dense sandy to silty sandy sediments that have been recently disturbed by anthropogenic activity (anthropogenic fill). Sediments with high potential for liquefaction are found in the various man-made fill marina infrastructure in the study area that are composed of loose, dredged fill. Examples of such structures are Long Beach harbors and its ancillary jetties, slips and wharfs; and Long Beach and San Pedro breakwaters.

Past geotechnical engineering investigations in the Ports of Long Beach and Los Angeles indicate varying degrees of potential for soil liquefaction in the project area. An investigation at Pier J (Kleinfelder, 1996) indicated potential for liquefaction in soils as deep as elevation -57 with earthquake-related ground settlement of 8 to 12 inches. Additional geotechnical reports for Pier J (Geofon 1986) and for Pier T (Diaz-Yourman 2002) suggested that liquefaction of artificial fill is likely but liquefaction of the underlying native marine sediments is not likely.

A detailed geotechnical investigation of the subsurface conditions in the project study area, including drilling, sampling, and testing, would be necessary to draw firm conclusions regarding the potential for soil liquefaction in the study area and its impact on the proposed project features. The leftover deepening footprint after dredging is composed of the same sandy native sediment before dredging. Therefore liquefaction potential of native sediments after dredging activities remains unchanged as not very likely.

3.6 Faulting and Seismicity

All of southern California including the study area is seismically active. The project study is located in the San Pedro Bay shelf, whose seismicity is characteristic of recurring small earthquakes with moment magnitudes less than 4.5. The Bay is located within the inner margin of the southern California Continental Borderland, and north of the Newport submarine canyon and south of the Palos Verdes peninsula. This margin trends from southeast to northwest with a system of marine basins and ridges which are bound by several active faults.

Three major active faults in the vicinity of the study area are the San Andreas, Palos Verdes and Newport-Inglewood. They are all capable of producing a moment magnitude 7 earthquake. The San Andreas is the largest principal active fault in Southern California and is located approximately 65 miles north-northeast of the study area. The Newport-Inglewood and Palos Verdes are located approximately 2 miles northeast and 2 miles southeast of the study area, respectively. Historically, the study area has been subjected to seismic events with a Magnitude 6 (1933 Long Beach earthquake – Magnitude 6.3). A study by EMI (2015), presents the geography, source, and probabilistic seismic hazard parameters for the local faults.

Of those, the THUMS-Huntington Beach and Compton thrust faults are considered the most significant tectonic features from the San Pedro margin because they both pass directly through the port of Long Beach. Both of these faults are potentially active and capable of producing a moment magnitude 7 earthquake.

3.6.1 Historic Earthquakes

The Advanced National Seismic System (ANSS) provides a national network comprised of 15 regional seismic networks which are operated by United States Geologic Survey (USGS), among which include the California Integrated Seismic Network (CISN). This network is capable of providing detection and data of seismic events which are available for public records as the ANSS Comprehensive Earthquake Catalog. Table 3-1 provides a brief summary of the seismic history given a provided radius from the study area.

Table 3-1 Seismic History

Magnitude	Number of Events within Radius			
Richter Scale	1 mile	10 miles	25 miles	100 miles
<4	10	1429	8439	208473
4<M<6	1	35	101	669
>6	0	0	1	9

Recorded or documented events extend from 1933 to the present. Within 100 miles, the greatest earthquake event was a magnitude of 7.5 on July 21, 1952 in Grapevine, California approximately 95 miles north of the POLB. Nearer to the study area, 15 miles southeast at Newport Beach, on March 11, 1933 a magnitude 6.4 event was recorded; this event likely led to an aftershock earthquake the same day in Signal Hill, less than 1 mile away, with a magnitude of 4.4. The region is well characterized by earthquake events Magnitude 4 and less.

3.6.2 Design Earthquake Levels

The POLB's Wharf Design Criteria (POLB 2015) refers to an Operational Level Earthquake (OLE), Contingency Level Earthquake (CLE) and Code-Level Design Earthquake (DE) as the three levels to be modeled as the earthquake shaking motion for the various harbor improvements. The OLE corresponds to a 72 year return period ground motion having a 50 percent probability of being exceeded in 50 years; the CLE has 475-year return period with 10 percent chance of exceedance in 50 years. During an OLE, a structure is anticipated to experience minimal non-structural damage such that operations may resume promptly after the event. The CLE, however, considers an event where public safety is not impacted though there may be significant structural damage including total loss or failure of the structure. The design earthquake is determined in accordance with the California Building Code and ASCE 7-10 with 2 percent chance of exceedance in 50 years for a return period of 2,475 years.

For stability analysis of the breakwaters, the USGS online design maps tool was used to obtain the necessary seismic shaking information at the Queens Gate location. Based on site class D: the peak ground acceleration (PGA) modified for site class (PGA_M) is 0.627g; the short period design spectral acceleration (SDS) is 1.055g; and the design 1-second spectral acceleration (SD1) is 0.6g.

3.7 Physical Character of Sediment

The physical character of the native (undisturbed) sediments are the same as those described in the Local Marine Geology and its Engineering Classification is sediment composed of predominantly thick made up of thick alternating layers of silty sand (SM), sand (SP-SM) with some silt, with some occasional thin layers of clay (CH). Sandy portions of the sediment are predominantly fine grained, rounded and composed of quartz and mica minerals. Minor thin layers and localized lenses of gravel and clays are present within the sandy sediment and are found mostly within the upper 50 feet. The sediment is unconsolidated and increases in density with increasing depth.

Sediments in the study area comprise sand, silt, and clay of varying proportions. Gravel, cobble, and debris may be encountered in limited quantities, within project depths. A thin layer of semi-floating silt and mud (clay) exists atop the ocean bottom surface, in areas of less disturbance or where recent man-made activities (e.g., dredging and harbor modifications) have not altered the surrounding natural subsurface conditions. This layer is approximately 2 to 6 inches thick and overlies a very loose unconsolidated layer of sand or silt. Underlying this shallow surface sediment are the thicker alternating layers of silty sand to sand, as mentioned above.

3.8 Chemistry and Biotoxicity Character of Sediment

Bulk sediment chemistry and bio toxicity (bio assay) testing has been performed on the sediments in the project site limits as part of past dredge investigations. The testing was done to evaluate the suitability of dredged sediments for disposal and/or placement in the vicinity of the project area and at the USEPA offshore disposal area of LA-2. The testing areas are shown on Inventory Map of Environmental Testing Events (attachment plates). Four testing events are described as follows:

1994 Queens Gate Approach Channel - Bulk sediment chemistry tests were run on sediment collected by Los Angeles District Corps of Engineers via vibracores for the approach channel. Chemistry results showed low detections of phthalate compounds and tributyltin and metals that were all below Effects Range Low criteria. Test conclusions indicated that all sediments were acceptable for placement at nearby beach nourishment areas and as fill at North Energy Island ocean borrow pit.

2012 Pier J Entrance Channel and Pier T - Bulk sediment chemistry tests were run by POLB on sediment collected from vibracores from areas on east entrance area of Pier J and at the Pier T and its West Basin entrance channel. Chemistry results indicated that all sediments were below ERL, except for Copper and Nickel that were above ERL for Pier J DU-COMP sample; and 4.4"-DDE and Total DDT above ERL for Pier T DU1-COMP and Pier T DU2-COMP. Pier T and J sediments were considered suitable for placement at Long Beach Middle Harbor fill site.

2013 Pier J Turning Basin, Pier J Berths 245-247, Pier T Berths 132-134 - Bulk sediment chemistry and effluent elutriate tests were run by POLB on sediment collected from these areas by vibracores and surface grab samples. Chemistry results for Pier J Turning Basin showed 4,4'-DDE and Total DDT above ERL but below ERM and elutriate results were below criterion continuous concentration (acute). All Pier J elutriate chemical results were below all criterion continuous concentration (CCC and CMC). Pier T chemical elutriate results were all below criterion continuous concentration, except for Copper which was above criterion maximum concentration (CMC). Pier J and T sediments were considered suitable for placement at Long Beach Middle Harbor fill site.

2014 Pier T and Pier Echo - Bulk sediment chemistry, bio toxicity and effluent elutriate tests were run on sediment collected by POLB via vibracores and ponar samplers from Pier T and Pier Echo. Bio toxicity results indicated that samples Pier T-DU08, 10 and 11 did not meet limiting permissible concentration requirements for ocean disposal due to amphipod toxicity. Marine organism tissue samples were analyzed further for mercury, dichlorodiphenyltrichloroethanes (DDT) and polychlorinated biphenyls (PCB). Tissue results indicated low bioaccumulation potential, with concentrations less than Food and Drug Administration (FDA) action levels and those shown to have toxic effects. Elutriate test results were below Criterion Continuous Concentrations and Criterion Maximum Concentrations criteria. Chemistry results were all below ERL except for detections of silver and 4,4'-DDT above ERM for Pier T-DU06-COMP surface sample. Suspended particulate phase testing results indicated that sediments did not pose a toxicity risk to water column organisms during placement activities. Sediment from Pier Echo showed elutriate test results less than CMC and CCC criteria and indicated that placement activities would also not result in water quality impacts. Pier T and Echo sediments were considered suitable for placement at Long Beach Middle Harbor fill site.

2018 Queens Gate Approach Channel - Bulk sediment chemistry tests were run by Los Angeles District Corps of Engineers on sediment collected from vibracores from a small shoaled area near the entrance to the Long Middle Breakwater at the Approach Channel. Chemistry results indicated that all sediments were below ERM except for DDT and 4.4'-DDE, which were elevated above ERL. Biotoxicity tests were run on clams and worms mixed with the approach channel sediment. Chemistry and biotoxicity results indicated no adverse ecological effects were predicted based on these results. The sediment was considered suitable for placement at the offshore USEPA LA-2 open ocean disposal site.

3.9 Dredgeability of Sediment

All sediment is dredgeable by either hydraulic (cutterhead or hopper dredge) or mechanical (clamshell) dredging methods. Sediment to be dredged for Federal Channel deepening near marine terminals, piers and revetments should be removed by mechanical dredging methods to reduce potential sloughing or slope failures near these structures. The deepening of sediment near Queens Gate within the east portion of the Federal Channel Limits at the east side Long Beach breakwater and its junction with the Pier J Approach Basin could be subject to slope failures. Dredging within the this area would need to consider clamshell methods because the bottom toe of the east breakwater is less than 100 feet from the Federal Channel and increases the risk for slope failure here. The deeper oceanward portions of the Queens Gate alternative dredge footprints should consider more robust hydraulic cutterhead or mechanical clamshell dredge methods. This is because the sediment here is somewhat denser than sediment to be dredged from all of the alternative footpints that lie inside (harborside) of Queens Gate. The central portions for the majority of the selected alternative dredge footprints to be deepened could be dredged by hydraulic methods since the slope stability concern here is very low.

3.10 Physical and Chemical Compatibility of Sediment for Placement

The historical physical test sample locations for years 1961 to 2014 (past 53 years) and the environmental chemistry and biotoxicity testing sample areas for the last fourteen years (1994 to 2014) are shown as maps on the Plate Attachment as Borehole Locations for Geotechnical and Environmental Sampling Purposes and Inventory Map of Environmental Sampling Events for Sediment, respectively. The last fourteen years of physical test results show that much of the sediment previously dredged from the project study final alternative footprints is composed of approximately 30 to 60% silty sediment. This sediment was too fine and was not very physically compatible for use as nourishment material for nearby nearshore and/or onshore beach placement areas. Chemical and biotoxicity testing results of the same timeframe show that much of the sediment previously dredged was also too contaminated to be placed as beach material. Because of this the Southern California Dredge Material Management Team (SC-DMMT) and the U.S. Environmental Protection Agency approved of its use as disposal material at the USEPA offshore LA-2 disposal site and for use as artificial fill (engineered fill) at POLB middle harbor slip (confined disposal site).

3.11 Environmental and Geotechnical Sampling and Analysis

Additional physical, chemistry and/or biotoxicity sampling and testing and sediment suitability analysis will be required as part of pre-dredge investigations prior to deepening any one of the project study final alternative array footprints. A sampling and analysis plan (SAP) and sampling and analysis report (SAPR) will also need to be prepared prior to sampling and testing according to the latest SC-DMMT guidelines. The SC-DMMT and USEPA will need to review and approve the SAP and SAPR and will also need to approve the suitability for final placement of dredged sediment. All of these activities will need to occur as part of the Pre-Construction Engineering Design phase.

4 SLOPE STABILITY OF PROPOSED DREDGING

As part of the feasibility study, slope stability for the basins, wharfs and piers in the study area of the POLB was evaluated by POLB's consultant (Earth Mechanics 2017). Stability was expressed as allowable standoff distances from structures. Within the federal waters of the approach channel at the Queens Gate Entry through the Long Beach Breakwater, USACE performed an evaluation of the slope stability based upon the parameters and configurations of previously performed investigations, studies, and as-built plans.

4.1 Queens Gate Entry

Cross-sections of the main breakwaters were obtained from historical design documents as well as repairs associated with the Middle Breakwater to the west of Queens Gate Entry and the Long Beach Breakwater to the east. These documents also provide subsurface data collected from two borings, M2 in the Middle Breakwater, and L1 in the Long Beach Breakwater (USACE 1987). USACE analysis for the current feasibility study is based upon the information presented in those documents in conjunction with the NOAA Nautical Chart of the Los Angeles and Long Beach Harbors (Chart No. 18751) which provides sounding depths based upon the MLLW (see Attachment C).

4.1.1 Design Parameters and Assumptions

The unit weights and strength parameters for stability analysis of the soil and breakwater materials were based partly on the limited data available near the Queens Gate Entry and partly on assumptions and engineering judgment. Values used for the analysis and are provided in Attachment D Slope Stability Modeling.

Middle and Long Beach Breakwater

Construction and parameters for the breakwater are typical of the material types as described by the previous comprehensive condition assessments performed for the Long Beach and Middle Breakwaters (USACE 1987, 2014). The breakwater cross-sections were modeled as their idealized construction formation as shown in Figure 3-1 absent any deformations or significant void space.

Foundation Soils

The soil deposition and strength parameters are based on the data collected from 1986-1987 and presented in the Comprehensive Condition Survey of the Los Angeles-Long Beach Breakwaters (USACE 1987) from borings M2 (Middle Breakwater) and L1 explorations (Long Beach Breakwater). The soil (sediments) underlying the breakwaters and within the Queens Gate Entry vary from sands and silty sands to sandy silts and silts, and minor amounts of clay were taken as a "simplified" single layer of silty sand for modeling purposes. Soft sediments, such as loose surface mud or compressible clays, were not included as part of the stability model, since there has been no appreciable decrease in channel depth to indicate accumulating sediments since dredging activities in the late 1990s (USACE 1998). As indicated by the chart and map attached in Attachment C, the channel depth is actually deeper than the plans from 2001; current channel depth is at or lower than the depth dredged indicated in the chart and plans (see Attachment B).

Stability Modeling

The analyses address global stability concerns presented by the proposed dredging and do not address the internal stability of the breakwaters. Slope stability analysis was performed using Geostudio software with the 2016 Slope/W extension and may be considered conservative as it only evaluated the condition in two dimensions. Pseudostatic modeling for seismic conditions considered the DE for the study area. A reduction was applied to the PGA to arrive at a seismic coefficient for psuedostatic analysis consistent with the method presented by FHWA/NCHRP 12-70. The seismic coefficient for limit-equilibrium pseudostatic slope stability analysis was estimated to be 0.23 for the design earthquake, using a slope height of 97 feet, site class D, PGA_M = 0.627, S_1 = 0.6, F_{pga} = 1.0. and F_v = 1.5.

4.1.2 Results

In accordance with USACE standards, minimum required factors of safety are 1.5 for slope stability. By increasing the standoff distance to 100 feet, the factor of safety increases by 5 to 10 percent for the Middle and Long Beach Breakwater; there were no appreciable changes in the factor of safety by increasing beyond 100 feet as the stand-off distance for dredging activities.

For seismic conditions, USACE minimum required factors of safety are 1.1. Increasing the standoff distance, beyond the toe of the breakwater, yielded no appreciable change in the factor of safety for a series of seismic conditions.

Table 4-1 presents the factors of safety computed based upon particular static and seismic conditions.

Table 4-1 Queens Gate Entry – Factor of Safety

Middle Breakwater				Long Beach Breakwater			
No Standoff	50'	100'	200'	No Standoff	50’	100’	200'
Static Conditions							
1.80	1.93	1.97	1.97	1.67	1.74	1.74	1.76
Seismic Conditions (DE)							
0.74	0.74	0.74	0.74	0.67	0.68	0.68	0.68

Standoff distances are measured from the toe of slopes and were determined utilizing the parameters and assumptions presented above in USACE analysis of the federal channel located at the Queens Gate Entry.

Based on this analysis, any dredging activities that remain contained to within the limits of the main channel to a depth of -81 MLLW, with 2 feet of over-dredge, will not further impact the stability of the breakwaters. All dredging should be performed in accordance with port practices of slopes being maintained no steeper than 3H:1V. Setback distances to structures should be measured from the base of the slope at the toe. The models for stability analysis of the federal channel are included in Attachment D.

Since the seismic (psuedostatic) slope stability analyses computed safety factors are less than 1.0, those slopes are expected to fail during the design earthquake. A slope displacement calculation was conducted to evaluate whether such earthquake-related failures of the breakwater slopes would involve significant loss of material from the breakwaters or minor displacements of stones. Using the method presented in FHWA/NCHRP 12-70, the yield acceleration (expressed in terms of gravity) for Middle Breakwater ranged between 0.14 and 0.15 with a computed lateral displacement of 3 to 4 inches. Long Beach Breakwater had a marginally lower yield acceleration of 0.12 to 0.13 and displacement of 5 to 6 inches.

See Table 4-2 for the calculated yield accelerations and lateral displacements for corresponding standoff distances.

Table 4-2 Queens Gate Entry – Computed Lateral Displacement

Middle Breakwater				**Long Beach Breakwater**			
No Standoff	50'	100'	200'	No Standoff	50’	100’	200'
Yield Acceleration (g)							
0.145	0.148	0.149	0.149	0.125	0.125	0.126	0.128
Lateral Displacement (inches) at Design Earthquake							
3.8	3.6	3.5	3.5	5.2	5.2	5.1	5.0

4.2 Port of Long Beach Harbor Slope Stability Analyses

POLB’s consultant, AECOM, tasked their sub-consultant, EMI, to perform a Berth and Channel Deepening study within the POLB harbor. The study considered three different dredging elevations of -53 ft, -55 ft, and -57 ft MLLW within the basins and as deep as -81 ft within the main channel. Those elevations include 2 feet of over dredging as well as standoff boundaries from the existing port structures to prevent potential damage or undermining due to the proposed dredging activities within the waterways of the port harbor. The study also included recommendations for wharf improvements where necessary to facilitate the scope of dredging.

Five loading conditions were analyzed:

- Static
- Static and Operational Level Earthquake
- Static and Modified Operational Level Earthquake
- Static and Contingency Level Earthquake
- Static and Design Level Earthquake

Wharf improvements include a few scenarios: a continuous Z-section bulkhead, combination of soldier piles and Z-sheets, and double soldier piles with Z-sheets. The methodology for ground improvement is assumed to be various configurations of jet grouting. A brief summary of the proposed improvements for dredging configurations is presented in Table 4-3.

Table 4-3 Improvements

Pier	Depth*	Static	Static + Modified OLE	Static + OLE	Static + CLE	Static + DE
F	-53	WI	WI	WI & GI	WI & GI	WI & GI
	-55	WI	WI	WI & GI	WI & GI	WI & GI
	-57	WI	WI	WI & GI	WI & GI	WI & GI
G	-53	None	None	None	None	WI
	-55	None	None	None	None	WI
	-57	WI	WI	WI	WI	WI
J	-53	WI	WI	WI & GI	WI & GI	WI & GI
	-55	WI	WI	WI & GI	WI & GI	WI & GI
	-57	WI	WI	WI & GI	WI & GI	WI & GI
T	-53	None	None	None	None	WI
	-55	None	None	None	None	WI
	-57	None	None	None	WI	WI

WI Wharf Improvement *OLE Operating Level Earthquake*
GI Ground Improvement *CLE Contingency Level Earthquake*
**feet below MLLW, includes 2 feet of over-dredge* *DE Design Earthquake*

AECOM provides a discussion and summary of the improvements and associated costs in the document Wharf Structure Improvements and Berth Dredging Evaluation. A memo summarizing the geotechnical analysis within the POLB is included as Attachment B**.** The recommended standoff distances are provided in Section 5.0.

5 CONCLUSIONS AND RECOMMENDATIONS

Geotechnical conclusions are presented herein regarding the proposed dredging for the POLB Deep Draft Navigation Project. This Feasibility-Level geotechnical study includes summary of the geotechnical constraints and recommendations for dredging based on the existing conditions as presented by the previous studies, reports and existing design cross-sections and As-built plans.

The geotechnical evaluation of conditions within the port and recommendations for harbor structures were performed by the POLB's consultants and sub consultants. Those studies are summarized within this report as Attachment B.

In order to maintain the USACE minimum factors of safety Table 5 provides "stand-off" distances have been proposed based upon stability analysis performed by the USACE and POLB:

Table 5-1 Port of Long Beach Dredging Standoff (Feet)

Pier T	Pier F	Southeast Basin	Pier J	Pier J Breakwater	Queens Gate Entry
150	100	100	100	50	100

Although the slope stability analysis of Queens Gate Entry satisfy USACE static factors of safety with no standoff, the distance was recommended for constructability to reduce potential for undermining slopes of the breakwaters. The standoff distance would allow for dredging to extend outside of the main channel's current boundaries, and allow space for future ground improvement if desired for the project.

Seismic stability analysis of the Middle and Long Beach Breakwaters at Queens Gate Entry indicate ground improvement may be required to meet the USACE standards for factors of safety. Engineering Manual 1110-2-2904: Design of Breakwaters and Jetties states,

> *Since failure of most breakwater and jetty projects that are a result of an earthquake will not result in catastrophic consequences, these structures are generally not designed with seismic considerations. For projects located in high seismic risk zones, however, the geotechnical evaluation for these projects should at least consider the potential impact of seismic damage. If the cost to repair the seismic damage is considerable, as compared with the replacement cost, a detailed seismic evaluation may be warranted. The decision to design for seismic considerations should be decided on a case-by-case basis.*

A cost analysis should be performed to assess the level of impact if Queens Gate Entry was no longer accessible due to slope failure of either of the main breakwaters and if structural or seismic upgrades are prudent/desirable. It should be noted that since the construction of the breakwaters, there have been several seismic events ranging up to a magnitude of 6 and any sustained damage did not impede port activities.

6 RECOMMENDED ADDITIONAL STUDIES

If the project progresses beyond the feasibility level, the following geotechnical studies should be conducted:

- Exploration and laboratory testing of foundation soils within the Queens Gate Entry Channel and Long Beach Breakwater (nearer to the project area).
- Perform 3D stability analysis at breakwaters for further refinement of slope stability if lesser standoff distances are needed.
- Conduct cost analysis for seismic stability of the main breakwaters.

7 LIMITATIONS AND RISK

This report is intended only for use by USACE, the POLB, and its designers for the proposed Berth and Channel Dredging Study. The recommendations contained in this report are based on available drawings, assumptions made due to incomplete information, and engineering judgement.

Specific to the federal channel at Queens Gate Entry, the current design assumptions and analysis indicate there are underlying stability issues that may pose issues in the future; these have been previously studied and documented elsewhere in the port. Lacking more detailed explorations and testing immediately within the channel and breakwaters, design assumptions may not appropriately characterize the subsurface conditions which could lead to construction or design challenges leading to costly changes in the future as the project progresses.

Discussion of the limitations and risk within the Port of Long Beach can be found in the analysis memorandums attached in Attachment B.

8 REFERENCES

AECOM 2016, “Port of Long Beach, Port-Wide Dredge Plan and Federal Channel Expansion Study,” December 14.

Bryant, W.A., compiler, 2017, Fault number 260, THUMS-Huntington Beach, in Quaternary fault and fold database of the United States: U.S. Geological Survey website, https://earthquakes.usgs.gov/hazards/qfaults

Coastal Engineering Research Center, 1986, “Stability Test of Modified Repair Options for San Pedro Breakwater,” July.

Diaz and Yourman Associates, 2003, “Geotechnical Investigation Data Report Volume 1 (HD – S1980 and S2070) Pier T container Terminal Long Beach, California.”

Dames and Moore, 1994, “Geotechnical Investigation Proposed Landfill and Wharf Construction Slip No. 2, Port of Long Beach for the Port of Long Beach.”

Earth Mechanics, Inc., 2006, “Port-Wide Ground Motion Study, Port of Long Beach, California,” Final Report, Prepared for Port of Long Beach, EMI Project No 01-143, August 7.

Earth Mechanics, Inc., 2015, “Final Addendum No. 3 to Port-Wide Ground Motion Study, Site-Specific Ground Motion Recommendations per CBC 2013, Port of Long Beach, California,” Prepared for Port of Long Beach, May 13.

Earth Mechanics, Inc., 2017, “Geotechnical Input for Berth and Channel Deepening, Port-Wide Dredge Plan and Federal Channel Expansion Study, Port of Long Beach, California,” EMI Project No. 15-152, January 19.

Fisher, M.A., and Bryant, W.A., compilers, 2017, Fault number 133, Compton thrust fault, in Quaternary fault and fold database of the United States: U.S. Geological Survey website, https://earthquakes.usgs.gov/hazards/qfaults

Naval Operating Base, Terminal Island, 1944, “General Plan of Breakwater & Dredging, West Arm,” Drawing No. 265-503, September 25.

Port of Long Beach, 1952, “Pier A Berth 201, Quay Wall,” Drawing No. HD-10496, Specification No. 347, May 28.

Port of Long Beach, 1956, “As-Built Drawing, Pier E Berths 122-124 Wharf,” Drawing No. HD-10734, Specification No. 448, September 14.

Port of Long Beach, 1961, “Pier F & Pier G, Diking, Dredging & Filling,” Drawing No. HD-10866, Specification No. 526, February 8.

Port of Long Beach, 1966, “Pier F Berths 204-205 Wharf,” Drawing No. HD-20263, Specification No. 842, April 12.

Port of Long Beach, 1967, “As-Built Drawing, Pier J and Pier F Extension, Rock Dike –

Hydraulic Fill," Drawing No. HD-100063, Specification No. 660, September 4.

Port of Long Beach, 1991, "As-Built Drawing, Pier J Expansion, Rock Dike and Hydraulic Fill," Drawing No. HD-10-1068, Specification No. HD-S1688, April 4.

Port of Long Beach, 1994, "As-Built Drawing, Pier J Berths 245-247, Wharf Modification," Drawing No. HD-10-1113, Specification No. HD-S1733, May 17.

Port of Long Beach, 1995, "Pier J Breakwater," Drawing No. HD-2-781, September 21.

Port of Long Beach, 1995, "As-Built Drawing, Pier J Expansion, Berths 266-270 Wharf," Drawing No. HD-10-1156, Specification No. HD-S1771, October 19.

Port of Long Beach, 2002, "As-Built Drawing, Pier T Marine Terminal, Dredging and Wharf Construction," Drawing No. HD-10-1436, Specification No. HD-S1980, November 22.

Port of Long Beach, 2002, "As-Built Drawing, Pier T Marine Terminal, Berths 134-136, Dredging and Wharf Extension," Drawing No. HD-10-1637, Specification No. HD-S2107, November 25.

Port of Long Beach, 2003, "Pier S Berths 102-110, Dike Realignment," Proposed Pier J Typical New Dike Section, Drawing No. HD-10-1711, Specification No. HD-S2161, September 2.

Port of Long Beach, 2005, "As-Built Drawing, Pier T Marine Terminal, Berths 132-134, Dredging and Wharf Extension, Volume 2" Drawing No. HD-10-1641, Specification No. HD-S2111, July 8.

Port of Long Beach, 2005, "As-Built Drawing, Pier G Berths 232-236, Terminal Redevelopment, Berth 236 Wharf, Landfill and Back Area," Drawing No. HD-10-1741, Specification No. HD-S2142, February 25.

Port of Long Beach, 2006, "Pier G Berths 232-236, Terminal Redevelopment, Berth 232 Wharf and Backlands," Drawing No. HD-10-1937, Specification No. HD-S20170A, June 20.

Port of Long Beach, 2015, "Wharf Design Criteria, Version 4.0," May 20.

Sea Surveyor Inc, 1994, "Queens Gate Dredging Geotechnical and Chemical Investigation," Prepared for Port of Long Beach, December 30.

U.S. Army Corps of Engineers, 1987, "Comprehensive Condition Survey Los Angeles – Long Beach Breakwaters: Geotechnical Appendix."

U.S. Army Corps of Engineers, 1998, "Port of Long Beach Main Channel Deepening," Specification No. DACW09-9B-0024, June 20.

U.S. Army Corps of Engineers, 2014, "Comprehensive Condition Assessment of the Middle Breakwater."

Wolfe, F.D., Shaw, J.H., Plesch, A., Ponti, D.J., Dolan, J.F., and Legg, M.R., 2019, The Wilmington Blind Thrust Fault: An Active Concealed Earthquake Source beneath Los Angeles, California, Bulletin of the Seismological Society of America, Early Edition, published 08/06/2019, 17p.

ATTACHMENT A

PLATES

Plate A1 – Study Area

Plate A2 – Cross Section A-A’ Through Queens Gate

Plate A3 – Inventory Map of Environmental Testing Events for Sediment

Plate A4 – Borehole Sediment Sample Locations for Geotechnical and Environmental Sampling Purposes (1961 to 2014)

Plate A5 – Local Marine Geology

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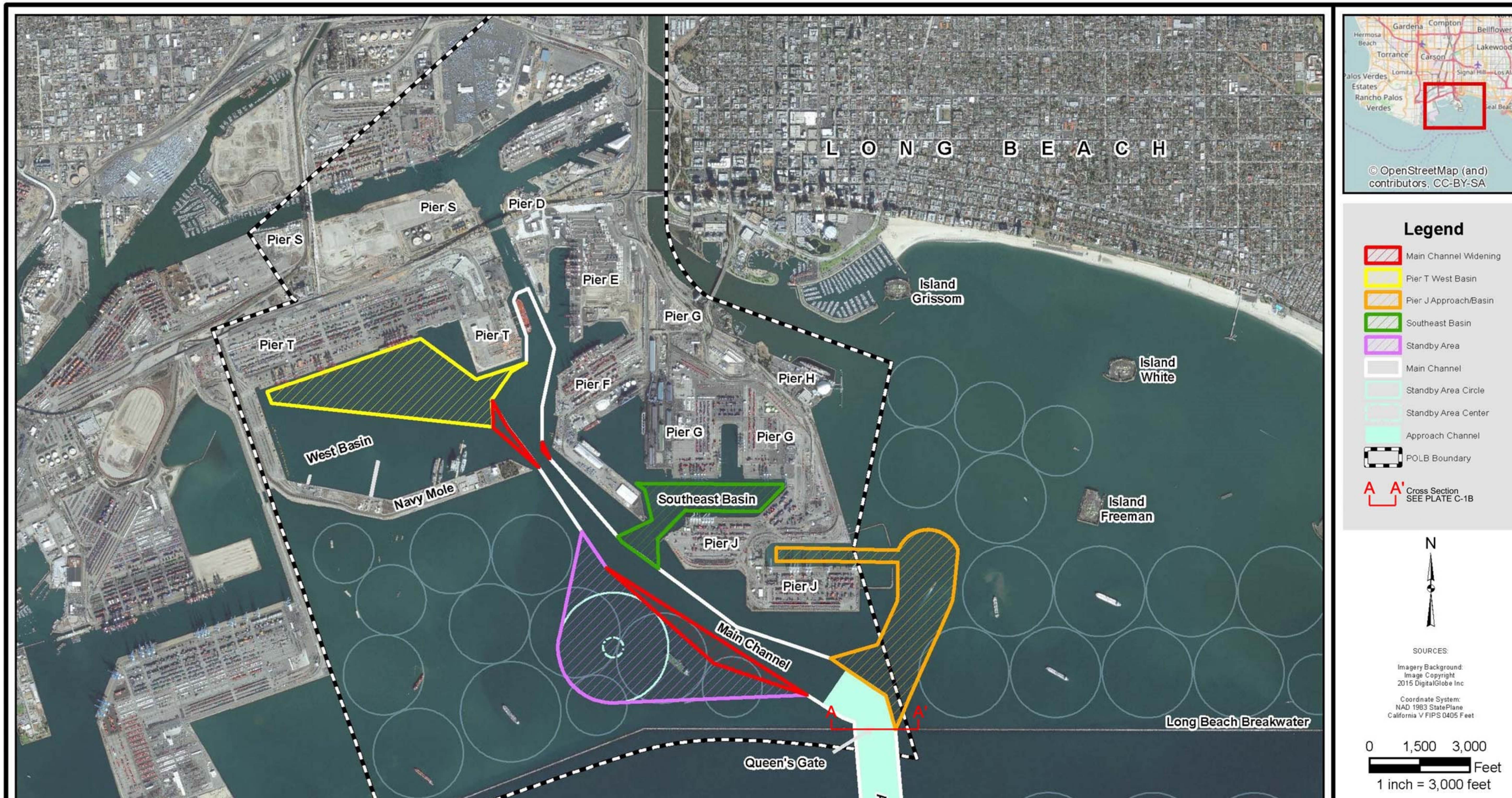


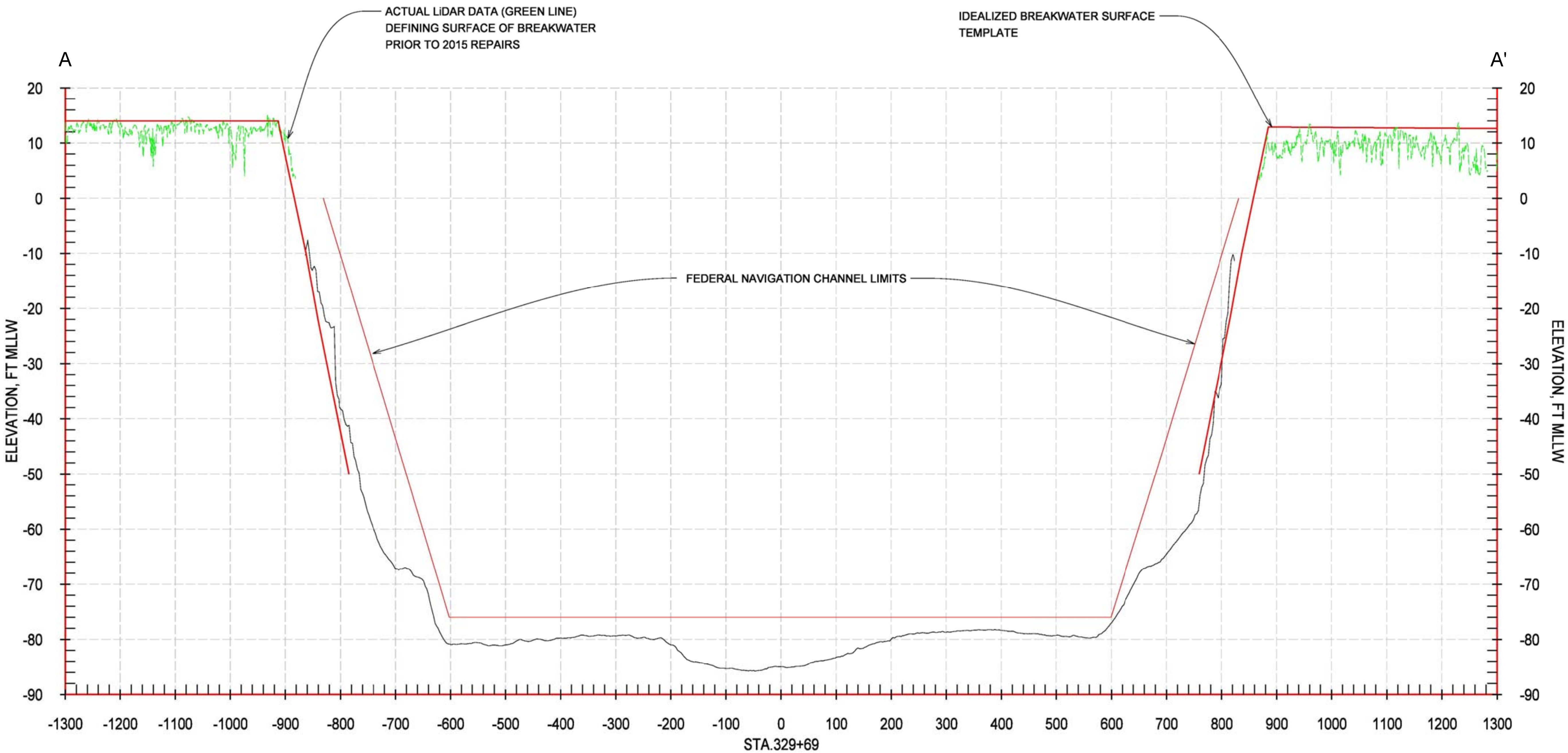
POLB
NAVIGATION IMPROVEMENTS

STUDY AREA

DATE: NOVEMBER 2017

PLATE
A1

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT



PORT OF LONG BEACH ENTRANCE CHANNEL
AT
QUEENS GATE

SURVEY DATA FROM USACE SURVEY
NOVEMBER, 2015

10 5 0 10 20FT
VERTICAL SCALE: 1"= 10'

100 50 0 100 200FT
HORIZONTAL SCALE: 1"= 100'

LOS ANGELES AND LONG BEACH HARBOR, CALIFORNIA
NAVIGATION IMPROVEMENTS

PORT OF LONG BEACH
PORT OF LONG BEACH ENTRANCE CHANNEL
AT QUEENS GATE

US Army Corps of Engineers®
Los Angeles District

CKD BY: JY/MR
DWN BY: EH
DATE: NOVEMBER 2017

PLATE
A2

PLOT DATE: 8/18/2017 10:02:04 AM PLOTTED BY: l1edgeh9 FILE NAME: PLATEBORDER22X34.DGN

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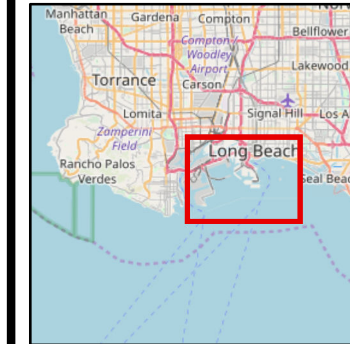


Legend

Sediment Chemistry and Biotoxicity Testing Areas

- 1994 Queen's Gate Approach Channel Sediment Chemistry Testing Area
- 2012 Bulk Sediment Chemistry & Effluent Ellutriate Testing Boundary
- 2012 Pier J Environmental Testing Area
- 2013 Pier T Berths 132 to 134 Environmental Testing Area
- 2013 Pier J Berths 245 to 247 Environmental Testing Area
- 2013 Pier J Turning Basin Environmental Testing Area
- 2013 Pier T West Basin Access Channel Environmental Testing Area
- 2014 Pier Echo Sediment & Biotoxicity Testing Boundary
- 2014 Pier T Bulk Environmental Testing Area
- POLB Boundary

SOURCES:
Imagery Background:
Image Copyright
2015 DigitalGlobe Inc

Reference Map:
© OpenStreetMap (and) contributors, CC-BY-SA

Coordinate System:
NAD 1983 StatePlane
California V FIPS 0405 Feet
Datum: NAD 1983

N

0 1,500 3,000 Feet

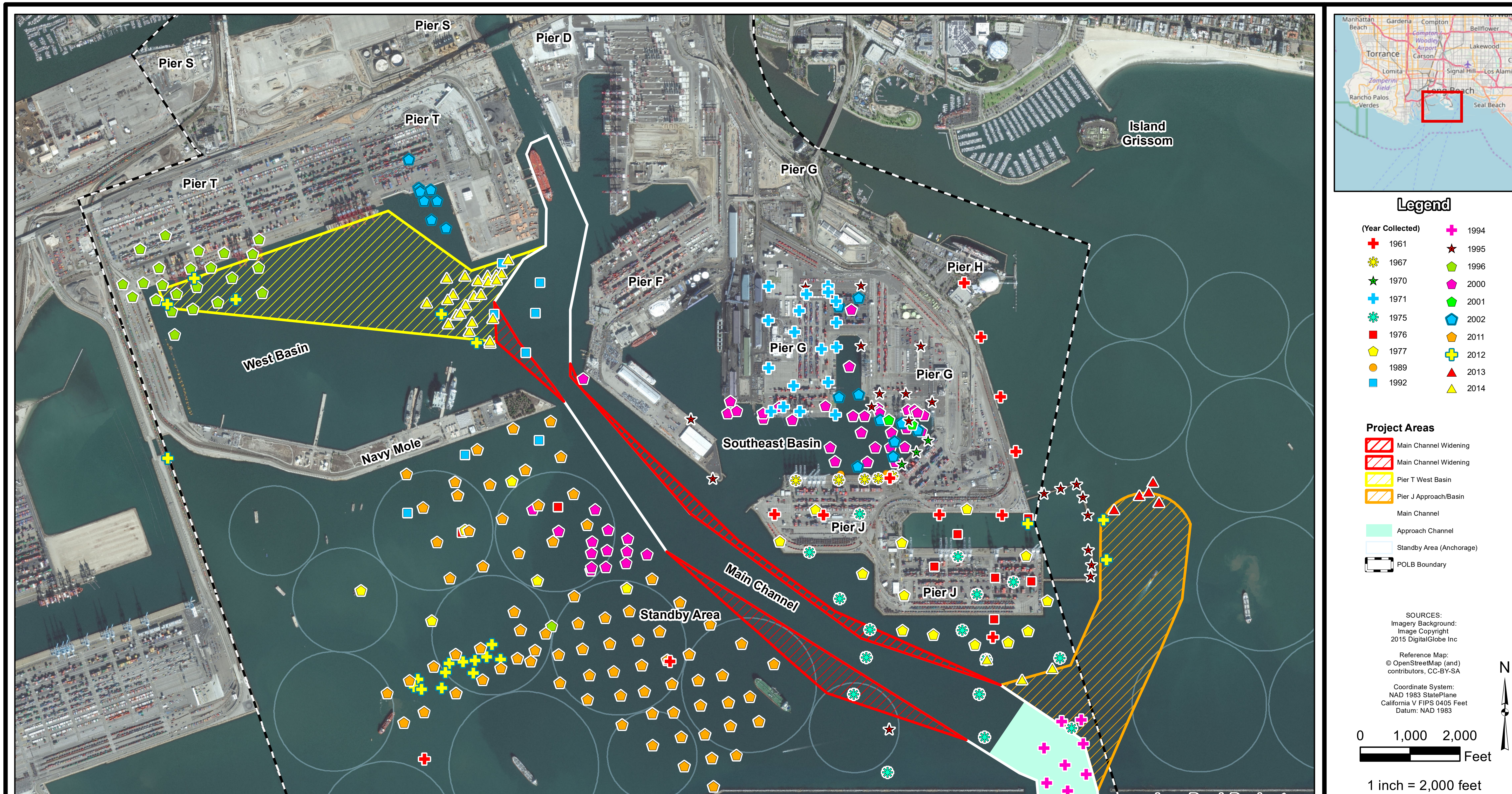
1 inch = 3,000 feet

POLB NAVIGATION IMPROVEMENTS

A3: INVENTORY MAP OF ENVIRONMENTAL TESTING EVENTS FOR SEDIMENT

Map Date: 9/3/2019

U.S. ARMY CORPS OF ENGINEERS LOS ANGELES DISTRICT

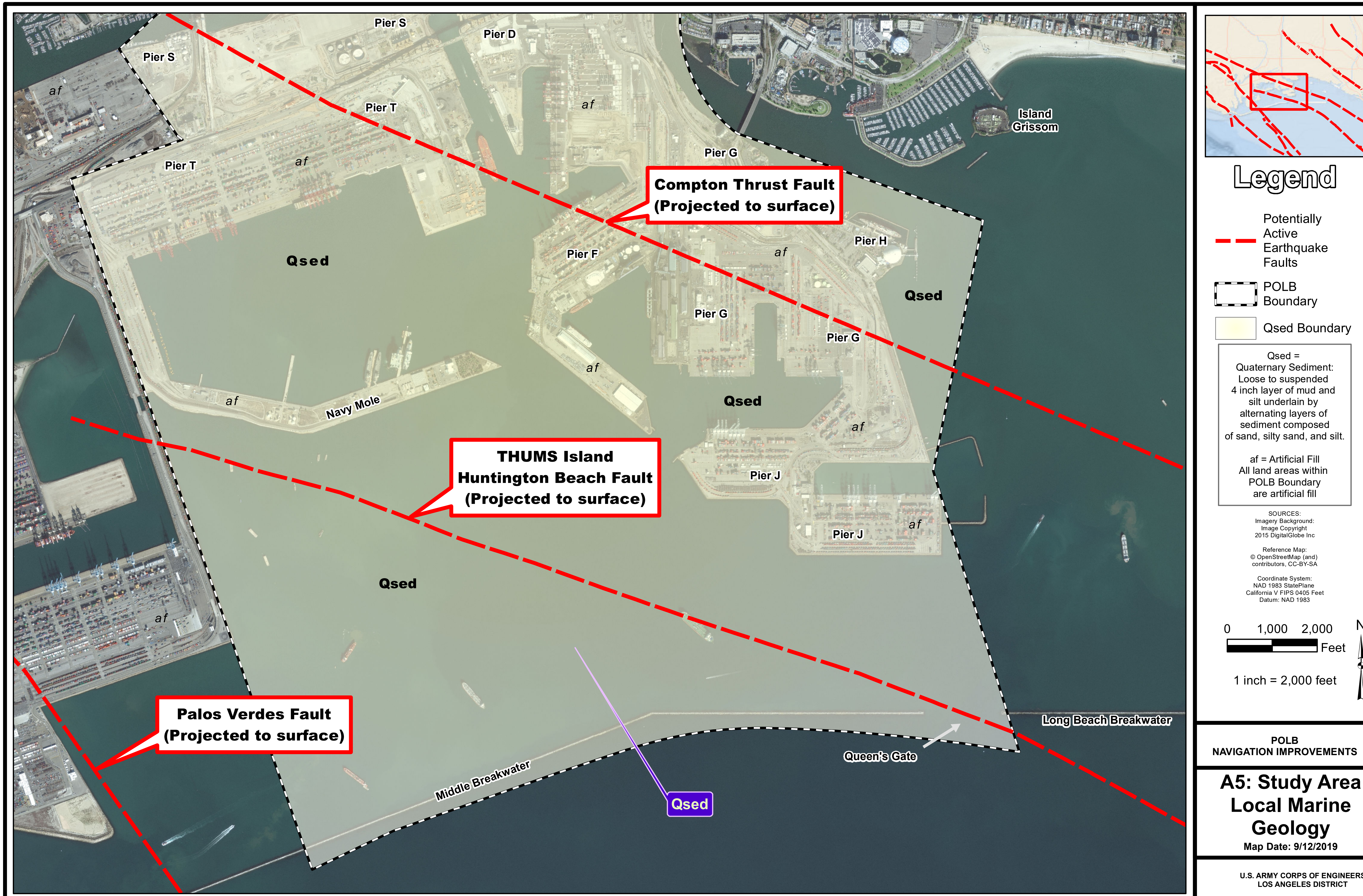


POLB
NAVIGATION IMPROVEMENTS

A4: Borehole Sediment Sample Locations for Geotechnical and Environmental Sampling Purposes (1961 to 2014)

Map Date: 9/3/2019

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT



Pier S
Pier D
Pier S
af
Pier T
af
Pier T
af
Pier G
Island Grissom
Compton Thrust Fault (Projected to surface)
Qsed
Pier F
af
Pier H
Qsed
Pier G
Pier G
af
af
Navy Mole
Qsed
af
THUMS Island Huntington Beach Fault (Projected to surface)
Pier J
Pier J
af
Qsed
af
Palos Verdes Fault (Projected to surface)
Middle Breakwater
Qsed
Queen's Gate
Long Beach Breakwater
Legend
Potentially Active Earthquake Faults
POLB Boundary
Qsed Boundary
Qsed = Quaternary Sediment: Loose to suspended 4 inch layer of mud and silt underlain by alternating layers of sediment composed of sand, silty sand, and silt.
af = Artificial Fill All land areas within POLB Boundary are artificial fill
SOURCES: Imagery Background: Image Copyright 2015 DigitalGlobe Inc
Reference Map: © OpenStreetMap (and) contributors, CC-BY-SA
Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet Datum: NAD 1983
0 1,000 2,000 Feet
N
1 inch = 2,000 feet
POLB NAVIGATION IMPROVEMENTS
A5: Study Area Local Marine Geology
Map Date: 9/12/2019
U.S. ARMY CORPS OF ENGINEERS LOS ANGELES DISTRICT

ATTACHMENT B

FEDERAL CHANNEL EXPANSION STUDY GEOTECHNICAL INPUT FOR BIRTH AND CHANNEL DEEPENING (Earth Mechanics 1-19-2017)

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Orange, CA 92868-4786
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Port of LONG BEACH
The Green Port

Port of Long Beach
Port-Wide Dredge Plan and Federal Expansion Study
Subtask 1.8 Assessment of Existing Wharves – Geotechnical Memo

To:	Derek Davis – Port of Long Beach	Page	1 of 1
CC			
Subject :	Geotechnical Memo to Support USACOE Federal Channel Deepening Study		
From	Jeffrey Khouri – AECOM		
Date	January 19, 2017		

1.0 Introduction

The attached Geotechnical Memo prepared by AECOM subconsultant Earth Mechanics, Inc (EMI) outlines geotechnical recommendations that support recommendations for the following:

- Work associated with deepening at berths
- “Stand-off” distances for dredging adjacent to existing port infrastructure

The recommendations in this memo were used as input for the “Wharf Structure Improvements and Berth Dredging Evaluation” report submitted on December 14, 2016 and work current being performed to evaluate channel deepening adjacent to port infrastructure such as revetments, moles, and breakwaters.

DATE: January 19, 2017 **EMI PROJECT NO:** 15-152

TO: Jeff Khouri, P.E. / AECOM
Richard Mast, P.E. / AECOM

FROM: Pratheep K. Pratheepan, P.E. / Earth Mechanics, Inc. (EMI)
Arul K. Arulmoli, G.E. / EMI

SUBJECT: ***Geotechnical Input for Berth and Channel Deepening***
Port-Wide Dredge Plan and Federal Channel Expansion Study
Port of Long Beach, California

Introduction

Port of Long Beach (POLB) retained AECOM team to provide engineering consultancy services for the Port-Wide Dredge Plan and Federal Channel Expansion Study Project. As a part of this project, a Berth and Channel Deepening study (Sub-Task 1.8) was performed in support of the Federal Expansion Study. The objective of this study is to provide cost input to the US Army Corps of Engineers for the work associated with deepening the berths, as well as provide input on required "stand-off" distances for the deepened channel from critical infrastructure. Three potential dredge depths (-53 ft MLLW, -55 ft MLLW and -57 ft MLLW) with a 2-ft over dredge allowance were considered for the dredging in this study. This study also includes widening of the main channel at some locations (to -76 ft MLLW). Attachment 1 shows the proposed Navigation Improvements. To facilitate this study, potential wharf improvement solutions and associated costs for each berth dredge depth were developed by the AECOM team. In addition to the wharf improvement solutions, Earth Mechanics, Inc (EMI) also provided "stand-off" distances from the existing port structures (dikes, bulkhead walls, breakwaters, etc.) to protect the port structures from any potential undermining/damage due to the dredging and operations within the Federal Channels and waterways.

This memorandum provides the summary of preliminary geotechnical input provided by EMI for the Berth and Channel Deepening study. EMI provided the geotechnical input as a subconsultant to AECOM.

Review of Available Drawings

From the design/record drawings database, POLB provided available drawings and details of various port structures along the channels and waterways. These drawings included critical data such as, the design water depths of existing port structures, current water depths and distances to the proposed/existing channels and waterways from the toe of the existing port structures. The list of reports provided by POLB and reviewed by EMI are included in the References section.

The information from these drawings was used to develop potential wharf improvement solutions and to determine the "stand-off" distances.

Proposed "Stand-Off" Distances

Portions of the proposed channel dredging are within the vicinity of existing port structures such as bulkhead walls, breakwaters and rock dikes. "Stand-off" distances from the toe of these structures are recommended to minimize any potential damages/undermining of these existing structures. Recommended "stand-off" distances are summarized in Table 1 and a schematic diagram shown in Figure 1. Assumptions involved in developing these "stand-off" distances are listed below.

1. No dredging will be performed within the standoff distance.
2. The dredge slopes beyond the standoff distances will be designed to be stable during dredging and long term operational conditions.

Proposed Wharf Improvements

The proposed berth dredging depths, are deeper than the design/existing water depths at many of the berths. Therefore, wharf improvement solutions need to be implemented before dredging near the existing wharves to avoid any damages to the existing wharf structures due to failure of the existing slopes during dredging. Based on past experience with similar projects, an underwater bulkhead wall at the toe of the existing slope is considered to be an effective and practical wharf improvement solution.

However, since the underwater bulkhead walls are cantilever type structures, under high loading conditions, such as very tall dredge cuts or seismic loadings, additional backland or mid slope ground improvements may be required. Due the rock protections on slopes and buried utilities in the backland, jet grouting is considered to be most suitable ground improvement option.

The below listed assumptions were used to develop the wharf improvement solutions.

1. Bulkhead and other improvements are based on engineering judgement and limited high level evaluations. Further geotechnical and structural analyses are needed to finalize these configurations.
2. Under Static and all seismic conditions [i.e., Operating Level Earthquake (OLE), Contingency Level Earthquake (CLE) and Design Earthquake (DE)], bulkheads should generally not reduce stability of the existing slope. Maximum lateral displacements at the top of the bulkhead: 3", 12", and 36", under OLE, CLE and DE, respectively, to meet the POLB Wharf Design Criteria (WDC) screening criteria for 24" octagonal precast, prestressed concrete piles. Moment demand on the bulkhead section under OLE was kept within the elastic moment capacity of the bulkhead section (Fy = 50 ksi).
3. Maximum lateral displacement at the top of the bulkhead under Modified OLE was assumed to be about 12 inches. Moment demand on the bulkhead section was kept below approximately 1.5 times the elastic moment capacity of the bulkhead section (Fy = 50 ksi).
4. "Berth Pocket" in front of the proposed bulkhead (i.e. waterside filled with rock) was assumed for scour protection.
5. An over dredge allowance of 2 feet was assumed.

Based on past experience with similar berth deepening projects and engineering judgement, potential wharf improvement solutions were developed for each berth area. Recommended wharf improvement solutions are summarized in Tables 2, 3 and 4, respectively for dredge depths, -53 ft, -55 ft and -57 ft MLLW water depths.

Limitations

This memorandum is intended only for the use of AECOM, its designers, and the Port of Long Beach for proposed Berth and Channel Dredging Study. This memorandum is based on the project as described and the information provided by AECOM and obtained from available drawings. The recommendations contained in this memorandum are based on available drawings, assumptions made due to incomplete information, and engineering judgement. EMI has no responsibility for errors and incompleteness of available design drawings and assumptions made by EMI due to these errors and incomplete information.

EMI should be notified of any pertinent changes or new information in the as-built and proposed plans. Such changes or variations may require a re-evaluation of the recommendations contained in this report.

The data, opinions, and recommendations contained in this study memorandum are applicable to the specific project element(s) and location(s) which is (are) the subject of this memorandum. They are not intended for design and have no applicability to any other design elements or to any other locations and any and all subsequent users accept any and all liability resulting from any use or reuse of the data, opinions, and recommendations without the prior written consent of EMI.

Services performed by EMI have been conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions. No other representation, expressed or implied, and no warranty or guarantee is included or intended.

References

Earth Mechanics, Inc., 2006, “Port-Wide Ground Motion Study, Port of Long Beach, California,” Final Report, Prepared for Port of Long Beach, EMI Project No 01-143, August 7.

Earth Mechanics, Inc., 2015, “Final Addendum No. 3 to Port-Wide Ground Motion Study, Site-Specific Ground Motion Recommendations per CBC 2013, Port of Long Beach, California,” Prepared for Port of Long Beach, May 13.

Naval Operating Base, Terminal Island, 1944, “General Plan of Breakwater & Dredging, West Arm,” Drawing No. 265-503, September 25.

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Port of Long Beach, 1956, “As-Built Drawing, Pier E Berths 122-124 Wharf,” Drawing No. HD-10734, Specification No. 448, September 14.

Port of Long Beach, 1961, “Pier F & Pier G, Diking, Dredging & Filling,” Drawing No. HD-10866, Specification No. 526, February 8.

Port of Long Beach, 1961, "As-Built Drawing, Pier E Berths 125-127, Cast-In-Place Wharf," Drawing No. HD-10946, Specification No. 569, July 24.

Port of Long Beach, 1966, "Pier F Berths 204-205 Wharf," Drawing No. HD-20263, Specification No. 842, April 12.

Port of Long Beach, 1967, "As-Built Drawing, Pier J and Pier F Extension, Rock Dike – Hydraulic Fill," Drawing No. HD-100063, Specification No. 660, September 4.

Port of Long Beach, 1983, "As-Built Drawing, Pier E Berth 121, Tanker Terminal Offshore facilities," Drawing No. 10-616, Specification No. HD-S1374, June 23.

Port of Long Beach, 1991, "As-Built Drawing, Pier J Expansion, Rock Dike and Hydraulic Fill," Drawing No. HD-10-1068, Specification No. HD-S1688, April 4.

Port of Long Beach, 1994, "As-Built Drawing, Pier J Berths 245-247, Wharf Modification," Drawing No. HD-10-1113, Specification No. HD-S1733, May 17.

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Port of Long Beach, 2002, "As-Built Drawing, Pier T Marine Terminal, Dredging and Wharf Construction," Drawing No. HD-10-1436, Specification No. HD-S1980, November 22.

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Port of Long Beach, 2003, "Pier S Berths 102-110, Dike Realignment," Proposed Pier J Typical New Dike Section, Drawing No. HD-10-1711, Specification No. HD-S2161, September 2.

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Port of Long Beach, 2015, "Wharf Design Criteria, Version 4.0," May 20.

Table 1: Recommended "Stand-Off" Distances from Port Structures

<table>
<tr><th colspan="2">Existing Structures</th><th rowspan="2">Recommended "Stand-Off" Distance[1] (ft)</th></tr>
<tr><th>Structure Type</th><th>Structure Location</th></tr>
<tr><td>Bulkhead Wall</td><td>Berths D32 and D33</td><td rowspan="2">150</td></tr>
<tr><td>Steel Cells</td><td>Berths T122, T124 and T126</td></tr>
<tr><td rowspan="6">Rock Dike</td><td>Future potential Pier J South triangular fill</td><td rowspan="6">100</td></tr>
<tr><td>West face of Pier F from the tip of the Pier F Mole to the Pilot Station and around the corner to F202.</td></tr>
<tr><td>Berths F202 and F203</td></tr>
<tr><td>Berths G230</td></tr>
<tr><td>Berths J260, J262, J264 and J265</td></tr>
<tr><td>Tip of the Navy Mole</td></tr>
<tr><td>Breakwater</td><td>Pier J South Breakwaters</td><td>50</td></tr>
<tr><td colspan="3">1) Please note the "stand-off" distances are measured from the toe of the existing dikes or bulkhead walls (See Figure 1).</td></tr>
</table>

Table 2: Berth Deepening to EL. -53 ft MLLW plus 2 FT Over Dredge (i.e. Lowest El. -55 ft MLLW)

Pier / Berth	Mudline Elevation at Pierhead Line[1] (ft, MLLW)		Bulkhead and Additional Improvements				
	Designed	Existing	Static Only[2]	Static + Modified OLE[3]	Static + OLE	Static + CLE	Static + DE
Pier F/ F204 & F205	-36	-38.2 to -39.5	Solution 12 HZ1180MA & AZ36-700N Combination HZ1180MA from -32' to -100' AZ36-700N from -32' to -65'	Solution 24 Double HZ1080MD & AZ36-700N Combination HZ1080MD from -32' to -125' AZ36-700N from -32' to -65'	Solution 12 HZ1180MD & AZ36-700N Combination HZ1180MD from -32' to -110' AZ36-700N from -32' to -65' + Top GI - 30 ft Wide From +10' to -60' + Mid Slope GI - 15 ft Wide From -20 to -65	Solution 24 Double HZ1080MD & AZ36-700N Combination HZ1080MD from -32' to -115' AZ36-700N from -32' to -65' + Top GI - 30 ft Wide From +10' to -60' + Mid Slope GI - 30 ft Wide From -20 to -65	Solution C23 Continuous HZ880MA HZ880MA from -32' to -120' + Top GI - 30 ft Wide From +10' to -60' + Mid Slope GI - 30 ft Wide From -20 to -65
Pier G/ G232 & G236	-55	-52 to -53	No improvements needed	No improvements needed	No improvements needed	No improvements needed	AZ36-700N Sheet Pile From -51 to -70
Pier J North/ J245 Thru J247	-48	48.6 to -49.6	AZ36-700N Sheet Pile From -44' to -80'	Solution 12 HZ1180MA & AZ36-700N Combination HZ1180MA from -44' to -100' AZ36-700N from -44' to -65'	Solution 12 HZ1080MA & AZ36-700N Combination HZ1080MA from -44' to -85' AZ36-700N from -44' to -65' + Top GI 30 ft Wide From +10' to -60'	Solution 12 HZ880MC & AZ36-700N Combination HZ880MC from -44' to -85' AZ36-700N from -44' to -65' + Top GI - 30 ft Wide From +10' to -60' + Mid Slope GI - 30 ft Wide From -35 to -65	Solution 12 HZ1080MD & AZ36-700N Combination HZ1080MD from -44' to -90' AZ36-700N from -44' to -65' + Top GI - 30 ft Wide From +10' to -60' + Mid Slope GI - 30 ft Wide From -35 to -65
Pier J South/ J266 Thru J270	-55	-47.5 to -47.9	No improvements needed	AZ50 Sheet Pile From -51 to -90	AZ36-700N Sheet Pile From -51 to -70 + Top GI 30 ft Wide From +10' to -60'	AZ36-700N Sheet Pile From -51 to -75 + Top GI - 30 ft Wide From +10' to -60' + Mid Slope GI - 30 ft Wide From -30 to -65	AZ50 Sheet Pile From -51 to -80 + Top GI - 30 ft Wide From +10' to -60' + Mid Slope GI - 30 ft Wide From -30 to -65
Pier T/ T132 Thru T140	-55	-48 to -51	No improvements needed	No improvements needed	No improvements needed	No improvements needed	AZ40-700N Sheet Pile From -51 to -70

NOTES:
[1] Information provided by POLB
[2] Static condition is expected to accommodate PGA of approximately 0.1g
[3] Maximum lateral displacement at the top of the bulkhead under Modified OLE is assumed to be about 12 inches. Moment demand on the bulkhead section was kept below approximately 1.5 times the elastic moment capacity of the bulkhead section (Fy = 50 ksi).

PGA – Horizontal Peak Ground Acceleration
OLE – Operational Level Earthquake; PGA = 0.21g (WDC, 2015 & EMI, 2006); CLE – Contingency Level Earthquake; PGA = 0.51g (WDC, 2015 & EMI, 2006); DE – Design Earthquake; PGE = 0.54g (WDC, 2015 & EMI, 2015)
WDC – POLB Wharf Design Criteria
Sheet piles and King piles used are by Skyline Steel (NUCOR Company). Equivalent sections by other manufacturers are also acceptable.

See Assumptions and References listed respectively, in Page 2 and 3 of the memorandum.

Table 3: Berth Deepening to EL. -55 ft MLLW plus 2 FT Over Dredge (i.e. Lowest El. -57 ft MLLW)

Pier / Berth	Mudline Elevation at Pierhead Line[1] (ft, MLLW)		Bulkhead and Additional Improvements				
	Designed	Existing	Static Only[2]	Static + Modified OLE[3]	Static + OLE	Static + CLE	Static + DE
Pier F/ F204 & F205	-36	-38.2 to -39.5	Solution 12 HZ1180MD & AZ36-700N Combination HZ1180MD from -32' to -105' AZ36-700N from -32' to -67'	Solution 24 Double HZ1180MD & AZ36-700N Combination HZ1180MD from -32' to -130' AZ36-700N from -32' to -67'	Solution 12 Double HZ1080MD & AZ36-700N Combination HZ1080MD from -32' to -115' AZ36-700N from -32' to -67' + Top GI - 30 ft Wide From +10' to -60' + Mid Slope GI - 15 ft Wide From -20 to -65	Solution C23 Continuous HZ880MC HZ880MC from -32' to -120' + Top GI - 30 ft Wide From +10' to -60' + Mid Slope GI - 30 ft Wide From -20 to -65	Solution C23 Continuous HZ1080MD HZ1080MD from -32' to -125' + Top GI - 30 ft Wide From +10' to -60' + Mid Slope GI - 30 ft Wide From -20 to -65
Pier G/ G232 & G236	-55	-52 to -53	No improvements needed	No improvements needed	No improvements needed	No improvements needed	AZ40-700N Sheet Pile From -51 to -80
Pier J North/ J245 Thru J247	-48	48.6 to -49.6	AZ40-700N Sheet Pile From -44' to -85'	Solution 24 Double HZ1080MA & AZ36-700N Combination HZ1080MA from -44' to -105' AZ36-700N from -44' to -67'	Solution 12 HZ1180MA & AZ36-700N Combination HZ1180MA from -44' to -90' AZ36-700N from -44' to -67' + Top GI 30 ft Wide From +10' to -60'	Solution 12 HZ1080MA & AZ36-700N Combination HZ1080MA from -44' to -90' AZ36-700N from -44' to -67' + Top GI - 30 ft Wide From +10' to -60' + Mid Slope GI - 30 ft Wide From -35 to -65	Solution 12 HZ1180MD & AZ36-700N Combination HZ1180MD from -44' to -95' AZ36-700N from -44' to -67' + Top GI - 30 ft Wide From +10' to -60' + Mid Slope GI - 30 ft Wide From -35 to -65
Pier J South/ J266 Thru J270	-55	-47.5 to -47.9	No improvements needed	Solution 12 HZ880MC & AZ36-700N Combination HZ880MC from -51' to -95' AZ36-700N from -51' to -67'	AZ50 Sheet Pile From -51 to -75 + Top GI 30 ft Wide From +10' to -60'	AZ46-700N Sheet Pile From -51 to -80 + Top GI - 30 ft Wide From +10' to -60' + Mid Slope GI - 30 ft Wide From -30 to -65	Solution 12 HZ880MC & AZ36-700N Combination HZ880MC from -51' to -85' AZ36-700N from -51' to -67' + Top GI - 30 ft Wide From +10' to -60' + Mid Slope GI - 30 ft Wide From -30 to -65
Pier T/ T132 Thru T140	-55	-48 to -51	No improvements needed	No improvements needed	No improvements needed	No improvements needed	AZ50 Sheet Pile From -51 to -80

NOTES:
[1] Information provided by POLB
[2] Static condition is expected to accommodate PGA of approximately 0.1g
[3] Maximum lateral displacement at the top of the bulkhead under Modified OLE is assumed to be about 12 inches. Moment demand on the bulkhead section was kept below approximately 1.5 times the elastic moment capacity of the bulkhead section (Fy = 50 ksi).
PGA – Horizontal Peak Ground Acceleration
OLE – Operational Level Earthquake; PGA = 0.21g (WDC, 2015 & EMI, 2006); CLE – Contingency Level Earthquake; PGA = 0.51g (WDC, 2015 & EMI, 2006); DE – Design Earthquake; PGE = 0.54g (WDC, 2015 & EMI, 2015)
WDC – POLB Wharf Design Criteria
Sheet piles and King piles used are by Skyline Steel (NUCOR Company). Equivalent sections by other manufacturers are also acceptable.

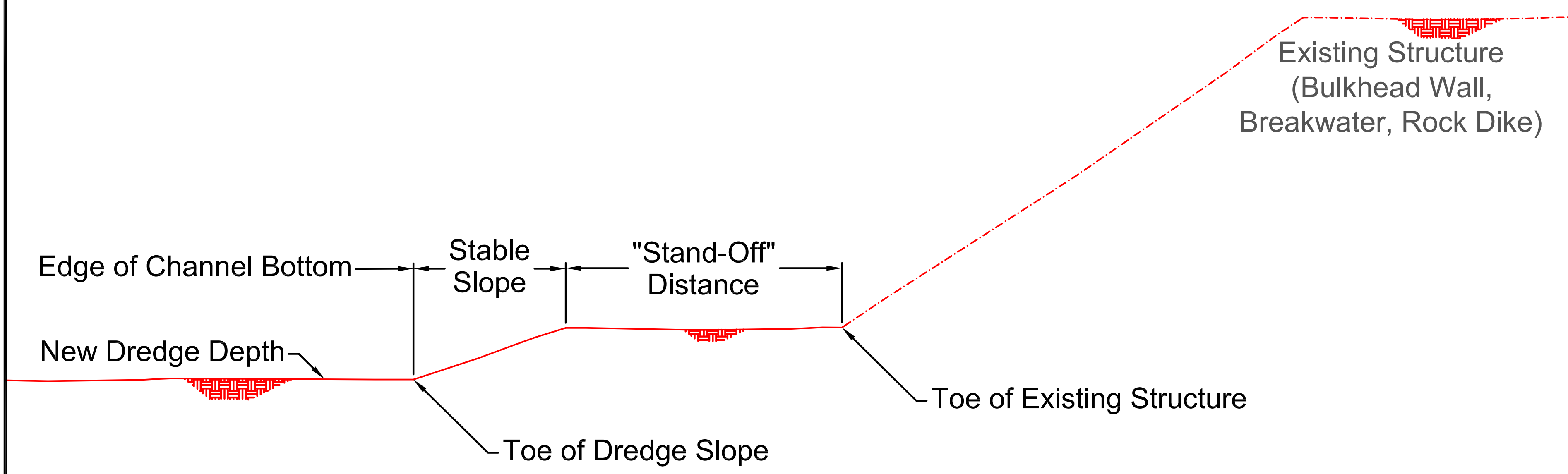
See Assumptions and References listed respectively, in Page 2 and 3 of the memorandum.

