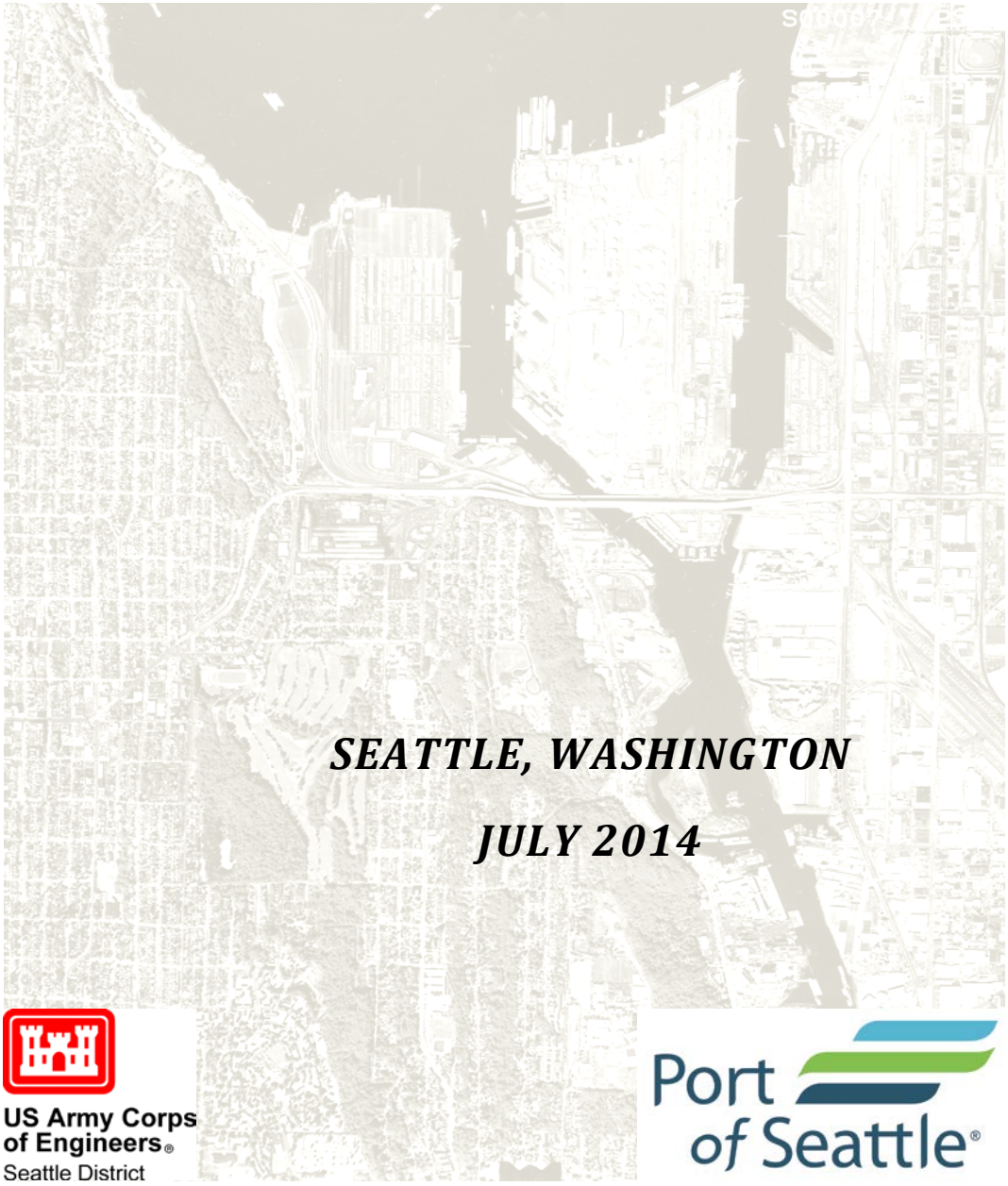
SECTION 905(b) ANALYSIS
SEATTLE HARBOR, WASHINGTON
NAVIGATION IMPROVEMENT PROJECT



SEATTLE, WASHINGTON

JULY 2014

US Army Corps of Engineers®
Seattle District

Port of Seattle®

This page intentionally left blank.

Table of Contents

List of Figures ii

List of Tables ii

1 Study Authority 1

2 Study Purpose 1

3 Recommendation / Finding of Federal Interest 1

4 Study Area 2

5 Summary of Applicable Prior Studies, Reports, and Existing Water Projects 5

6 Existing and Future Without-Project Conditions 6

6.1 Project Area Conditions: History and Overview 7

6.2 Project Area Conditions: Existing Conditions 11

6.2.1 Project Area Conditions: Coastal Hydraulics 11

6.2.2 Project Area Conditions: Economics 15

6.3 Project Area Conditions: Future 20

6.4 Fish and Wildlife Resources 23

6.5 Historical and Cultural Resources 24

6.6 Tribal Considerations 25

6.7 Environmental (Hazardous, Toxic, and Radioactive Waste & Superfund) Conditions 25

7 Problems and Opportunities 29

8 Planning Goals and Objectives 30

9 Planning Constraints 31

10 Plan Formulation 31

10.1 Management Measures 31

10.2 Array of Alternatives 32

11 Evaluation of Alternatives 34

11.1 Benefits of Alternatives 35

11.2 Costs of Alternatives 36

11.3 Fish and Wildlife Resources Considerations 37

11.4 Historical and Cultural Resources Considerations 39

11.5 Tribal Considerations 39

11.6 Economic Considerations 39

11.7 Real Estate Considerations 40
12 Key Feasibility Study Assumptions and Associated Uncertainties 40
12.1 Fish and Wildlife Resources Considerations 40
12.2 Historical and Cultural Resources Considerations 41
12.3 Tribal Considerations 41
12.4 HTRW and Dredged Material Disposal Considerations 42
12.5 Coordination with Federal and State Resource Agencies and Federally Recognized Tribes 43
13 Feasibility Phase Cost Estimate and Schedule 43
14 Letter of Intent 44
15 Recommendation 44

List of Figures

Figure 4-1. Federally Authorized Navigation Channel (East, West, and Duwamish Waterways). 3
Figure 6-1. Seattle Harbor Vicinity Map and Nearby Terminals. 7
Figure 6-2. Panamax, Post-Panamax, and New Post-Panamax Vessel Sizes. 9
Figure 6-3. Vessel Sizes. 10
Figure 6-4. Wind Rose at West Point Coastal-Marine Automated Network (C-MAN) station 12
Figure 6-5. Measured and Predicted Suspended Sediment Load in the Duwamish River 14
Figure 6-6. Vessel Calls by Waterway, 2007-2013 16
Figure 6-7. Containerized Cargo in TEUs by Year, 2007-2013 17
Figure 6-8. Select Ports Share of West Cost Volumes, 2007-2013 19
Figure 6-9. Average Containership Size per Call at U.S. Ports 20
Figure 6-10. Vessel Capacity Range for Major Ocean Carriers. 21
Figure 6-11. Existing Superfund Sites near the Study Area. Note: Boundaries are approximate 28

List of Tables

Table 4-1. East and West Waterway Authorizing Language 4
Table 6-1. Tidal Data at Seattle NOS/CO-OPS station 9447130 (1983-2001 tidal epoch) 11
Table 6-2. Predicted Future Sea Level Change (in feet) at Seattle, WA 13
Table 6-3. Tidal Limitations on Port of Seattle Vessel Draft 15
Table 6-4. ESA-listed species that may occur in the study area according to USFWS and NMFS. 23
Table 6-5. List of HTRW Sites within the Study Area. 27
Table 18-1. Dredged material quantities for Seattle Harbor Navigation Improvement Project 33
Table 18-2. Shoaling Rates and estimated annual O&M dredging requirements for Seattle Harbor 34
Table 19-1 Trade Route Potential Benefits 35

Table 19-2. Proposed Project Expected Costs and Benefits 37
Table 13-1. Feasibility Study Milestones, Schedule, and Budget 43

This page intentionally left blank.

1 Study Authority

This study is authorized by Section 216 of the Flood Control Act of 1970 (33 USC 426 et seq) as amended, which reads:

"The Secretary of the Army, acting through the Chief of Engineers, is authorized to review the operation of projects the construction of which has been completed and which were constructed by the Corps of Engineers in the interest of navigation, flood control, water supply, and related purposes, when found advisable due to significantly changed physical or economic conditions, and to report thereon to Congress with recommendations on the advisability of modifying the structures or their operation, and for improving the quality of the environment in the overall public interest."

2 Study Purpose

The purpose of the Reconnaissance Study 905(b) analysis is to determine whether there is a Federal interest in participating in a cost-shared feasibility study to investigate modification of the existing Seattle Harbor project in the interest of navigation improvements and water resource development opportunities.

The reconnaissance phase shall determine whether the water resource problem(s) warrant Federal participation in a feasibility study based on a preliminary appraisal consistent with Army policies, costs, benefits, and environmental impacts of identified potential study alternatives. Project goals, objectives, assumptions, and constraints will be defined. A comprehensive review of other problems and opportunities will be deferred to the feasibility study phase. The reconnaissance study phase will assess the level of interest and support of non-Federal entities in the identified potential solutions and cost sharing of feasibility phase and construction. Following MSC approval of the Section 905(b) analysis (Reconnaissance Report) and recommendation to continue study, the Project Development Team (PDT) begins development of the Project Management Plan (PMP). The PMP for the feasibility phase will include a detailed breakdown of costs by fiscal year and any identified sponsor work-in-kind. A letter of intent from the local sponsor stating the willingness to pursue the cost-shared feasibility study described in the PMP and to share in the costs of design and construction is required. A Feasibility Cost Sharing Agreement (FCSA) will be negotiated and executed, thus concluding the reconnaissance phase and initiating the feasibility phase

3 Recommendation / Finding of Federal Interest

Based on the discussion in the 905(b) report, there is Federal interest in proceeding to the feasibility phase of this study to further analyze and evaluate improvements to Seattle Harbor. Preliminary data suggests that there are additional National Economic Development (NED) benefits associated with navigation improvements to both the East and West Waterways of Seattle Harbor.

This 905(b) summarizes existing conditions, problems, opportunities, objectives, and identifies potential benefits associated with navigation improvements at Seattle Harbor. As described in this report, channel

deepening is essential to maintaining the Port of Seattle's competitive position as a premier international trade gateway, particularly relative to Canadian Ports. Navigational challenges have been identified in both the East and West Waterways of Seattle Harbor and authorized depths do not meet the draft requirements of today's fleet of larger container ships. The Port of Seattle exports more cargo by weight than it imports and is a last port of call for several of the Asian – West Coast routes. As a result, the East and West Waterways of Seattle Harbor, a major gateway for containerized traffic, must have sufficient depth of water for partially loaded vessels to call and to take on additional cargo. Tide restrictions, light loading, or other operational inefficiencies created by inadequate channel depth will limit Seattle Harbor competitiveness, especially when competing with nearby Canadian Ports like Prince Rupert.

4 Study Area

The federally authorized Seattle Harbor navigation project, consisting of the East, West, and Duwamish Waterways, is located in Puget Sound's Elliott Bay at Seattle, Washington (Figure 4-1). The authorized project is located from Elliott Bay upstream approximately five miles to the head of the Federal navigation channel which lies in the lower Duwamish River. The authorized project consists of the East Waterway, -39 to -51 feet mean lower low water (MLLW); the West Waterway, -34 feet MLLW; the Duwamish Waterway, -30 feet MLLW for 2.6 miles, -20 feet MLLW for 0.8 miles, and -15 feet MLLW for 1.8 miles to the head of navigation. These three waterways provide over 7 miles of deep draft navigation accessible from Elliott Bay, Puget Sound, and the Pacific Ocean. While the study area includes the East, West, and Duwamish Waterways, the project area for the Reconnaissance and Feasibility phases will include only the East and West Waterways, as they have been identified by the Corps and Port of Seattle as the areas of critical importance for navigation improvements.

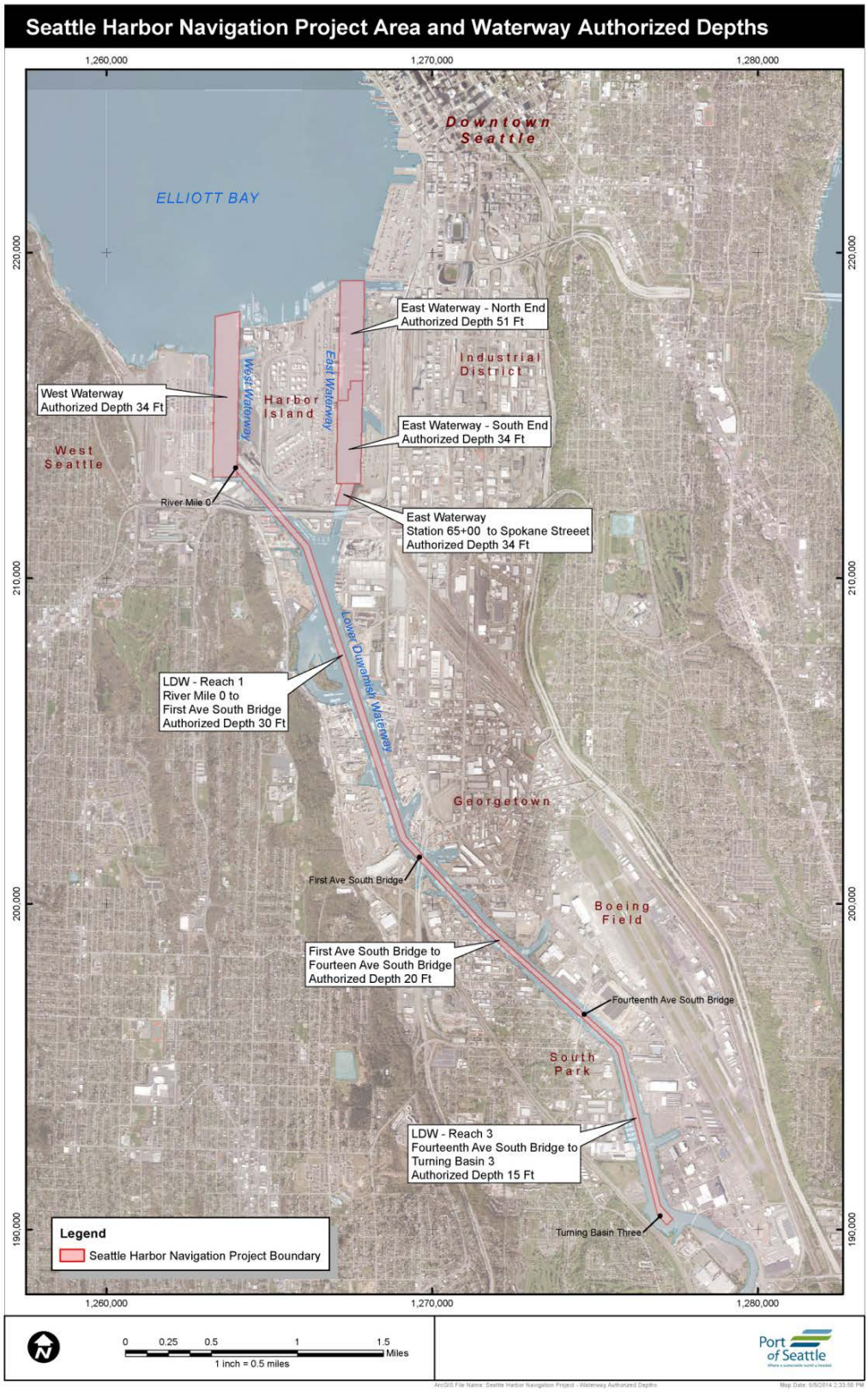


Figure 4-1. Federally Authorized Navigation Channel (East, West, and Duwamish Waterways).

The authorized purpose of the Seattle Harbor is navigation. A number of legislative authorities apply to the existing project including the East Waterway and West Waterways, as summarized in Table 4-1 below. However, this table contains only authorizing language relating to the East and West Waterways, as they are the focus of this 905(b) analysis. There are several other authorizations that relate solely to the Duwamish Waterway and are not included in this table.

Table 4-1. East and West Waterway Authorizing Language

Document	Date	Citation	Authorizing Language
Senate Doc 313	15 Dec 1918	S.D. 313, 65th Cong. 3d Sess.	…the United States take over and assume the maintenance of these portions of the East and West Waterways for distances of 6,500 feet and 5,200 feet, respectively, from the pierhead line at Elliott Bay …maintaining the East and West Waterways to a depth of 34 feet
River and Harbor Act (RHA) 1919	2 Mar 1919	40 Stat. 1285	Construction, completion, repair, and preservation of the works hereinafter named: …maintenance of East and West Waterways, Seattle Harbor, in accordance with the report in Senate Document numbered 313, Sixty-fifth Congress, third session, and subject to the conditions set forth in said document
House Doc 211 Examination and Survey of East Waterway, Seattle, Washington	6 Jan 1932	H.D. 211, 72nd Cong. 1st Sess.	…in addition to the work now authorized, for the maintenance of East Waterway north of Spokane Street, 700 feet long and 400 feet wide, to a depth of 34 feet
RHA 1935	30 Aug 1935	74 Pub. L. 409	That the following works of improvement of rivers, harbors, and other waterways are hereby adopted and authorized, to be prosecuted under the direction of the Secretary of War and supervision of the Chief of Engineers, in accordance with the plans recommended in the respective reports hereinafter designated and subject to the conditions set forth in such documents; Seattle Harbor, Washington; House Document Numbered 211, Seventy-second Congress
WRDA 1986	17 Nov 1986	99 Pub. L. 662	Sec. 202 GENERAL CARGO AND SHALLOW HARBOR PROJECTS (a) AUTHORIZATION FOR CONSTRUCTION. - The following projects for harbors are authorized to be prosecuted by the Secretary substantially in accordance with the plans and subject to the conditions recommended in the respective reports designated in this subsection, except as otherwise provided in this subsection: EAST, WEST, AND DUWAMISH WATERWAYS, WASHINGTON The project for navigation, East, West, and Duwamish Waterways Navigation Improvement Study, Seattle Harbor, Washington: Report of the Chief of Engineers, dated May 31 1985, at a total cost of $60,200,000 Sec. 1001 (a) Any project authorized for construction by this Act shall not be authorized after the last day of the 5-year period beginning on the date of enactment of this Act unless during such period funds have been obligated for

Document	Date	Citation	Authorizing Language
			construction, including planning and designing, of such project. Sec. 1002 The following projects … are not authorized after the date of enactment of this Act, except with respect to any portion of such a project which portion has been completed before such date or is under construction on such date: The feature of the project for navigation, Seattle Harbor, King County, Washington, authorized by the Act of July 3, 1930, Public Law 520, Seventy-first Congress, which feature consists of a settling basin located at the upper end of the existing Duwamish Waterway navigation project about 1.4 miles above the 14th Avenue South Bridge.
WRDA 1996	12 Oct 1996	104 Pub. L. 303	Sec. 356 EAST WATERWAY, WASHINGTON The project for navigation, East and West Waterways, Seattle Harbor, Washington, authorized by the 1st section of the Act entitled "An Act making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes", approved March 2, 1919 (40 Stat. 1285), is modified to direct the Secretary- (1) To expedite review of potential deepening of the channel in the East Waterway from Elliott Bay to Terminal 25 to a depth of up to 51 feet; and (2) If determined to be feasible, to implement such deepening as part of project maintenance. In carrying out work authorized by this section, the Secretary shall coordinate with the Port of Seattle regarding use of Slip 27 as a dredged material disposal area.