Table 4: Berth Deepening to EL. -57 ft MLLW plus 2 FT Over Dredge (i.e. Lowest El. -59 ft MLLW)

Pier / Berth	Mudline Elevation at Pierhead Line[1] (ft, MLLW)		Bulkhead and Additional Improvements				
	Designed	Existing	Static Only[2]	Static + Modified OLE[3]	Static + OLE	Static + CLE	Static + DE
Pier F/ F204 & F205	-36	-38.2 to -39.5	Solution 24 Double HZ1080MD & AZ36-700N Combination HZ1080MD from -32' to -110' AZ36-700N from -32' to -69'	Solution C23 Continuous HZ1080MA HZ1080MA from -32' to -135'	Solution 12 Double HZ1180MD & AZ36-700N Combination HZ1080MD from -32' to -120' AZ36-700N from -32' to -69' + Top GI - 30 ft Wide From +10' to -60' + Mid Slope GI - 15 ft Wide From -20 to -65	Solution C23 Continuous HZ1080MD HZ1080MA from -32' to -125' + Top GI - 30 ft Wide From +10' to -60' + Mid Slope GI - 30 ft Wide From -20 to -65	Solution C23 Continuous HZ1180MD HZ1180MD from -32' to -130' + Top GI - 30 ft Wide From +10' to -60' + Mid Slope GI - 30 ft Wide From -20 to -65
Pier G/ G232 & G236	-55	-52 to -53	AZ36-700N Sheet Pile From -51' to -80'	AZ36-700N Sheet Pile From -51' to -80'	AZ36-700N Sheet Pile From -51' to -80'	AZ40-700N Sheet Pile From -51 to -80	Solution 12 HZ880MC & AZ36-700N Combination HZ880MC from -51' to -85' AZ36-700N from -51' to -69'
Pier J North/ J245 Thru J247	-48	48.6 to -49.6	AZ48-700N Sheet Pile From -44' to -90'	Solution 24 Double HZ1180MD & AZ36-700N Combination HZ1180MD from -44' to -110' AZ36-700N from -44' to -69'	Solution 24 Double HZ1080MA & AZ36-700N Combination HZ1080MA from -44' to -95' AZ36-700N from -44' to -69' + Top GI 30 ft Wide From +10' to -60'	Solution 12 HZ1180MD & AZ36-700N Combination HZ1180MD from -44' to -95' AZ36-700N from -44' to -69' + Top GI - 30 ft Wide From +10' to -60' + Mid Slope GI - 30 ft Wide From -35 to -65	Solution 24 Double HZ1080MD & AZ36-700N Combination HZ1080MD from -44' to -100' AZ36-700N from -44' to -69' + Top GI - 30 ft Wide From +10' to -60' + Mid Slope GI - 30 ft Wide From -35 to -65
Pier J South/ J266 Thru J270	-55	-47.5 to -47.9	AZ36-700N Sheet Pile From -51' to -80'	Solution 12 HZ1080MD & AZ36-700N Combination HZ1080MD from -51' to -100' AZ36-700N from -51 to -69'	Solution 12 HZ880MC & AZ36-700N Combination HZ880MC from -51' to -85' AZ36-700N from -44' to -69' + Top GI 30 ft Wide From +10' to -60'	AZ50 Sheet Pile From -51 to -90 + Top GI - 30 ft Wide From +10' to -60' + Mid Slope GI - 30 ft Wide From -30 to -65	Solution 12 HZ1080MA & AZ36-700N Combination HZ1080MA from -51' to -95' AZ36-700N from -51' to -69' + Top GI - 30 ft Wide From +10' to -60' + Mid Slope GI - 30 ft Wide From -30 to -65
Pier T/ T132 Thru T140	-55	-48 to -51	No improvements needed	No improvements needed	No improvements needed	AZ50 Sheet Pile From -51 to -80	Solution 12 HZ1180MA & AZ36-700N Combination HZ1180MA from -51' to -85' AZ36-700N from -51' to -69'

NOTES:
[1] Information provided by POLB
[2] Static condition is expected to accommodate PGA of approximately 0.1g
[3] Maximum lateral displacement at the top of the bulkhead under Modified OLE is assumed to be about 12 inches. Moment demand on the bulkhead section was kept below approximately 1.5 times the elastic moment capacity of the bulkhead section (Fy = 50 ksi).
PGA – Horizontal Peak Ground Acceleration
OLE – Operational Level Earthquake; PGA = 0.21g (WDC, 2015 & EMI, 2006); CLE – Contingency Level Earthquake; PGA = 0.51g (WDC, 2015 & EMI, 2006); DE – Design Earthquake; PGE = 0.54g (WDC, 2015 & EMI, 2015)
WDC – POLB Wharf Design Criteria
Sheet piles and King piles used are by Skyline Steel (NUCOR Company). Equivalent sections by other manufacturers are also acceptable.

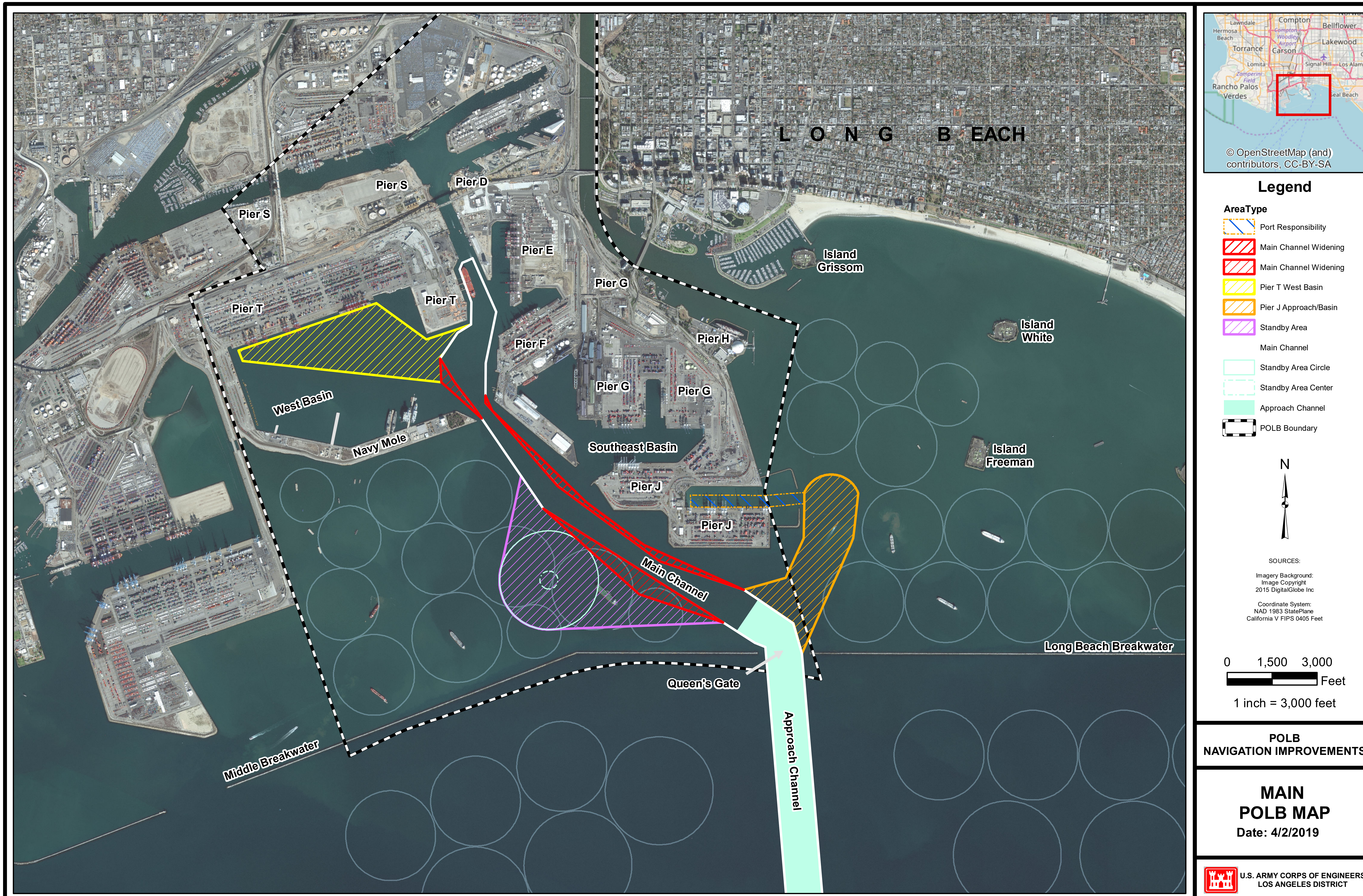
See Assumptions and References listed respectively, in Page 2 and 3 of the memorandum.



NOT TO SCALE

Earth Mechanics, Inc. Geotechnical and Earthquake Engineering	BERTH AND CHANNEL DEEPENING PORT WIDE DREDGE PLAN AND FEDERAL CHANNEL EXPANSION STUDY PORT OF LONG BEACH, CALIFORNIA	Schematic Diagram of "Stand-Off" Distance
	Project No: 15-152 / Date: 01-19-2017	Figure 1

ATTACHMENT 1: POLB NAVIGATION IMPROVEMENT PLAN



LONG BEACH
Pier S
Pier S
Pier D
Pier E
Pier T
Pier T
Pier G
Pier F
Pier H
Pier G
Pier G
West Basin
Navy Mole
Southeast Basin
Pier J
Pier J
Island Grissom
Island White
Island Freeman
Main Channel
Queen's Gate
Approach Channel
Long Beach Breakwater
Middle Breakwater
Compton
Bellflower
Lawndale
Hermosa Beach
Torrance
Carson
Lakewood
Rancho Palos Verdes
Seal Beach
© OpenStreetMap (and) contributors, CC-BY-SA
Legend
AreaType
Port Responsibility
Main Channel Widening
Main Channel Widening
Pier T West Basin
Pier J Approach/Basin
Standby Area
Main Channel
Standby Area Circle
Standby Area Center
Approach Channel
POLB Boundary
N
SOURCES:
Imagery Background: Image Copyright 2015 DigitalGlobe Inc
Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
0 1,500 3,000
Feet
1 inch = 3,000 feet
POLB
NAVIGATION IMPROVEMENTS
MAIN
POLB MAP
Date: 4/2/2019
U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

ATTACHMENT C

BATHYMETRY MAP
&
NOAA CHART NO 18571

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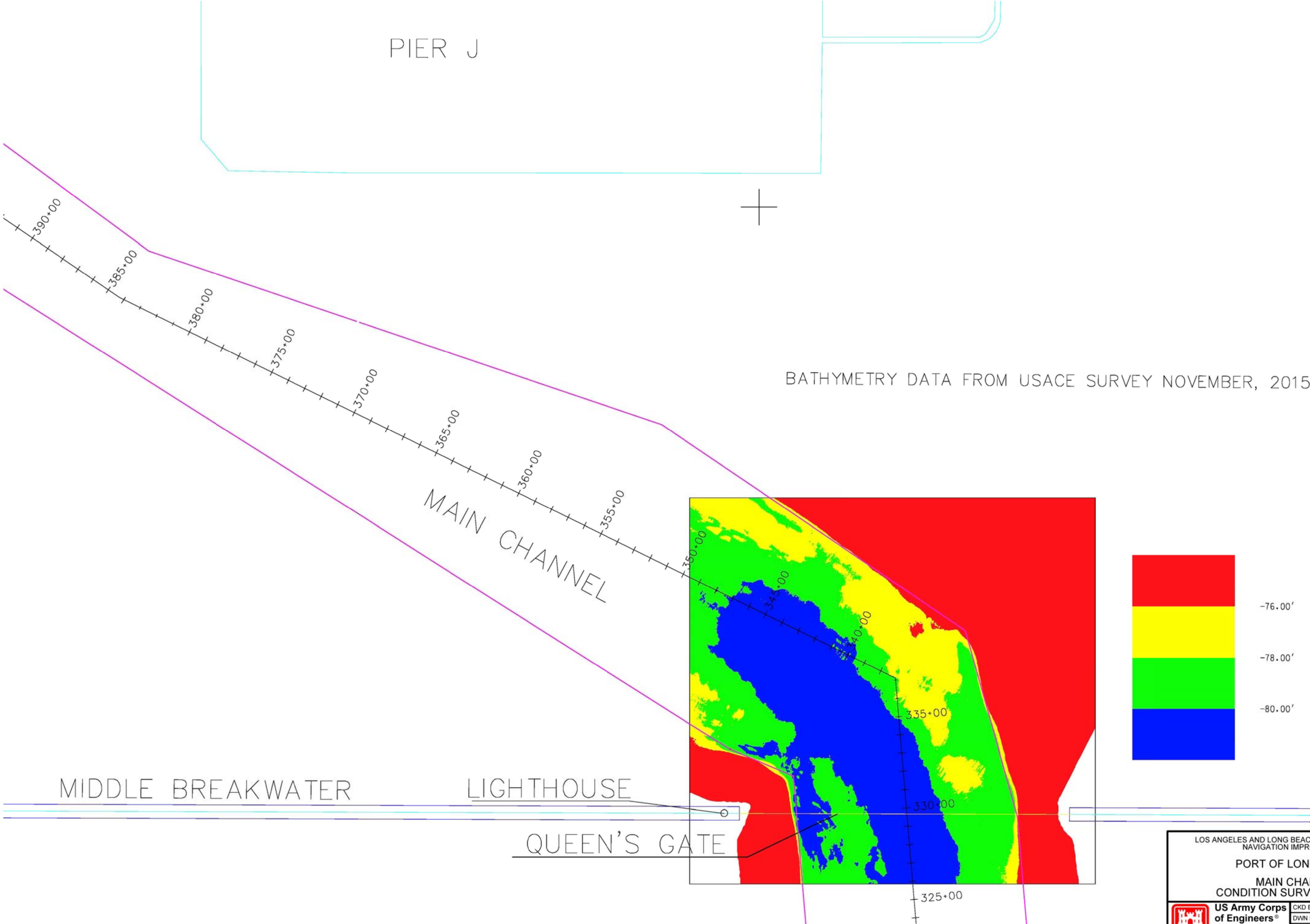

LOS ANGELES AND LONG BEACH HARBOR, CALIFORNIA
NAVIGATION IMPROVEMENTS

PORT OF LONG BEACH

MAIN CHANNEL
CONDITION SURVEY NOV 2015

US Army Corps of Engineers® Los Angeles District

CKD BY: JY/MR
DWN BY: EH
DATE: NOVEMBER 2017

PLATE C1

PLOT DATE: 10/26/2017 1:21:35 PM PLOTTED BY: l1edgeh9 FILE NAME: PLATEBORDER22X34_3D.DGN

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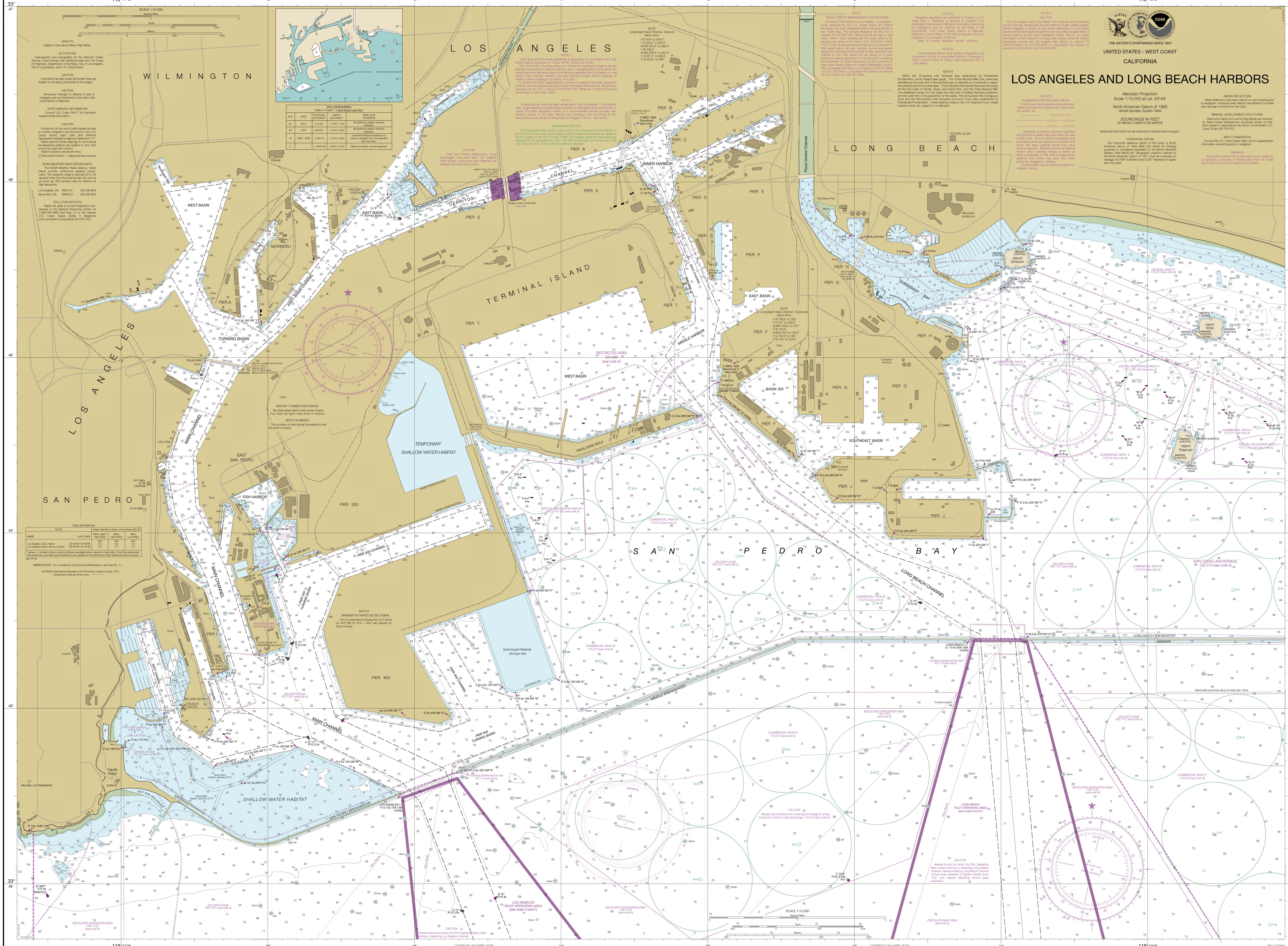

48th Ed., Jul. 2016. Last Correction: 2/28/2017. Cleared through:
LNM: 0817 (2/21/2017), NM: 0917 (3/4/2017)

To ensure that this chart was printed at the proper scale, the line below should measure six inches (152 millimeters).
If the line does not measure six inches (152 millimeters), this copy is not certified safe for navigation.

CAUTION
This chart has been corrected from the Notice to Mariners (NM) published weekly by the National Geospatial-Intelligence Agency and the Local Notice to Mariners (LNM) issued periodically by each U.S. Coast Guard district to the dates shown in the lower left hand corner. Chart updates corrected from Notice to Mariners published after the dates shown in the lower left hand corner are available at nauticalcharts.noaa.gov.

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SOUNDINGS IN FEET

Published at Washington, D.C.
U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SERVICE
COAST SURVEY

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Los Angeles and Long Beach Harbors
SOUNDINGS IN FEET - SCALE 1:12,000

US Army Corps of Engineers®
Los Angeles District

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DRAWN BY: eh	C2
DATE: NOVEMBER 2017	

ATTACHMENT D

USACE SLOPE STABILITY MODELS

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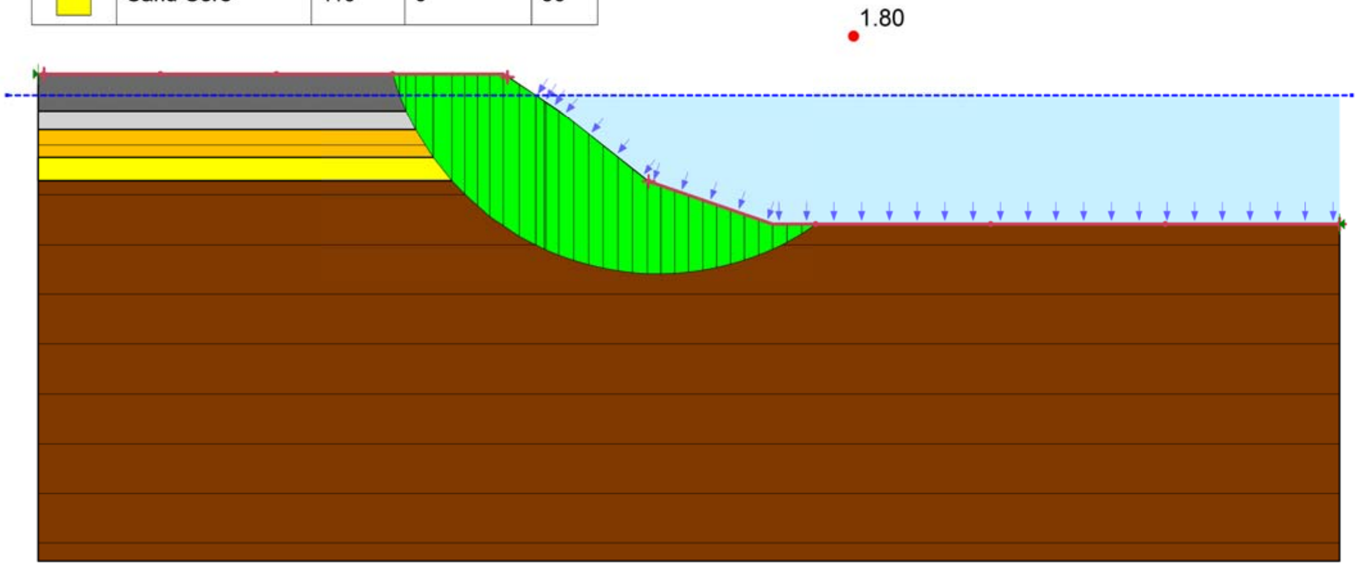
Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Class A Stone	111	0	45
	Clay Core	110	1,000	0
	Class B Stone	120	0	45
	Foundations Soils	119	1,200	11
	Sand Core	110	0	30



MIDDLE BREAKWATER - NO STANDOFF
STATIC

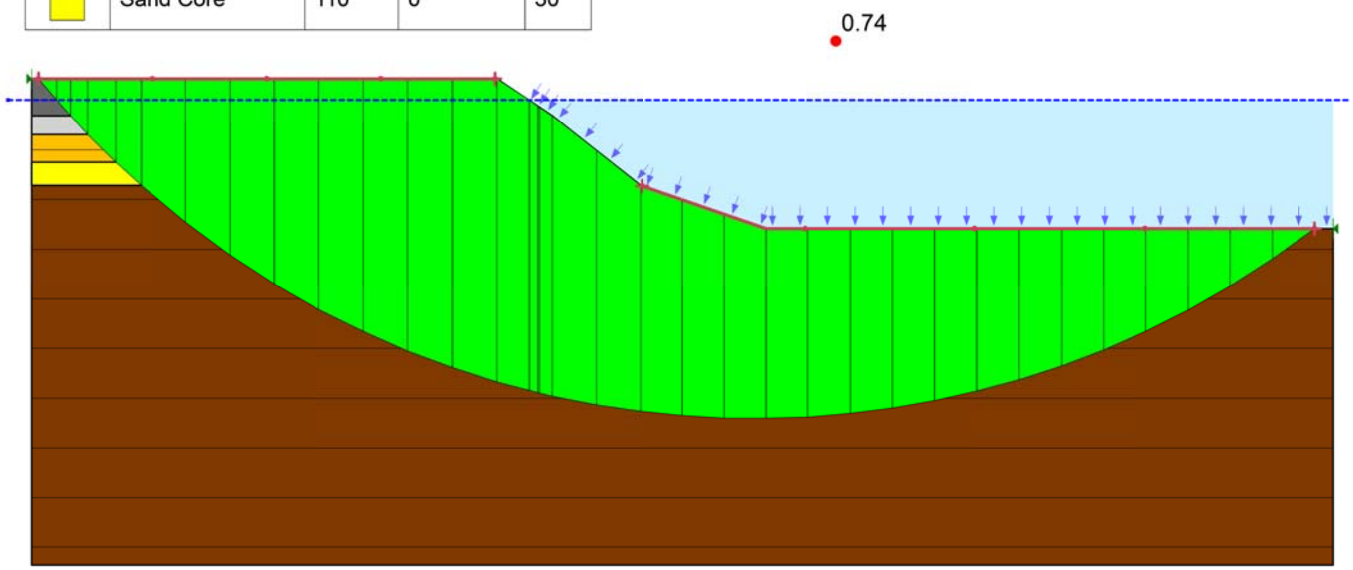
LOS ANGELES AND LONG BEACH HARBOR, CALIFORNIA
NAVIGATION IMPROVEMENTS
PORT OF LONG BEACH
DREDGING SLOPE STABILITY
MIDDLE BREAKWATER
NO STANDOFF STATIC

US Army Corps of Engineers ® Los Angeles District

CKD BY: JY/MR	PLATE
DWN BY: EH	D1
DATE:NOVEMBER2017	

HERNANDEZ F: \\SPL\DOCUMENTS\GEOTECH\YANG\PORT OF LB\REPORT\FIGURES_PLATES\C-4 GPOLC_D01.DGN

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Class A Stone	111	0	45
	Clay Core	110	1,000	0
	Class B Stone	120	0	45
	Foundations Soils	119	1,200	11
	Sand Core	110	0	30



MIDDLE BREAKWATER - NO STANDOFF SEISMIC

LOS ANGELES AND LONG BEACH HARBOR, CALIFORNIA
NAVIGATION IMPROVEMENTS
PORT OF LONG BEACH
DREDGING SLOPE STABILITY
MIDDLE BREAKWATER
NO STANDOFF SEISMIC

US Army Corps of Engineers ®
Los Angeles District

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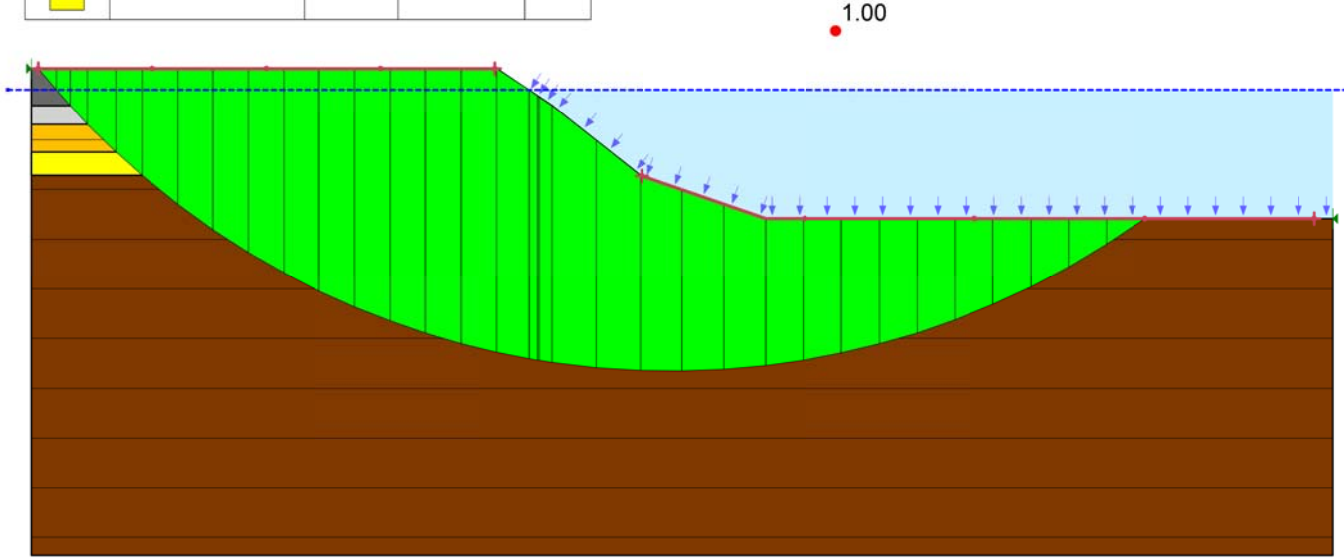
DWN BY: EH	D2
DATE:NOVEMBER2017	

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
(dark grey)	Class A Stone	111	0	45
(orange)	Clay Core	110	1,000	0
(light grey)	Class B Stone	120	0	45
(brown)	Foundations Soils	119	1,200	11
(yellow)	Sand Core	110	0	30



MIDDLE BREAKWATER - NO STANDOFF YIELD ACCELERATION

LOS ANGELES AND LONG BEACH HARBOR, CALIFORNIA
NAVIGATION IMPROVEMENTS
PORT OF LONG BEACH
DREDGING SLOPE STABILITY
MIDDLE BREAKWATER
NO STANDOFF YIELD ACCELERATION

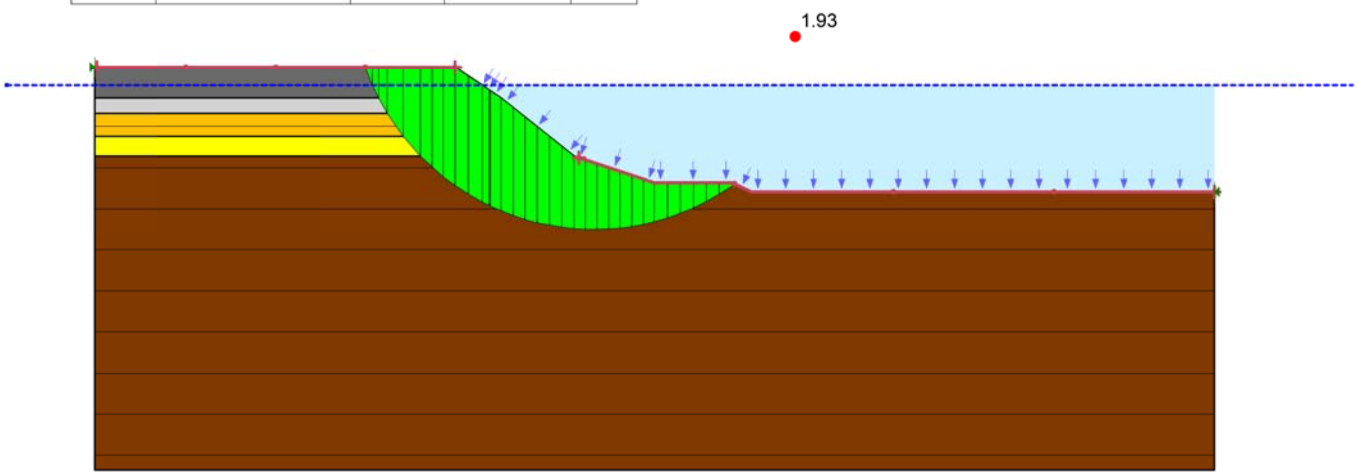
US Army Corps of Engineers ®
Los Angeles District

CKD BY: JY/MR
DWN BY: EH
DATE:NOVEMBER2017

PLATE
D3

HERNANDEZ F: \\SPL\DOCUMENTS\GEOTECH\YANG\PORT OF LB\REPORT\FIGURES_PLATES\C-4 GPOLC_D03.DGN

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Class A Stone	111	0	45
	Clay Core	110	1,000	0
	Class B Stone	120	0	45
	Foundations Soils	119	1,200	11
	Sand Core	110	0	30



MIDDLE BREAKWATER - STANDOFF 50 FEET
STATIC

LOS ANGELES AND LONG BEACH HARBOR, CALIFORNIA
NAVIGATION IMPROVEMENTS

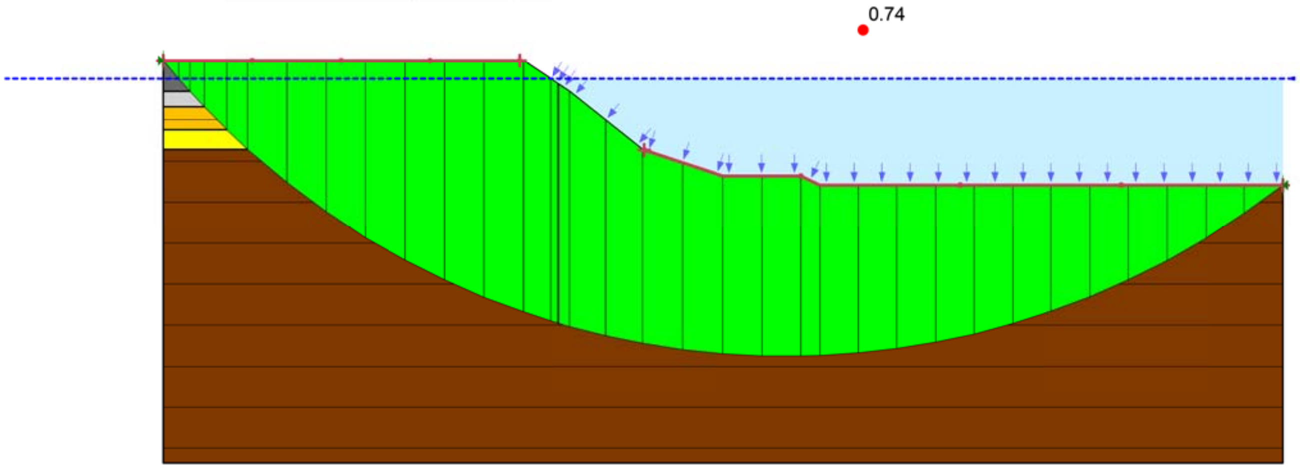
PORT OF LONG BEACH

DREDGING SLOPE STABILITY
MIDDLE BREAKWATER
STANDOFF 50FT STATIC

US Army Corps of Engineers ®
Los Angeles District

CKD BY: JY/MR	PLATE
DWN BY: EH	D4
DATE:NOVEMBER2017	

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Class A Stone	111	0	45
	Clay Core	110	1,000	0
	Class B Stone	120	0	45
	Foundations Soils	119	1,200	11
	Sand Core	110	0	30



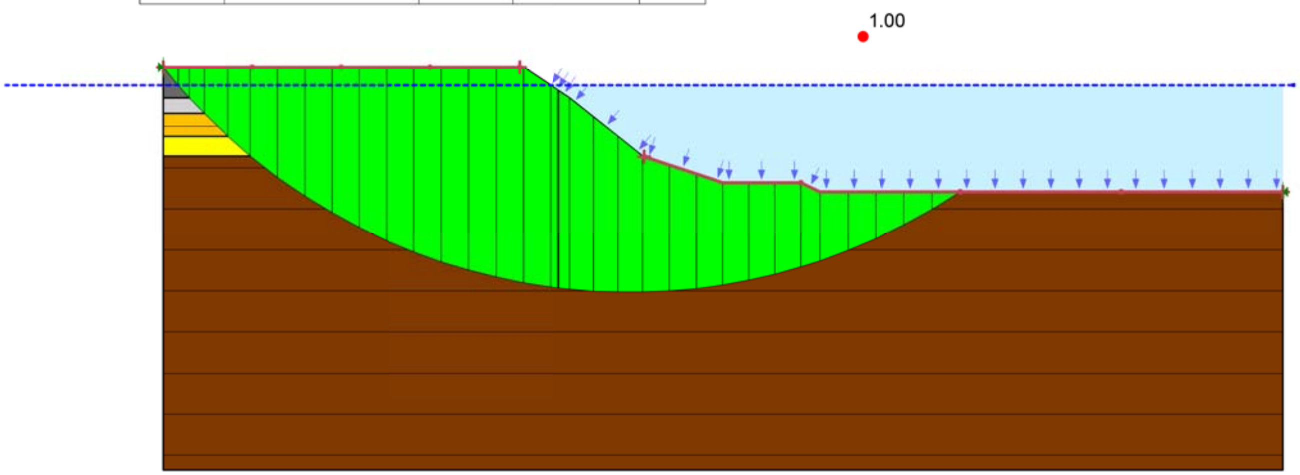
MIDDLE BREAKWATER - STANDOFF 50 FEET SEISMIC

LOS ANGELES AND LONG BEACH HARBOR, CALIFORNIA
NAVIGATION IMPROVEMENTS
PORT OF LONG BEACH
DREDGING SLOPE STABILITY
MIDDLE BREAKWATER
STANDOFF 50FT SEISMIC

US Army Corps of Engineers® Los Angeles District	CKD BY: JY/MR	PLATE
	DWN BY: EH	D5
	DATE:NOVEMBER2017	

HERNANDEZ F: \\SPL\DOCUMENTS\GEOTECH\YANG\PORT OF LB\REPORT\FIGURES_PLATES\C-4 GPOLC_D05.DGN

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Class A Stone	111	0	45
	Clay Core	110	1,000	0
	Class B Stone	120	0	45
	Foundations Soils	119	1,200	11
	Sand Core	110	0	30



MIDDLE BREAKWATER - STANDOFF 50 FEET
YIELD ACCELERATION

LOS ANGELES AND LONG BEACH HARBOR, CALIFORNIA
NAVIGATION IMPROVEMENTS
PORT OF LONG BEACH
DREDGING SLOPE STABILITY
MIDDLE BREAKWATER
STANDOFF 50FT YIELD ACCELERATION

US Army Corps of Engineers ®
Los Angeles District

CKD BY: JY/MR	PLATE
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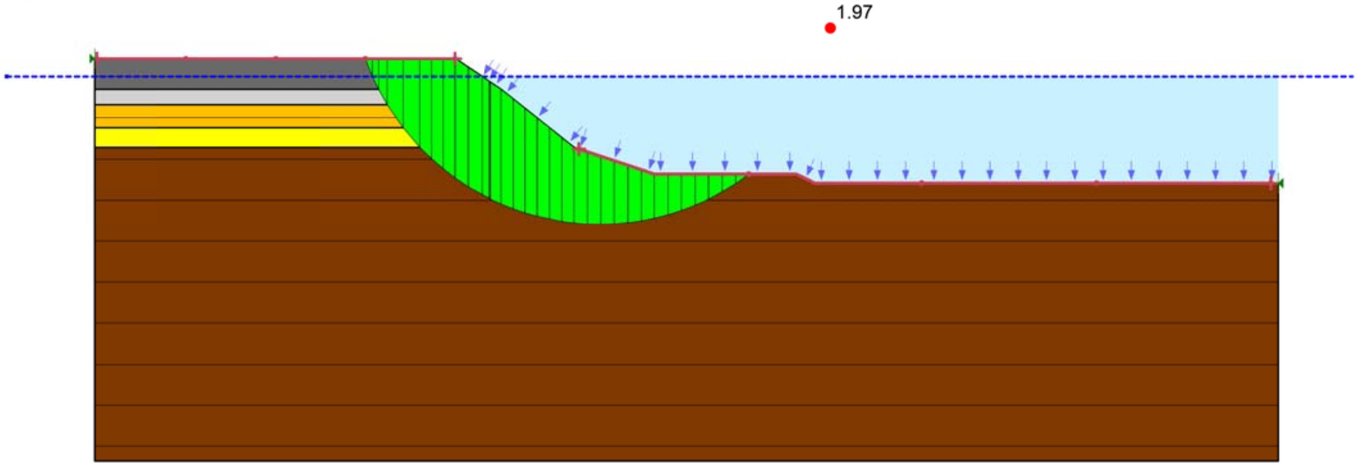
DATE:NOVEMBER2017	

HERNANDEZ F: \\SPL\DOCUMENTS\GEOTECH\YANG\PORT OF LB\REPORT\FIGURES_PLATES\C-4 GPOLC_D06.DGN

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Class A Stone	111	0	45
	Clay Core	110	1,000	0
	Class B Stone	120	0	45
	Foundations Soils	119	1,200	11
	Sand Core	110	0	30



MIDDLE BREAKWATER - STAND OFF 100 FEET STATIC

LOS ANGELES AND LONG BEACH HARBOR, CALIFORNIA
NAVIGATION IMPROVEMENTS
PORT OF LONG BEACH
DREDGING SLOPE STABILITY
MIDDLE BREAKWATER
STANDOFF 100FT STATIC

US Army Corps of Engineers ®
Los Angeles District

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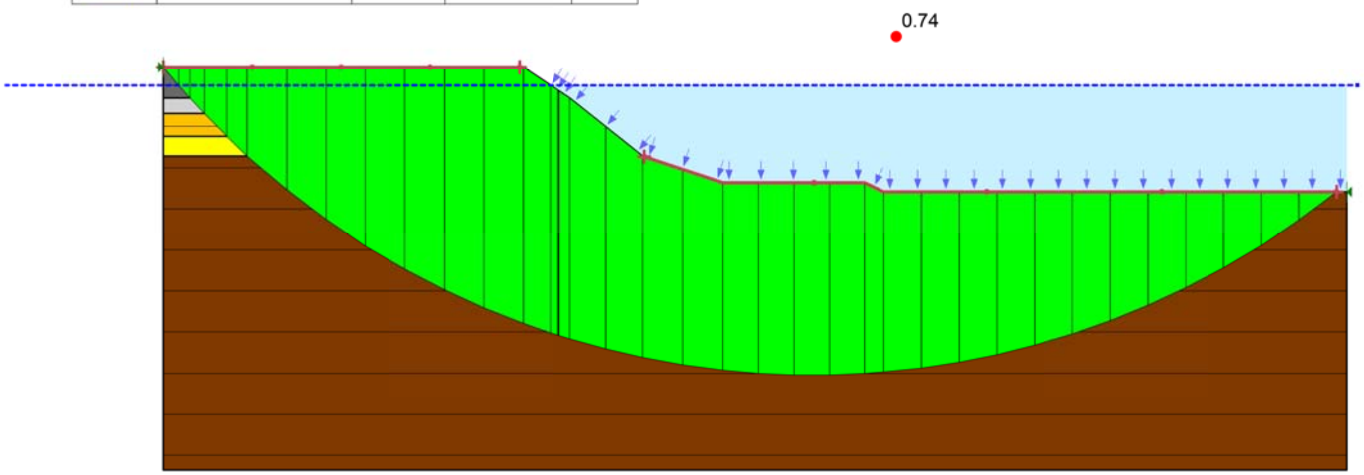
DWN BY: EH
DATE:NOVEMBER2017

PLATE
D7

HERNANDEZ F: \\SPL\DOCUMENTS\GEOTECH\YANG\PORT OF LB\REPORT\FIGURES_PLATES\C-4 GPOLC_D07.DGN

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Class A Stone	111	0	45
	Clay Core	110	1,000	0
	Class B Stone	120	0	45
	Foundations Soils	119	1,200	11
	Sand Core	110	0	30



MIDDLE BREAKWATER - STAND OFF 100 FEET SEISMIC

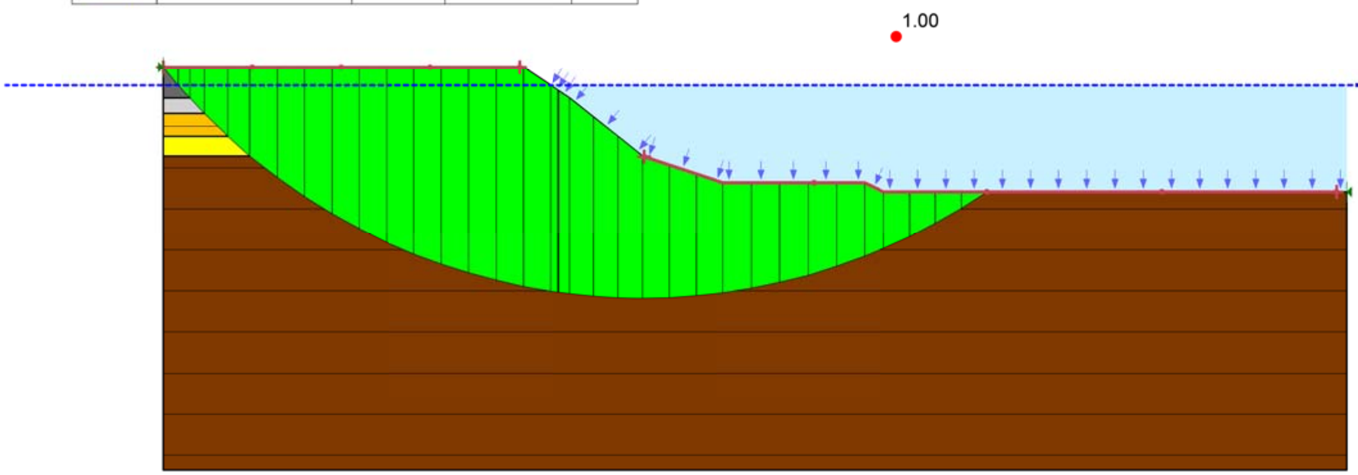
LOS ANGELES AND LONG BEACH HARBOR, CALIFORNIA
NAVIGATION IMPROVEMENTS
PORT OF LONG BEACH
DREDGING SLOPE STABILITY
MIDDLE BREAKWATER
STANDOFF 100FT SEISMIC

US Army Corps of Engineers ®
Los Angeles District

CKD BY: JY/MR	PLATE
DWN BY: EH	
DATE:NOVEMBER2017	D8

HERNANDEZ F: \\SPL\DOCUMENTS\GEOTECH\YANG\PORT OF LB\REPORT\FIGURES_PLATES\C-4 GPOLC_D08.DGN

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Class A Stone	111	0	45
	Clay Core	110	1,000	0
	Class B Stone	120	0	45
	Foundations Soils	119	1,200	11
	Sand Core	110	0	30



MIDDLE BREAKWATER - STAND OFF 100 FEET
YIELD ACCELERATION

LOS ANGELES AND LONG BEACH HARBOR, CALIFORNIA
NAVIGATION IMPROVEMENTS
PORT OF LONG BEACH
DREDGING SLOPE STABILITY
MIDDLE BREAKWATER
STANDOFF 100FT YIELD ACCELERATION

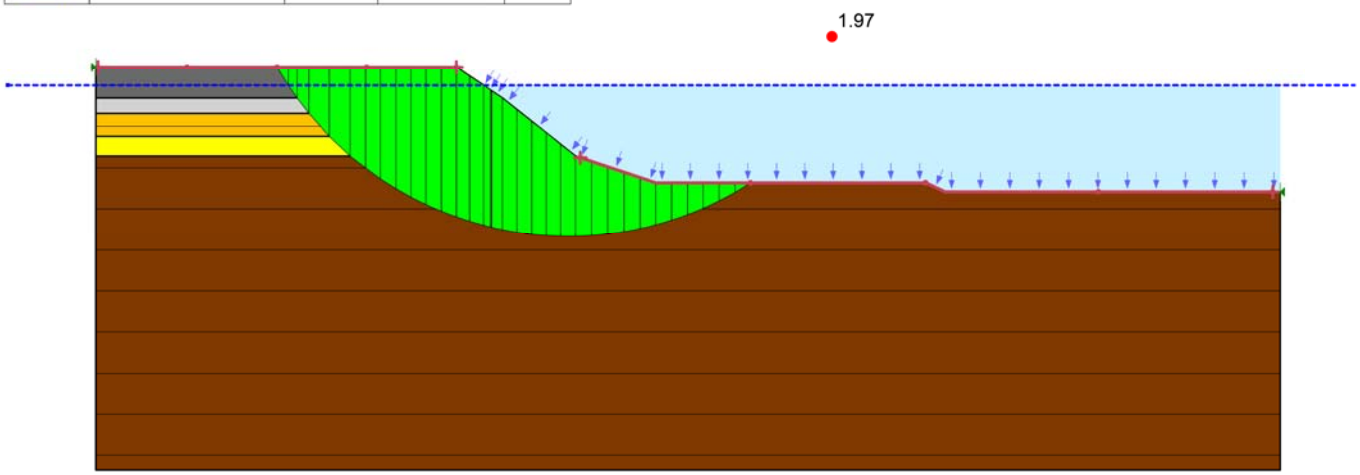
US Army Corps of Engineers ®
Los Angeles District

CKD BY: JY/MR
DWN BY: EH
DATE:NOVEMBER2017

PLATE
D9

HERNANDEZ F: \\SPL\DOCUMENTS\GEOTECH\YANG\PORT OF LB\REPORT\FIGURES_PLATES\C-4 GPOLC_D09.DGN

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Class A Stone	111	0	45
	Clay Core	110	1,000	0
	Class B Stone	120	0	45
	Foundations Soils	119	1,200	11
	Sand Core	110	0	30



MIDDLE BREAKWATER - STAND OFF 200 FEET STATIC

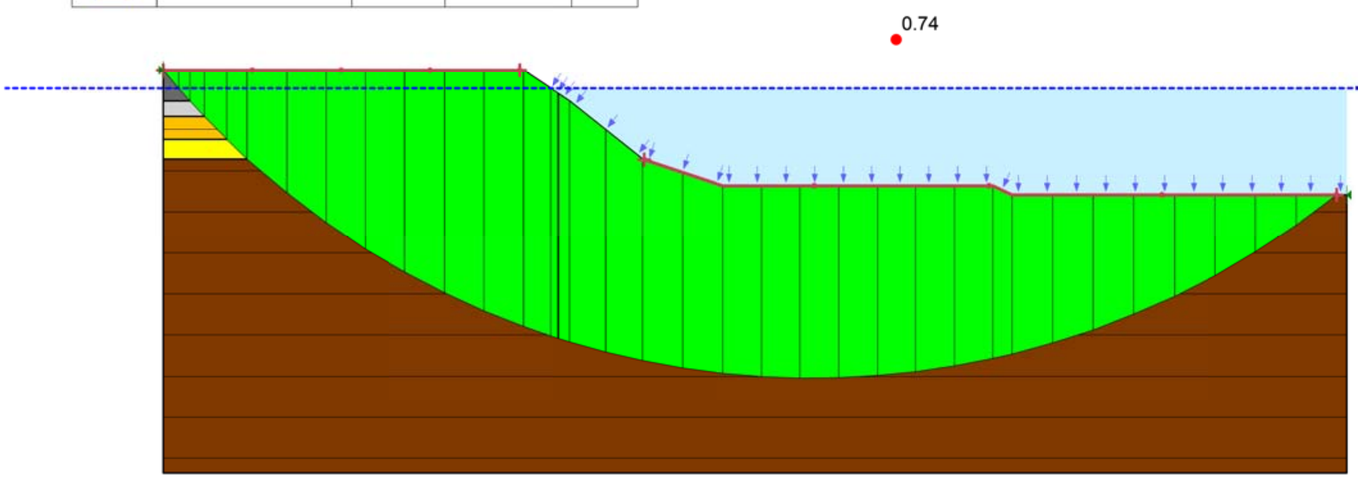
LOS ANGELES AND LONG BEACH HARBOR, CALIFORNIA
NAVIGATION IMPROVEMENTS
PORT OF LONG BEACH
DREDGING SLOPE STABILITY
MIDDLE BREAKWATER
STANDOFF 200FT STATIC

US Army Corps of Engineers ®
Los Angeles District

CKD BY: JY/MR	PLATE
DWN BY: EH	
DATE:NOVEMBER2017	D10

HERNANDEZ F: \\SPL\DOCUMENTS\GEOTECH\YANG\PORT OF LB\REPORT\FIGURES_PLATES\C-4 GPOLC_D10.DGN

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Class A Stone	111	0	45
	Clay Core	110	1,000	0
	Class B Stone	120	0	45
	Foundations Soils	119	1,200	11
	Sand Core	110	0	30



MIDDLE BREAKWATER - STAND OFF 200 FEET SEISMIC

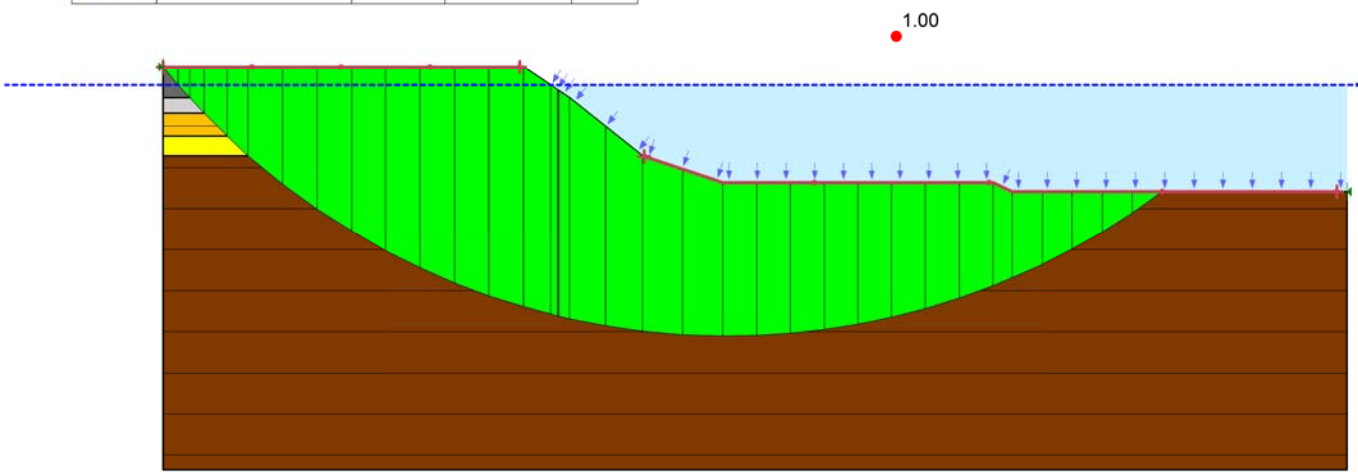
LOS ANGELES AND LONG BEACH HARBOR, CALIFORNIA
NAVIGATION IMPROVEMENTS
PORT OF LONG BEACH
DREDGING SLOPE STABILITY
MIDDLE BREAKWATER
STANDOFF 200FT SEISMIC

US Army Corps of Engineers ®
Los Angeles District

CKD BY: JY/MR	PLATE
DWN BY: EH	D11
DATE:NOVEMBER2017	

HERNANDEZ F: \\SPL\DOCUMENTS\GEOTECH\YANG\PORT OF LB\REPORT\FIGURES_PLATES\C-4 GPOLC_D11.DGN

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Class A Stone	111	0	45
	Clay Core	110	1,000	0
	Class B Stone	120	0	45
	Foundations Soils	119	1,200	11
	Sand Core	110	0	30



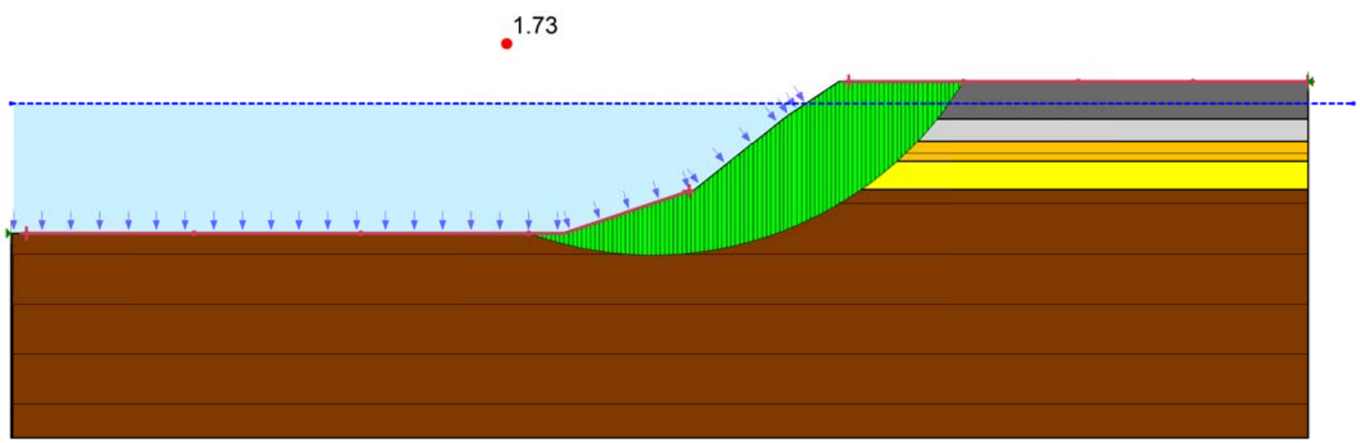
MIDDLE BREAKWATER - STAND OFF 200 FEET YIELD ACCELERATION

LOS ANGELES AND LONG BEACH HARBOR, CALIFORNIA
NAVIGATION IMPROVEMENTS
PORT OF LONG BEACH
DREDGING SLOPE STABILITY
MIDDLE BREAKWATER
STANDOFF 200FT YIELD ACCELERATION

US Army Corps of Engineers ®
Los Angeles District

CKD BY: JY/MR	PLATE
DWN BY: EH	D12
DATE:NOVEMBER2017	

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Class A Stone	111	0	45
	Clay Core	110	1,000	0
	Class B Stone	120	0	45
	Foundations Soils	136	1,200	9
	Sand Core	110	0	30



LONG BEACH BREAKWATER - NO STANDOFF - STATIC

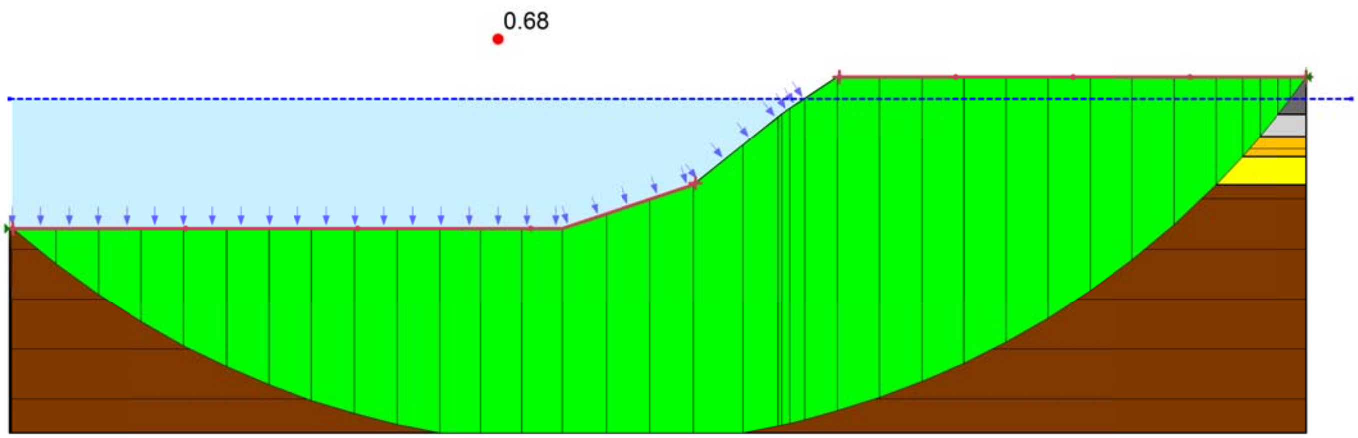
LOS ANGELES AND LONG BEACH HARBOR, CALIFORNIA
NAVIGATION IMPROVEMENTS
PORT OF LONG BEACH
DREDGING SLOPE STABILITY
LONG BEACH BREAKWATER
NO STANDOFF STATIC

US Army Corps of Engineers ®
Los Angeles District

CKD BY: JY/MR	PLATE	
DWN BY: EH	D13	
DATE:NOVEMBER2017		

HERNANDEZ F: \\SPL\DOCUMENTS\GEOTECH\YANG\PORT OF LB\REPORT\FIGURES_PLATES\C-4 GPOLC_D13.DGN

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Class A Stone	111	0	45
	Clay Core	110	1,000	0
	Class B Stone	120	0	45
	Foundations Soils	136	1,200	9
	Sand Core	110	0	30



LONG BEACH BREAKWATER - NO STANDOFF - SEISMIC

LOS ANGELES AND LONG BEACH HARBOR, CALIFORNIA
NAVIGATION IMPROVEMENTS
PORT OF LONG BEACH
DREDGING SLOPE STABILITY
LONG BEACH BREAKWATER
NO STANDOFF SEISMIC

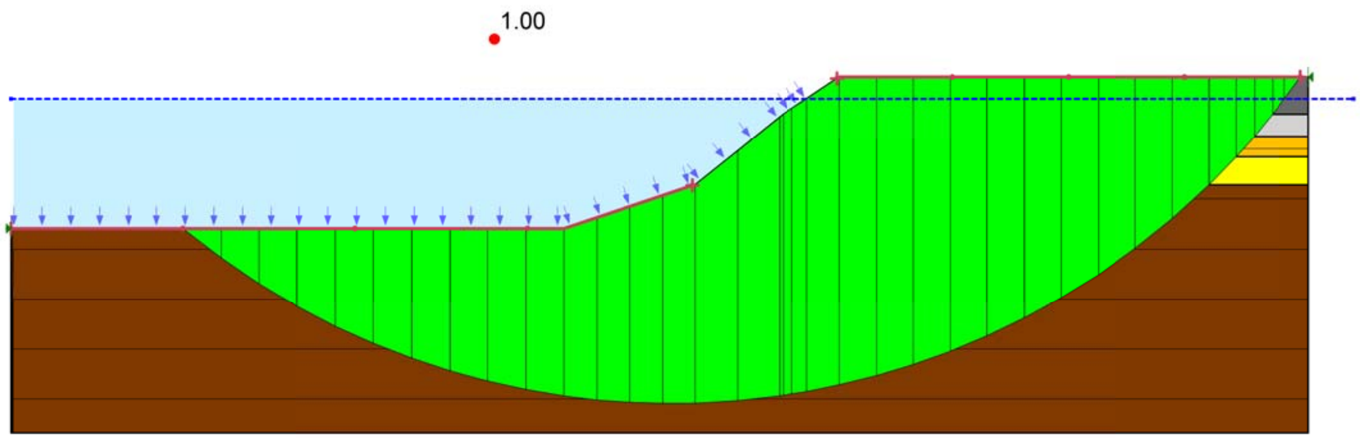
US Army Corps of Engineers ®
Los Angeles District

CKD BY: JY/MR
DWN BY: EH
DATE:NOVEMBER2017

PLATE
D14

HERNANDEZ F: \\SPL\DOCUMENTS\GEOTECH\YANG\PORT OF LB\REPORT\FIGURES_PLATES\C-4 GPOLC_D14.DGN

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Class A Stone	111	0	45
	Clay Core	110	1,000	0
	Class B Stone	120	0	45
	Foundations Soils	136	1,200	9
	Sand Core	110	0	30



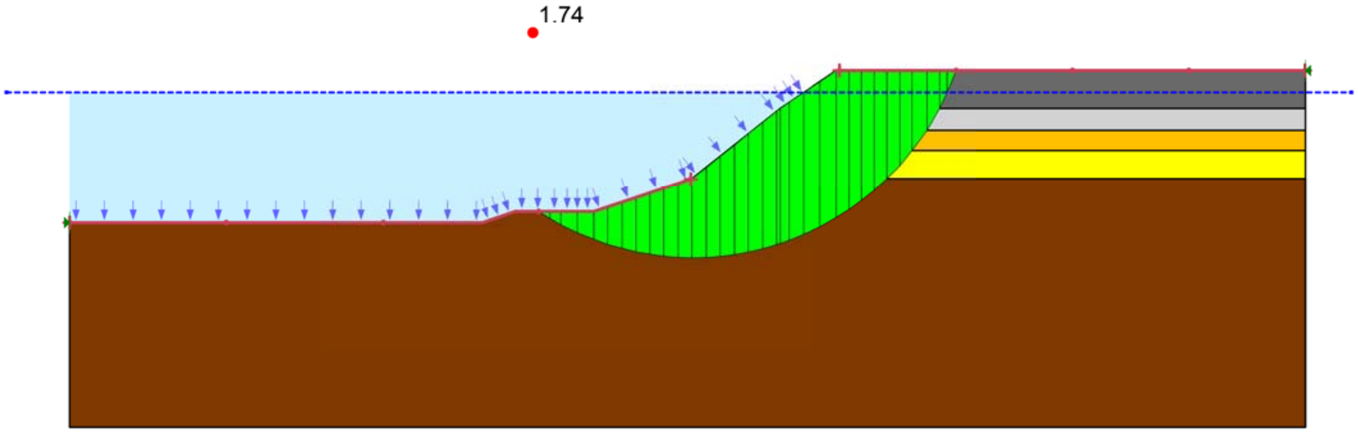
LONG BEACH BREAKWATER - NO STANDOFF
YIELD ACCELERATION

LOS ANGELES AND LONG BEACH HARBOR, CALIFORNIA
NAVIGATION IMPROVEMENTS
PORT OF LONG BEACH
DREDGING SLOPE STABILITY
LONG BEACH BREAKWATER
NO STANDOFF YIELD ACCELERATION

US Army Corps of Engineers ®
Los Angeles District

CKD BY: JY/MR	PLATE
DWN BY: EH	D15
DATE:NOVEMBER2017	

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Class A Stone	111	0	45
	Clay Core	110	1,000	0
	Class B Stone	120	0	45
	Foundations Soils	136	1,200	9
	Sand Core	110	0	30



LONG BEACH BREAKWATER - STANDOFF 50 FEET
STATIC

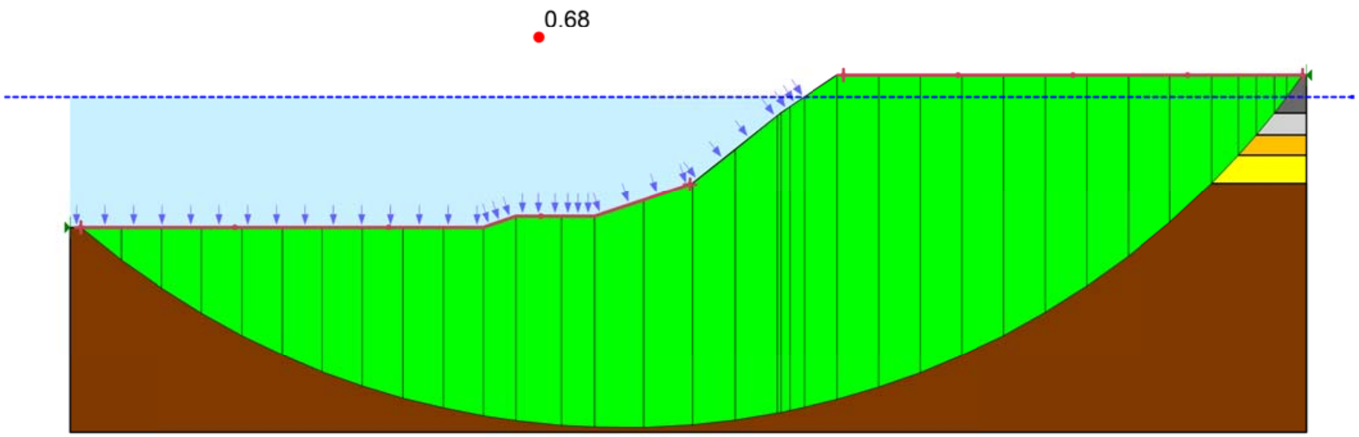
LOS ANGELES AND LONG BEACH HARBOR, CALIFORNIA
NAVIGATION IMPROVEMENTS
PORT OF LONG BEACH
DREDGING SLOPE STABILITY
LONG BEACH BREAKWATER
STANDOFF 50FT STATIC

US Army Corps of Engineers ®
Los Angeles District

CKD BY: JY/MR	PLATE
DWN BY: EH	D16
DATE:NOVEMBER2017	

HERNANDEZ F: \\SPL\DOCUMENTS\GEOTECH\YANG\PORT OF LB\REPORT\FIGURES_PLATES\C-4 GPOLC_D16.DGN

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Class A Stone	111	0	45
	Clay Core	110	1,000	0
	Class B Stone	120	0	45
	Foundations Soils	136	1,200	9
	Sand Core	110	0	30



LONG BEACH BREAKWATER - STANDOFF 50 FEET
SEISMIC

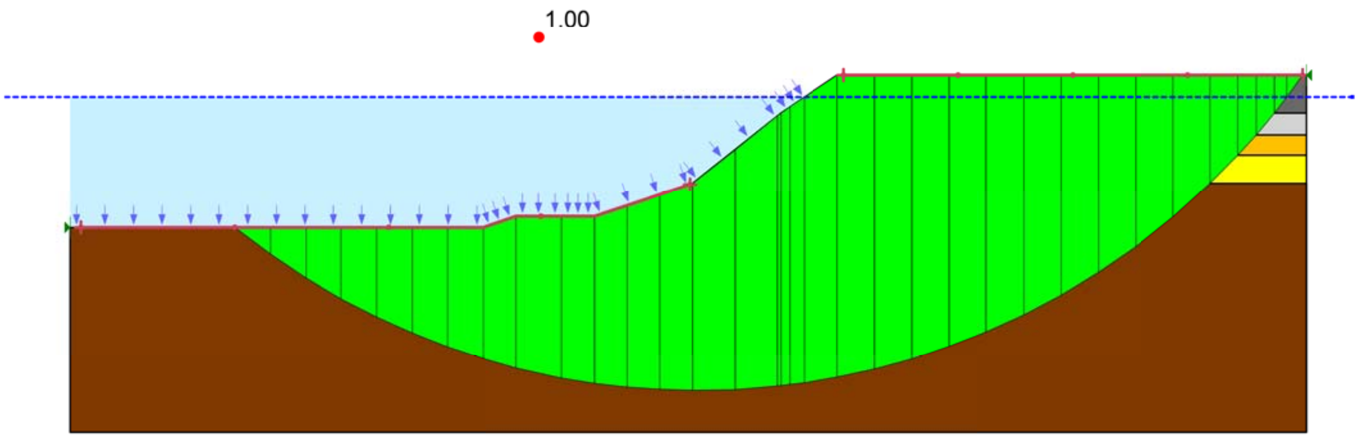
LOS ANGELES AND LONG BEACH HARBOR, CALIFORNIA
NAVIGATION IMPROVEMENTS
PORT OF LONG BEACH
DREDGING SLOPE STABILITY
LONG BEACH BREAKWATER
STANDOFF 50FT SEISMIC

US Army Corps of Engineers ®
Los Angeles District

CKD BY: JY/MR	PLATE
DWN BY: EH	17
DATE:NOVEMBER2017	

HERNANDEZ F: \\SPL\DOCUMENTS\GEOTECH\YANG\PORT OF LB\REPORT\FIGURES_PLATES\C-4 GPOLC_D17.DGN

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Class A Stone	111	0	45
	Clay Core	110	1,000	0
	Class B Stone	120	0	45
	Foundations Soils	136	1,200	9
	Sand Core	110	0	30



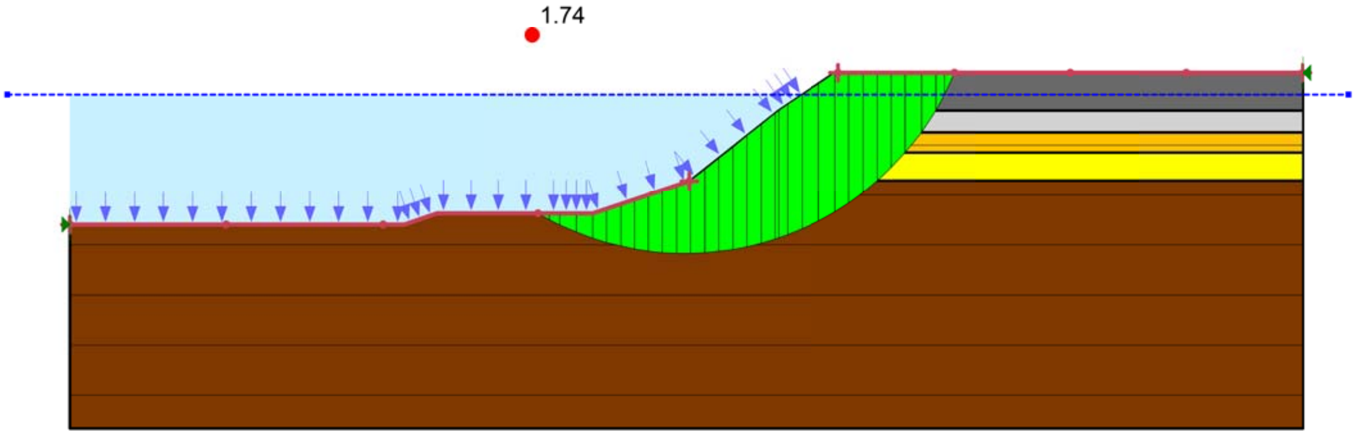
LONG BEACH BREAKWATER - STANDOFF 50 FEET
YIELD ACCELERTATION

LOS ANGELES AND LONG BEACH HARBOR, CALIFORNIA
NAVIGATION IMPROVEMENTS
PORT OF LONG BEACH
DREDGING SLOPE STABILITY
LONG BEACH BREAKWATER
STANDOFF 50FT YIELD ACCELERATION

US Army Corps of Engineers ®
Los Angeles District

CKD BY: JY/MR	PLATE
DWN BY: EH	D18
DATE:NOVEMBER2017	

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Class A Stone	111	0	45
	Clay Core	110	1,000	0
	Class B Stone	120	0	45
	Foundations Soils	136	1,200	9
	Sand Core	110	0	30