Below is a summary of current authorized boundaries for each waterway:

West Waterway: from the pierhead line at Elliott Bay, 5,200 feet long, 750 feet wide, -34 feet MLLW.

East Waterway: from the pierhead line at Elliott bay, 6,500 feet long, 750 wide; from that point an additional 700 feet long and 400 feet wide and terminating at Spokane Street. In the area defined as "Stage I" in the East Waterway Channel Deepening Stage I Project Report, the authorized depth is -51 feet. In all other areas of the East Waterway, the authorized depth is -34 feet.

5 Summary of Applicable Prior Studies, Reports, and Existing Water Projects

Various reports have been prepared for the Seattle Harbor since authorization. The reports listed below are only a partial list with a brief summary report of content. These reports are particularly significant as they are the major study documents related to modification of the East and West Waterways.

- *Final Environmental Impact Statement (August 1975) and Supplement (June 1979), Seattle Harbor Maintenance, U.S. Army Corps of Engineers, Seattle District.* The EIS documents the economic justification and environmental acceptability of continuing Federal maintenance of the current navigation project on the East, West, and Duwamish Waterways. The supplement describes and evaluates use of open-water disposal for project maintenance.

- *Final Feasibility Report and Final Environmental Impact Statement for East, West, and Duwamish Waterways Navigation Improvement Study (January 1983), U.S. Army Corps of Engineers, Seattle District.* The feasibility study recommended modifications in the Federal Project and bridges that were authorized by WRDA of 1986. The construction features authorized by WRDA 1986 have never been implemented due to the lack of a non-Federal sponsor for cost-sharing of construction.

- *East Waterway Channel Deepening, Stage I Project Report, Seattle Harbor, Washington (January 1999), U.S. Army Corps of Engineers, Seattle District.* The Stage 1 report recommends deepening the East Waterway to -51 feet MLLW and narrowing the channel to 450 feet wide. The Stage 1 project area was constructed in 1999-2000.

6 Existing and Future Without-Project Conditions

The Port of Seattle seaport is made up of 1,543 acres of waterfront land and nearby properties including container terminals, general purpose/cargo terminals, foreign trade zone, break-bulk cargo, and refrigerated cargo and storage. The West Waterway provides access to Terminal 5. Only the West Waterway provides navigation from Puget Sound up the Duwamish Waterway to the head of navigation at river mile 5.1 near the south end of King County International Airport (Boeing Field). The East Waterway provides access to Terminals 18, 25, and 30 and is limited by low level, non-opening highway and railroad bridges at its upstream end. Figure 6-1 shows a project area vicinity map, including nearby terminals.

Figure 6-1. Seattle Harbor Vicinity Map and Nearby Terminals.

6.1 Project Area Conditions: History and Overview

The East and West Waterways of Seattle Harbor have served the navigational needs for the Puget Sound region and West Coast for over 100 years. As discussed throughout this 905(b) report, existing authorized depths for the East and West Waterways do not meet the draft requirements of today's fleet of container ships. Ships often light load or experience tidal restrictions, causing lost transportation efficiencies and lost cost efficiencies at Seattle Harbor. There are also navigational challenges at the entrances to both waterways. High spots at the entrance of the West Waterway as well as a narrow "key way" cause consistent delays for ships. In the East Waterway, high spots at the north end of Terminal 30 and south of Slip 27 pose additional vessel safety and navigational challenges. Finally, ships departing Seattle are not realizing economies of scale afforded by the larger ships currently being deployed and even larger ships in the future. Tide restrictions, light loading or other operational inefficiencies created by inadequate channel depth will limit Port of Seattle competitiveness with West Coast ports, especially with nearby Canadian ports like Prince Rupert. The following paragraphs describe the history and overview of project area conditions and reinforce the need for Federal action at Seattle Harbor.

The Port of Seattle has adapted to increased vessel type and size since its creation in 1911. The terminals around the East and West Waterways (Terminals 5, 18, 25, and 30) have undergone significant

expansion and modernization since the 1980s and are all designed for Panamax and post-Panamax vessels. Additionally, the surrounding infrastructure (roads, railroads, container cranes, etc.) has also been developed to match the significant growth of the Port over the last 100 years, with over $1 billion in capital project improvements in the past 20 years. To further adapt to the current and future economic climate, the Port of Seattle is seeking to deepen the East and West Waterways to meet the needs of domestic and international commerce.

Since their introduction in the mid-1960s, container vessels have been increasing in capacity and size. Panamax vessels are the largest ships designed to pass through the existing locks of the Panama Canal. After the canal widening is completed in 2015, the New Post-Panamax vessels (Figure 6-3 and Figure 6-3) will exceed 13,000 TEU. Vessels with 8,000 TEU capacity and larger classes of container vessels are more cost-efficient to operate due to greater capacity than previous generations of the container vessels as well as improvements in fuel efficiency. Because of their draft, these vessels generally require channel depths of up to -55 feet MLLW (compared to -40 feet MLLW for the previous fleet of Panamax vessels). In addition, there are vessels in the World fleet order book that will be larger than those that can be accommodated by the Panama Canal expansion (Figure 6-3). Some of these existing vessels are currently calling or expected to call West Coast ports. Every major shipping line operating on Asian – West Coast trade routes has at least one string of these state-of-the-art post-Panamax or super post-Panamax container vessels. Super post-Panamax ships call the Port of Seattle regularly. All major ports on the West Coast are in the processes of deepening the navigation channels to allow long-term deep draught access to container cargo facilities. The Port of Seattle exports more cargo by weight than it imports, and is a last port of call for several of the Asian – West Coast routes. As a result, the Port of Seattle, a major gateway for containerized traffic, must have sufficient depth of water for partially loaded vessels to call and to take on additional cargo.

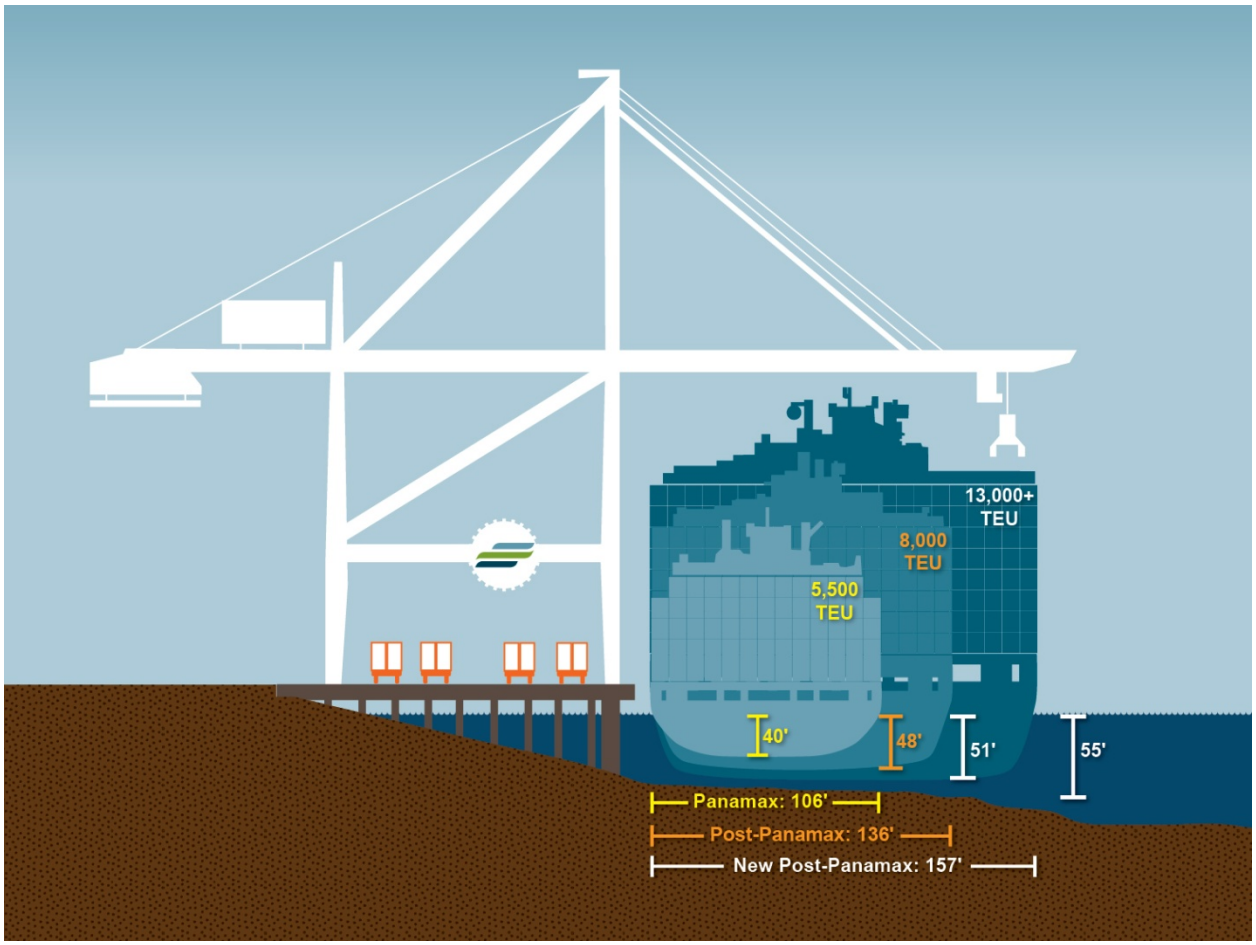


Figure 6-2. Panamax, Post-Panamax, and New Post-Panamax Vessel Sizes.

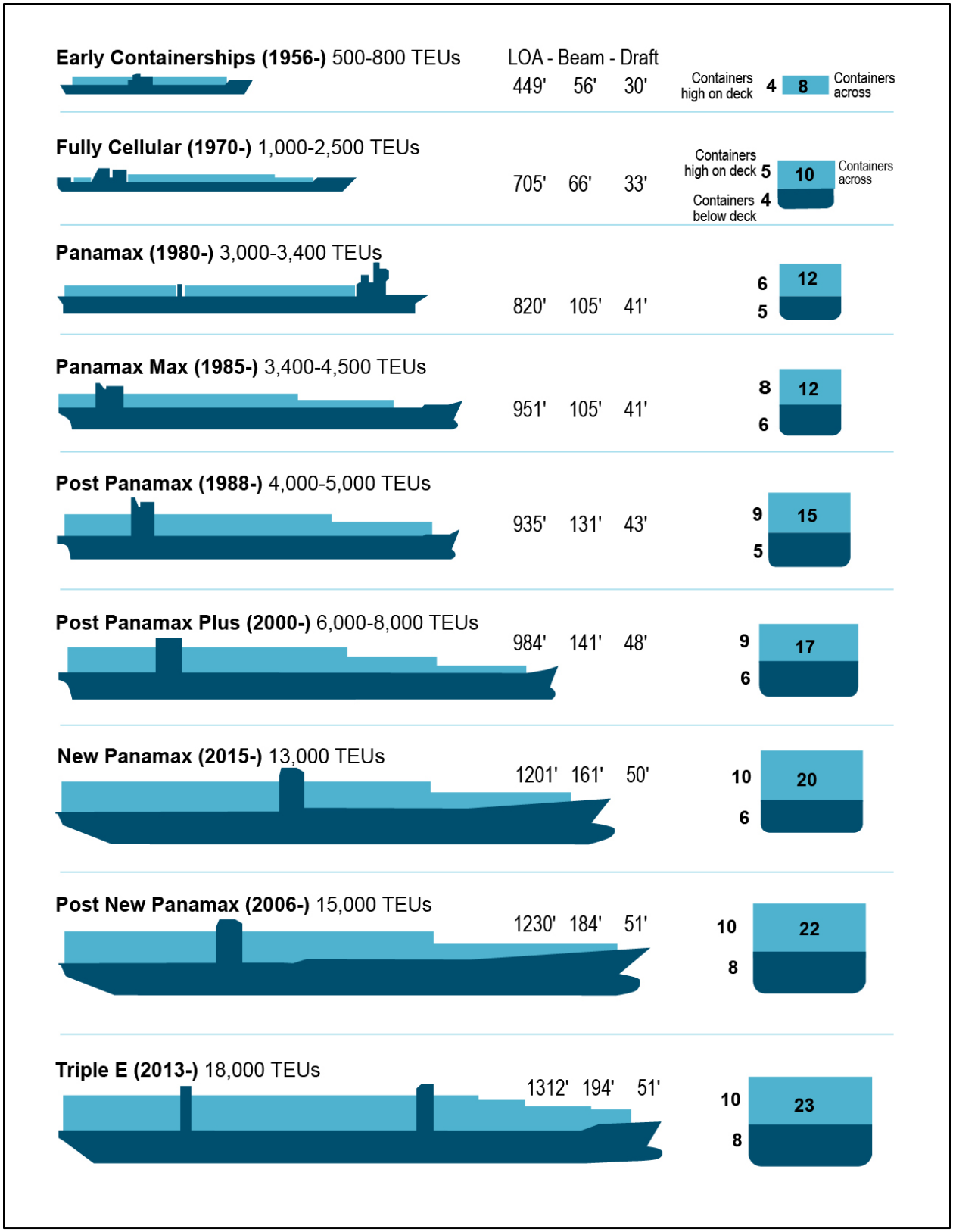


Figure 6-3. Vessel Sizes.

6.2 Project Area Conditions: Existing Conditions

The Port of Seattle is a deep-water port. Existing Federal navigation channels serving the container terminals within the study area are mostly at -51 feet MLLW, with a significant percentage deeper than -53 feet MLLW. The West Waterway has current depths ranging from -34 to over -60 feet MLLW. The East Waterway has current depths ranging from -30 to -53 feet MLLW (condition surveys from 2014 are provided in Appendix 1). However, entrances to both the East and West Waterways are significantly shallower, causing larger ships to experience transportation delays due to insufficient depths at channel entrances. To reach port terminals, larger ships must light-load or cargo must be shipped using smaller vessels, foregoing potential transportation cost savings available from the economies of scale associated with larger ships.

6.2.1 Project Area Conditions: Coastal Hydraulics

Tides in Puget Sound are mixed semidiurnal in type. The mean tidal range published by NOAA for Seattle, Washington is 7.66 feet. The great diurnal tidal range is 11.36 feet. Tidal data for Seattle, Washington are listed in Table 6-1. The strongest and most frequent winds at Seattle are oriented from the north and south due to the geometry of the Central Puget Sound basin as shown in the wind rose in Figure 6-5. However, due to the orientation of Elliott Bay, Seattle Harbor is predominantly sheltered from southerly winds and wind-generated waves.

Table 6-1. Tidal Data at Seattle NOS/CO-OPS station 9447130 (1983-2001 tidal epoch)

Datum	Value (feet)	Description
MHHW	11.36	Mean Higher-High Water
MHW	10.49	Mean High Water
MTL	6.66	Mean Tide Level
MSL	6.64	Mean Sea Level
MLW	2.83	Mean Low Water
MLLW	0	Mean Lower-Low Water
NAVD	2.34	North American Vertical Datum
Maximum	14.48	Highest Observed Water Level
Minimum	-5.04	Lowest Observed Water Level

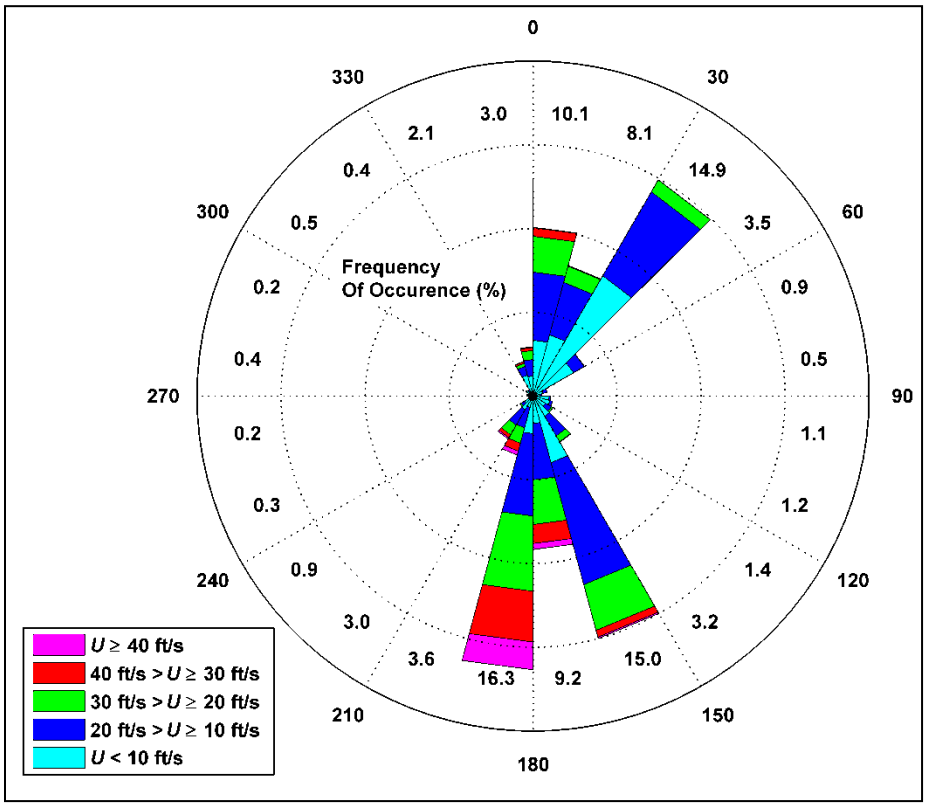


Figure 6-4. Wind Rose at West Point Coastal-Marine Automated Network (C-MAN) station (1984-2007). Wind speeds are shown in feet per second, and directions are in degrees from true north (0°)

Drainage from the Green/Duwamish River basin is the primary sediment source in the Duwamish, East, and West Waterways. The Green/Duwamish River is regulated by Howard A. Hanson Dam, operated by the Corps, located at river mile (RM) 64.5. Below the dam at about river mile 59, the Green River enters the Puget Sound lowlands. The remaining 48-mile reach of the Green River drains the Puget Sound lowlands and flows through a region of increasingly intensive agricultural and urban land use. At RM 11, the Green becomes the Duwamish River, which flows through a heavily industrialized area of Seattle and then enters Elliott Bay. The average daily discharge reported at the USGS 12113000 Green River gauge at Auburn is 1,345 ft^3/s. A peak regulated discharge of 12,400 ft^3/s was observed on February 8, 1996. An annual average suspended sediment load of 270,000 tons per year (as measured from 1996 to 1998) is transported into Puget Sound through the Green/Duwamish[1].

Sea Level Change

Planning guidance in the form of an USACE Engineering Circular (EC), USACE EC-1165-2-212, (USACE 2011), incorporates new information, including projections by the Intergovernmental Panel on Climate Change (IPCC, 2007). The EC specifies that project plans and designs should be evaluated to determine how sensitive they are to various scenarios of future sea-level change. Since precise estimates of future

[1] Embry and Frans, 2003; USGS WRIR 02-4190.

sea level rise are unknown, the risks associated with three sea level change scenarios should be addressed. These scenarios are termed low, intermediate and high and correspond to different rates of global sea level acceleration. Historically this global mean sea level (GMSL) rise rate has been approximately 1.7 mm per year.

Locally, sea level change varies geographically as it is the difference between the global sea level change (1.7 mm/year according to IPCC 2007) and local vertical land movement (VLM). The accuracy of local mean sea level rates is a function of the period of record of the water level time series. EC-1165-2-212 recommends that a NOAA water level station should be used with a period of record of at least 40 years. Table 6-2 lists the predicted sea level change for Seattle, WA for the low, intermediate, and high scenarios. By 2065 sea level change is predicted to range from 0.4 feet (4.5 inches) to 2.2 feet (26.5 inches).

Table 6-2. Predicted Future Sea Level Change (in feet) at Seattle, WA

Year	Low	Int	High	Year	Low	Int	High
2015	0.00	0.00	0.00	2070	0.40	0.90	2.46
2020	0.04	0.06	0.13	2075	0.44	1.01	2.80
2025	0.07	0.12	0.28	2080	0.48	1.12	3.15
2030	0.11	0.19	0.45	2085	0.51	1.24	3.52
2035	0.15	0.26	0.64	2090	0.55	1.36	3.92
2040	0.18	0.34	0.84	2095	0.59	1.48	4.32
2045	0.22	0.42	1.07	2100	0.62	1.61	4.75
2050	0.26	0.51	1.31	2105	0.66	1.75	5.20
2055	0.29	0.60	1.57	2110	0.70	1.89	5.66
2060	0.33	0.69	1.85	**2115**	**0.73**	**2.03**	**6.15**
2065	**0.37**	**0.79**	**2.15**				

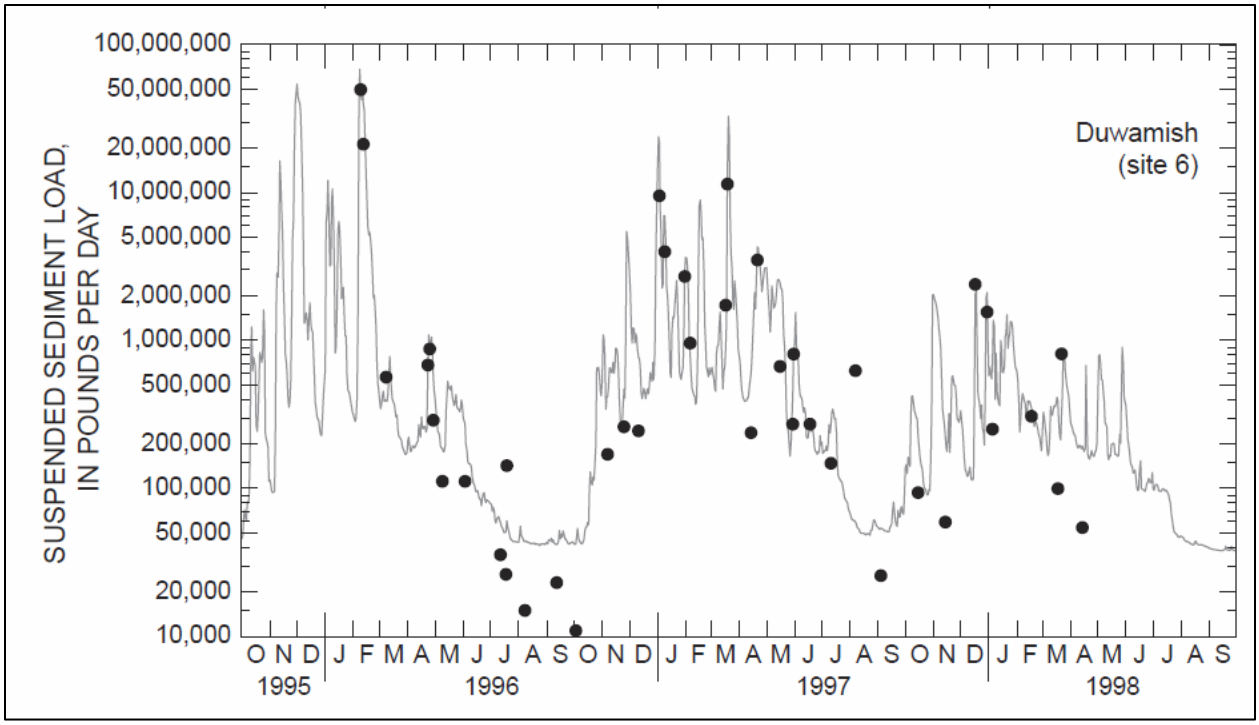


Figure 6-5. Measured and Predicted Suspended Sediment Load in the Duwamish River (USGS 2003)

Existing O&M Activities

Federally funded Operations and Maintenance (O&M) dredging is performed in portions of the Duwamish Waterway. Maintenance dredging has generally been restricted to the upper turning basin and the channel adjacent to the turning basin (station 242+00 to 275+56), as these areas are designed to capture the sediment bedload coming from the Duwamish River. If O&M dredging did not occur in the upper turning basin, the downstream reaches of the Federal navigation channel would shoal in. In 2013, approximately 70,000 cubic yards were dredged from the navigation channel and turning basin. Up to 200,000 cubic yards may be dredged from the federal navigation channel every 1 to 3 years depending on availability and funding. Federal O&M dredging in the East and West Waterways has not been performed in recent history.

Tidal Delays

The June 2014 condition survey indicates the controlling depth for the East Waterway is on the channel sideslope at Station 25+00 near Terminal 30. The controlling depth in the West Waterway is near Station 18+00 near the entrance to the Waterway. Table 6-3 summarizes the tidal limitations on vessel drafts for the East and West Waterways at Seattle Harbor.

Table 6-3. Tidal Limitations on Port of Seattle Vessel Draft

East Waterway		West Waterway	
Hours/Day available for transit[1]	Vessel Draft (feet)	Hours/Day available for transit[1]	Vessel Draft (feet)
24	40	19	40
24	41	18	41
24	42	17	42
24	43	16	43
24	44	11	44
24	45	8	45
24	46	5	46
23	47	3	47
21	48	2	48
20	49	0	49
19	50	0	50
18	51	0	51
17	52	0	52
16	53	0	53
11	54	0	54
8	55	0	55

[1] Based on depths observed in the June 2014 condition survey and a 3 foot underkeel clearance requirement.

6.2.2 Project Area Conditions: Economics

The Port of Seattle is a nationally significant port and a critical regional and national export gateway. The Port of Seattle is the 10th largest U.S. port in terms of Twenty-Foot Equivalent Unit containers (TEUs) and the 14th largest North American port terms of TEUs[2]. The Port of Seattle exports more cargo than it imports by metric tons, but imports more TEUs than it exports, and is a last port of call for several of the Asian – West Coast routes. The Port's inland markets extend to Chicago, Memphis, and St. Louis, making it an ideal gateway for import and export of goods moving between Asia and the U.S. Midwest. The Midwest makes up nearly two-thirds of the Port's hinterlands[3] (i.e., the inland area served by a port). The Port's top three trading partners for both imports and exports include China, Japan, and South Korea. Machinery, toys and sports equipment, furniture and bedding, clothing, footwear, plastic, and iron/steel products were among the greatest value of imported commodities in 2013. High value export commodities included a variety of food products (grain, fish and seafood, preserved food, meat, fruit, dairy, vegetables, cereals, etc.), paper products, and wood products. The Port of Seattle is also a natural gateway for exports that originate in Washington State. The State is a top national producer of apples, pears, potatoes, onions, red raspberries, hay, and hops.

[2] Seaport Statistics. Port of Seattle. 2013. Accessed online at http://www.portseattle.org/About/Publications/Statistics/Seaport/Pages/default.aspx on 2 June 2014.
[3] Data Source: IANA (Intermodal Association of North America), 2013.

Imports and exports were valued at $21.2 billion and $7.4 billion, respectively, and over half of the trade value is with China alone[4]. Washington's exports are heavier than imports and are sensitive to vessel size and depth limitations.

Vessels currently calling at the Port of Seattle include 48-foot draft vessels in the East Waterway, including 8,500 TEU capacity Compagnie Maritime d'Affrètement/Compagnie Générale Maritime (CMA/CGM) Opera class vessels and 49 foot draft 10,000 TEU capacity ZIM vessels. In the West Waterway 48-foot draft vessels have already called, including 8,600 TEU capacity Hyundai vessels. The large Hyundai ships began calling in November 2013, but were restricted in load in the West Waterway due to pilotage requirements for 10% under keel. Annual vessel calls average around 559 calls in the East Waterway and 224 calls in the West Waterway for 2007 to 2013, as shown in Figure 6-6.. Associated average TEUs from 2007 to 2013 for the East and West Waterways is 789,000 and 501,000 TEUs, respectively. Total TEUs averaged 1.3 million over this time period. TEUs by waterway from 2007 to 2013 is shown in Figure 6-7.. Non-containerized cargo and bulk also call at the East and West Waterway and included 48,000 metric tons of molasses and 788,000 metric tons of petroleum in the East Waterway in 2013.

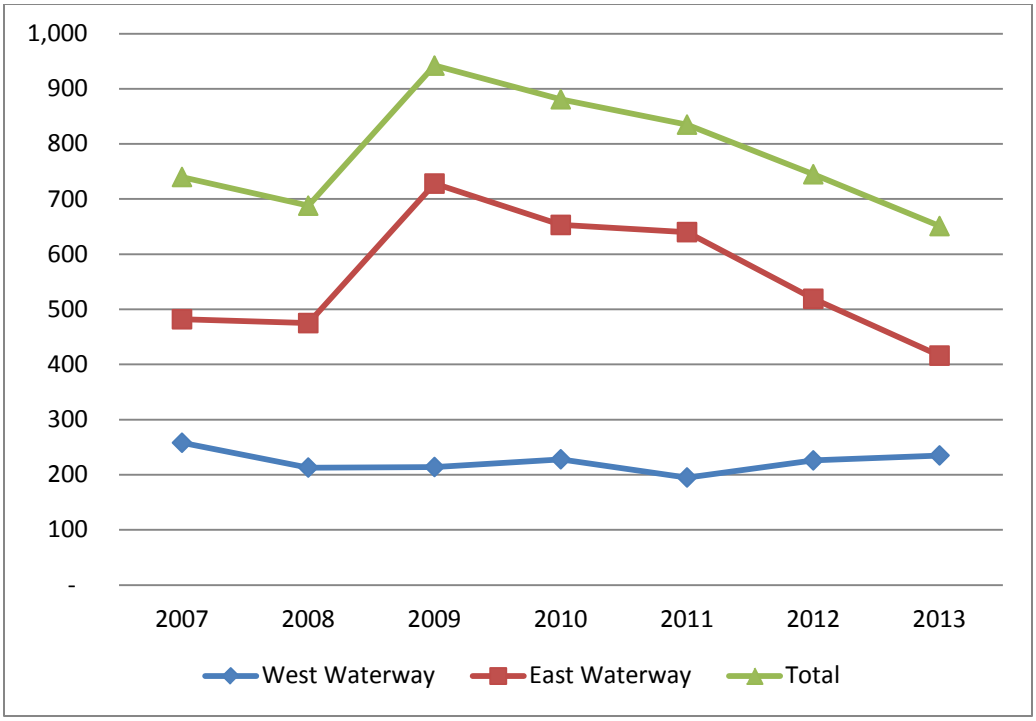


Figure 6-6. Vessel Calls by Waterway, 2007-2013

[4] Port of Seattle. "2013 Port of Seattle Foreign Waterborne Trade Report". 2013.

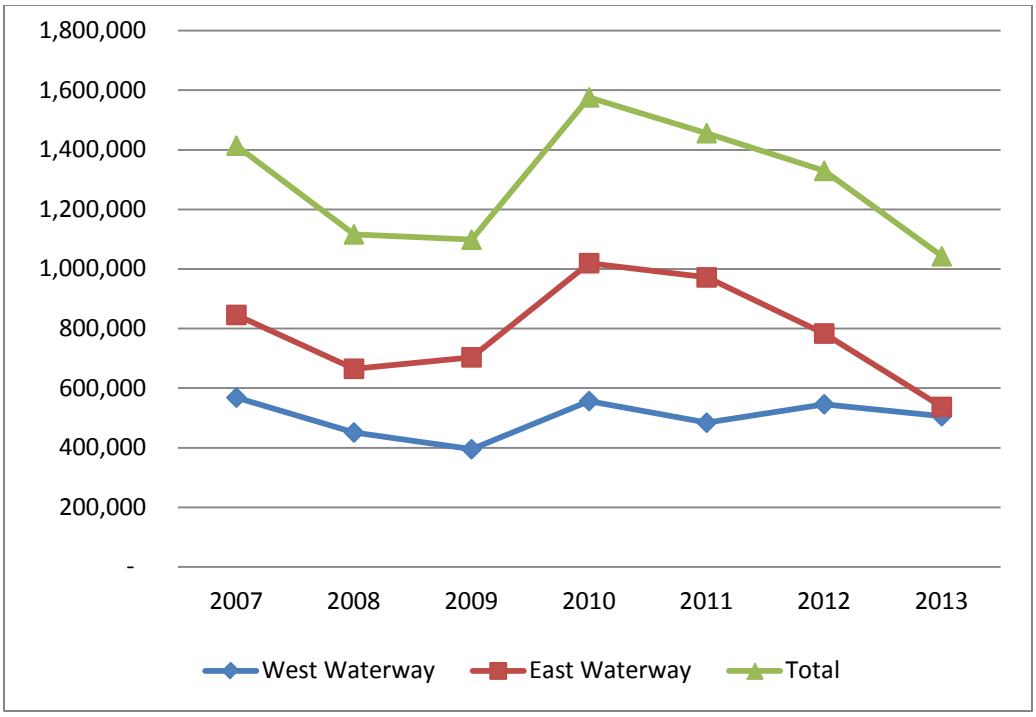


Figure 6-7. Containerized Cargo in TEUs by Year, 2007-2013

Containerized traffic declined after 2007, with declines continuing in 2008 and 2009. This decline in container traffic is likely related to global economic recession that impacted commerce in many sectors of the economy, both nationally and internationally. Container traffic increased again in 2010 to its peak of 2.1 million TEUs (1.6 million TEUs in the East and West Waterways), and has been on the decline to present day. This decline is partly due to new container operations at the Port of Prince Rupert (British Columbia, Canada) starting in 2007. Additional discussion about the Port of Prince Rupert is included in the following paragraphs.

Seattle's average share of the West Coast trade volumes from 2007 to 2013 is approximately 8.1 percent and has declined from its high of 9.3 percent in 2010 to 6.6 percent in 2013. During this same period, the share at the Port of Prince Rupert has increased from 1.5 percent in 2010 to 2.2 percent in 2013. Figure 6-8. shows the share of West Coast port trade volumes by port between 2007 and 2013.

Los Angeles, Long Beach, Tacoma, Vancouver (British Columbia, Canada), and Prince Rupert (British Columbia, Canada) all have ports with channels and berths as deep or deeper than the Port of Seattle. Prince Rupert has a natural depth of -60 feet MLLW, has grown quickly and plans major expansion that would allow that port to handle 2.5 million TEUs by 2020 and 4 to 5 million TEUs in subsequent years[5,6], more than the current combined volumes of the ports of Seattle, Tacoma, and Portland (3.7 million TEUs in 2013 for these three ports). Prince Rupert is one of the deepest ports in North America, giving it a

[5] Prince Rupert Port Authority. "A Vision for the Future". Accessed online at http://www.rupertport.com/trade/vision on 23 Jun 2014.
[6] U.S. Department of Transportation Maritime Administration. "Panama Canal Expansion Study, Phase 1 Report: Developments in Trade and National and Global Economies. November 2013.

competitive advantage. It has shown positive growth since 2008 and may capture more of the West Coast market share because of having no depth limitations.

The naturally deep waterways of Prince Rupert provide an advantage to vessels working under very tight Asian market shipping schedules. Because shipping line vessel deployments are closely scheduled to meet berthing windows in all of the ports of call in a rotation, any delay in Seattle, whether heading to a Canadian port or an Asian port, would increase cost for a shipping line by creating a need for them to speed up the ship and burn more fuel to catch up their long term schedule. Shipping lines are extremely focused on cost reduction, especially in managing fuel consumption (they have implemented slow steaming on all of their routes). Continued delay at any port creates a need to speed up and burn more fuel to regain a schedule. Delays due to tidal restrictions at Seattle Harbor create an incentive for shipping lines to look for ways to avoid that port in order to meet tight schedules; ultimately, these shipping lines may potentially call more often at naturally deeper ports like Prince Rupert.

Other West Coast ports with positive growth trends from 2007 to 2013 include Oakland and Vancouver. Long Beach had the most significant decline of 0.34% per year, followed by Los Angeles, Tacoma, and Seattle.