LONG BEACH BREAKWATER - STANDOFF 100 FEET STATIC

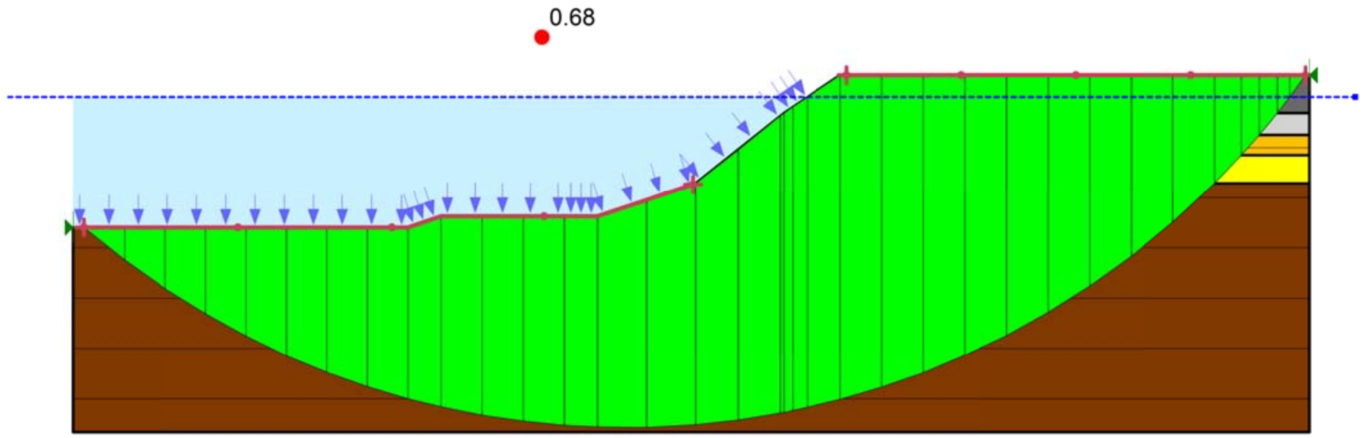
LOS ANGELES AND LONG BEACH HARBOR, CALIFORNIA
NAVIGATION IMPROVEMENTS
PORT OF LONG BEACH
DREDGING SLOPE STABILITY
LONG BEACH BREAKWATER
STANDOFF 100FT STATIC

US Army Corps of Engineers ®
Los Angeles District

CKD BY: JY/MR	PLATE
DWN BY: EH	D19
DATE:NOVEMBER2017	

HERNANDEZ F: \\SPL\DOCUMENTS\GEOTECH\YANG\PORT OF LB\REPORT\FIGURES_PLATES\C-4 GPOLC_D19.DGN

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Class A Stone	111	0	45
	Clay Core	110	1,000	0
	Class B Stone	120	0	45
	Foundations Soils	136	1,200	9
	Sand Core	110	0	30



LONG BEACH BREAKWATER - STANDOFF 100 FEET
SEISMIC

LOS ANGELES AND LONG BEACH HARBOR, CALIFORNIA
NAVIGATION IMPROVEMENTS

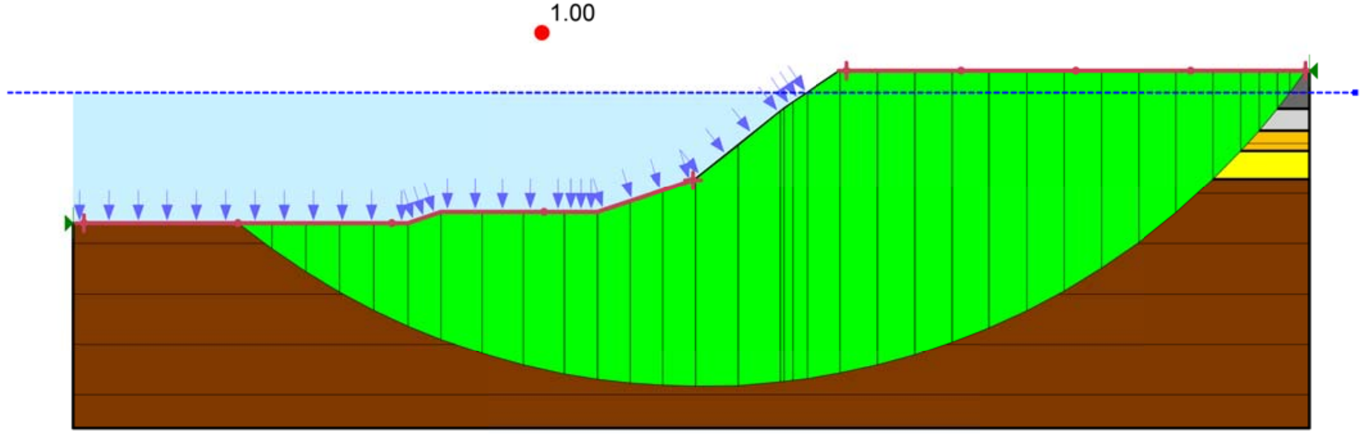
PORT OF LONG BEACH

DREDGING SLOPE STABILITY
LONG BEACH BREAKWATER
STANDOFF 100FT SEISMIC

US Army Corps of Engineers ®
Los Angeles District

CKD BY: JY/MR	PLATE
DWN BY: EH	
DATE:NOVEMBER2017	20

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Class A Stone	111	0	45
	Clay Core	110	1,000	0
	Class B Stone	120	0	45
	Foundations Soils	136	1,200	9
	Sand Core	110	0	30



LONG BEACH BREAKWATER - STANDOFF 100 FEET YIELD ACCELERATION

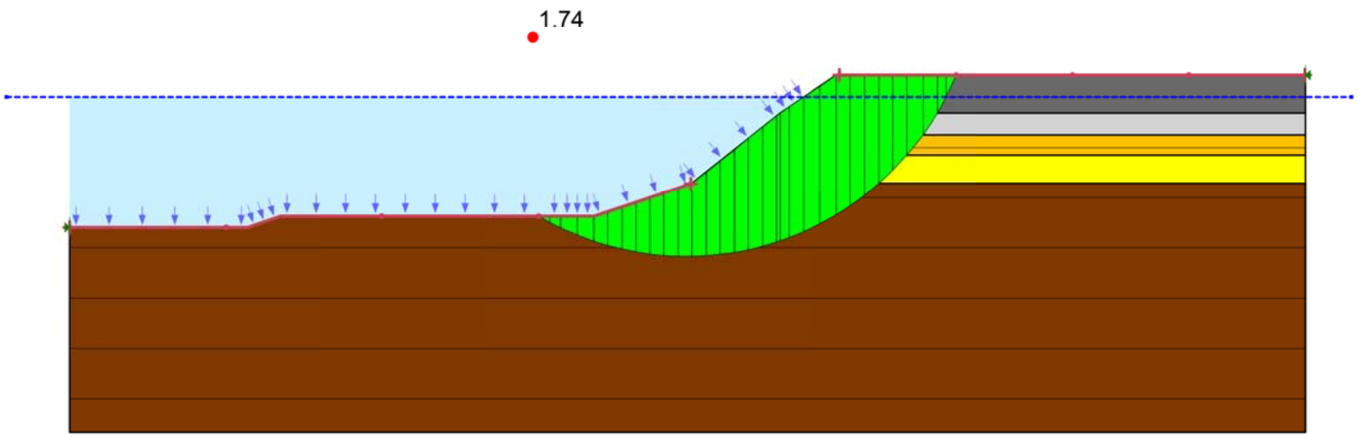
LOS ANGELES AND LONG BEACH HARBOR, CALIFORNIA
NAVIGATION IMPROVEMENTS
PORT OF LONG BEACH
DREDGING SLOPE STABILITY
LONG BEACH BREAKWATER
STANDOFF 100FT YIELD ACCELERATION

US Army Corps of Engineers ®
Los Angeles District

CKD BY: JY/MR	PLATE
DWN BY: EH	D21
DATE:NOVEMBER2017	

HERNANDEZ F: \\SPL\DOCUMENTS\GEOTECH\YANG\PORT OF LB\REPORT\FIGURES_PLATES\C-4 GPOLC_D21.DGN

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Class A Stone	111	0	45
	Clay Core	110	1,000	0
	Class B Stone	120	0	45
	Foundations Soils	136	1,200	9
	Sand Core	110	0	30



LONG BEACH BREAKWATER - STANDOFF 200 FEET
STATIC

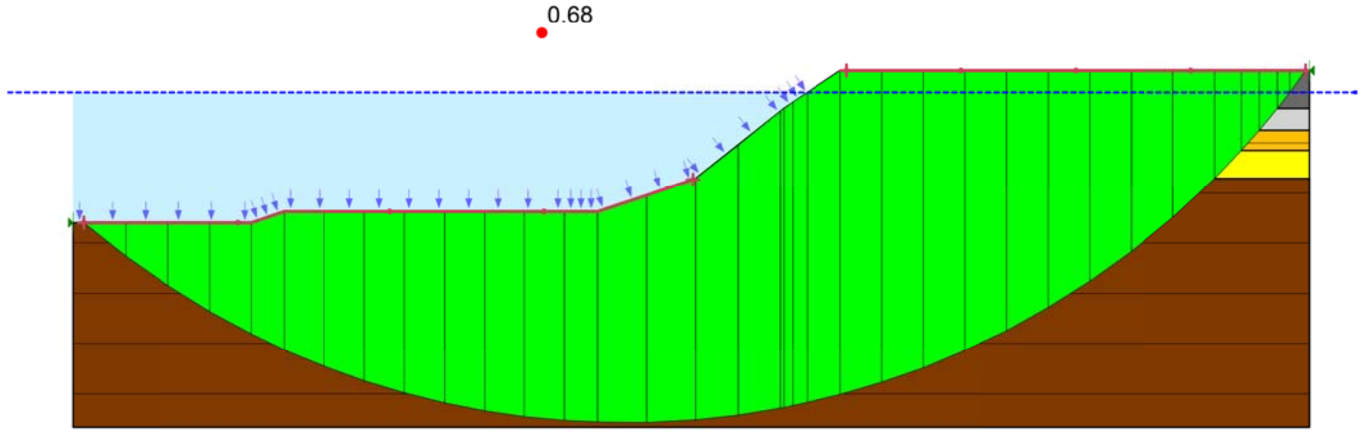
LOS ANGELES AND LONG BEACH HARBOR, CALIFORNIA
NAVIGATION IMPROVEMENTS
PORT OF LONG BEACH
DREDGING SLOPE STABILITY
LONG BEACH BREAKWATER
STANDOFF 200FT STATIC

US Army Corps of Engineers ®
Los Angeles District

CKD BY: JY/MR
DWN BY: EH
DATE:NOVEMBER2017

PLATE
D22

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Class A Stone	111	0	45
	Clay Core	110	1,000	0
	Class B Stone	120	0	45
	Foundations Soils	136	1,200	9
	Sand Core	110	0	30



LONG BEACH BREAKWATER - STANDOFF 200 FEET
SEISMIC

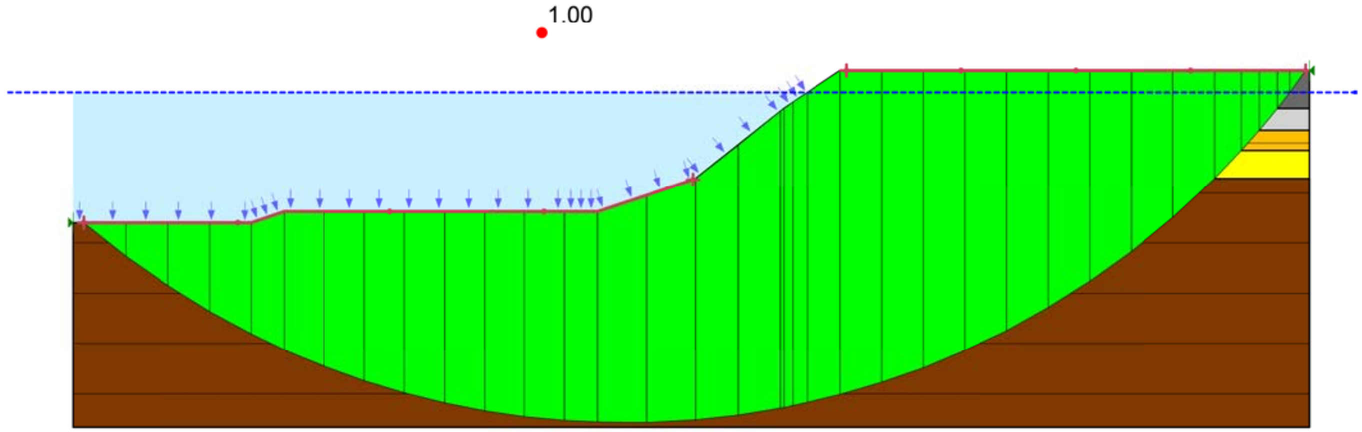
LOS ANGELES AND LONG BEACH HARBOR, CALIFORNIA
NAVIGATION IMPROVEMENTS
PORT OF LONG BEACH
DREDGING SLOPE STABILITY
LONG BEACH BREAKWATER
STANDOFF 200FT SEISMIC

US Army Corps of Engineers ®
Los Angeles District

CKD BY: JY/MR	PLATE
DWN BY: EH	D23
DATE:NOVEMBER2017	

HERNANDEZ F: \\SPL\DOCUMENTS\GEOTECH\YANG\PORT OF LB\REPORT\FIGURES_PLATES\C-4 GPOLC_D23.DGN

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Class A Stone	111	0	45
	Clay Core	110	1,000	0
	Class B Stone	120	0	45
	Foundations Soils	136	1,200	9
	Sand Core	110	0	30



LONG BEACH BREAKWATER - STANDOFF 200 FEET
YIELD ACCELERATION

LOS ANGELES AND LONG BEACH HARBOR, CALIFORNIA
NAVIGATION IMPROVEMENTS

PORT OF LONG BEACH

DREDGING SLOPE STABILITY
LONG BEACH BREAKWATER
STANDOFF 200FT YIELD ACCELERATION

US Army Corps of Engineers ®
Los Angeles District

CKD BY: JY/MR	PLATE
DWN BY: EH	D24
DATE:NOVEMBER2017	

HERNANDEZ F: \\SPL\DOCUMENTS\GEOTECH\YANG\PORT OF LB\REPORT\FIGURES_PLATES\C-4 GPOLC_D24.DGN

DRAFT INTEGRATED FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT STATEMENT / ENVIRONMENTAL IMPACT REPORT (EIS/EIR)

APPENDIX D: 404(b)(1)

PORT OF LONG BEACH
DEEP DRAFT NAVIGATION STUDY
Los Angeles County, California

October 2019

US Army Corps of Engineers®

Port of LONG BEACH
The Green Port

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THE EVALUATION OF THE EFFECTS OF THE DISCHARGE OF DREDGED OR FILL MATERIAL INTO THE WATERS OF THE UNITED STATES IN SUPPORT OF THE INTEGRATED FEASIBILITY REPORT FOR PORT OF LONG BEACH DEEP DRAFT NAVIGATION STUDY LONG BEACH, CALIFORNIA

INTRODUCTION. The following evaluation is provided in accordance with Section 404(b)(1) of the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500) as amended by the Clean Water Act of 1977 (Public Law 95-217). Its intent is to succinctly state and evaluate information regarding the effects of discharge of dredged or fill material into the waters of the U.S. As such, it is not meant to stand-alone and relies heavily upon information provided in the environmental document to which it is attached. Citation in brackets [] refer to expanded discussion found in the Draft Integrated Feasibility Report (Draft IFR), to which the reader should refer for details.

I. Project Description [1.1]

a. Location: [1.6] The Port of Long Beach is located in the city of Long Beach in the central portion of San Pedro Bay.

b. General Description: [1.2; 9.1] The proposed project is part of a continued effort to improve navigational efficiency and vessel safety throughout the Port of Long Beach (POLB).

   The combination of measures for container vessels (constructing the Pier J Approach Channel and Turning Basin, and deepening the West Basin Channel to a new depth of -55' MLLW) and liquid bulk vessels (deepening the Approach Channel to -80' MLLW, and widening portions of the Main Channel to match the currently authorized depth in the Main Channel of -76' MLLW) represents the General Navigation Features of the Tentatively Selected Plan (Alternative 3). Local features to be constructed by the POLB to fully realize benefits from the General Navigation Features include dredging of the Pier J South Basin and wharves.

   Total dredging is approximately 7,359,000 cubic yards (cy). Table 1 displays the approximate dredging volumes by location.

Table 1 Dredging Volume by Location

Dredge Location	Dredge Depth (ft MLLW)	Dredge Quantity (CY)
Approach Channel	-80	2,600,000
Main Channel Widening	-76	1,065,000
West Basin	-55	717,000
Pier J Approach	-55	2,673,000
Pier J Basin (Port Responsibility)	-55	304,000
Total Dredge Volume:		**7,359,000**

Dredged material would be placed in a nearshore placement site (i.e., Surfside Borrow Site) and disposed of at the LA-2 and LA-3 ocean-dredged material disposal sites (ODMDS). The nearshore placement site, approximately 5 miles from the project, can accommodate about 2.5 million cubic yards (mcy) of dredged material. LA-2 and LA-3, approximately 9 miles and 22 miles, respectively, from the project site, have an annual disposal volume limit of 1.0 and 2.5 mcy, respectively, from all sources. It is assumed that 0.9 mcy for LA-2 and 2.2 mcy for LA-3 is available for use by this project each year. The approximate duration of the Tentatively Selected Plan is approximately 28 months. Placement of dredged material from the Approach Channel at the nearshore placement site would occur over the first 5 months of dredging and would place approximately 2,500,000 cy. Dredging of the remaining areas would begin at the same time extending over the full duration of 28 months. Approximately 2,479,000 cy would be placed at the LA-2 ODMDS; approximately 2,380,000 cy would be placed at the LA-3 ODMDS (refer to Table 2). Disposal at the two ODMDS are outside the Clean Water Act authority and will not be addressed further in this Evaluation. All of the sediments proposed for fill in the nearshore placement area would come from the Approach Channel and the Evaluation below will be confined to this area.

Table 2 Approximate Construction Equipment, Disposal Location, and Duration

Yr	Dredge Location	Dredge Quantity (CY)	Dredge Material Disposal Location	Dredge Disposal Location Capacity (CY)	Dredge Type	Dredge Rate (CY/day)	Dredging Days Required (days)
1	Approach Channel	2,600,000	Nearshore	2,500,000	Hopper	17,500	143
			LA2	100,000	Hopper	15,100	7
	Main Channel Widening	1,065,000	LA2	800,000	Clamshell	6,000	133
			LA3	265,000	Clamshell	6,000	44
	West Basin	717,000	LA3	717,000	Clamshell	6,000	120
	Pier J Basin	258,000	LA3	258,000	Clamshell	6,000	43
2	Pier J Basin	46,000	LA2	46,000	Clamshell	6,000	8
	Pier J Approach	1,994,000	LA2	854,000	Clamshell	6,000	142
			LA3	1,140,000	Clamshell	6,000	190
3	Pier J Approach	679,000	LA2	679,000	Clamshell	6,000	113

At the entrance to Pier J, the deepened channel would pass adjacent to existing breakwaters. In order to protect these existing structures, the top of the deepened channel could be kept away from the toe of the existing marine structures by a "standoff" distance. It would be impractical to incorporate a standoff given the limited channel width and some type of improvement would be required to stabilize the structures. The most likely breakwater stabilization method would be submerged bulkhead walls of steel sheet pile structures with rock being required for scour protection in front of the wall and rock possibly being required for slope stability behind the wall.

c. Basic and Overall Purpose. [1.4] The basic project purpose is navigation. The overall project purpose is to increase transportation efficiencies, during the period of analysis, for container and liquid bulk vessels operating in the POLB, for both the current and future fleet, and to improve conditions for vessel operations and safety, including reducing constraints of harbor pilot operating practices.

d. General Description of Dredged or Fill Material: [3.1 & 3.3, Appendix C]

(1) General Characteristics of Material (grain size, soil type): A sediment sampling program was conducted in 2018 to support maintenance dredging in the Approach Channel. While the areas and depths do not correspond to the proposed deepening in the Approach Channel, results provide information that is expected to be similar to or worse then what we expect to find in the proposed deepening area. That is because most of the deepening will entail dredging of virgin sediments that have never been dredged before with the underlying assumption that these sediments are clean. POLB Approach Channel locations were sampled and identified as being silty sand. The weighted average composite sand content for the dredge area as a whole was 55%. Overall analyte concentrations in the POLB Approach Channel area composite sample were below detection limits or low compared to NOAA effects based screening values and LA-2 reference concentrations. The only constituents detected above NOAA ERL values were total DDT and 4,4’-DDE, which were also elevated above ERL values in the LA-2 reference sample. There were no sample values that exceeded a NOAA ERM value. Low levels of metals and some PAH compounds were the only other constituents reported above a laboratory reporting limit. None of the sediments were toxic based on bioassay testing. Sediments were determined to be suitable for ocean disposal. Based on these results, the sediments in the deepening area should be compatible with the nearshore placement site and contaminants levels should represent minimal threat to the marine benthic environment. Clean, quarry-run rock would be used to support the Pier J jetty stabilization efforts. Rock would be free from contaminants and fine-grained sediments.

(2) Quantity of Material: Approximately 2,500,000 cy of sediments dredged from the project area would be placed in the Surfside Borrow Site Nearshore Placement Area. The range of rock used for the Pier J breakwater stabilization varies between the differing seismic options is approximately 1,500 tons to 29,000 tons. The 1,500 tons was reflective of armor only being needed for scour protection in front of the new bulkhead wall, with the 29,000 tons being required for scour protection in front of the wall and rock being required for slope stability behind the wall. Exact quantities would be determined during PED.

(3) Source Material: Approach Channel of Port of Long Beach harbor. Quarry run rock for the Pier J jetty stabilization would likely come from the quarry on Santa Catalina Island, although inland quarries would also be considered depending on quantities needed and availability to the selected construction contractor.

e. Description of the Proposed Discharge Site:

(1) Suitable dredged material would be placed in the nearshore area of the Surfside Borrow Site. The characteristic habitat type subject to impact by dredge material discharge is open-coast sandy beach. The site is a borrow pit created by historic beach fill projects at Surfside and Sunset Beach for purposes of storm damage reduction. Current bottom elevations in the pit range from -55’ to -65’ MLLW in an area averaging -35’ to -50’ MLLW. Proposed fill depths would result in a final depth of no shallower than approximately –45’ MLLW across the site. The pier J jetty stabilization site is soft bottom habitat adjacent to the rocky jetties.

(2) Size (acres): Suitable dredged material would be placed in an approximately 195 acre site. The Pier J jetty stabilization site is approximately 0.6 acres.

(3) Type of Site (confined, unconfined, open water): Unconfined, open water.

Types of Habitat: nearshore placement site is offshore of a typical southern California sandy beach. Bottom type is poorly graded, fine to medium sands. The borrow pit is expected to harbor a degraded benthic community, as shown in other nearby borrow pits, as a result of reduced water circulation and lowered dissolved oxygen levels.

f. Description of Disposal Method: [9.1] Material would be dredged and transported via hopper dredge for all sediments placed in the Surfside Borrow Site Nearshore Placement Area. Rock placed at the Pier J jetty stabilization would be placed by crane from a rock barge.

II. Factual Determinations**.**

a. Physical Substrate Determinations:

(1) Substrate Elevation and Slope:

Current bottom elevations in the Surfside Borrow Site Nearshore Placement Area range from -55’ to -65’ MLLW. The area is relatively flat with stable side slopes that have existed since the borrow pit was dredged in 2009. The proposed project is expected to fill in the borrow site to match surrounding bathymetry. The Pier J jetty stabilization site is on a slope adjacent to the jetties at approximately -45 feet MLLW.

(2) Sediment Type.

Geotechnical studies indicate that the sediment consists primarily of poorly graded, fine to medium sands. Suitable sediments are expected to be compatible with existing borrow site materials, a sediment testing program would be conducted during the PED Phase to ensure compatibility.

(3) Dredged Material Movement.

Suitable dredged material would be placed into the Surfside Borrow Site Nearshore Placement Area. The area experiences low levels of sand movement, as evidenced by the continued existence of the borrow pits ten years after sand borrowed was placed on nearby beaches. Sediments are not expected to move, but are expected to restore pre-borrow bathymetry.

(4) Physical Effects on Benthos (burial, changes in sediment type, etc.).

Temporary, short-term adverse impacts would occur. The placement area would bury benthic organisms. Recolonization would be expected to occur quickly. Minor turbidity levels may exist in the immediate vicinity of the placement operations that may result in minor, temporary reductions in dissolved oxygen. Rock placed at the Pier J jetty stabilization site would transition from soft bottom to rocky reef habitat. No long-term adverse effects are expected.

(5) Other Effects. The resulting bathymetry is expected to support a more diverse, populous community that would be equivalent to the surrounding area.

(6) Actions Taken to Minimize Impacts (Subpart H).

Needed: X YES NO

Monitoring of water quality to control turbidity and to monitor for possible resuspension of contaminants during disposal would occur. If turbidity exceeds set standards and/or dissolved oxygen fall below a set standard of 5 mg/l, disposal would be evaluated and modifications made to get back into compliance.

If needed, Taken:____X YES______NO

A water quality monitoring plan will be part of the construction contract and will be coordinated with the Regional Water Quality Control Board, Los Angeles Region.

b. Water Circulation, Fluctuation, and Salinity Determinations

(1) Water (refer to 40 CFR sections 230.11(b), 230.22 Water, and 230.25 Salinity Gradients; test specified in Subpart G may be required). Consider effects on salinity, water chemistry, clarity, odor, taste, dissolved gas levels, nutrients, eutrophication, others.

Placement of dredged material in the nearshore area of the Surfside Borrow Site is not expected to significantly affect water circulation, fluctuation, and/or salinity. Only clean, compatible sands from the project would be used for the nearshore placement. These sands are not a source of contaminants. Minor turbidity levels may exist in the immediate vicinity of the placement operations that may result in minor, temporary reductions in dissolved oxygen. Sands will not be a source of nutrients, thus eutrophication is not expected to result. Water used to entrain sands would be sea water as is water adjacent to nearshore placement, thus there will be no effect on salinity levels.

(2) Current Patterns and Circulation (consider items in sections 230.11(b), and 230.23), Current Flow, and Water Circulation.

Placement of dredged material in the nearshore area is not expected to significantly affect circulation. Placement of material would result in minor, localized changes to circulation patterns within the area. However, long-term beneficial effects to current patterns or circulation are anticipated to occur.

(3) Normal Water Level Fluctuations (tides, river stage, etc.) (consider items in sections 230.11(b) and 230.24)

Placement of dredged material in the nearshore area is not expected to have a significant impact on normal water level fluctuations. There would no change to tidal elevations, which is determined by access to the open ocean, which would not be changed.

(4) Salinity Gradients (consider items in sections 230.11(b) and230.25)

Placement of dredged material in the nearshore area is not expected to have any impact on normal water salinity nor is it expected to create salinity gradients. Sands and water used to entrain sands would be sea water as is water adjacent to the Surfside Borrow Site Nearshore Placement Area, thus there will be no creation of salinity gradients.

(5) Actions That Will Be Taken to Minimize Impacts (refer to SubpartH)

Needed: X____YES _ NO
If needed, Taken: X____YES___ NO

All nearshore placement operations would be monitored for effects on water quality, including turbidity, temperature, salinity, dissolved oxygen, and pH; monthly water samples will be taken and analyzed for total dissolved solids and TRPH. Best management practices would be implemented if turbidity and/or dissolved oxygen exceeds water quality criteria.

c. Suspended Particulate/Turbidity Determinations

(1) Expected Changes in Suspended Particulates and Turbidity Levels in Vicinity of Disposal Site (consider items in sections 230.11(c) and 230.21)

Placement of sediments generally results in negligible impacts to water quality from turbidity. Impacts would be temporary and adverse, but not significant. This is expected to be highly localized and visually indistinguishable from normal turbidity levels. The area is expected to return to background after placement ceases. Water quality monitoring during placement will allow USACE to modify operations (such as by slowing rate of discharge) until any water quality problems abate.

(2) Effects (degree and duration) on Chemical and Physical Properties of the Water Column (consider environmental values in section 230.21, as appropriate)

Only clean, sandy sediment would be placed in the nearshore area. Minor turbidity levels may exist in the immediate vicinity of the placement operations that may result in minor, temporary reductions in dissolved oxygen.

(3) Effects on Biota (consider environmental values in sections 230.21, as appropriate).

Biota buried during disposal are expected to recolonize over the short term. Filling in the borrow pit is expected to result in improved benthic communities due to increased water circulation and higher levels of dissolved oxygen. Impacts will be temporary and adverse, but not significant.

(4) Actions taken to Minimize Impacts (Subpart H)

Needed: X YES _ NO
If needed, Taken: _X___YES__ _ NO

Monitoring of water quality to control turbidity during placement would occur. If turbidity exceeds set standards and/or dissolved oxygen exceeds water quality criteria, disposal would be evaluated and modifications made to get back into compliance.

A water quality monitoring plan will be part of the construction contract and will be coordinated with the Regional Water Quality Control Board, Los Angeles Region.

d. Contaminant Determinations (consider requirements in section 230.11(d)): The following information has been considered in evaluating the biological availability of possible contaminants in dredged or fill material. (Check only those appropriate.)

(1) Physical characteristics _X_

(2) Hydrography in relation to known or anticipated sources of contaminants _X_

(3) Results from previous testing of the material or similar material in the vicinity of the proposed project _X_

(4) Known, significant sources of contaminants (e.g. pesticides) from land runoff or percolation ______

(5) Spill records for petroleum products or designated (Section 311 of the CWA) hazardous substances

(6) Other public records of significant introduction of contaminants from industries, municipalities, or other sources

(7) Known existence of substantial material deposits of substances which could be released in harmful quantities to the aquatic environment by man- induced discharge activities

(8) Other sources (specify) X

An evaluation of historic sediment testing indicates that the proposed dredged material is not a carrier of contaminants and that levels of contaminants are substantively similar in the extraction and placement sites and are not likely to be constraints.

e. Aquatic Ecosystem and Organism Determinations (use evaluation and testing procedures in Subpart G, as appropriate).

(1) Plankton, Benthos and Nekton

Disposal operations would result in short-term turbidity impacts that would affect plankton in the area. Organisms could stifle in the immediate vicinity as these small organisms are impacted by turbidity. However, these effects would be small in both area and time and the plankton would be expected to recover quickly once disposal is completed. Benthic organisms would be buried by placement, but the areas would be minor in area and would quickly recolonize. Larger organisms in the nekton would be expected to avoid disposal operations and would not be impacted.

(2) Food Web

Impacts to the bottom of the food chain (plankton and nekton) would be short term and occur in a small area. Recovery would be quick once disposal operations are concluded.

(3) Special Aquatic Sites

There are no special aquatic sites in the project area.

(4) Threatened & Endangered Species

There would be no effect to any listed threatened or endangered species or to their designated critical habitat. The federally listed endangered California least tern

(*Sternula antillarum browni*) is a migratory bird. California least terns predominately nest on coastal foredunes and other sites with gravelly or sandy substrate and sparse vegetation. Because terns would abandon nests if disturbed, they require nest areas relatively free of human disturbance and predators. The historical habitat of the California least tern has been significantly reduced and modified by human activities including marine and industrial development and residential development along beaches. This loss of habitat has resulted in small isolated breeding colonies that are vulnerable to local extirpation. Primary threats to California least tern populations include increased predation and recreation-related disturbances. California least terns arrive and move through the harbor area in late April and utilize nest areas in Los Angeles County from mid-May through August. Although nesting does not occurin the vicinity of the Surfside-Sunset Borrow Site Nearshore Placement Area, other areas in the region provide suitable habitat. These areas include Pier 400 in the Port of Los Angeles to the west. California least terns have been observed foraging San Pedro Bay and could forage in waters of the placement area during the breeding season. Because the placement area is routinely subject to elevated noise and activity of workers and equipment associated with common commercial and military practices, short-term project-related disturbances are not expected to effect the foraging and nesting of least terns.

(5) Other fish and wildlife:

Marine mammals would not be affected by placement activities. Birds would generally avoid the placement site, although placement could attract birds to the benthic organisms coming out of the hopper dredge as an alternate food source.

(6) Actions to Minimize Impacts (refer to Subpart H)

Needed:__X__________YES NO

Monitor and control turbidity to minimize impacts to plankton and nekton.

f. Proposed Disposal Site Determinations

(1) Mixing Zone Determination (consider factors in section 230.11(f)(2))

Is the mixing zone for each disposal site confined to the smallest practicable zone?
__X_ YES_NO

Sediments do not require a mixing zone in order to remain in compliance with water quality standards. As such, the mixing zone is considered to be the smallest practicable.

(2) Determination of Compliance with Applicable Water Quality Standards (present the standards and rationale for compliance or non-compliance with each standard)

The project will be in compliance with state water quality standards. Placement of material at the receiver site would result in short-term elevated turbidity levels and suspended sediment concentrations, but no appreciable long-term changes in other water quality parameters, including dissolved oxygen, pH, nutrients, or chemical contaminants. Factors considered in this assessment include the relatively localized nature of the expected turbidity plumes for the majority of the disposal/placement period and rapid diluting capacity of the receiving environment. Water quality monitoring would be required as part of the overall project. If monitoring indicated that suspended particulate concentrations outside the zone of initial dilution exceeded permissible limits, disposal/placement operations would be modified to reduce turbidity to permissible levels. Therefore, impacts to water quality from disposal/placement of material at the receiver site would not violate water quality objectives or compromise beneficial uses listed in the Basin Plan. USACE will continue to coordinate with the Regional Water Quality Control Board during construction to minimize impacts to water quality.

(3) Potential Effects on Human Use Characteristic

(a) Municipal and Private Water Supply (refer to section 230.50)

There are no municipal or private water supply resources (i.e. aquifers, pipelines) in the nearshore area. Placement of dredged material in the nearshore area would have no effect on municipal or private water supplies or water conservation.

(b) Recreational and Commercial Fisheries (refer to section 230.51)

The harbor and nearshore areas are not subject to commercial fishing. Recreational fishing would move to avoid the placement activities and to follow fish out of these areas.

(c) Water Related Recreation (refer to section 230.52)

Construction equipment would be required to maintain ocean access for all uses. During placement activities, proper advanced notice to mariners would occur and navigational traffic would not be allowed within the nearshore placement discharge area. The displacement of recreational boating would be temporary and short-term. However, the nearshore placement activities would not significantly impact surfing conditions or other water sports once completed. The currents are not expected to change in magnitude or direction. Therefore, the nearshore placement activities is not expected to measurably change currents or change surfing in any discernible way. To minimize navigation impacts and threats to vessel safety, all floating equipment would be equipped with markings and lightings in accordance with the U.S. Coast Guard regulations. The location and schedule of the work would be published in the U.S. Coast Guard Local Notice to Mariners

In the long term, the nearshore placement would create a uniform benthic environment filling in the existing borrow pit, enhancing the benthic community. Pier J jetty stabilization efforts would create additional rocky reef habitat.

(d) Aesthetics (refer to section 230.53)

Minor, short term effects during placement are anticipated. During nearshore placement activities, the visual character of the site would be affected by the hopper dredge; however, nearshore placement is temporary, and as such, would not result in permanent effects to the visual character of the site. Placement of dredged material in the borrow pit would not result in any visible changes to the nearshore area.

(e) Parks, National and Historical Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves (refer to section 230.54)

Nearshore placement activities would not have any effect on national and historic monuments, national seashores, wild and scenic rivers, wilderness areas or research sites.

(f) Determination of Cumulative Effects on the Aquatic Ecosystem (consider requirements in section 230.11(g))

Cumulative effects were determined to be less than significant, refer to section 6 of the Integrated Feasibility Report.

(g) Determination of Secondary Effects on the Aquatic Ecosystem (consider requirements in section 230.11(h))

Secondary effects of the discharge of dredged or fill would be negligible. Areas outside the direct impact would have only negligible turbidity effects from disposal. Turbidity levels would be low and in the immediate vicinity of the disposal operations. Impacts of the federal action are all temporary construction impacts. Movement of sand downcoast would be indistinguishable from natural sand movement.

III. Findings of Compliance or Non-Compliance with the Restrictions on Discharge

a. Adaptation of the Section 404(b)(l) Guidelines to this Evaluation

No significant adaptations of the guidelines were made relative to this evaluation.

b. Evaluation of Availability of Practicable Alternatives to the Proposed Discharge Site Which Would Have Less Adverse Impact on the Aquatic Ecosystem:

All action alternatives evaluated in the Draft IFR include disposal of dredged material at this nearshore disposal area. Because Alternatives 2 would involve less dredging and disposal and a shorter construction period than the Tentatively Selected Plan, adverse impacts would be similar to but less than impacts for the Tentatively Selected Plan, and separate analyses have not been prepared. These alternatives would also provide fewer economic benefits than the Tentatively Selected Plan. Impacts of Alternatives 4 and 5 would have impacts similar to, but sometimes greater than the Tentatively Selected Plan. The Tentatively Selected Plan is the least environmentally damaging practicable alternative.

c. Compliance with Applicable State Water Quality Standards.

The proposed project meets State of California water quality standards.

d. Compliance with Applicable Toxic Effluent Standard or Prohibition Under Section 307 of the Clean Water Act.

No toxic materials/wastes are expected to be produced or introduced into the environment by nearshore placement.

e. Compliance with Endangered Species Act of 1973.

As discussed above, the USACE has determined the placement of dredged/fill material into the placement area or Pier J Jetty stabilization area would not have an effect on any species Federally-listed as threatened or endangered nor any designated critical habitat. Consultation pursuant to Section 7 of this Act is not required.

f. Compliance with Specified Protection Measures for Marine Sanctuaries Designated by the Marine Protection, Research, and Sanctuaries Act of 1972.

No sanctuaries as designated by the Marine Protection, Research and Sanctuaries Act of 1972 would be affected by the nearshore placement activities. A sediment test program would be conducted during PED to ensure that only suitable sediments are disposed of in the placement area, which will be coordinated with the SC-DMMT.

g. Evaluation of Extent of Degradation of the Waters of the United States

(1) Significant Adverse Effects on Human Health and Welfare

(a) Municipal and Private Water Supplies

Nearshore placement activities would have no significant adverse effects on municipal and private water supplies.

(b) Recreation and Commercial Fisheries

The proposed project will have minor, short-term impacts, but no significant adverse effects on recreation fisheries. The nearshore areas is not subject to commercial fishing. Recreational fishing would move to avoid the disposal activities and to follow fish out of these areas. To minimize navigation impacts and threats to vessel safety, all floating equipment would be equipped with markings and lightings in accordance with the U.S. Coast Guard regulations. The location and schedule of the work would be published in the U.S. Coast Guard Local Notice to Mariners.

(c) Plankton

Disposal operations would result in short-term turbidity impacts that would affect plankton in the area. Organisms could stifle in the immediate vicinity as these small organisms are impacted by turbidity. However, these effects would be small in both area and time and the plankton would be expected to recover quickly once disposal is completed.

(d) Fish

Larger organisms in the nekton would be expected to avoid disposal operations and would not be impacted.

(e) Shellfish

Benthic organisms, including shellfish, would be buried by disposal, but the areas would be minor in area and would quickly recolonize.

(f) Wildlife

Marine mammals would not be affected by disposal. Birds would generally avoid the disposal, although nearshore placement could attract birds to the benthic organisms coming out of the dredge pipe as an alternate food source.

(g) Special Aquatic Sites

There are no special aquatic sites in the project area.

(2) Significant Adverse Effects on Life Stages of Aquatic Life and Other Wildlife Dependent on Aquatic Ecosystems: Any adverse effects would be short-term and insignificant. Refer to section 5 of the Integrated Feasibility Report.

(3) Significant Adverse Effects on Aquatic Ecosystem Diversity, Productivity and Stability: Any adverse effects would be short-term and less than significant. Refer to section 5 of the Integrated Feasibility Report.

(4) Significant Adverse Effects on Recreational, Aesthetic, and Economic Values: Any adverse effects would be short-term and less than significant. Refer to section 5 of the

Integrated Feasibility Report.

h. Appropriate and Practicable Steps Taken to Minimize Potential Adverse Impacts of the Discharge on the Aquatic Ecosystem

Specific environmental commitments are outlined in the analysis above and in the attached Integrated Feasibility Report. All appropriate and practicable steps have been taken which will minimize potential adverse impacts of the discharge on the aquatic ecosystem.

i. On the Basis of the Guidelines, the Proposed Disposal Site(s) for the Discharge of Dredged or Fill Material (specify which) is:

The final 404(b)(1) evaluation and Findings of Compliance will be included with the final IFR.

__ (1) Specified as complying with the requirements of these guidelines; or,

______ (2) Specified as complying with the requirements of these guidelines, with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects on the aquatic ecosystem; or,

_____ (3) Specified as failing to comply with the requirements of these guidelines.

Prepared by: Larry Smith Date: DRAFT

DRAFT INTEGRATED FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT STATEMENT / ENVIRONMENTAL IMPACT REPORT (EIS/EIR)

APPENDIX E: ECONOMICS

PORT OF LONG BEACH
DEEP DRAFT NAVIGATION STUDY
Los Angeles County, California

October 2019

US Army Corps of Engineers ®

Port of LONG BEACH
The Green Port

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1 INTRODUCTION

This document presents the economic evaluations performed for the Port of Long Beach Deep Draft Navigation Feasibility Study. . This study serves as an interim response to the Resolution of the House Committee on Public Works adopted 10 July 1968 and in response to the Port of Long Beach's (POLB) request to the U.S. Army Corps of Engineers Los Angeles District (USACE) seeking Federal assistance to address on-going operating constraints to the efficient movement of goods through the port. The study is part of a continued effort to identify projects to improve navigational efficiency and vessel safety throughout the POLB. The USACE Los Angeles District, together with the Deep Draft Navigation Planning Center of Expertise, performed the economic analyses contained within this document in support of the feasibility study.

1.1 Study Purpose and Scope

The purpose of the study is to identify and evaluate alternatives to increase transportation efficiencies, for container and liquid bulk vessels operating in the Port of Long Beach, for both the current and future fleet, and to improve conditions for vessel operations and safety in the event of vessel malfunction or weather-related events. The scope of this feasibility study involves analysis of existing conditions and requirements, identifying opportunities for improvement, preparing economic analyses of alternatives, identifying environmental impacts, and analyzing the National Economic Development (NED) plan.

Navigational challenges identified include existing channel depths that do not meet the draft requirements of the current and future fleet of larger container and liquid bulk vessels. Tide restrictions, light loading, lightering, and other operational inefficiencies result in economic inefficiencies that translate into increased costs for the national economy at one of the nation's busiest ports. Container movements along the secondary channels serving Pier J and Pier T/West Basin, and liquid bulk vessel movements along the main channel have been identified as constrained by current conditions.

The concerns of POLB were used to develop the problem statements, study goals, and objectives for this study. The primary problem is the existing channel depths and widths that create limitation of the harbor, resulting in inefficient operation of deep draft vessels in the main channel (Federal) and secondary channels within the Port complex, which increases the Nation's transportation costs. The planning objectives are to 1) increase transportation efficiencies, during the period of analysis, for container and liquid bulk vessels operating in the Port of Long Beach, for both the current and future fleet, and to 2) improve conditions, during the period of analysis, for vessel operation and safety, including reducing constraints of harbor pilot operating practices.

Potential navigation improvements include deepening and bend easing of navigation channels, construction of a new approach channel, turning basins, and a standby area.

1.2 Document Layout

Section 2 details the existing conditions at the POLB. Sections 3 examines the future without project and the future with project conditions, and includes an evaluation and description of the trade forecast, port improvement projects, and the vessel fleet and operations at the harbor. Section 4 presents the transportation cost savings benefit analysis.

2 EXISTING CONDITIONS

The without project conditions, as well as benefits and costs for proposed alternatives, are evaluated over a 50-year period of analysis, beginning with a Base Year of 2027. The Base Year corresponds to the year in which it is reasonable to assume that construction of the chosen project alternative is complete and it begins to accrue benefits. These projections reflect existing conditions at the completion of the Feasibility Study, as well as anticipated changes in conditions throughout the period of analysis. This section focuses on existing conditions prior to the Base Year, while the following section focuses on the projections of relevant changes under future without project conditions.

The existing POLB channels have depths from -50 to -53 feet MLLW, limiting containerships to 44-49 foot draft with tide riding. Vessels have an additional 2-3 foot draft of usable tide with tide riding, however, tidal delays are also incurred depending on the time of day and pilot practices. Bar pilot limitations have led to offshore-waiting periods for large liquid bulk vessels until the one-way traffic in the main channel is cleared. This limitation has had a historic impact on 5-10% of crude oil imports, and a current impact on approximately 15% of crude oil imports. Current transportation inefficiencies for container and liquid bulk vessels will further be exacerbated by future fleet changes.

In the past century, the POLB has become a major transportation and trade hub and has gone through significant expansions which have provided for the shipping terminals for nearly one-third of the waterborne trade moving through the West Coast. Currently, trade valued at more than $194 billion is moving through the port, classifying the POLB as the second- busiest seaport in the United States. The port handles more than 7.5 million twenty-foot equivalent units (TEUs) and 82 million tons of cargo with top imports and exports, including crude oil, electronics, plastics, furniture, petroleum products, chemicals, and agriculture. The port has over 2,000 vessel calls and port facilities, including 10 piers, 62 berths, and 68 Post-Panamax gantry cranes.

2.1 Economic Study Area (Hinterland) and Regional Distribution Centers

The POLB is on the coast of southern California in San Pedro Bay, approximately 20 miles south of downtown Los Angeles, California. To the west and northwest of San Pedro Bay are the cities of San Pedro and Wilmington, respectively; and to the east, the community of Seal Beach. The study area includes the waters in the immediate vicinity (and shoreward) of the breakwaters through the entire POLB, and the downstream reaches the Los Angeles River that have direct impact on the Bay, including Outer Harbor, Inner Harbor, Cerritos Channel, West Basin, and the Back Channel (see **Figure 2-1**:).

POLB is served by more than 140 shipping lines with connections to 217 seaports worldwide. Once vessels reach POLB, nearly half of all the cargo is moved by rail to the rest of the country, much of it loaded right on dock.

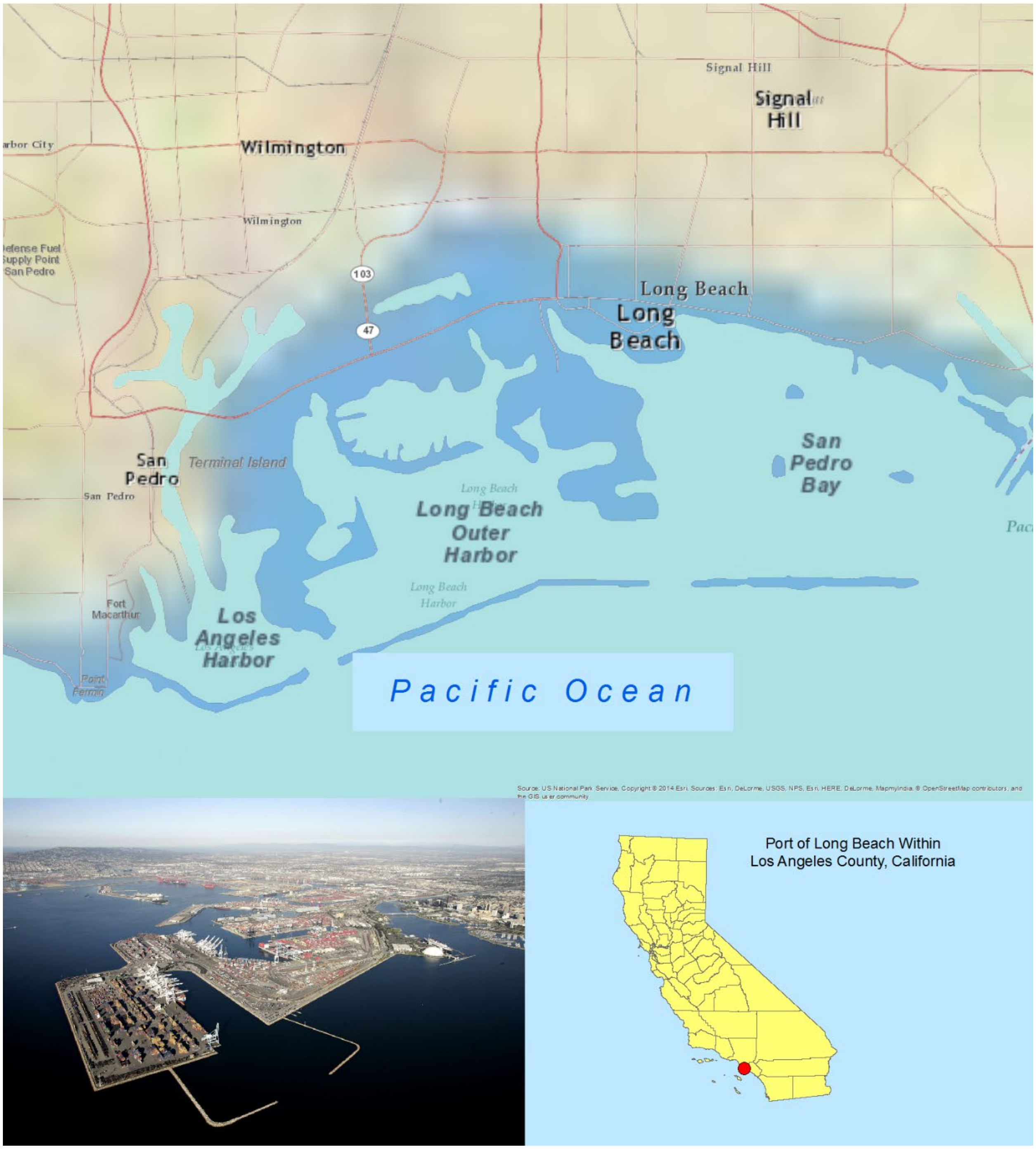


Figure 2-1: Study Area Location Map

The catchment area (geographic area from which the Port attracts a population that uses its services) for the San Pedro Bay Ports (Port of Long Beach and Port of Los Angeles) includes a local catchment area, comprising of area located within California, and an extended catchment area, including Colorado, New Mexico, Utah, Arizona, Nevada, and California (See **Figure 2-2**:)

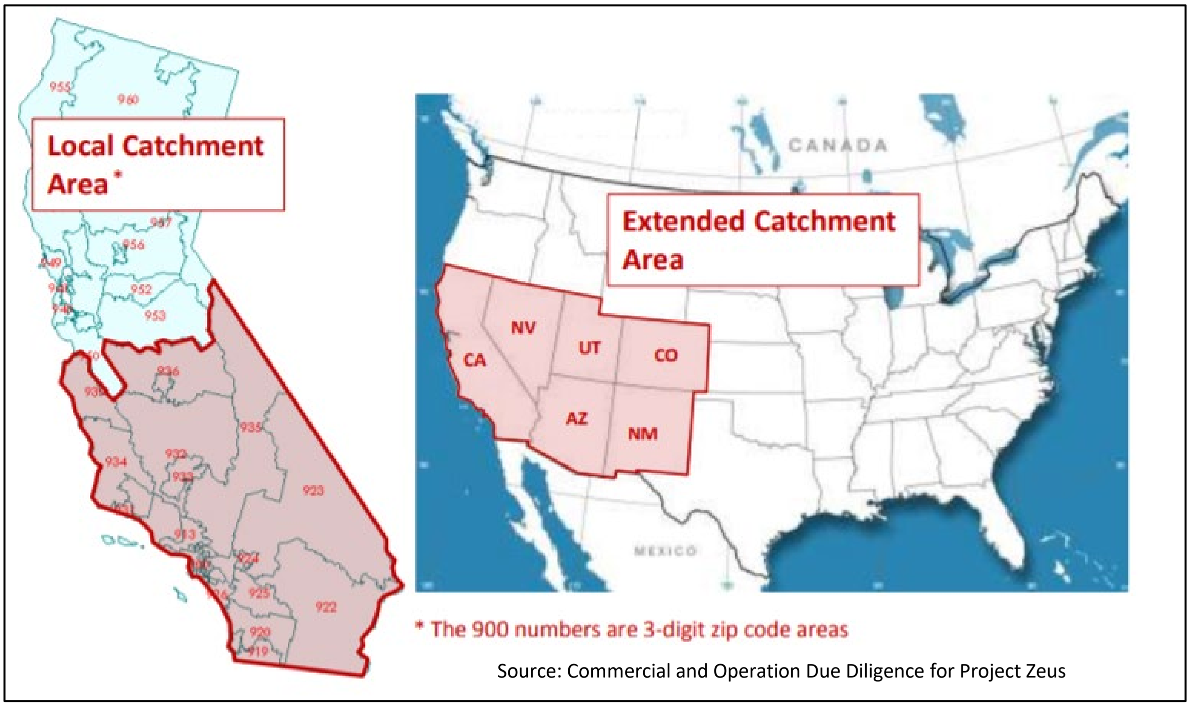


Figure 2-2: Local and Extended Catchment Areas for San Pedro Bay Ports

Because a majority of the services that call the POLB also call at the Port of Oakland, the local catchment encompasses only the areas in California that are closer on over-the-road mileage to the POLB. Areas that extend beyond this are included in the extended catchment area. Northern California is included in the extended catchment area due to importers stopping at the POLB to discharge containers with goods for consumption across California, emphasizing those that are trans-loaded because most of the population of California is located in Southern California. The other five states included in the extended catchment area are land-locked, with a majority of goods that are trans-loaded being handled through the POLB or the Port of Los Angeles.

Non-crude oil is the only one high-volume commodity associated with liquid bulk exports. This encompasses refined products that are exported from local refineries in Southern California. The two high-volume commodities being shipped through the POLB are gypsum and salt. Gypsum accounts for the largest portion of dry bulk imports and is a major input to the construction industry. High commodity dry bulk exports include Petroleum coke, coal, and metal scraps.

2.1.1 Cargo Profile

In Fiscal Year (FY) 2018, the POLB served 2,278 vessels, including approximately 8 million TEU's, up 10% from FY 2017. The port's break bulk cargo totaled approximately 1.2 million tons. Top commodities include consumer goods, construction materials, machinery, chemicals, plastics, and woods. Additionally, the Port's containerized cargo totaled 108,091 tons, while the Port's Dry and Liquid bulk totaled 445,000 tons and 29,819,000 tons, respectively. **Table 2-1** gives an overview of the commodities for the Port of Long Beach from 2013 through 2017. Petroleum and petroleum products accounts for close to 50% of the total tonnage in 2017.

Table 2-1: Commodity Report for Port of Long Beach

Commodity	CY 2017	CY 2016	CY 2015	CY 2014	CY 2013
Coal, Lignite, & Coal Coke	1,241,887	310,439	628,263	1,662,778	1,610,989
Petroleum and Petroleum Products	39,942,990	34,549,242	33,667,183	36,508,670	36,525,023
Chemicals and Related Products	3,905,301	4,150,415	3,985,862	4,560,923	4,865,026
Crude Materials	5,565,988	5,403,920	5,615,393	6,397,247	7,452,433
Primary Manufactured Goods	5,826,873	5,592,172	5,698,318	6,334,496	6,203,893
Food and Farm Products	8,207,360	8,413,161	8,423,959	8,275,904	8,337,633
Manufactured Equipment	19,538,746	17,711,594	18,557,878	19,643,239	18,545,534
Waste Material	112	105	142	85	62
Miscellaneous	1,767,835	1,682,185	1,587,599	1,642,722	952,146
Total	85,997,092	77,813,233	78,164,597	85,026,064	84,492,739

2.1.2 Cargo Value

Table 2-2 presents the top ten U.S seaport districts in dollar value of goods handled in the Calendar Year (CY) 2017. As shown in the table below, the Los Angeles/Long Beach district ranks number one in dollar value of shipments, with cargo valued at about $400 billion in CY 2017. Imports totaled more than $300 billion and exports totaled more than $70 billion for CY 2017. The Port of Long Beach comprises approximately 48% of the export value and 20% of the import value for CY 2017.

Table 2-2: Top Ten U.S Seaport Districts in Dollar Value (Millions) of All goods Handled CY 2017

Port District	Exports	Imports	TOTAL
Los Angeles/Long Beach, CA	$70,458	$327,206	$397,664
New York City, NY	$43,260	$150,078	$193,338
Houston-Galveston, TX	$100,611	$76,597	$177,209
Savannah, GA	$31,552	$76,190	$107,743
New Orleans, LA	$58,104	$39,596	$97,701
Seattle, WA	$21,082	$61,747	$82,830
Norfolk, VA	$27,051	$46,036	$73,088
Charleston, SC	$24,919	$45,040	$69,960
San Francisco, CA	$24,245	$45,070	$69,316
Baltimore, MD	$15,777	$38,115	$53,893

*"Exports" are FAS value of U.S. exports of domestic
**Source: U.S Census Bureau Merchandise Trade Report FT920 December 2017

2.2 Facilities and Infrastructure

The Port of Long Beach has undergone significant expansion in the past century and has become a major transportation and trade center, providing the shipping terminals for nearly one-third of the waterborne trade moving through the West Coast. There are 22 shipping terminals to process break bulk (lumber, steel), bulk (salt, cement, and gypsum), containers, and liquid bulk (petroleum). The surrounding area includes 1.7 billion square feet of warehouse and distribution facilities. See **Figure 2-3**: POLB Container Terminals for an overview of the POLB facilities.

The following sections focus on terminals, vessel fleets and characteristics, trade, shipping operations, and design vessels for container and liquid bulk vessels, which are the vessel types that are the focus of this Feasibility Study.

2.3 Container Services

According to the Waterborne Commerce Statistics Center, in 2017, the POLB was the second largest U.S container port in terms of TEU throughput. The container terminals are located at Piers A, C, E, G, J, and T. These terminals handle various kinds of cargo moving within the standard shipping containers -- primarily finished goods like clothes, toys, and furniture. East Asia accounts for approximately 90% of container shipments. **Figure 2-3** depicts the container terminals and their design depths.

POLB Container Terminals					
Pier	**Operator**	**Size (Acres)**	**Cargoes**	**On Dock Rail**	**Design Depth**
A	SSA Terminals	159.3	General	Yes	50'
C	SSA Terminals	70	General & Autos	No	42'
E	Long Beach Container Terminal, Inc.	170	General	Yes	55'
G	International Transportation Service	246	General	Yes	42'-52'
J	Pacific Container Terminal	256	General	Yes	50'
T	Total Terminals, International	385	General	Yes	55'

Figure 2-3: POLB Container Terminals

2.3.1 Existing Container Terminals and Capabilities

As discussed, the POLB container terminals include Pier A, Pier C, Pier E, Pier G, Pier J, and Pier T. The terminals had a record throughput of 8 million TEUs in CY 2018, with a 10.7% increase from the previous year. **Figure 2-3**: POLB Container Terminals outlines the container terminals infrastructure.

2.3.2 Carriers and Trade Lanes

According to the data gathered from the Port, the POLB has had, on average, about 17 weekly container calls from 2010-2016. **Table 2-3** provides a summary of the weekly ocean carrier services for the POLB. Some of the major lines include Maersk, MSC, CMA CGM, OOCL, and Evergreen.

Table 2-3: Port of Long Beach Weekly Ocean Carrier Services

TERMINAL	ALLIANCE	CARRIER	SERVICE CODE	ROTATION
SSA Pier A	Oceana Vessel Sharing Agreement	Hamburg Sud Hapag-Lloyd ANL MSC PIL	PANZ - WSN - PCX - Oceana Loop 1 - AOS	Oakland - Seattle - Vancouver - LONG BEACH - Auckland - Sydney - Melbourne - Adelaide - Sydney - Tauranga - Papeete - Oakland
SSA Pier A	Independent	Hamburg Sud Polynesia Line	SSEA	Papeete - Apia - Pago Pago - LONG BEACH - Oakland - Papeete
SSA Pier A	Independent	Swire	WCNA - West Coast North America	Brisbane - Port Kembla - Melbourne - Tauranga - Vancouver BC - Everett - LONG BEACH - Suva - Brisbane
SSA Pier A	Independent	SM Lines	CPX China Pacific Express	Ningbo - Shanghai - Kwangyang - Busan - LONG BEACH - Busan - Kwangyang - Ningbo
SSA Pier A	Independent	Hamburg Sud Hapag-Lloyd	MPS MedPac Service	Cagliari - Livorno - Genoa - Marseilles-Fos - Barcelona - Valencia - Cartagena - Puerto Quetzal - Manzanillo (Mexico) - LONG BEACH - Oakland - Seattle - Vancouver - Oakland - LONG BEACH - Manzanillo (Mexico) - Cartagena - Caucedo - Tangier - Valencia - Cagliari
SSA Pier C	Independent	Matson	CLX1 - China Long Beach Express	Naha - Ningbo - Shanghai - LONG BEACH - Honolulu - Guam - Naha
SSA Pier C	Independent	Matson	Hawaii Service Loop 2	Honolulu - LONG BEACH - Honolulu
Long Beach Container Terminal (LBCT) Pier E	OCEAN Alliance	OCEAN Alliance COSCO OOCL CMA CGM Evergreen APL	AAS - PVCS - SCS South China Sea - SC6 South China Loop 6	Cai Mep - Hong Kong - Yantian/Shenzhen - Kaohsiung - LONG BEACH - Kaohsiung - Cai Mep

TERMINAL	ALLIANCE	CARRIER	SERVICE CODE	ROTATION
Long Beach Container Terminal (LBCT) Pier E	OCEAN Alliance	OCEAN Alliance COSCO OOCL CMA CGM Evergreen APL PIL	AAC4 - PCC1 - HIX Hibiscus Express - PCC1 - CC9 Central China Loop 9 - AC7	Ningbo - Shanghai - Busan - LONG BEACH - Busan - Ningbo
International Transportation Services (ITS) Pier G	THE Alliance	THE Alliance ONE Hapag-Lloyd Yang Ming	PS3	Nhava Sheva - Pipavav - Colombo - Port Kelang - Singapore - Laem Chabang - Cai Mep - LONG BEACH - Oakland - Pusan - Ningbo - Shekou - Singapore - Port Kelang - Nhava Sheva
International Transportation Services (ITS) Pier G	THE Alliance	THE Alliance ONE Hapag-Lloyd Yang Ming	AL5	Southampton - Le Havre - Rotterdam - Hamburg - Antwerp - Savannah - Cartagena -Balboa - Los Angeles - Oakland - Seattle - Vancouver - LONG BEACH - Balboa - Cartagena - Caucedo - Savannah - Southampton
Pacific Container Terminal (PCT) Pier J	Independent	PIL WHL COSCO YML OOCL	ACS - CP2 - AAC3 - AAC - PCC2	Lianyungang - Shanghai - Ningbo - LONG BEACH - Seattle - Lianyungang
Pacific Container Terminal (PCT) Pier J	Independent	PIL WHL COSCO CMA CGM APL	AC5 - CP1 - SEA - PSX Pacific South Express - SC3	Haiphong - Nansha - Hong Kong - Yantian/Shenzhen - LONG BEACH - Oakland - Yantian/Shenzhen - Haiphong
Total Terminals Inc. (TTI) Pier T	2M+H	Maersk MSC HSD HMM	TP2 - Jaguar - UPAS2 - PS3	Singapore - Cai Mep - Yantian/Shenzhen - Ningbo - Shanghai - LONG BEACH - Oakland - Vostchny - Busan - Ningbo - Shekou/Chiwan - Singapore
Total Terminals Inc. (TTI) Pier T	2M+H	Maersk MSC HSD HMM	TP8 - New Orient - UPAS1 -PS4	Xingang - Qingdao - Ningbo - Shanghai - Busan - Yokohama - Prince Rupert - LONG BEACH - Oakland - Vostochniy - Xingang
Total Terminals Inc. (TTI) Pier T	Independent	MSC	CEX	Gioia Tauro - Civitavecchia - La Spezia - Valencia - Sines - Cristobal - Balboa - Manzanillo - LONG BEACH - Oakland - Vancouver - Seattle - Oakland - LONG BEACH - Balboa - Cristobal - Gioia Tauro
Total Terminals Inc. (TTI) Pier T	2M+H	HMM Maersk MSC	PS2 - TP7 - Lotus	Laem Chabang - Cai Mep - Kaohsiung - Busan - LONG BEACH - Oakland - Busan - Kaohsiung - Hong Kong - Laem Chabang
Total Terminals Inc. (TTI) Pier T	Independent	Maersk Hamburg Sud Sealand Alianca APL CMA CGM	WCCA2 - WC2	Balboa - Corinto - Acajutla - Lazaro Cardenas - LONG BEACH - Oakland - Lazaro Cardenas - Corinto - Puerto Caldera - Arrijan- Balboa

1 *Source: Port of Long Beach Website

2.3.3 TEU Weight per Containers

Data was collected from the POLB to determine weight per TEU. **Table 2-4** provides the weight per TEU by trade route. Generally, exports are heavier than imports, as noted in the data.

Table 2-4: Average Weight per Loaded TEU by Trade Lane

Route Group	Description	Import Weight/TEU (Metric Tons)	Export Weight/TEU (Metric Tons)	Imports and Exports Weight/TEU (Metric Tons)
NEA-WCUS	Northeast Asia Container Route	5.7	9.7	6.8
SEA-WCUS	Southeast Asia + ISCME Container Route	5.8	9.4	6.9
EU-NA-LA-WCUS	Europe/North America/Latin America/ WCUS	8.3	9.1	8.5
OCEANIA-WCUS	New Zealand/Australia/Pacific Island/Hawaii	8.6	8.5	8.5

2.4 Historical Commerce

As noted, the POBL handles more than 7 million TEUs. **Figure 2-4**: illustrates the total container throughput (TEUs) for the port, from 1995 through 2017. During this time frame, throughput increased by approximately 4.7 million TEUs, which is an increase by about 165%, or an annual compounded growth rate of 4.54%. There was a decline in throughput between 2008 and 2009, as a result of the 2008 global recession. In 2017, 7.54 million loaded TEUs were reported, including items from clothing, shoes, toys, furniture, and electronics.

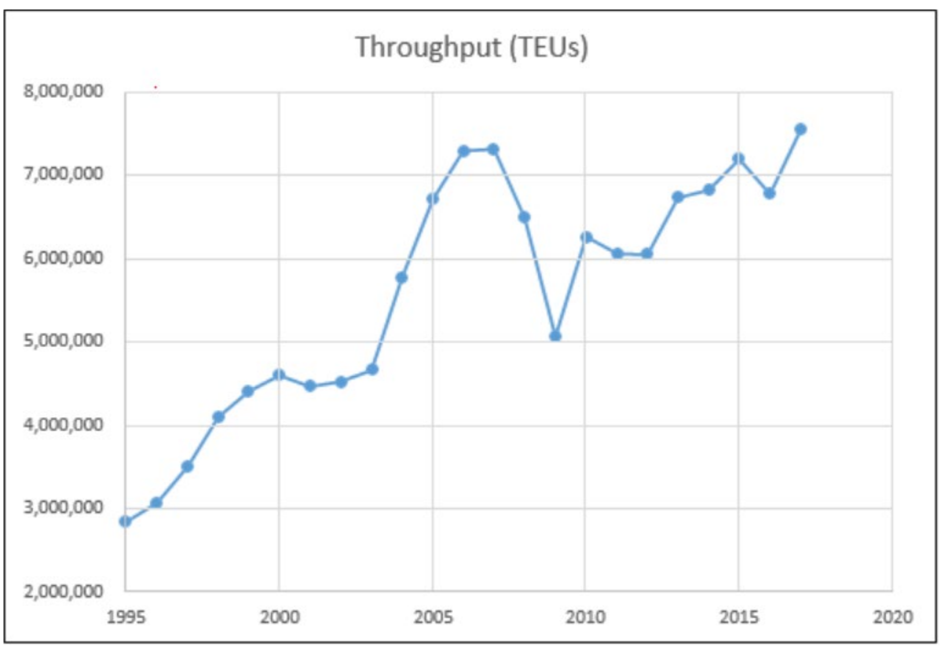


Figure 2-4: Port of Long Beach Historical Container Throughput

Figure 2-5 illustrates the historic import tonnage of crude oil, the primary liquid bulk commodity for the POLB. From 2006 through 2016, there was no discernable trend in tonnage. In 2016, crude oil tonnage was above 17 million tons. On trend with the historic container throughput, there was a dip in crude oil tonnages from 2008-2010, likely for the same reason.

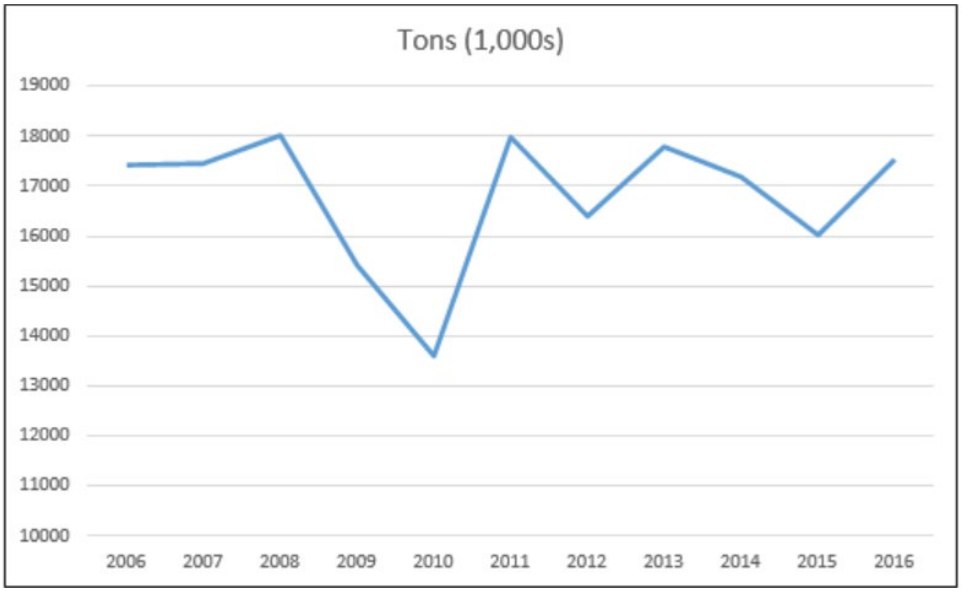
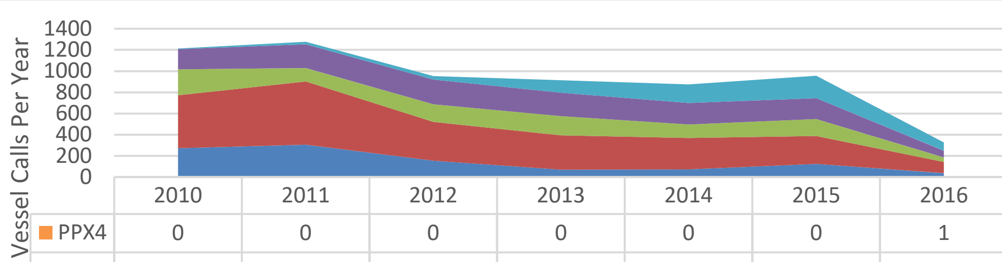


Figure 2-5: Port of Long Beach Historical Crude Oil Imports

2.5 Existing Fleet

Data for the existing fleet was obtained from the POLB and a variety of container ships called to the port between 2010 and 2016. These ships are classified as sub-Panamax (SPX), Panamax (PX), Post-Panamax Generation 1 (PPX Gen 1), Post-Panamax Generation II (PPX Gen 2), Post-Panamax Generation III (PPX Gen 3), and Post-Panamax Generation IV (PPX Gen 4) depending on their capacity. The vessels are distinguished based on their physical and operation characteristics, including lengths overall (LOA), design draft, beam, speed, and TEU capacity. It is common practice to separate the containership fleet in TEU bands or classes to analyze the supply within the industry. However, due to the evolution of vessel design over time, these TEU bands do not correspond to a breakdown of the fleet by dimensions, such as beam or draft. **Figure 2-6** shows the vessel calls at the POLB from 2010 - 2016, broken down by vessel class.