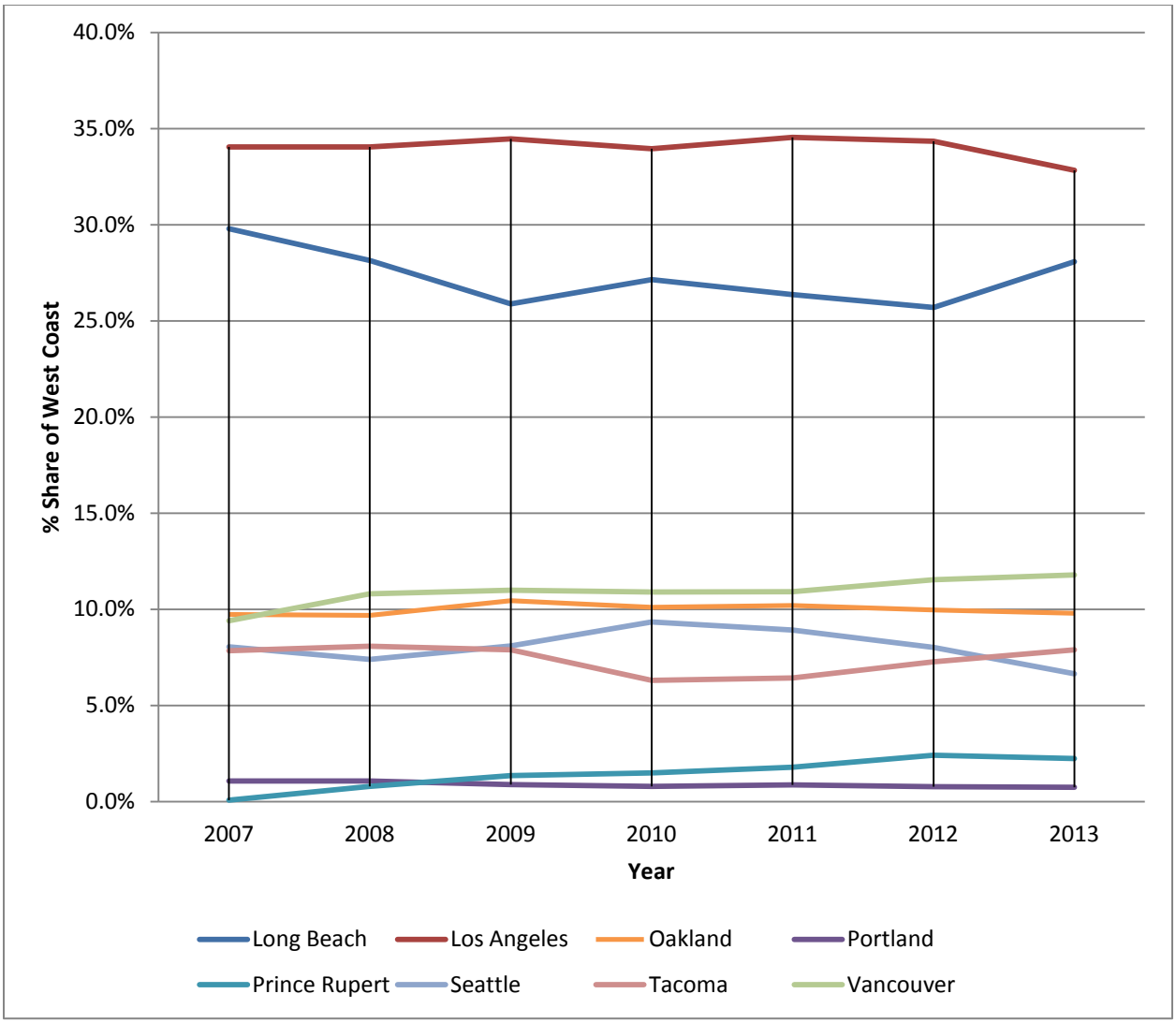


Figure 6-8. Select Ports Share of West Cost Volumes, 2007-2013

In 2011, the average vessel size per call at U.S. ports was 53,832 deadweight tons (DWT), up 6.3 percent from five years before. The average size of containerships increased by 13.3 percent in terms of TEU capacity (9.9 percent in terms of DWT) as carriers expanded the deployment of post-Panamax (5,000+ TEU) containerships in U.S. trades. As Figure 6-3 depicts, these post-Panamax vessels generally require drafts of -43 feet MLLW or greater, with the largest vessel classes requiring -51 feet MLLW. Over the last five years, calls by containerships of 5,000 TEU or greater, which are largely Post-Panamax class and generally require drafts of -43 feet MLLW or greater, increased by 78.2 percent. Additionally, the number of 5,000+ TEU containerships deployed in U.S. trades increased by 60.4 percent; these ships generally require drafts of -48 feet MLLS or greater. In 2011, 5,000+ TEU containerships accounted for

27.0 percent of containership calls at U.S. ports, up from 17.1 percent five years before[7]. Figure 6-9. shows the average containership capacity per call at U.S. ports from 2006 to 2011.

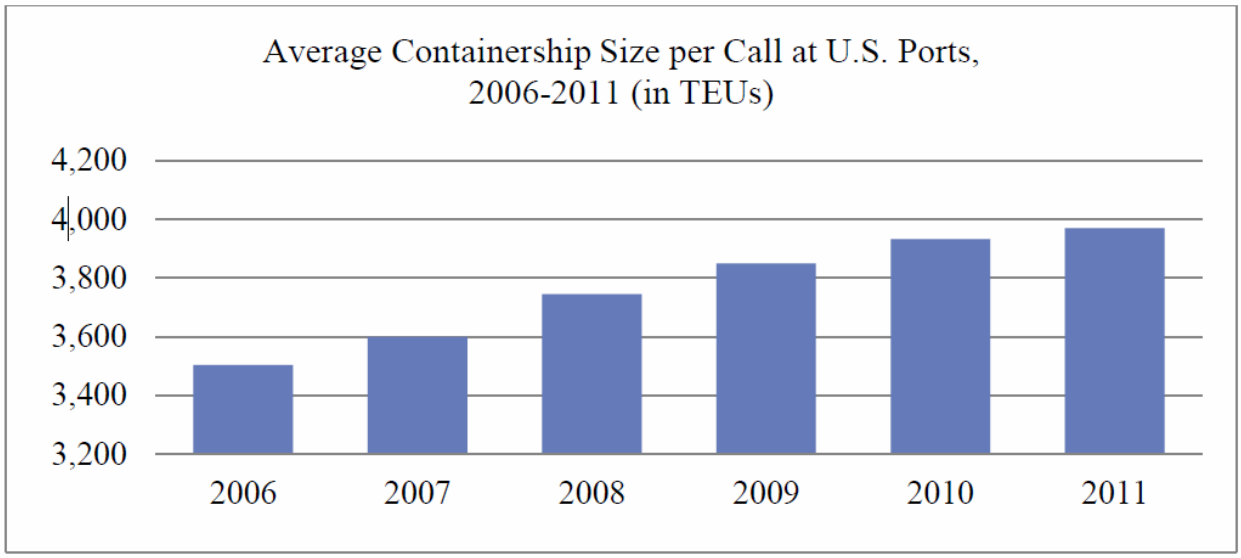


Figure 6-9. Average Containership Size per Call at U.S. Ports[8]

6.3 Project Area Conditions: Future

The with- and without-project conditions represent future states beginning in project year one and extending over a 50-year period of analysis. For the purposes of this reconnaissance study, the years 2024 through 2074 will be examined. The purpose of identifying the difference between the with- and without-project conditions is to note the changes that would be expected to occur in the future as a result of the project compared to the conditions that would occur in the future without a project. The without-project condition is the most likely condition expected to exist over the 50-year period in the absence of the proposed project, including any known changes in law or public policy. For the purposes of this analysis, the without-project conditions are those that are expected to occur over time without further channel deepening. Project benefits and costs can be identified by comparing the with- and without-project conditions.

Figure 6-10 shows vessel capacity by TEUs for the major ocean carriers that currently call at the Port of Seattle. The red indicates the capacity of the existing fleet as of 2012, and the blue indicates the future capacity for containerships on order with delivery dates between 2012 and 2015. Much of the existing fleet is comprised of Panamax or greater size vessels, with a shift to even larger vessels in the future. Maersk Line, for example, is taking delivery of 18,000 TEU containerships and other carriers like China Shipping and MSC have placed orders for ships from 16,000 TEU – 19,000 TEU. All major ocean carriers are expanding their fleets with vessels with 8,000 TEU or greater capacity and are rapidly deploying

[7] U.S. Department of Transportation Maritime Administration. "2011 U.S. Water Transportation Statistical Snapshot". November 2013.
[8] U.S. Department of Transportation Maritime Administration. "2011 U.S. Water Transportation Statistical Snapshot". November 2013.

these ships in the Transpacific Trade. Many of these new vessels will be too large to serve the existing Port of Seattle, and some exports may have already shifted to Prince Rupert due to depth restrictions at Seattle Harbor.

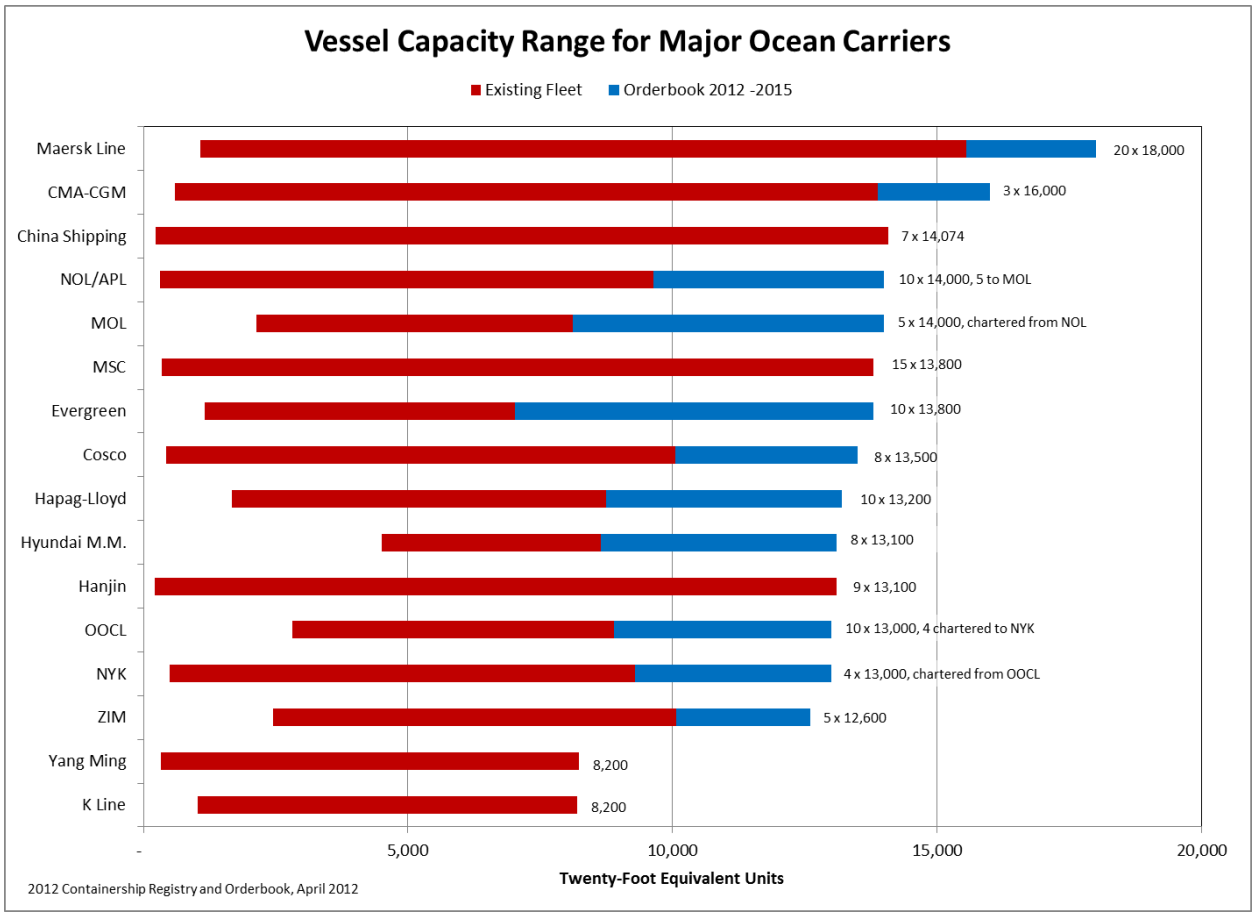


Figure 6-10. Vessel Capacity Range for Major Ocean Carriers.

Overall, containerized imports from Northeast Asia are projected to quadruple in terms of TEUs from 2010 to 2040, representing a change in share from 62 to 65 percent of all U.S. waterborne imports. On the other hand, containerized exports to Northeast Asia are substantially smaller (in terms of TEUs), but are forecast to increase by a factor of roughly 2.5, representing a change in share from 40 to 41 percent of all U.S. exports.

According to research completed for the Panama Canal Expansion Study by the U.S. Department of Transportation Maritime Administration, a potential effect of the Panama Canal expansion and projected economics for U.S. trade includes average size of vessels serving West Coast ports increasing over time from an average of 6,000 TEUs per vessel today to 13,000 TEUs (or greater), and the cost from transportation to West Coast ports from Asia would be reduced, with a portion of those savings being

passed on to shippers[9]. In general, the Panama Canal expansion is not expected to change the demand on West Coast ports; shifts in shipments from West Coast to East Coast ports may occur due to per-TEU cost reductions but these shifts will be limited, relatively, by the already high current Panama Canal shares[10].

Navigational improvements in the Seattle Harbor will increase the capability to serve larger vessels with deeper draught requirements and will also serve the existing fleet more efficiently, ensuring continuing and increased benefits to regional and nation-wide export shippers and allow more U.S. exports to enter world markets. Channel deepening is essential to maintaining Seattle Harbor's competitive position relative to Canadian ports and preserving U.S. jobs. The seaport as a whole supports 56,000 direct, indirect, and induced jobs. Of this, the Port's container business provides nearly 23,000 direct and indirect U.S. jobs, many of which are at risk from cargo diversion to Canada, as are thousands of jobs with shippers who rely on the port. Marine cargo at the Port supports over 33,000 total direct and indirect U.S. jobs.

To the north of Seattle in British Columbia, Canada, the Port of Prince Rupert uses a business model that relies on diversion of U.S.-bound discretionary cargo from U.S. ports. Roughly two-thirds of Prince Rupert's import volumes are U.S.-bound. Practically speaking, Prince Rupert has no depth limitation and is poised to capture any cargo Puget Sound ports are unable to handle. Prince Rupert has aggressive growth plans for a two-stage expansion that would allow them to handle 2.5 million TEUs by 2020 and 4 to 5 million TEUs in subsequent years.[11,12]. This is more than the current combined volumes of the ports of Seattle, Tacoma, and Portland.

The potential economic impact of cargo diversion to Prince Rupert is threefold:

1. Jobs: Diversion of discretionary cargo threatens nearly 6,200 direct and indirect U.S. jobs in Seattle alone, as well as thousands of jobs with exporters and importers that rely on the Seattle seaport.
2. U.S. exports: Puget Sound ports have enabled Washington and Midwest exports to be more competitive in global markets, providing advantages that include lower shipping costs and greater vessel capacity. Losing ocean carrier service to Canadian ports has a negative impact on Northwest and Midwest exporters, which translates to fewer U.S. jobs and impacts U.S. business which used to move cargo through U.S. ports.
3. Northwest agricultural jobs: These jobs are especially dependent on competitive, deep-water ports. Agricultural exporters depend on inbound discretionary cargo to supply containers and vessel space on the outbound leg. Some Northwest industries, like the hay industry, might not

[9] U.S. Department of Transportation Maritime Administration. "Panama Canal Expansion Study, Phase 1 Report: Developments in Trade and National and Global Economies. November 2013.
[10] U.S. Department of Transportation Maritime Administration. "Panama Canal Expansion Study, Phase 1 Report: Developments in Trade and National and Global Economies. November 2013.
[11] Prince Rupert Port Authority. "A Vision for the Future". Accessed online at http://www.rupertport.com/trade/vision on 23 Jun 2014.
[12] U.S. Department of Transportation Maritime Administration. "Panama Canal Expansion Study, Phase 1 Report: Developments in Trade and National and Global Economies. November 2013.

continue to export from the Port of Seattle if Seattle is unable to receive larger vessels or load vessels more efficiently. Additionally, because agricultural exports are heavier than imports, they are more sensitive to vessel size and depth limitations.

The diversion of U.S. import cargo to the Canadian gateway and the potential of ships to avoid U.S. ports due to inadequate depths in favor of a deeper Canadian port mean that no Harbor Maintenance Trust Fund contributions are paid by that importer. Continued diversion of U.S.-bound cargo to Canadian ports of discharge ultimately results in less Harbor Maintenance Trust Fund dollars for improving U.S. infrastructure.

6.4 Fish and Wildlife Resources

The project area lies at the transition zone between the Duwamish River and the Elliott Bay area of Puget Sound, referred to as the Duwamish estuary. Fish and wildlife resources within the urbanized/industrial portion of the Duwamish River in south Elliott Bay include numerous species of migratory and resident fish and wildlife.

The Green/Duwamish River system supports a diversity of salmonid species including bull trout, summer/fall Chinook salmon, fall coho salmon, fall chum salmon, sea-run cutthroat trout, sockeye salmon, summer and winter steelhead, native char (Dolly Varden), and pink salmon. Chinook salmon, chum salmon, coho salmon, pink salmon, and steelhead use Elliott Bay to access upstream freshwater spawning habitat in the Duwamish/Green River watershed. Chinook and chum salmon use Elliott Bay and the Duwamish River estuary more extensively than other anadromous species, especially as an estuarine rearing area to grow and gain fitness for ocean life-stage survival.

Around the Duwamish estuary, bird species seen in the area include bald eagles, osprey, great blue herons, cormorants, and numerous resident and migratory birds. Species that may occur in the marine environment of Elliott Bay include marine mammals such as harbor seals, sea lions, and occasionally the Southern resident killer whales. Crab and shrimp are common invertebrates in this area. The confines of the proposed action area involves deepening and is limited to sub-tidal marine environment/water column, affecting only sub-tidal portions of migratory pathway in south Elliott Bay.

Nine species that are listed as threatened or endangered under the Endangered Species Act potentially occur in the Elliott Bay reach of Puget Sound or the lower Duwamish Waterway and vicinity (Table 6-4). The project area is used as a migratory corridor for adult and juvenile salmonids.

Table 6-4. ESA-listed species that may occur in the study area according to USFWS and NMFS.

Species	Listing Status	Critical Habitat
Bull trout (Coastal/Puget Sound DPS) *Salvelinus confluentus*	Threatened	Designated
Puget Sound Chinook salmon (*Oncorhynchus tshawytscha*)	Threatened	Designated
Puget Sound Steelhead (*Oncorhynchus mykiss*)	Threatened	Designated

Bocaccio (*Sebastes paucispinis*)	Endangered	Proposed
Canary rockfish (*Sebastes pinniger*)	Threatened	Proposed
Yelloweye rockfish (*Sebastes ruberrimus*)	Threatened	Proposed
Green sturgeon (southern DPS) *Acipenser medirostris*	Threatened	Designated
Southern resident killer whale *Orcinus orca*	Endangered	Designated
Marbled murrelet *Brachyramphus marmoratus marmoratus*	Threatened	Designated

An issue of concern for fish and wildlife species in the study area is contaminated sediment that is currently present in both the East and West Waterways (refer to Section 6.7). This contamination affects the benthic species directly and continues its negative effects up the trophic levels (food chain). Fish consume the benthic species and are then consumed by larger fish.

In the future without-project condition, the industrial waterway would remain as a completely developed estuary with few large-scale physical changes to fish and wildlife habitat expected to occur. The anticipated future changes include site-specific projects and Superfund cleanup/remediation, which would mainly result in improved water quality and benthic habitat.

6.5 Historical and Cultural Resources

The Seattle Harbor project is located within the traditional territory of the Duwamish, Snoqualmie, Suquamish, and Muckleshoot Indian Tribes. Prior to the straightening and dredging of the Duwamish River and the creation of Harbor Island, the project area was located in Elliott Bay. The Washington Information System for Architectural and Archaeological Records Database was reviewed to determine if any cultural resources surveys have been conducted within the project area and if there are any previously recorded archaeological sites located within the project area. Of the nineteen cultural resource surveys conducted in close proximity to the Seattle Harbor Project area two surveys (removal of pilings and a replacement of a bulkhead on Harbor Island) are directly adjacent to project area. The remaining cultural resource surveys are associated with transportation related projects. No cultural resource surveys have been conducted within either the East or West Waterways. The review of the database revealed that there are no known cultural resources located within the East or West Waterways. The closest recorded archaeological site is located approximately 0.25 miles from the project area. In addition, a Duwamish winter village was located at the former mouth of the Duwamish River.

In the future without-project condition, no effects to cultural resources are anticipated. No cultural resources are known to exist within the current channel depths of the East or West Waterways.

6.6 Tribal Considerations

The Federal government and federally-recognized Indian tribes have a unique trust relationship; rights guaranteed by treaty cannot be abrogated without Congressional approval, and Federal agencies may not take any action that would infringe upon those treaty rights. There are two federally-recognized tribes that hold a treaty right to take fish within the project area. The Muckleshoot Indian Tribe and the Suquamish Indian Tribe of the Port Madison Reservation are both signatories to the Point Elliott Treaty of 1855, which guarantees "the right of taking fish at usual and accustomed grounds and stations." The Muckleshoot and Suquamish Tribes' usual and accustomed fishing grounds overlap in the Duwamish estuary, where both tribes harvest seafood.

The Duwamish Tribe, while not federally recognized, also inhabits and is active in the project area. They are an organized group with approximately 600 enrolled members with a cultural center on the west bank of the Duwamish just upstream of the project area.

Proposed activities in the project area will be closely coordinated with the tribes to ensure that treaty rights are respected and to address any other tribal concerns.

The future without-project conditions for Native American tribes around the project area are anticipated to be the same as existing conditions. The Corps does not anticipate there would be any change to fishing resources or access.

6.7 Environmental (Hazardous, Toxic, and Radioactive Waste & Superfund) Conditions

Due to the highly industrialized nature of the study area, numerous sites containing hazardous substances as described in ER 1165-2-132 exist in and near the proposed project area (Figure 6-11). This section and Section 12.4 describe the current status of environmental conditions including Hazardous, Toxic, and Radioactive Waste (HTRW) conditions in and around the study area, as well as future considerations that will be accounted for as this study moves into the feasibility phase. The Corps and non-Federal sponsor are continuing to coordinate closely on existing and future Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and HTRW activities to ensure current or future clean-up activities are consistent with proposed deepening alternatives that will be evaluated during the feasibility phase.

The focus of the CERCLA and HTRW activities is to reduce environmental and human exposure risk, rather than to completely remove all contamination. Therefore, contaminated sediments and completed and future expected remedies exist in the proposed project area. This section and Table 6-5 summarizes the HTRW site information including completed and future remedial activities within the proposed project area. Section 12.4 below describes how the proposed dredging project will interact with existing and known CERCLA site actions.

The proposed project area includes the East and West Waterways. Within these waterways, two CERCLA Sites exist, one with multiple Operable Units (areas designated to manage various cleanup strategies on different schedules): The Lockheed West Superfund Site; and, the Harbor Island Superfund Site which contains the Lockheed Shipyard Sediment OU, Todd Shipyard OU, West Waterway OU, and East Waterway OU (Figure 6-11). The West Waterway includes portions of the Lockheed West Superfund Site, a portion of the Todd Shipyard OU and the entirety of the West Waterway OU of the Harbor Island Superfund Site. The East Waterway contains the entirety of the East Waterway OU of the Harbor Island Superfund site. The Lower Duwamish Waterway Superfund Site is upstream of both the East and West Waterway and beyond the limits of the proposed project area. However, it is relevant in that it is upstream of all other sites and remedy decisions at this site are likely to affect remedy decisions at both the East and West Waterways. Table 6-5 summarizes the current status of HTRW sites and their projected timeline for implementation of final remedies under the future without project condition. In addition, historical dredge disposal sediment characterization and known sediment chemical concentrations in the East and West Waterways suggest that bioassay and bioaccumulation testing will be needed during feasibility and/or design when additional dredge disposal characterization will occur (see Section 12.4).

For remedies that include dredging, contaminant concentrations left in surface sediments may be at or below remedial action cleanup levels but, may not be at concentrations suitable for navigation dredging open water disposal. In addition, any contamination left below cleanup elevations is likely to be affected by navigation dredging that is deeper than the cleanup elevations. Cleanup remedies that include capping over contaminated sediments left in place, enhanced natural recovery, or monitored natural recovery within the federal waterway boundary may be affected by the proposed navigation dredging project area. While the sponsor will be responsible for the full cost of removing those sediments, significant coordination with the EPA Superfund Office will be required during the feasibility phase to address these issues. The non-Federal sponsor is involved in all CERCLA activities at this site and is aware of the need for full coordination with the EPA CERCLA program (Table 6-5).

Table 6-5. List of HTRW Sites within the Study Area. Only the East and West Waterways are within the proposed project area.

Waterway	Superfund Site / Operable Unit*	Contaminants	Relevant History	Remedial Action	Non-Federal Sponsor Involvement
	Harbor Island Superfund Site	Copper, lead, zinc, mercury, arsenic, tributyltin, polychlorinated biphenyls, and carcinogenic polycyclic aromatic hydrocarbons in sediments.	National Priority Listing, 1983. Lead smelter releases and release of other hazardous substances from other industrial operations including shipbuilding, maintenance, and repair activities. Sources in sediments include historical disposal practices, direct dishcharge, storm drains, and other nonpoint discharges.	See below for each Operable Unit	Port of Seattle owns and manages parts of the Harbor Island property; however, others are involved in various projects as shown below. Subtidal sediments are owned and managed by the Washington State Department of Natural Resources.
West	- Todd Shipyard OU			Remedy Completed 2007: subtidal and intertidal dredging and capping. No further action expected.	Port of Seattle, Todd Shipyard responsible for cleanup.
West	- West Waterway OU			No CERCLA action is necessary to protect public health or welfare or the environment because environmental investigations and site-specific risk assessments found that chemical concentrations in marine sediments within the operable unit do not pose unacceptable risks to human health and the environment after remediation of Todd and Lockheed Shipyards. However, sediment concentrations of various contaminants above cleanup criteria remain in the channel. Therefore, Section 12 describes the process for determining whether dredged sediments are suitable for open water disposal.	Port of Seattle, Todd Shipyard, Lockheed Martin Corporation responsible for cleanup.
East	- East Waterway OU		Navigation and environmental dredging activities identified that contamination remains at depth and a 9 inch sediment cap exists in parts of the waterway.	Remedy not yet selected. Remedy implementation approximately 2020 or later. Technologies are expected to include a combination of dredging, capping, enhanced natural recovery and natural recovery.	East Waterway Group consisting of Port of Seattle (lead), King County, City of Seattle responsible for investigation and feasibility. The county and city support the Port led efforts by conducting source control measures. Additional responsible parties may be identified.
West	- Lockheed Shipyard Sediment OU			Remedy Completed 2005: subtidal and intertidal dredging and capping. No further action expected.	Lockheed Martin Corporation responsible for cleanup. Portions of the property are currently owned and managed by Port of Seattle.
West	**Lockheed West Seattle Superfund Site**	Cadmium, chromium, copper, lead, zinc, mercury, tributyltin, dioxins/furans, carcinogenic polyaromatic hydrocarbons, pentachlorophenol, and polychlorinated biphenyls in sediments.	National Priority Listing- 2007. Historical shipyard operations/activities and related discharges from historical shipyard operations. Contaminants were released into the surface receiving waters during Site operations and accumulated in sediments. The adjacent Pacific Sound Resources site was a potential source of dioxins/furans.	Remedy includes subtidal and intertidal dredging, capping, and enhanced natural recovery and is expected to begin approximately 2017-2021. , In addition, the remedy includes institutional controls that require coordination with EPA for any disturbances such as dredging within the boundaries of the Site. Remedial dredging is expected to occur within the federal navigation channel.	Lockheed Martin Corporation responsible for cleanup. Portions of the property are currently owned and managed by Port of Seattle.
Duwamish	**Lower Duwamish Waterway Superfund Site**	Arsenic, dioxins/furans, polychlorinated biphenyls, and carcinogenic polycyclic aromatic hydrocarbons in sediments.		Record of Decision to be completed in late 2014 will include subtidal and intertidal dredging, capping, enhanced natural recovery, and natural recovery remedies. Remedy implementation approximately 2019 or later. While this site is not within the proposed project area, it is within the study area and remedy decisions at this site influences remedy decisions for the East and West Waterway OU's.	Port of Seattle, King County, City of Seattle, Boeing Company.

**Operable Units are areas within one Superfund Site that are separately managed. For example, an operable unit may be designated because contaminants or site conditions differ significantly from other areas, or the need to use different technologies on differing media such as treatment of groundwater through a pump and treat system vs. sediment dredging.*

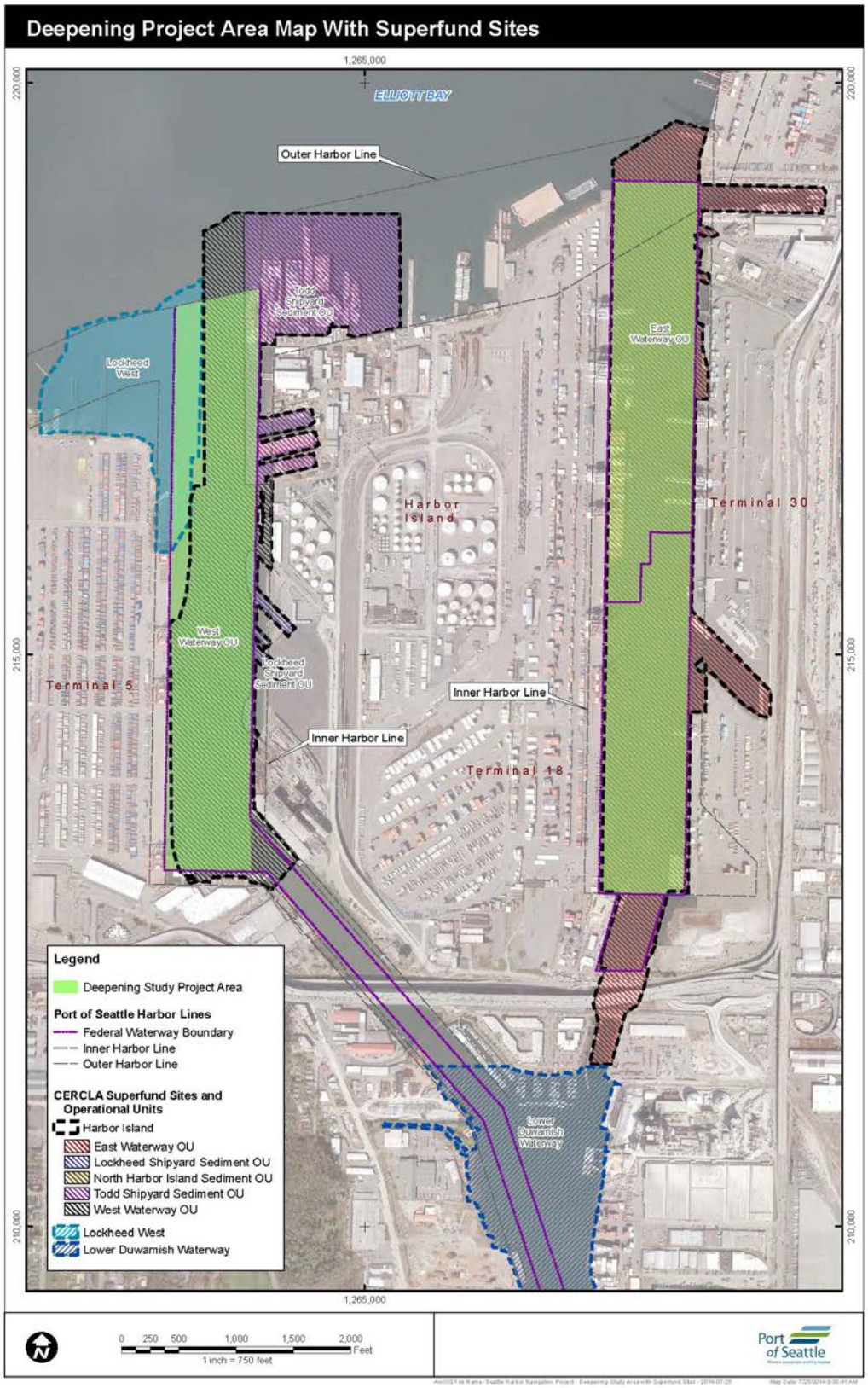


Figure 6-11. Existing Superfund Sites near the Study Area. Note: Boundaries are approximate.

7 Problems and Opportunities

This section summarizes the problems and opportunities at Seattle Harbor.

Existing Problems

The West Waterway is authorized to -34 feet MLLW, a depth that does not meet the draft requirements of today's fleet of container ships. The East Waterway has similar authorization challenges at the south end, where it is authorized to -34 feet MLLW.

The Puget Sound pilots have indicated navigational challenges at entrances to both waterways. High spots at the entrance of the West Waterway mean that a draft of no more than 39 feet can be accommodated at zero tide. In addition, the current bathymetry has only a narrow "key way" at all times, creating safety concerns during transit. In the East Waterway, high spots at the north end of Terminal 30, outside the Federal navigation channel, create issues when larger, wider ships must transit past a full berth and fueling boom, potentially bringing into question whether the width of the waterway is adequate for the transit of large ships. Within the authorized channel, there are some high spots (approximately 35-37 feet) south of Slip 27 with associated navigational access impediments and safety/risk concerns due to vessel maneuvering requirements resulting from shoal conditions adjacent to vessels moored along each side of the waterway.

Ships in the West Waterway have consistently experienced delays due to tidal restrictions and their departing or arrival draft. With the upsized ships in current rotations, shipping lines are facing the potential of limiting their payload and cost disadvantages around waiting for tides where they will potentially miss a scheduled berth window in Vancouver, Canada, or need to make up time by sailing faster and burning more fuel.

Future Challenges

The Port of Seattle is a natural gateway for exports, both from the local Pacific Northwest market and from the upper Midwest market, as well as a natural gateway for Asian markets to import goods to the United States without travelling through the Panama Canal. The industry is rapidly increasing the size of ships in deployment on the West Coast. These ships have a draft requirement deeper than -50' MLLW or face the potential of not being able to depart fully laden. Ships departing Seattle need to realize economies of scale afforded by the larger ships currently being deployed and even larger ships in the future. Tide restrictions, light loading or other operational inefficiencies created by inadequate channel depth will limit Port of Seattle competitiveness, especially when competing with Canadian ports (Vancouver and Prince Rupert) for the U.S. Midwest intermodal cargo. Prince Rupert has a deep enough draft to handle large, fully laden outbound vessels. Seattle will be at a disadvantage compared with navigational access conditions at other existing deep draught west coast marine cargo facilities for handling increasing containerized exports from the U.S. Midwest. In addition, exporters in the Pacific Northwest and others along the nation's northern tier rail corridor who depend on the Seattle gateway will lose access to global markets if the Seattle harbor loses ocean carrier calls. Because railroads favor round-trip economics, there will be incentives to match imports to exports through the deeper ports and Seattle will also lose its advantage as a gateway for imports.

A summary of specific existing problems include the following points:

- Existing authorized depths for the East and West Waterways do not meet the draft requirements of today's fleet of container ships. Ships often light load or experience tidal restrictions, causing lost transportation efficiencies and lost cost efficiencies at Seattle Harbor.
- There are navigational challenges at the entrances to both waterways. High spots at the entrance of the West Waterway as well as a narrow "key way" cause consistent delays for ships. In the East Waterway, high spots at the north end of Terminal 30 and south of Slip 27 pose additional vessel safety and navigational challenges.
- Ships departing Seattle are not realizing economies of scale afforded by the larger ships currently being deployed and even larger ships in the future. Tide restrictions, light loading or other operational inefficiencies created by inadequate channel depth will limit Port of Seattle competitiveness with West Coast ports, especially with nearby Canadian ports as major ocean carriers both reduce the number of calls and call ports multiple times to receive additional exports before returning to Asia.

Opportunities:

Opportunities exist to increase safety while improving the efficiency of vessels transiting Seattle Harbor's East and West Waterways. Deepening these waterways will result in cost and time savings, potentially lowering project operations and maintenance costs, as well as allowing for the removal of draft restrictions for certain vessels. By being able to more fully load these vessels, transportation costs will likely decrease, ultimately leading to a more cost-efficient transportation system as well as improved capacity for increased trade and lower-priced goods. In addition, there are opportunities to fully utilize investments the Port of Seattle has made in facility upgrades to handle larger vessels. Terminals servicing the East and West Waterways have undergone significant expansion and modernization since the 1980s and are all designed for Panamax and post-Panamax vessels. Surrounding infrastructure (roads, railroads, container cranes, etc.) has also been developed to match the significant growth of the Port over the last 100 years, with over $1 billion in capital project improvements in the past 20 years. There is also an opportunity for reduced fuel consumption and a reduction in air emissions due to larger capacity vessel services associated with navigation improvements to the East and West Waterways. Finally, Elliott Bay, Puget Sound, and many areas of the East and West Waterways are already naturally deep. There is an opportunity to take advantage of these existing depths without full-scale dredging throughout the entire channel. As discussed in Section 10.2 and throughout Section 11, a relatively small Federal investment (limited dredging quantity) will likely result in significant National Economic Development benefits.

8 Planning Goals and Objectives

The Federal objective of water and related land resources project planning is to contribute to national economic development consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements.

The objectives for this study are the following (ranked in order of highest priority):

1. Achieve transportation cost savings to and from Seattle Harbor to the extent possible over the 50-year period of analysis.
2. Develop an alternative that is environmentally sustainable for the 50-year period of analysis.
3. Reduce navigation challenges facing harbor pilots and their operating practices for the 50-year period of analysis.

9 Planning Constraints

Planning constraints are significant barriers or restrictions that limit the extent of the planning process. Study-specific planning constraints are statements of things unique to a specific planning study that alternative plans should avoid. The following constraints (i.e. limitations on the range of measures and alternatives that can be proposed) have been identified for the study:

1. There are multiple Superfund sites within the project footprint and project vicinity (Section 6.7 and Table 6-5). While the sponsor will be responsible for the full cost of removing contaminated sediments, significant coordination with the EPA Superfund Office will be required during the feasibility phase.
2. Plans must be developed to be consistent with the U.S. Coast Guard's stated need for port security.
3. The project area is within treaty reserved usual and accustomed fishing areas for the Muckleshoot and Suquamish Indian Tribes. Plans will avoid or minimize impacts to tribal fishing areas consistent with treaty obligations.
4. There are threatened and endangered species within the project footprint. Avoidance and minimization of impacts to endangered species will be consistent with applicable laws and consultation under the Endangered Species Act.