	2010	2011	2012	2013	2014	2015	2016
PPX4	0	0	0	0	0	0	1
PPX3	5	24	33	118	176	210	78
PPX2	190	225	232	220	202	197	64
PPX1	247	126	167	182	128	161	43
PX	500	597	367	324	298	262	105
SPX	271	305	153	70	71	125	37

Figure 2-6: POLB Vessel Calls by Class, 2010 - 2016

2.6 Shipping Operations

2.6.1 Underkeel Clearance

The measure of underkeel clearance (UKC) for economic studies is applied according to the planning guidance. According to this guidance, UKC is evaluated based on actual vessel operator and pilot practice within a harbor and subject to present conditions, with adjustment as appropriate or practical for with-project conditions. Generally, practices for UKC are determined through a review of written pilotage rules and guidelines, interviews with pilots and vessel operators, and analysis of actual past and present practices based on relevant data for vessel movements. Typically, UKC is measured relative to immersed vessel draft in the static condition (i.e., motionless at dockside). When clearance is measured in the static condition, explicit allowances for squat, trim, and sinkage are unnecessary. Evaluation of when the vessel is moved or initiates transit relative to immersed draft, tide stage, and commensurate water depth allows reasonable evaluation of clearance throughout the time of vessel transit.

Evaluation of all movements renders a distribution of UKC requirements. Evaluation of minimal clearance (i.e., some level of clearance below which operators or pilots will not move a vessel due to concerns for insufficient safety) helps to quantify the period of time each day, within a tide cycle; a given vessel with a specified immersed draft can be moved relative to tide.

Given the general evaluation of practices for UKC at most coastal ports in the U.S., minimal clearances for all vessel types are often 2.0 to 3.0 feet measured in the static condition for many historical fleets having Panamax or lesser service. The average UKC for vessels of sub-Panamax up through Post-Panamax Gen IV is approximately 4.5 feet. It is important to consider, however, that most coastal ports have comparatively limited distances between ocean approaches and dock facilities (i.e., less than 20 miles).

Regarding vessel sizes under with-project conditions, it is understood that most Post-Panamax vessels need more clearance depending on blockage factors, currents, and relative confinement of the waterway. As such, most Post-Panamax containerships need about 4 to 5 feet for vessels with breadths of 120 to nearly 200 feet, LOA approaching 1,300 feet, and summer loadline drafts of 46.0 to approximately 55.0 feet. **Table 2-5** displays the UKC requirements for the Sub-Panamax through the Post-Panamax Generation IV.

Table 2-5: Containerized Vessel Underkeel Clearance

Vessel Class	Total Underkeel Clearance (feet)
Sub-Panamax (SPX)	4.0
Panamax (PX)	4.0
Post-Panamax Gen I (PPX1)	4.0
Post-Panamax Gen II (PPX2)	4.5
Post-Panamax Gen III (PPX3)	4.5
Post-Panamax Gen IV (PPX4)	5.0

2.6.2 Tidal Range

The variability of sea level must also be considered when determining the level of water needed for navigation. According to the 2018 NOAA tidal data, the POLB experienced an average tide range of approximately 3.9 feet MLLW. **Table 2-6** summarizes the High Tide and Low Tide data for the Port of Long Beach in 2018. **Table 2-7** presents the tidal data through the tidal epoch relative the MLLW. **Figure 2-8** depicts a tide prediction table for NOAA. The solid blue line depicts a curve fit between the high and low values.

Table 2-6: Tide Statistics Summary (feet MLLW)

	Low Tide	High Tide	Low and High Tide
Min	3.4	2.9	-1.9
Max	-1.9	7.3	7.3
Mean	0.9	4.8	2.9

Table 2-7: Tidal Data at Port of Long Beach Station 9410660 (1983-2001 Tidal Epoch)

Datum	**Value (feet)**	**Description**
MHHW	5.49	Mean Higher-High Water
MHW	4.75	Mean High Water
MTL	2.84	Mean Tide Level
MSL	2.82	Mean Sea Level
MLW	0.94	Mean Low Water
MLLW	0	Mean Lower-Low Water

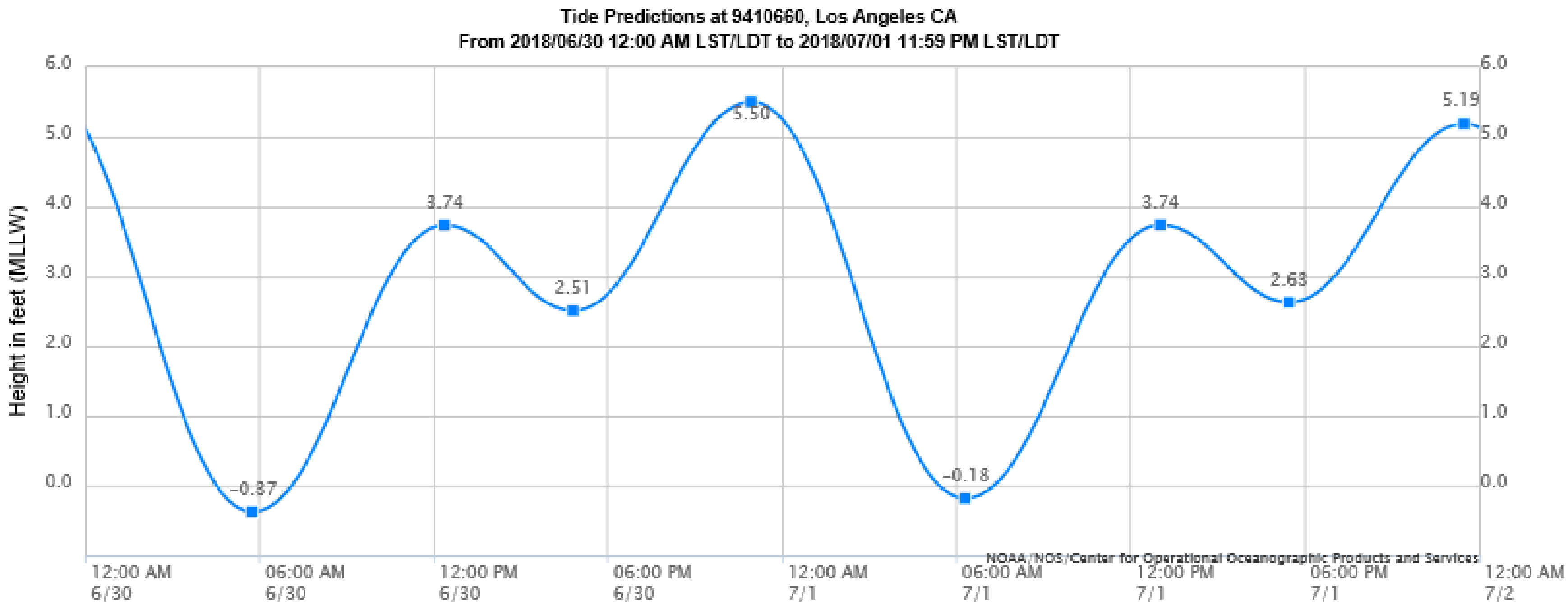


Figure 2-7: Tide predictions for Port of Long Beach (Feet MLLW)

2.7 Design Vessel

"For deep-draft projects, the design ship or ships is/are selected on the basis of economic studies of the types and sizes of the ship fleet expected to use the proposed channel over the project life. The design ship is chosen as the maximum or near maximum size ship in the forecasted fleet" (USACE 1984, 1995, 1999).

The selection of vessel specifications for fleet service forecasts and waterway engineering evaluations sometimes poses unique concerns given the requirements to evaluate design and improvements for waterway systems over time. Generally, waterway improvements should be designed to be optimized across the entire fleet forecast regime or structure. Typically, it may include service by several sizes and types of vessels (i.e., bulk carriers, containerships, tankers, etc.). Where vessel designs are relatively mature (tankers and dry bulk carriers), the task is comparatively straightforward. However, where consideration is to include fully cellular containership services, associated hull designs are still evolving. On a world fleet basis, containership designs continue to change with respect to size and cargo carrying capacity, and have not reached an absolute limiting threshold for rated carrying capacity as measured by weight (deadweight tonnage) or nominal intake for standard-unit slot capacity (i.e., nominal TEUs).

With respect to current and projected fleet service for deep-draft harbors, such as the POLB, post and new Panamax designs are divided into three (3) general groupings, largely separated by beam or extreme breadth and capacity for nominal TEU intake. Building trends for the first two groupings (Generation I and Generation II, with beams typically less than 150 to 152 feet) are reasonably well established with respect to typical physical dimensions and size relative to displacement, associated deadweight capacity, and typical homogeneous and nominal TEU ratings. What can be termed the Generation III class of containership (beams exceeding 150 feet through 168 feet) has only recently become better defined in terms of typical dimensions that a project analyst would expect to encounter due in large part to announcement of the specifications for maximum hull size to be accommodated by the new locks currently nearing completion of construction for the Panama Canal. This class has dimensions designed with an emphasis of consideration for specifications of the new locks under construction for the Panama Canal expansion. The length and beam limitations of the new locks for the Panama Canal are now known and these parameters are considered fixed. Conversely, while the specification for draft typically does have a limit, as with employment of the existing lock system, actual immersed draft can be adjusted or allowed to vary based on variability in cargo density, loading, and utilization of weight carrying capacity of the hull.

Table 2-8: shows the containerized design vessel specification that were recommended by the Economics team in collaboration with the USACE's Institute for Water Resources (IWR). . **Table 2-9**: shows the liquid bulk design vessel specifications.

Table 2-8: Containerized Design Vessel

Post Panamax Gen IV	
Maximum Draft:	52 ft
LOA:	1,300 ft
Beam:	193 ft
DWT:	188,000
TEUs:	18,000 - 19,000

Table 2-9: Liquid Bulk Design Vessel

VLCC	
Maximum Draft:	70 ft
LOA:	1,100 ft
Beam:	200-210 ft
DWT:	325,000

In addition to new or evolving Panamax specification, fleet service for harbors on the west of the United States such as the POLB have the potential to be serviced by the new Post-Panamax class(es) of ships, especially where concerns for depth and limitation on air draft of little concern. The primary issue for these carriers is a matter of timing or when they will initiate service, frequency of service, and applicable load factor specifications applicable to the trades involved. These vessels fall within the classification of what could be called Generation IV (and above) Post-Panamax (with the definition of Post-Panamax based on the original or lock specifications of the Canal) or new Post-Panamax based on the new locks expected to be placed into service by 2015. The Generation IV Post-Panamax class of containership have beams exceeding 168 feet through 185 to nearly 190 feet and accordingly this class of ship represent hulls that are considered to clearly exceed the margins for accommodation of the new lock system of the Panama canal and as previously described fall into the realm of what may be considered to the “new” Post-Panamax standard once the new lock system is commissioned into service.

2.8 Liquid Bulk Services

Liquid forms of bulk cargo include crude oil, gasoline, and miscellaneous chemicals. The primary liquid bulk commodity for the port is crude oil imports. As shown in **Figure 2-5**, crude oil imports have varied with no discernable trend from 2006 through 2016. Projected imports are not anticipated to be significantly different from historical volumes.

3 FUTURE CONDITIONS

3.1 Terminal Expansions

The Port's ability to accommodate large container ships and handle additional cargo is a key objective of the POLB. In preparation of the next generation of vessels, the POLB has a 10 year, $4.0 billion capital program to update their infrastructure and facilities to improve the efficiency of cargo operations. The program has a plan for projected spending of $2.3 billion over the next 10 years. This includes the Middle Harbor Redevelopment Project, the Gerald Desmond Bridge Replacement, the Pier B Rail Support Facility, The Pier G and J modification project, and berth deepening.

3.1.1 Existing Container Terminal Facilities and Infrastructure

Figure 2-3: POLB Container Terminals outlines the existing container terminal facilities and infrastructure. These facilities include:

- Pier A: SSA terminals
- Pier C: SSA Terminal
- Pier E: Long Beach Container Terminal Inc.
- Pier G: International Transportation Service
- Pier J: Pacific Container Terminal
- Pier T: Total Terminals International

As aforementioned, the POLB has an improvement plan of $2.3 billion projected capital spends over the next 10 years. This includes the following improvements:

- Middle Harbor Redevelopment Project: $1.5 billion to combine and modernize two aging shipping terminal. The project will quintuple dock rail capacity and is expected to be completed in 2020.

- Gerald Desmond Bridge Replacement: A $1.5 billion project to build a new bridge that spans the port's main channel. This will allow for better traffic management and is intended to be complete in late 2019.

- Pier B Rail Support Facility: The Pier B support facility will provide a more efficient transfer of cargo between marine terminals and Class 1 railroads.

- Pier G and Pier J modernization: Berth and rail facility improvements.

- Berth deepening

Additionally, the Port is currently updating their master plan. This includes improvements to Pier G, which would allow the design vessel to call on that berth, and the infill of Pier J South, which would allow greater landside terminal facilities and capacity for Pier J North.

3.2 Operations

3.2.1 Container Terminal Use Plan

Thee POLB's future container use plan will generally conform to its historical practices, however, as ships get larger, terminal operators globally are looking for ways to handle higher densities of cargo more efficiently and in a cost effective manner. The Long Beach City Council recently directed the city's harbor department to study the economic implications of automation on the city. Construction for the Middle Harbor Terminal Redevelopment Project began in 2011 and is creating one of the world's greenest container shipping terminals. The 311 acre facility will be able to handle twice as much cargo and will be nearly fully electric with zero emissions. The first phase (170 acres) of the project opened in 2016 with Orient Overseas Container Line agreeing in 2012 to a 40 year lease to operate the new terminal.

3.3 Commodity Forecast

An essential step when evaluating navigation improvements is to analyze the types and volumes of cargo moving through the port. Trends in cargo history can offer insights into a port's long-term trade forecasts, and thus, the estimated cargo volume upon which future vessel calls are based. Under future without and future with project conditions, the same volume of cargo is assumed to move through the Port of Long Beach. However, a deepening project will allow shippers to load their vessels more efficiently or take advantage of larger vessels. This efficiency translates to savings and is the main driver of National Economic Development (NED).

3.3.1 Baseline

To minimize the impact of potential anomalies in trade volumes on long-term forecasts, seven years of data were employed to establish the baseline for the commodity forecast. Empirical data from 2010 to 2016 were used to develop a baseline, allowing the forecast to capture both economic prosperity and downturn which occurred over that timeframe. The year 2015 was used as the baseline for the forecast. While this study was underway, two additional years of data (2016 and 2017) became available. Those data were evaluated and no significant changes were found; therefore the baseline condition was not changed.

Containerized Imports

Table 3-1 illustrates the historical containerized imports for the POLB from 2008 – 2017. In this period, there has been an average annual growth of 1.3%. The Port implemented an automated billing system in 2012 that does not collect private berth statistics. Private berth statistics are given for the years prior to 2012. Imports showed a decrease in tonnage in 2009, due to the economic recession of the time period. A small decrease in tonnage is also seen in 2012 and 2016.

Table 3-1: Historical Containerized Imports (Metric Revenue Tons)

Fiscal Year	Municipal	Private	Total
2008	118,563	654	119,217
2009	99,835	233	100,068
2010	108,278	209	108,487
2011	112,962	192	113,154
2012	107,283	-	107,283
2013	119,504	-	119,504
2014	112,244	-	122,244
2015	124,525	-	124,525
2016	122,937	-	122,937
2017	130,435	-	130,435

Containerized Exports

Table 3-2: illustrates the historical containerized exports for POLB from 2008 – 2017. In this period, there was an average annual reduction of 1.2% from 43,693 metric revenue tons in 2008 to 37,664 metric revenue tons 2017.

Table 3-2: Historical Containerized Exports (Metric Revenue Tons)

Fiscal Year	Municipal	Bunkers	Total
2008	41,605	2,088	43,693
2009	33,077	2,110	35,187
2010	36,667	2,412	39,079
2011	39,717	1,546	41,263
2012	36,947	914	37,861
2013	41,910	843	42,753
2014	42,415	867	43,282
2015	38,436	1,313	39,749
2016	36,733	1,652	38,385
2017	36,190	1,474	37,664

3.3.2 Trade Forecast

The preceding section describes the methodology that was used to develop the import and export baseline. The following sections discuss the methodology employed to develop the import and export long-term trade forecasts. While the forecasts presented in the following sections are truncated in the year 2040, the Port will in all likelihood continue to grow. However, due to the substantial uncertainty of developing projections past 2040, benefits are assumed to remain constant for the remainder of the period of analysis (2027-2076).

The long-term trade forecast for the POLB study combined data obtained from the Mercator International LLC and empirical data obtained from the POLB. The Cargo Forecast from the Mercator Report identifies the economic factors that drive future performance of commodities and uses an Econometric model to provide a forecast of volumes by commodity and direction.

First, a baseline was established from historical trade information, as discussed in Section 3.3.1. Next, a long-term trade forecast for the POLB was obtained from the Mercator Report. In the following sections, the methodology to develop a long-term containerized trade forecast for the Port of Long Beach is discussed.

Mercator Report

The Mercator Report was released in February 2016, and provides a 25-year volume forecast for container and non-container cargo for the Ports of Long Beach and Los Angeles, collectively referred to as the San Pedro Bay Ports (SPB). The Port of Long Beach comprises approximately 50% of SPB values. The forecast is conducted by separating volumes by direction, commodity, and major segments. Economic factors are identified that may influence the performance of each commodity by direction to create a 25-year forecast. These forecasted economic variables are used as inputs for an Econometric model to create a 25-year forecast of both the SPB ports and national volumes by commodity and direction. This is combined with the quantified risk of cargo diversion to other ports based on changes to the SPB ports over the 25 year time frame. This analysis is done with three macro-economic assumptions to produce three separate volume forecasts: High, Expected, and Low. Additional analysis was conducted on cargo types that had the potential of diversion that quantified the risk of diversion based on three sets of assumptions: Upside, Base case, and Downside. These are defined by the amount of volume that is diverted, with Base case being the most likely volume diverted, Upside being the least volume diverted, and downside with the greatest volume diverted. The analysis therefore produced nine forecast scenarios, with the Expected economic assumptions and Base Case risk diversion assumption resulting in the most likely outcome. We only reference the results of the Expected-Base case results in this appendix. It is noted that the analysis is unconstrained and actual future volumes will be constrained by physical and operation capacities of the SPB ports.

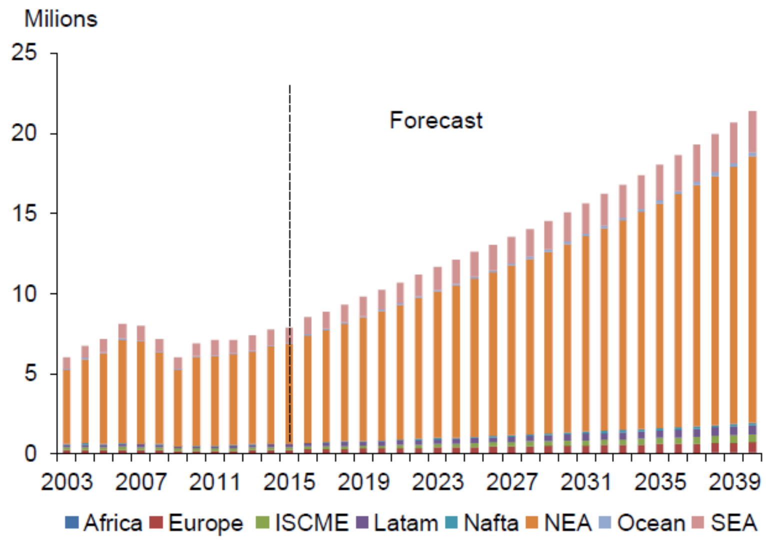
Oxford Economics and Haver Analytics provided data and models for trade forecasts. This includes information on macro-economic factor effects from the Oxford Economic's Global Scenarios Service that was combined to build import/export change scenarios for the U.S. and the Port of Long Beach.

Mercator Trade Forecast

a. *Mercator Containerized Imports*

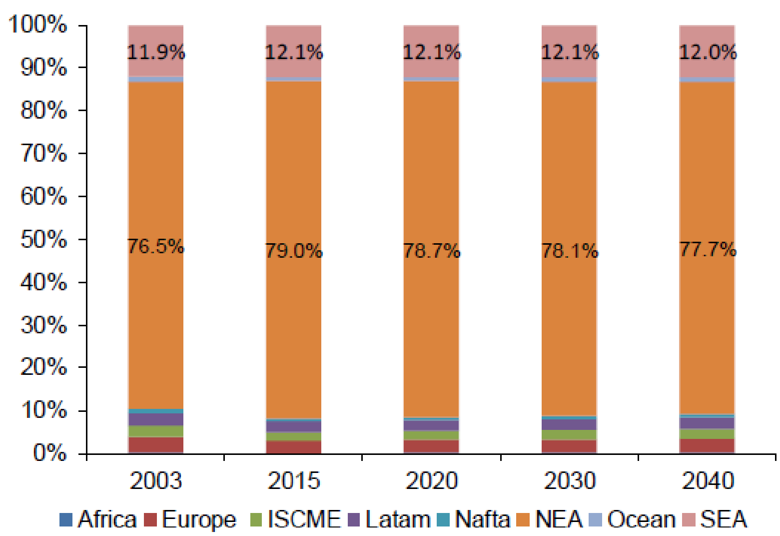
The relationship between imports into SPB ports and the nation as a whole were analyzed for each commodity and region combination. Two important factors when performing this analysis were the SPB port's changing structure through time and the SPB port's importance to the national economy. Structural economic factors (population growth, manufacturing and service sector growth) imply that the SPB port's share of US container imports is set to grow over the 25-year forecast period. Average container growth from 2015-2020 is 5.7% and 3.75% from 2021-2041.

SPB import arrivals are shown to be comprised of higher densities from the Asia-Pacific region (79%) than the national average. Because the imports from regions other than Northeast Asia (NEA) grew faster than that of NEA, we would expect the proportion of imports from the NEA region to decrease comparatively, while the share of imports from other regions are expected to increase throughout the overall analysis period. **Figure 3-1** and **Figure 3-2** show container imports for the SPB region over the analysis period by source region.



Source : Oxford Economics/Haver Analytics

Figure 3-1: SPB Container Imports by Source Region



Source : Oxford Economics/Haver Analytics

Figure 3-2: SPB Container Imports by Region

b. Mercator Containerized Exports

A similar analysis was performed as with the containerized imports in the Mercator Report. National TEU container exports are expected to rise 4.7% per year from 2015-2020. Energy products (Chemicals and machinery) are expected to be an increase proportion of the US export, as well as wood products through the analysis period. Europe is expected to have a decreasing share of US exports compared to that of emerging markets. The most rapid growth is seen in the Indian Sub-Continent and Middle East region, as well as growth in NEA and SEA. It is estimated that SPB port's exports of TEU's will increase 5.5% per annum from 2016-2020. Machinery and waste are expected to be an increasing portion of the exports from SPB, with NEA having an increasing portion of SPB exports. . **Figure 3-3** and **Figure 3-4** show container exports for the SPB region over the analysis period by destination region.

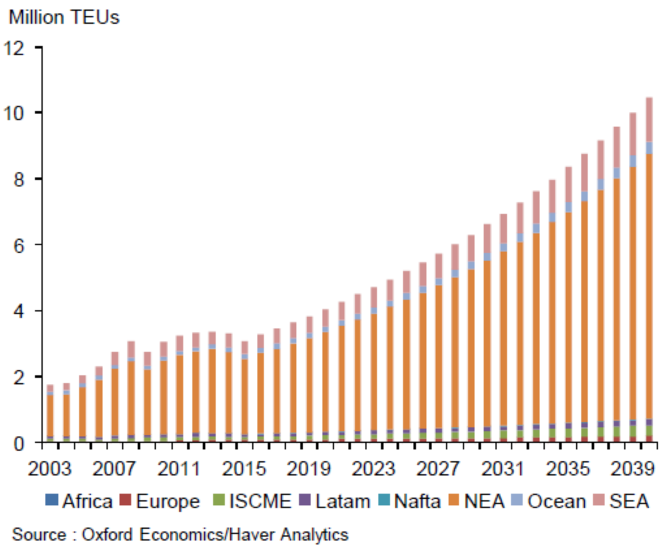


Figure 3-3: SPB Ports Exports by Destination Region

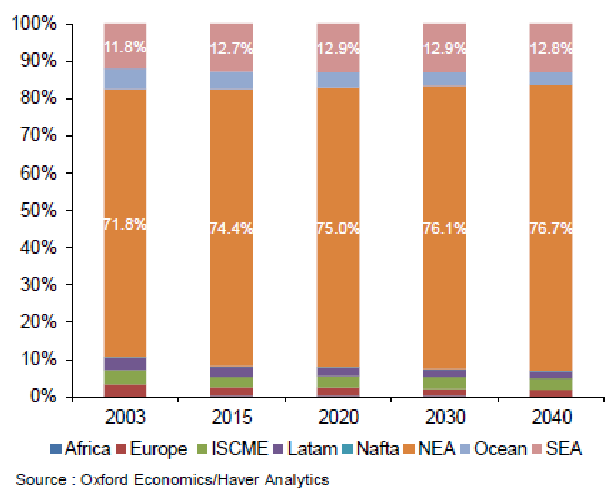


Figure 3-4: SPB Ports Exports by Region

3.3.3 Port of Long Beach Long-Term Trade Forecast – Methodology

Numerous container services call on the POLB, which have trade routes that originate all of the world. **Table 3-3** displays the trade routes used for the analyses in this study. Distances of the services included in the route group were evaluated to determine the minimum, most likely, and maximum sailing distances in nautical miles to the prior port, next port, and remaining sailing distance.

Table 3-3: Trade Routes

Route Group Name	Description
NEA-WCUS	Northeast Asia Container Route
SEA-WCUS	Southeast Asia + ISCME Container Route
EU-NA-LA-WCUS	Europe/North America/Latin America/ WCUS
OCEANIA-WCUS	New Zealand/Australia/Pacific Island/Hawaii

Table 3-4 presents the total growth rates that were developed by generating the route groups to represent all world regions. It should be noted that each trade route contains unique characteristics, such as cargo volume, cargo weight, ports of call, vessel types, mix of vessels, etc., and are therefore evaluated separately before being combined as part of the National Economic Development (NED) analysis presented in the next chapter.

Table 3-4: Port of Long Beach Forecast (Import and Export) - Total Rate of Change (%)

Year	EU-NA-LA-WCUS	NEA-WCUS	OCEANIA-WCUS	SEA-WCUS
2015	-	-	-	-
2016	5.74%	5.74%	5.74%	5.74%
2017	5.43%	5.43%	5.43%	5.43%
2018	5.15%	5.15%	5.15%	5.15%
2019	4.90%	4.90%	4.90%	4.90%
2020	4.67%	4.67%	4.67%	4.67%
2021	4.46%	4.46%	4.46%	4.46%
2022	4.75%	4.75%	4.75%	4.75%
2023	4.54%	4.54%	4.54%	4.54%
2024	4.34%	4.34%	4.34%	4.34%
2025	4.16%	4.16%	4.16%	4.16%
2026	3.99%	3.99%	3.99%	3.99%
2027	3.84%	3.84%	3.84%	3.84%
2028	3.70%	3.70%	3.70%	3.70%
2029	3.57%	3.57%	3.57%	3.57%
2030	3.44%	3.44%	3.44%	3.44%
2031	4.68%	4.68%	4.68%	4.68%
2032	4.47%	4.47%	4.47%	4.47%
2033	4.28%	4.28%	4.28%	4.28%
2034	4.11%	4.11%	4.11%	4.11%
2035	3.94%	3.94%	3.94%	3.94%
2036	3.80%	3.80%	3.80%	3.80%
2037	3.66%	3.66%	3.66%	3.66%
2038	3.53%	3.53%	3.53%	3.53%
2039	3.41%	3.41%	3.41%	3.41%
2040	3.29%	3.29%	3.29%	3.29%

Containerized Import Trade

The respective world region route import rates of change were applied to the 2015 baseline to estimate the POLB long-term import forecast, as shown in **Table 3-5**. Port capacity is not forecasted to be reached before 2040. The forecast to 2040 was included in the economic analysis presented in the next chapter of this appendix given the expectation that port capacity will not be exceeded by 2040 with benefits being held constant throughout the remaining period of analysis.

Table 3-5: Port of Long Beach Containerized Trade Forecasts - Import Tonnes

Year	EU-NA-LA-WCUS	NEA-WCUS	OCEANIA-WCUS	SEA-WCUS	Total
2015	4,280,121	9,431,645	2,178,759	5,994,495	21,885,020
2021	5,754,179	12,679,869	2,929,115	8,058,978	29,422,142
2030	8,215,775	18,104,223	4,182,169	11,506,549	42,008,716
2040	12,063,948	26,584,032	6,141,049	16,896,084	61,685,113

Containerized Export Trade

Table 3-6: Port of Long Beach Containerized Trade Forecasts - Export Tonnes

Year	EU-NA-LA-WCUS	NEA-WCUS	OCEANIA-WCUS	SEA-WCUS	Total
2015	2,599,801	5,728,903	1,323,406	3,641,134	13,293,245
2021	3,495,163	7,701,917	1,779,183	4,895,128	17,871,391
2030	4,990,368	10,996,740	2,540,304	6,989,227	25,516,639
2040	7,327,799	16,147,486	3,730,152	10,262,900	37,468,337

Using the containerized trade forecast for imports and exports and the average weight per loaded container (in terms of twenty-foot equivalent units, or TEUs), a loaded container forecast was developed. **Table 3-7** provides the weight per loaded container for the four route groups. Additionally, **Table 3-8** provides the loaded import and export TEU forecast for the four route groups.

Table 3-7 Port of Long Beach Containerized Trade Weight per TEU

Year	EU-NA-LA-WCUS	NEA-WCUS	OCEANIA-WCUS	SEA-WCUS
2015	8.47	6.78	8.52	6.87
2021	8.44	6.81	8.44	6.81
2030	8.47	6.90	8.36	6.83
2040	8.50	7.01	8.32	6.81

Table 3-8: Port of Long Beach Loaded TEU Forecast

Route Group	2015	2021	2030	2040
EU-NA-LA-WCUS	517,787	696,100	982,611	1,427,312
NEA-WCUS	1,646,550	2,226,954	3,199,399	4,693,378
OCEANIA-WCUS	254,273	346,424	499,958	733,858
SEA-WCUS	1,038,691	1,427,687	2,054,473	3,073,389
Total Imports	**3,457,301**	**4,697,166**	**6,736,442**	**9,927,937**
Route Group	**2015**	**2021**	**2030**	**2040**
EU-NA-LA-WCUS	287,368	388,727	565,307	846,502
NEA-WCUS	593,749	796,727	1,138,080	1,675,691
OCEANIA-WCUS	155,802	211,033	304,166	449,892
SEA-WCUS	386,455	520,833	749,937	1,114,428
Total Exports	**1,423,373**	**1,917,320**	**2,757,490**	**4,086,514**

Crude Oil Import Trade

Table 3-9 shows the forecasted crude oil imports for POLB through year 2040. As shown, crude oil shows a decrease after years 2021, through 2030 and 2040. Improvements in energy efficient is expected to drive the easing of oil import demand.

Table 3-9: Forecasted Crude Oil Imports

Year	Crude Oil Imports
2015	22,985,501
2021	23,917,152
2030	22,751,027
2040	22,494,704

3.4 Vessel Fleet

3.4.1 World Fleet

In addition to a commodity forecast, a forecast of the future fleet is required when evaluating navigation projects. To develop projections of the future fleet calling at the POLB, the study team obtained a World Fleet forecast of containerships developed by Maritime Strategies Inc. (MSI), which forecasted the total capacity calling at the POLB and provided a breakdown of that capacity calling into the containership size and TEU classes.

The methodology developed by MSI was then linked to the IHS commodity forecast data for U.S. West Coast and Long Beach. The commodity forecasts were unconstrained forecasts, and consequently MSI's model was similarly unconstrained with respect to the inter-port competition on the U.S. West Coast. Furthermore, MSI did not consider land-based infrastructure as a limiting factor in its approach to forecasting the world fleet. **Table 3-10** shows the fleet subdivision using the common vessel labeling terminology and vessel specifications for design draft, beam, and length overall (LOA).

Table 3-10: Fleet Subdivisions on Draft, Beam, and LOA (feet)

Vessel Fleet Subdivision (Containerships)		From	To
Sub Panamax (SPX)	**Beam**		98
(MSI size brackets: 0.1-1.3, 1.3-2.9 k TEU)	**Draft**	8.2	38.1
	LOA	222	813.3
Panamax (PX)	**Beam**	98	106
(MSI size brackets: 1.3-2.9, 2.9-3.9, 3.9-5.2, 5.2-7.6 k TEU)	**Draft**	30.8	44.8
	LOA	572	970
Post-Panamax (PPX1)	**Beam**	106	138
(MSI size brackets: 2.9-3.9, 3.9-5.2, 5.2-7.6, 7.6-12 k TEU)	**Draft**	35.4	47.6
	LOA	661	1045
Super Post-Panamax (PPX2)	**Beam**	138	144
(MSI size brackets: 5.2-7.6, 7.6-12 k TEU)	**Draft**	39.4	49.2
	LOA	911	1205
Ultra Post-Panamax (PXX3)	**Beam**	144	168
(MSI size brackets: 5.2-7.6, 7.6-12, 12 k + TEU)	**LOA**	Up to	1220
Post-Panamax (PPX4)	**Beam**	168	200
(MSI size brackets: 12 k + TEU)			

By combining information from the commodity forecast with MSI's forecasted fleet capacity and the POLB's average share of cargo on a containerized vessel, the study team was able to allocate a number of Post-Panamax, Panamax, and sub-Panamax vessels calls to the POLB fleet. The number of transits, particularly those made by larger vessels, is a key variable in calculating the transportation costs. MSI's forecasting technique begins with performing a detailed review of the current world fleet and how it is deployed throughout various trade routes of the world. Forecasting of the world fleet was made possible through MSI's proprietary Container Shipping Planning Service (CSPS) model (**Figure 3-5**), which applies the historical and forecasted time series data from 1980 to 2035 for:

- Macroeconomic indicators
- Global container trade and movements by region
- TEU lifts by type (primary/transshipment and full/empty) and by region
- Bilateral trade data for major routes
- Containership supply and fleet developments by vessels size range
- Explicit scrapping, cancellation and slippage assumptions
- Time-charter rates, freight rates and operating costs by segment
- Newbuilding, secondhand (by age) and scrap prices by segment

Data sources for the CSPS model include:

- Macroeconomics: Oxford Economics, leading investment banks;
- World Trade: UNCTAD, Drewry Shipping Consultants, Containerization International;
- Fleet Supply: LR-Fairplay, Worldyards, Howe Robinson;
- Charter Rates, Freight Rates and Vessel Prices: Drewry Shipping Consultants, Howe Robinson, Clarksons and various contacts at shipping lines; and

World Trade history is provided by UNCTAD, Drewry Shipping Consultants and Containerization International. MSI's forecast for trade in dry goods, including containerized trade, are derived from a series of constantly evolving econometric relationships between trade volumes and macroeconomic drivers. The latter drivers are country/regional specific and form the proprietary core of MSI's business.

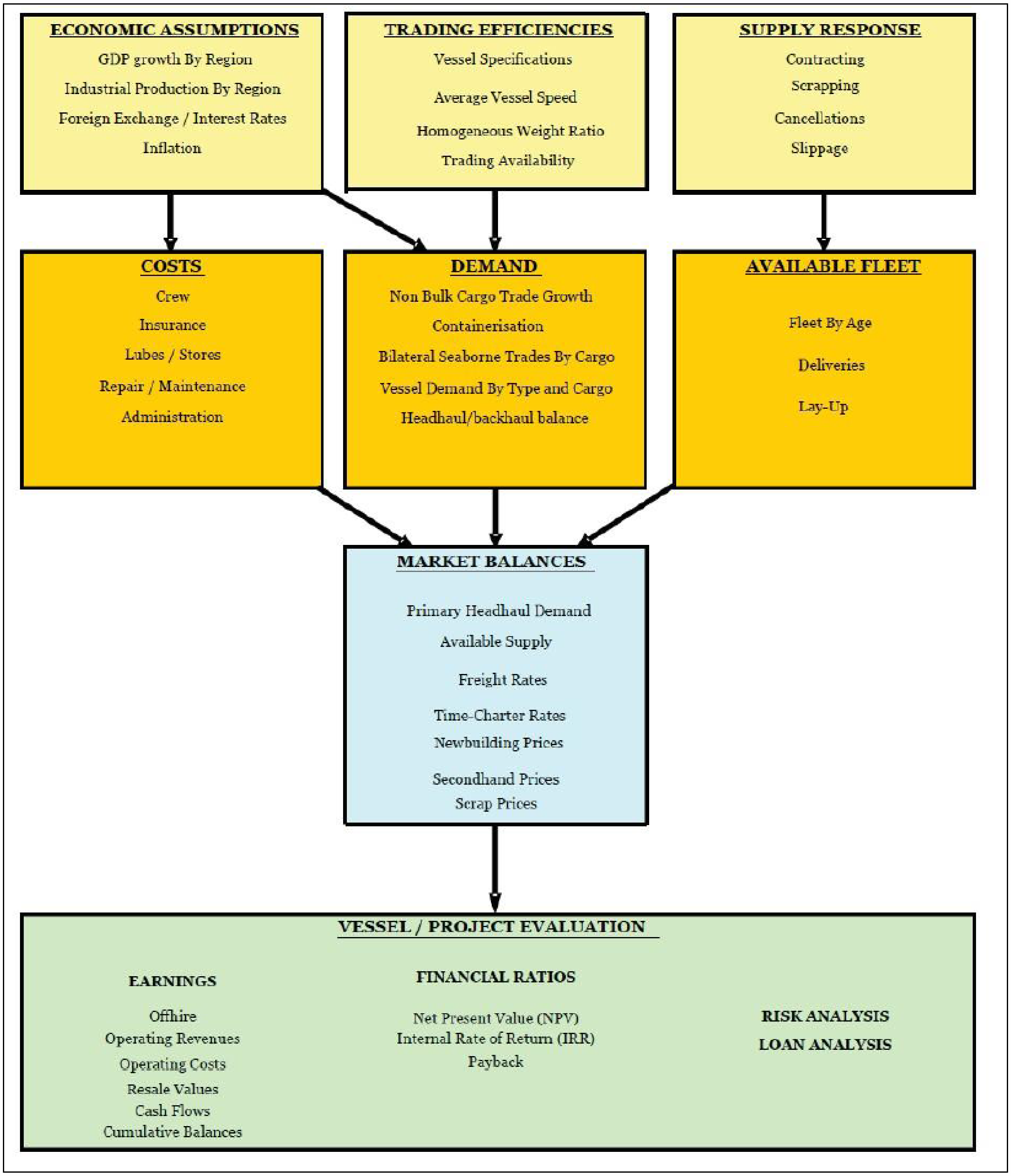


Figure 3-5: Schematic Overview of MSI's CSPS Model

When evaluating data on vessel composition, vessel age, and container markets, MSI considered the "order book" to estimate new deliveries to the fleet into the future. Vessel scrapping is accounted for based on historical scrapping rates by vessel class and age. Containerships, particularly the largest ones, are relatively new, so widespread scrapping is not expected to take place until well in the future. Likewise, when economies are strong, vessel owners are more likely to hold onto their existing vessels (or build new ones) and less likely to scrap them. The forecasted world fleet provides a frame of reference to verify the validity of the POLB fleet forecast and is provided as background information. As new larger vessels become a greater percentage of the world fleet and are deployed to the POLB, they replace smaller vessels which are redeployed to shorter routes, which may utilize the smaller vessels more efficiently.

There is a strong relationship between the economic condition of a port and its total nominal vessel capacity. As an economy grows, exports from the port often increase (from the increased output) or demand for imports increase (from increased consumer purchasing power). Vessels respond accordingly to satisfy this increased level of trade. In the Charleston port deepening study, MSI examined the empirical relationship between the nominal capacity of the fleet calling at the port and the historical tonnages moving through the port. MSI found the variables to be highly correlated, having an R-squared value of 0.967. The same statistical relationship observed in that port's study was then applied to the POLB's forecasted tonnages in order to estimate the future nominal TEU vessel capacity calling the POLB. Similar to the previously mentioned study, as the tonnage in the POLB grew over time, the nominal TEU vessel capacity, i.e., the total number of available container slots, also grew. Capacity was adjusted by operators to match the demand. Once the forecasted nominal TEU vessel capacity at the POLB was determined, the future containers were allocated to various vessel classes (Post-Panamax, Panamax, and sub-Panamax). The allocation to vessel classes was based on MSI's examination of historical utilization of Panamax vessels, current trends in vessel design and orders, and the worldwide redeployment of vessels affected by the expansion of the Panama Canal.

World Fleet

A projection of the world fleet provides the necessary background for evaluating the future fleet forecast for the POLB. The starting point for this projection was the world fleet by vessel class extracted from the Lloyd's Register (LR)-Fairplay database for the years 2013, 2014, and 2017[1]. As shown in **Table 3-11**, larger vessels are quickly becoming a higher percentage of the world fleet. In 2013, container vessels larger than 12,000 TEUs made up just under 3 percent of the world fleet while vessels greater than 7,600 TEUs totaled around 10.5 percent. As of 2017, 12,000 TEU vessels have increased to about 7.6 percent of the world fleet and vessels greater than 7,600 TEUs now make up about 20 percent.

Table 3-11: World Fleet by TEU Band – 2013, 2014 and 2017

TEU Band	2013	2014	2017
0.1 - 1.3 k TEU	1,600	1,557	1,553
1.3 - 2.9 k TEU	1,352	1,333	1,476
2.9 - 3.9 k TEU	303	295	271
3.9 - 5.2 k TEU	762	750	656
5.2 - 7.6 k TEU	519	536	468
7.6 - 12 k TEU	379	438	670
12 k TEU +	151	193	422
TOTAL	**5,066**	**5,102**	**5,516**

[1] LR-Fairplay maintains the largest maritime databases covering ships, movements, owners and managers, maritime companies, ports and terminals.

The "Order Book"

The "order book" is short hand for the vessels that have been contracted to be built by ship builders around the world. Vessel deliveries are primarily the function of new building contracting. These contracts can take several forms. There are firm contracts for vessels that are under construction. There are also option contracts that secure the capacity of the shipyard but do not require the buyer to exercise the option to construct the vessel. Some contracts have financing that is committed; others do not. There are several other nuances that pose possible challenges in translating the number of vessels and types of contracts into future vessels coming online at a specific time. This requires knowledge and expertise of this market and this process. Forecasts must be made for future contracts, vessel scrapping, and vessel deliveries[2]. Over the long term, new building investment tends to equate to the incremental demand for new tonnages to meet cargo growth or replacement of aged or obsolete ships.

A historical breakdown of contracting by TEU band was accomplished using a widely recognized fleet database provided by LR-Fairplay. The breakdown was expressed as a percentage of ships for each TEU band size. These percentages were used as a baseline for forecasting future contracting. **Figure 3-6** depicts historical and future forecasted contracting by TEU bands for fully cellular container (FCC) vessels[3] for years 2000 to 2035.

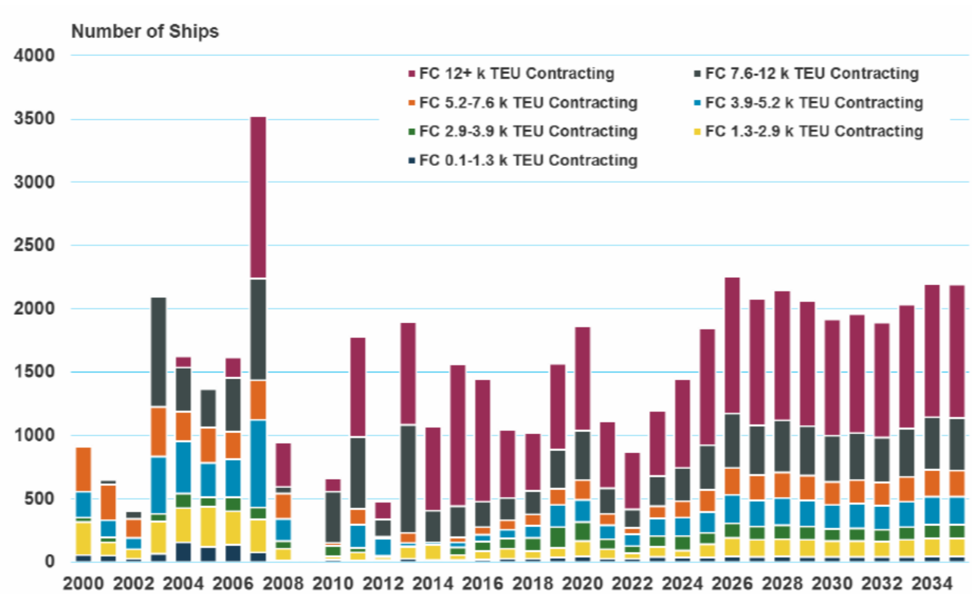


Figure 3-6: Container Contracting, 2000-2035 (Source: MSI)

Deliveries and Scrapping Assumptions

MSI modeled the relationship between annual contracting and annual deliveries by TEU band. The forecast of deliveries by TEU band are depicted in **Figure 3-7**. The number of new vessel deliveries is expected to increase each year until a 2030 peak, and then taper off to the end of the forecast period, with an upward bounce in 2034.

[2] Factors such as economic conditions, price of steel, exchange rates, and a host of others can influence the forecasted world fleet.
[3] The term "fully cellular" refers to vessels that are purpose built to carry ocean containers. The containers are generally stored in vertical slots on the ship.

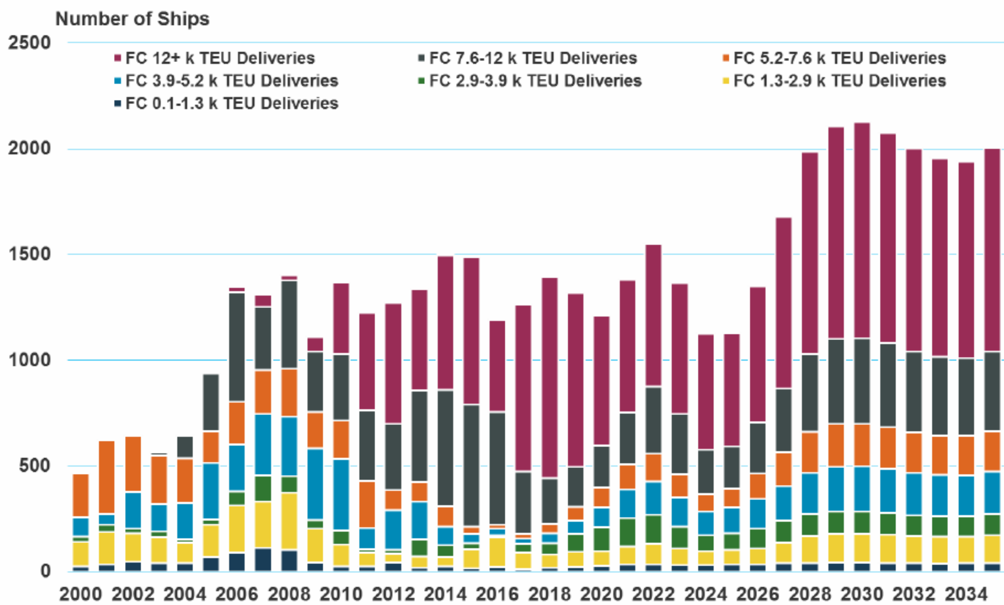


Figure 3-7: Containership Deliverables. 2000-2035 (Source: MSI)

An estimate of annual scrapping was accomplished by examining the LR-Fairplay database for the world fleet each year and noting which vessels drop out each year. This was done by TEU band and transformed into a scrapping profile for each band. **Figure 3-8** shows the estimated scrapping by TEU band class.

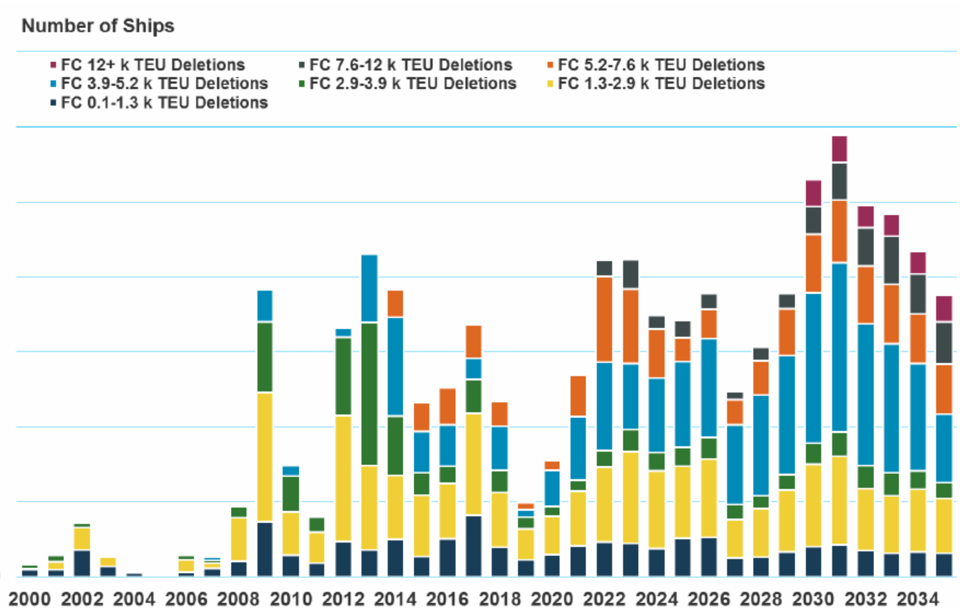


Figure 3-8: Containership Deletions, 2000-2035 (Source MSI)

World Fleet Forecast

With data for deliveries, scrapping, and the 2011 fleet calculated, forecast of the fleet for the end of each forecast year was estimated using the following equation:

$$Fleet\ EoP\ (Year) = Fleet\ EoP\ (Year-1) + Deliveries\ (Year) - Scrapping\ (Year)\ EoP = End\ of\ period$$

Figure 3-9 displays the world FCC forecast by TEU band through 2035.

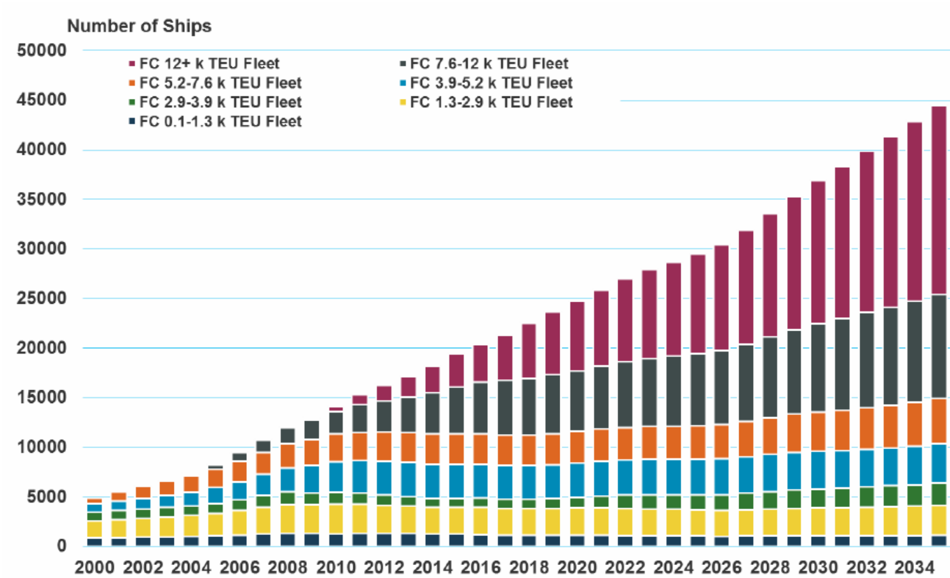
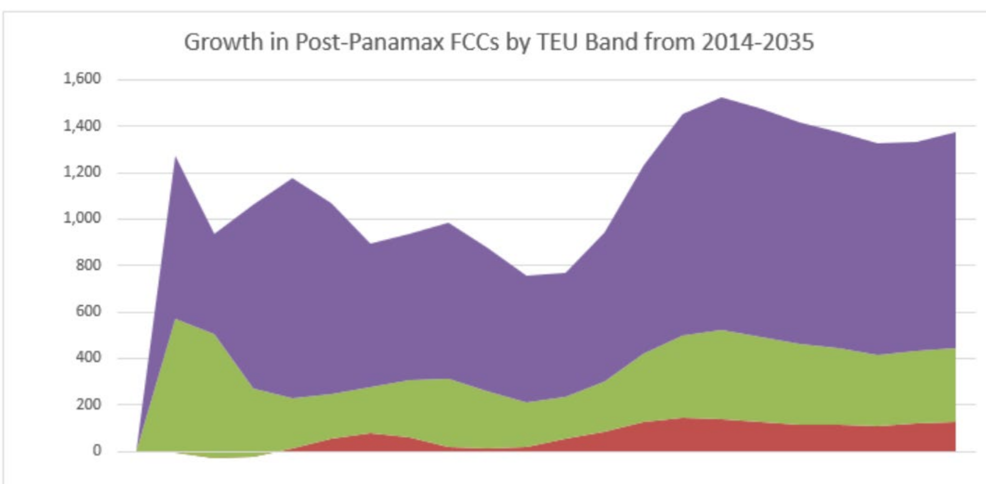


Figure 3-9: World Fleet, Historical and Forecasted FCC by TEU Band, 2000-2035 (Source: MSI)

Figure 3-10 shows the net growth in selected Post-Panamax TEU bands from the 2014 fleet. The figure shows the additional vessels added to the fleet. These types of vessels are a key factor in the evaluation of port deepening studies such as the POLB.



	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
12+ k	0	698	432	791	950	823	616	627	677	617	547	536	644	815	956	1006	987	956	931	910	900	927
7.6-12 k	0	576	534	296	217	187	198	244	293	248	192	178	218	291	350	380	367	347	331	307	313	319
5.2-7.6 k	0	-4	-32	-22	11	57	81	63	17	10	17	56	82	128	147	141	125	115	114	108	121	126

Figure 3-10: World Fleet Net Growth Forecast of Selected TEU Bands

4 TRANSPORTATION COST SAVINGS BENEFIT ANALYSIS

The purpose of this analysis is to describe the benefits associated with the deepening and widening at the Port of Long Beach channels. NED benefits were estimated by calculating the reduction in transportation cost for each project depth using the HarborSym Model (HSM), developed by IWR. The HSM incorporates USACE guidance on transportation cost savings analysis. Within this section, the HSM is described in detail and its application in this study.

4.1 Methodology

Channel improvement modifications result in reduced transportation cost by allowing a more efficient future fleet mix (and less congestion) when traversing the harbor. The HSM was designed to allow users to model these benefits. With a deepened channel, carriers will be able to load Post-Panamax vessels more efficiently and thereby reduce transiting costs. In the future, these carriers are anticipated to replace smaller less efficient vessels with the larger more efficient vessels on West Coast service lanes that will call the POLB. There are three primary effects from channel deepening that can benefit the future fleet at the POLB. The first is an increase in a vessel's maximum practicable loading capacity, if the vessel is depth constrained in the current channel. Channel restrictions can limit a vessel's capacity by limiting its ability to load to its design draft. Deepening the channel can reduce this constraint and the vessel's maximum practicable capacity can increase towards its design capacity if commodities are available to transit, vessel loading practices allow, and the weight of all commodities on a vessel can "push" deeper into the water. This increase in vessel capacity utilization can result in fewer vessel trips being required to transport the forecasted cargo. The second effect of increased channel depth is the increased operational reliability of water depth, which encourages the deployment of larger vessels to high volume lanes. The third effect is a consequence of the second; the increase in Post-Panamax vessels displaces the less economically efficient Panamax class vessels.

While lesser in magnitude when compared to channel deepening, additional transportation cost saving benefits result from the channel modifications aimed at reducing congestion within the harbor. The creation of meeting areas reduces wait times within the harbor. HarborSym allows for detailed modeling of vessel movements and transit rules on the waterway.

To begin, HarborSym was setup with the basic required variables. To estimate Origin- Destination (OD) cost saving benefits, a tool was used to generate a vessel call list based on the commodity forecast at the POLB for particular, defined years and available channel depth under the various examined depth alternatives. The resulting vessel traffic was simulated using HarborSym, producing an average annual vessel OD transportation cost. The transportation costs saving benefits were then calculated from the existing channel depths for each additional project depth. The NED Plan was identified by considering the highest net benefit based on the OD transportation cost saving benefits

4.1.1 HarborSym Model

IWR developed HarborSym as a planning level, general-purpose model to analyze the transportation costs of various waterway modifications within a harbor. HarborSym is a Monte Carlo simulation model of vessel movements at a port for use in economic analyses. While many harbor simulation models focus on landside operations, such as detailed terminal management, HarborSym instead concentrates on specific vessel movements and transit rules on the waterway, fleet and loading changes, as well as incorporating calculations for both within harbor costs and costs associated with the ocean voyage.

HarborSym represents a port as a tree-structured network of reaches, docks, anchorages, and turning areas. Vessel movements are simulated along the reaches, moving from the bar to one or more docks, and then exiting the port. Features of the model include intra-harbor vessel movements, tidal influence, the ability to model complex shipments, incorporation of turning areas and anchorages, and within-simulation visualization. The driving parameter for the HarborSym model is a vessel call at the port. A HarborSym analysis revolves around the factors that characterize or affect a vessel movement within the harbor.

Model Behavior

HarborSym is an event driven model. Vessel calls are processed individually and the interactions with other vessels are taken into account. For each iteration, the vessel calls for an iteration that fall within the simulation period are accumulated and placed in a queue based on arrival time. When a vessel arrives at the port, the route to all of the docks in the vessel call is determined. This route is comprised of discrete legs (contiguous sets of reaches, from the entry to the dock, from a dock to another dock, and from the final dock to the exit). The vessel attempts to move along the initial leg of the route.

Potential conflicts with other vessels that have previously entered the system are evaluated according to the user-defined set of rules for each reach within the current leg, based on information maintained by the simulation as to the current and projected future state of each reach. If a rule activation occurs, such as no passing allowed in a given reach, the arriving vessel must either delay entry or proceed as far as possible to an available anchorage, waiting there until it can attempt to continue the journey. Vessels move from reach to reach, eventually arriving at the dock that is the terminus of the leg.

After the cargo exchange calculations are completed and the time the vessel spends at the dock has been determined, the vessel attempts to exit the dock, starting a new leg of the vessel call; rules for moving to the next destination (another dock or an exit of the harbor) are checked in a similar manner to the rule checking on arrival, before it is determined that the vessel can proceed on the next leg. As with the entry into the system, the vessel may need to delay departure and re-try at a later time to avoid rule violations and, similarly, the waiting time at the dock is recorded.

A vessel encountering rule conflicts that would prevent it from completely traversing a leg may be able to move partially along the leg, to an anchorage or mooring. If so, and if the vessel can use the anchorage (which may be impossible due to size constraints or the fact that the anchorage is filled by other vessels), then HarborSym will direct the vessel to proceed along the leg to the anchorage, where it will stay and attempt to depart periodically, until it can do so without causing rule conflicts in the remainder of the leg. The determination of the total time a vessel spends within the system is the summation of time waiting at entry, time transiting the reaches, time turning, time transferring cargo, and time waiting at docks or anchorages. HarborSym collects and reports statistics on individual vessel movements, including time in system, as well as overall summations for all movements in an iteration.

Each vessel call has a known (calculated) associated cost, based on time spent in the harbor and ocean voyage and cost per hour. Also for each vessel call, the total quantity of commodity transferred to the port (both import and export) is known, in terms of commodity category, quantity, tonnage and value. The basic problem is to allocate the total cost of the call to the various commodity transfers thatare made. Each vessel call may have multiple dock visits and multiple commodity transfers at each visit, but each commodity transfer record refers to a single commodity and specifies the import and export tonnage. Also, at the commodity level, the “tons per unit” for the commodity is known, so that each commodity transfer can be associated with an export and import tonnage. As noted above, the process is greatly simplified if all commodity transfers within a call are for categories that are measured in the same unit, but that need not be the case.

When a vessel leaves the system, the total tonnage, export tonnage, and import tonnage transferred by the call are available, as is the total cost of the call. The cost per ton can be calculated at the call level (divide total cost by respective total of tonnage). Once these values are available, it is possible to cycle through all of the commodity transfers for the vessel call. Each commodity transfer for a call is associated with a single vessel class and unit of measure. Multiplying the tons or value in the transfer by the appropriate per ton cost, the cost totals by class and unit for the iteration can be incremented. In this fashion, the total cost of each vessel call is allocated proportionately to the units of measure that are carried by the call, both on a tonnage and a value basis. Note that this approach does not require that each class or call carry only a commensurate unit of measure.

The model calculates import and export tons, import and export value, and import and export allocated cost. This information allows for the calculation of total tons and total cost, allowing for the derivation of the desired metrics at the class and total level. The model can thus deliver a high level of detail on individual vessel, class, and commodity level totals and costs.

Either all or a portion of the at-sea costs are associated with the subject port, depending on whether the vessel call is a partial or full load. The at-sea cost allocation procedure is implemented within the HarborSym Monte-Carlo processing kernel and utilizes the estimate total trip cargo (ETTC) field from the vessel call information along with import tonnage and export tonnage. In all cases the ETTC is the user's best estimate of total trip cargo. .

Data Requirements

The data required to run HarborSym are separated into six categories, as described below. Key data for the POLB Channel Improvement study are provided.

Simulation Parameters

Parameters include start date, the duration of the iteration, the number of iterations, the level of detail of the result output, and the wait time before rechecking rule violations when a vessel experiences a delay. These inputs were included in the model runs for this study. For this analysis, detailed forecasts were developed for years 2021, 2030, and 2040. After 2040 the forecasted number of TEUs and liquid bulk were held constant throughout the period of analysis.

Physical and Descriptive Harbor Characteristics: These data inputs include the specific network of the POLB, such as the node location and type, reach length, width, and depth, in addition to tide and current stations. This also includes information about the docks in the harbor, such as length and maximum number of vessels the dock can accommodate at any given time. **Figure 4-1**: displays the Node network used for Long Beach Harbor.

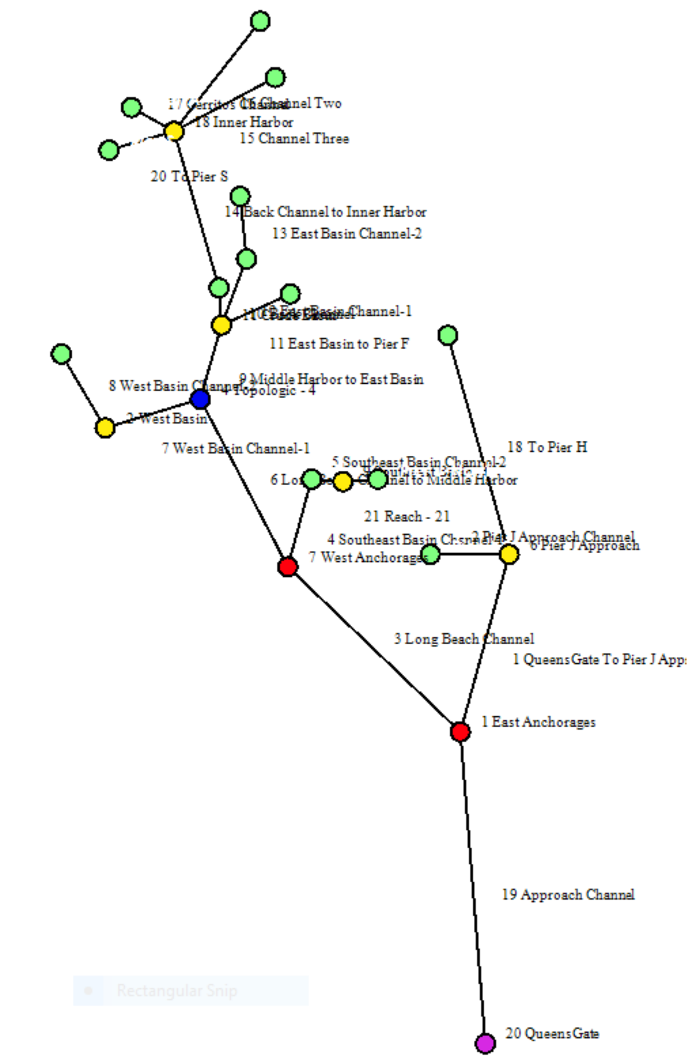


Figure 4-1: POLB HarborSym Node Network

General Information

General information used as inputs to the model include: specific vessel and commodity classes, route groups **(Table 4-1**:**),** commodity transfer rates at each dock **(**Table 4-2**),** specifications of turning area usage at each dock, and specifications of anchorage use within the harbor. Distances between the route groups were developed by evaluating the 9 trade routes calling on the Port of Long Beach in 2015. The route group distance included in the analysis for each trade lane is calculated from the average distance for each trade route that was identified.

Table 4-1: HarborSym Route Groups

Route Group Name	Description	Sea Distance (nautical miles)
NEA-WCUS	Northeast Asia Container Route	14,000
SEA-WCUS	Southeast Asia + ISCME Container Route	16,000
EU-NA-LA-WCUS	Europe/North America/Latin America/ WCUS	17,000
OCEANIA-WCUS	New Zealand/Australia/Pacific Island/Hawaii	13,000
WCSA-WCUS	West Coast South America / WCUS	7,000
LATAM-WCUS	Latin America / WCUS	7,000
AL-WCUS-MEX	Alaska / WCUS /Mexico / Crude Oil	2,800
FE-WCUS	Far East / WCUS / Crude Route	12,500

Table 4-2: HarborSym Commodity Transfer Rates

Dock Name	Loading/Unloading Rate for Containerized Commodities (tonnes/hour)		
	Min	Most Likely	Max
Pier J North TEUs	880	1,936	2,816
Pier J South TEUs	880	1,936	2,816
Pier T TEUs	950	1,000	1,200
Pier T-Crude MT	5,400	6,000	6,600

Vessel Speeds

The speed at which vessels operate in the harbor, by vessel class both loaded and light loaded, were determined for each channel segment by evaluating pilot logs and port records as well as by verifying the data with the pilots. Vessel speed inputs are provided in **Table 4-3**: for each reach of the node network for containerized vessels.

Table 4-3: HarborSym Vessel Speed in Reaches (knots)

Reach	Sub-Panamax		Panamax		PPX1		PPX2		PPX3 & PPX4		Tankers	
	Light	Loaded	Light	Loaded	Light	Loaded	Light	Loaded	Light	Loaded	Light	Loaded
All Reaches	12	10	12	10	12	10	12	10	12	10	12	10

Vessel Operations

Hourly operating costs while in-port and at-sea were determined for both domestic and foreign flagged containerized vessels. Sailing speeds at-sea were also determined. These values are entered as a triangular distribution. The inputs are shown in **Table 4-4**:.

Table 4-4: Containerized Vessel Operations

Description	Panamax	PPX 1	PPX 2	PPX 3	PPX4	Sub Panamax	Tankers
Vessel Speed at Sea, Min (knots)	19.0	20.0	20.0	20.0	20.0	16.0	13.0
Vessel Speed at Sea, Most Likely (knots)	20.0	21.0	21.0	21.0	21.0	17.0	14.0
Vessel Speed at Sea, Max (knots)	21.0	22.0	22.0	22.0	22.0	18.0	15.0

Reach Transit Rules

Vessel transit rules for each reach reflect restrictions on passing, overtaking, and meeting in particular segments of Long Beach Harbor, and are used to simulate actual conditions in the reaches. For the Tidal Advantage and Meeting Area analysis, underkeel clearance requirements are also used along with tide to determine if a vessel can enter the system.

Vessel Calls

The vessel call lists are made up of forecasted vessel calls for a given year. Each vessel call list contains the following information: arrival date, arrival time, vessel name, entry point, exit point, arrival draft, import/export, dock name, dock order, commodity, units, origin/destination, vessel type, Lloyds Registry, net registered tons, gross registered tons, dead weight tons, capacity, length overall, beam, draft, flag, tons per inch immersion factor, ETTC, and the route group for which it belongs.

4.1.2 Containerized Vessel Call List

The forecasted commodities for the POLB were allocated to the future fleet using a forecast spreadsheet tool. This produces a containership-only future vessel call list based on user inputs describing commodity forecasts at docks and the available fleet. The module is designed to process in two unique steps to generate a shipment list for use in HarborSym. First, a synthetic fleet of vessels is generated that can service the port. This fleet includes the maximum possible vessel calls based on the user provided availability information. Second, the commodity forecast demand is allocated to individual vessels from the generated fleet, creating a vessel call and fulfilling an available call from the synthetic fleet.

In order to successfully utilize this tool on a planning study, users provide extensive data describing containership loading patterns and services frequenting the study port. The user provides a vessel fleet forecast by vessel class, season, and service, and a commodity forecast by dock, season, and region.

Container Loading Practice Changes

A load factor analysis (LFA) was done to determine the maximum practicable draft and the maximum practicable cargo capacity for each trade unit. A load factor analysis is used to account for the physical components that determine the vessel draft. Combining these factors allows the analyst to determine whether the vessel will reach its volumetric capacity before it reaches its deadweight capacity. Once the vessel reaches its volumetric cargo capacity, the vessel is said to have "cubed out", meaning it can carry no more cargo no matter how much additional channel depth is available. **Table 4-5** provides details on the vessel subclasses, which is used by the LFA to create vessels to satisfy the commodity forecast. The user provides the linkage between the HarborSym vessel class and the IWR-defined vessel subclass.

Table 4-5: Vessel Class Inputs

Service	Vessel Class	AVG Loading Weight Per Loaded TEU (tonnes)	AVG Container Weight Per TEU (tonnes)	Empty TEU Allotment	Vacant Slot Allotment	Operation Allowance (% of DWT)	Variable Ballast (% of DWT)	Import Shipment Size Proportion	Export Shipment Size Proportion
NEA-WCUS	PX	7.28	2	22.3%	6.2%	7.1%	14.9%	23%	15%
NEA-WCUS	PPX 1	7.28	2	19.2%	6.2%	7.1%	14.9%	28%	12%
NEA-WCUS	PPX 2	7.28	2	24.9%	6.2%	7.1%	14.9%	46%	28%
NEA-WCUS	PPX 3	7.28	2	21.2%	6.2%	7.1%	14.9%	49%	36%
NEA-WCUS	PPX 4	7.28	2	21.2%	6.2%	6.1%	13.0%	44%	25%
NEA-WCUS	SPX	7.28	2	21.2%	6.2%	6.1%	11.5%	32%	18%
SEA-WCUS	PX	7.22	2	22.3%	6.2%	7.1%	14.9%	23%	15%
SEA-WCUS	PPX 1	7.22	2	19.2%	6.2%	7.1%	14.9%	29%	12%
SEA-WCUS	PPX 2	7.22	2	24.9%	6.2%	7.1%	14.9%	46%	29%
SEA-WCUS	PPX 3	7.22	2	21.2%	6.2%	7.1%	14.9%	49%	36%
SEA-WCUS	PPX 4	7.22	2	21.2%	6.2%	6.1%	13.0%	44%	25%
SEA-WCUS	SPX	7.22	2	21.2%	6.2%	6.1%	11.5%	32%	18%
EU-NA-LA-WCUS	PX	8.86	2	22.3%	6.2%	7.1%	14.9%	20%	13%
EU-NA-LA-WCUS	PPX 1	8.86	2	19.2%	6.2%	7.1%	14.9%	26%	11%
EU-NA-LA-WCUS	PPX 2	8.86	2	24.9%	6.2%	7.1%	14.9%	43%	27%
EU-NA-LA-WCUS	PPX 3	8.86	2	21.2%	6.2%	7.1%	14.9%	47%	35%
EU-NA-LA-WCUS	PPX 4	8.86	2	21.2%	6.2%	6.1%	13.0%	44%	24%
EU-NA-LA-WCUS	SPX	8.86	2	21.2%	6.2%	6.1%	11.5%	32%	18%
OCEANIA-WCUS	PX	8.79	2	29.6%	6.2%	7.1%	14.9%	21%	14%
OCEANIA-WCUS	PPX 1	8.79	2	22.3%	6.2%	7.1%	14.9%	26%	11%
OCEANIA-WCUS	PPX 2	8.79	2	9.7%	6.2%	7.1%	14.9%	43%	27%
OCEANIA-WCUS	PPX 3	8.79	2	9.7%	6.2%	7.1%	14.9%	46%	34%
OCEANIA-WCUS	PPX 4	8.79	2	12.4%	6.2%	6.1%	13.0%	44%	24%

The percentage share of each subclass was defined by historical data provided by the Port. **Table 4-6** provides additional detail on the shipment sizes per trade unit. The table illustrates the average combined imported and exported shipment per vessel call. **Table 4-7** provides detail on the annual cargo tonnage projected for 2021.