10 Plan Formulation

The guidance for conducting civil works planning studies, Engineering Regulation (ER) 1105-2-100, Planning Guidance Notebook, requires the systematic formulation of alternative plans that contribute to the Federal objective. While the following sections summarize the plan formulation process for the 905(b) analysis, the reconnaissance-level alternatives analysis does not constitute a complete analysis of the full array of potential alternatives nor does it define a preferred alternative or National Economic Development (NED) plan. Detailed analyses are expected to be conducted in the proposed feasibility phase and would likely involve evaluation of all reasonable alternatives to address problems and opportunities.

10.1 Management Measures

A management measure is a feature or activity at a site that addresses one or more of the planning objectives and is a discrete element of a recommended project solution. A preliminary list of structural and non-structural management measures is included below.

<u>Non-Structural Measures</u>

- **Tug Assists:** Use additional tug assists to help larger vessels and vessels with decreased maneuverability transit the harbor.

- **High-Tide Transiting:** Time transits to use high tide to allow for the current fleet to transit the harbor under existing project conditions.
- **Light-Loading:** Light-load the larger vessels to allow the current fleet (larger than the existing project's design vessel) to transit the harbor under existing project conditions.
- **Lightering:** Transfer cargo between vessels of different sizes to allow vessels to enter and transit the harbor.

Structural Measures

- **Channel Deepening:** Deepen the channels to allow for passage of larger, deep-draft vessels.
- **Channel Widening:** Widen the channels to allow for passage of wider vessels, as well as the potential for two-way passage of vessels.
- **Widen and/or Lengthen Turning Basins:** Increase the size of the turning basin(s) to allow for additional maneuverability of vessels.
- **Entrance Channel Breakwaters/Jetties**: Construct breakwaters or jetties to allow for less wind/current impact to vessels entering the waterways.

10.2 Array of Alternatives

The array of alternatives that may be examined in the feasibility study would likely include navigational improvements to both the East and West Waterways in Seattle Harbor, including a combination of the measures identified in Section 10.1. For the purposes of the 905(b) analysis presented in this report, a single alternative will be evaluated for each waterway: (1) Deepening the East Waterway to -51 feet MLLW, and (2) Deepening the West Waterway to -51 feet MLLW. The preliminary evaluation of these alternatives is presented below. Table 10-1 lists the required dredging volumes for each waterway.

West Waterway

Much of the West Waterway is already at a depth below -51 feet MLLW; however, high spots at the entrance of the West Waterway as well as a narrow "key way" cause consistent delays for ships, creating a need for deeper channel to realize transportation cost savings. The proposed improvement of the West Waterway would consist of deepening the navigation channel for a length of 6,109 feet, to a depth of-51 feet MLLW, and maintaining a width of 750 feet from pierhead line to pierhead line. It is assumed 50% of the 2–foot allowable overdepth (OD) will be obtained during initial construction, as past experience indicates dredging contractors do not obtain the full overdepth volume to ensure they are compensated for all material dredged. The required dredged volume to improve the West Waterway is approximately 505,840 cubic yards.

East Waterway

The East Waterway has current depths ranging from -30 to -53 feet MLLW. The proposed improvement of the East Waterway would consist of deepening the navigation channel for a length of 7,232 feet, to a depth of -51 feet MLLW, and maintaining a width of 750 feet from pierhead line to pierhead line. The southernmost portion of the East Waterway (approximately 400-feet wide; refer to Figure 4-1) would not be included in the proposed dredging area. The required dredged volume to improve the East Waterway is approximately 176,720 cubic yards.

Table 10-1. Dredged material quantities for Seattle Harbor Navigation Improvement Project

	Depth (feet, MLLW)	West Waterway Volume (cubic yards)[1]
Project	-51	437,950
Project + OD[2]	-52	505,840

[1] Volumes include a 10% contingency; Volumes computed with respect to the 2-3 June 2014 condition survey performed by the USACE, Seattle District Hydrosurvey Unit
[2] OD = overdepth dredging

	Depth (feet, MLLW)	East Waterway Volume (cubic yards)[1]		
		East Waterway	**Clean-Up[3]**	**Total Deepening**
Project	-51	573,270	479,750	93,520
Project + OD[2]	-52	647,900	501,740	146,160

[1] Volumes computed with respect to the 2-3 June 2014 condition survey performed by the USACE, Seattle District Hydrosurvey Unit
[2] OD = over depth dredging
[3]Clean-Up quantities are the volume of cleanup within the navigation channel associated with Alternatives 3, 5, and 7 of EPA's Draft Supplemental Feasibility Study. Alternatives 3, 5, 7, and 8 were utilized to produce the most conservative quantities for the purposes of the 905(b) analysis. Future Corps of Engineers construction activities in the East Waterway will not include this separate clean-up effort; it is assumed that CERCLA cleanup will precede or be coincident with construction of the deepening project.

O&M Requirements and Future Uncertainties

Federal O&M dredging responsibilities include only the authorized navigation channel. The Port of Seattle is responsible for performing any additional O&M dredging outside of the navigation channel or deeper than authorized depths. The majority of Federal Operation and Maintenance (O&M) dredging for the Seattle Harbor project is performed upstream on the Duwamish River. The West and East Waterways have historically received little maintenance dredging with the exception of berthing area dredging by the Port of Seattle adjacent to the Port of Seattle marine cargo piers (this dredging generally occurs annually but individual berth frequency depends on use and shoaling rates). However, periodic maintenance dredging is anticipated. Historically, the southern 1000 feet of the East Waterway has experienced the majority of shoaling from riverine derived sediments. There is minimal marine sediment input into the project as the coastal bluffs of Duwamish Head are heavily armored, ultimately limiting the source and longshore transport of sediment toward the entrance of the West Waterway. Historic condition surveys indicate periodic dredging near the entrance to the West Waterway will likely be required as bank encroachment has been observed on the western sideslope. Historic shoaling rates were computed from condition surveys performed by the Seattle District Hydrosurvey Unit in 2009 and 2014. Table 10-2 indicates the historic average annual shoaling rate in the East and West Waterways is approximately 10,000 and 20,000 cubic yards per year respectively. Historically, channel deepening and widening projects result in a net increase in O&M dredging requirements. This has been well documented by Rosati[13], which shows a net increase in

[13] Rosati (2005) - ERDC/CHL CHETN-IV-64

O&M dredging over six historic deepening and widening projects. An empirical relationship was developed relating the volume deficit, or the volumetric difference between the dredged and natural equilibrium channel geometry. A linear regression using historic data indicates the annual increase in dredging is approximately 6% of the volume deficit. Using the relationship with the computed volumes to -52 feet MLLW listed in Table 10-1, the volume deficit would be increased by approximately 36,100 and 28,200 cubic yards per year for the East and West Waterways, respectively.

Sea level change presents an uncertainty regarding future O&M requirements. As described in Section 6.2, the predicted mean sea level is expected to rise between 0.4 and 2.2 feet by 2065. Sea level rise would add additional depth in each Waterway but may alter sedimentation patterns throughout the project as salt wedge dynamics would be altered. Also, climate change models suggest hydrologic changes, with wetter winters and drier springs in western Washington. For the Green-Duwamish River basin, this could mean a shift in regulated river flows from Hanson Dam, potentially with earlier reservoir refill dates in the spring if reservoir operations are adapted to accommodate climate changes[14]. A shift in regulated flows may affect downstream sedimentation rates in the Duwamish River. However, sedimentation impacts would be more likely upstream in the Duwamish Waterway than in the East or West Watererway. Additionally, local service facilities (LSF) may need to be modified to mitigate future coastal storm damage. Presently there are not any bridges located within the project area. Two bridges are located immediately upstream of the project crossing the Duwamish Waterway. Vessel traffic is not anticipated to be impacted by sea level change.

Table 10-2. Shoaling Rates and estimated annual O&M dredging requirements for Seattle Harbor Navigation Improvement Project

	East Waterway	**West Waterway**
Shoaling from 2009 to 2014 (CY)	49,810	100,260
Avg. Annual shoaling (CY/yr)	10,000	20,000
Increase in shoaling rate (CY/yr) per Rosati (2005)	39,700	31,000
Total project O&M dredging (CY/yr)	**49,700**	**51,000**

[1]Shoaling volume represents total accretion in waterway using surface to surface computations
[2]Rosati (2005) predicts Increase in shoaling rate is predicted as R = 0.0613*Vd, where Vd = volume deficit

11 Evaluation of Alternatives

Preliminary considerations are identified below to inform the initial evaluation of alternatives. The sub-sections presented in this chapter are a preliminary analysis of potential benefits, costs, and other considerations that may be attributable to proposed deepening of the East and West Waterways. Detailed analysis would be conducted in the feasibility phase and would involve evaluation of all reasonable alternatives to address potential outcomes and opportunities.

[14] USACE (2014) – Howard Hanson Dam Climate Change Impacts and Adaptation Study.

11.1 Benefits of Alternatives

The economic considerations documented below are a preliminary analysis of potential benefits attributable to the proposed navigation improvement. Detailed analysis would be conducted in the feasibility phase and would involve economic evaluation of all reasonable alternatives to address the problems and opportunities.

Benefits for the proposed -51-foot MLLW project of both the East and West Waterways are based on transportation cost savings for the expected container throughput. These benefits were developed using a cost per mile analysis, using information from Corps of Engineers findings on transportation costs per Twenty Foot Equivalent Units (TEU) using different size vessels[15]. Transporting containers using Panamax ships at typical service draft costs about $30 per TEU per 1,000 miles sailing distance. Using an average round-trip length from Asian ports to the Port of Seattle via the Pacific Ocean of 12,600 miles results in TEU costs of approximately $378 per TEU for shipping from Asia via the Pacific Ocean. Shifting those containers to Post-Panamax ships saves 20 percent or approximately $75.60 per TEU. All foreign flag vessels calling to the East and West Waterways are currently all on Asian Pacific trade routes. Table 11-1 summarizes the calculation of potential benefits.

Table 11-1 Trade Route Potential Benefits

Trade Route	Roundtrip Distance (Miles)	Current cost per TEU mile ($)	Current Cost per TEU ($)	Cost per TEU mile Post Panamax ($)	Cost per TEU Post Panamax ($)	Savings per TEU ($)	Weighted Savings per TEU ($)
Asia (Pacific)	12,600	0.03	378.00	0.024	302.40	75.60	75.60
						Total Savings	75.60

Adjusting the total savings ($75.60) for the possibility that up to 25 percent of the container traffic may not benefit from the proposed project yields an average savings of $56.70 per TEU. The Port of Seattle Century Agenda Goal is to grow to 3.5 million TEUs by 2036. The Port of Seattle evaluated low, medium, and high growth rates that range from 2 to 4.35 percent and result in 2.2 to 3.5 million TEUs by 2036. As a result of the recession, current annual container traffic of 1.6 million TEUs (of which the East and West Waterways account for 1 million TEUs), is down from the Port's 2.1 million TEU peak in 2010 and is also down from a recent average of about 1.8 million TEUs (of which the East and West Waterways account for about 1.3 million TEUs). Using the low growth forecasts, the Port is expected to reach its recent average of 1.8 million TEUs in 2025. However, given the Port's current constraints with regards to authorized depths of the East and West Waterways, and the recent development of container terminals at the Port of Prince Rupert, a no growth assumption was used to show conservative benefits associated with the proposed -51 MLLW project in both waterways.

[15] Moser, David. "Issues in Economics of Container Ship Driven Channel Deepening." U.S. Army Corps of Engineers Senior Economist Meeting. June 2009.

The Port is capable of handling greater capacity and larger vessels. Existing Port facilities ready for the higher throughput larger vessels include:

- Ample terminal/rail yard capacity (current facilities capable of handling 50% higher volumes with no additional development)
- The biggest cranes in the world, capable of working the largest ships (Triple E class)
- Two Class 1 railroads with high-volume intermodal links to inland markets

11.2 Costs of Alternatives

The reconnaissance-level cost estimate is based on input from the Port of Seattle and assumptions made by the Project Delivery Team (PDT). The Port was able to provide historical unit price data for open-water disposal and upland disposal. The PDT made assumptions on the dredging method and upland disposal method based on knowledge of previous dredging efforts. Costs are based on expected first costs for the assumed East and West Waterway channel alignments to -51 feet MLLW, plus costs associated with one foot of overdepth dredging. These numbers include the estimated costs for dredging, disposal, and mitigation.

The cost estimate assumes that all materials will be dredged by a clamshell and the material will be transported by a bottom dump scow. Material classified as suitable for in-water disposal will be placed at the Elliott Bay open-water disposal site. Material classified as contaminated will be transported to an approved dredged material receiving and handling facility in south Elliott Bay or the Duwamish Waterway for transshipment. Contaminated material will be handled appropriately and shipped by rail to an Eastern Washington or Northern Oregon landfill site. Appropriate measures will be taken to ensure that any contaminated material does not return to the harbor consistent with standard BMPs that include but are not limited to environmental buckets where feasible, barge liners, water pumps, water diversion, and water filtration.

As presented in Table 10-2, operations and maintenance (O&M) is expected to increase compared to future without-project conditions. Interest during construction was computed for both waterways and added to first costs to determine total financial first costs. Interest and amortization was calculated at the current Federal discount rate of 3.5 percent over the 50-year period of analysis.

Costs and benefits for the proposed project depth are summarized in Table 11-2 for the East Waterway, West Waterway, and combined project. These benefits are conservative and assume no growth over the period of analysis of 2024 to 2074 due to uncertainties in the growth projections.

This preliminary analysis contains significant uncertainty in benefit and cost estimation due to lack of availability of information and simplification of analysis. However, even with a significant reduction of the potential benefits or increase in costs, there is still Federal interest in further study as the potential benefits would still outweigh the costs.

Table 11-2. Proposed Project Expected Costs and Benefits

	East Waterway - 51-Feet Project	West Waterway - 51-Feet Project	Total Project (East + West Waterway)
Estimated Construction Costs (includes estimated costs for dredging plus one-foot overdepth, disposal, and mitigation, Jun 2014 price level)	$2,854,000	$92,289,000	$95,143,000
Interest During Construction (IDC)	$148,000	$4,791,000	$4,939,000
Present Worth Financial Costs (Estimated Construction + IDC)	$3,002,000	$97,080,000	$100,082,000
Average Annual Costs			
Interest and Amortization (50 years, 3.5% discount rate)	$128,000	$4,138,000	$4,266,000
Increased Annual Operations and Maintenance (O&M)	$1,020,000	$1,061,000	$2,081,000
Total Average Annual Costs	$1,148,000	$5,199,000	$6,347,000
Present Worth Average Annual Benefits	$27,259,000	$26,190,000	$53,449,000
Net Average Annual Benefits	$26,111,000	$20,991,000	$47,102,000

11.3 Fish and Wildlife Resources Considerations

The quantity that would be dredged from each waterway is approximately 176,720 cy from the East Waterway and approximately 505,840 cy from the West Waterway. This work will likely be accomplished with a clamshell dredge. The Corps anticipates that dredging will most likely be accomplished with one derrick dredge with two scows used in each waterway. Each operation would likely have one, and possibly a second tugboat associated with the dredge and scows. Dredging these quantities would take one dredge-year for the East Waterway and as much as four dredge-years for the West Waterway depending on multiple factors such as dredge efficiency, interruptions for ship traffic, and the need for water management and BMPs during the process. The Corps in-water work window guidelines for the Duwamish Waterway are 1 October to 15 February; this is primarily for the protection of the ESA-listed bull trout and Chinook salmon. The estimated dredging duration for the East Waterway is shorter than the in-water work window, so the Corps would not anticipate a need to extend the time allowed for in-water work. The dredging duration for the West Waterway may take the entire fish window each year for four years.

Potential questions related to fish, wildlife, and vegetation resource protection as a result of the project include the following:

- Excessive underwater noise has the potential for negative physiological and behavioral effects to fish, diving birds, and marine mammals

- The duration of dredging may occur during migration periods for ESA-listed fish species, even if the in-water work window is strictly observed
- A potential increase to the upstream extent of the salinity gradient could affect the estuarine transitional area where salmonids undergo adaptations in their osmoregulation and may decrease the dissolved oxygen in the Turning Basin where adult salmon hold before migrating upstream
- Resuspension, release, and residual settling of contaminated sediment during dredging
- Impacts to water quality due to turbidity during dredging
- Potential changes in vessel traffic patterns, which could increase long-term ambient sound levels in Puget Sound
- Entrainment of bottom-dwelling fish and invertebrate prey items during dredging
- Short-term and long-term cumulative effects of maintenance dredging

The contaminants in the sediment of greatest concern include heavy metals (including mercury), tributyltin (TBT), polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), some other semivolatile organics (e.g. pesticides, phthalates), and possibly dioxin. Issues with dredging contaminated sediments include resuspension of contaminated sediments, releases of contaminants from substrate, and residual material that escapes the dredge and settles after dredging. These contaminants can impact aquatic species, as well as terrestrial species that prey on fish and invertebrates, due to the wide range of negative biological effects and the problem of bioaccumulation in larger, longer-lived species.

For protection of water quality in areas of contaminated sediment, dredgers use three types of control measures. These are operational controls such as timing, sequencing, and speed of operation; engineered controls such as silt curtains and sheet pile enclosures; and management actions for residuals such as backfill, capping, and re-dredging. Contractors can use an environmental clamshell bucket (an engineered control), which closes around the substrate to prevent resuspension of contaminants, and can reduce the amount of water that will need treatment during the sediment processing steps of the project. While contaminated sediments are being dredged, the scows in use will be sealed from leakage and will have on-board water management.

Mitigation measures that can reduce risk of negative effects of underwater sound include scheduled temporal restrictions like work windows, monitoring for species presence and reducing or stopping dredging during close proximity of sensitive species.

In a preliminary analysis of potential changes to saltwater inundation due to the alternative under consideration, hydraulic engineers conservatively estimate that the salinity wedge may extend a maximum distance of up to 0.5 mile upstream from its present extent, although it is more likely there will be no change to the extent of the saltwater wedge. According to the USFWS National Wetlands Inventory Database, the study area contains approximately 17 acres of estuarine and marine wetlands at Kellogg Island at RM 1.3, and another 2 acres along the right and left banks of the river at this location. At the upstream extent of saltwater inundation at approximately RM 5.5, there is an 8-acre site of estuarine wetlands. This is the Turning Basin and upstream extent of the Duwamish Navigation Channel. The Hamm Creek restoration site constructed under the Green/Duwamish GI is at the upstream end of the Turning Basin. The riparian zone is very narrow at this reach and bounded by roads and industrial development. An

increase to the extent of the salinity wedge would likely have no effect to vegetation along this shoreline. An increase to the extent of saltwater may affect the assemblage of fish species at this location, and may benefit adult salmon that use the Turning Basin as a thermal refuge and holding area before migrating upstream, and may slightly increase the area available for juvenile Chinook to adapt to saltwater. The salinity could change the benthic prey base for the half mile of further intrusion, which would likely affect the sculpin and flatfish in this reach. The range of tidal inundation is not expected to change.