Table 4-6: Mean Shipment Size by Trade Unit & Alternative Depth

	Class	50 feet	53 feet	55 feet	57 feet
NEA-WCUS	SPX	4,690	4,690	4,690	4,690
	PX	11,973	11,973	11,973	11,973
	PPX1	24,510	24,510	24,510	24,510
	PPX2	39,096	39,096	39,096	39,096
	PPX3	45,711	46,174	46,174	46,174
	PPX4	45,711	50,648	50,781	50,781
SEA-WCUS	SPX	4,690	4,690	4,690	4,690
	PX	11,973	11,973	11,973	11,973
	PPX1	24,510	24,510	24,510	24,510
	PPX2	39,096	39,096	39,096	39,096
	PPX3	45,711	46,147	46,147	46,147
	PPX4	45,711	50,648	50,781	50,781
EU-NA-LA-WCUS	SPX	4,690	4,690	4,690	4,690
	PX	11,973	11,973	11,973	11,973
	PPX1	24,510	24,510	24,510	24,510
	PPX2	39,096	39,096	39,096	39,096
	PPX3	45,711	46,269	46,269	46,269
	PPX4	45,711	50,648	50,781	50,781
OCEANIA-WCUS	SPX	4,690	4,690	4,690	4,690
	PX	11,973	11,973	11,973	11,973
	PPX1	24,510	24,510	24,510	24,510
	PPX2	39,096	39,096	39,096	39,096
	PPX3	45,711	46,269	46,269	46,269
	PPX4	45,711	50,648	50,781	50,781

Table 4-7: Annual Container Cargo by Trade Unit and Measure Depth (metric tonnes)

	Class	50 feet	53 feet	55 feet	57 feet
NEA-WCUS	SPX	135,748	135,748	135,748	135,748
	PX	1,970,127	1,909,795	1,908,616	1,908,616
	PPX1	2,091,005	2,045,756	2,044,872	2,044,872
	PPX2	3,955,982	3,925,816	3,925,227	3,925,227
	PPX3	3,495,291	3,532,299	3,532,299	3,532,299
	PPX4	1,031,716	1,130,455	1,133,108	1,133,108
SEA-WCUS	SPX	75,476	75,476	75,476	75,476
	PX	439,033	407,399	406,810	406,810
	PPX1	778,189	754,464	754,022	754,022
	PPX2	3,604,218	3,588,401	3,588,106	3,588,106
	PPX3	2,498,072	2,519,878	2,519,878	2,519,878
	PPX4	663,990	713,360	714,686	714,686
EU-NA-LA-WCUS	SPX	486,255	486,255	486,255	486,255
	PX	1,483,844	1,456,945	1,456,355	1,456,355
	PPX1	627,063	606,888	606,446	606,446
	PPX2	1,653,618	1,640,168	1,639,873	1,639,873
	PPX3	1,035,202	1,046,357	1,046,357	1,046,357
	PPX4	468,197	517,567	518,893	518,893
OCEANIA-WCUS	SPX	495,560	495,560	495,560	495,560
	PX	1,009,372	1,009,372	1,009,372	1,009,372
	PPX1	949,456	949,456	949,456	949,456
	PPX2	474,728	474,728	474,728	474,728
	PPX3	-	-	-	-
	PPX4	-	-	-	-

Vessel Calls

Vessel calls by vessel class for containerized vessels are shown in **Table 4-8**. Vessel calls by vessel class for bulker vessels are shown in **Table 4-9**. These are a result of the containerized trade forecast for the POLB, the available vessel fleet by service, and the LFA data inputs.

Table 4-8: Containerized Vessel Calls by Class and Channel Depth

Vessel Class	50 feet	53 feet	55 feet	57 feet
2021				
SPX	252	252	252	252
PX	408	399	398	398
PPX 1	180	180	180	180
PPX 2	248	244	244	244
PPX 3	150	150	150	150
PPX 4	40	40	40	40
Total	**1,278**	**1,265**	**1,264**	**1,264**
2030				
SPX	212	212	212	212
PX	328	296	296	296
PPX 1	212	199	199	199
PPX 2	332	327	327	327
PPX 3	280	280	280	280
PPX 4	130	130	130	130
Total	**1,494**	**1,444**	**1,444**	**1,444**
2040				
SPX	188	188	188	188
PX	116	102	102	102
PPX 1	192	159	159	159
PPX 2	288	255	254	254
PPX 3	490	490	490	490
PPX 4	450	450	450	450
Total	**1,724**	**1,644**	**1,643**	**1,643**

Table 4-9: Tanker Vessel Calls by Vessel Class and Channel Depth

Vessel Class	76 feet	78 feet	80 feet	83 feet
2021				
10K DWT Tanker	1	1	1	1
20K DWT Tanker	46	46	46	46
30K DWT Tanker	35	35	35	35
40K DWT Tanker	4	4	4	4
50K DWT Tanker	217	217	217	217
60K DWT Tanker	18	18	18	18
70KDWT Tanker	155	151	147	147
80K DWT Tanker	5	5	5	5
100K DWT Tanker	179	178	177	177
200K DWT Tanker	167	167	167	167
300K DWT Tanker	105	105	105	105
Total	**932**	**927**	**922**	**922**
2030				
10K DWT Tanker	1	1	1	1
20K DWT Tanker	46	46	46	46
30K DWT Tanker	34	34	34	34
40K DWT Tanker	4	4	4	4
50K DWT Tanker	213	213	213	213
60K DWT Tanker	18	18	18	18
70K DWT Tanker	151	147	146	146
80K DWT Tanker	5	5	5	5
100K DWT Tanker	176	175	173	173
200K DWT Tanker	167	167	167	167
300K DWT Tanker	101	101	101	101
Total	**916**	**911**	**908**	**908**
2040				
10K DWT Tanker	1	1	1	1
20K DWT Tanker	43	43	43	43
30K DWT Tanker	33	33	33	33
40K DWT Tanker	4	4	4	4
50K DWT Tanker	213	213	213	213
60K DWT Tanker	18	18	18	18
70K DWT Tanker	151	147	145	145
80K DWT Tanker	5	5	5	5
100K DWT Tanker	176	174	173	173
200K DWT Tanker	167	167	167	167
300K DWT Tanker	101	101	101	101
Total	**912**	**906**	**903**	**903**

Table 4-10 displays the average load for crude oil imports by channel depth. The trend shows that as depth increases, the average load increases through 2040.

Table 4-10: Crude Oil Average Load by Channel Depth (metric tons)

Year	76 feet	78 feet	80 feet	83 feet
2021	25,156	25,354	25,478	-
2030	24,418	24,585	24,714	-
2040	24,498	24,617	24,766	-

Sailing Draft Distribution Changes

Table 4-11 provides detail on the change to the arrival draft distribution for POLB container vessels.

Table 4-11: Container Sailing Draft Changes by Channel Depth

	Vessel Class	50 feet	53 feet	55 feet	57 feet
NEA-WCUS	PPX3	37.48	37.86	37.86	37.86
	PPX4	37.48	41.53	41.64	41.64
SEA-WCUS	PPX3	37.48	37.84	37.84	37.84
	PPX4	37.48	41.53	41.64	41.64
EU-NA-LA-WCUS	PPX3	37.48	37.94	37.94	37.94
	PPX4	37.48	41.53	41.64	41.64
OCEANIA-WCUS	PPX3	37.48	37.48	37.48	37.48
	PPX4	37.48	37.48	37.48	37.48

4.2 Origin-Destination (OD) Transportation Cost Savings Benefit by Project Depth

From the onset of this analysis, the alternatives considered—primarily deepening scenarios but also a potential stand-by area—acknowledged that there were three "separable elements" (basically an independent beneficial measure that must be economically justified on its own merits) to be analyzed. The first piece would address depths needed to allow calls by Post–Panamax container ships that are becoming the norm in international maritime shipping and are already calling on West Coast ports, albeit not fully loaded. With the existing depth for container Piers T and J being 53' and 50' respectively, team economists discussed anticipated future operational needs and decided to examine scenarios of 53', 55', and 57' depths.

Additionally, POLB officials were interested in the benefits accruing to each facility separately (Pier J South vs Pier T West Basin). Also, the Port indicated that their long-term plans are to implement modifications that would fill in and therefore eliminate Pier J South by about 20 years after the Base Year (approximately 2047). Thus the economic model runs and results incorporated these issues. Benefits and costs were separated out for the two container piers and the benefiting stream for Pier J South was truncated to year 2046 (rather than the full period of analysis end year of 2076).

The next element that was addressed was liquid bulk tankers, in this instance primarily for crude oil shipments. The approach and Main Channel currently has a draft of 76', making it necessary for tankers to arrive into POLB particularly light-loaded due to pilots rules concerning safety underkeel clearances of 10% design draft for these classes of vessels (thus translating to underkeel clearance safety factors to upwards of 8'). Large crude/liquid bulk vessels use the west side of Pier T abutted against the Main Channel. Meetings with Port officials and pilots resulted in the decision to analyze deeper depths of 78', 80', and 83' to accommodate vessels to transit the harbor with crude amounts closer to their capacity. Tidal delays rather than vessel design draft lead to analyzing depths greater than 80'.

Finally, the Port and pilots expressed an interest in providing a stand-by area for vessels waiting to dock and providing some degree of safety coverage by being within the harbor breakwater rather than in open water. Based upon design drafts of both design vessel classes, the team decided to analyze stand-by area depth of 67', 68', 71', 72', and 73'; primarily, this stand-by area would accommodate tankers waiting to process its load at the single Pier T crude facility. The analysis did not analyze two-way traffic, only queuing needs which per guidance did not result in an incremental economic justification.

Transportation cost benefits were estimated using the HarborSym Economic Reporter, a tool that summarizes and annualizes HarborSym results from multiple simulations. This tool collects the transportation costs from various model run output files and generates the transportation cost reduction for all project years, and then produces an Average Annual Equivalent (AAEQ). Results and calculations were also verified using spreadsheet models used in previous deep draft navigation analyses.

Transportation costs were estimated for a 50-year period of analysis for the years 2027 through 2076. Transportation costs were calculated using the Corps certified HarborSym model for the years 2021, 2030, and 2040 and are shown in **Table 4-12** and **Table 4-13**. Results for the base year 2027 are calculated by interpolating between the 2021 and 2030 results. This was due to a change in the anticipated base year (2027 from 2021) during the study phase of the analysis. Also, due to the risk and uncertainty associated with forecasting beyond 2040, along with time frame any additional benefits would be discounted back to the base year 2027, transportation costs were held constant beyond 2040. Transportation costs were then determined for each alternative project depth.

In the following cost-benefit tables, all calculations of transportation cost savings used the FY 2019 Federal Discount Rate of 2.875% (including figures estimated by interpolating between the modeled years and calculating Net Present Value). All cost estimates provided by Cost Estimating are in FY 2019 (Oct 2018) Price Levels and were annualized using the same Federal Discount rate and amortizing over 50 years.

Table 4-12: Container Vessel Transportation Cost Savings

Model Year	Class	FWOP	53 feet	55 feet	57 feet
2021	SPX	$ 114,794,282	$ 114,794,282	$ 114,794,282	$ 114,794,282
	PX	$ 482,202,619	$ 479,677,998	$ 473,997,601	$ 473,366,446
	PPX1	$ 500,201,662	$ 500,201,662	$ 498,534,323	$ 496,866,984
	PPX2	$ 900,189,684	$ 900,189,684	$ 900,189,684	$ 900,189,684
	PPX3	$ 681,907,102	$ 681,907,102	$ 681,907,102	$ 681,907,102
	PPX4	$ 161,407,340	$ 161,407,340	$ 161,407,340	$ 161,407,340
2030	SPX	$ 98,038,353	$ 98,038,353	$ 98,038,353	$ 98,038,353
	PX	$ 389,637,859	$ 387,107,743	$ 378,252,338	$ 377,619,809
	PPX1	$ 588,838,317	$ 588,838,317	$ 582,295,669	$ 582,295,669
	PPX2	$ 1,203,256,658	$ 1,203,256,658	$ 1,203,256,658	$ 1,203,256,658
	PPX3	$ 1,283,963,703	$ 1,283,963,703	$ 1,283,963,703	$ 1,283,963,703
	PPX4	$ 476,025,237	$ 476,025,237	$ 476,025,237	$ 476,025,237
2040	SPX	$ 87,822,491	$ 87,822,491	$ 87,822,491	$ 87,822,491
	PX	$ 144,545,910	$ 143,277,964	$ 139,474,124	$ 138,840,151
	PPX1	$ 571,267,073	$ 558,848,223	$ 552,638,799	$ 552,638,799
	PPX2	$ 1,075,974,124	$ 1,075,974,124	$ 1,075,974,124	$ 1,075,974,124
	PPX3	$ 2,164,422,412	$ 2,164,422,412	$ 2,164,422,412	$ 2,164,422,412
	PPX4	$ 1,612,179,964	$ 1,612,179,964	$ 1,612,179,964	$ 1,612,179,964

Table 4-13: Tanker Vessel Transportation Cost Savings

Model Year	Class	FWOP	78 feet	79 feet	80 feet
2021	10K DWT Tanker	$250,900	$250,900	$250,900	$250,900
	20K DWT Tanker	$19,434,426	$19,434,426	$19,434,426	$19,434,426
	30K DWT Tanker	$17,432,431	$17,432,431	$17,432,431	$17,432,431
	40K DWT Tanker	$2,635,599	$2,635,599	$2,635,599	$2,635,599
	50K DWT Tanker	$154,512,012	$154,512,012	$154,512,012	$154,512,012
	60K DWT Tanker	$8,487,067	$8,487,067	$8,487,067	$8,487,067
	70K DWT Tanker	$104,871,066	$102,164,716	$100,811,540	$99,458,365
	80K DWT Tanker	$1,667,498	$1,667,498	$1,667,498	$1,667,498
	100K DWT Tanker	$64,654,526	$64,293,328	$63,932,129	$63,932,129
	200K DWT Tanker	$73,381,804	$73,381,804	$73,381,804	$73,381,804
	300K DWT Tanker	$31,392,999	$31,392,999	$31,392,999	$31,392,999
2030	10K DWT Tanker	$249,660	$249,660	$249,660	$249,660
	20K DWT Tanker	$18,043,291	$18,043,291	$18,043,291	$18,043,291
	30K DWT Tanker	$16,813,147	$16,813,147	$16,813,147	$16,813,147
	40K DWT Tanker	$2,547,115	$2,547,115	$2,547,115	$2,547,115
	50K DWT Tanker	$147,125,724	$147,125,724	$147,125,724	$147,125,724
	60K DWT Tanker	$7,461,248	$7,461,248	$7,461,248	$7,461,248
	70K DWT Tanker	$91,938,429	$89,502,974	$89,502,974	$88,894,110
	80K DWT Tanker	$1,448,981	$1,448,981	$1,448,981	$1,448,981
	100K DWT Tanker	$55,194,292	$54,880,688	$54,253,480	$54,253,480
	200K DWT Tanker	$64,588,626	$64,588,626	$64,588,626	$64,588,626
	300K DWT Tanker	$28,514,713	$28,514,713	$28,514,713	$28,514,713
2040	10K DWT Tanker	$250,424	$250,424	$250,424	$250,424
	20K DWT Tanker	$14,990,002	$14,990,002	$14,990,002	$14,990,002
	30K DWT Tanker	$16,310,580	$16,310,580	$16,310,580	$16,310,580
	40K DWT Tanker	$2,640,507	$2,640,507	$2,640,507	$2,640,507
	50K DWT Tanker	$151,631,922	$151,631,922	$151,631,922	$151,631,922
	60K DWT Tanker	$9,115,057	$9,115,057	$9,115,057	$9,115,057
	70K DWT Tanker	$85,467,452	$83,203,414	$83,203,414	$82,071,394
	80K DWT Tanker	$1,653,664	$1,653,664	$1,653,664	$1,653,664
	100K DWT Tanker	$62,260,526	$61,553,020	$61,199,267	$61,199,267
	200K DWT Tanker	$68,926,301	$68,926,301	$68,926,301	$68,926,301
	300K DWT Tanker	$34,845,677	$34,845,677	$34,845,677	$34,845,677

Table 4-14 through Table 4-18 presents the preliminary economic benefit summaries using the FY 2019 Federal Discount Rate of 2.875% by measure for each of the two container terminals, then separately for containers and tankers, and finally for a stand-by area. An estimated 7.4 million cubic yards of material would be dredged. Proposed disposal sites include LA-2, LA-3, surfside borrow pits off Huntington Beach/Seal Beach, and Port fill sites (nearshore). LA -2 disposal site is located at the upper southern wall of San Pedro Sea Valley, about 6.8 miles south-southwest of the Queens Gate entrance to Los Angeles and Long Beach Harbor. LA -3 disposal site is located on the continental slope near the Newport Submarine Canyon about 5.4 miles southwest of the entrance of Newport Harbor.

Container annualized benefits were calculated separately for Pier J (for 20 years, as previously described per Port master plans) and Pier T/West Basin. Cost Estimating figures were allocated appropriately between each and subsequently annualized. As the table shows, each pier is economically justified as a separable element of subsequent alternatives. Moreover, each pier shows maximized annual net benefits at a project improvement depth of -55-ft.

Table 4-14: Preliminary Economic Benefit Summary for Pier J

Alternative	Avg Annual Benefits Pier J	Avg Annual Costs Pier J	Net Annual Benefits	Benefit-Cost Ratio
Containers 53 Offshore	$2,752,936.08	$2,015,000	$737,936	1.4
Containers 55 Offshore	$6,184,171.13	$2,557,000	$3,627,171	2.4
Containers 57 Offshore	$6,468,887.54	$3,569,000	$2,899,888	1.8
Containers 53 Nearshore	$2,752,936.08	$1,832,000	$920,936	1.5
Containers 55 Nearshore	$6,184,171.13	$2,283,000	$3,901,171	2.7
Containers 57 Nearshore	$6,468,887.54	$3,267,000	$3,201,888	2.0

Table 4-15: Preliminary Economic Benefit Summary for Pier T

Alternative	Avg Annual Benefits Pier T	Avg Annual Costs Pier T	Net Annual Benefits	Benefit-Cost Ratio
Containers 53 Offshore	$6,076,565	$685,000	$5,391,565	8.9
Containers 55 Offshore	$13,650,343	$846,000	$12,804,343	16.1
Containers 57 Offshore	$14,278,798	$1,778,000	$12,500,798	8.0
Containers 53 Nearshore	$6,076,565	$623,000	$5,453,565	9.8
Containers 55 Nearshore	$13,650,343	$755,000	$12,895,343	18.1
Containers 57 Nearshore	$14,278,798	$1,628,000	$12,650,798	8.8

Once both of the container terminals were shown to be incrementally justified, annualized costs were updated (thus, they may not match exactly the costs presented in the previous table) and combined to show that the overall container analysis was also economically justified. **Table 4-16** documents that the combined elements of Nearshore sediment placement and a channel depth of -55-ft maximizes container annual net benefits at just shy of $16.8M and results in a containers B-C ratio 0f 6.5.

Table 4-16: Preliminary Container Economic Benefit Summary

Alternative	Avg Annual Benefits Pier J	Avg Annual Benefits Pier T	Avg Annual Benefits	Ave Annual Costs	Net Annual Benefits	Benefit-Cost Ratio
Containers 53 Offshore	$2,752,936	$6,076,565	$8,829,501	$2,699,924	$ 6,129,578	3.3
Containers 54 Offshore	$4,468,554	$9,863,454	$14,332,008	$3,047,512	$11,284,496	4.7
Containers 55 Offshore	$6,184,171	$13,650,343	$19,834,514	$3,402,270	$16,432,245	5.8
Containers 56 Offshore	$6,326,530	$13,964,571	$20,291,100	$4,416,749	$15,874,352	4.6
Containers 57 Offshore	$6,468,888	$14,278,798	$20,747,686	$6,961,124	$13,786,562	3.0
Containers 53 Nearshore	$2,752,936	$6,076,565	$8,829,501	$2,454,892	$6,374,610	3.6
Containers 54 Nearshore	$4,468,554	$9,863,454	$14,332,008	$2,742,839	$11,589,169	5.2
Containers 55 Nearshore	**$6,184,171**	**$13,650,343**	**$19,834,514**	**$3,037,643**	**$16,796,872**	**6.5**
Containers 56 Nearshore	$6,326,530	$13,964,571	$20,291,100	$4,387,947	$15,903,154	4.6
Containers 57 Nearshore	$6,468,888	$14,278,798	$20,747,686	$6,508,701	$14,238,985	3.2

Table 4-17 displays the same analysis of the Pier T liquid bulk terminal. Annual benefits were calculated for project depths of -78-ft through -83-ft, considering both Nearshore and Offshore placement site cost estimates. Annual net benefits top out at approximately $2.2M and at an improved project depth of -80-feet.

Table 4-17: Preliminary Tanker Economic Benefit Summary

Alternative	Avg Annual Benefits	Ave Annual Costs	Net Annual Benefits	Benefit-Cost Ratio
Tankers 78 Offshore	$2,928,195	$1,971,945	$956,250	1.5
Tankers 79 Offshore	$3,583,587	$2,441,265	$1,142,323	1.5
Tankers 80 Offshore	$4,612,903	$2,918,776	$1,694,127	1.6
Tankers 81 Offshore	$4,713,299	$3,546,947	$1,166,352	1.3
Tankers 82 Offshore	$4,762,700	$4,099,996	$662,704	1.2
Tankers 83 Offshore	$4,762,700	$4,679,067	$83,633	1.0
Tankers 78 Nearshore	$2,928,195	$1,677,278	$1,250,917	1.7
Tankers 79 Nearshore	$3,583,587	$1,994,737	$1,588,851	1.8
Tankers 80 Nearshore	**$4,612,903**	**$2,374,526**	**$2,238,377**	**1.9**
Tankers 81 Nearshore	$4,713,299	$2,796,911	$1,916,388	1.7
Tankers 82 Nearshore	$4,762,700	$3,164,410	$1,598,290	1.5
Tankers 83 Nearshore	$4,762,700	$3,553,590	$1,209,110	1.3

Finally, the results of stand-by measure are displayed in **Table 4-18**. None of the proposed depths for the stand-by area for either material placement option proved to be economically justified. Nearshore material placement at -67 and -68-ft come close to reaching unity.

Table 4-18: Preliminary Economic Benefit Summary for Standby Area

Alternative	Avg Annual Benefits	Ave Annual Costs	Net Annual Benefits	Benefit-Cost Ratio
Standby Area 67 Nearshore Clamshell	$650,000	$1,780,909	$(1,130,909)	0.4
Standby Area 68 Nearshore Clamshell	$776,000	$1,809,075	$(1,033,075)	0.4
Standby Area 71 Nearshore Clamshell	$1,030,000	$2,283,305	$(1,253,305)	0.5
Standby Area 72 Nearshore Clamshell	$1,092,500	$2,518,532	$(1,426,032)	0.4
Standby Area 73 Nearshore Clamshell	$1,155,000	$2,755,991	$(1,600,991)	0.4
Standby Area 67 Nearshore Hopper	$650,000	$671,318	$(21,318)	0.97
Standby Area 68 Nearshore Hopper	$776,000	$818,085	$(42,085)	0.95
Standby Area 71 Nearshore Hopper	$1,030,000	$1,412,651	$(382,651)	0.7
Standby Area 72 Nearshore Hopper	$1,092,500	$1,630,543	$(538,043)	0.7
Standby Area 73 Nearshore Hopper	$1,155,000	$1,852,848	$(697,848)	0.6

4.3 Preliminary Transportation Cost Savings Benefit Analysis Summary for Final Array Plans

Based upon the analysis results shown on Tables 4-16 through 4-18, it was determined that net benefits maximized at a depth of -55' for container alternatives and -80' for liquid bulk alternatives for both disposal options/scenarios. However, dredging to depths of -53' to -57' for containers and -78' to -83' for liquid bulk vessels were also economically justified. Based upon these results, three scales of combined container/liquid bulk alternatives were selected for more detailed analysis as Final Array plans. These included a smaller scale plan of -53'/-78', the tentative NED scale of -55'/-80', and a larger scale plan of -57'/-83', representing the depths of deepening for container and liquid bulk vessels, respectively. In addition, an additional plan is being carried forward into the Final Array, that is based upon the NED scale of -55'/-80' for container and liquid bulk vessels, plus a -67' Standby Area measure. Although the Standby Area was not economically justified, it is being included as a Final Array plan option as it may be considered as a locally preferred plan by the non-Federal sponsor.

Table 4-19 below provides the Origin-Destination benefit cost analysis for these alternatives based upon rough order cost analysis.

As shown, the 55'/80' depth provides the greatest total net benefits.

Table 4-19 Origin-Destination Benefit Cost Analysis (Million $)

Project Depth	Total AAEQ Costs	O-D AAEQ Benefits	Total Net Benefits	Incremental Net Benefits	Benefit/Cost Ratio
53/78	$4.10	$11.80	$7.70	-	2.9
55/80	$5.40	$24.40	$19.00	$11.30	4.5
57/83	$10.10	$25.50	$15.40	($3.60)	2.5
55/80/67*	$6.10	$25.10	$19.00	$0	4.1

- *Net benefits slightly lower for 5/5/80/67 Plan*

4.4 Economic Cost Analysis (Refined Costs for Final Array Plans)

This section presents the evaluation of costs based upon refined costs for the Final Array Plans identified in the prior section. These costs also incorporate contingencies based upon an abbreviated cost risk analysis. Interest during construction (IDC) was calculated for the Federal Costs assuming that the schedule may vary depending on the time required to obtain congressional authorization and funding. Other areas of project uncertainties include the dredging industry execution of bid and contract requirements, availability of contractors' dredging equipment to comply with environmental windows, and delays due to unexpected weather conditions. Based on these uncertainties the construction duration for the project may vary from 24 to 60 months.
Table 4-20**, Table 4-21**, **Table 4-22, and Table 4-23** show the initial project costs for each alternative, including the federal and non federal portions.

Table 4-20: Alternative 2 Initial Costs

Alternative 2 - 53 feet / 78 feet				
	PED	Navigation	Construction Management	Total Initial Cost

Local Service Facilities	$2,206,000	$11,234,000	$2,068,000	$15,508,000
General Navigation Features	$11,625,000	$77,507,000	$5,193,000	$94,325,000
Total	$13,831,000	$88,741,000	$7261,000	$109,833,000
Interest during Construction (2 Years) - $2,712,000				

Table 4-21 **Alternative 3 Initial Costs**

Alternative 3 - 55 feet / 80 feet				
	PED	**Navigation**	**Construction Management**	**Total Initial Cost**
Local Service Facilities	$2,297,000	$14,998,000	$2,153,000	$19,448,000
General Navigation Features	$16,177,000	$107,853,000	$7,226,000	$131,256,000
Total	$18,474,000	$122,851,000	$9,379,000	$150,704,000
Interest during Construction (3 Years) - $5,678				

Table 4-22 **Alternative 4 Initial Costs**

Alternative 4 - 57 feet / 83 feet				
	PED	**Navigation**	**Construction Management**	**Total Initial Cost**
Local Service Facilities	$11,585,000	$76,106,000	$10,861,000	$98,552,000
General Navigation Features	$28,490,000	$189,909,000	$12,724,000	$231,123,000
Total	$40,075,000	$266,015,000	$23,585,000	$329,675,000
Interest during Construction (5 years) - $16,798,000				

Table 4-23 **Alternative 5 Initial Costs**

Alternative 5 - 55 feet / 80 feet / 67 feet				
	PED	**Navigation**	**Construction Management**	**Total Initial Cost**
Local Service Facilities	$2,297 ,000	$14,998,000	$10,861,000	$2,153,000
General Navigation Features	$21,579,000	$143,845,000	$9,637,000	$175,061,000
Total	$40,075,000	$266,015,000	$23,585,000	$194,509,000
Interest during Construction (4 Years) - $10,136,000				

The cost benefit analysis for the Final Array Plans based upon the refined and updated costs is shown in **Table 4-24**, with the NED plan highlighted in yellow. The NED plan has approximately $18 million average annual net benefits, about $1.3 million more than Alternative 5.

Table 4-24: Alternative Cost - Benefit Analysis

Alternative	Total Initial cost	Total Investment Cost	Average Annual Cost	Annual O&M	Total Annual Economic Cost	Average Annual Benefits	Average Net Benefits	Incremental Benefits	B/C
1 - No Action	-	-	-	-	-	-	-	-	
2 - 53/78	$109,833,000	$112,545,000	$4,270,867	$500,000	$4,770,867	$11,758,000	$6,987,133	$(11,025,470)	2.5
3 - 55/80	$150,704,000	$156,382,000	$5,934,398	$500,000	$6,434,398	$24,447,000	$18,012,602	-	3.8
4 - 57/83	$329,675,000	$346,473,000	$13,147,987	$500,000	$13,647,987	$25,510,000	$11,862,013	$(6,150,590)	1.9
5 - 55/80/67	$194,510,000	$207,233,000	$7,864,096	$500,000	$8,364,096	$25,097,000	$16,732,904	$(1,279,698)	3.0

5 MULTIPORT ANALYSIS

Multiport competition was assessed qualitatively for this study as it relates to shifting of cargo from one port to another port based on factors such as deepening of a harbor. The recommended plan includes a deeper channel to more efficiently operate larger containerships and crude oil tankers. Larger ships alone do not drive growth for the harbor. Many factors may influence the growth of a particular harbor: landside development and infrastructure, location of distribution centers for imports, source locations for exports, population and income growth and location, port logistics and fees, business climate and taxes, carrier preferences, labor stability and volatility, and business relationships. Harbor depth is just one of many factors involved in determining growth and market share for a particular port. The economic analysis was conducted with the historical cargo share at the POLB remaining the same in both the future without-project and future with-project conditions. Cargo may vary in the future as investments are made in port facilities and supporting infrastructure, and long-term leases are renewed or changed at individual terminals; however, the POLB's share of cargo is expected to remain relatively consistent with growth in the future being attributed to GDP growth for the U.S. West Coast and associated hinterland based on the information provided in the Mercator Report's commodity forecast conducted for this study in 2016. To restate the multiport considerations in another way, justification of the recommendation for this study is not based on an assumption that cargo will shift to the POLB based on deepening alone. It does take into account an evaluation of historical cargo data along the West Coast, including changes in growth when other harbor improvements have been made at various other West Coast ports. Based on that evaluation, the analysis takes into account that the POLB will receive a relatively similar share of regional cargo volumes with or without navigation improvements.

Two other deep water reports were considered for this study: the Ports of Los Angeles (adjacent to POLB) and Oakland. With rail transport being the preferred transportation mode for both exports and imports across the United States, rail services to these ports were examined. As the map below illustrates, both Oakland and LA/LB areas are served by major rail lines. Oakland is served by Union Pacific via major distribution cities of Reno, Salt Lake City, and Denver before reaching the markets of the Midwest. LA/LB is served by both Union Pacific and BNSF which provide access to Phoenix, Tucson, and El Paso before reaching the major southwest markets of Dallas/Fort Worth, Houston, and Memphis. While there may inevitably be some overlap in the areas served, these rail routes and their demand for goods would not be shifted from Northern to Southern CA due to the Federal project.

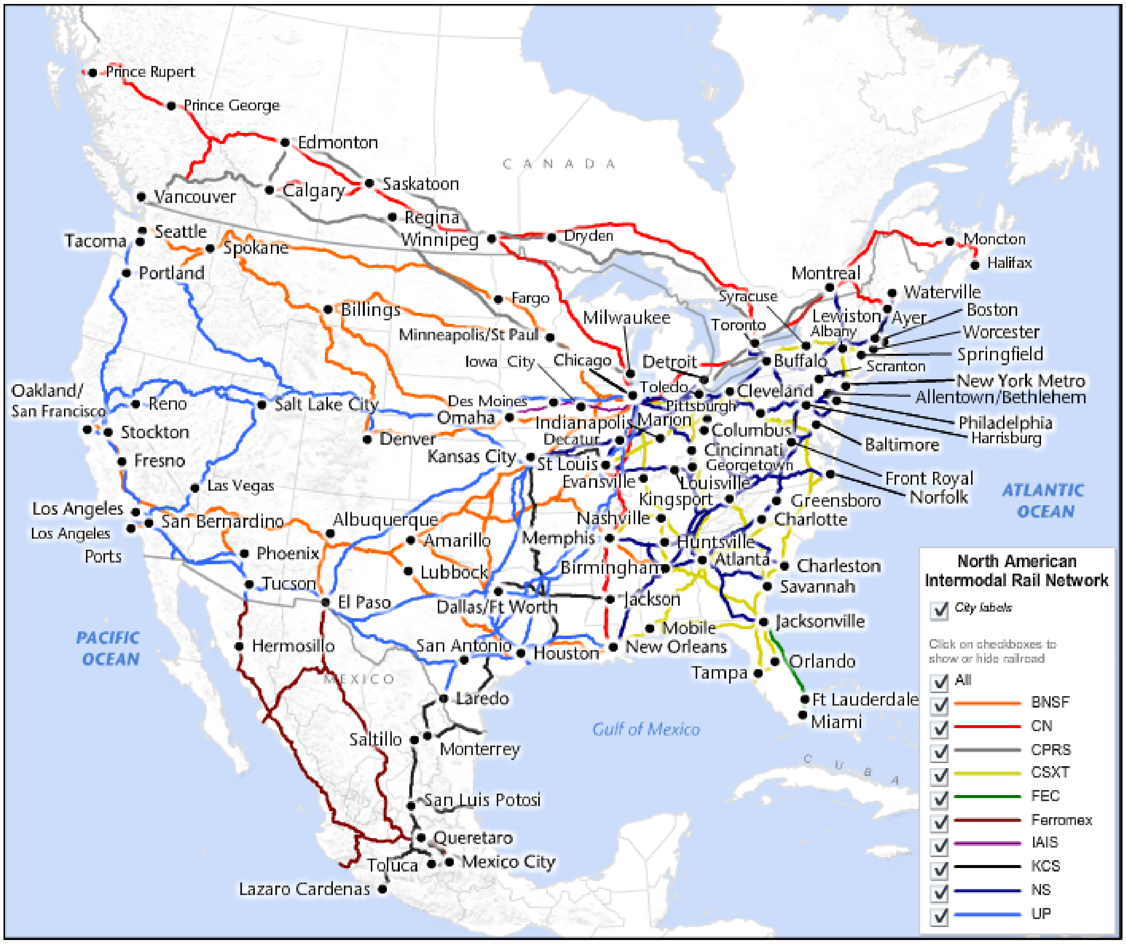


Figure 5-1: North American Intermodal Network

Next, the overall economic health of the potentially impacted ports was considered. According to the Port of Oakland, it recognizes that it is one of the three Pacific Coast gateways for cargo, along with Seattle & Tacoma and LA/LB. In 2018, 78% of its trade was with Asia, 11% with Europe, and 2% with Australia/New Zealand/Oceana. Its container history has grown from approximately 1.7M TEUs in 2002 to 2.6M TEUs in 2018, which amounts to around 2.7% growth per year.

The Port of Los Angeles also reports robust activity. In 2018, it handled about 9.5M TEUs and has a main channel water depth of 53'. It has ranked as the number one container port in the US since the year 2000. Its Top Five Trade Routes in 2018 were Northeast Asia (73%), Southeast Asia (21%), the Indian Subcontinent (2%), Northern Europe (1%) and the Middle East (1%).

Finally, the trade routes of the POLB were examined vis-à-vis Los Angeles and Oakland. East Asian trade already accounts for upwards of 90% of POLB shipments. Their top trading partners are China, South Korea, Japan, Hong Kong, Taiwan, Vietnam, Iraq, Australia, Ecuador, and Indonesia. So, while there definitely are some overlapping trade lanes to the other two ports, all three are already heavily invested in Asia, while Oakland also has a sizable market with Europe and Los Angeles has had a deeper channel for some time. These factors, as well as contracts and established business partnerships lend to the unlikelihood of the recommended Federal project substantially shifting cargo from either LA or Oakland to the POLB.

6 REGIONAL ECONOMIC DEVELOPMENT ANALYSIS

The regional economic development (RED) account measures changes in the distribution of regional economic activity that would result from each alternative plan. Evaluations of regional effects are measured using nationally consistent projection of income, employment, output, and population. For this regional analysis, the anticipated impacts of the recommended plan have been evaluated.

6.1 Regional Analysis

The USACE online Regional Economic System (RECONS), a regional economic impact modeling tool developed by the USACE Institute for Water Resources, the Louis Berger Group, and Michigan State University, is a system designed to provide estimates of regional, state, and national contributions of federal spending associated with Civil Works and American Recovery and Reinvestment Act ARRA Projects. It also provides a means for estimating the forward linked benefits (stemming from effects) associated with non-federal expenditures sustained, enabled, or generated by USACE Recreation, Navigation, and Formally Utilized Sites Remedial Action Program (FUSRAP). Contributions are measured in terms of economic output, jobs, earnings, and/or value added. The system was used to perform the following regional analysis for the proposed Long Beach Harbor, CA improvement project.

This RECONS report provides estimates of the economic impacts of Civil Works Budget Analysis for Long Beach Harbor, CA. It provide estimates of regional and national job creation, and retention and other economic measures such as income, value added, and sales. This modeling tool automates calculations and generates estimates of jobs and other economic measures, such as income and sales associated with USACE's ARRA spending, annual Civil Work program spending and stem-from effects for Ports, Inland Water Way, FUSRAP and Recreation. This is done by extracting multipliers and other economic measures from more than 1,500 regional economic models that were built specifically for USACE's project locations. These multipliers were then imported to a database and the tool matches various spending profiles to the matching industry sectors by location to produce economic impact estimates. The tool will be used as a means to evaluate project and program expenditures associated with the annual expenditure by the USACE.

Table 6-1: Project Information

Project Name:	LONG BEACH HARBOR CHANNEL DEEPENING, CA
Project ID:	
Division:	SPD
District:	LOS ANGELES DISTRICT
Type of Analysis:	Civil Works Budget Analysis
Business Line:	Navigation
Work Activity:	CWB - Navigation

Table 6-2: Economic Impact Regions

Regional Impact Area:	Los Angeles Long Beach Santa Ana CA MSA
Regional Impact Area ID:	24
Counties included	Los Angeles/Orange/
State Impact Area:	California
National Impact:	Yes

6.2 Results of the Economic Impact Analysis

The RED impact analysis was evaluated at three geographical levels: Local, State, and National. The local represents the Los Angeles/Long Beach/Santa Ana MSA impact area which encompasses the area included in about a 50-mile radius around the project area. The State level will include the State of California. The National level will include the 48 contiguous United States.

The following table displays the overall spending profile that makes up the dispersion of the total project construction cost among the major industry sectors. The spending profile also identifies the geographical capture rate, also called Local Purchase Coefficient (LPC) in RECONS, of the cost components. The geographic capture rate is the portion of USACE spending on industries (sales) captured by industries located within the impact area. In many cases, IMPLAN's trade flows Regional Purchase Coefficients (RPCs) are utilized as a proxy to estimate where the money flows for each of the receiving industry sectors of the cost components within each of the impact areas.

Table 6-3: Input Assumptions (Spending and LPC)

Category	Spending (%)	Spending Amount	Local LPC (%)	State LPC (%)	National LPC (%)
Dredging Fuel	6%	$9,272,000	87%	87%	90%
Metals and Steel Materials	4%	$6,536,000	45%	55%	90%
Textiles, Lubricants, and Metal Valves and Parts (Dredging)	2%	$3,192,000	44%	45%	65%
Pipeline Dredge Equipment and Repairs	5%	$7,904,000	48%	51%	100%
Aggregate Materials	3%	$4,408,000	57%	78%	97%
Switchgear and Switchboard Apparatus Equipment	0%	$456,000	38%	42%	80%
Hopper Equipment and Repairs	2%	$2,888,000	1%	10%	97%
Construction of Other New Nonresidential Structures	14%	$20,672,000	100%	100%	100%
Industrial and Machinery Equipment Rental and Leasing	7%	$11,096,000	100%	100%	100%
Planning, Environmental, Engineering and Design Studies and Services	5%	$6,992,000	100%	100%	100%
USACE Overhead	7%	$10,032,000	71%	71%	100%
Repair and Maintenance Construction Activities	4%	$6,232,000	100%	100%	100%
Industrial Machinery and Equipment Repair and Maintenance	11%	$15,960,000	100%	100%	100%
USACE Wages and Benefits	13%	$20,216,000	75%	100%	100%
Private Sector Labor or Staff Augmentation	15%	$23,256,000	100%	100%	100%
All Other Food Manufacturing	2%	$2,888,000	58%	75%	90%
Total	**100%**	**$152,000,000**	**-**	**-**	**-**

The USACE is planning on expending approximately $152,000,000 on the project. Of this total project expenditure about $127 million will be captured within the regional impact area. The rest will be leaked out to the state or the nation. The expenditures made by the USACE for various services and products are expected to generate additional economic activity in that can be measured in jobs, income, sales and gross regional product as summarized in the following table and includes impacts to the region, the State impact area, and the Nation. **Table 6-4** is the overall economic impacts for this analysis.

The labor income represents all forms of employment earnings. In IMPLAN's regional economic model, it is the sum of employee compensation and proprietor income. The Gross Regional Product (GRP) which is also known as value added, is equal to gross industry output (i.e., sales or gross revenues The Gross Regional Product (GRP) which is also known as value added, is equal to gross industry output (i.e., sales or gross revenues) less its intermediate inputs (i.e., the consumption of goods and services purchased from other U.S. industries or imported). The number of jobs equates to the labor income. An interesting note is that in the local geography one job averages an annual wage of $59,908, the state equivalent is $61,636 and the National equivalent is $60,951 (labor income/job). The total impact, direct and secondary, yields a local average wage of $56,700, state $56,862 and $54,818 nationally.

Table 6-4: Overall Summary Economic Impacts

Impacts	Impact Areas	Regional	State	National
Total Spending		$152,000,000	$152,000,000	$152,000,000
Direct Impact				
	Output	$127,067,481	$134,731,844	$148,665,586
	Job	1,261.91	1,314.77	1,411.64
	Labor Income	$75,598,302	$81,037,070	$86,040,213
	GRP	$88,396,051	$94,569,662	$100,883,443
Total Impact				
	Output	$252,273,259	$278,942,389	$395,725,178
	Job	2,113.21	2,292.96	3,040.36
	Labor Income	$119,819,949	$130,382,377	$166,667,393
	GRP	$164,766,600	$180,573,851	$240,533,691

The next three tables present the economic impacts by Industry Sector both for each geographical region. Note that Labor -5001- is the largest impact area at the regional, state and national levels, implying that all the labor demand can be met at the regional level. Impacts at the National level show a tremendous expansion most certainly due to the many multiple turnover of money that ripples throughout the national economy.

Table 6-5: Economic Impact at Regional Level

IMPLAN No.	Industry Sector	Sales	Jobs	Labor Income	GRP
	Direct Effects				
115	Petroleum refineries	$6,816,525	0.87	$208,791	$1,052,790
171	Steel product manufacturing from purchased steel	$1,972,786	4.30	$355,146	$435,289
198	Valve and fittings other than plumbing manufacturing	$989,594	3.00	$269,434	$505,167
201	Fabricated pipe and pipe fitting manufacturing	$2,277,084	9.02	$523,865	$911,247
26	Mining and quarrying sand, gravel, clay, and ceramic and refractory minerals	$692,165	4.55	$326,450	$390,521
268	Switchgear and switchboard apparatus manufacturing	$97,465	0.29	$24,953	$47,315
290	Ship building and repairing	$5,967	0.03	$1,836	$2,276
319	Wholesale trade businesses	$3,324,767	18.61	$1,467,856	$2,590,822
322	Retail Stores - Electronics and appliances	$14,563	0.10	$7,407	$9,666
323	Retail Stores - Building material and garden supply	$601,950	6.81	$293,442	$420,493
324	Retail Stores - Food and beverage	$20,168	0.30	$10,191	$14,760
326	Retail Stores - Gasoline stations	$212,996	1.36	$87,237	$148,445
332	Transport by air	$7,731	0.03	$2,245	$3,857
333	Transport by rail	$124,717	0.36	$45,419	$70,997
334	Transport by water	$50,463	0.11	$8,282	$21,314
335	Transport by truck	$2,087,600	16.59	$994,114	$1,177,760
337	Transport by pipeline	$47,135	0.05	$23,315	$22,307
36	Construction of other new nonresidential structures	$20,672,000	127.53	$8,542,519	$10,695,378
365	Commercial and industrial machinery and equipment rental and leasing	$11,096,000	37.55	$2,937,481	$6,202,534
375	Environmental and other technical consulting services	$6,987,778	69.95	$4,779,851	$4,797,617
386	Business support services	$7,086,144	111.02	$4,796,089	$4,748,826
39	Maintenance and repair construction of nonresidential structures	$6,225,445	42.84	$2,793,596	$3,526,921
417	Commercial and industrial machinery and equipment repair and maintenance	$15,960,000	128.48	$9,843,672	$11,851,481
439	* Employment and payroll only (federal govt, non-military)	$15,162,000	119.99	$13,797,729	$15,162,000
5001	Labor	$23,256,000	554.34	$23,256,000	$23,256,000
69	All other food manufacturing	$1,278,438	3.79	$201,382	$330,268
	Total Direct Effects	$127,067,481	1,261.91	$75,598,302	$88,396,051
	Secondary Effects	$125,205,779	851.30	$44,221,647	$76,370,549
	Total Effects	**$252,273,259**	**2,113.21**	**$119,819,949**	**$164,766,600**

Table 6-6: Economic Impact at State Level

IMPLAN No.	Industry Sector	Sales	Jobs	Labor Income	GRP
	Direct Effects				
115	Petroleum refineries	$6,816,525	0.87	$208,791	$1,052,790
171	Steel product manufacturing from purchased steel	$2,562,457	5.59	$464,297	$568,247
198	Valve and fittings other than plumbing manufacturing	$989,594	3.00	$269,434	$505,167
201	Fabricated pipe and pipe fitting manufacturing	$2,413,581	9.56	$555,267	$965,871
26	Mining and quarrying sand, gravel, clay, and ceramic and refractory minerals	$1,505,798	10.13	$710,189	$849,574
268	Switchgear and switchboard apparatus manufacturing	$115,261	0.34	$29,509	$55,955
290	Ship building and repairing	$241,847	1.08	$83,529	$100,383
319	Wholesale trade businesses	$3,486,199	19.52	$1,539,127	$2,716,618
322	Retail Stores - Electronics and appliances	$14,563	0.10	$7,407	$9,666
323	Retail Stores - Building material and garden supply	$687,724	7.80	$335,256	$480,411
324	Retail Stores - Food and beverage	$20,168	0.30	$10,191	$14,760
326	Retail Stores - Gasoline stations	$248,964	1.59	$102,183	$173,623
332	Transport by air	$7,731	0.03	$2,245	$3,857
333	Transport by rail	$138,610	0.40	$50,478	$78,906
334	Transport by water	$50,463	0.11	$8,282	$21,314
335	Transport by truck	$2,147,403	17.09	$1,022,592	$1,211,498
337	Transport by pipeline	$48,218	0.06	$23,885	$22,855
36	Construction of other new nonresidential structures	$20,672,000	127.53	$8,542,519	$10,695,378
365	Commercial and industrial machinery and equipment rental and leasing	$11,096,000	37.55	$2,937,481	$6,202,534
375	Environmental and other technical consulting services	$6,988,323	69.96	$4,780,224	$4,797,991
386	Business support services	$7,086,144	111.02	$4,796,089	$4,748,826
39	Maintenance and repair construction of nonresidential structures	$6,225,445	42.84	$2,793,596	$3,526,921
417	Commercial and industrial machinery and equipment repair and maintenance	$15,960,000	128.48	$9,843,672	$11,851,481
439	* Employment and payroll only (federal govt, non-military)	$20,208,380	160.26	$18,390,038	$20,208,380
5001	Labor	$23,256,000	554.34	$23,256,000	$23,256,000
69	All other food manufacturing	$1,744,447	5.21	$274,788	$450,655
	Total Direct Effects	$134,731,844	1,314.77	$81,037,070	$94,569,662
	Secondary Effects	$144,210,546	978.18	$49,345,306	$86,004,189
	Total Effects	**$278,942,389**	**2,292.96**	**$130,382,377**	**$180,573,851**

Table 6-7: Economic Impact at National Level

IMPLAN No.	Industry Sector	Sales	Jobs	Labor Income	GRP
	Direct Effects				
115	Petroleum refineries	$6,942,381	0.89	$213,872	$1,075,828
171	Steel product manufacturing from purchased steel	$4,734,505	10.40	$866,356	$1,057,996
198	Valve and fittings other than plumbing manufacturing	$1,636,838	5.15	$445,657	$835,573
201	Fabricated pipe and pipe fitting manufacturing	$6,242,182	24.72	$1,480,489	$2,576,557
26	Mining and quarrying sand, gravel, clay, and ceramic and refractory minerals	$2,177,380	14.74	$1,026,931	$1,228,482
268	Switchgear and switchboard apparatus manufacturing	$285,109	0.87	$72,994	$138,950
290	Ship building and repairing	$2,762,848	12.39	$956,643	$1,148,924
319	Wholesale trade businesses	$3,533,468	19.81	$1,559,995	$2,753,452
322	Retail Stores - Electronics and appliances	$14,592	0.10	$7,422	$9,685
323	Retail Stores - Building material and garden supply	$816,060	9.52	$397,818	$570,060
324	Retail Stores - Food and beverage	$20,216	0.30	$10,215	$14,795
326	Retail Stores - Gasoline stations	$250,338	1.86	$102,755	$174,585
332	Transport by air	$8,835	0.03	$2,566	$4,408
333	Transport by rail	$180,288	0.53	$65,656	$102,632
334	Transport by water	$50,760	0.11	$8,343	$21,447
335	Transport by truck	$2,277,650	18.20	$1,084,615	$1,284,980
337	Transport by pipeline	$101,957	0.13	$52,182	$50,082
36	Construction of other new nonresidential structures	$20,672,000	127.53	$8,542,519	$10,695,378
365	Commercial and industrial machinery and equipment rental and leasing	$11,096,000	37.55	$2,937,481	$6,202,534
375	Environmental and other technical consulting services	$6,991,073	69.99	$4,782,137	$4,799,911
386	Business support services	$10,028,833	164.27	$6,787,778	$6,720,888
39	Maintenance and repair construction of nonresidential structures	$6,230,223	42.88	$2,795,740	$3,529,628
417	Commercial and industrial machinery and equipment repair and maintenance	$15,960,000	128.48	$9,843,672	$11,851,481
439	* Employment and payroll only (federal govt, non-military)	$20,215,998	160.32	$18,396,971	$20,215,998
5001	Labor	$23,256,000	554.34	$23,256,000	$23,256,000
69	All other food manufacturing	$2,180,050	6.53	$343,405	$563,188
	Total Direct Effects	$148,665,586	1,411.64	$86,040,213	$100,883,443
	Secondary Effects	$247,059,593	1,628.72	$80,627,180	$139,650,248
	Total Effects	**$395,725,178**	**3,040.36**	**$166,667,393**	**$240,533,691**

The total economic impact from the improvements made at the POLB on the State of California, as shown in **Table 6-6,** is just under $279 million in sales, around 2,300 jobs equating to about $130 million in labor income, and a contribution of $180.5 million to GRP.

Table 6-8 displays the impact region profile for 19 selected sectors. It displays the geographical capture amounts for the Los Angeles/Long Beach/Santa Ana CA MSA, which is that portion of USACE spending that is captured in the impact area. The labor income represents all forms of employment earnings. In IMPLAN's regional economic model, it is the sum of employee compensation and proprietor income. The Gross Regional Product (GRP) which is also known as value added, is equal to gross industry output (i.e., sales or gross revenues) less its intermediate inputs (i.e., the consumption of goods and services purchased from other U.S. industries or imported). The number of jobs equates to the labor income. The total Long Beach Harbor project economic impact for the metropolitan statistical area is composed of $1.3 trillion in output (sales), 7.7 million in employment, $450 billion in labor income and a contribution of $721 billion to GRP. An interesting note is that in the MSA one job averages an annual wage of $57,955 (labor income/employment).

Table 6-8: Impact Region Profile (2019)

Regional Impact Area ID:	24
Regional Impact Area Name:	Los Angeles Long Beach Santa Ana CA MSA
Impact Area Type	Metropolitan Impact Area
State Impact Region::	California

Section	**Output (millions)**	**Labor Income (millions)**	**GRP (millions)**	**Employment**
Accommodations and Food Service	$34,802	$12,634	$19,394	506,670
Administrative and Waste Management Services	$36,818	$19,270	$24,621	559,124
Agriculture, Forestry, Fishing and Hunting	$974	$480	$502	12,122
Arts, Entertainment, and Recreation	$29,510	$12,142	$18,228	246,606
Construction	$55,939	$24,103	$26,420	362,746
Education	$32,654	$25,051	$28,196	480,559
Finance, Insurance, Real Estate, Rental and Leasing	$176,324	$46,865	$119,045	815,966
Government	$54,465	$39,280	$44,929	482,253
Health Care and Social Assistance	$63,661	$35,073	$41,503	641,159
Imputed Rents	$90,657	$12,833	$58,782	500,434
Information	$121,758	$32,480	$55,129	305,431
Management of Companies and Enterprises	$19,459	$8,784	$11,785	86,388
Manufacturing	$269,098	$49,317	$71,290	633,174
Mining	$7,887	$1,771	$4,942	12,415
Professional, Scientific, and Technical Services	$127,029	$58,047	$76,317	761,141
Retail Trade	$62,231	$26,340	$42,944	735,704
Transportation and Warehousing	$30,287	$13,148	$18,379	221,871
Utilities	$20,803	$3,943	$11,364	17,165
Wholesale Trade	$73,293	$27,959	$47,838	375,410
Total	**$1,307,649**	**$449,521**	**$721,610**	**7,756,338**

The following table shows the top ten industries that typically benefit from the types of expenditures made for this project by the USACE. This analysis was conducted at the national level and thus it cannot be guaranteed that these industries would be present in the regional impact area as analyzed.

Table 6-9: Top Ten Industries Affected by Work Activity (2019)

Project:	LONG BEACH HARBOR, CA		
Business Line:	Navigation		
Work Activity:	CWB - Navigation		
Rank	**Industry (millions)**	**IMPLAN No.**	**% of Total Employment**
1	* Employment and payroll only (federal govt, non-military)	439	8 %
2	Business support services	386	7 %
3	Construction of other new nonresidential structures	36	6 %
4	Food services and drinking places	413	5 %
5	Commercial and industrial machinery and equipment repair and maintenance	417	4 %
6	Real estate establishments	360	3 %
7	Wholesale trade businesses	319	3 %
8	Employment services	382	3 %
9	Maintenance and repair construction of nonresidential structures	39	3 %
10	Offices of physicians, dentists, and other health practitioners	394	2 %
			43 %

7 SENSITIVITY ANALYSIS

The Principle & Guidelines and subsequent ER1105-2-100 recognize the inherent variability to water resources planning. Navigation projects and container studies in particular are fraught with uncertainty about future conditions. Therefore, a sensitivity analysis with changes to key quantitative assumptions and computations is required to assess their effect on the final outcome. The sensitivity analysis for this study was a repeat of the primary analysis, substituting commodity and fleet forecasts with a range of values that were projected to be below the base scenario. The HarborSym model used in the baseline evaluation included variations or ranges for many of the variables involved in the vessel operating costs, loading practices, trade lane distances, etc. However, it used only one base line commodity forecast, a key area of potential uncertainty. This sensitivity analysis presents the results of multiple forecasts of future commodity traffic at Long Beach Harbor.

7.1 Inputs for Sensitivity Analysis

Benefits are a function of projected cargo and fleet forecasts, vessel operating costs, vessel itineraries, and changes in the overall economy, including the balance of trade between nations – for Long Beach, Asia in particular. There are also uncertainties regarding changes in port operations and infrastructure. To evaluate the uncertainty in the calculated benefits for the proposed project, multiple commodity and vessel fleet forecasts were developed for lower growth scenarios based on the baseline forecast presented in Section 3.3.3. The focus of these sensitivity scenarios are changes in the anticipated number of containers handled at the POLB. Crude oil imports were not included in the scenarios because the annual throughput is not anticipated to significantly change during the period of analysis.

Three lower growth scenarios were developed to assess the risk in Federal Investment of the proposed channel modifications at the Port of Long Beach. Scenario 1 assumed that commodity growth would occur from the baseline tonnage (2015) through 2021, at the same rate as the NED analysis. Then, from 2022 through the period of analysis the benefits were held constant. Scenario 2 assumed a lower growth rate of 2 percent annually from the baseline tonnage, 2015, to the base year that would continue throughout the period of analysis. Scenario 3 assumed a growth rate of 1.2 percent from the baseline tonnage through 2076. **Table 7-1** displays the total TEU forecast for each scenario.

Table 7-1: Total TEUs for Sensitivity Scenarios

Total TEU Throughput (million)				
Year	NED Analysis	Scenario 1	Scenario 2	Scenario 3
2015	4.9	4.9	4.9	4.9
2021	6.6	6.6	5.7	5.4
2030	9.5	6.6	6.6	6.0
2040	14.0	6.6	8.1	6.6

7.2 Sensitivity Results

HarborSym was run with changes in commodities imported and exported from base year tonnage. The results of the three sensitivity analyses are provided in the table below. As with the "most likely" scenario, the results for 2027 and calculated using the detailed model runs from 2021 and 2030. The results are compared to both the nearshore and offshore placement areas. As shown in each scenario the 55 foot recommended channel depth remains justified.

Table 7-2: Benefit/Cost for Sensitivity Scenarios

	Scenario 1	Scenario 2	Scenario 3
Average Annual Benefit	$ 10,045,000	$ 11,067,000	$ 9,472,000
Average Annual Cost (Nearshore)	$ 3,038,000	$ 3,038,000	$ 3,038,000
Net Benefits	$ 7,007,000	$ 8,029,000	$ 6,434,000
BC Ratio	3.3	3.6	3.1
Average Annual Cost (Offshore)	$ 3,402,000	$ 3,402,000	$ 3,402,000
Net Benefits	$ 6,643,000	$ 7,665,000	$ 6,070,000
BC Ratio	3.0	3.3	2.8

DRAFT INTEGRATED FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT STATEMENT / ENVIRONMENTAL IMPACT REPORT (EIS/EIR)

APPENDIX F: COST ENGINEERING

PORT OF LONG BEACH
DEEP DRAFT NAVIGATION STUDY
Los Angeles County, California

October 2019

US Army Corps of Engineers ®

Port of LONG BEACH
The Green Port

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1 EXECUTIVE SUMMARY

1.1 Purpose

The purpose of the Study is to identify and evaluate alternatives to increase transportation efficiencies for the current and future fleet of container and liquid bulk vessels operating in the Port of Long Beach (POLB), and to improve overall conditions for vessel operations and safety in the event of vessel malfunction or weather-related events. The purpose of this appendix is to summarize and document the Total Project Costs for comparison of the final array of alternatives in order to select the Tentatively Selected Plan (TSP). Once selected, the TSP will be refined, a Cost and Schedule Risk Analysis will be performed and the Total Project Cost for TSP will be finalized and submitted to the Cost Agency Technical Review (ATR) Certification from the Civil Works Cost Engineering and Agency Technical Review Mandatory Center of Expertise (Cost MCX) to assess the project's total cost, schedule, and risks associated with the planned construction.

The alternative costs provided have undergone District Quality Control Review by the Los Angeles District Coastal Section and the Walla Walla Cost Center of Expertise. These reviews have verified the reasonableness of total project costs, including the construction costs and calculated contingencies using the mandated Abbreviated Risk Analysis techniques.

1.2 Project Scope

Alternatives include the following:

(1) The design vessels considered in the analysis include the Post-Panamax Generation IV (containerized carrier) with a design draft of 52 feet and very large crude carriers (VLCC) for bulk liquid cargoes with a design draft of 70 feet.

(2) Dredged material will be disposed of either in a nearshore placement site (i.e. Surfside Borrow Site), an ocean-dredged material disposal site (ODMDS) (LA-2 and/or LA-3), or a combination of the two. The nearshore placement site can accommodate up to 2.5 million cubic yards (mcy) of dredged material. LA-2 and LA-3 have annual disposal volumes of 1.0 and 2.5 mcy, respectively, from all sources. It is assumed that 0.9 mcy for LA-2 and 2.2 mcy for LA-3 is available for use by this project annually.

(3) It is assumed that dredging will be performed using a hopper dredge as well as a clamshell dredge. To minimize transit time, disposal of material from the hopper dredge will maximize use of the nearshore site until all hopper dredging is complete, while a clamshell dredge will be evaluated for disposal at an ODMDS. If there is capacity available at the nearshore site for the clamshell dredging, that will be utilized first.

(4) Dredging areas are named as follows:
   a. Approach Channel
   b. West Basin
   c. West Basin Berth (Non-Federal)
   d. Pier J Basin Slip and Berth (Non-Federal)
   e. Pier J Approach Channel and Transition from Main Channel
   f. Main Channel Bend Easing

1.3 Cost

The cost estimate for the project has been developed from detail using the Cost Engineering Dredge Estimating Program (CEDEP) estimating software to ensure that cost estimates for dredging alternatives are prepared accurately and efficiently. This program meets the requirement for preparing estimates in lieu of using the Micro-Computer Aided Cost Engineering system (MCACES) software program, since none of the cost alternatives include land work.

Estimates include non-federal costs. Costs were provided for Non-federal activities performed by the sponsor, the Port of Long Beach. Non-federal work performed by the sponsor includes:

(1) Pier J Wharf improvement/stabilization: underwater bulkhead (sheet pile) to accommodate deepening (only required for Alternative 4)
(2) Pier J Breakwater Stabilization: bulkhead wall
(3) Pier T Wharf Improvements (only required for Alternative 4)

Non-federal work performed by the US Army Corps of Engineers (USACE), but paid by the sponsor includes:

(1) Berth Dredging near Pier J and
(2) Berth Dredging near West Basin Area

Real Estate costs are not anticipated/required. Land acquisitions are not needed. All work is performed on State/Federal waters.

The estimate considers all project costs including construction, engineering, design, and contract supervision & administration.

1.4 Schedule

Construction schedules for each alternative have been developed using Microsoft Project. They can be found with each alternative in the sections.

1.5 Risk

Abbreviated Risk Analysis was performed on the final array of alternatives in accordance with ER 1110-1-1300 Cost Engineering Policy and General Requirements with project contingencies calculated accordingly. A Cost and Schedule Risk Analysis will be performed on the TSP to establish the 80-percent confidence level for both cost and schedule for the Tentatively Selected Plan. The 80% Confidence Level (P80) is more likely to ensure the funds received will be adequate for implementation and is the recommended level for USACE cost estimates. The risk analysis results are also intended to provide project leadership with contingency information for scheduling, budgeting, and project control purposes, as well as provide tools to support decision making and risk management as the project progresses through implementation.

2 SCOPE OF WORK

2.1 Federal Construction

2.1.1 12 – Ports

Scope of work includes the following alternatives:

- Alternative 1
  - No action
- Alternative 2
  - Deepen West Basin Channel to -53 feet.
  - Construct Pier J Approach Channel to -53 feet, including the transition from the Main Channel to Pier J Approach Channel.
  - Bend Easing of Main Channel to a design depth of -76'
  - Deepen Approach Channel to a design depth of -78'
- Alternative 3 (NED)
  - Deepen West Basin Channel to -55 feet.
  - Construct Pier J Approach Channel to -55 feet, including the transition from the Main Channel to Pier J Approach Channel.
  - Bend Easing of Main Channel to a design depth of -76'
  - Deepen Approach Channel to a design depth of -80'
- Alternative 4
  - Deepen West Basin Channel to -57 feet.
  - Construct Pier J Approach Channel to -57 feet, including the transition from the Main Channel to Pier J Approach Channel.
  - Bend Easing of Main Channel to a design depth of -76'
  - Deepen Approach Channel to a design depth of -83'
- Alternative 5 (NED in including the Standby Area)
  - Deepen West Basin Channel to -55 feet.
  - Construct Pier J Approach Channel to -55 feet, including the transition from the Main Channel to Pier J Approach Channel.
  - Bend Easing of Main Channel to a design depth of -76'
  - Deepen Approach Channel to a design depth of -80'
  - Construct Standby Area to design depth of -67'

2.2 Non-Federal Construction

2.2.1 12 – Ports

- The primary purpose of the Port's project is to deepen the West Basin Berth (Pier T); the Pier J Basin Slip and Berth to facilitate safety and improve navigation for the fleet vessels. Depth analyzed range from -53' to -57'.
- Wharf improvements and breakwater improvements construction work is performed and priced by the sponsor.

2.3 Non-Construction

2.3.1 30 – Planning, Engineering, and Design (PED)

The work covered under this account includes project management, project planning, preparation of plans & specifications, engineering during construction, contract advertisement, opening of bids, and contract award. PED was estimated based on average historical percentages. Additionally, a percentage of cost was allocated for monitoring activities assumed to be required after discussion with the PDT. These costs are captured on the TPCS under "Monitoring and Adaptive Management" and are assumed include sediment sampling, water sampling, and other necessary activities during dredging.

2.3.2 31 – Supervision and Administration (S&A)

The work covered under this account includes contract supervision, contract administration, construction administration, technical management activities, and District office supervision and administration costs. S&A was estimated based on average historical percentages.

3 MAJOR ASSUMPTIONS

3.1 Construction

- All work inside the breakwater (Queens Gate), within the port, is performed by an electric clamshell as a mitigation measure in order to reduce air quality impacts.
- All work outside the breakwater (Queens Gate) is performed by a generic large hopper. Work encompass dredging the Approach Channel. A large hopper is well suited for work on the Approach Channel. Dredging a large volume of sand outside the breakwater justifies the use of the larger vessel. The excavation consists of a thin layer (2-5 feet) along the ocean bottom.
- There is an existing electric substation near Pier T that can serve as a power supply to the electric clamshell dredge when working on the West Basin, Main Channel Bend Easing, and Standby areas.
- Marine fuel prices are based on average of current prices due to market fluctuation
- Mob/demob costs are dependent on the placement sites limitations. Once the yearly placement sites volume capacities are met, it is assumed dredging equipment is demobilized. Dredging is resumed the following year with associated mobilization costs.
- Contract may be low bid, but potential for multiple Small Business contracts are captured in the risk analysis.
- Real estate and environmental mitigation costs are anticipated at no expense for all alternatives (non-differentiating factors)
- Additional assumptions are documented within the CEDEP files.

3.2 Scheduling

- It is assumed that dredging will be performed using one hopper dredge and one clamshell dredge. To minimize transit time, disposal of material from the hopper dredge will maximize use of the Nearshore Placement Site, while a clamshell dredge will be evaluated for disposal at LA2 or LA3 Placement Sites.
- Dredging of Pier J Slip, berth, and Approach is dependent on construction of the electric substation near Pier J.
- Nearshore placement site (Surfside borrow site) can accommodate 2,500,000 CY of material (Max.)
- Offshore placement sites (LA2 and LA3) max allowable placements are 900,000 CY/year (LA2) and 2,200,000 CY/year (LA3). However, these volumes are also limited by the work that one clamshell can perform per year.
- Assume Approach Channel sediment is transported to the Nearshore placement site first.

4 COST ESTIMATE

Cost estimates were prepared in CEDEP for all dredging feature accounts and summarized on the Cost Summary Alternative Comparison. Costs were primarily developed from detail while some were provided by the sponsor, Port of Long Beach.

4.1 Estimate Methodology

4.1.1 Reasons for Selecting Hopper Dredge to Work on the Approach Channel

In selecting the dredging equipment, engineering considers traffic, disposal site restrictions, hauling distance and cost.

The hopper dredge is the equipment of choice in heavy traffic and it is capable of high productions resulting in a cost effective choice. The hopper dredge maneuverability is excellent and is therefore more mobile in traffic. The hopper dredge does not need scows (barges), thus equipment footprint in the area near Queens Gate is reduced and vessel traffic impacts are reduced. Reduction of traffic impacts near Queens Gate is encouraged by the project requirements.

The use of a clamshell (mechanical dredge) in the area is unlikely. When excavating close to a wharf, deck or confined areas the clamshell is the dredge of choice due to its dredging accuracy. However, the clamshell dredging operation is significantly more expensive than the hopper dredge operation because the clamshell low capacity and production is significantly slower than the hopper dredge.

Also, the best choice in disposing material in the open sea is the hopper for hauling distances below 10 miles. With hauling distances over 10 miles, the clamshell-scow operation may be more economical.

Converting the diesel hopper dredge into an electric hopper dredge is not feasible as it is a seagoing ship. A suction pipe hydraulically discharges material into a self-contained hopper, and the material is then transported to a disposal site. The use of an electric line (cord) would prevent the hopper from sailing or transporting the material to the disposal site.

4.1.2 Reasons for Selecting Clamshell Dredge to Work inside the Harbor

A conventional clamshell dredge was selected to dredge the areas on the harbor side of Queens Gate. The hydraulic cutterhead would not be suitable for long delivery distances. Hauling distances to LA-2 and LA-3 placement sites range mostly from 10 miles and 25 miles out in the ocean. Also, the clamshell dredge seems more economical and suitable for site conditions: selected dredge must run on electric power, a large part of the required deepening of the sea floor runs along the wharf face, and cutting depths are greater than -55 feet.

4.1.3 Non-Federal Estimates

Non-federal work encompass Pier J Basin wharf improvements, Pier T Basin wharf improvements, Pier J berth dredging, and West Basin berth dredging.

Pier J Basin wharf improvements include an underwater bulkhead construction; Pier J breakwater improvements (bulkhead wall). Costs were provided by the Port of Long Beach. An electric substation near Berth J 260 will be constructed and was previously part of the non-fed costs; however, this will now be the responsibility of the Corps and has been included in the Federal portion of the estimate as a mitigation measure.

Pier T Basin wharf improvements includes retrofitting for seismic conditions.

4.1.4 Detailed CEDEP Cost Estimate

The CEDEP estimating software was used to develop production rates. Equipment selection and production rates were reviewed by the USACE Coastal Engineering Section and the Port of Long Beach. A construction sequence for area of work was developed based on placement site limitations and equipment production rates. Crews were developed in correspondence with the work being performed. The labor rates were adjusted to the local and current Davis-Bacon wage determinations. CEDEP area factors were updated.

4.2 Direct Costs

Direct costs are based on anticipated equipment, labor, and materials necessary to construct the project. Following formulation of the direct cost, a determination was made that the work is suitable for a marine prime contractor.

4.2.1 Overtime

Overtime is anticipated. Dredging work is assumed to occur 24 hours a day, 6 days per week, Monday through Saturday. Sunday was allowed for equipment maintenance.

4.2.2 Labor - Wage Determination

Los Angeles County, California Davis-Bacon wage rates were obtained from the Department of Labor and used for all craft labor. The base wage rate and taxable fringe were entered into CEDEP and applied accordingly.

4.2.3 Equipment Costs

The clamshell dredge is electric, therefore, the CEDEP program was altered to accommodate the diesel to electric conversion.

The hopper dredge runs on diesel, and the generic large dredge was the best fit to attain required production rates.

4.2.4 Crews

Project specific crews are applied to the detailed costs as appropriate. Number of crew members was modified according to the number of shifts. In considering the crews and productivities, the engineer considered historical project data, input from Coastal Engineering, and the sponsor for checking the overall dredging production rates.

Quantities were developed by the USACE Coastal Engineering Section. Quantities were confirmed by the estimator and adjusted to account for non-pay dredging volume.