11.4 Historical and Cultural Resources Considerations

No cultural resources have been identified within either the East or West Waterways. Present depths in proposed dredge areas are significantly deeper than historic depths. Historic georeferenced T-sheets indicate both waterways were constructed through the existing tide flats of the Duwamish River delta[16]. Any existing cultural resources would have been removed during original construction of the waterways thus there is low probability for encountering intact cultural resources. At this time there are no known shipwrecks in either waterway based on review of the June 2014 USACE multibeam hydrosurveys and the Duwamish delta seafloor mapping multibeam survey performed in 2001[17] . Coordination with the tribe(s) and the State Historic Preservation Officer (SHPO) will be required under Section 106 of the National Historic Preservation Act (NHPA). All alternatives will be reviewed for their potential effect to historic properties under Section 106 of the NHPA. If new upland disposal areas are necessary existing cultural resource information will be reviewed to determine if there are existing studies in that location or if a cultural resource survey will need to be conducted. Based on the information known to date there will likely be no impacts to cultural resources within the East and West Waterway.

11.5 Tribal Considerations

Consideration of action alternatives will include methods to avoid interruption or interference with any tribal fisheries events or resources. Alternatives will also be evaluated on their effects to water quality, which is of concern for fisheries resources. The project area is within treaty reserved usual and accustomed fishing areas for the Muckleshoot and Suquamish Indian Tribes. The timing and location of the alternative under consideration may coincide with tribal fisheries periods. The Corps regularly coordinates with these two tribes and negotiates work times each year for the routine O&M dredging of the Duwamish Waterway. The Corps consults with the tribes regularly and will continue to do so.

Based on the preliminary conceptualized alternative of deepening the harbor to -51 feet MLLW, the Corps does not anticipate significant negative effects to resources of concern to the tribes. The Corps will initiate tribal consultation at the earliest appropriate time for execution of the feasibility study.

11.6 Economic Considerations

During the feasibility phase, a full analysis of reasonable alternatives (including the No Action Alternative) will be performed to optimize potential feasible, environmentally sustainable alternatives in depth and alignment. A detailed economic analysis will be performed in the economic evaluation in order to identify

[16] University of Washington Puget Sound River History Group. http://riverhistory.ess.washington.edu/data.php
[17] USGS Open-File Report 01-266. Multi-beam mapping of the Major Deltas in Southern Puget Sound, Washington

the effect of using neighboring ports. An incremental analysis will also be performed in selected increments of channel depth to identify the optimum channel depths and widths.

11.7 Real Estate Considerations

A formal Real Estate Plan has not been developed for the reconnaissance phase and Real Estate needs will be assessed as part of the feasibility analysis. At this time it is anticipated that real property rights will not be required to support the project. The entire dredging operation will be performed in-water; construction equipment will be waterborne as well. No temporary work area lands will be necessary. No utility, business, or family relocations will be required. Any contaminated materials will be transported to a commercial facility for final disposal. All other dredged materials will be disposed of in-water.

The District's Real Estate effort will be focused on the exercise of the Government's Navigational Servitude Rights. Navigation Servitude is the dominant right of the Government under the Commerce Clause of the U.S. Constitution to use, control, and regulate the navigable waters of the United States and the submerged lands thereunder for various commerce-related purposes including navigation[18]. The project features serve a purpose that is in the aid of commerce; lands required to support the project are submerged. Because the Government will exercise its Navigation Servitude rights, no real property interest in those lands is required.

The submerged lands are managed for the State of Washington by the Washington Department of Natural Resources (DNR). If project implemented, the District would provide written notification to DNR of its intent to exercise Navigation Servitude Rights approximately ninety (90) days prior to the advertisement of the solicitation. The District will subsequently certify the availability of Navigation Servitude rights for the project.

The District has secured Northwestern Real Estate Division's alignment with the above named course of action.

12 Key Feasibility Study Assumptions and Associated Uncertainties

The following sections summarize key assumptions and uncertainties taken into consideration as the scope, schedule, and budget were developed for the feasibility phase. Changes in these assumptions or uncertainties will impact feasibility study activities and associated scope; these assumptions will be added to and/or revised as needed during future iterations of the planning process.

12.1 Fish and Wildlife Resources Considerations

Each identified concern for fish and wildlife resources will be investigated for potential effects of the proposed alternatives. Literature searches and consultation with the relevant natural resource agencies and tribes will provide a great deal of the information for the analysis. The study team will use existing data and best professional judgment to the extent practicable; however, the team will make risk-informed decisions and may determine that new studies may be needed where the data gaps are too great to proceed without reducing risk of unquantified potential effects. Studies that may be needed during feasibility phase include

[18] ER 405-1-12, Change 31, 1 May 1998, para. 12-7

evaluation of underwater noise in the project area, analysis of potential impacts to wetlands, and analysis of any potential upstream effects at restoration sites and preserved properties such as Kellogg Island. Additionally, if there are insufficient data to predict turbidity during dredging and potential fate of resuspended sediments, the Corps may need to conduct modeling to adequately address these concerns.

Key assumptions for addressing concerns for fish and wildlife in the feasibility phase include the following:

- Existing information on underwater noise in the region and sound propagation levels from the vessels involved with dredging is sufficient to determine scope and intensity of effects
- Duration of dredging will be completed within the allowable in-water work window, or will not extend substantially beyond this period
- No or very little effect of the alternatives considered will occur to upstream habitats or natural resources such as wetlands
- Turbidity during dredging will be similar in nature and managed like typical O&M dredging in the East and West Waterways
- Environmental organizations and concerned citizens will have concerns over potential for increased development, vessel traffic, or air quality impacts
- To the extent practicable, environmental concerns can be addressed through mitigation measures of avoidance, minimization, or compensation, and through public education and outreach efforts

12.2 Historical and Cultural Resources Considerations

Key assumptions for cultural resources include the following:

- Existing data (geological borings, bathymetry data, and historical data of past dredging activities and land use) for both the East and West Waterway will be sufficient to make a determination of effect regarding the alternatives under consideration.
- No cultural resources (i.e. shipwrecks) are present and/or buried within the sediments to be dredged in either the East or West Waterway.
- No additional investigative work (e.g., side scan sonar) will be necessary.
- Consultation with the SHPO and tribe(s) under Section 106 of the NHPA will occur and neither SHPO nor the tribe(s) will have cultural resource concerns.

12.3 Tribal Considerations

The tribes do not voice objections to the Corps' O&M dredging regime in the lower Duwamish River but are invited to consult on these activities twice yearly. However, the tribes may have objections to the resulting environmental effects, interruption of fishing activities, or to a potential for increases in vessel traffic at the Port of Seattle.

Key assumptions for addressing concerns expressed by the Native American tribes include the following:

- Tribes will have concerns over potential impacts to fisheries resources and interruption of tribal fishing events, including access to their usual and accustomed fishing sites, but the timing of dredging activities will be coordinated and mitigated for if possible. Any positive or negative effects to salmon or salmon habitat are considered effects to tribal resources

- Plans will avoid or minimize impacts to tribal fishing areas consistent with treaty obligations
- The Corps will coordinate early and often with the tribes with interests in the project area

12.4 HTRW and Dredged Material Disposal Considerations

As described in Section 6.7, the Corps and non-Federal sponsor are continuing to coordinate closely on existing and future CERCLA and HTRW activities to ensure current or future clean-up activities are consistent with proposed deepening alternatives that will be evaluated during the feasibility phase. The following paragraphs outline key HTRW and dredged material assumptions or considerations for the feasibility phase; these assumptions will continue to be revisited throughout the feasibility phase as close coordination with the non-Federal Sponsor, EPA, and other stakeholders continues.

The proposed navigation dredging project is likely to interact with existing and future CERCLA/HTRW sediment remedies that leave contaminated sediments in place within the Federal navigation channel boundary (Section 6.7, Figure 6-11). In addition, the schedule for remedial activities is currently unknown for some of the sites and interaction between remediation projects and the proposed dredging project will be addressed in the feasibility study. All sediment within the Federal navigation boundary is also within the boundary of designated CERCLA NPL sites (Figure 6-11). Because of the high differential cost of upland versus in-water disposal, uncertainties associated with the predicted outcomes are critical when estimating disposal costs. Determining the actual quantity of dredged material that is suitable for in-water disposal versus the quantity of material requiring upland disposal will require sediment characterization under the Dredged Material Management Program (DMMP) as required by ER 1165-2-132. Suitability determinations must occur within three years prior to actual disposal; therefore, a limited investigation in West Waterway will occur during the feasibility phase as described below.

In West Waterway the level of effort included in the scope for sediment characterization during the feasibility phase is 35 percent of what would be required under full characterization to inform alternative development. Based on a limited subsurface investigation conducted by Seattle District in 2012, it is assumed that contamination in the West Waterway is most likely to occur in the upper four feet of sediment and that levels of contamination are below disposal criteria in material below 4 feet. Hence, sediment testing during the feasibility phase will focus on the upper four feet, with a smaller number of deeper samples to verify the predicted trend of decreasing contamination with depth. Should feasibility study testing demonstrate that contamination extends into deeper sediments, testing of additional, archived core sections may be necessary. This may result in greater analytical costs and potential but limited schedule delays. Full characterization will occur in the West Waterway during the Preconstruction Engineering Design (PED) phase and may result in additional material that must be disposed upland. The non-Federal sponsor will be responsible for the full cost of removal and upland disposal of contaminated sediments.

For the East Waterway, remediation may not occur in advance of the dredging project or completely remove all sediment that is unsuitable for in-water disposal. The sediment characterization data already collected or to be collected under CERCLA are adequate to predict the quantities of material requiring upland disposal from the East Waterway during the feasibility phase. However, the level of uncertainty associated with the timing and efficacy of the CERCLA cleanup is indeterminable. Therefore, full

characterization under DMMP will occur during the PED phase and may result in material that must be disposed upland during the deepening project. The non-Federal sponsor will be responsible for the full cost of removal and upland disposal of contaminated sediments.

It is assumed that the regulatory guidelines for open-water disposal in place during feasibility will remain in effect at the time of full DMMP characterization. However, regulatory guidelines are constantly evolving and predictions made during feasibility about the eventual suitability of dredged material for in-water disposal have a degree of uncertainty due to this evolution. The most likely regulatory change that could impact project assumptions is the evaluation of bioaccumulation of chemicals of concern. The level of uncertainty depends, in part, on the length of time it takes to complete the deepening project.

Two other assumptions with low levels of uncertainty are the continued availability of the Elliott Bay open-water disposal site and the continued existence of a rehandling facility on the Duwamish for material slated for upland disposal. The Elliott Bay site has been in existence for over 25 years and the rehandling facility has been used for other CERCLA cleanup projects. Both are currently expected to be available in the future anticipated timeframe of the deepening project.

12.5 Coordination with Federal and State Resource Agencies and Federally Recognized Tribes

The Corps of Engineers has completed initial coordination and outreach with Federal and State Resource Agencies as well as federally recognized tribes near the study area. Coordination and outreach with agencies, stakeholders, tribes, and members of the public will continue throughout the feasibility phase.

13 Feasibility Phase Cost Estimate and Schedule

A detailed feasibility phase cost estimate has been developed and will be included in the Project Management Plan. It is estimated that the feasibility cost will be approximately $2,835,000, with completion of the feasibility study in approximately three years. Key feasibility milestones, costs, and schedule are summarized in Table 13-1.

Table 13-1. Feasibility Study Milestones, Schedule, and Budget

Milestone	Date	Budget
Alternatives Milestone	Q3 FY2015	$400,000
Tentatively Selected Plan	Q3 FY2016	$1,360,000
Agency Decision Milestone	Q4 FY2016	$610,000
Final Report	Q3 FY2017	$400,000
Chief's Report	Q4 FY2017	$65,000
TOTAL		**$2,835,000**

TOTAL		**$2,835,000**

14 Letter of Intent

As the non-Federal sponsor, the Port of Seattle will be required to provide 50 percent of the cost of the feasibility phase. The local sponsor is also aware of the cost sharing requirements for potential project implementation. A letter of intent from the Port of Seattle stating a willingness to purse a feasibility study and to share in its cost, and an understanding of the cost sharing that is required for project construction is included as Attachment 2 to this report.

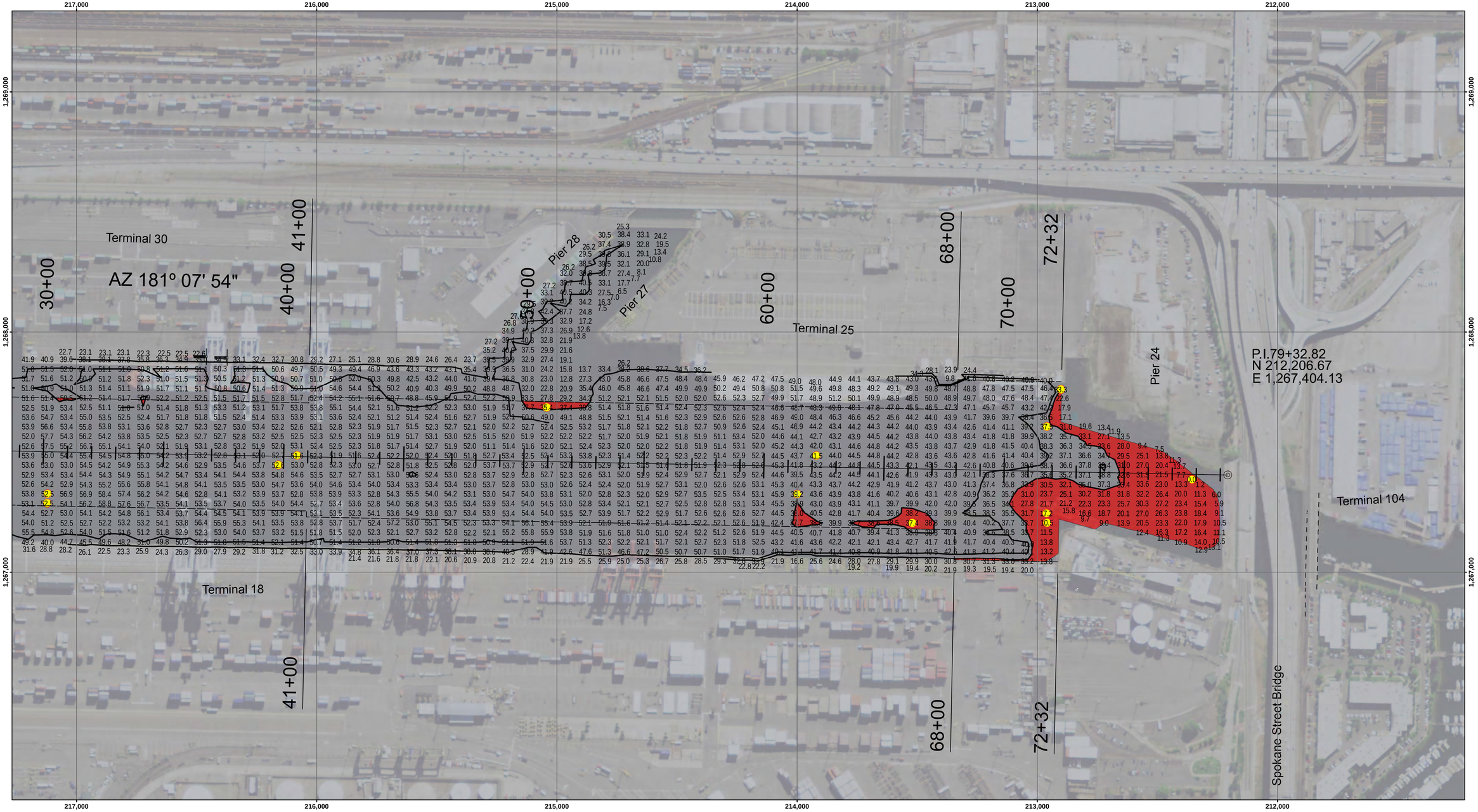
15 Recommendation

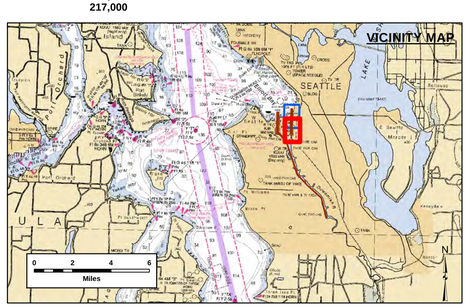
I recommend that the Seattle Harbor, Washington study proceed into the feasibility phase based on the findings presented in this 905(b) Reconnaissance Report. The study team and non-Federal sponsor have identified at least one viable alternative for both the East and West Waterways (deepening each waterway to -51 feet MLLW). Preliminary economic analysis indicates that there is a Federal Interest in proceeding into the feasibility phase for Seattle Harbor. It is recommended that the feasibility study further analyze additional alternatives for navigation improvements at Seattle Harbor.

John G. Buck
Colonel, Corps of Engineers
District Commander

APPENDIX 1

2014 Condition Surveys





LEGEND

- Federal Navigation Channel
- Federal Navigation Center Line
- Cable Submarine
- Cable Overhead
- Contour Line
- Cable Area
- Placement Area
- Anchorage Area
- Obstruction Point
- Wrecks-Submerged
- Shoaling Area
- Shoalest Sounding**
- Beacon, General
- Red Navigation Buoy
- Green Navigation Buoy

Feet
0 200 400 600 800 1,000

** Shoalest sounding per quarter, per each reach.

DU_02_EWW_20140603_E_12_6_1_55

NOTES:
The channel alignment shown on this map is Alignment 2014
The following equipment was used for this survey:
Reson 7125 Multibeam, 140 degree swath, 1.5 x 1.5 individual beam. 400 khz transducer.

Survey Vessel, NWS 1-16-32

The following surveys were used to create this drawing set:
Condition, 3 JUN 2014, 2014se013 (Sta. -10+00 to Sta. 69+00)

NOTES:
Sounding and elevations are in feet and refer to the plane of NOS Mean Lower Low Water (MLLW). Epoch 1983-2001. Tide correction Based on Geoid03 using Real Time Kinematic (RTK).

Horizontal Datum: WGS-84. Projected coordinate system: Lambert Grid Projection, State Plane, Washington North Zone, 4601, North American Datum of 1983 (NAD 83/91).

Horizontal units are U.S. Survey Feet.

The information depicted on this map represents the results of surveys made on the date indicated and can only be considered as indicating the general conditions existing at that time.

Soundings taken above the datum plane are prefixed with a (+) sign.

The location of navigation aids are provided by the U.S. Coast Guard or the Corps of Engineers.

Base imagery prepared from natural color four band imagery provided by the National Agriculture Imagery Program (NAIP) taken by United States Department of Agriculture (2013).

(Project Depth, Stations, Width): (51', 0+00 to 41+00, 450'); (39', 41+00 to 68+00, 500'); (34', 68+00 to 72+32, 750'); (34', 72+32 to 79+32, varies).