4.3 Indirect Costs

4.3.1 Contractor Acquisition Strategy

Through discussions with the PDT, the contract is assumed to be a full and open Invitation for Bid (IFB) type contract with the possibility for a Small Business Contract. Dredging work was assumed to be performed by a marine prime contractor. The scope of work associated with land or marine non-federal is assumed to be coordinated with the Port of Long Beach and for the Port of Long Beach to contract out the work. Acquisition strategy uncertainties have been captured in the contingency formulation from the Abbreviated Risk Analyses for each alternative.

4.3.2 Contractor Markups

Field Office Overhead (FOOH)

For Field Office Overhead (FOOH), the cost estimate includes a percentage based upon the estimator's judgment, discussion with the PDT, and current estimated construction duration. This value represents the anticipated prime contractor field overhead costs for items such as project supervision, contractor quality control, contractor field office supplies, personal protective equipment, field engineering, and other incidental field overhead costs.

Home Office Overhead (HOOH)

For Home Office Overhead (HOOH) expense, the cost estimate includes an allowance applied as a percentage of direct cost plus FOOH. HOOH includes items such as office rental/ownership costs, utilities, office equipment ownership/maintenance, office staff (managers, accountants, clerical, etc.), insurance, and miscellaneous. In reality, the range of home office overhead can be quite broad and depends largely on the contractor's annual volume of work and the type of work that is generally performed by the contractor.

Profit

Profit was applied to the prime contractor on the CEDEP estimates since working estimates are built for project authorization.

Bond

For the main contract, bond was assumed to be 1% and applied as a running percentage.

4.4 Owner Costs

4.4.1 Contingency

Contingencies for Alternative Project Costs were determined through Abbreviated Risk Analysis (ARA) workshops with the PDT and applied to the construction costs using the Cost MCX ARA template. Overall calculated project contingencies range from 43% to 50% based on the results of the ARA. Individual contingencies for each measure of a given alternative were calculated during the ARA PDT workshop. Contingency calculations are based on the likelihood and potential impact of an identified risk.

Upon selection of the TSP, the contingency for both the cost and schedule will be established at the 80% confidence level using a risk based Monte Carlo simulation.

4.4.2 Escalation

No escalation was applied to the compared alternatives. Project schedules for the alternatives are of similar duration and not anticipated to cause significant differences in project costs. For the TSP the civil works breakdown structure (CWBS) feature accounts associated with each contract will be escalated to the mid-point of construction or design period using the Civil Works Construction Cost Index System (CWCCIS) factors as contained in EM 1110-2-1304.

5 COST MCX REVIEW

Cost MCX cursory review of the final array of alternatives was performed to ensure that all cost engineering products are well developed, consistent, and to a level of quality and detail necessary in order to determine the TSP.

6 ALTERNATIVE SUMMARY OF TOTAL PROJECT COSTS

Total Project Cost Summary - 1Oct 18 Price Level (Project First Cost) 13-Aug-19

Alternative Number	Construction Cost	Planning Engineering and Design	Construction Management	Real Estate	Project Cost	Contingency	Contingency	Construction Duration (YEARS)	Total Project Cost
Alternarive 1 No action									
Alternative 2 West Basin, Pier J, Main Channel Widening Depth: -53' Approach Channel Depth: -78'	$59,160,812	$9,220,556	$4,840,646	$0	$73,222,014	50%	$36,611,007	2	**$109,833,021**
Alternative 3 (NED) West Basin, Pier J, Main Channel Widening Depth: -55' Approach Channel Depth: -80' (EXCLUDING STAND-BY AREA)	$84,144,404	$12,653,172	$6,423,848	$0	$103,221,424	46%	$47,481,855	3	**$150,703,279**
Alternative 4 West Basin, Pier J, Main Channel Widening Depth: -57' Approach Channel Depth: -83'	$183,458,833	$27,637,856	$16,265,490	$0	$227,362,179	45%	$102,312,981	5	**$329,675,160**
Alternative 5 (NED plus STAND-BY AREA) West Basin, Pier J, Main Channel Widening Depth: -55' Approach Channel Depth: -80'	$108,796,824	$16,353,172	$8,075,848	$0	$133,225,844	46%	$61,283,888	4	**$194,509,732**

Total Project Cost Summary (Fully Funded Cost) 13-Aug-19

Alternative Number	Construction Cost	Planning Engineering and Design	Construction Management	Real Estate	Project Cost	Contingency	Contingency	Construction Duration (YEARS)	Total Project Cost
Alternarive 1 No action									
Alternative 2 West Basin, Pier J, Main Channel Widening Depth: -53' Approach Channel Depth: -78'	$67,724,436	$10,684,432	$6,312,718	$0	$84,721,586	50%	$42,360,793	2	**$127,082,379**
Alternative 3 (NED) West Basin, Pier J, Main Channel Widening Depth: -55' Approach Channel Depth: -80' (EXCLUDING STAND-BY AREA)	$96,538,507	$14,671,746	$8,377,382	$0	$119,587,636	46%	$55,010,312	3	**$174,597,948**
Alternative 4 West Basin, Pier J, Main Channel Widening Depth: -57' Approach Channel Depth: -83'	$212,150,682	$31,947,737	$21,211,932	$0	$265,310,350	45%	$119,389,657	5	**$384,700,007**
Alternative 5 (NED plus STAND-BY AREA) West Basin, Pier J, Main Channel Widening Depth: -55' Approach Channel Depth: -80'	$125,753,404	$18,972,176	$10,531,766	$0	$155,257,346	46%	$71,418,379	4	**$226,675,725**

6.1 Alternative 2

6.1.1 Total Project Cost Summary (TPCS)

**** TOTAL PROJECT COST SUMMARY ****

PROJECT: **Port of Long Beach**
PROJECT NO: **xxxxxx**
LOCATION: **Long Beach, CA**

DISTRICT: **Los Angeles District** PREPARED: **7/18/2019**
POC: **CHIEF, COST ENGINEERING, XXX**

This Estimate reflects the scope and schedule in report; Engineering alternatives

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
							Program Year (Budget EC):			2025					
							Effective Price Level Date:			1-Oct- 24					
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	REMAINING COST ($K)	Spent Thru: 1-Aug-19 ($K)	TOTAL FIRST COST ($K)	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
12	NAVIGATION PORTS & HARBORS	$51,671	$25,836	50%	$77,507		$51,671	$25,836	$77,507		$77,507	14.6%	$59,205	$29,602	$88,807
12	NAVIGATION PORTS & HARBORS - Non-Fed	$7,490	$3,745	50%	$11,234		$7,490	$3,745	$11,234		$11,234	13.8%	$8,519	$4,260	$12,779
				-		-						-			
				-		-						-			
	CONSTRUCTION ESTIMATE TOTALS:	$59,161	$29,580		$88,741		$59,161	$29,580	$88,741		$88,741	14.5%	$67,724	$33,862	$101,587
01	LANDS AND DAMAGES			-		-						-			
30	PLANNING, ENGINEERING & DESIGN	$9,221	$4,610	50%	$13,831		$9,221	$4,610	$13,831		$13,831	15.9%	$10,684	$5,342	$16,027
31	CONSTRUCTION MANAGEMENT	$4,841	$2,420	50%	$7,261	0.0%	$4,841	$2,420	$7,261		$7,261	30.4%	$6,313	$3,156	$9,469
	PROJECT COST TOTALS:	$73,222	$36,611	50%	$109,833		$73,222	$36,611	$109,833		**$109,833**	15.7%	$84,722	$42,361	$127,082

ESTIMATED TOTAL PROJECT COST: $127,082

______________________ CHIEF, COST ENGINEERING, XXX

______________________ PROJECT MANAGER, XXX

______________________ CHIEF, REAL ESTATE, XXX

______________________ CHIEF, PLANNING, XXX

______________________ CHIEF, ENGINEERING, XXX

______________________ CHIEF, OPERATIONS, XXX

______________________ CHIEF, CONSTRUCTION, XXX

______________________ CHIEF, CONTRACTING, XXX

______________________ CHIEF, PM-PB, xxxx

______________________ CHIEF, DPM, XXX

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: Port of Long Beach
LOCATION: Long Beach, CA
This Estimate reflects the scope and schedule in report; Engineering alternatives

DISTRICT: Los Angeles District
POC: CHIEF, COST ENGINEERING, XXX
PREPARED: 7/18/2019

WBS Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: / Estimate Price Level:			16-Jul-19 / 1-Oct-18	Program Year (Budget EC): / Effective Price Level Date:			2025 / 1 -Oct-24					
				RISK BASED										
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	PHASE 1 or CONTRACT 1													
12	NAVIGATION PORTS & HARBORS - Year 1	$32,838	$16,419	50.0%	$49,257		$32,838	$16,419	$49,257	2025Q3	13.8%	$37,353	$18,677	$56,030
12	NAVIGATION PORTS & HARBORS - Year 2	$18,833	$9,417	50.0%	$28,250		$18,833	$9,417	$28,250	2026Q3	16.0%	$21,852	$10,926	$32,778
12	NAVIGATION PORTS & HARBORS - Year 3			50.0%										
12	NAVIGATION PORTS & HARBORS - Year 4			50.0%										
	CONSTRUCTION ESTIMATE TOTALS:	$51,671	$25,836	50.0%	$77,507		$51,671	$25,836	$77,507			$59,205	$29,602	$88,807
01	LANDS AND DAMAGES			25.0%										
30	PLANNING, ENGINEERING & DESIGN													
1.5%	Project Management	$775	$388	50.0%	$1,163		$775	$388	$1,163	2022Q2	14.0%	$884	$442	$1,326
0.5%	Planning & Environmental Compliance	$258	$129	50.0%	$387		$258	$129	$387	2022Q2	14.0%	$294	$147	$441
8.0%	Engineering & Design	$4,134	$2,067	50.0%	$6,201		$4,134	$2,067	$6,201	2022Q2	14.0%	$4,715	$2,357	$7,072
0.5%	Reviews, ATRs, IEPRs, VE	$258	$129	50.0%	$387		$258	$129	$387	2022Q2	14.0%	$294	$147	$441
1.0%	Life Cycle Updates (cost, schedule, risks)	$517	$259	50.0%	$776		$517	$259	$776	2022Q2	14.0%	$590	$295	$884
0.5%	Contracting & Reprographics	$258	$129	50.0%	$387		$258	$129	$387	2025Q3	30.4%	$336	$168	$505
1.5%	Engineering During Construction	$775	$388	50.0%	$1,163		$775	$388	$1,163	2025Q3	30.4%	$1,011	$505	$1,516
1.0%	Planning During Construction	$517	$259	50.0%	$776		$517	$259	$776	2022Q2	14.0%	$590	$295	$884
0.5%	Adaptive Management & Monitoring	$258	$129	50.0%	$387		$258	$129	$387	2022Q2	14.0%	$294	$147	$441
	NON-FED Portion of PED	$1,471	$735	50.0%	$2,206		$1,471	$735	$2,206	2022Q2	14.0%	$1,677	$839	$2,516
31	CONSTRUCTION MANAGEMENT													
6.7%	Construction Management	$3,462	$1,731	50.0%	$5,193		$3,462	$1,731	$5,193	2025Q3	30.4%	$4,515	$2,257	$6,772
	NON-FED Portion of S&A	$1,379	$689	50.0%	$2,068		$1,379	$689	$2,068	2025Q3	30.4%	$1,798	$899	$2,697
	Project Management			50.0%										
	CONTRACT COST TOTALS:	$65,732	$32,866		$98,599		$65,732	$32,866	**$98,599**			$76,202	$38,101	**$114,303**

6.1.2 Abbreviated Cost and Schedule Risk Analysis

Abbreviated Risk Analysis

Alternative: **Alt 2**
West Basin, Pier J, Main Channel Widening
Depth: -53'
Approach Channel Depth: -78'

Project (less than $40M): **POLB Deepening**
Project Development Stage/Alternative: **Feasibility (Alternatives)**
Risk Category: **Moderate Risk: Typical Project Construction Type**

Meeting Date: **4/10/2019**

Total Estimated Construction Contract Cost = **$ 59,102,722**

	CWWBS	Feature of Work	Contract Cost		% Contingency	$ Contingency	Total
	01 LANDS AND DAMAGES	Real Estate	$ -		0.00%	$ -	$ -
1	12 NAVIGATION, PORTS AND HARBORS	Hopper Mob/Demob	$ 3,289,728		23.92%	$ 786,771	$ 4,076,499
2	12 NAVIGATION, PORTS AND HARBORS	Clamshell Mob/Demob	$ 3,602,782		17.31%	$ 623,558	$ 4,226,340
3	12 NAVIGATION, PORTS AND HARBORS	Approach Channel Dredging (Hopper)	$ 7,310,160		24.41%	$ 1,784,264	$ 9,094,424
4	12 NAVIGATION, PORTS AND HARBORS	West Basin Dredging (Clam)	$ 4,604,190		60.12%	$ 2,768,212	$ 7,372,402
5	12 NAVIGATION, PORTS AND HARBORS	Pier J Dredging (Clam)	$ 20,249,790		56.31%	$ 11,401,771	$ 31,651,561
6	12 NAVIGATION, PORTS AND HARBORS	Main Channel Widening Dredging (Clam)	$ 10,855,100		62.16%	$ 6,747,522	$ 17,602,622
7	12 NAVIGATION, PORTS AND HARBORS	Pier J Breakwater Stabilization	$ 4,824,357		58.69%	$ 2,831,398	$ 7,655,755
8	12 NAVIGATION, PORTS AND HARBORS	Electric Substation Near Berth J 260	$ 4,366,615		137.59%	$ 6,007,910	$ 10,374,525
9			$ -		0.00%	$ -	$ -
10			$ -		0.00%	$ -	$ -
11			$ -		0.00%	$ -	$ -
12	All Other	Remaining Construction Items	$ -	0.0%	0.00%	$ -	$ -
13	30 PLANNING, ENGINEERING, AND DESIGN	Planning, Engineering, & Design	$ 8,957,319		22.97%	$ 2,057,433	$ 11,014,752
14	31 CONSTRUCTION MANAGEMENT	Construction Management	$ 4,722,733		21.81%	$ 1,029,847	$ 5,752,580
XX	FIXED DOLLAR RISK ADD (EQUALLY DISPERSED TO ALL, MUST INCLUDE JUSTIFICATION SEE BELOW)					$ -	

Totals	Contract Cost	% Contingency	$ Contingency	Total
Real Estate	$ -	0.00%	$ -	$ -
Total Construction Estimate	$ 59,102,722	55.75%	$ 32,951,406	$ 92,054,128
Total Planning, Engineering & Design	$ 8,957,319	22.97%	$ 2,057,433	$ 11,014,752
Total Construction Management	$ 4,722,733	21.81%	$ 1,029,847	$ 5,752,580
Total Excluding Real Estate	**$ 72,782,774**	**50%**	**$ 36,038,687**	**$ 108,821,461**

	Base	50%	80%
Confidence Level Range Estimate ($000's)	$72,783k	$94,406k	$108,821k

* 50% based on base is at 5% CL.

Fixed Dollar Risk Add: (Allows for additional risk to be added to the risk analsyis. Must include justification. Does not allocate to Real Estate.	

POLB Deepening **Alt 2** **West Basin, Pier J, Main Channel Widening Depth: -53' Approach Channel Depth: -78'**

Feasibility (Alternatives)
Abbreviated Risk Analysis
Meeting Date: 10-Apr-19

Risk Register

Risk Level

	Negligible	Marginal	Moderate	Significant	Critical
Very Likely	2	3	4	5	5
Likely	1	2	3	4	5
Possible	0	1	2	3	4
Unlikely	0	0	1	2	3

Risk Element	Feature of Work	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Impact	Likelihood	Risk Level
Project Management & Scope Growth				**Maximum Project Growth**		**75%**
PS-1	Hopper Mob/Demob	Scope at Alternative Formulation Stage	Scope definition changes may alter dredging equipment selection and affect mobilization/demobilization. Hopper dredges may not be available delaying the project by a year (schedule impacts only)	Marginal	Unlikely	0
PS-2	Clamshell Mob/Demob	Scope at Alternative Formulation Stage	Scope definition changes due to possible environmental restrictions may alter dredging equipment selection and affect mobilization/demobilization	Marginal	Unlikely	0
PS-3	Approach Channel Dredging (Hopper)	Lacking complete design.	General scope dredging volumes and distances changes may affect the cost and schedule. However, scope of work associated with the Approach Channel is well defined and unlikely to increase. Possible munitions findings likelihood is negligible. Length, width and depth of cut is defined. Scope changes are negligible along the Approach Channel. Maintenance dredging accounts for design depths up to 78'. Therefore, assume marginal additional sediment transport.	Marginal	Possible	1
PS-4	West Basin Dredging (Clam)	Lacking complete design, potential exists for encountering contaminated material	Contaminated material may be found. Material will need to be handled differently. Risk is very likely. Sponsor may already have an identified location nearby for contaminated material placement. Capping may be involved. Design evolution will very likely result in revisions to dredging volumes, but impact is marginal since the site layout is well established.	Marginal	Very LIKELY	3
PS-5	Pier J Dredging (Clam)	Design evolution	Design evolution will very likely result in revisions to dredging volumes, but impact is marginal since the site layout is well established. An 18,000 Twenty-feet Equivalent Units (TEU) ship simulation was done to define the site layout. The project scope is based on the 18,000 TEU design vessel, but the world is building 21,000 TEU ships leading to a scope change. A new re-authorization would be required if we need to change the layout. This is outside the project scope and not included in the risk analysis.	Marginal	Very LIKELY	3
PS-6	Main Channel Widening Dredging (Clam)	Lacking complete design, potential exists for encountering contaminated material	Contaminated material may be found. Material will need to be handled differently. Risk is very likely. Sponsor may already have an identified location nearby for contaminated material placement. Capping may be involved. Design evolution will very likely result in revisions to dredging volumes, but impact is marginal since the site layout is well established.	Marginal	Very LIKELY	3

PS-7	Pier J Breakwater Stabilization	Design evolution of the Pier J Breakwater Bulkhead Wall	Design evolution will likely result in revisions to the Pier J Breakwater Bulkhead Wall design structure. Design criteria may have a moderate impact on cost.	Moderate	Likely	3
PS-8	Electric Substation Near Berth J 260	Design evolution may impact this item	General design is in the beginning stages and subject to change. Electrical design is typically very limited in this stage of project development. There is every likelyhood of design evolution and cost impacts.	Significant	Very LIKELY	5
PS-13	Planning, Engineering, & Design	Scope evolution could impact design costs. Also, as the project is delayed, new issues may come to light. As delays occur, designers change, retire, etc, resulting in lost knowledge and rework.	Any delays or further scope identification can impact costs.	Moderate	Possible	2
PS-14	Construction Management	Scope evolution could cause an impact to the construction management of the project.	Project is located at one site. Further management costs due to scope changes are unlikely to impact the construction management costs.	Marginal	Unlikely	0
Acquisition Strategy				**Maximum Project Growth**		**30%**
AS-1	Hopper Mob/Demob	Acquisition Plan not yet determined	The hopper dredge is the most adequate choice for open ocean dredging (i.e. outside Queen's gate) considering the Approach Channel sediment deposition and sailing distance. Large marine contractors own hoppers. The reasonable assumption is that the project will be advertised as an unrestricted open-bid contract, instead of a small business, MATOC or negotiated procurement.	Marginal	Unlikely	0
AS-2	Clamshell Mob/Demob	Contract acquisition may result in some small business contracts	The PDT feels the project will pursue one contract; maybe a joint venture for such a large project; maybe a hopper dredge contractor and a clamshell dredge contractor. Dredging areas inbound by the breakwater (i.e. inside Queen's Gate) where the electric clamshell may be implemented could be candidates for small business contracts. Small business with extensive subcontracting; 8a prime contractor markups and poor bid competition are not factored into the estimate.	Moderate	Possible	2
AS-3	Approach Channel Dredging (Hopper)	Acquisition Plan not yet determined	Small Business contract is unlikely since the work is outside outside the breakwater (Queen's Gate). In open ocean, the hopper dredge is the most likely dredging equipment choice. Hopper dredges accommodate poor weather better than pipeline dredges; and clamshells are unstable. Historically, only large marine contractors owns hopper dredges.	Negligible	Unlikely	0
AS-4	West Basin Dredging (Clam)	Acquisition Plan not yet determined	Estimate is based on an unrestricted fixed-firm price contract. Since it is a huge investment (large impact) to convert a clamshell dredge into an electrical clamshell dredge, it is a very unlikely the project will pursue a small business contract.	Critical	Unlikely	3
AS-5	Pier J Dredging (Clam)	Acquisition Plan not yet determined	Estimate is based on an unrestricted fixed-firm price contract. Due to the nature of the work, it is unlikely this area is advertised as a small business set-aside contract, impacts to the cost would be moderate.	Moderate	Unlikely	1
AS-6	Main Channel Widening Dredging (Clam)	Acquisition Plan not yet determined	Estimate is based on an unrestricted fixed-firm price contract. Since it is a huge investment (large impact) to convert a clamshell dredge into an electrical clamshell dredge, it is a very unlikely the project will pursue a small business contract.	Critical	Unlikely	3

AS-7	Pier J Breakwater Stabilization	Acquisition Plan not yet determined	Acquisition plan not yet determined. Small business unlikely. Accelerated schedule possible. Normal competition expected.	Marginal	Possible	1
AS-8	Electric Substation Near Berth J 260	Acquisition Plan not yet determined	Acquisition plan not yet determined. Small business may be likely. Accelerated schedule possible. Normal competition expected.	Negligible	Likely	1
AS-13	Planning, Engineering, & Design	Contract acquisition plan could change over time, impacting design and solicitations efforts of the PED.	The reasonable assumption is that the project will be advertised as an open bid, instead of small business, MATOC or negotiated procurement. Contract acquisition changes are possible and they may result in design variations impacting PED, but assume cost impacts are negligible.	Negligible	Possible	0
AS-14	Construction Management	Contract acquisition has a direct correlation to construction contract management.	The reasonable assumption is that the project will be advertised as an open bid, instead of small business, MATOC or negotiated procurement. Small business w/ extensive subcontracting; 8a prime contractor markups and poor bid competition are not factored into the estimate. Risk is unlikely. A less skilled contractor on marine construction can result in more construction management.	Negligible	Unlikely	0
Construction Elements				Maximum Project Growth		**25%**
CE-1	Hopper Mob/Demob	Availability of hopper dredges on West Coast is scarce	The baseline estimate assumes mob/demob from the Gulf Coast. The only hopper dredging work that occurs on the West coast is in the Porland District. Likelihood of a dredge mob/demob from the North East Coast is possible, but impact on cost would be moderate.	Moderate	Possible	2
CE-2	Clamshell Mob/Demob	Availability of electric clamshell dredges	Air quality regulations restrictions limit the type to dredging equipment within the port to the use of an electric driven dredge. The estimate accounts for electric drive upgrade to clamshell derricks. Maybe additional lead time during mob/demob is required for converting diesel driven clams to electric driven. Likelihood is possible but the cost/schedule impacts should be negligile.	Negligible	Possible	0
CE-3	Approach Channel Dredging (Hopper)	Disposal Sites availability	Currently, most of the sediment volume from the Approach Channel is hauled to the Nearshore disposal site which is the closest disposal site (~4 miles). If the Nearshore disposal site becomes unavailable dredge material needs to go to a farther disposal site: LA2 is situated at ~10 miles or LA3 is situated at ~20 miles.	Moderate	Possible	2
CE-4	West Basin Dredging (Clam)	Possibility of encountering old navy timber and concrete piles.	Dredging work is considered new dredging, production rates could vary specially if piles are encountered during dredging operations. Removal of piles is not included in the project or estimate. Risk is unlikely, but may have a marginal impact.	Marginal	Unlikely	0
CE-5	Pier J Dredging (Clam)	Electric Clamshell requirements	The required use of the electric clamshell on Pier J is dependent on the construction of the electrical substation, near berth J 260, to be on schedule. Delays are possible impacting construction schedule and extended in-house labor costs.	Marginal	Possible	1

CE-6	Main Channel Widening Dredging (Clam)	Inefficient Contractor, Traffic concerns	It is unlikely a new dredging contractor obtains the contract and is unable to perform the work. The nature of this type of work makes the ocurrence of this risk unlikely. Capable remaining dredging contractors in the area are experienced and the work is not complex. However, there are traffic concerns in the area, concern carries a low impact since vessels will be able to sail around excavation site.	Marginal	Unlikely	0
CE-7	Pier J Breakwater Stabilization	Contractor's ability to install	Work consists on building a Pier J Breakwater Bulkhead Wall. Carrying out the work posses possible risks due to the nature of the work.	Marginal	Possible	1
CE-8	Electric Substation Near Berth J 260	Accelerated schedule. Site is confined	Accelerated schedule is possible. Pier J dredging work is dependent on the construction completion of the Electric Substation near Berth 260. Work will take place in a confined area, likley impacting construction.	Moderate	Likely	3
CE-13	Planning, Engineering, & Design	Contract modifications	Additional design effort during the construction period in the form of RFIs and modifications are possible, but cost and schedule impacts should be negligible	Marginal	Possible	1
CE-14	Construction Management	Contract modifications; Construction schedule extension	Construction schedule slips will impact construction management. Additional construction management effort during the construction period in the form of RFIs, modifications and claims are possible, but cost and schedule impacts should be negligible	Marginal	Likely	2
Specialty Construction or Fabrication				**Maximum Project Growth**		**65%**
SC-2	Clamshell Mob/Demob	Electric dredges are required inside the POLB	Conversion of diesel driven clamshell dredge to electric driven. Availability of electric driven dredges anticipated. Impact is low.	Negligible	Unlikely	0
SC-3	Approach Channel Dredging (Hopper)	Dredging Equipment choice	The hopper dredge is the best equipment choice outside the breakwater (Queen's Gate). As a specialty equipment, the hopper dredge is the best choice for the Approach Channel dredging because the excavation layer is thin and work is outside the breakwater. However, the contract will not specify which equipment the contractor must use, and it is unlikely a clamshell barge meeting ABS-class ocean work dredges outside the line of demarcation (outside the breakwater). Use of another dredge will significantly impact cost. Also, the baseline estimate considered a large size hopper, however, there is the possibility of a medium hopper dredge bidding the job. The use of a large size hopper results in a lower dredging	Significant	Unlikely	2
SC-4	West Basin Dredging (Clam)	Electric dredges are required inside the POLB and may be required for mitigation of air quality impacts	Conversion of diesel driven clamshell dredge to electric driven. Availability of electric driven dredges anticipated. Impact is low.	Negligible	Unlikely	0
SC-5	Pier J Dredging (Clam)	Electric dredges are required inside the POLB and may be required for mitigation of air quality impacts	Conversion of diesel driven clamshell dredge to electric driven. Availability of electric driven dredges anticipated. Impact is low.	Negligible	Unlikely	0
SC-6	Main Channel Widening Dredging (Clam)	Electric dredges are required inside the POLB and may be required for mitigation of air quality impacts	Conversion of diesel driven clamshell dredge to electric driven. Availability of electric driven dredges anticipated. Impact is low.	Negligible	Unlikely	0
SC-8	Electric Substation Near Berth J 260	Any specialized fabrication of electric components could impact cost due to change of material costs, design complexity, long lead fabrication	Material costs vary with market. Electric Sub-station fabrication takes skilled trades and carries a long lead time. It is possible fabrication and installation of the electric substation have a moderate impact on its cost.	Moderate	Likely	3
SC-13	Planning, Engineering, & Design	Specialty construction and material fabrication	Specialty construction and material fabrication do not apply to these cost items.	Negligible	Unlikely	0
Technical Design & Quantities				**Maximum Project Growth**		**30%**
T-3	Approach Channel Dredging (Hopper)	Potential sea level changes resulting in a reduction of base quantities in the cost estimate. Geotechnical investigations remain.	The Approach Channel is situated outside the breakwater and therefore more subseptible to quantity variations associated with sea level change. Sea level change has a certain probability within itself. Risk is limited in the near term, but it increases substantially in the out years. Likelihood is certain, but impact is marginal because work will take place in the near term, unlikely multi-year maintenance dredging projects. Geotech investigations has not been done to 80' leading to possible scope change. Channel width thorugh Queen's Gate may change slightly, material classifications not determined. Associated cost risks are marginal.	Marginal	Possible	1

T-4	West Basin Dredging (Clam)	Quantities are based on outdated surveys. Disposal sites (LA2 and LA3) capacities limitations. Design assumption of 0.9 MCY/disposal site may not be accurate.	Dredging area is located inside the breakwater so volume variations should not be high, however current calculated dredging volumes are based on outdated surveys. Project may face competition from other projects on Disposal sites. LA2 and LA3 Disposal sites may reach yearly capacity from other Non-COE projects impacting the project schedule.	Critical	Likely	5
T-5	Pier J Dredging (Clam)	Quantities are based on outdated surveys. Disposal sites (LA2 and LA3) capacities limitations. Design assumption of 0.9 MCY/disposal site may not be accurate.	Dredging area is located inside the breakwater so volume variations should not be high, however current calculated dredging volumes are based on outdated surveys. Project may face competition from other projects on Disposal sites. LA2 and LA3 Disposal sites may reach yearly capacity from other Non-COE projects impacting the project schedule. If calculated disposal sites capacities change, impact on cost and schedule will be critical in nature. Another key design risk is associated with the Pier J breakwater slope stability. Slope excavation may go underneath the rock structure and undermine it.	Critical	Likely	5
T-6	Main Channel Widening Dredging (Clam)	Quantities are based on outdated surveys. Disposal sites (LA2 and LA3) capacities limitations. Design assumption of 0.9 MCY/disposal site may not be accurate.	Dredging area is located inside the breakwater so volume variations should not be high, however current calculated dredging volumes are based on outdated surveys. Project may face competition from other projects on Disposal sites. LA2 and LA3 Disposal sites may reach yearly capacity from other Non-COE projects impacting the project schedule.	Critical	Likely	5
T-7	Pier J Breakwater Stabilization	Design is in the early phases	Project has not been designed and it is subject to likely affect the cost. Risk of design and construction complications at Pier J modifications. Project involves installing sheet pile or similar stabilizing measures around Pier J to allow deepening of channel adjacent to Pier J and jetties.	Moderate	Very LIKELY	4
T-8	Electric Substation Near Berth J 260	Design is in the early phases	Project has not been designed and it is subject to likely affect the cost	Moderate	Very LIKELY	4
T-13	Planning, Engineering, & Design	Design confidence	Additional / more accurate quantities will need to be calculated. No major impact to PED. Cost and schedule impacts are assumed to be negligible.	Negligible	Unlikely	0
T-14	Construction Management	Design confidence	I additional quantities are calculated the project schedule will grow resulting in additional S&A. Cost and Schedule impacts are assumed to be marginal	Marginal	Unlikely	0
Cost Estimate Assumptions				**Maximum Project Growth**		**35%**
EST-1	Hopper Mob/Demob	Estimate assumption on the number of mobs and demobs	Estimate assumption of one single large generic hopper dredge. The estimate assumes a single mob/demob event. It is unlikely that the hopper dredge mob/demobs more than one occasion. Cost and schedule impacts would be signficant if more than one mob/demob is required.	Significant	Unlikely	2
EST-2	Clamshell Mob/Demob	Estimate assumption on the number of mobs and demobs	Estimate assumes yearly mobs and demobs of the clamshell dredge. It is possible to have multiple mob/demobs in a single year depending on how the contract is broken out.	Marginal	Possible	1
EST-3	Approach Channel Dredging (Hopper)	Quantities variations	Since the design is at the feasibility stage, quantities variations are possible having a marginal impact on the cost and schedule.	Marginal	Possible	1
EST-4	West Basin Dredging (Clam)	Possibility of a different type of dredge bidding the job	Estimate assumes one clamshell bucket dredge, but equipment is not restrictive within the contract. Selected clamshell size and number can affect estimated cost and productivity. The potential that a pipeline dredge is used in lieu of the clamshell dredge is unlikely since scows would be required due to the long hauling distance (LA2 or LA3). Overflow is not allowed due to environmental limitations.	Marginal	Unlikely	0
EST-5	Pier J Dredging (Clam)	Possibility of a different type of dredge bidding the job	Estimate assumes one clamshell bucket dredge, but equipment is not restrictive within the contract. Selected clamshell size and number can affect the cost and productivity. The potential that a pipeline dredge is used in lieu of the estimated clamshell is highly unlikely due to the disposal site distance.	Marginal	Unlikely	0

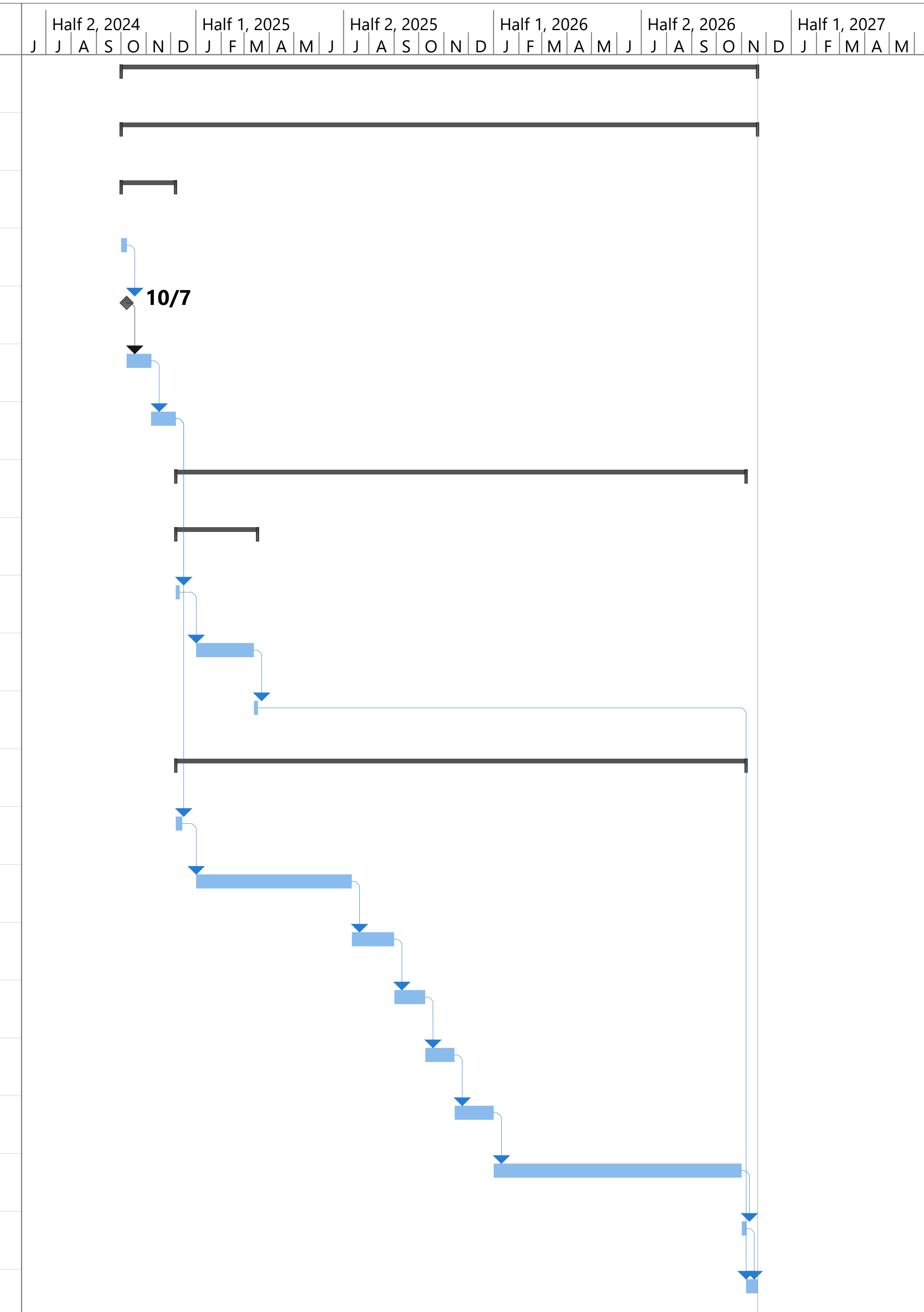
EST-6	Main Channel Widening Dredging (Clam)	Possibility of a different type of dredge bidding the job Possible harder than expected dredging	Estimate assumes one clamshell bucket dredge, but equipment is not restrictive within the contract. Selected clamshell size and number can affect estimated cost and productivity. The potential that a pipeline dredge is used in lieu of the clamshell dredge is unlikely since scows would be required due to the long hauling distance (LA2 or LA3). Overflow is not allowed due to environmental limitations. Possible harder than expected dredging especially at main channel, where there is not yet any geotech investigation and we are going to depths not done before at PoLB. Seems like this is at least a marginal risk considering the last time we dredged the main channel there was a claim for hard material.	Marginal	Possible	1
EST-7	Pier J Breakwater Stabilization	Pier J Breakwater Bulkhead Wall design is at the feasibility stage.	Uncertainty on the level of cost confidence based on the current design stage may impact the Pier J Breakwater Bulkhead Wall cost item.	Moderate	Very LIKELY	4
EST-8	Electric Substation Near Berth J 260	Electric Substation estimate is at the early stage	Uncetainty on the level of cost confidence based on the current design stage may impact the Electric Substation cost item.	Moderate	Very LIKELY	4
EST-13	Planning, Engineering, & Design	Calculated as percentage of construction cost	Common percentages used for type of work, but subject to change. 30 account costs can vary greatly.	Moderate	Likely	3
EST-14	Construction Management	Calculated as percentage of construction cost	Common percentages used for type of work, but subject to change. 31 account costs typically close to estimated percentage, but mary vary more for larger project.	Marginal	Possible	1
External Project Risks				**Maximum Project Growth**		**40%**
EX-1	Hopper Mob/Demob	Market Conditions	Large dredging projects requiring hopper dredges have always being handled by a limited pool of contractors. For open ocean dredge projects, bidding climate has historically been limited to a small circle of contractors and it is not expected to change. Lack of competition may have a moderate impact on the construction cost.	Moderate	Likely	3
EX-2	Clamshell Mob/Demob	Market Conditions	Lack of competition may have an impact on costs.	Marginal	Likely	2
EX-3	Approach Channel Dredging (Hopper)	Unanticipated fuel inflation, Encountering Green Sea Turtles and marine mammals	Hopper dredges are sensitive to fuel price fluctuations. Fluctuations in fuel prices will affect dredging unit cost. Our current position is that green sea turtles are not present in San Pedro Bay. Green sea turtles are an endangered species under the federal Endangered Species Act (ESA). Absence from the study area would result in a no effect determination made by the Corps that does not require consultation with the National Marine Fisheries Service (NMFS). The risk involves encountering green sea turtles in San Pedro Bay project area. Presence of green sea turtles would trigger consultation with the NMFS under the ESA. This could add delays to complete the study as well as possible monitoring and protective measures for dredging and placement activities that would add costs and schedule delays during construction. This risk would carry a marginal cost and schedule impact with low possibility of occurrence. NMFS is requiring the Port to perform approximately two years of sea turtle monitoring. This study will determine green sea turtles actually occur within the Harbor District. Currently, they are known to occur in nearby rivers, but not within the Port Complex itself. With that said, we do not believe this will be an issue for the project. Marine mammals may impact the work. Work may need to stop intermittently	Marginal	Possible	1

EX-4	West Basin Dredging (Clam)	Bidding environment, Weather, Encountering Green Sea Turtles and Marine Mammals	Amount of bidders in a competitively bid contract will affect price. Weather will affect construction schedule. Assume these risks are possible and have a marginal effect on cost. Our current position is that green sea turtles are not present in San Pedro Bay. Green sea turtles are an endangered species under the federal Endangered Species Act (ESA). Absence from the study area would result in a no effect determination made by the Corps that does not require consultation with the National Marine Fisheries Service (NMFS). The risk involves encountering green sea turtles in San Pedro Bay project area. Presence of green sea turtles would trigger consultation with the NMFS under the ESA. This could add delays to complete the study as well as possible monitoring and protective measures for dredging and placement activities that would add costs and schedule delays during construction. This risk would carry a marginal cost and schedule impact with low possibility of occurrence. NMFS is requiring the Port to perform approximately two years of sea turtle monitoring. This study will determine green sea turtles actually occur within the Harbor District. Currently, they are known to occur in nearby rivers, but not within the Port Complex itself. With that said, we do not believe this will be an issue for the project. Marine mammals may impact the work. Work may need to stop intermittently	Marginal	Possible	1
EX-5	Pier J Dredging (Clam)	Bidding environment, Weather, Encountering Green Sea Turtles and Marine Mammals	Amount of bidders in a competitively bid contract will affect price. Weather will affect construction schedule. Assume these risks are possible and have a marginal effect on cost. Our current position is that green sea turtles are not present in San Pedro Bay. Green sea turtles are an endangered species under the federal Endangered Species Act (ESA). Absence from the study area would result in a no effect determination made by the Corps that does not require consultation with the National Marine Fisheries Service (NMFS). The risk involves encountering green sea turtles in San Pedro Bay project area. Presence of green sea turtles would trigger consultation with the NMFS under the ESA. This could add delays to complete the study as well as possible monitoring and protective measures for dredging and placement activities that would add costs and schedule delays during construction. This risk would carry a marginal cost and schedule impact with low possibility of occurrence. NMFS is requiring the Port to perform approximately two years of sea turtle monitoring. This study will determine green sea turtles actually occur within the Harbor District. Currently, they are known to occur in nearby rivers, but not within the Port Complex itself. With that said, we do not believe this will be an issue for the project. Marine mammals may impact the work. Work may need to stop intermittently	Marginal	Possible	1
EX-6	Main Channel Widening Dredging (Clam)	Bidding environment, Weather, Encountering Green Sea Turtles and Marine Mammals	Amount of bidders in a competitively bid contract will affect price. Weather will affect construction schedule. Assume these risks are possible and have a marginal effect on cost. Our current position is that green sea turtles are not present in San Pedro Bay. Green sea turtles are an endangered species under the federal Endangered Species Act (ESA). Absence from the study area would result in a no effect determination made by the Corps that does not require consultation with the National Marine Fisheries Service (NMFS). The risk involves encountering green sea turtles in San Pedro Bay project area. Presence of green sea turtles would trigger consultation with the NMFS under the ESA. This could add delays to complete the study as well as possible monitoring and protective measures for dredging and placement activities that would add costs and schedule delays during construction. This risk would carry a marginal cost and schedule impact with low possibility of occurrence. NMFS is requiring the Port to perform approximately two years of sea turtle monitoring. This study will determine green sea turtles actually occur within the Harbor District. Currently, they are known to occur in nearby rivers, but not within the Port Complex itself. With that said, we do not believe this will be an issue for the project. Marine mammals may impact the work. Work may need to stop intermittently	Marginal	Possible	1

EX-7	Pier J Breakwater Stabilization	Bidding environment, weather, Encountering White Abalone, Encountering Marine Mammals	Amount of bidders in a competitively bid contract will affect price. Weather will affect construction schedule. Assume these risks are likely and have a marginal effect on cost. NMFS is requiring the Port to perform approximately two years of sea turtle monitoring. This study will determine green sea turtles actually occur within the Harbor District. Currently, they are known to occur in nearby rivers, but not within the Port Complex itself. With that said, we do not believe this will be an issue for the project. Marine mammals may impact the work. Work may need to stop intermittently	Marginal	Possible	**1**
EX-8	Electric Substation Near Berth J 260	Bidding environment, weather	Amount of bidders in a competitively bid contract will affect price. Weather will affect construction schedule. Assume these risks are likely and have a negligible effect on cost.	Negligible	Likely	**1**
EX-13	Planning, Engineering, & Design	Political factors. Funding availability	The longer it takes to get to construction, the more it will cost to prepare economic updates. Environmental documents may need to updated.	Negligible	Possible	**0**
EX-14	Construction Management	Lack of personnel	Lack of personnel will have a moderate impact on the project.	Moderate	Likely	**3**

6.1.3 Construction Schedule

ID		Task Mode	Task Name	Duration	Start	Finish	Predecessors
1			**Construction Schedule**	**781 days**	**Tue 10/1/24**	**Fri 11/20/26**	
2			Alternative 2	781 days	Tue 10/1/24	Fri 11/20/26	
3			**Preconstruction Phase**	**67 days**	**Tue 10/1/24**	**Fri 12/6/24**	
4			Construction Contract Award	5 days	Tue 10/1/24	Mon 10/7/24	
5			Notice to Proceed	0 days	Mon 10/7/24	Mon 10/7/24	4
6			Generate Contractor Submittals	30 edays	Mon 10/7/24	Wed 11/6/24	5
7			Review/Approve Submittals	30 edays	Wed 11/6/24	Fri 12/6/24	6
8			**Construction Phase**	**700 days**	**Sat 12/7/24**	**Fri 11/6/26**	
9			**Hopper Dredging**	**101 days**	**Sat 12/7/24**	**Mon 3/17/25**	
10			Mobilization	5 days	Sat 12/7/24	Wed 12/11/24	7
11			Approach Channel Dredging - Nearshore Disposal	66 days	Wed 1/1/25	Wed 3/12/25	10
12			Demobilization	5 days	Thu 3/13/25	Mon 3/17/25	11
13			**Clamshell Dredging**	**700 days**	**Sat 12/7/24**	**Fri 11/6/26**	
14			Mobilization	8 days	Sat 12/7/24	Sat 12/14/24	7
15			Main Channel Widening - Nearshore Disposal	178 days	Wed 1/1/25	Thu 7/10/25	14
16			West Basin - Nearshore Disposal	49 days	Fri 7/11/25	Sun 8/31/25	15
17			West Basin - LA2 Disposal	35 days	Mon 9/1/25	Wed 10/8/25	16
18			Pier J Basin - LA2 Disposal	34 days	Thu 10/9/25	Thu 11/13/25	17
19			Pier J Approach - LA2 Disposal	44 days	Fri 11/14/25	Wed 12/31/25	18
20			Pier J Approach 2nd Year - LA2/LA3 Disposal	284 days	Thu 1/1/26	Sat 10/31/26	19
21			Demobilization	5 days	Sun 11/1/26	Fri 11/6/26	20
22			Contract Closeout	14 edays	Fri 11/6/26	Fri 11/20/26	21,12



Project: POLB Deepening_Alt 2-
Date: Thu 7/18/19

Task	Project Summary	Manual Task	Start-only	Deadline
Split	Inactive Task	Duration-only	Finish-only	Progress
Milestone	Inactive Milestone	Manual Summary Rollup	External Tasks	Manual Progress
Summary	Inactive Summary	Manual Summary	External Milestone	

6.2 Alternative 3

6.2.1 Total Project Cost Summary (TPCS)

**** TOTAL PROJECT COST SUMMARY ****

PROJECT: **Port of Long Beach**
PROJECT NO: **xxxxxx**
LOCATION: **Long Beach, CA**

DISTRICT: **Los Angeles District**
PREPARED: **7/18/2019**
POC: **CHIEF, COST ENGINEERING, XXX**

This Estimate reflects the scope and schedule in report; Engineering alternatives

Civil Works Work Breakdown Structure		**ESTIMATED COST**				**PROJECT FIRST COST (Constant Dollar Basis)**						**TOTAL PROJECT COST (FULLY FUNDED)**			
								Program Year (Budget EC):		2025					
								Effective Price Level Date:		1-Oct- 24					
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	REMAINING COST ($K)	Spent Thru: 1-Oct-18 ($K)	**TOTAL FIRST COST ($K)**	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
12	NAVIGATION PORTS & HARBORS	$73,872	$33,981	46%	$107,853		$73,872	$33,981	$107,853		$107,853	14.9%	$84,853	$39,032	$123,886
12	NAVIGATION PORTS & HARBORS - Non-Fed	$10,273	$4,725	46%	$14,998		$10,273	$4,725	$14,998		$14,998	13.8%	$11,685	$5,375	$17,061
			-			-						-			
	CONSTRUCTION ESTIMATE TOTALS:	$84,144	$38,706		$122,851		$84,144	$38,706	$122,851		$122,851	14.7%	$96,539	$44,408	$140,946
01	LANDS AND DAMAGES		-			-						-			
30	PLANNING, ENGINEERING & DESIGN	$12,653	$5,820	46%	$18,474		$12,653	$5,820	$18,474		$18,474	16.0%	$14,672	$6,749	$21,421
31	CONSTRUCTION MANAGEMENT	$6,424	$2,955	46%	$9,379		$6,424	$2,955	$9,379		$9,379	30.4%	$8,377	$3,854	$12,231
	PROJECT COST TOTALS:	$103,221	$47,482	46%	$150,703		$103,221	$47,482	$150,703		**$150,703**	15.9%	$119,588	$55,010	$174,598

ESTIMATED TOTAL PROJECT COST: **$174,598**

______________________ CHIEF, COST ENGINEERING, XXX

______________________ PROJECT MANAGER, XXX

______________________ CHIEF, REAL ESTATE, XXX

______________________ CHIEF, PLANNING, XXX

______________________ CHIEF, ENGINEERING, XXX

______________________ CHIEF, OPERATIONS, XXX

______________________ CHIEF, CONSTRUCTION, XXX

______________________ CHIEF, CONTRACTING, XXX

______________________ CHIEF, PM-PB, xxxx

______________________ CHIEF, DPM, XXX

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: Port of Long Beach
LOCATION: Long Beach, CA
This Estimate reflects the scope and schedule in report; Engineering alternatives

DISTRICT: Los Angeles District
POC: CHIEF, COST ENGINEERING, XXX

PREPARED: 7/18/2019

WBS Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 16-Jul-19 Estimate Price Level: 1-Oct-18				Program Year (Budget EC): 2025 Effective Price Level Date: 1 -Oct-24								
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	RISK BASED CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	PHASE 1 or CONTRACT 1													
12	NAVIGATION PORTS & HARBORS - Year 1	$44,787	$20,602	46.0%	$65,389		$44,787	$20,602	$65,389	2025Q3	13.8%	$50,946	$23,435	$74,381
12	NAVIGATION PORTS & HARBORS - Year 2	$22,114	$10,173	46.0%	$32,287		$22,114	$10,173	$32,287	2026Q3	16.0%	$25,658	$11,803	$37,461
12	NAVIGATION PORTS & HARBORS - Year 3	$6,970	$3,206	46.0%	$10,176		$6,970	$3,206	$10,176	2027Q3	18.3%	$8,249	$3,795	$12,044
12	NAVIGATION PORTS & HARBORS - Year 4			46.0%										
12	NAVIGATION PORTS & HARBORS - Non-Fed Pier J Basin			46.0%										
	CONSTRUCTION ESTIMATE TOTALS:	$73,872	$33,981	46.0%	$107,853		$73,872	$33,981	$107,853			$84,853	$39,032	$123,886
01	LANDS AND DAMAGES			25.0%										
30	PLANNING, ENGINEERING & DESIGN													
1.5%	Project Management	$1,108	$510	46.0%	$1,618		$1,108	$510	$1,618	2022Q2	14.0%	$1,264	$581	$1,845
0.5%	Planning & Environmental Compliance	$369	$170	46.0%	$539		$369	$170	$539	2022Q2	14.0%	$421	$194	$614
8.0%	Engineering & Design	$5,910	$2,719	46.0%	$8,629		$5,910	$2,719	$8,629	2022Q2	14.0%	$6,740	$3,100	$9,840
0.5%	Reviews, ATRs, IEPRs, VE	$369	$170	46.0%	$539		$369	$170	$539	2022Q2	14.0%	$421	$194	$614
1.0%	Life Cycle Updates (cost, schedule, risks)	$739	$340	46.0%	$1,079		$739	$340	$1,079	2022Q2	14.0%	$843	$388	$1,230
0.5%	Contracting & Reprographics	$369	$170	46.0%	$539		$369	$170	$539	2025Q3	30.4%	$481	$221	$703
1.5%	Engineering During Construction	$1,108	$510	46.0%	$1,618		$1,108	$510	$1,618	2025Q3	30.4%	$1,445	$665	$2,110
1.0%	Planning During Construction	$739	$340	46.0%	$1,079		$739	$340	$1,079	2022Q2	14.0%	$843	$388	$1,230
0.5%	Adaptive Management & Monitoring	$369	$170	46.0%	$539		$369	$170	$539	2022Q2	14.0%	$421	$194	$614
	NON-FED Portion of PED	$1,573	$724	46.0%	$2,297		$1,573	$724	$2,297	2022Q2	14.0%	$1,794	$825	$2,619
31	CONSTRUCTION MANAGEMENT													
6.7%	Construction Management	$4,949	$2,277	46.0%	$7,226		$4,949	$2,277	$7,226	2025Q3	30.4%	$6,454	$2,969	$9,423
	NON-FED Portion of S&A	$1,475	$678	46.0%	$2,153		$1,475	$678	$2,153	2025Q3	30.4%	$1,923	$885	$2,808
	Project Management			46.0%										
	CONTRACT COST TOTALS:	$92,949	$42,756		$135,705		$92,949	$42,756	**$135,705**			$107,902	$49,635	**$157,537**

6.2.2 Abbreviated Cost and Schedule Risk Analysis

Abbreviated Risk Analysis

Alternative: **Alt 3 (NED)**
West Basin, Pier J, Main Channel Widening
Depth: -55'
Approach Channel Depth: -80'
EXCLUDING STAND-BY AREA

Project (less than $40M): **POLB Deepening**
Project Development Stage/Alternative: **Feasibility (Alternatives)**
Risk Category: **Moderate Risk: Typical Project Construction Type**

Meeting Date: **4/10/2019**

Total Estimated Construction Contract Cost = $ 85,525,925

	CWWBS	Feature of Work	Contract Cost		% Contingency	$ Contingency	Total
	01 LANDS AND DAMAGES	Real Estate	$ -		0.00%	$ -	$ -
1	12 NAVIGATION, PORTS AND HARBORS	Hopper Mob/Demob	$ 3,289,728		23.92%	$ 786,771	$ 4,076,499
2	12 NAVIGATION, PORTS AND HARBORS	Clamshell Mob/Demob	$ 7,205,564		17.31%	$ 1,247,116	$ 8,452,680
3	12 NAVIGATION, PORTS AND HARBORS	Approach Channel Dredging (Hopper)	$ 16,716,000		24.41%	$ 4,080,042	$ 20,796,042
4	12 NAVIGATION, PORTS AND HARBORS	West Basin Dredging (Clam)	$ 7,198,680		60.12%	$ 4,328,117	$ 11,526,797
5	12 NAVIGATION, PORTS AND HARBORS	Pier J Dredging (Clam)	$ 30,641,030		56.31%	$ 17,252,624	$ 47,893,654
6	12 NAVIGATION, PORTS AND HARBORS	Main Channel Widening Dredging (Clam)	$ 10,642,600		62.16%	$ 6,615,432	$ 17,258,032
7	12 NAVIGATION, PORTS AND HARBORS	Pier J Breakwater Stabilization	$ 5,465,708		58.69%	$ 3,207,805	$ 8,673,513
8	12 NAVIGATION, PORTS AND HARBORS	Electric Substation Near Berth J 260	$ 4,366,615		137.59%	$ 6,007,910	$ 10,374,525
9			$ -		0.00%	$ -	$ -
10			$ -		0.00%	$ -	$ -
11			$ -		0.00%	$ -	$ -
12	All Other	Remaining Construction Items	$ -	0.0%	0.00%	$ -	$ -
13	30 PLANNING, ENGINEERING, AND DESIGN	Planning, Engineering, & Design	$ 12,927,212		22.97%	$ 2,969,290	$ 15,896,502
14	31 CONSTRUCTION MANAGEMENT	Construction Management	$ 6,546,319		21.81%	$ 1,427,501	$ 7,973,820
XX	FIXED DOLLAR RISK ADD (EQUALLY DISPERSED TO ALL, MUST INCLUDE JUSTIFICATION SEE BELOW)					$ -	

Totals	Contract Cost	% Contingency	$ Contingency	Total
Real Estate	$ -	0.00%	$ -	$ -
Total Construction Estimate	$ 85,525,925	50.89%	$ 43,525,816	$ 129,051,741
Total Planning, Engineering & Design	$ 12,927,212	22.97%	$ 2,969,290	$ 15,896,502
Total Construction Management	$ 6,546,319	21.81%	$ 1,427,501	$ 7,973,820
Total Excluding Real Estate	$ 104,999,456	46%	$ 47,922,607	$ 152,922,063

	Base	50%	80%
Confidence Level Range Estimate ($000's)	$104,999k	$133,753k	$152,922k

* 50% based on base is at 5% CL.

Fixed Dollar Risk Add: (Allows for additional risk to be added to the risk analsyis. Must include justification. Does not allocate to Real Estate.	

POLB Deepening **Alt 3 (NED)West Basin, Pier J, Main Channel Widening Depth: -55'Approach Channel Depth: -80'EXCLUDING STAND-BY AREA**

Feasibility (Alternatives)
Abbreviated Risk Analysis
Meeting D 10-Apr-19

Risk Register

Risk Level

	Negligible	Marginal	Moderate	Significant	Critical
Very Likely	2	3	4	5	5
Likely	1	2	3	4	5
Possible	0	1	2	3	4
Unlikely	0	0	1	2	3

Risk Element	Feature of Work	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Impact	Likelihood	Risk Level
Project Management & Scope Growth			Maximum Project Growth			75%
PS-1	Hopper Mob/Demob	Scope at Alternative Formulation Stage	Scope definition changes may alter dredging equipment selection and affect mobilization/demobilization. Hopper dredges may not be available delaying the project by a year (schedule impacts only)	Marginal	Unlikely	0
PS-2	Clamshell Mob/Demob	Scope at Alternative Formulation Stage	Scope definition changes due to possible environmental restrictions may alter dredging equipment selection and affect mobilization/demobilization	Marginal	Unlikely	0
PS-3	Approach Channel Dredging (Hopper)	Lacking complete design.	General scope dredging volumes and distances changes may affect the cost and schedule. However, scope of work associated with the Approach Channel is well defined and unlikely to increase. Possible munitions findings likelihood is negligible. Length, width and depth of cut is defined. Scope changes are negligible along the Approach Channel. Maintenance dredging accounts for depth from 78' to 80'. Therefore, assume marginal additional sediment transport.	Marginal	Possible	1
PS-4	West Basin Dredging (Clam)	Lacking complete design, potential exists for encountering contaminated material	Contaminated material may be found. Material will need to be handled differently. Risk is very likely. Sponsor may already have an identified location nearby for contaminated material placement. Capping may be involved. Design evolution will very likely result in revisions to dredging volumes, but impact is marginal since the site layout is well established.	Marginal	Very LIKELY	3
PS-5	Pier J Dredging (Clam)	Design evolution	Design evolution will very likely result in revisions to dredging volumes, but impact is marginal since the site layout is well established. An 18,000 Twenty-feet Equivalent Units (TEU) ship simulation was done to define the site layout. The project scope is based on the 18,000 TEU design vessel, but the world is building 21,000 TEU ships leading to a scope change. A new re-authorization would be required if we need to change the layout. This is outside the project scope and not included in the risk analysis.	Marginal	Very LIKELY	3
PS-6	Main Channel Widening Dredging (Clam)	Lacking complete design, potential exists for encountering contaminated material	Contaminated material may be found. Material will need to be handled differently. Risk is very likely. Sponsor may already have an identified location nearby for contaminated material placement. Capping may be involved. Design evolution will very likely result in revisions to dredging volumes, but impact is marginal since the site layout is well established.	Marginal	Very LIKELY	3

PS-7	Pier J Breakwater Stabilization	Design evolution of the Pier J Breakwater Bulkhead Wall	Design evolution will likely result in revisions to the Pier J Breakwater Bulkhead Wall design structure. Design criteria may have a moderate impact on cost.	Moderate	Likely	3
PS-8	Electric Substation Near Berth J 260	Design evolution may impact this item	General design is in the beginning stages and subject to change. Electrical design is typically very limited in this stage of project development. There is every likelyhood of design evolution and cost impacts.	Significant	Very LIKELY	5
PS-13	Planning, Engineering, & Design	Scope evolution could impact design costs. Also, as the project is delayed, new issues may come to light. As delays occur, designers change, retire, etc, resulting in lost knowledge and rework.	Any delays or further scope identification can impact costs.	Moderate	Possible	2
PS-14	Construction Management	Scope evolution could cause an impact to the construction management of the project.	Project is located at one site. Further management costs due to scope changes are unlikely to impact the construction management costs.	Marginal	Unlikely	0
Acquisition Strategy				**Maximum Project Growth**		**30%**
AS-1	Hopper Mob/Demob	Acquisition Plan not yet determined	The hopper dredge is the most adequate choice for open ocean dredging (i.e. outside Queen's gate) considering the Approach Channel sediment deposition and sailing distance. Large marine contractors own hoppers. The reasonable assumption is that the project will be advertised as an unrestricted open-bid contract, instead of a small business, MATOC or negotiated procurement.	Marginal	Unlikely	0
AS-2	Clamshell Mob/Demob	Contract acquisition may result in some small business contracts	The PDT feels the project will pursue one contract; maybe a joint venture for such a large project; maybe a hopper dredge contractor and a clamshell dredge contractor. Dredging areas inbound by the breakwater (i.e. inside Queen's Gate) where the electric clamshell may be implemented could be candidates for small business contracts. Small business with extensive subcontracting; 8a prime contractor markups and poor bid competition are not factored into the estimate.	Moderate	Possible	2
AS-3	Approach Channel Dredging (Hopper)	Acquisition Plan not yet determined	Small Business contract is unlikely since the work is outside outside the breakwater (Queen's Gate). In open ocean, the hopper dredge is the most likely dredging equipment choice. Hopper dredges accommodate poor weather better than pipeline dredges; and clamshells are unstable. Historically, only large marine contractors owns hopper dredges.	Negligible	Unlikely	0
AS-4	West Basin Dredging (Clam)	Acquisition Plan not yet determined	Estimate is based on an unrestricted fixed-firm price contract. Since it is a huge investment (large impact) to convert a clamshell dredge into an electrical clamshell dredge, it is a very unlikely the project will pursue a small business contract.	Critical	Unlikely	3
AS-5	Pier J Dredging (Clam)	Acquisition Plan not yet determined	Estimate is based on an unrestricted fixed-firm price contract. Due to the nature of the work, it is unlikely this area is advertised as a small business set-aside contract, impacts to the cost would be moderate.	Moderate	Unlikely	1
AS-6	Main Channel Widening Dredging (Clam)	Acquisition Plan not yet determined	Estimate is based on an unrestricted fixed-firm price contract. Since it is a huge investment (large impact) to convert a clamshell dredge into an electrical clamshell dredge, it is a very unlikely the project will pursue a small business contract.	Critical	Unlikely	3
AS-7	Pier J Breakwater Stabilization	Acquisition Plan not yet determined	Acquisition plan not yet determined. Small business unlikely. Accelerated schedule possible. Normal competition expected.	Marginal	Possible	1

AS-8	Electric Substation Near Berth J 260	Acquisition Plan not yet determined	Acquisition plan not yet determined. Small business may be likely. Accelerated schedule possible. Normal competition expected.	Negligible	Likely	1
AS-13	Planning, Engineering, & Design	Contract acquisition plan could change over time, impacting design and solicitations efforts of the PED.	The reasonable assumption is that the project will be advertised as an open bid, instead of small business, MATOC or negotiated procurement. Contract acquisition changes are possible and they may result in design variations impacting PED, but assume cost impacts are negligible.	Negligible	Possible	0
AS-14	Construction Management	Contract acquisition has a direct correlation to construction contract management.	The reasonable assumption is that the project will be advertised as an open bid, instead of small business, MATOC or negotiated procurement. Small business w/ extensive subcontracting; 8a prime contractor markups and poor bid competition are not factored into the estimate. Risk is unlikely. A less skilled contractor on marine construction can result in more construction management.	Negligible	Unlikely	0
Construction Elements					**Maximum Project Growth**	**25%**
CE-1	Hopper Mob/Demob	Availability of hopper dredges on West Coast is scarce	The baseline estimate assumes mob/demob from the Gulf Coast. The only hopper dredging work that occurs on the West coast is in the Porland District. Likelihood of a dredge mob/demob from the North East Coast is possible, but impact on cost would be moderate.	Moderate	Possible	2
CE-2	Clamshell Mob/Demob	Availability of electric clamshell dredges	Air quality regulations restrictions limit the type to dredging equipment within the port to the use of an electric driven dredge. The estimate accounts for electric drive upgrade to clamshell derricks. Maybe additional lead time during mob/demob is required for converting diesel driven clams to electric driven. Likelihood is possible but the cost/schedule impacts should be negligile.	Negligible	Possible	0
CE-3	Approach Channel Dredging (Hopper)	Disposal Sites availability	Currently, most of the sediment volume from the Approach Channel is hauled to the Nearshore disposal site which is the closest disposal site (~4 miles). If the Nearshore disposal site becomes unavailable dredge material needs to go to a farther disposal site: LA2 is situated at ~10 miles or LA3 is situated at ~20 miles.	Moderate	Possible	2
CE-4	West Basin Dredging (Clam)	Possibility of encountering old navy timber and concrete piles.	Dredging work is considered new dredging, production rates could vary specially if piles are encountered during dredging operations. Removal of piles is not included in the project or estimate. Risk is unlikely, but may have a marginal impact.	Marginal	Unlikely	0
CE-5	Pier J Dredging (Clam)	Electric Clamshell requirements	The required use of the electric clamshell on Pier J is dependent on the construction of the electrical substation, near berth J 260, to be on schedule. Delays are possible impacting construction schedule and extended in-house labor costs.	Marginal	Possible	1
CE-6	Main Channel Widening Dredging (Clam)	Inefficient Contractor, Traffic concerns	It is unlikely a new dredging contractor obtains the contract and is unable to perform the work. The nature of this type of work makes the ocurrence of this risk unlikely. Capable remaining dredging contractors in the area are experienced and the work is not complex. However, there are traffic concerns in the area, concern carries a low impact since vessels will be able to sail around excavation site.	Marginal	Unlikely	0
CE-7	Pier J Breakwater Stabilization	Contractor's ability to install	Work consists on building a Pier J Breakwater Bulkhead Wall. Carrying out the work posses possible risks due to the nature of the work.	Marginal	Possible	1

CE-8	Electric Substation Near Berth J 260	Accelerated schedule. Site is confined	Accelerated schedule is possible. Pier J dredging work is dependent on the construction completion of the Electric Substation near Berth 260. Work will take place in a confined area, likley impacting construction.	Moderate	Likely	3
CE-13	Planning, Engineering, & Design	Contract modifications	Additional design effort during the construction period in the form of RFIs and modifications are possible, but cost and schedule impacts should be negligible	Marginal	Possible	1
CE-14	Construction Management	Contract modifications; Construction schedule extension	Construction schedule slips will impact construction management. Additional construction management effort during the construction period in the form of RFIs, modifications and claims are possible, but cost and schedule impacts should be negligible	Marginal	Likely	2
Specialty Construction or Fabrication					**Maximum Project Growth**	**65%**
SC-2	Clamshell Mob/Demob	Electric dredges are required inside the POLB	Conversion of diesel driven clamshell dredge to electric driven. Availability of electric driven dredges anticipated. Impact is low.	Negligible	Unlikely	0
SC-3	Approach Channel Dredging (Hopper)	Dredging Equipment choice	The hopper dredge is the best equipment choice outside the breakwater (Queen's Gate). As a specialty equipment, the hopper dredge is the best choice for the Approach Channel dredging because the excavation layer is thin and work is outside the breakwater. However, the contract will not specify which equipment the contractor must use, and it is unlikely a clamshell barge meeting ABS-class ocean work dredges outside the line of demarcation (outside the breakwater). Use of another dredge will significantly impact cost. Also, the baseline estimate considered a large size hopper, however, there is the possibility of a medium hopper dredge bidding the job. The use of a large size hopper results in a lower dredging unit cost. The use of a medium size hopper is possible and it will result in a higher dredging unit cost with moderate cost impacts. Dredging equipment selection impactssignificantly impacts cost and schedule	Significant	Unlikely	2
SC-4	West Basin Dredging (Clam)	Electric dredges are required inside the POLB and may be required for mitigation of air quality impacts	Conversion of diesel driven clamshell dredge to electric driven. Availability of electric driven dredges anticipated. Impact is low.	Negligible	Unlikely	0
SC-5	Pier J Dredging (Clam)	Electric dredges are required inside the POLB and may be required for mitigation of air quality impacts	Conversion of diesel driven clamshell dredge to electric driven. Availability of electric driven dredges anticipated. Impact is low.	Negligible	Unlikely	0
SC-6	Main Channel Widening Dredging (Clam)	Electric dredges are required inside the POLB and may be required for mitigation of air quality impacts	Conversion of diesel driven clamshell dredge to electric driven. Availability of electric driven dredges anticipated. Impact is low.	Negligible	Unlikely	0
SC-8	Electric Substation Near Berth J 260	Any specialized fabrication of electric components could impact cost due to change of material costs, design complexity, long lead fabrication	Material costs vary with market. Electric Sub-station fabrication takes skilled trades and carries a long lead time. It is possible fabrication and installation of the electric substation have a moderate impact on its cost.	Moderate	Likely	3
SC-13	Planning, Engineering, & Design	Specialty construction and material fabrication	Specialty construction and material fabrication do not apply to these cost items.	Negligible	Unlikely	0
Technical Design & Quantities					**Maximum Project Growth**	**30%**

T-3	Approach Channel Dredging (Hopper)	Potential sea level changes resulting in a reduction of base quantities in the cost estimate. Geotechnical investigations remain.	The Approach Channel is situated outside the breakwater and therefore more subseptible to quantity variations associated with sea level change. Sea level change has a certain probability within itself. Risk is limited in the near term, but it increases substantially in the out years. Likelihood is certain, but impact is marginal because work will take place in the near term, unlikely multi-year maintenance dredging projects. Geotech investigations has not been done to 80' leading to possible scope change. Channel width thorugh Queen's Gate may change slightly, material classifications not determined. Associated cost risks are marginal.	Marginal	Possible	1
T-4	West Basin Dredging (Clam)	Quantities are based on outdated surveys. Disposal sites (LA2 and LA3) capacities limitations. Design assumption of 0.9 MCY/disposal site may not be accurate.	Dredging area is located inside the breakwater so volume variations should not be high, however current calculated dredging volumes are based on outdated surveys. Project may face competition from other projects on Disposal sites. LA2 and LA3 Disposal sites may reach yearly capacity from other Non-COE projects impacting the project schedule. If calculated disposal sites capacities change, impact on cost and schedule will be critical in nature.	Critical	Likely	5
T-5	Pier J Dredging (Clam)	Quantities are based on outdated surveys. Disposal sites (LA2 and LA3) capacities limitations. Design assumption of 0.9 MCY/disposal site may not be accurate.	Dredging area is located inside the breakwater so volume variations should not be high, however current calculated dredging volumes are based on outdated surveys. Project may face competition from other projects on Disposal sites. LA2 and LA3 Disposal sites may reach yearly capacity from other Non-COE projects impacting the project schedule. If calculated disposal sites capacities change, impact on cost and schedule will be critical in nature. Another key design risk is associated with the Pier J breakwater slope stability. Slope excavation may go underneath the rock structure and undermine it.	Critical	Likely	5
T-6	Main Channel Widening Dredging (Clam)	Quantities are based on outdated surveys. Disposal sites (LA2 and LA3) capacities limitations. Design assumption of 0.9 MCY/disposal site may not be accurate.	Dredging area is located inside the breakwater so volume variations should not be high, however current calculated dredging volumes are based on outdated surveys. Project may face competition from other projects on Disposal sites. LA2 and LA3 Disposal sites may reach yearly capacity from other Non-COE projects impacting the project schedule. If calculated disposal sites capacities change, impact on cost and schedule will be critical in nature.	Critical	Likely	5
T-7	Pier J Breakwater Stabilization	Design is in the early phases	Project has not been designed and it is subject to likely affect the cost. Risk of design and construction complications at Pier J modifications. Project involves installing sheet pile or similar stabilizing measures around Pier J to allow deepening of channel adjacent to Pier J and jetties.	Moderate	Very LIKELY	4
T-8	Electric Substation Near Berth J 260	Design is in the early phases	Project has not been designed and it is subject to likely affect the cost	Moderate	Very LIKELY	4
T-13	Planning, Engineering, & Design	Design confidence	Additional / more accurate quantities will need to be calculated. No major impact to PED. Cost and schedule impacts are assumed to be negligible.	Negligible	Unlikely	0
T-14	Construction Management	Design confidence	I additional quantities are calculated the project schedule will grow resulting in additional S&A. Cost and Schedule impacts are assumed to be marginal	Marginal	Unlikely	0
Cost Estimate Assumptions					**Maximum Project Growth**	**35%**

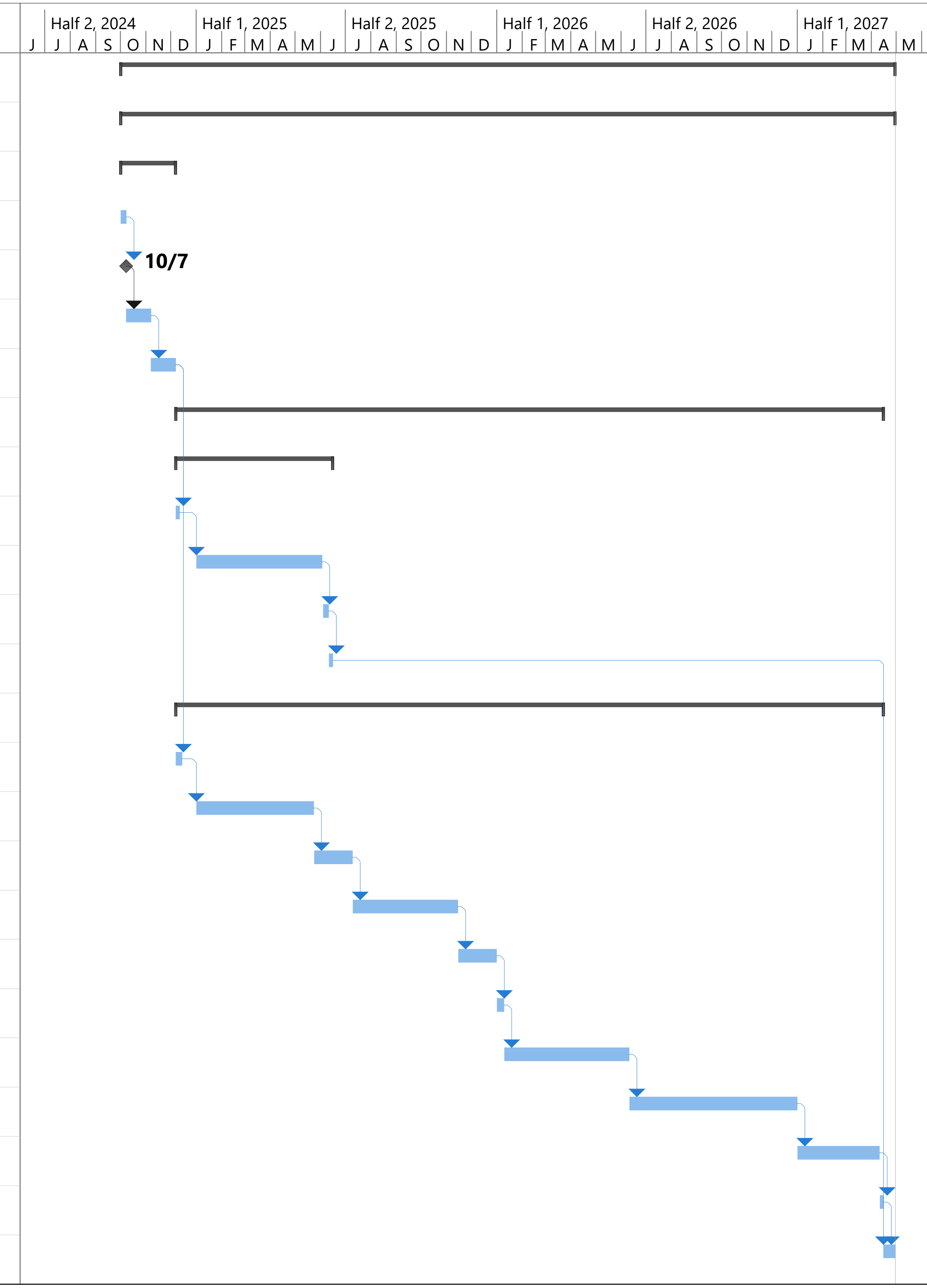
EST-1	Hopper Mob/Demob	Estimate assumption on the number of mobs and demobs	Estimate assumption of one single large generic hopper dredge. The estimate assumes a single mob/demob event. It is unlikely that the hopper dredge mob/demobs more than one occasion. Cost and schedule impacts would be signficant if more than one mob/demob is required.	Significant	Unlikely	2
EST-2	Clamshell Mob/Demob	Estimate assumption on the number of mobs and demobs	Estimate assumes yearly mobs and demobs of the clamshell dredge. It is possible to have multiple mob/demobs in a single year depending on how the contract is broken out.	Marginal	Possible	1
EST-3	Approach Channel Dredging (Hopper)	Quantities variations	Since the design is at the feasibility stage, quantities variations are possible having a marginal impact on the cost and schedule.	Marginal	Possible	1
EST-4	West Basin Dredging (Clam)	Possibility of a different type of dredge bidding the job	Estimate assumes one clamshell bucket dredge, but equipment is not restrictive within the contract. Selected clamshell size and number can affect estimated cost and productivity. The potential that a pipeline dredge is used in lieu of the clamshell dredge is unlikely since scows would be required due to the long hauling distance (LA2 or LA3). Overflow is not allowed due to environmental limitations.	Marginal	Unlikely	0
EST-5	Pier J Dredging (Clam)	Possibility of a different type of dredge bidding the job	Estimate assumes one clamshell bucket dredge, but equipment is not restrictive within the contract. Selected clamshell size and number can affect the cost and productivity. The potential that a pipeline dredge is used in lieu of the estimated clamshell is highly unlikely due to the disposal site distance.	Marginal	Unlikely	0
EST-6	Main Channel Widening Dredging (Clam)	Possibility of a different type of dredge bidding the job Possible harder than expected dredging	Estimate assumes one clamshell bucket dredge, but equipment is not restrictive within the contract. Selected clamshell size and number can affect estimated cost and productivity. The potential that a pipeline dredge is used in lieu of the clamshell dredge is unlikely since scows would be required due to the long hauling distance (LA2 or LA3). Overflow is not allowed due to environmental limitations. Possible harder than expected dredging especially at main channel, where there is not yet any geotech investigation and we are going to depths not done before at PoLB. Seems like this is at least a marginal risk considering the last time we dredged the main channel there was a claim for hard material.	Marginal	Possible	1
EST-7	Pier J Breakwater Stabilization	Pier J Breakwater Bulkhead Wall design is at the feasibility stage.	Uncertainty on the level of cost confidence based on the current design stage may impact the Pier J Breakwater Bulkhead Wall cost item.	Moderate	Very LIKELY	4
EST-8	Electric Substation Near Berth J 260	Electric Substation estimate is at the early stage	Uncetainty on the level of cost confidence based on the current design stage may impact the Electric Substation cost item.	Moderate	Very LIKELY	4
EST-13	Planning, Engineering, & Design	Calculated as percentage of construction cost	Common percentages used for type of work, but subject to change. 30 account costs can vary greatly.	Moderate	Likely	3

EST-14	Construction Management	Calculated as percentage of construction cost	Common percentages used for type of work, but subject to change. 31 account costs typically close to estimated percentage, but mary vary more for larger project.	Marginal	Possible	1
External Project Risks					**Maximum Project Growth**	**40%**
EX-1	Hopper Mob/Demob	Market Conditions	Large dredging projects requiring hopper dredges have always being handled by a limited pool of contractors. For open ocean dredge projects, bidding climate has historically been limited to a small circle of contractors and it is not expected to change. Lack of competition may have a moderate impact on the construction cost.	Moderate	Likely	3
EX-2	Clamshell Mob/Demob	Market Conditions	Lack of competition may have an impact on costs.	Marginal	Likely	2
EX-3	Approach Channel Dredging (Hopper)	Unanticipated fuel inflation, Encountering Green Sea Turtles and marine mammals	Hopper dredges are sensitive to fuel price fluctuations. Fluctuations in fuel prices will affect dredging unit cost. Our current position is that green sea turtles are not present in San Pedro Bay. Green sea turtles are an endangered species under the federal Endangered Species Act (ESA). Absence from the study area would result in a no effect determination made by the Corps that does not require consultation with the National Marine Fisheries Service (NMFS). The risk involves encountering green sea turtles in San Pedro Bay project area. Presence of green sea turtles would trigger consultation with the NMFS under the ESA. This could add delays to complete the study as well as possible monitoring and protective measures for dredging and placement activities that would add costs and schedule delays during construction. This risk would carry a marginal cost and schedule impact with low possibility of occurrence. NMFS is requiring the Port to perform approximately two years of sea turtle monitoring. This study will determine green sea turtles actually occur within the Harbor District. Currently, they are known to occur in nearby rivers, but not within the Port Complex itself. With that said, we do not believe this will be an issue for the project. Marine mammals may impact the work. Work may need to stop intermittently	Marginal	Possible	1
EX-4	West Basin Dredging (Clam)	Bidding environment, Weather, Encountering Green Sea Turtles and Marine Mammals	Amount of bidders in a competitively bid contract will affect price. Weather will affect construction schedule. Assume these risks are possible and have a marginal effect on cost. Our current position is that green sea turtles are not present in San Pedro Bay. Green sea turtles are an endangered species under the federal Endangered Species Act (ESA). Absence from the study area would result in a no effect determination made by the Corps that does not require consultation with the National Marine Fisheries Service (NMFS). The risk involves encountering green sea turtles in San Pedro Bay project area. Presence of green sea turtles would trigger consultation with the NMFS under the ESA. This could add delays to complete the study as well as possible monitoring and protective measures for dredging and placement activities that would add costs and schedule delays during construction. This risk would carry a marginal cost and schedule impact with low possibility of occurrence. NMFS is requiring the Port to perform approximately two years of sea turtle monitoring. This study will determine green sea turtles actually occur within the Harbor District. Currently, they are known to occur in nearby rivers, but not within the Port Complex itself. With that said, we do not believe this will be an issue for the project. Marine mammals may impact the work. Work may need to stop intermittently	Marginal	Possible	1

EX-5	Pier J Dredging (Clam)	Bidding environment, Weather, Encountering Green Sea Turtles and Marine Mammals	Amount of bidders in a competitively bid contract will affect price. Weather will affect construction schedule. Assume these risks are possible and have a marginal effect on cost. Our current position is that green sea turtles are not present in San Pedro Bay. Green sea turtles are an endangered species under the federal Endangered Species Act (ESA). Absence from the study area would result in a no effect determination made by the Corps that does not require consultation with the National Marine Fisheries Service (NMFS). The risk involves encountering green sea turtles in San Pedro Bay project area. Presence of green sea turtles would trigger consultation with the NMFS under the ESA. This could add delays to complete the study as well as possible monitoring and protective measures for dredging and placement activities that would add costs and schedule delays during construction. This risk would carry a marginal cost and schedule impact with low possibility of occurrence. NMFS is requiring the Port to perform approximately two years of sea turtle monitoring. This study will determine green sea turtles actually occur within the Harbor District. Currently, they are known to occur in nearby rivers, but not within the Port Complex itself. With that said, we do not believe this will be an issue for the project. Marine mammals may impact the work. Work may need to stop intermittently	Marginal	Possible	1
EX-6	Main Channel Widening Dredging (Clam)	Bidding environment, Weather, Encountering Green Sea Turtles and Marine Mammals	Amount of bidders in a competitively bid contract will affect price. Weather will affect construction schedule. Assume these risks are possible and have a marginal effect on cost. Our current position is that green sea turtles are not present in San Pedro Bay. Green sea turtles are an endangered species under the federal Endangered Species Act (ESA). Absence from the study area would result in a no effect determination made by the Corps that does not require consultation with the National Marine Fisheries Service (NMFS). The risk involves encountering green sea turtles in San Pedro Bay project area. Presence of green sea turtles would trigger consultation with the NMFS under the ESA. This could add delays to complete the study as well as possible monitoring and protective measures for dredging and placement activities that would add costs and schedule delays during construction. This risk would carry a marginal cost and schedule impact with low possibility of occurrence. NMFS is requiring the Port to perform approximately two years of sea turtle monitoring. This study will determine green sea turtles actually occur within the Harbor District. Currently, they are known to occur in nearby rivers, but not within the Port Complex itself. With that said, we do not believe this will be an issue for the project. Marine mammals may impact the work. Work may need to stop intermittently	Marginal	Possible	1
EX-7	Pier J Breakwater Stabilization	Bidding environment, weather, Encountering White Abalone, Encountering Marine Mammals	Amount of bidders in a competitively bid contract will affect price. Weather will affect construction schedule. Assume these risks are likely and have a marginal effect on cost. NMFS is requiring the Port to perform approximately two years of sea turtle monitoring. This study will determine green sea turtles actually occur within the Harbor District. Currently, they are known to occur in nearby rivers, but not within the Port Complex itself. With that said, we do not believe this will be an issue for the project. Marine mammals may impact the work. Work may need to stop intermittently	Marginal	Possible	1
EX-8	Electric Substation Near Berth J 260	Bidding environment, weather	Amount of bidders in a competitively bid contract will affect price. Weather will affect construction schedule. Assume these risks are likely and have a negligible effect on cost.	Negligible	Likely	1
EX-13	Planning, Engineering, & Design	Political factors. Funding availability	The longer it takes to get to construction, the more it will cost to prepare economic updates. Environmental documents may need to updated.	Negligible	Possible	0
EX-14	Construction Management	Lack of personnel	Lack of personnel will have a moderate impact on the project.	Moderate	Likely	3

6.2.3 Construction Schedule

ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors
1		**Construction Schedule**	**941 days**	**Tue 10/1/24**	**Thu 4/29/27**	
2		Alternative 3	941 days	Tue 10/1/24	Thu 4/29/27	
3		**Preconstruction Phase**	**67 days**	**Tue 10/1/24**	**Fri 12/6/24**	
4		Construction Contract Award	5 days	Tue 10/1/24	Mon 10/7/24	
5		Notice to Proceed	0 days	Mon 10/7/24	Mon 10/7/24	4
6		Generate Contractor Submittals	30 edays	Mon 10/7/24	Wed 11/6/24	5
7		Review/Approve Submittals	30 edays	Wed 11/6/24	Fri 12/6/24	6
8		**Construction Phase**	**860 days**	**Sat 12/7/24**	**Thu 4/15/27**	
9		**Hopper Dredging**	**191 days**	**Sat 12/7/24**	**Sun 6/15/25**	
10		Mobilization	5 days	Sat 12/7/24	Wed 12/11/24	7
11		Approach Channel Dredging - Nearshore Disposal	143 days	Wed 1/1/25	Mon 6/2/25	10
12		Approach Channel Dredging - LA2 Disposal	7 days	Wed 6/4/25	Tue 6/10/25	11
13		Demobilization	5 days	Wed 6/11/25	Sun 6/15/25	12
14		**Clamshell Dredging**	**860 days**	**Sat 12/7/24**	**Thu 4/15/27**	
15		Mobilization	8 days	Sat 12/7/24	Sat 12/14/24	7
16		Main Channel Widening - LA2 Disposal	133 days	Wed 1/1/25	Fri 5/23/25	15
17		Main Channel Widening - LA3 Disposal	44 days	Sat 5/24/25	Wed 7/9/25	16
18		West Basin - LA3 Disposal	120 days	Thu 7/10/25	Fri 11/14/25	17
19		Pier J Basin - LA3 Disposal	43 days	Sat 11/15/25	Wed 12/31/25	18
20		Pier J Basin 2nd Year - LA2 Disposal	8 days	Thu 1/1/26	Fri 1/9/26	19
21		Pier J Approach 2nd Year - LA2 Disposal	142 days	Sat 1/10/26	Wed 6/10/26	20
22		Pier J Approach 2nd Year - LA3 Disposal	190 days	Thu 6/11/26	Thu 12/31/26	21
23		Pier J Approach 3rd Year - LA2 Disposal	93 days	Fri 1/1/27	Sat 4/10/27	22
24		Demobilization	5 days	Sun 4/11/27	Thu 4/15/27	23
25		Contract Closeout	14 edays	Thu 4/15/27	Thu 4/29/27	13,24



Project: POLB Deepening_Alt 3-
Date: Thu 7/18/19

Task		Project Summary		Manual Task		Start-only		Deadline	
Split		Inactive Task		Duration-only		Finish-only		Progress	
Milestone		Inactive Milestone		Manual Summary Rollup		External Tasks		Manual Progress	
Summary		Inactive Summary		Manual Summary		External Milestone			

6.3 Alternative 4

6.3.1 Total Project Cost Summary (TPCS)

**** TOTAL PROJECT COST SUMMARY ****

PROJECT: **Port of Long Beach**
PROJECT NO: **xxxxxx**
LOCATION: **Long Beach, CA**

DISTRICT: **Los Angeles District** PREPARED: **7/18/2019**
POC: **CHIEF, COST ENGINEERING, XXX**

This Estimate reflects the scope and schedule in report; Engineering alternatives

Civil Works Work Breakdown Structure		**ESTIMATED COST**				**PROJECT FIRST COST (Constant Dollar Basis)**						**TOTAL PROJECT COST (FULLY FUNDED)**			
						Program Year (Budget EC):				2025					
						Effective Price Level Date:				1-Oct- 24					
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	REMAINING COST ($K)	Spent Thru: 1-Oct-18 ($K)	**TOTAL FIRST COST** ($K)	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
12	NAVIGATION PORTS & HARBORS	$130,972	$58,937	45%	$189,909		$130,972	$58,937	$189,909		$189,909	16.4%	$152,446	$68,601	$221,047
12	NAVIGATION PORTS & HARBORS - Non-Fed	$52,487	$23,619	45%	$76,106		$52,487	$23,619	$76,106		$76,106	13.8%	$59,705	$26,867	$86,572
	CONSTRUCTION ESTIMATE TOTALS:	$183,459	$82,556		$266,015		$183,459	$82,556	$266,015		$266,015	15.6%	$212,151	$95,468	$307,618
01	LANDS AND DAMAGES			-		-						-			
30	PLANNING, ENGINEERING & DESIGN	$27,638	$12,437	45%	$40,075		$27,638	$12,437	$40,075		$40,075	15.6%	$31,948	$14,376	$46,324
31	CONSTRUCTION MANAGEMENT	$16,265	$7,319	45%	$23,585		$16,265	$7,319	$23,585		$23,585	30.4%	$21,212	$9,545	$30,757
	PROJECT COST TOTALS:	$227,362	$102,313	45%	$329,675		$227,362	$102,313	$329,675		**$329,675**	16.7%	$265,310	$119,390	$384,700

ESTIMATED TOTAL PROJECT COST: $384,700

________________ CHIEF, COST ENGINEERING, XXX

________________ PROJECT MANAGER, XXX

________________ CHIEF, REAL ESTATE, XXX

________________ CHIEF, PLANNING, XXX

________________ CHIEF, ENGINEERING, XXX

________________ CHIEF, OPERATIONS, XXX

________________ CHIEF, CONSTRUCTION, XXX

________________ CHIEF, CONTRACTING, XXX

________________ CHIEF, PM-PB, xxxx

________________ CHIEF, DPM, XXX

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: Port of Long Beach
LOCATION: Long Beach, CA
This Estimate reflects the scope and schedule in report; Engineering alternatives

DISTRICT: Los Angeles District
POC: CHIEF, COST ENGINEERING, XXX
PREPARED: 7/18/2019

WBS Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 16-Jul-19 Estimate Price Level: 1-Oct-18				Program Year (Budget EC): 2025 Effective Price Level Date: 1 -Oct-24								
				RISK BASED										
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	***B***	***C***	***D***	***E***	***F***	***G***	***H***	***I***	***J***	***P***	***L***	***M***	***N***	***O***
	PHASE 1 or CONTRACT 1													
12	NAVIGATION PORTS & HARBORS - Year 1	$57,710	$25,969	45.0%	$83,679		$57,710	$25,969	$83,679	2025Q3	13.8%	$65,645	$29,540	$95,186
12	NAVIGATION PORTS & HARBORS - Year 2	$27,990	$12,596	45.0%	$40,586		$27,990	$12,596	$40,586	2026Q3	16.0%	$32,476	$14,614	$47,090
12	NAVIGATION PORTS & HARBORS - Year 3	$18,255	$8,215	45.0%	$26,470		$18,255	$8,215	$26,470	2027Q3	18.3%	$21,604	$9,722	$31,326
12	NAVIGATION PORTS & HARBORS - Year 4	$22,557	$10,151	45.0%	$32,708		$22,557	$10,151	$32,708	2028Q3	20.7%	$27,230	$12,253	$39,483
12	NAVIGATION PORTS & HARBORS - Year 5	$4,460	$2,007	45.0%	$6,466		$4,460	$2,007	$6,466	2029Q3	23.1%	$5,491	$2,471	$7,962
	CONSTRUCTION ESTIMATE TOTALS:	$130,972	$58,937	45.0%	$189,909		$130,972	$58,937	$189,909			$152,446	$68,601	$221,047
01	LANDS AND DAMAGES			25.0%										
30	PLANNING, ENGINEERING & DESIGN													
1.5%	Project Management	$1,965	$884	45.0%	$2,849		$1,965	$884	$2,849	2022Q2	14.0%	$2,241	$1,008	$3,249
0.5%	Planning & Environmental Compliance	$655	$295	45.0%	$950		$655	$295	$950	2022Q2	14.0%	$747	$336	$1,083
8.0%	Engineering & Design	$10,478	$4,715	45.0%	$15,193		$10,478	$4,715	$15,193	2022Q2	14.0%	$11,949	$5,377	$17,327
0.5%	Reviews, ATRs, IEPRs, VE	$655	$295	45.0%	$950		$655	$295	$950	2022Q2	14.0%	$747	$336	$1,083
1.0%	Life Cycle Updates (cost, schedule, risks)	$1,310	$590	45.0%	$1,900		$1,310	$590	$1,900	2022Q2	14.0%	$1,494	$672	$2,166
0.5%	Contracting & Reprographics	$655	$295	45.0%	$950		$655	$295	$950	2025Q3	30.4%	$854	$384	$1,239
1.5%	Engineering During Construction	$1,965	$884	45.0%	$2,849		$1,965	$884	$2,849	2025Q3	30.4%	$2,563	$1,153	$3,716
1.0%	Planning During Construction	$1,310	$590	45.0%	$1,900		$1,310	$590	$1,900	2022Q2	14.0%	$1,494	$672	$2,166
0.5%	Adaptive Management & Monitoring	$655	$295	45.0%	$950		$655	$295	$950	2022Q2	14.0%	$747	$336	$1,083
	NON-FED Portion of PED	$7,990	$3,595	45.0%	$11,585		$7,990	$3,595	$11,585	2022Q2	14.0%	$9,112	$4,100	$13,212
31	CONSTRUCTION MANAGEMENT													
6.7%	Construction Management	$8,775	$3,949	45.0%	$12,724		$8,775	$3,949	$12,724	2025Q3	30.4%	$11,444	$5,150	$16,593
	NON-FED Portion of S&A	$7,490	$3,371	45.0%	$10,861		$7,490	$3,371	$10,861	2025Q3	30.4%	$9,768	$4,396	$14,164
	Project Management			45.0%										
	CONTRACT COST TOTALS:	$174,875	$78,694		$253,569		$174,875	$78,694	**$253,569**			$205,606	$92,523	**$298,128**

6.3.2 Abbreviated Cost and Schedule Risk Analysis

Abbreviated Risk Analysis

Alternative: **Alt 4**
West Basin, Pier J, Main Channel Widening Depth: -57'
Approach Channel Depth: -83'
EXCLUDING STAND-BY AREA

Project (less than $40M): **POLB Deepening**
Project Development Stage/Alternative: **Feasibility (Alternatives)**
Risk Category: **Moderate Risk: Typical Project Construction Type**
Meeting Date: **4/10/2019**

Total Estimated Construction Contract Cost = $ 175,162,345

	CWWBS	Feature of Work	Contract Cost		% Contingency	$ Contingency	Total
	01 LANDS AND DAMAGES	Real Estate	$ -		0.00%	$ -	$ -
1	12 NAVIGATION, PORTS AND HARBORS	Hopper Mob/Demob	$ 6,579,456		23.92%	$ 1,573,541	$ 8,152,997
2	12 NAVIGATION, PORTS AND HARBORS	Clamshell Mob/Demob	$ 10,808,346		17.31%	$ 1,870,674	$ 12,679,020
3	12 NAVIGATION, PORTS AND HARBORS	Approach Channel Dredging (Hopper)	$ 43,194,270		24.41%	$ 10,542,859	$ 53,737,129
4	12 NAVIGATION, PORTS AND HARBORS	West Basin Dredging (Clam)	$ 14,700,620		60.12%	$ 8,838,565	$ 23,539,185
5	12 NAVIGATION, PORTS AND HARBORS	Pier J Dredging (Clam)	$ 38,628,950		56.31%	$ 21,750,272	$ 60,379,222
6	12 NAVIGATION, PORTS AND HARBORS	Main Channel Widening Dredging (Clam)	$ 11,314,100		62.16%	$ 7,032,836	$ 18,346,936
7	12 NAVIGATION, PORTS AND HARBORS	Pier J Wharf Improvements/Stabilization	$ 11,803,521		76.13%	$ 8,985,583	$ 20,789,104
8	12 NAVIGATION, PORTS AND HARBORS	Pier J Breakwater Stabilization	$ 5,966,467		58.69%	$ 3,501,699	$ 9,468,166
9	12 NAVIGATION, PORTS AND HARBORS	Electric Substation Near Berth J 260	$ 4,366,615		137.59%	$ 6,007,910	$ 10,374,525
10	12 NAVIGATION, PORTS AND HARBORS	Pier T Wharf Improvements/Stabilization	$ 27,800,000		63.28%	$ 17,590,825	$ 45,390,825
11			$ -		0.00%	$ -	$ -
12			$ -		0.00%	$ -	$ -
13	All Other	Remaining Construction Items	$ -	0.0%	0.00%	$ -	$ -
14	30 PLANNING, ENGINEERING, AND DESIGN	Planning, Engineering, & Design	$ 26,773,717		22.97%	$ 6,149,734	$ 32,923,451
15	31 CONSTRUCTION MANAGEMENT	Construction Management	$ 15,880,615		21.81%	$ 3,462,953	$ 19,343,568
XX	FIXED DOLLAR RISK ADD (EQUALLY DISPERSED TO ALL, MUST INCLUDE JUSTIFICATION SEE BELOW)					$ -	

Totals	Contract Cost	% Contingency	$ Contingency	Total
Real Estate	$ -	0.00%	$ -	$ -
Total Construction Estimate	$ 175,162,345	50.06%	$ 87,694,765	$ 262,857,110
Total Planning, Engineering & Design	$ 26,773,717	22.97%	$ 6,149,734	$ 32,923,451
Total Construction Management	$ 15,880,615	21.81%	$ 3,462,953	$ 19,343,568
Total Excluding Real Estate	**$ 217,816,677**	**45%**	**$ 97,307,452**	**$ 315,124,129**

	Base	50%	80%
Confidence Level Range Estimate ($000's)	$217,817k	$276,201k	$315,124k

* 50% based on base is at 5% CL.

Fixed Dollar Risk Add: (Allows for additional risk to be added to the risk analsyis. Must include justification. Does not allocate to Real Estate.	

POLB Deepening Alt 4 West Basin, Pier J, Main Channel Widening Depth: -57' Approach Channel Depth: -83' EXCLUDING STAND-BY AREA

Feasibility (Alternatives)
Abbreviated Risk Analysis

Meeting Date: 10-Apr-19

Risk Register

Risk Level

	Negligible	Marginal	Moderate	Significant	Critical
Very Likely	2	3	4	5	5
Likely	1	2	3	4	5
Possible	0	1	2	3	4
Unlikely	0	0	1	2	3

Risk Element	Feature of Work	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Impact	Likelihood	Risk Level
Project Management & Scope Growth				**Maximum Project Growth**		**75%**
PS-1	Hopper Mob/Demob	Scope at Alternative Formulation Stage	Scope definition changes may alter dredging equipment selection and affect mobilization/demobilization. Hopper dredges may not be available delaying the project by a year (schedule impacts only)	Marginal	Unlikely	0
PS-2	Clamshell Mob/Demob	Scope at Alternative Formulation Stage	Scope definition changes due to possible environmental restrictions may alter dredging equipment selection and affect mobilization/demobilization	Marginal	Unlikely	0
PS-3	Approach Channel Dredging (Hopper)	Lacking complete design.	General scope dredging volumes and distances changes may affect the cost and schedule. However, scope of work associated with the Approach Channel is well defined and unlikely to increase. Possible munitions findings likelihood is negligible. Length, width and depth of cut is defined. Scope changes are negligible along the Approach Channel. Maintenance dredging accounts for depth from 78' to 80'. Therefore, assume marginal additional sediment	Marginal	Possible	1
PS-4	West Basin Dredging (Clam)	Lacking complete design, potential exists for encountering contaminated material	Contaminated material may be found. Material will need to be handled differently. Risk is very likely. Sponsor may already have an identified location nearby for contaminated material placement. Capping may be involved. Design evolution will very likely result in revisions to dredging volumes, but impact is marginal since the site layout is well established.	Marginal	Very LIKELY	3
PS-5	Pier J Dredging (Clam)	Design evolution	Design evolution will very likely result in revisions to dredging volumes, but impact is marginal since the site layout is well established. An 18,000 Twenty-feet Equivalent Units (TEU) ship simulation was done to define the site layout. The project scope is based on the 18,000 TEU design vessel, but the world is building 21,000 TEU ships leading to a scope change. A new re-authorization would be required if we need to change the layout. This is outside the project scope and not included in the risk analysis.	Marginal	Very LIKELY	3
PS-6	Main Channel Widening Dredging (Clam)	Lacking complete design, potential exists for encountering contaminated material	Contaminated material may be found. Material will need to be handled differently. Risk is very likely. Sponsor may already have an identified location nearby for contaminated material placement. Capping may be involved. Design evolution will very likely result in revisions to dredging volumes, but impact is marginal since the site layout is well established.	Marginal	Very LIKELY	3
PS-7	Pier J Wharf Improvements/Stabilization	Limited design of the underwater bulkhead to accommodate deepening.	Design evolution will likely result in revisions to the underwater bulkhead design structure. Design criteria may have a moderate impact on cost.	Moderate	Likely	3

PS-8	Pier J Breakwater Stabilization	Design evolution of the Pier J Breakwater Bulkhead Wall	Design evolution will likely result in revisions to the Pier J Breakwater Bulkhead Wall design structure. Design criteria may have a moderate impact on cost.	Moderate	Likely	3
PS-9	Electric Substation Near Berth J 260	Design evolution may impact this item	General design is in the beginning stages and subject to change. Electrical design is typically very limited in this stage of project development. There is every likelyhood of design evolution and cost impacts.	Significant	Very LIKELY	5
PS-10	Pier T Wharf Improvements/Stabilization	Design evolution may impact this item	Design evolution will likely result in revisions to the current design structure. Design criteria may have a moderate impact on cost.	Moderate	Likely	3
PS-11	Pier T Wharf Improvements/Stabilization			Negligible	Unlikely	0
PS-14	Planning, Engineering, & Design	Scope evolution could impact design costs. Also, as the project is delayed, new issues may come to light. As delays occur, designers change, retire, etc, resulting in lost knowledge and rework.	Any delays or further scope identification can impact costs.	Moderate	Possible	2
PS-15	Construction Management	Scope evolution could cause an impact to the construction management of the project.	Project is located at one site. Further management costs due to scope changes are unlikely to impact the construction management costs.	Marginal	Unlikely	0
Acquisition Strategy				**Maximum Project Growth**		**30%**
AS-1	Hopper Mob/Demob	Acquisition Plan not yet determined	The hopper dredge is the most adequate choice for open ocean dredging (i.e. outside Queen's gate) considering the Approach Channel sediment deposition and sailing distance. Large marine contractors own hoppers. The reasonable assumption is that the project will be advertised as an unrestricted open-bid contract, instead of a small business, MATOC or negotiated procurement.	Marginal	Unlikely	0
AS-2	Clamshell Mob/Demob	Contract acquisition may result in some small business contracts	The PDT feels the project will pursue one contract; maybe a joint venture for such a large project; maybe a hopper dredge contractor and a clamshell dredge contractor. Dredging areas inbound by the breakwater (i.e. inside Queen's Gate) where the electric clamshell may be implemented could be candidates for small business contracts. Small business with extensive subcontracting; 8a prime contractor markups and poor bid competition are not factored into the estimate.	Moderate	Possible	2
AS-3	Approach Channel Dredging (Hopper)	Acquisition Plan not yet determined	Small Business contract is unlikely since the work is outside outside the breakwater (Queen's Gate). In open ocean, the hopper dredge is the most likely dredging equipment choice. Hopper dredges accommodate poor weather better than pipeline dredges; and clamshells are unstable. Historically, only large marine contractors owns hopper dredges.	Negligible	Unlikely	0
AS-4	West Basin Dredging (Clam)	Acquisition Plan not yet determined	Estimate is based on an unrestricted fixed-firm price contract. Since it is a huge investment (large impact) to convert a clamshell dredge into an electrical clamshell dredge, it is a very unlikely the project will pursue a small business contract.	Critical	Unlikely	3
AS-5	Pier J Dredging (Clam)	Acquisition Plan not yet determined	Estimate is based on an unrestricted fixed-firm price contract. Due to the nature of the work, it is unlikely this area is advertised as a small business set-aside contract, impacts to the cost would be moderate.	Moderate	Unlikely	1
AS-6	Main Channel Widening Dredging (Clam)	Acquisition Plan not yet determined	Estimate is based on an unrestricted fixed-firm price contract. Since it is a huge investment (large impact) to convert a clamshell dredge into an electrical clamshell dredge, it is a very unlikely the project will pursue a small business contract.	Critical	Unlikely	3

AS-7	Pier J Wharf Improvements/Stabilization	Acquisition Plan not yet determined	Acquisition plan not yet determined. Small business unlikely. Accelerated schedule possible. Normal competition expected.	Marginal	Possible	1
AS-8	Pier J Breakwater Stabilization	Acquisition Plan not yet determined	Acquisition plan not yet determined. Small business unlikely. Accelerated schedule possible. Normal competition expected.	Marginal	Possible	1
AS-9	Electric Substation Near Berth J 260	Acquisition Plan not yet determined	Acquisition plan not yet determined. Small business may be likely. Accelerated schedule possible. Normal competition expected.	Negligible	Likely	1
AS-10	Pier T Wharf Improvements/Stabilization	Acquisition Plan not yet determined	Acquisition plan not yet determined. Small business may be likely. Accelerated schedule possible. Normal competition expected.	Negligible	Likely	1
AS-13	Planning, Engineering, & Design	Contract acquisition plan could change over time, impacting design and solicitations efforts of the PED.	The reasonable assumption is that the project will be advertised as an open bid, instead of small business, MATOC or negotiated procurement. Contract acquisition changes are possible and they may result in design variations impacting PED, but assume cost impacts are negligible.	Negligible	Possible	0
AS-14	Construction Management	Contract acquisition has a direct correlation to construction contract management.	The reasonable assumption is that the project will be advertised as an open bid, instead of small business, MATOC or negotiated procurement. Small business w/ extensive subcontracting; 8a prime contractor markups and poor bid competition are not factored into the estimate. Risk is unlikely. A less skilled contractor on marine construction can result in more construction management.	Negligible	Unlikely	0
Construction Elements					**Maximum Project Growth**	**25%**
CE-1	Hopper Mob/Demob	Availability of hopper dredges on West Coast is scarce	The baseline estimate assumes mob/demob from the Gulf Coast. The only hopper dredging work that occurs on the West coast is in the Porland District. Likelihood of a dredge mob/demob from the North East Coast is possible, but impact on cost would be moderate.	Moderate	Possible	2
CE-2	Clamshell Mob/Demob	Availability of electric clamshell dredges	Air quality regulations restrictions limit the type to dredging equipment within the port to the use of an electric driven dredge. The estimate accounts for electric drive upgrade to clamshell derricks. Maybe additional lead time during mob/demob is required for converting diesel driven clams to electric driven. Likelihood is possible but the cost/schedule impacts should be negligile.	Negligible	Possible	0
CE-3	Approach Channel Dredging (Hopper)	Disposal Sites availability	Currently, most of the sediment volume from the Approach Channel is hauled to the Nearshore disposal site which is the closest disposal site (~4 miles). If the Nearshore disposal site becomes unavailable dredge material needs to go to a farther disposal site: LA2 is situated at ~10 miles or LA3 is situated at ~20 miles.	Moderate	Possible	2
CE-4	West Basin Dredging (Clam)	Possibility of encountering old navy timber and concrete piles.	Dredging work is considered new dredging, production rates could vary specially if piles are encountered during dredging operations. Removal of piles is not included in the project or estimate. Risk is unlikely, but may have a marginal impact.	Marginal	Unlikely	0
CE-5	Pier J Dredging (Clam)	Electric Clamshell requirements	The required use of the electric clamshell on Pier J is dependent on the construction of the electrical substation, near berth J 260, to be on schedule. Delays are possible impacting construction schedule and extended in-house labor costs.	Marginal	Possible	1
CE-6	Main Channel Widening Dredging (Clam)	Inefficient Contractor, Traffic concerns	It is unlikely a new dredging contractor obtains the contract and is unable to perform the work. The nature of this type of work makes the ocurrence of this risk unlikely. Capable remaining dredging contractors in the area are experienced and the work is not complex. However, there are traffic concerns in the area, concern carries a low impact since vessels will be able to sail around excavation site.	Marginal	Unlikely	0
CE-7	Pier J Wharf Improvements/Stabilization	Underwater Bulkhead construction complexity	There is a possibility that a new contractor obtains the contract and is unable to perform the work. The nature of this type of work makes the ocurrence of this risk very unlikely. Capable remaining dredging contractors in the area are experienced.	Negligible	Unlikely	0

CE-8	Pier J Breakwater Stabilization	Contractor's ability to install	Work consists on building a Pier J Breakwater Bulkhead Wall. Carrying out the work posses possible risks due to the nature of the work.	Marginal	Possible	1
CE-9	Electric Substation Near Berth J 260	Accelerated schedule. Site is confined	Accelerated schedule is possible. Pier J dredging work is dependent on the construction completion of the Electric Substation near Berth 260. Work will take place in a confined area, likely impacting construction.	Moderate	Likely	3
CE-10	Pier T Wharf Improvements/Stabilization	Contractor's ability to install	Accelerated schedule is possible. South Basin dredging work is dependent on the construction completion of Pier T Wharf Improvements.	Marginal	Possible	1
CE-13	Planning, Engineering, & Design	Contract modifications	Additional design effort during the construction period in the form of RFIs and modifications are possible, but cost and schedule impacts should be negligible	Marginal	Possible	1
CE-14	Construction Management	Contract modifications; Construction schedule extension	Construction schedule slips will impact construction management. Additional construction management effort during the construction period in the form of RFIs, modifications and claims are possible, but cost and schedule impacts should be negligible	Marginal	Likely	2
Specialty Construction or Fabrication				**Maximum Project Growth**		**65%**
SC-2	Clamshell Mob/Demob	Electric dredges are required inside the POLB	Conversion of diesel driven clamshell dredge to electric driven. Availability of electric driven dredges anticipated. Impact is low.	Negligible	Unlikely	0
SC-3	Approach Channel Dredging (Hopper)	Dredging Equipment choice	The hopper dredge is the best equipment choice outside the breakwater (Queen's Gate). As a specialty equipment, the hopper dredge is the best choice for the Approach Channel dredging because the excavation layer is thin and work is outside the breakwater. However, the contract will not specify which equipment the contractor must use, and it is unlikely a clamshell barge meeting ABS-class ocean work dredges outside the line of demarcation (outside the breakwater). Use of another dredge will significantly impact cost.	Significant	Unlikely	2
SC-4	West Basin Dredging (Clam)	Electric dredges are required inside the POLB and may be required for mitigation of air quality impacts	Conversion of diesel driven clamshell dredge to electric driven. Availability of electric driven dredges anticipated. Impact is low.	Negligible	Unlikely	0
SC-5	Pier J Dredging (Clam)	Electric dredges are required inside the POLB and may be required for mitigation of air quality impacts	Conversion of diesel driven clamshell dredge to electric driven. Availability of electric driven dredges anticipated. Impact is low.	Negligible	Unlikely	0
SC-6	Main Channel Widening Dredging (Clam)	Electric dredges are required inside the POLB and may be required for mitigation of air quality impacts	Conversion of diesel driven clamshell dredge to electric driven. Availability of electric driven dredges anticipated. Impact is low.	Negligible	Unlikely	0
SC-7	Pier J Wharf Improvements/Stabilization	Contractor's ability to install (specialty construction)	Work consists on building an underwater bulkhead driving sheet piles from a barge. Carrying out the work posses high risks due to the nature of the work.	Marginal	Possible	1
SC-9	Electric Substation Near Berth J 260	Any specialized fabrication of electric components could impact cost due to change of material costs, design complexity, long lead fabrication	Material costs vary with market. Electric Sub-station fabrication takes skilled trades and carries a long lead time. It is possible fabrication and installation of the electric substation have a moderate impact on its cost.	Moderate	Likely	3
SC-10	Pier T Wharf Improvements/Stabilization	Contractor's ability to install (specialty construction)	Carrying out the work posses high risks due to the nature of the work.	Marginal	Possible	1
SC-13	Planning, Engineering, & Design	Specialty construction and material fabrication	Specialty construction and material fabrication do not apply to these cost items.	Negligible	Unlikely	0
Technical Design & Quantities				**Maximum Project Growth**		**30%**

T-3	Approach Channel Dredging (Hopper)	Potential sea level changes resulting in a reduction of base quantities in the cost estimate. Geotechnical investigations remain.	The Approach Channel is situated outside the breakwater and therefore more subseptible to quantity variations associated with sea level change. Sea level change has a certain probability within itself. Risk is limited in the near term, but it increases substantially in the out years. Likelihood is certain, but impact is marginal because work will take place in the near term, unlikely multi-year maintenance dredging projects. Geotech investigations has not been done to 80' leading to possible scope change. Channel width thorugh Queen's Gate may change slightly, material classifications not determined. Associated cost risks are marginal.	Marginal	Possible	1
T-4	West Basin Dredging (Clam)	Quantities are based on outdated surveys. Disposal sites (LA2 and LA3) capacities limitations. Design assumption of 0.9 MCY/disposal site may not be accurate.	Dredging area is located inside the breakwater so volume variations should not be high, however current calculated dredging volumes are based on outdated surveys. Project may face competition from other projects on Disposal sites. LA2 and LA3 Disposal sites may reach yearly capacity from other Non-COE projects impacting the project schedule. If calculated disposal sites capacities change, impact on cost and schedule will be critical in nature.	Critical	Likely	5
T-5	Pier J Dredging (Clam)	Quantities are based on outdated surveys. Disposal sites (LA2 and LA3) capacities limitations. Design assumption of 0.9 MCY/disposal site may not be accurate.	Dredging area is located inside the breakwater so volume variations should not be high, however current calculated dredging volumes are based on outdated surveys. Project may face competition from other projects on Disposal sites. LA2 and LA3 Disposal sites may reach yearly capacity from other Non-COE projects impacting the project schedule. If calculated disposal sites capacities change, impact on cost and schedule will be critical in nature. Another key design risk is associated with the Pier J breakwater slope stability. Slope excavation may go underneath the rock structure and undermine it.	Critical	Likely	5
T-6	Main Channel Widening Dredging (Clam)	Quantities are based on outdated surveys. Disposal sites (LA2 and LA3) capacities limitations. Design assumption of 0.9 MCY/disposal site may not be accurate.	Dredging area is located inside the breakwater so volume variations should not be high, however current calculated dredging volumes are based on outdated surveys. Project may face competition from other projects on Disposal sites. LA2 and LA3 Disposal sites may reach yearly capacity from other Non-COE projects impacting the project schedule. If calculated disposal sites capacities change, impact on cost and schedule will be critical in nature.	Critical	Likely	5
T-7	Pier J Wharf Improvements/Stabilization	Design is in the early phases	Project is at approx. 20% design and subject likely change affecting the cost	Moderate	Very LIKELY	4
T-8	Pier J Breakwater Stabilization	Design is in the early phases	Project has not been designed and it is subject to likely affect the cost. Risk of design and construction complications at Pier J modifications. Project involves installing sheet pile or similar stabilizing measures around Pier J to allow deepening of channel adjacent to Pier J and jetties.	Moderate	Very LIKELY	4
T-9	Electric Substation Near Berth J 260	Design is in the early phases	Project has not been designed and it is subject to likely affect the cost	Moderate	Very LIKELY	4
T-10	Pier T Wharf Improvements/Stabilization	Design is in the early phases	Project has not been designed and it is subject to likely affect the cost	Moderate	Very LIKELY	4
T-13	Planning, Engineering, & Design	Design confidence	Additional / more accurate quantities will need to be calculated. No major impact to PED. Cost and schedule impacts are assumed to be negligible.	Negligible	Unlikely	0
T-14	Construction Management	Design confidence	I additional quantities are calculated the project schedule will grow resulting in additional S&A. Cost and Schedule impacts are assumed to be marginal	Marginal	Unlikely	0
Cost Estimate Assumptions				**Maximum Project Growth**		**35%**
EST-1	Hopper Mob/Demob	Estimate assumption on the number of mobs and demobs	Estimate assumption of one single large generic hopper dredge. The estimate assumes a single mob/demob event. It is unlikely that the hopper dredge mob/demobs more than one occasion. Cost and schedule impacts would be signficant if more than one mob/demob is required.	Significant	Unlikely	2
EST-2	Clamshell Mob/Demob	Estimate assumption on the number of mobs and demobs	Estimate assumes yearly mobs and demobs of the clamshell dredge. It is possible to have multiple mob/demobs in a single year depending on how the contract is broken out.	Marginal	Possible	1

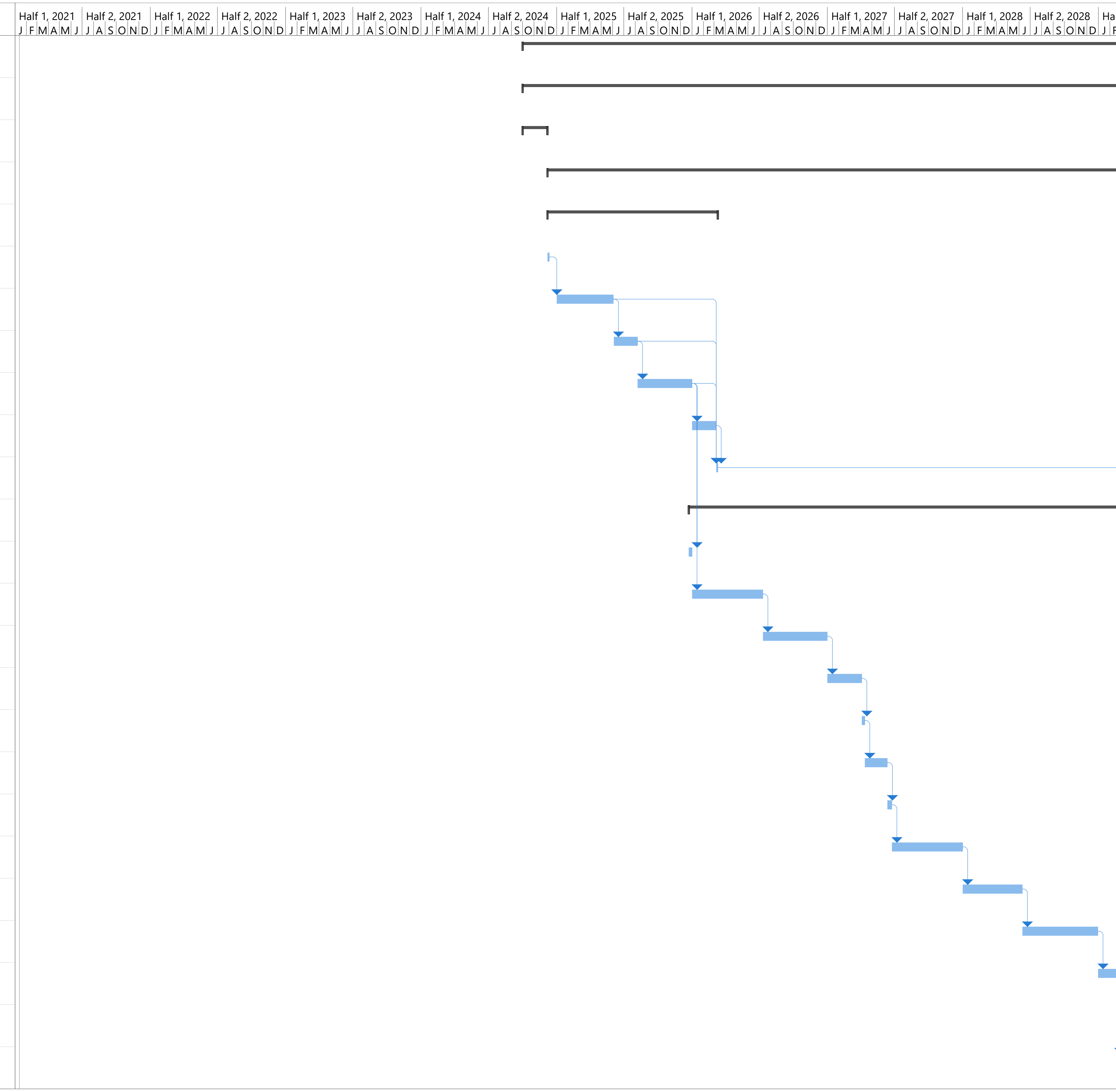
EST-3	Approach Channel Dredging (Hopper)	Quantities variations	Since the design is at the feasibility stage, quantities variations are possible having a marginal impact on the cost and schedule.	Marginal	Possible	1
EST-4	West Basin Dredging (Clam)	Possibility of a different type of dredge bidding the job	Estimate assumes one clamshell bucket dredge, but equipment is not restrictive within the contract. Selected clamshell size and number can affect estimated cost and productivity. The potential that a pipeline dredge is used in lieu of the clamshell dredge is unlikely since scows would be required due to the long hauling distance (LA2 or LA3). Overflow is not allowed due to environmental limitations.	Marginal	Unlikely	0
EST-5	Pier J Dredging (Clam)	Possibility of a different type of dredge bidding the job	Estimate assumes one clamshell bucket dredge, but equipment is not restrictive within the contract. Selected clamshell size and number can affect the cost and productivity. The potential that a pipeline dredge is used in lieu of the estimated clamshell is highly unlikely due to the disposal site distance.	Marginal	Unlikely	0
EST-6	Main Channel Widening Dredging (Clam)	Possibility of a different type of dredge bidding the job Possible harder than expected dredging	Estimate assumes one clamshell bucket dredge, but equipment is not restrictive within the contract. Selected clamshell size and number can affect estimated cost and productivity. The potential that a pipeline dredge is used in lieu of the clamshell dredge is unlikely since scows would be required due to the long hauling distance (LA2 or LA3). Overflow is not allowed due to environmental limitations. Possible harder than expected dredging especially at main channel, where there is not yet any geotech investigation and we are going to depths not done before at PoLB. Seems like this is at least a marginal risk considering the last time we dredged the main channel there was a claim for hard material.	Marginal	Possible	1
EST-7	Pier J Wharf Improvements/Stabilization	Underwater Bulkhead design is at the feasibility stage	Uncetainty on the level of cost confidence based on the current design stage may impact the Underwater Bulkhead cost item.	Moderate	Very LIKELY	4
EST-8	Pier J Breakwater Stabilization	Pier J Breakwater Bulkhead Wall design is at the feasibility stage.	Uncertainty on the level of cost confidence based on the current design stage may impact the Pier J Breakwater Bulkhead Wall cost item.	Moderate	Very LIKELY	4
EST-9	Electric Substation Near Berth J 260	Electric Substation estimate is at the early stage	Uncetainty on the level of cost confidence based on the current design stage may impact the Electric Substation cost item.	Moderate	Very LIKELY	4
EST-10	Pier T Wharf Improvements/Stabilization	Design is at the feasibility stage	Uncetainty on the level of cost confidence based on the current design stage may impact cost and schedule.	Moderate	Very LIKELY	4
EST-13	Planning, Engineering, & Design	Calculated as percentage of construction cost	Common percentages used for type of work, but subject to change. 30 account costs can vary greatly.	Moderate	Likely	3
EST-14	Construction Management	Calculated as percentage of construction cost	Common percentages used for type of work, but subject to change. 31 account costs typically close to estimated percentage, but mary vary more for larger project.	Marginal	Possible	1
External Project Risks					**Maximum Project Growth**	**40%**
EX-1	Hopper Mob/Demob	Market Conditions	Large dredging projects requiring hopper dredges have always being handled by a limited pool of contractors. For open ocean dredge projects, bidding climate has historically been limited to a small circle of contractors and it is not expected to change. Lack of competition may have a moderate impact on the construction cost.	Moderate	Likely	3
EX-2	Clamshell Mob/Demob	Market Conditions	Lack of competition may have an impact on costs.	Marginal	Likely	2

EX-3	Approach Channel Dredging (Hopper)	Unanticipated fuel inflation, Encountering Green Sea Turtles and marine mammals	Hopper dredges are sensitive to fuel price fluctuations. Fluctuations in fuel prices will affect dredging unit cost. Our current position is that green sea turtles are not present in San Pedro Bay. Green sea turtles are an endangered species under the federal Endangered Species Act (ESA). Absence from the study area would result in a no effect determination made by the Corps that does not require consultation with the National Marine Fisheries Service (NMFS). The risk involves encountering green sea turtles in San Pedro Bay project area. Presence of green sea turtles would trigger consultation with the NMFS under the ESA. This could add delays to complete the study as well as possible monitoring and protective measures for dredging and placement activities that would add costs and schedule delays during construction. This risk would carry a marginal cost and schedule impact with low possibility of occurrence. NMFS is requiring the Port to perform approximately two years of sea turtle monitoring. This study will determine green sea turtles actually occur within the Harbor District. Currently, they are known to occur in nearby rivers, but not within the Port Complex itself. With that said, we do not believe this will be an issue for the project. Marine mammals may impact the work. Work may need to stop intermittently	Marginal	Possible	1
EX-4	West Basin Dredging (Clam)	Bidding environment, Weather, Encountering Green Sea Turtles and Marine Mammals	Amount of bidders in a competitively bid contract will affect price. Weather will affect construction schedule. Assume these risks are possible and have a marginal effect on cost. Our current position is that green sea turtles are not present in San Pedro Bay. Green sea turtles are an endangered species under the federal Endangered Species Act (ESA). Absence from the study area would result in a no effect determination made by the Corps that does not require consultation with the National Marine Fisheries Service (NMFS). The risk involves encountering green sea turtles in San Pedro Bay project area. Presence of green sea turtles would trigger consultation with the NMFS under the ESA. This could add delays to complete the study as well as possible monitoring and protective measures for dredging and placement activities that would add costs and schedule delays during construction. This risk would carry a marginal cost and schedule impact with low possibility of occurrence. NMFS is requiring the Port to perform approximately two years of sea turtle monitoring. This study will determine green sea turtles actually occur within the Harbor District. Currently, they are known to occur in nearby rivers, but not within the Port Complex itself. With that said, we do not believe this will be an issue for the project. Marine mammals may impact the work. Work may need to stop intermittently	Marginal	Possible	1
EX-5	Pier J Dredging (Clam)	Bidding environment, Weather, Encountering Green Sea Turtles and Marine Mammals	Amount of bidders in a competitively bid contract will affect price. Weather will affect construction schedule. Assume these risks are possible and have a marginal effect on cost. Our current position is that green sea turtles are not present in San Pedro Bay. Green sea turtles are an endangered species under the federal Endangered Species Act (ESA). Absence from the study area would result in a no effect determination made by the Corps that does not require consultation with the National Marine Fisheries Service (NMFS). The risk involves encountering green sea turtles in San Pedro Bay project area. Presence of green sea turtles would trigger consultation with the NMFS under the ESA. This could add delays to complete the study as well as possible monitoring and protective measures for dredging and placement activities that would add costs and schedule delays during construction. This risk would carry a marginal cost and schedule impact with low possibility of occurrence. NMFS is requiring the Port to perform approximately two years of sea turtle monitoring. This study will determine green sea turtles actually occur within the Harbor District. Currently, they are known to occur in nearby rivers, but not within the Port Complex itself. With that said, we do not believe this will be an issue for the project. Marine mammals may impact the work. Work may need to stop intermittently	Marginal	Possible	1

EX-6	Main Channel Widening Dredging (Clam)	Bidding environment, Weather, Encountering Green Sea Turtles and Marine Mammals	Amount of bidders in a competitively bid contract will affect price. Weather will affect construction schedule. Assume these risks are possible and have a marginal effect on cost. Our current position is that green sea turtles are not present in San Pedro Bay. Green sea turtles are an endangered species under the federal Endangered Species Act (ESA). Absence from the study area would result in a no effect determination made by the Corps that does not require consultation with the National Marine Fisheries Service (NMFS). The risk involves encountering green sea turtles in San Pedro Bay project area. Presence of green sea turtles would trigger consultation with the NMFS under the ESA. This could add delays to complete the study as well as possible monitoring and protective measures for dredging and placement activities that would add costs and schedule delays during construction. This risk would carry a marginal cost and schedule impact with low possibility of occurrence. NMFS is requiring the Port to perform approximately two years of sea turtle monitoring. This study will determine green sea turtles actually occur within the Harbor District. Currently, they are known to occur in nearby rivers, but not within the Port Complex itself. With that said, we do not believe this will be an issue for the project. Marine mammals may impact the work. Work may need to stop intermittently	Marginal	Possible	1
EX-7	Pier J Wharf Improvements/Stabilization	Bidding environment, weather, Encountering Green Sea Turtle / Marine Mammals	Amount of bidders in a competitively bid contract will affect price. Weather will affect construction schedule. Assume these risks are very likely and have a significant effect on cost. Wharf improvements work consists of driven sheet pile from -51 to -80'. Pile driven activities must cease if there is a sighting of a green sea turtle within 400' of the monitoring zone. NMFS is requiring the Port to perform approximately two years of sea turtle monitoring. This study will determine green sea turtles actually occur within the Harbor District. Currently, they are known to occur in nearby rivers, but not within the Port Complex itself. With that said, we do not believe this will be an issue for the project. Marine mammals may impact the work. Work may need to stop intermittently	Moderate	Very LIKELY	4
EX-8	Pier J Breakwater Stabilization	Bidding environment, weather, Encountering White Abalone, Encountering Marine Mammals	Amount of bidders in a competitively bid contract will affect price. Weather will affect construction schedule. Assume these risks are likely and have a marginal effect on cost. NMFS is requiring the Port to perform approximately two years of sea turtle monitoring. This study will determine green sea turtles actually occur within the Harbor District. Currently, they are known to occur in nearby rivers, but not within the Port Complex itself. With that said, we do not believe this will be an issue for the project. Marine mammals may impact the work. Work may need to stop intermittently	Marginal	Possible	1
EX-9	Electric Substation Near Berth J 260	Bidding environment, weather	Amount of bidders in a competitively bid contract will affect price. Weather will affect construction schedule. Assume these risks are likely and have a negligible effect on cost.	Negligible	Likely	1
EX-10	Pier T Wharf Improvements/Stabilization	Bidding environment, weather, Encountering Green Sea Turtle / Marine Mammals	Amount of bidders in a competitively bid contract will affect price. Weather will affect construction schedule. Assume these risks are very likely and have a significant effect on cost. Constructions activities must cease if there is a sighting of a green sea turtle within 400' of the monitoring zone. NMFS is requiring the Port to perform approximately two years of sea turtle monitoring. This study will determine green sea turtles actually occur within the Harbor District. Currently, they are known to occur in nearby rivers, but not within the Port Complex itself. With that said, we do not believe this will be an issue for the project. Marine mammals may impact the work. Work may need to stop intermittently	Marginal	Likely	2
EX-13	Planning, Engineering, & Design	Political factors. Funding availability	The longer it takes to get to construction, the more it will cost to prepare economic updates. Environmental documents may need to updated.	Negligible	Possible	0
EX-14	Construction Management	Lack of personnel	Lack of personnel will have a moderate impact on the project.	Moderate	Likely	3

6.3.3 Construction Schedule

ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors
1		**Construction Schedule**	**1625 days**	**Tue 10/1/24**	**Tue 3/13/29**	
2		Alternative 4	1625 days	Tue 10/1/24	Tue 3/13/29	
3		**Preconstruction Phase**	**67 days**	**Tue 10/1/24**	**Fri 12/6/24**	
8		**Construction Phase**	**1544 days**	**Sat 12/7/24**	**Tue 2/27/29**	
9		**Hopper Dredging**	**460 days**	**Sat 12/7/24**	**Wed 3/11/26**	
10		Mobilization	5 days	Sat 12/7/24	Wed 12/11/24	7
11		Approach Channel Dredging - Nearshore Disposal	143 days	Wed 1/1/25	Mon 6/2/25	10
12		Approach Channel Dredging - LA2 Disposal	60 days	Wed 6/4/25	Wed 8/6/25	11
13		Approach Channel Dredging - LA3 Disposal	137 days	Thu 8/7/25	Wed 12/31/25	12
14		Approach Channel Dredging Year 2 - LA2 Disposal	60 days	Thu 1/1/26	Fri 3/6/26	13
15		Demobilization	5 days	Sat 3/7/26	Wed 3/11/26	11,12,13,14
16		**Clamshell Dredging**	**1163 days**	**Tue 12/23/25**	**Tue 2/27/29**	
17		Mobilization	8 days	Tue 12/23/25	Wed 12/31/25	13FS-8 days
18		Main Channel Widening 2nd Year - LA3 Disposal	178 days	Thu 1/1/26	Fri 7/10/26	13
19		West Basin 2nd Year - LA3 Disposal	162 days	Sat 7/11/26	Thu 12/31/26	18
20		West Basin 3rd Year - LA2 Disposal	87 days	Fri 1/1/27	Sat 4/3/27	19
21		Pier T Berths 3rd Year - LA2 Disposal	7 days	Sun 4/4/27	Sun 4/11/27	20
22		Pier J Basin 3rd Year- LA2 Disposal	57 days	Mon 4/12/27	Fri 6/11/27	21
23		Pier J Basin 3rd Year - LA3 Disposal	11 days	Sat 6/12/27	Wed 6/23/27	22
24		Pier J Approach 3rd Year - LA3 Disposal	178 days	Thu 6/24/27	Fri 12/31/27	23
25		Pier J Approach 4th Year - LA2 Disposal	150 days	Sat 1/1/28	Fri 6/9/28	24
26		Pier J Approach 4th Year - LA3 Disposal	190 days	Sat 6/10/28	Sat 12/30/28	25
27		Pier J Approach 5th Year - LA2 Disposal	50 days	Sun 12/31/28	Thu 2/22/29	26
28		Demobilization	5 days	Fri 2/23/29	Tue 2/27/29	27
29		Contract Closeout	14 edays	Tue 2/27/29	Tue 3/13/29	15,28



Project: POLB Deepening_Alt 4-
Date: Thu 7/18/19

Task	Summary	Inactive Milestone	Duration-only	Start-only	External Milestone	Manual Progress	
Split	Project Summary	Inactive Summary	Manual Summary Rollup	Finish-only	Deadline		
Milestone	Inactive Task	Manual Task	Manual Summary	External Tasks	Progress		

6.4 Alternative 5

6.4.1 Total Project Cost Summary (TPCS)

**** TOTAL PROJECT COST SUMMARY ****

PROJECT: **Port of Long Beach**
PROJECT NO: **xxxxxx**
LOCATION: **Long Beach, CA**

DISTRICT: **Los Angeles District** PREPARED: **7/18/2019**
POC: **CHIEF, COST ENGINEERING, XXX**

This Estimate reflects the scope and schedule in report; Engineering alternatives

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
						Program Year (Budget EC): 2025									
						Effective Price Level Date: 1-Oct- 24									
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	REMAINING COST ($K)	Spent Thru: 1-Oct-18 ($K)	**TOTAL FIRST COST ($K)**	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
12	NAVIGATION PORTS & HARBORS	$98,524	$45,321	46%	$143,845		$98,524	$45,321	$143,845		$143,845	15.8%	$114,068	$52,471	$166,539
12	NAVIGATION PORTS & HARBORS - Non-Fed	$10,273	$4,725	46%	$14,998		$10,273	$4,725	$14,998		$14,998	13.8%	$11,685	$5,375	$17,061
	CONSTRUCTION ESTIMATE TOTALS:	$108,797	$50,047		$158,843		$108,797	$50,047	$158,843		$158,843	15.6%	$125,753	$57,847	$183,600
01	LANDS AND DAMAGES			-		-						-			
30	PLANNING, ENGINEERING & DESIGN	$16,353	$7,522	46%	$23,876		$16,353	$7,522	$23,876		$23,876	16.0%	$18,972	$8,727	$27,699
31	CONSTRUCTION MANAGEMENT	$8,076	$3,715	46%	$11,791		$8,076	$3,715	$11,791		$11,791	30.4%	$10,532	$4,845	$15,376
	PROJECT COST TOTALS:	$133,226	$61,284	46%	$194,510		$133,226	$61,284	$194,510		**$194,510**	16.5%	$155,257	$71,418	$226,676

ESTIMATED TOTAL PROJECT COST: **$226,676**

______________________ CHIEF, COST ENGINEERING, XXX

______________________ PROJECT MANAGER, XXX

______________________ CHIEF, REAL ESTATE, XXX

______________________ CHIEF, PLANNING, XXX

______________________ CHIEF, ENGINEERING, XXX

______________________ CHIEF, OPERATIONS, XXX

______________________ CHIEF, CONSTRUCTION, XXX

______________________ CHIEF, CONTRACTING, XXX

______________________ CHIEF, PM-PB, xxxx

______________________ CHIEF, DPM, XXX

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: Port of Long Beach
LOCATION: Long Beach, CA
This Estimate reflects the scope and schedule in report; Engineering alternatives

DISTRICT: Los Angeles District
POC: CHIEF, COST ENGINEERING, XXX

PREPARED: 7/18/2019

WBS Structure		**ESTIMATED COST**				**PROJECT FIRST COST (Constant Dollar Basis)**				**TOTAL PROJECT COST (FULLY FUNDED)**				
		Estimate Prepared: / Estimate Price Level:			16-Jul-19 / 1-Oct-18	Program Year (Budget EC): / Effective Price Level Date:			2025 / 1 -Oct-24					
				RISK BASED										
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	***B***	***C***	***D***	***E***	***F***	***G***	***H***	***I***	***J***	***P***	***L***	***M***	***N***	***O***
	PHASE 1 or CONTRACT 1													
12	NAVIGATION PORTS & HARBORS - Year 1	$44,787	$20,602	46.0%	$65,389		$44,787	$20,602	$65,389	2025Q3	13.8%	$50,946	$23,435	$74,381
12	NAVIGATION PORTS & HARBORS - Year 2	$22,114	$10,173	46.0%	$32,287		$22,114	$10,173	$32,287	2026Q3	16.0%	$25,658	$11,803	$37,461
12	NAVIGATION PORTS & HARBORS - Year 3	$29,955	$13,779	46.0%	$43,735		$29,955	$13,779	$43,735	2027Q3	18.3%	$35,451	$16,308	$51,759
12	NAVIGATION PORTS & HARBORS - Year 4	$1,667	$767	46.0%	$2,434		$1,667	$767	$2,434	2028Q3	20.7%	$2,013	$926	$2,938
	CONSTRUCTION ESTIMATE TOTALS:	$98,524	$45,321	46.0%	$143,845		$98,524	$45,321	$143,845			$114,068	$52,471	$166,539
01	LANDS AND DAMAGES			25.0%										
30	PLANNING, ENGINEERING & DESIGN													
1.5%	Project Management	$1,478	$680	46.0%	$2,158		$1,478	$680	$2,158	2022Q2	14.0%	$1,686	$775	$2,461
0.5%	Planning & Environmental Compliance	$493	$227	46.0%	$720		$493	$227	$720	2022Q2	14.0%	$562	$259	$821
8.0%	Engineering & Design	$7,882	$3,626	46.0%	$11,508		$7,882	$3,626	$11,508	2022Q2	14.0%	$8,989	$4,135	$13,124
0.5%	Reviews, ATRs, IEPRs, VE	$493	$227	46.0%	$720		$493	$227	$720	2022Q2	14.0%	$562	$259	$821
1.0%	Life Cycle Updates (cost, schedule, risks)	$985	$453	46.0%	$1,438		$985	$453	$1,438	2022Q2	14.0%	$1,123	$517	$1,640
0.5%	Contracting & Reprographics	$493	$227	46.0%	$720		$493	$227	$720	2025Q3	30.4%	$643	$296	$939
1.5%	Engineering During Construction	$1,478	$680	46.0%	$2,158		$1,478	$680	$2,158	2025Q3	30.4%	$1,927	$887	$2,814
1.0%	Planning During Construction	$985	$453	46.0%	$1,438		$985	$453	$1,438	2022Q2	14.0%	$1,123	$517	$1,640
0.5%	Adaptive Management & Monitoring	$493	$227	46.0%	$720		$493	$227	$720	2022Q2	14.0%	$562	$259	$821
	NON-FED Portion of PED	$1,573	$724	46.0%	$2,297		$1,573	$724	$2,297	2022Q2	14.0%	$1,794	$825	$2,619
31	CONSTRUCTION MANAGEMENT													
6.7%	Construction Management	$6,601	$3,036	46.0%	$9,637		$6,601	$3,036	$9,637	2025Q3	30.4%	$8,608	$3,960	$12,568
	NON-FED Portion of S&A	$1,475	$678	46.0%	$2,153		$1,475	$678	$2,153	2025Q3	30.4%	$1,923	$885	$2,808
	Project Management			46.0%										
	CONTRACT COST TOTALS:	$122,953	$56,558		$179,512		$122,953	$56,558	**$179,512**			$143,572	$66,043	**$209,615**

Filename: TPCS_Construction Seq and Qtys_TC_Final.xlsx
TPCS Alt 5

6.4.2 Abbreviated Cost and Schedule Risk Analysis

Abbreviated Risk Analysis

Alternative: **Alt 5** **(NED INCLUDING STAND-BY AREA)**
West Basin, Pier J, Main Channel Widening
Depth: -55'
Approach Channel Depth: -80'

Project (less than $40M): **POLB Deepening**
Project Development Stage/Alternative: **Feasibility (Alternatives)**
Risk Category: **Moderate Risk: Typical Project Construction Type**

Meeting Date: **4/10/2019**

Total Estimated Construction Contract Cost = $ 110,011,185

	CWWBS	Feature of Work	Contract Cost		% Contingency	$ Contingency	Total
	01 LANDS AND DAMAGES	Real Estate	$ -		0.00%	$ -	$ -
1	12 NAVIGATION, PORTS AND HARBORS	Hopper Mob/Demob	$ 3,289,728		23.92%	$ 786,771	$ 4,076,499
2	12 NAVIGATION, PORTS AND HARBORS	Clamshell Mob/Demob	$ 7,205,564		17.31%	$ 1,247,116	$ 8,452,680
3	12 NAVIGATION, PORTS AND HARBORS	Approach Channel Dredging (Hopper)	$ 16,716,000		24.41%	$ 4,080,042	$ 20,796,042
4	12 NAVIGATION, PORTS AND HARBORS	West Basin Dredging (Clam)	$ 7,198,680		60.12%	$ 4,328,117	$ 11,526,797
5	12 NAVIGATION, PORTS AND HARBORS	Pier J Dredging (Clam)	$ 30,641,030		62.03%	$ 19,005,838	$ 49,646,868
6	12 NAVIGATION, PORTS AND HARBORS	Main Channel Widening Dredging (Clam)	$ 10,642,600		62.16%	$ 6,615,432	$ 17,258,032
7	12 NAVIGATION, PORTS AND HARBORS	Stand-By Area Dredging (Clam)	$ 24,485,260		49.16%	$ 12,036,674	$ 36,521,934
8	12 NAVIGATION, PORTS AND HARBORS	Pier J Breakwater Stabilization	$ 5,465,708		58.69%	$ 3,207,805	$ 8,673,513
9	12 NAVIGATION, PORTS AND HARBORS	Electric Substation Near Berth J 260	$ 4,366,615		137.59%	$ 6,007,910	$ 10,374,525
10			$ -		0.00%	$ -	$ -
11			$ -		0.00%	$ -	$ -
12	All Other	Remaining Construction Items	$ -	*0.0%*	0.00%	$ -	$ -
13	30 PLANNING, ENGINEERING, AND DESIGN	Planning, Engineering, & Design	$ 16,600,001		22.97%	$ 3,812,903	$ 20,412,904
14	31 CONSTRUCTION MANAGEMENT	Construction Management	$ 8,186,832		14.75%	$ 1,207,668	$ 9,394,500
XX	FIXED DOLLAR RISK ADD (EQUALLY DISPERSED TO ALL, MUST INCLUDE JUSTIFICATION SEE BELOW)					$ -	

Totals	Contract Cost	% Contingency	$ Contingency	Total
Real Estate	$ -	0.00%	$ -	$ -
Total Construction Estimate	$ 110,011,185	52.10%	$ 57,315,704	$ 167,326,889
Total Planning, Engineering & Design	$ 16,600,001	22.97%	$ 3,812,903	$ 20,412,904
Total Construction Management	$ 8,186,832	14.75%	$ 1,207,668	$ 9,394,500
Total Excluding Real Estate	**$ 134,798,018**	**46%**	**$ 62,336,276**	**$ 197,134,294**

	Base	50%	80%
Confidence Level Range Estimate ($000's)	$134,798k	$172,200k	$197,134k

* 50% based on base is at 5% CL.

Fixed Dollar Risk Add: (Allows for additional risk to be added to the risk analsyis. Must include justification. Does not allocate to Real Estate.	

POLB Deepening **Alt 5 (NED INCLUDING STAND-BY AREA) West Basin, Pier J, Main Channel Widening Depth: -55' Approach Channel Depth: -80'**

Risk Register

Feasibility (Alternatives)

Abbreviated Risk Analysis

Meeting Date: 10-Apr-19

Risk Level

	Negligible	Marginal	Moderate	Significant	Critical
Very Likely	2	3	4	5	5
Likely	1	2	3	4	5
Possible	0	1	2	3	4
Unlikely	0	0	1	2	3

Risk Element	Feature of Work	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Impact	Likelihood	Risk Level
Project Management & Scope Growth				**Maximum Project Growth**		**75%**
PS-1	Hopper Mob/Demob	Scope at Alternative Formulation Stage	Scope definition changes may alter dredging equipment selection and affect mobilization/demobilization. Hopper dredges may not be available delaying the project by a year (schedule impacts only)	Marginal	Unlikely	0
PS-2	Clamshell Mob/Demob	Scope at Alternative Formulation Stage	Scope definition changes due to possible environmental restrictions may alter dredging equipment selection and affect mobilization/demobilization	Marginal	Unlikely	0
PS-3	Approach Channel Dredging (Hopper)	Lacking complete design.	General scope dredging volumes and distances changes may affect the cost and schedule. However, scope of work associated with the Approach Channel is well defined and unlikely to increase. Possible munitions findings likelihood is negligible. Length, width and depth of cut is defined. Scope changes are negligible along the Approach Channel. Maintenance dredging accounts for depth from 78' to 80'. Therefore, assume marginal additional sediment transport.	Marginal	Possible	1
PS-4	West Basin Dredging (Clam)	Lacking complete design, potential exists for encountering contaminated material	Contaminated material may be found. Material will need to be handled differently. Risk is very likely. Sponsor may already have an identified location nearby for contaminated material placement. Capping may be involved. Design evolution will very likely result in revisions to dredging volumes, but impact is marginal since the site layout is well established.	Marginal	Very LIKELY	3
PS-5	Pier J Dredging (Clam)	Design evolution	Design evolution will very likely result in revisions to dredging volumes, but impact is marginal since the site layout is well established. An 18,000 Twenty-feet Equivalent Units (TEU) ship simulation was done to define the site layout. The project scope is based on the 18,000 TEU design vessel, but the world is building 21,000 TEU ships leading to a scope change. A new re-authorization would be required if we need to change the layout. This is outside the project scope and not included in the risk analysis.	Marginal	Very LIKELY	3
PS-6	Main Channel Widening Dredging (Clam)	Lacking complete design, potential exists for encountering contaminated material	Contaminated material may be found. Material will need to be handled differently. Risk is very likely. Sponsor may already have an identified location nearby for contaminated material placement. Capping may be involved. Design evolution will very likely result in revisions to dredging volumes, but impact is marginal since the site layout is well established.	Marginal	Very LIKELY	3
PS-7	Stand-By Area Dredging (Clam)	Lacking complete design, potential exists for encountering contaminated material	Contaminated material may be found. Material will need to be handled differently. Risk is less than at the other dredging sites; possible risk. Sponsor may already have an identified location nearby for contaminated material placement. Capping may be involved. Design evolution will very likely result in revisions to dredging volumes, but impact is marginal since the site layout is well established.	Marginal	Possible	1
PS-8	Pier J Breakwater Stabilization	Design evolution of the Pier J Breakwater Bulkhead Wall	Design evolution will likely result in revisions to the Pier J Breakwater Bulkhead Wall design structure. Design criteria may have a moderate impact on cost.	Moderate	Likely	3

PS-9	Electric Substation Near Berth J 260	Design evolution may impact this item	General design is in the beginning stages and subject to change. Electrical design is typically very limited in this stage of project development. There is every likelyhood of design evolution and cost impacts.	Significant	Very LIKELY	5
PS-13	Planning, Engineering, & Design	Scope evolution could impact design costs. Also, as the project is delayed, new issues may come to light. As delays occur, designers change, retire, etc, resulting in lost knowledge and rework.	Any delays or further scope identification can impact costs.	Moderate	Possible	2
PS-14	Construction Management	Scope evolution could cause an impact to the construction management of the project.	Project is located at one site. Further management costs due to scope changes are unlikely to impact the construction management costs.	Negligible	Unlikely	0
Acquisition Strategy				**Maximum Project Growth**		**30%**
AS-1	Hopper Mob/Demob	Acquisition Plan not yet determined	The hopper dredge is the most adequate choice for open ocean dredging (i.e. outside Queen's gate) considering the Approach Channel sediment deposition and sailing distance. Large marine contractors own hoppers. The reasonable assumption is that the project will be advertised as an unrestricted open-bid contract, instead of a small business, MATOC or negotiated procurement.	Marginal	Unlikely	0
AS-2	Clamshell Mob/Demob	Contract acquisition may result in some small business contracts	The PDT feels the project will pursue one contract; maybe a joint venture for such a large project; maybe a hopper dredge contractor and a clamshell dredge contractor. Dredging areas inbound by the breakwater (i.e. inside Queen's Gate) where the electric clamshell may be implemented could be candidates for small business contracts. Small business with extensive subcontracting; 8a prime contractor markups and poor bid competition are not factored into the estimate.	Moderate	Possible	2
AS-3	Approach Channel Dredging (Hopper)	Acquisition Plan not yet determined	Small Business contract is unlikely since the work is outside outside the breakwater (Queen's Gate). In open ocean, the hopper dredge is the most likely dredging equipment choice. Hopper dredges accommodate poor weather better than pipeline dredges; and clamshells are unstable. Historically, only large marine contractors owns hopper dredges.	Negligible	Unlikely	0
AS-4	West Basin Dredging (Clam)	Acquisition Plan not yet determined	Estimate is based on an unrestricted fixed-firm price contract. Since it is a huge investment (large impact) to convert a clamshell dredge into an electrical clamshell dredge, it is a very unlikely the project will pursue a small business contract.	Critical	Unlikely	3
AS-5	Pier J Dredging (Clam)	Acquisition Plan not yet determined	Estimate is based on an unrestricted fixed-firm price contract. Due to the nature of the work, it is unlikely this area is advertised as a small business set-aside contract, impacts to the cost would be moderate.	Critical	Unlikely	3
AS-6	Main Channel Widening Dredging (Clam)	Acquisition Plan not yet determined	Estimate is based on an unrestricted fixed-firm price contract. Since it is a huge investment (large impact) to convert a clamshell dredge into an electrical clamshell dredge, it is a very unlikely the project will pursue a small business contract.	Critical	Unlikely	3
AS-7	Stand-By Area Dredging (Clam)	Acquisition Plan not yet determined	Estimate is based on an unrestricted fixed-firm price contract. Since it is a huge investment (large impact) to convert a clamshell dredge into an electrical clamshell dredge, it is a very unlikely the project will pursue a small business contract.	Critical	Unlikely	3
AS-8	Pier J Breakwater Stabilization	Acquisition Plan not yet determined	Acquisition plan not yet determined. Small business unlikely. Accelerated schedule possible. Normal competition expected.	Marginal	Possible	1

AS-9	Electric Substation Near Berth J 260	Acquisition Plan not yet determined	Acquisition plan not yet determined. Small business unlikely. Accelerated schedule possible. Normal competition expected.	Negligible	Likely	1
AS-13	Planning, Engineering, & Design	Contract acquisition plan could change over time, impacting design and solicitations efforts of the PED.	The reasonable assumption is that the project will be advertised as an open bid, instead of small business, MATOC or negotiated procurement. Contract acquisition changes are possible and they may result in design variations impacting PED, but assume cost impacts are negligible.	Negligible	Possible	0
AS-14	Construction Management	Contract acquisition has a direct correlation to construction contract management.	The reasonable assumption is that the project will be advertised as an open bid, instead of small business, MATOC or negotiated procurement. Small business w/ extensive subcontracting; 8a prime contractor markups and poor bid competition are not factored into the estimate. Risk is unlikely. A less skilled contractor on marine construction can result in more construction management.	Negligible	Unlikely	0
Construction Elements				**Maximum Project Growth**		**25%**
CE-1	Hopper Mob/Demob	Availability of hopper dredges on West Coast is scarce	The baseline estimate assumes mob/demob from the Gulf Coast. The only hopper dredging work that occurs on the West coast is in the Porland District. Likelihood of a dredge mob/demob from the North East Coast is possible, but impact on cost would be moderate.	Moderate	Possible	2
CE-2	Clamshell Mob/Demob	Availability of electric clamshell dredges	Air quality regulations restrictions limit the type to dredging equipment within the port to the use of an electric driven dredge. The estimate accounts for electric drive upgrade to clamshell derricks. Maybe additional lead time during mob/demob is required for converting diesel driven clams to electric driven. Likelihood is possible but the cost/schedule impacts should be negligile.	Negligible	Possible	0
CE-3	Approach Channel Dredging (Hopper)	Disposal Sites availability	Currently, most of the sediment volume from the Approach Channel is hauled to the Nearshore disposal site which is the closest disposal site (~4 miles). If the Nearshore disposal site becomes unavailable dredge material needs to go to a farther disposal site: LA2 is situated at ~10 miles or LA3 is situated at ~20 miles.	Moderate	Possible	2
CE-4	West Basin Dredging (Clam)	Possibility of encountering old navy timber and concrete piles.	Dredging work is considered new dredging, production rates could vary specially if piles are encountered during dredging operations. Removal of piles is not included in the project or estimate. Risk is unlikely, but may have a marginal impact.	Marginal	Unlikely	0
CE-5	Pier J Dredging (Clam)	Electric Clamshell requirements	The required use of the electric clamshell on Pier J is dependent on the construction of the electrical substation, near berth J 260, to be on schedule. Delays are possible impacting construction schedule and extended in-house labor costs.	Marginal	Possible	1
CE-6	Main Channel Widening Dredging (Clam)	Inefficient Contractor, Traffic concerns	It is unlikely a new dredging contractor obtains the contract and is unable to perform the work. The nature of this type of work makes the ocurrence of this risk unlikely. Capable remaining dredging contractors in the area are experienced and the work is not complex. However, there are traffic concerns in the area, concern carries a low impact since vessels will be able to sail around excavation site.	Marginal	Unlikely	0
CE-7	Stand-By Area Dredging (Clam)	Inefficient Contractor, Traffic concerns	It is unlikely a new dredging contractor obtains the contract and is unable to perform the work. The nature of this type of work makes the ocurrence of this risk unlikely. Capable remaining dredging contractors in the area are experienced and the work is not complex. However, there are traffic concerns in the area, concern carries a very low impact since vessels can sail around the stand-by area excavation site.	Negligible	Unlikely	0

CE-8	Pier J Breakwater Stabilization	Contractor's ability to install	Work consists on building a Pier J Breakwater Bulkhead Wall. Carrying out the work posses possible risks due to the nature of the work.	Marginal	Possible	1
CE-9	Electric Substation Near Berth J 260	Accelerated schedule. Site is confined	Accelerated schedule is possible. Pier J dredging work is dependent on the construction completion of the Electric Substation near Berth 260. Work will take place in a confined area, likley impacting construction.	Moderate	Likely	3
CE-13	Planning, Engineering, & Design	Contract modifications	Additional design effort during the construction period in the form of RFIs and modifications are possible, but cost and schedule impacts should be negligible	Marginal	Possible	1
CE-14	Construction Management	Contract modifications; Construction schedule extension	Construction schedule slips will impact construction management. Additional construction management effort during the construction period in the form of RFIs, modifications and claims are possible, but cost and schedule impacts should be negligible	Marginal	Likely	2
Specialty Construction or Fabrication					**Maximum Project Growth**	**65%**
SC-2	Clamshell Mob/Demob	Electric dredges are required inside the POLB	Conversion of diesel driven clamshell dredge to electric driven. Availability of electric driven dredges anticipated. Impact is low.	Negligible	Unlikely	0
SC-3	Approach Channel Dredging (Hopper)	Dredging Equipment choice	The hopper dredge is the best equipment choice outside the breakwater (Queen's Gate). As a specialty equipment, the hopper dredge is the best choice for the Approach Channel dredging because the excavation layer is thin and work is outside the breakwater. However, the contract will not specify which equipment the contractor must use, and it is unlikely a clamshell barge meeting ABS-class ocean work dredges outside the line of demarcation (outside the breakwater). Use of another dredge will significantly impact cost. Also, the baseline estimate considered a large size hopper, however, there is the possibility of a medium hopper dredge bidding the job. The use of a large size hopper results in a lower dredging unit cost. The use of a medium size hopper is possible and it will result in a higher dredging unit cost with moderate cost impacts. Dredging equipment selection impactssignificantly impacts cost and schedule	Significant	Unlikely	2
SC-4	West Basin Dredging (Clam)	Electric dredges are required inside the POLB and may be required for mitigation of air quality impacts	Conversion of diesel driven clamshell dredge to electric driven. Availability of electric driven dredges anticipated. Impact is low.	Negligible	Unlikely	0
SC-5	Pier J Dredging (Clam)	Electric dredges are required inside the POLB and may be required for mitigation of air quality impacts	Conversion of diesel driven clamshell dredge to electric driven. Availability of electric driven dredges anticipated. Impact is low.	Negligible	Unlikely	0
SC-6	Main Channel Widening Dredging (Clam)	Electric dredges are required inside the POLB and may be required for mitigation of air quality impacts	Conversion of diesel driven clamshell dredge to electric driven. Availability of electric driven dredges anticipated. Impact is low.	Negligible	Unlikely	0
SC-7	Stand-By Area Dredging (Clam)	Electric dredges are required inside the POLB and may be required for mitigation of air quality impacts	Conversion of diesel driven clamshell dredge to electric driven. Availability of electric driven dredges anticipated. Impact is low.	Negligible	Unlikely	0
SC-9	Electric Substation Near Berth J 260	Any specialized fabrication of electric components could impact cost due to change of material costs, design complexity, long lead fabrication	Material costs vary with market. Electric Sub-station fabrication takes skilled trades and carries a long lead time. It is possible fabrication and installation of the electric substation have a moderate impact on its cost.	Moderate	Likely	3
SC-13	Planning, Engineering, & Design	Specialty construction and material fabrication	Specialty construction and material fabrication do not apply to these cost items.	Negligible	Unlikely	0
Technical Design & Quantities					**Maximum Project Growth**	**30%**

T-3	Approach Channel Dredging (Hopper)	Potential sea level changes resulting in a reduction of base quantities in the cost estimate. Geotechnical investigations remain.	The Approach Channel is situated outside the breakwater and therefore more subseptible to quantity variations associated with sea level change. Sea level change has a certain probability within itself. Risk is limited in the near term, but it increases substantially in the out years. Likelihood is certain, but impact is marginal because work will take place in the near term, unlikely multi-year maintenance dredging projects. Geotech investigations has not been done to 80' leading to possible scope change. Channel width thorugh Queen's Gate may change slightly, material classifications not determined. Associated cost risks are marginal.	Marginal	Possible	1
T-4	West Basin Dredging (Clam)	Quantities are based on outdated surveys. Disposal sites (LA2 and LA3) capacities limitations. Design assumption of 0.9 MCY/disposal site may not be accurate.	Dredging area is located inside the breakwater so volume variations should not be high, however current calculated dredging volumes are based on outdated surveys. Project may face competition from other projects on Disposal sites. LA2 and LA3 Disposal sites may reach yearly capacity from other Non-COE projects impacting the project schedule. If calculated disposal sites capacities change, impact on cost and schedule will be critical in nature.	Critical	Likely	5
T-5	Pier J Dredging (Clam)	Quantities are based on outdated surveys. Disposal sites (LA2 and LA3) capacities limitations. Design assumption of 0.9 MCY/disposal site may not be accurate.	Dredging area is located inside the breakwater so volume variations should not be high, however current calculated dredging volumes are based on outdated surveys. Project may face competition from other projects on Disposal sites. LA2 and LA3 Disposal sites may reach yearly capacity from other Non-COE projects impacting the project schedule. If calculated disposal sites capacities change, impact on cost and schedule will be critical in nature. Another key design risk is associated with the Pier J breakwater slope stability. Slope excavation may go underneath the rock structure and undermine it.	Critical	Likely	5
T-6	Main Channel Widening Dredging (Clam)	Quantities are based on outdated surveys. Disposal sites (LA2 and LA3) capacities limitations. Design assumption of 0.9 MCY/disposal site may not be accurate.	Dredging area is located inside the breakwater so volume variations should not be high, however current calculated dredging volumes are based on outdated surveys. Project may face competition from other projects on Disposal sites. LA2 and LA3 Disposal sites may reach yearly capacity from other Non-COE projects impacting the project schedule. If calculated disposal sites capacities change, impact on cost and schedule will be critical in nature.	Critical	Likely	5
T-7	Stand-By Area Dredging (Clam)	Quantities are based on outdated surveys. Disposal sites (LA2 and LA3) capacities limitations. Design assumption of 0.9 MCY/disposal site may not be accurate.	Dredging area is located inside the breakwater so volume variations should not be high, however current calculated dredging volumes are based on outdated surveys. Project may face competition from other projects on Disposal sites. LA2 and LA3 Disposal sites may reach yearly capacity from other Non-COE projects impacting the project schedule.	Critical	Likely	5
T-8	Pier J Breakwater Stabilization	Design is in the early phases	Project has not been designed and it is subject to likely affect the cost. Risk of design and construction complications at Pier J modifications. Project involves installing sheet pile or similar stabilizing measures around Pier J to allow deepening of channel adjacent to Pier J and jetties.	Moderate	Very LIKELY	4
T-9	Electric Substation Near Berth J 260	Design is in the early phases	Project has not been designed and it is subject to likely affect the cost	Moderate	Very LIKELY	4
T-13	Planning, Engineering, & Design	Design confidence	Additional / more accurate quantities will need to be calculated. No major impact to PED. Cost and schedule impacts are assumed to be negligible.	Negligible	Unlikely	0
T-14	Construction Management	Design confidence	I additional quantities are calculated the project schedule will grow resulting in additional S&A. Cost and Schedule impacts are assumed to be marginal	Marginal	Unlikely	0
Cost Estimate Assumptions				**Maximum Project Growth**		**35%**
EST-1	Hopper Mob/Demob	Estimate assumption on the number of mobs and demobs	Estimate assumption of one single large generic hopper dredge. The estimate assumes a single mob/demob event. It is unlikely that the hopper dredge mob/demobs more than one occasion. Cost and schedule impacts would be signficant if more than one mob/demob is required.	Significant	Unlikely	2

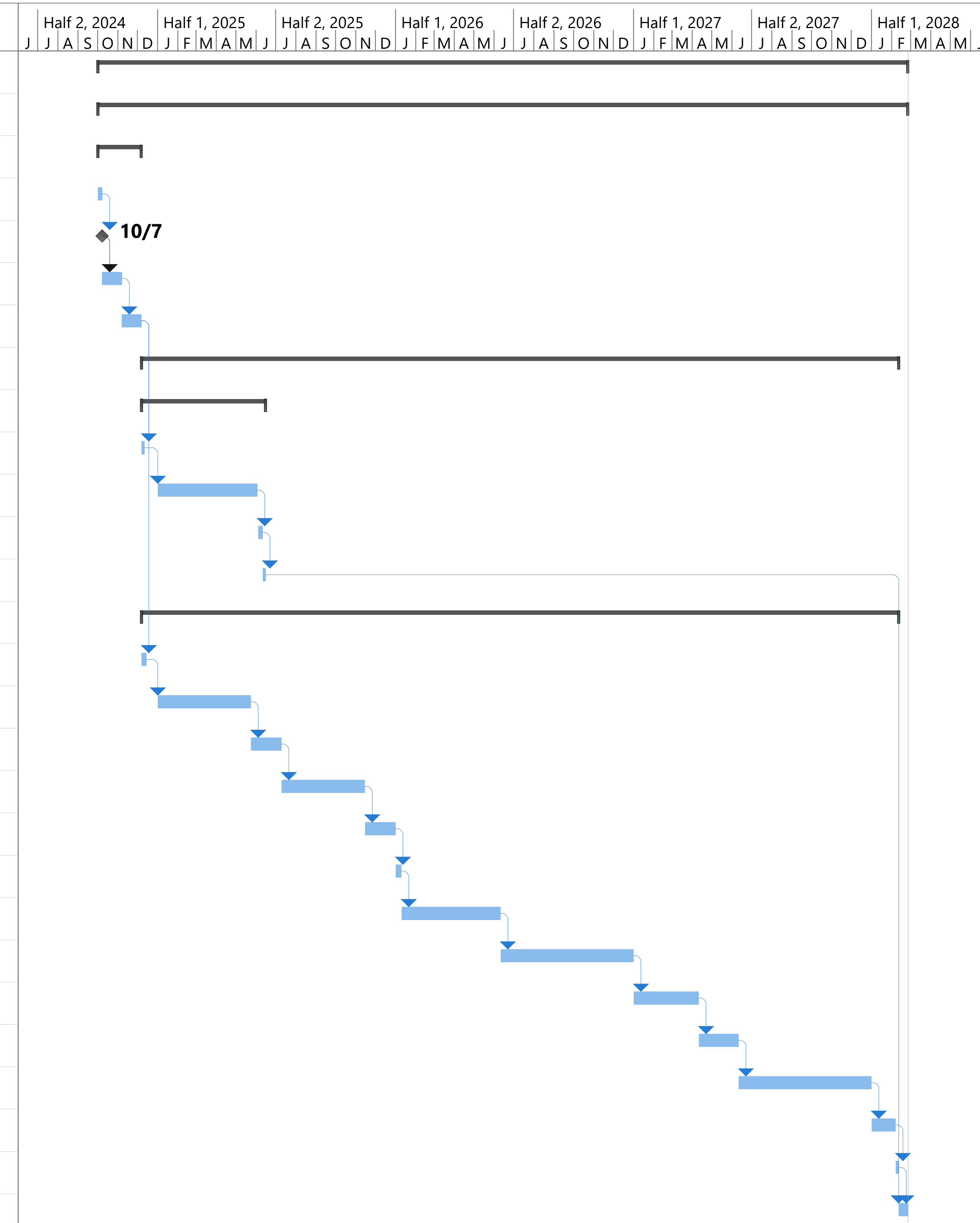
EST-2	Clamshell Mob/Demob	Estimate assumption on the number of mobs and demobs	Estimate assumes yearly mobs and demobs of the clamshell dredge. It is possible to have multiple mob/demobs in a single year depending on how the contract is broken out.	Marginal	Possible	1
EST-3	Approach Channel Dredging (Hopper)	Quantities variations	Since the design is at the feasibility stage, quantities variations are possible having a marginal impact on the cost and schedule.	Marginal	Possible	1
EST-4	West Basin Dredging (Clam)	Possibility of a different type of dredge bidding the job	Estimate assumes one clamshell bucket dredge, but equipment is not restrictive within the contract. Selected clamshell size and number can affect estimated cost and productivity. The potential that a pipeline dredge is used in lieu of the clamshell dredge is unlikely since scows would be required due to the long hauling distance (LA2 or LA3). Overflow is not allowed due to environmental limitations.	Marginal	Unlikely	0
EST-5	Pier J Dredging (Clam)	Possibility of a different type of dredge bidding the job	Estimate assumes one clamshell bucket dredge, but equipment is not restrictive within the contract. Selected clamshell size and number can affect the cost and productivity. The potential that a pipeline dredge is used in lieu of the estimated clamshell is highly unlikely due to the disposal site distance.	Marginal	Unlikely	0
EST-6	Main Channel Widening Dredging (Clam)	Possibility of a different type of dredge bidding the job Possible harder than expected dredging	Estimate assumes one clamshell bucket dredge, but equipment is not restrictive within the contract. Selected clamshell size and number can affect estimated cost and productivity. The potential that a pipeline dredge is used in lieu of the clamshell dredge is unlikely since scows would be required due to the long hauling distance (LA2 or LA3). Overflow is not allowed due to environmental limitations. Possible harder than expected dredging especially at main channel, where there is not yet any geotech investigation and we are going to depths not done before at PoLB. Seems like this is at least a marginal risk considering the last time we dredged the main channel there was a claim for hard material.	Marginal	Possible	1
EST-7	Stand-By Area Dredging (Clam)	Possibility of a different type of dredge bidding the job	Estimate assumes one clamshell bucket dredge, but equipment is not restrictive within the contract. Selected clamshell size and number can affect estimated cost and productivity. The potential that a pipeline dredge is used in lieu of the clamshell dredge is unlikely since scows would be required due to the long hauling distance (LA2 or LA3). Overflow is not allowed due to environmental limitations.	Marginal	Unlikely	0
EST-8	Pier J Breakwater Stabilization	Pier J Breakwater Bulkhead Wall design is at the feasibility stage.	Uncertainty on the level of cost confidence based on the current design stage may impact the Pier J Breakwater Bulkhead Wall cost item.	Moderate	Very LIKELY	4
EST-9	Electric Substation Near Berth J 260	Electric Substation estimate is at the early stage	Uncetainty on the level of cost confidence based on the current design stage may impact the Electric Substation cost item.	Moderate	Very LIKELY	4
EST-13	Planning, Engineering, & Design	Calculated as percentage of construction cost	Common percentages used for type of work, but subject to change. 30 account costs can vary greatly.	Moderate	Likely	3
EST-14	Construction Management	Calculated as percentage of construction cost	Common percentages used for type of work, but subject to change. 31 account costs typically close to estimated percentage, but mary vary more for larger project.	Marginal	Possible	1
External Project Risks					**Maximum Project Growth**	**40%**
EX-1	Hopper Mob/Demob	Market Conditions	Large dredging projects requiring hopper dredges have always being handled by a limited pool of contractors. For open ocean dredge projects, bidding climate has historically been limited to a small circle of contractors and it is not expected to change. Lack of competition may have a moderate impact on the construction cost.	Moderate	Likely	3

EX-2	Clamshell Mob/Demob	Market Conditions	Lack of competition may have an impact on costs.	Marginal	Likely	**2**
EX-3	Approach Channel Dredging (Hopper)	Unanticipated fuel inflation, Encountering Green Sea Turtles and marine mammals	Hopper dredges are sensitive to fuel price fluctuations. Fluctuations in fuel prices will affect dredging unit cost. Our current position is that green sea turtles are not present in San Pedro Bay. Green sea turtles are an endangered species under the federal Endangered Species Act (ESA). Absence from the study area would result in a no effect determination made by the Corps that does not require consultation with the National Marine Fisheries Service (NMFS). The risk involves encountering green sea turtles in San Pedro Bay project area. Presence of green sea turtles would trigger consultation with the NMFS under the ESA. This could add delays to complete the study as well as possible monitoring and protective measures for dredging and placement activities that would add costs and schedule delays during construction. This risk would carry a marginal cost and schedule impact with low possibility of occurrence. NMFS is requiring the Port to perform approximately two years of sea turtle monitoring. This study will determine green sea turtles actually occur within the Harbor District. Currently, they are known to occur in nearby rivers, but not within the Port Complex itself. With that said, we do not believe this will be an issue for the project. Marine mammals may impact the work. Work may need to stop intermittently	Marginal	Possible	**1**
EX-4	West Basin Dredging (Clam)	Bidding environment, Weather, Encountering Green Sea Turtles and Marine Mammals	Amount of bidders in a competitively bid contract will affect price. Weather will affect construction schedule. Assume these risks are possible and have a marginal effect on cost. Our current position is that green sea turtles are not present in San Pedro Bay. Green sea turtles are an endangered species under the federal Endangered Species Act (ESA). Absence from the study area would result in a no effect determination made by the Corps that does not require consultation with the National Marine Fisheries Service (NMFS). The risk involves encountering green sea turtles in San Pedro Bay project area. Presence of green sea turtles would trigger consultation with the NMFS under the ESA. This could add delays to complete the study as well as possible monitoring and protective measures for dredging and placement activities that would add costs and schedule delays during construction. This risk would carry a marginal cost and schedule impact with low possibility of occurrence. NMFS is requiring the Port to perform approximately two years of sea turtle monitoring. This study will determine green sea turtles actually occur within the Harbor District. Currently, they are known to occur in nearby rivers, but not within the Port Complex itself. With that said, we do not believe this will be an issue for the project. Marine mammals may impact the work. Work may need to stop intermittently	Marginal	Possible	**1**
EX-5	Pier J Dredging (Clam)	Bidding environment, Weather, Encountering Green Sea Turtles and Marine Mammals	Amount of bidders in a competitively bid contract will affect price. Weather will affect construction schedule. Assume these risks are possible and have a marginal effect on cost. Our current position is that green sea turtles are not present in San Pedro Bay. Green sea turtles are an endangered species under the federal Endangered Species Act (ESA). Absence from the study area would result in a no effect determination made by the Corps that does not require consultation with the National Marine Fisheries Service (NMFS). The risk involves encountering green sea turtles in San Pedro Bay project area. Presence of green sea turtles would trigger consultation with the NMFS under the ESA. This could add delays to complete the study as well as possible monitoring and protective measures for dredging and placement activities that would add costs and schedule delays during construction. This risk would carry a marginal cost and schedule impact with low possibility of occurrence. NMFS is requiring the Port to perform approximately two years of sea turtle monitoring. This study will determine green sea turtles actually occur within the Harbor District. Currently, they are known to occur in nearby rivers, but not within the Port Complex itself. With that said, we do not believe this will be an issue for the project. Marine mammals may impact the work. Work may need to stop intermittently	Marginal	Possible	**1**

EX-6	Main Channel Widening Dredging (Clam)	Bidding environment, Weather, Encountering Green Sea Turtles and Marine Mammals	Amount of bidders in a competitively bid contract will affect price. Weather will affect construction schedule. Assume these risks are possible and have a marginal effect on cost. Our current position is that green sea turtles are not present in San Pedro Bay. Green sea turtles are an endangered species under the federal Endangered Species Act (ESA). Absence from the study area would result in a no effect determination made by the Corps that does not require consultation with the National Marine Fisheries Service (NMFS). The risk involves encountering green sea turtles in San Pedro Bay project area. Presence of green sea turtles would trigger consultation with the NMFS under the ESA. This could add delays to complete the study as well as possible monitoring and protective measures for dredging and placement activities that would add costs and schedule delays during construction. This risk would carry a marginal cost and schedule impact with low possibility of occurrence. NMFS is requiring the Port to perform approximately two years of sea turtle monitoring. This study will determine green sea turtles actually occur within the Harbor District. Currently, they are known to occur in nearby rivers, but not within the Port Complex itself. With that said, we do not believe this will be an issue for the project. Marine mammals may impact the work. Work may need to stop intermittently	Marginal	Possible	1
EX-7	Stand-By Area Dredging (Clam)	Bidding environment, weather, Encountering White Abalone, Encountering Marine Mammals	Amount of bidders in a competitively bid contract will affect price. Weather will affect construction schedule. Assume these risks are likely and have a marginal effect on cost. NMFS is requiring the Port to perform approximately two years of sea turtle monitoring. This study will determine green sea turtles actually occur within the Harbor District. Currently, they are known to occur in nearby rivers, but not within the Port Complex itself. With that said, we do not believe this will be an issue for the project. Marine mammals may impact the work. Work may need to stop intermittently	Marginal	Possible	1
EX-8	Pier J Breakwater Stabilization	Bidding environment, weather, Encountering White Abalone, Encountering Marine Mammals	Amount of bidders in a competitively bid contract will affect price. Weather will affect construction schedule. Assume these risks are likely and have a marginal effect on cost. Marine mammals may impact the work. Work may need to stop intermittently.	Marginal	Possible	1
EX-9	Electric Substation Near Berth J 260	Bidding environment, weather	Amount of bidders in a competitively bid contract will affect price. Weather will affect construction schedule. Assume these risks are likely and have a negligible effect on cost.	Negligible	Likely	1
EX-13	Planning, Engineering, & Design	Political factors or funding availability lengthening the project	The longer it takes to get to construction, the more it will cost to prepare economic updates. Environmental documents may need to updated.	Negligible	Possible	0
EX-14	Construction Management	Lack of personnel	Lack of personnel will have a moderate impact on the project.	Negligible	Likely	1

6.4.3 Construction Schedule

ID	Task Mode	Task Name	Duration	Start	Finish
1		**Construction Schedule**	**1243 days**	**Tue 10/1/24**	**Fri 2/25/28**
2		Alternative 3	1243 days	Tue 10/1/24	Fri 2/25/28
3		**Preconstruction Phase**	**67 days**	**Tue 10/1/24**	**Fri 12/6/24**
4		Construction Contract Award	5 days	Tue 10/1/24	Mon 10/7/24
5		Notice to Proceed	0 days	Mon 10/7/24	Mon 10/7/24
6		Generate Contractor Submittals	30 edays	Mon 10/7/24	Wed 11/6/24
7		Review/Approve Submittals	30 edays	Wed 11/6/24	Fri 12/6/24
8		**Construction Phase**	**1162 days**	**Sat 12/7/24**	**Fri 2/11/28**
9		**Hopper Dredging**	**191 days**	**Sat 12/7/24**	**Sun 6/15/25**
10		Mobilization	5 days	Sat 12/7/24	Wed 12/11/24
11		Approach Channel Dredging - Nearshore Disposal	143 days	Wed 1/1/25	Mon 6/2/25
12		Approach Channel Dredging - LA2 Disposal	7 days	Wed 6/4/25	Tue 6/10/25
13		Demobilization	5 days	Wed 6/11/25	Sun 6/15/25
14		**Clamshell Dredging**	**1162 days**	**Sat 12/7/24**	**Fri 2/11/28**
15		Mobilization	8 days	Sat 12/7/24	Sat 12/14/24
16		Main Channel Widening - LA2 Disposal	133 days	Wed 1/1/25	Fri 5/23/25
17		Main Channel Widening - LA3 Disposal	44 days	Sat 5/24/25	Wed 7/9/25
18		West Basin - LA3 Disposal	120 days	Thu 7/10/25	Fri 11/14/25
19		Pier J Basin - LA3 Disposal	43 days	Sat 11/15/25	Wed 12/31/25
20		Pier J Basin 2nd Year - LA2 Disposal	8 days	Thu 1/1/26	Fri 1/9/26
21		Pier J Approach 2nd Year - LA2 Disposal	142 days	Sat 1/10/26	Wed 6/10/26
22		Pier J Approach 2nd Year - LA3 Disposal	190 days	Thu 6/11/26	Thu 12/31/26
23		Pier J Approach 3rd Year - LA2 Disposal	93 days	Fri 1/1/27	Sat 4/10/27
24		Standby Area 3rd Year - LA2 Disposal	57 days	Sun 4/11/27	Thu 6/10/27
25		Standby Area 3rd Year - LA3 Disposal	190 days	Fri 6/11/27	Fri 12/31/27
26		Special Portion Standby Area 4th Year - LA2 Disposal	34 days	Sat 1/1/28	Sun 2/6/28
27		Demobilization	5 days	Mon 2/7/28	Fri 2/11/28
28		Contract Closeout	14 edays	Fri 2/11/28	Fri 2/25/28



Project: POLB Deepening_Alt 3-
Date: Thu 7/18/19

Task
Split
Milestone
Summary
Project Summary
Inactive Task
Inactive Milestone
Inactive Summary
Manual Task
Duration-only
Manual Summary Rollup
Manual Summary
Start-only
Finish-only
External Tasks
External Milestone
Deadline
Progress
Manual Progress

7 MAPS

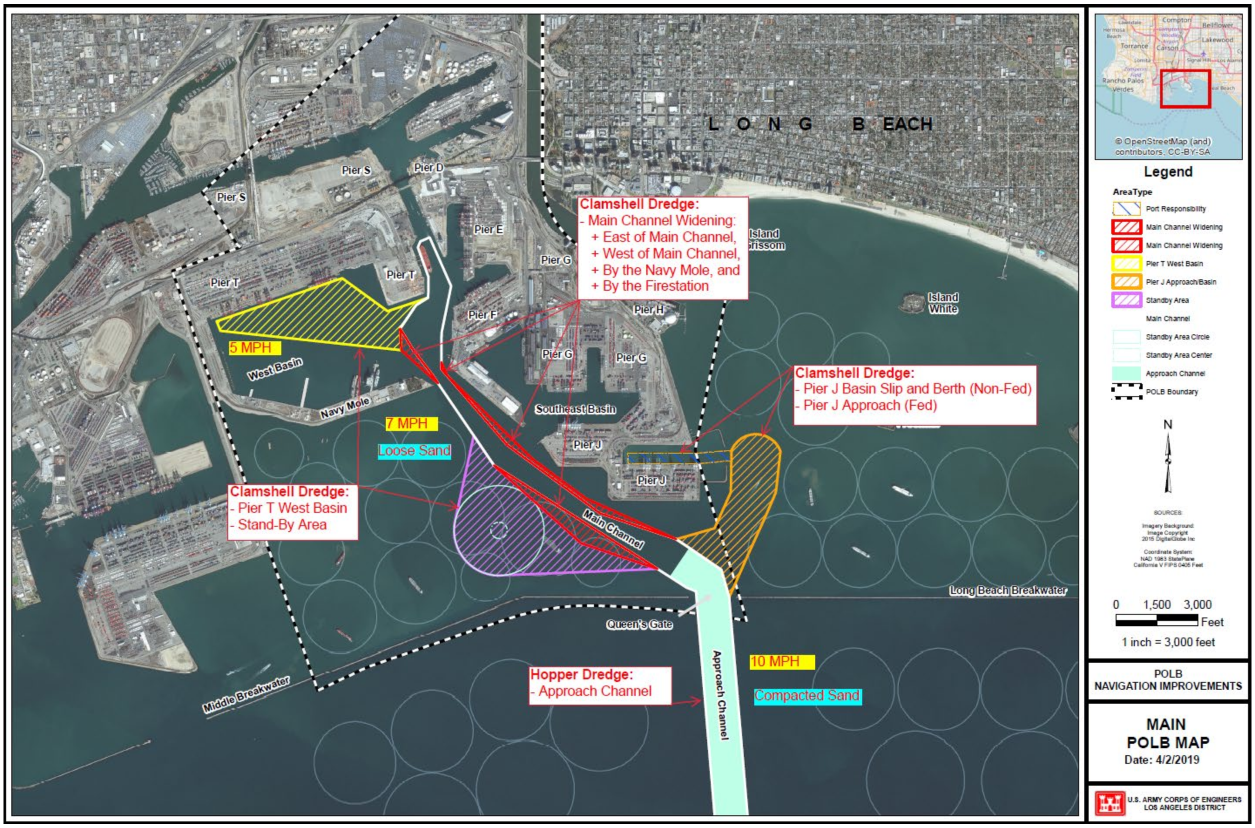


Figure 7-1 Port of Long Beach Study Map

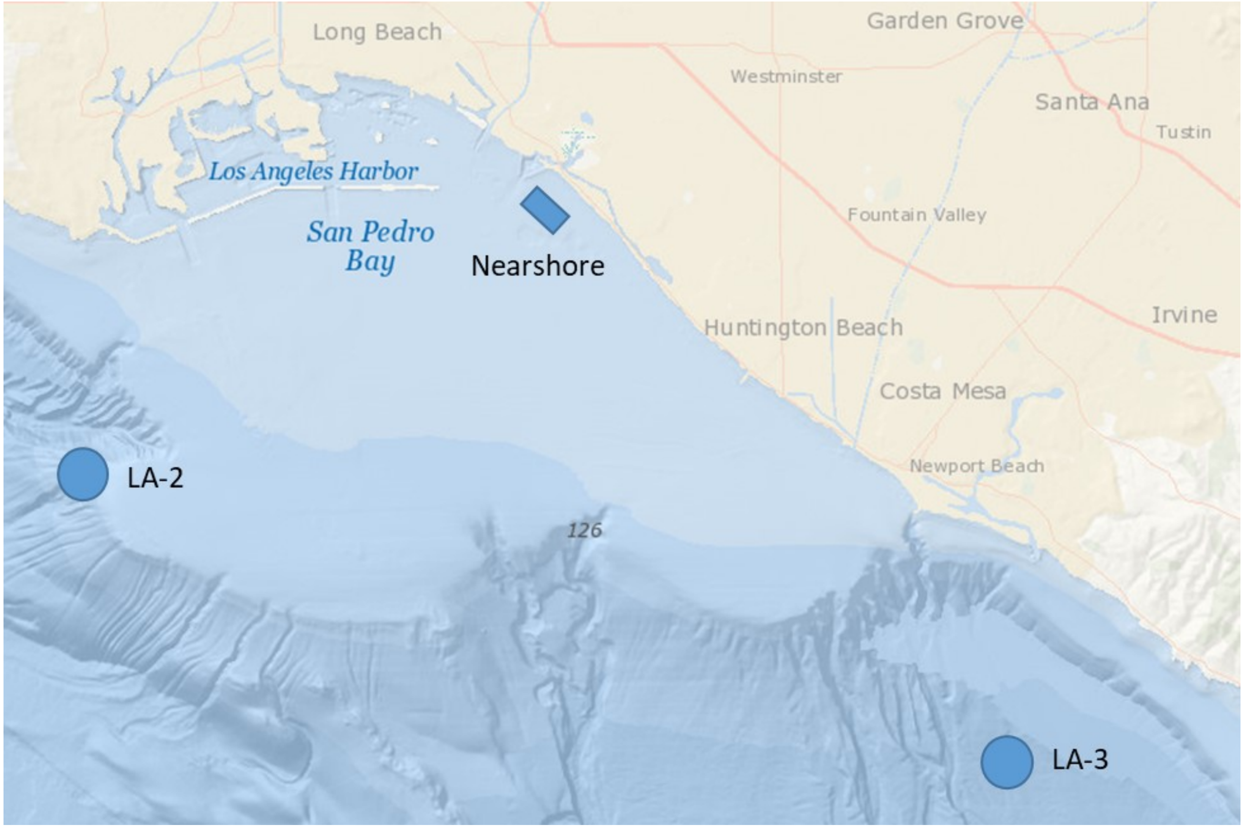


Figure 7-2 Potential Material Placement Sites

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DRAFT INTEGRATED FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT STATEMENT / ENVIRONMENTAL IMPACT REPORT (EIS/EIR)

APPENDIX G: REAL ESTATE

PORT OF LONG BEACH
DEEP DRAFT NAVIGATION STUDY
Los Angeles County, California

October 2019

US Army Corps of Engineers®

Port of LONG BEACH
The Green Port

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1 STATEMENT OF PURPOSE

This Real Estate Plan (REP) is prepared in accordance with the Real Estate Handbook, ER 405- 1-12. The purpose of this REP is provide data on lands, easements, relocations, rights-of-way and disposal areas (LERRD) requirements necessary to support the Port of Long Beach Deep Draft Navigation Study in determining if feasible alternatives exist to reduce transportation inefficiencies and improve navigation safety at the Port of Long Beach. The non-Federal sponsor (NFS) for the study is the Port of Long Beach (Port). The NFS shall be responsible for providing all of the LERRD for the proposed project.

2 STUDY AUTHORITY

This report serves as an interim response to the Resolution of the House Committee on Public Works adopted 10 July 1968 that reads as follows:

"That the Board of Engineers for Rivers and Harbors is hereby requested to review the reports on the Los Angeles and Long Beach Harbors, California, heretofore submitted to the Congress with a view to promoting and encouraging the efficient, economic, and logical development of the harbor complex. The scope will encompass investigation of current shipping problems, adequacy of facilities, delays in intermodal transfers, channel dimensions, storage locations, and capacities, and other physical aspects affecting waterborne commerce in the San Pedro Bay region, including the conduct of model studies as necessary to establish an efficient layout of the port complex and the design of navigation facilities."

3 PROJECT LOCATION

The Port of Long Beach encompasses the eastern part of the San Pedro Bay, located in the southwestern portion of the city of Long Beach, in southern Los Angeles County, approximately 20 miles south of downtown Los Angeles. The study area includes the waters in the immediate vicinity (and shoreward) of the breakwaters through the entire port, including Outer Harbor, Inner Harbor, Cerritos Channel, West Basin, and the Back Channel. Regional access to the project site is provided by the Long Beach Freeway (Interstate 710). **Figure 3-1** provides a map of the Los Angeles region in which the Project site is located.

Figure 3-1 Location Map

The Port of Los Angeles is adjacent to the Port of Long Beach. The Los Angeles and Long Beach harbor complex consists of about 1,800 acres of water in the inner navigation channels, 5,700 acres of landfill, and 6,000 acres of water sheltered anchorages and navigation channels between the landfills and the nine miles of federally constructed and maintained breakwaters (see **Figure 3-2**).

Figure 3-2 Study Area Location Map and Current Federal Project

4 PROJECT DESCRIPTION

The Tentatively Selected Plan includes a combination of measures for container vessels (constructing the Pier J Approach Channel and Turning Basin and deepening the West Basin Channel to a new depth of -55 ft MLLW) and liquid bulk vessels (deepening the Approach Channel to -80 ft MLLW, and bend easing in portions of the Main Channel to match the currently authorized depth in the Main Channel of -76 ft MLLW) provides the greatest contribution to net benefits and has been determined as the National Economic Development (NED) Plan. When combined with the Local Service Facilities, the NED Plan has also been identified as the Tentatively Selected Plan (TSP).

General Navigation Features of the TSP for liquid bulk vessels includes:

- deepening the Approach Channel to -80 ft MLLW; and
- bend easing within portions of the Main Channel to -76 ft MLLW.

General Navigation Features of the TSP for container ships includes:

- constructing an approach channel to Pier J South to -55 ft MLLW;
- constructing a turning basin outside of Pier J South; and
- deepening the West Basin to -55 ft MLLW.

Approximately 7.1 mcy of dredged material would be placed in a nearshore site as well as 2 EPA-designated offshore disposal sites for the General Navigation Features. **Figure 4-1** shows the location of the General Navigation Features. To support dredging at the Pier J berth, the approach channel and turning basin, a new dredge electric substation is required to be constructed. This is necessary to mitigate for air quality impacts.

Local Service Facilities includes berth dredging within the Pier J South Slip and berth T140 along Pier T to -55 feet MLLW. Approximately 304 kcy of dredged material would be placed in a nearshore site as well as 2 EPA-designated offshore disposal sites for the Local Service Facilities.

Figure 4-1 Potential Project Features in Final Array of Alternatives

5 NON-FEDERAL SPONSOR OWNED LANDS

The NFS owns several parcels totaling approximately 2,900 acres within and around the proposed project footprint as depicted in **Figure 5-1**. This includes the 12 acres staging area for the project and Pier J which will be the site for the construction of a new electrical substation.

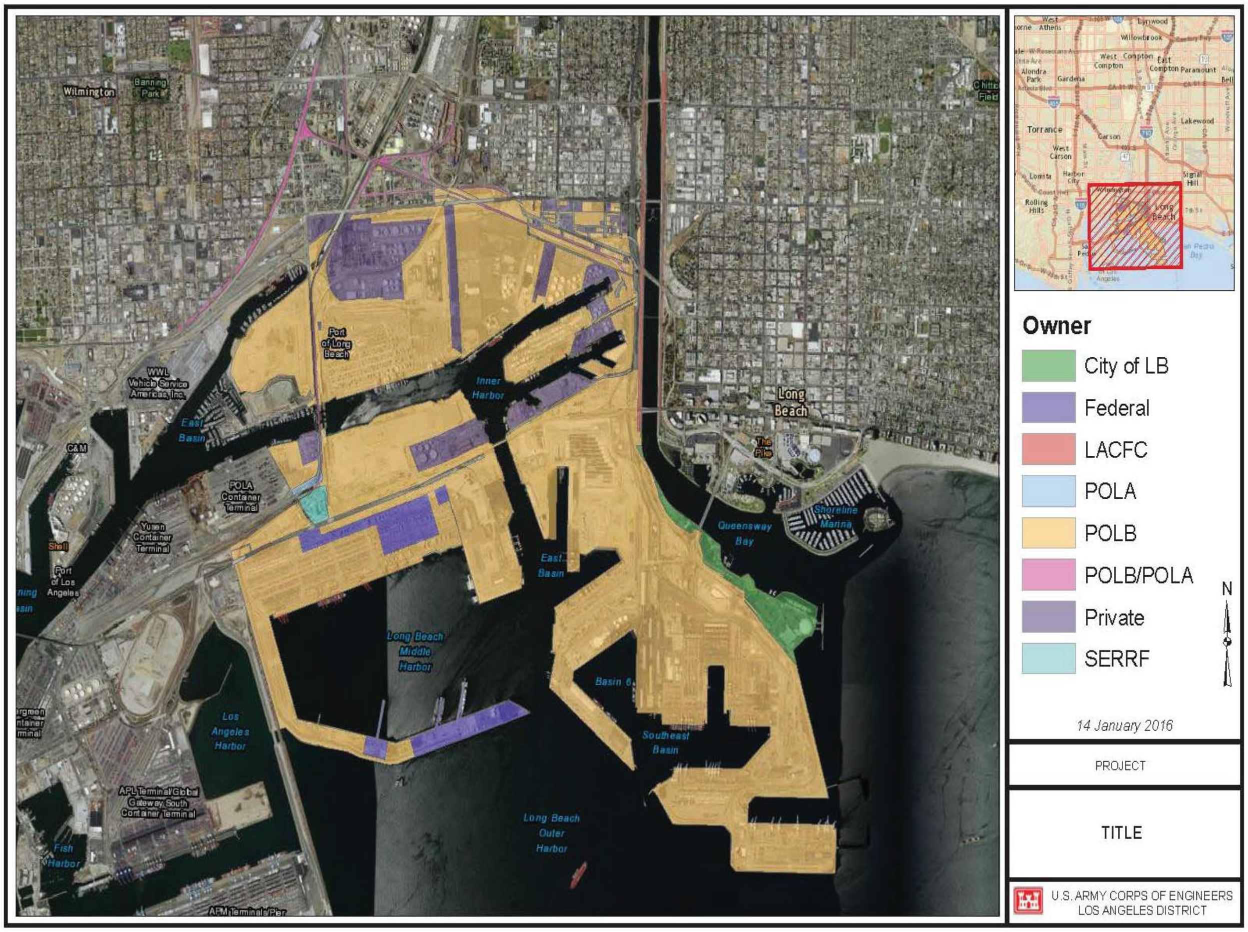


Figure 5-1 Proposed Project Area Parcel Ownership Map

6 EXISTING FEDERAL PROJECTS

Los Angeles and Long Beach Harbors are authorized by the 1896 River and Harbor Act and subsequent River and Harbor Acts. There are 3 breakwaters: San Pedro Breakwater is 11,150 ft long, Middle Breakwater is 18,500 ft long and the Long Beach Breakwater is 13,350 ft long. The Long Beach Harbor portion of the project (see **Figure 3-2**) includes the Approach Channel through Queens Gate that is about 15,800 ft long, 1200-1300 ft wide and has a depth of 76 ft below Mean Lower Low Water (MLLW). The Main Channel is about 16,700 ft long, with a varying width between 400-1400 ft and an authorized depth of 76 ft below MLLW.

Lastly, the Port of Long Beach was the former site of the Long Beach Naval Shipyard which was opened in 1943 and served as the homeport for several auxiliary ships throughout the years. Its later role was to overhaul and maintain conventionally-powered US Navy surface ships. Then Long Beach Naval Shipyard closed in 1997 and land was transferred to the Port of Long Beach.

7 FEDERALLY GOVERNMENT OWNED LANDS

The Federal government owns five parcels of land within the proposed project footprint as shown in **Figure 7-1** (see items A-E). These are remnants of the former Long Beach Navel Ship Yard and total approximately 126 acres. None of these parcels will be needed for the project.

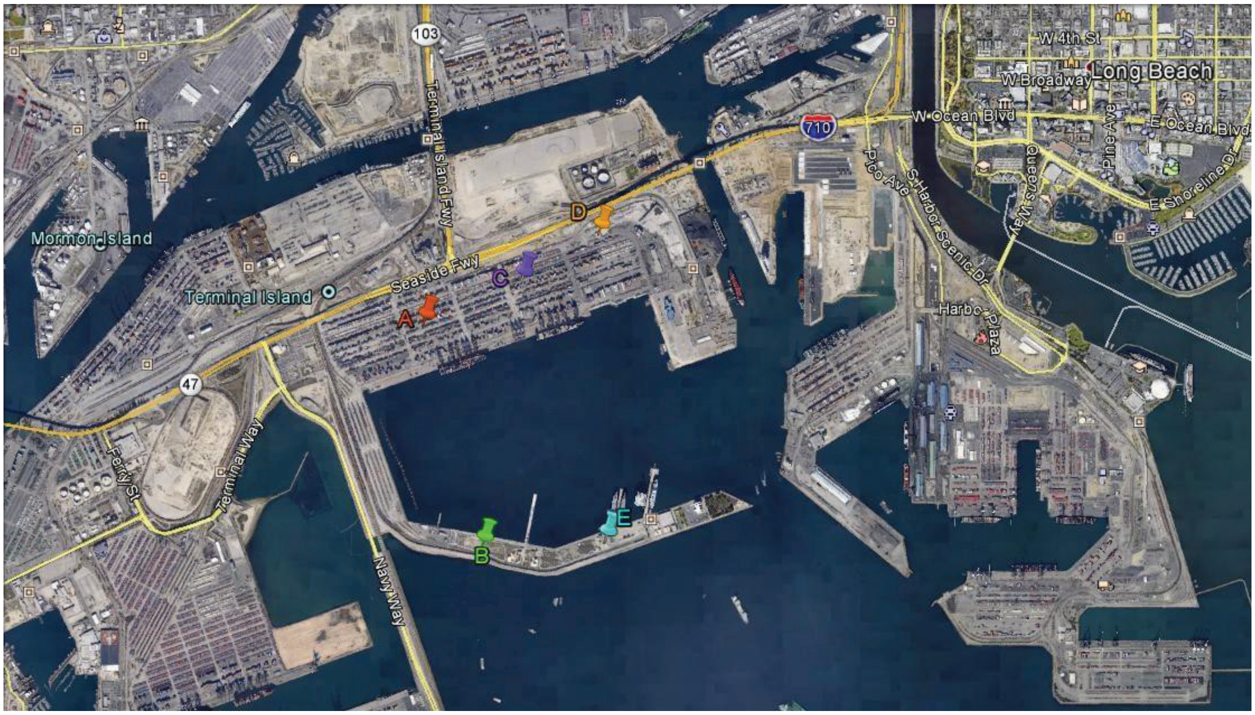


Figure 7-1 Federally Government Owned Lands

8 ESTATES

The Standard Estate for staging areas is a temporary work area easement. Since the proposed staging area is already owned in fee by the NFS, the staging area will be made available for the project. Should another staging area be required for the project under different ownership a temporary work area easement will be acquired.

The temporary work area easement will also be used for the one time deposition sites to place dredged material near shore.

TEMPORARY WORK AREA EASEMENT.

A temporary easement and right-of-way in, on, over and across (the land described in Schedule A) (Tracts Nos. _____, _____ and _____), for a period not to exceed ___________________, beginning with date possession of the land is granted to the United States, for use by the United States, its representatives, agents, and contractors as a (borrow area) (work area), including the right to (borrow and/or deposit fill, spoil and waste material thereon) (move, store and remove equipment and supplies, and erect and remove temporary structures on the land and to perform any other work necessary and incident to the construction of the ____________________ Project, together with the right to trim, cut, fell and remove therefrom all trees, underbrush, obstructions, and any other vegetation, structures, or obstacles within the limits of the right-of-way; reserving, however, to the landowners, their heirs and assigns, all such rights and privileges as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

9 REAL ESTATE REQUIREMENTS

The requirements for Lands, Easements, Rights-of-Way, Relocations and Disposal Areas (LERRD) are necessary to support construction, operation and maintenance for the proposed project. It is the responsibility of the NFS to acquire real estate interest required for the project. No real estate acquisition is required for the deepening/widening for any of the proposed alternatives which will entail 100% in-water construction. All dredging for the proposed project will be below Mean High Water (MHW) and are within the navigable waters of the United States and are available to the Federal government by navigation servitude.

The proposed placement areas have been identified as follows:

1. EPA Deep Ocean Placement sites at LA-2 and LA-3: LA-2 is located 9 miles southwest of Queens Gate – maximum cumulative allowable placement per calendar year from all sources= 1 million cubic yards. LA-3 is located 22 miles southeast of Queens Gate – maximum cumulative allowable placement per calendar year from all sources = 2.5 million cubic yards.
2. Orange County Surfside-Sunset Borrow Sites: Various sites off of Surfside-Sunset Beach have been used as sources of sand for the San Gabriel River to Newport Bay Beach Nourishment project since 1964. It is estimated that approximately 2.5 million cubic yards of capacity is available for placement of material into these sites.

There are three proposed staging areas: Pier T Echo (4.4 acres), Pier S (3.3 acres) and Pier D (1 acre) (shown in **Figure 9-2** in blue**)**. The NFS has fee ownership of the proposed staging area shown in Figure 6. If access to the proposed project and staging area will be by public roads and the NFS-owned lands are within the proposed project area, a Temporary Work Area Easement will not be required.

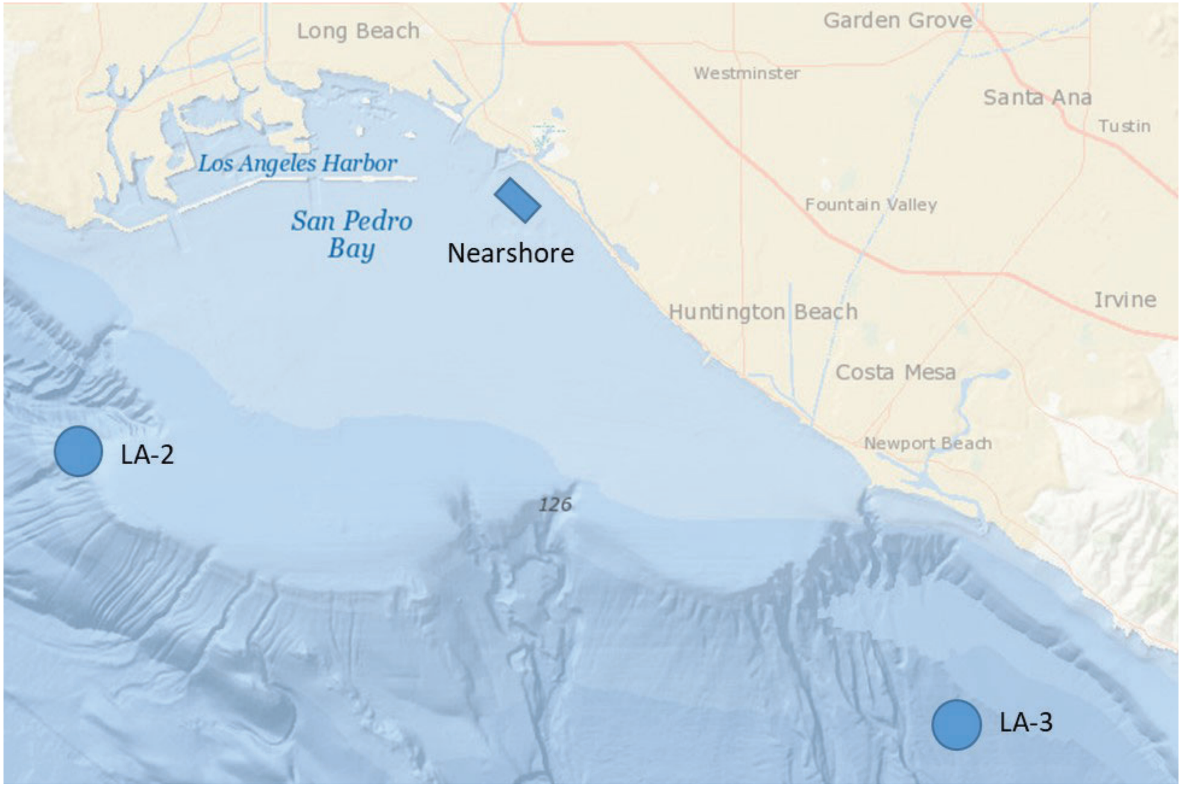
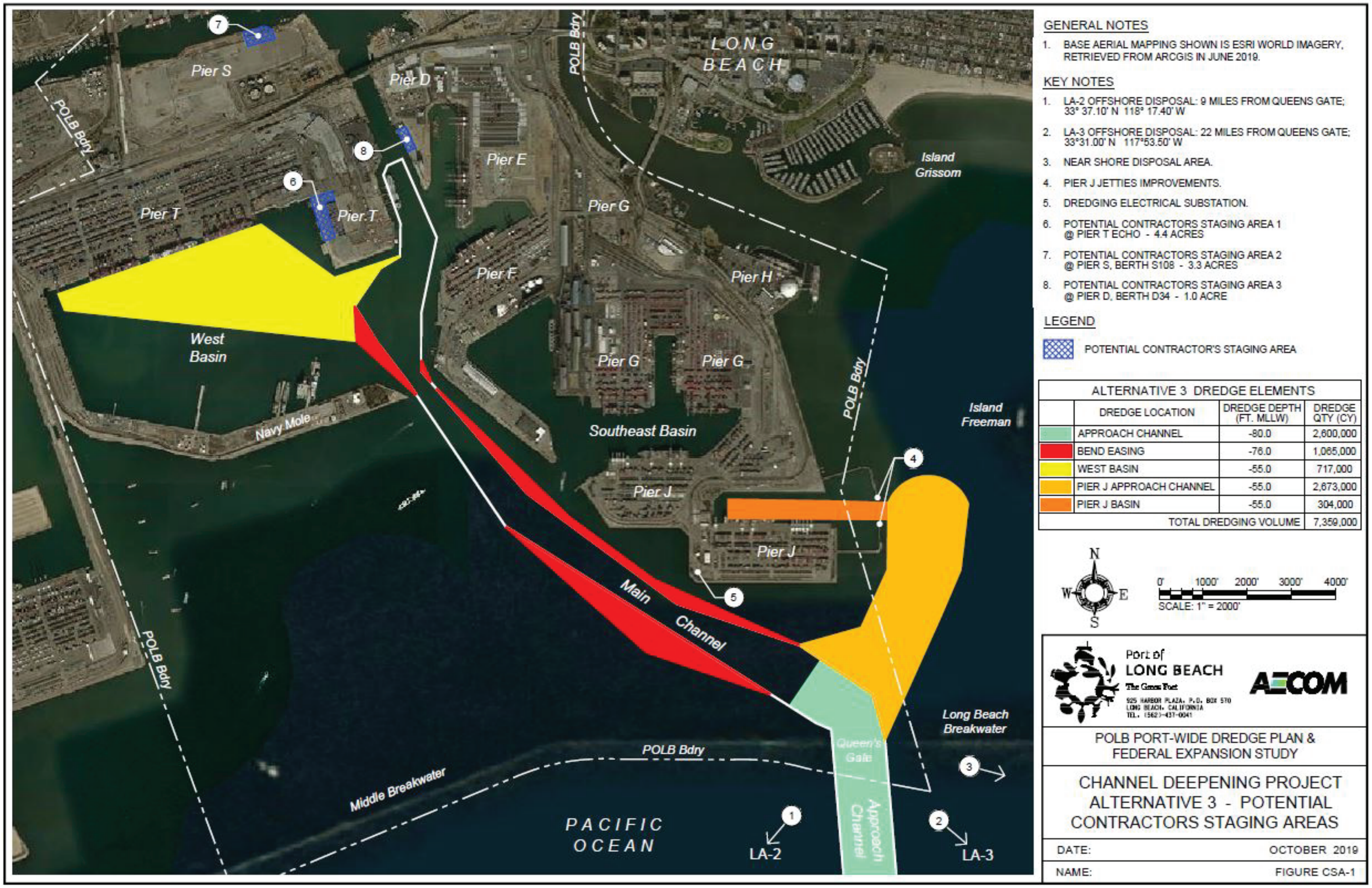


Figure 9-1 Proposed Placement Areas



ALTERNATIVE 3 DREDGE ELEMENTS			
	DREDGE LOCATION	DREDGE DEPTH (FT. MLLW)	DREDGE QTY (CY)
	APPROACH CHANNEL	-80.0	2,600,000
	BEND EASING	-76.0	1,065,000
	WEST BASIN	-55.0	717,000
	PIER J APPROACH CHANNEL	-55.0	2,673,000
	PIER J BASIN	-55.0	304,000
		TOTAL DREDGING VOLUME	7,359,000

Figure 9-2 Proposed Staging Area

10 NAVIGATION SERVITUDE

All deepening/widening for the proposed project will be below Mean High Water (MHW) and are within the navigable waters of the United States and are available to the Federal government by navigation servitude.

11 INDUCED FLOODING

There will be no flooding caused by the proposed project.

12 PUBLIC LAW 91-646, RELOCATION ASSISTANCE BENEFITS

Preliminary investigations indicate that there will be no persons, farms or businesses displaced during the acquisition of lands required for any of the proposed alternatives. If necessary, the sponsor will be required to certify compliance with the requirements of PL 91-646, including landowners being properly advised of their rights under the program and appropriate benefit determinations, if any.

13 MINERAL INTEREST

There are no known outstanding mineral interests or active mining operations in the project area that may affect implementation of the project.

14 BASELINE COST ESTIMATE FOR REAL ESTATE

Table 14-1 Baseline Cost Estimate

Baseline Cost for Real Estate			
	Federal	**Non-Federal**	**Totals**
a. Land and Improvements/Permits			
Temp Work Easement			
Staging Area Appraisal by NFS			
Additional Utility Station			
b. P.L. 91-646 Relocations		$0.00	
c. Administrative Cost			
Acquisitions by NFS		$15,000.00	
District Review of LERRD Crediting	$15,000.00		
Federal			
Non-Federal			
Contingencies (25%)			
		Total	**$30,000**

15 ASSESSMENT OF NON-FEDERAL SPONSOR'S ACQUISITION CAPABILITY

The Non-Federal Sponsor Real Estate Acquisition Assessment Form was sent to the NFS on December 5, 2016.

16 ZONING ORDINANCE

No enactments of zoning ordinances are being proposed in lieu of or to facilitate acquisition in connection with the project.

17 ACQUISITION SCHEDULE

The NFS is responsible for acquiring any real estate interests required for the proposed project. The NFS is the fee owner of the proposed staging area and the site where the electrical substation will be constructed. They will make the lands available for the project when provided the acquisition letter for the project. The NFS will also commence securing sites identified for placement of dredged materials 18 months prior to year 1 of dredging.

18 FACILITY/UTILITY RELOCATION

There are no relocations of utilities or facilities anticipated for the proposed project.

19 HAZARDOUS, TOXIC OR RADIOLOGICAL WASTE (HTRW)

There are no known HTRW in the proposed project area.

20 SPONSOR RISK NOTIFICATION

The Early Risk of Acquisition Letter to the NFS was sent on December 7, 2016 (see Exhibit A)

Signature Page

Prepared By:

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Lisa Sandoval

Reviewed By:

CONNETT.CHERYL.L.1231861358 Digitally signed by CONNETT.CHERYL.L.1231861358 Date: 2019.10.17 17:15:13 -07'00'

Cheryl L. Connett
Chief, Real Estate Division

EXHIBIT A – Early Risk of Acquisition Letter to Sponsor

DEPARTMENT OF THE ARMY
LOS ANGELES DISTRICT, U.S. ARMY CORPS OF ENGINEERS
915 WILSHIRE BOULEVARD, SUITE 930
LOS ANGELES, CALIFORNIA 90017

December 7, 2016

Office of Chief
Asset Management Division

Subject: Port of Long Beach Deep Draft Navigation Study

Mr. Duane L. Kenagy, P.E.
Interim Chief Executive Officer
Port of Long Beach
925 Harbor Plaza
Long Beach, California 90802

Dear Mr. Kenagy:

The intent of this letter is to formally advise the Port of Long Beach, as the potential non-Federal sponsor (NFS) for the proposed Port of Long Beach Deep Draft Navigation Study, of the risks associated with land acquisition prior to the execution of the Project Partnership Agreement (PPA) or prior to the Government's formal notice to proceed with acquisition. If a NFS deems it necessary to commence acquisition prior to an executed PPA for whatever reason, the NFS assumes full and sole responsibility for any and all cost, responsibility, or liability arising out of the acquisition effort. Generally, these risks include, but may not be limited to, the following:

1. Congress may not appropriate funds to construct the proposed project;

2. The proposed project may otherwise not be funded or approved for construction;

3. A PPA mutually agreeable to the non-Federal sponsor and the Government, may not be executed and implemented;

4. The non-Federal sponsor may incur liability and expense by virtue of its ownership of contaminated lands, or interests therein, whether such liability should arise out of local, state, or Federal laws or regulations including liability arising out of CERCLA as mentioned;

5. The non-Federal sponsor may acquire interests or estates that are later determined by the Government to be inappropriate, insufficient, or otherwise not required for the project;

6. The non-Federal sponsor may incur costs or expenses in connection with its decision to acquire or perform LERRD (lands, easements, rights-of-way, relocations, disposal areas) activities in advance of the executed PPA and the Government's notice to proceed which might not be creditable under the

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provisions of Public Law 99-662 or the PPA; and the non-Federal sponsor may initially acquire insufficient or excessive real property acreage which may result in additional negotiations and/or benefit payments under P.L. 91-646 as well as the payment of additional fair market value to affected landowners which could have been avoided by delaying acquisition until after PPA execution and the Government's notice to commence acquisition and performance of LERRD.

If you have any questions please contact Vicki Stephens-Allen at (213) 452-3398 or via email at vicki.k.stephens-allen@usace.army.mil.

Sincerely,

Cheryl L. Connett
Chief, Asset Management Division
Real Estate Contracting Officer