US Army Corps of Engineers
Seattle District

CAUTION: NOT INTENDED FOR NAVIGATIONAL OR RELATED PURPOSES. The information on this map results from hydro surveys performed on the dates indicated. Although the U.S. Army Corps of Engineers strives to maintain accurate and precise maps, the information on this map may not be accurate, may not be current, and/or may be incomplete or containing omissions. It may be in error. The U.S. Army Corps of Engineers and its suppliers makes no warranties, express or implied, as to the accuracy of conditions depicted except as described above, including no warranties as to the usability or suitability for any particular purpose.

U.S. ARMY CORPS OF ENGINEERS
SEATTLE DISTRICT

Surveyed By: KHK
Plotted By: LRT
Checked By: LMR

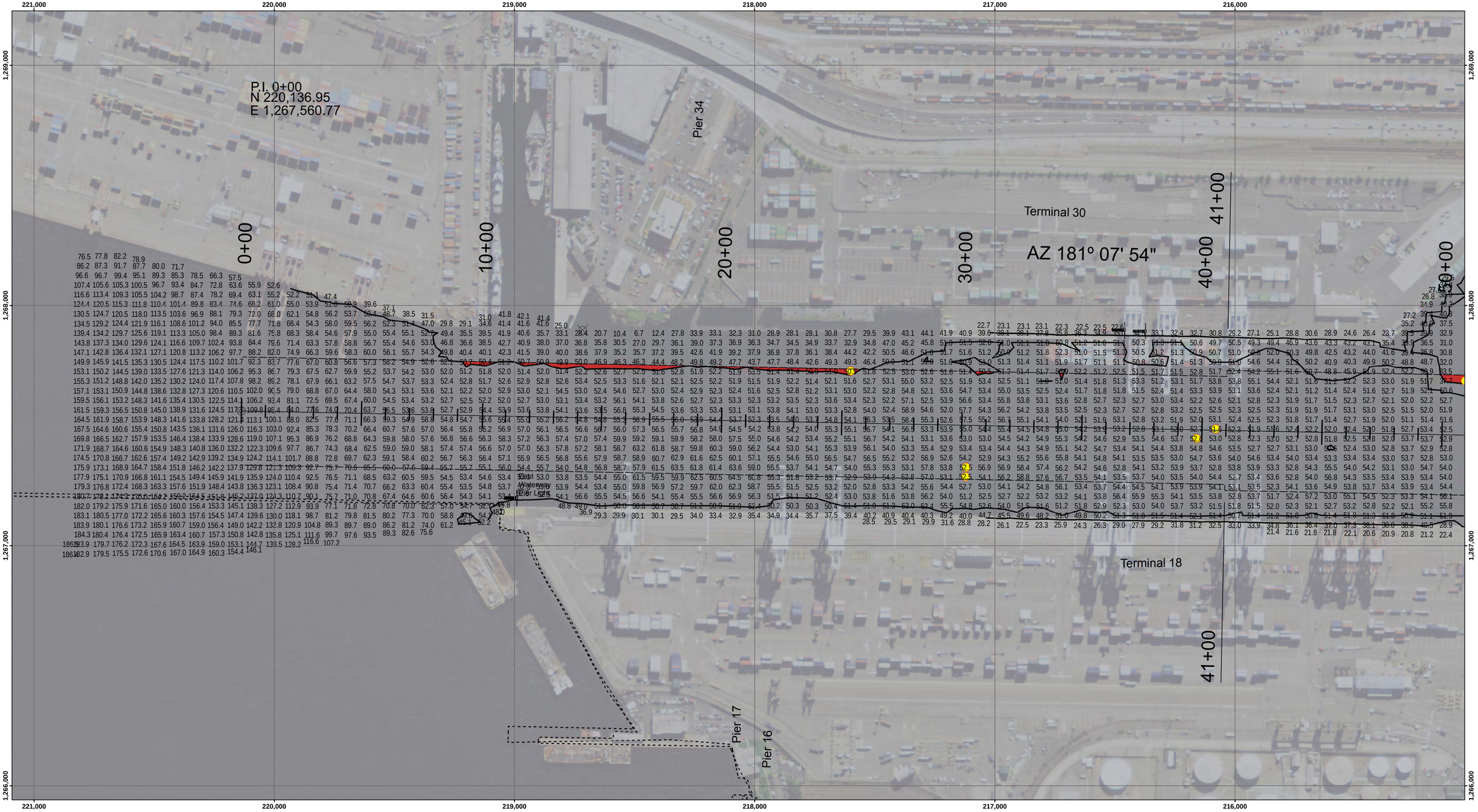
PREPARED: JOHN L. PELL
PROJECT MANAGER, NAVIGATION SECTION

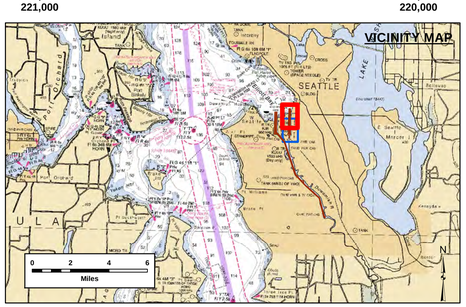
SUBMITTED: JOHN A. HICKS
CHIEF, NAVIGATION SECTION

SEATTLE HARBOR
EAST WATERWAY
E-12-6.1-55

Sheet Number
2 of 2

Revison Date:
3.6.1-20140429





LEGEND

- Federal Navigation Channel
- Federal Navigation Center Line
- Cable Submarine
- Cable Overhead
- Contour Line
- Cable Area
- Placement Area
- Anchorage Area
- Obstruction Point
- Wrecks-Submerged
- Shoaling Area
- Shoalest Sounding**
- Beacon, General
- Red Navigation Buoy
- Green Navigation Buoy

Feet: 0 200 400 600 800 1,000

** Shoalest sounding per quarter, per each reach.

DU_02_EWW_20140603_E_12_6_1_55

NOTES:
The channel alignment shown on this map is Alignment 2014
The following equipment was used for this survey:
Reson 7125 Multibeam, 140 degree swath, 1.5 x 1.5 individual beam. 400 khz transducer.

Survey Vessel, NWS 1-16-32

The following surveys were used to create this drawing set:
Condition, 3 JUN 2014, 2014se013 (Sta. -10+00 to Sta. 69+00)

NOTES:
Sounding and elevations are in feet and refer to the plane of NOS Mean Lower Low Water (MLLW). Epoch 1983-2001. Tide correction Based on Geoid03 using Real Time Kinematic (RTK).

Horizontal Datum: WGS-84. Projected coordinate system: Lambert Grid Projection, State Plane, Washington North Zone, 4601, North American Datum of 1983 (NAD 83/91).

Horizontal units are U.S. Survey Feet.

The information depicted on this map represents the results of surveys made on the date indicated and can only be considered as indicating the general conditions existing at that time.

Soundings taken above the datum plane are prefixed with a (+) sign.

The location of navigation aids are provided by the U.S. Coast Guard or the Corps of Engineers.

Base imagery prepared from natural color four band imagery provided by the National Agriculture Imagery Program (NAIP) taken by United States Department of Agriculture (2013).

(Project Depth, Stations, Width): (51', 0+00 to 41+00, 450'); (39', 41+00 to 68+00, 500'); (34', 68+00 to 72+32, 750'); (34', 72+32 to 79+32, varies).

US Army Corps of Engineers
Seattle District

CAUTION: NOT INTENDED FOR NAVIGATIONAL OR RELATED PURPOSES. The information on this map results from hydro surveys performed on the dates indicated. Although the U.S. Army Corps of Engineers strives to maintain accurate and precise maps, the information on this map may not be accurate, may not be current, and/or may be incomplete or containing omissions. It may be in error. The U.S. Army Corps of Engineers and its suppliers makes no warranties, express or implied, as to the accuracy of conditions depicted except as described above, including no warranties as to the usability or suitability for any particular purpose.

U.S. ARMY CORPS OF ENGINEERS
SEATTLE DISTRICT

Surveyed By: KHK
Plotted By: LKT
Checked By: LMR

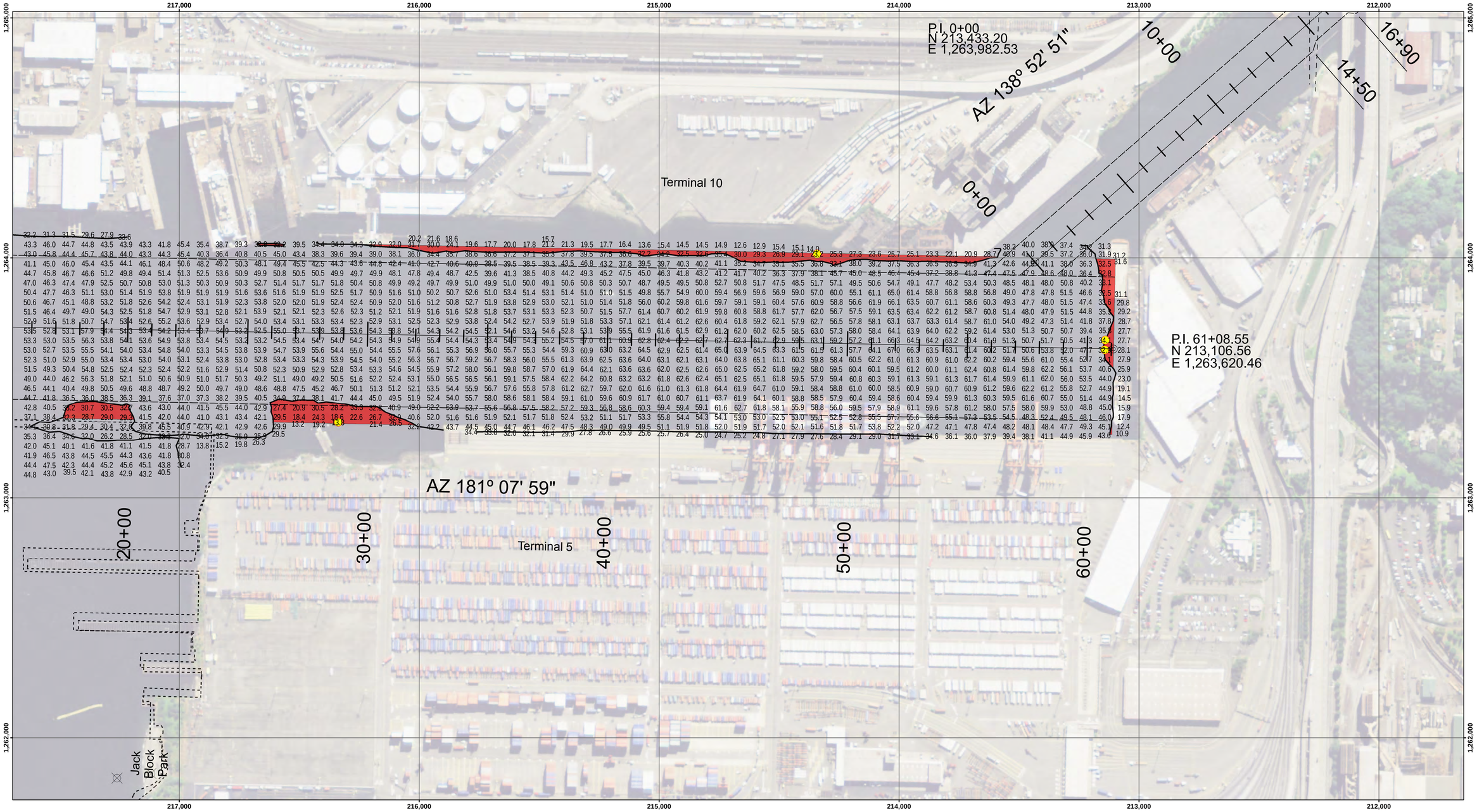
PREPARED: JOHN L. PELL
PROJECT MANAGER, NAVIGATION SECTION

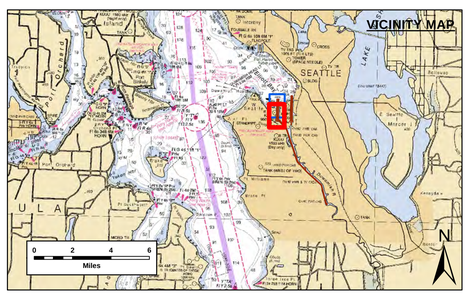
SUBMITTED: JOHN A. HICKS
CHIEF, NAVIGATION SECTION

SEATTLE HARBOR
EAST WATERWAY
E-12-6.1-55

Sheet Number
1 of 2

Revison Date:
3.6.1-20140429





LEGEND

- Federal Navigation Channel
- Federal Navigation Center Line
- Cable Submarine
- Cable Overhead
- Contour Line
- Cable Area
- Placement Area
- Anchorage Area
- Obstruction Point
- Wrecks-Submerged
- Shoaling Area
- Shoalest Sounding**
- Beacon, General
- Red Navigation Buoy
- Green Navigation Buoy

Feet
0 200 400 600 800 1,000

** Shoalest sounding per quarter, per each reach.

DU_01_WWW_20140602_E_12_6_2_46

NOTES:

The channel alignment shown on this map is Alignment 2014

The following equipment was used for this survey:

Reson 7125 Multibeam, 140 degree swath, 1.5 x 1.5 individual beam. 400 khz transducer.

Survey Vessel, NWS 1-16-32

The following surveys were used to create this drawing set:

Condition, 2 JUN 2014, 2014se014 (Sta. 0+00 to Sta. 61+00)

NOTES:

Sounding and elevations are in feet and refer to the plane of NOS Mean Lower Low Water (MLLW). Epoch 1983-2001. Tide correction Based on Geoid03 using Real Time Kinematic (RTK).

Horizontal Datum: WGS-84. Projected coordinate system: Lambert Grid Projection, State Plane, Washington North Zone, 4601, North American Datum of 1983 (NAD 83/91).

Horizontal units are U.S. Survey Feet.

The information depicted on this map represents the results of surveys made on the date indicated and can only be considered as indicating the general conditions existing at that time.

Soundings taken above the datum plane are prefixed with a (+) sign.

The location of navigation aids are provided by the U.S. Coast Guard or the Corps of Engineers.

Base imagery prepared from natural color four band imagery provided by the National Agriculture Imagery Program (NAIP) taken by United States Department of Agriculture (2013).

(Project Depth, Stations, Width): (34', 0+00 to 61+09, 750').

US Army Corps of Engineers
Seattle District

CAUTION: NOT INTENDED FOR NAVIGATIONAL OR RELATED PURPOSES. The information on this map results from hydro surveys performed on the dates indicted. Although the U.S. Army Corps of Engineers strives to maintain accurate and precise maps, the information on this map may not be accurate, may not be current, and/or may be incomplete or containing omissions. It may be in error. The U.S. Army Corps of Engineers and its suppliers makes no warranties, express or implied, as to the accuracy of conditions depicted except as described above, including no warranties as to the usability or suitability for any particular purpose.

U.S. ARMY CORPRPS OF ENGINEERS
SEATTLE DISTRICT

Surveyed By: KHK
Plotted By: LRT
Checked By: LMR

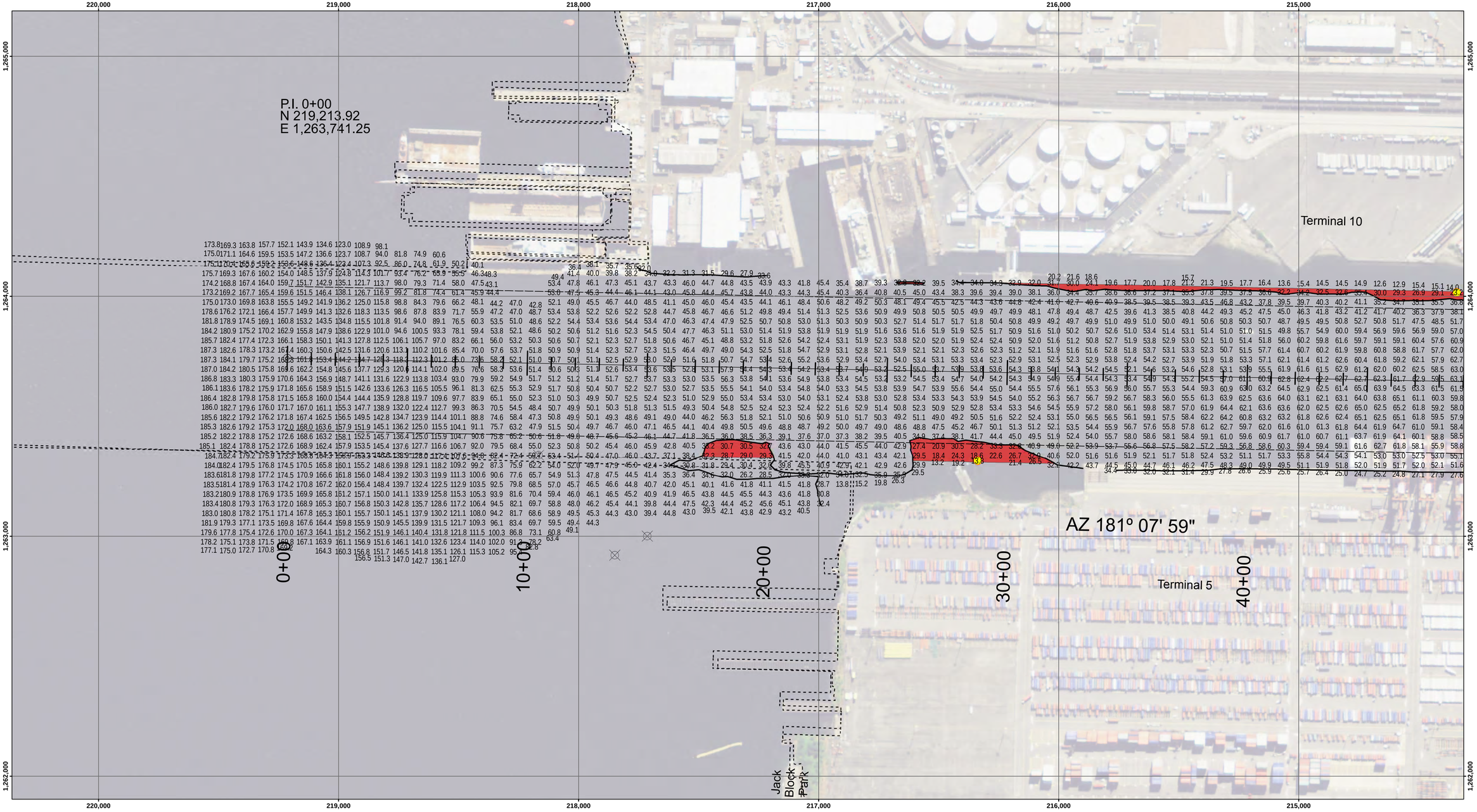
PREPARED: JOHN L. PELL
PROJECT MANAGER, NAVIGATION SECTION

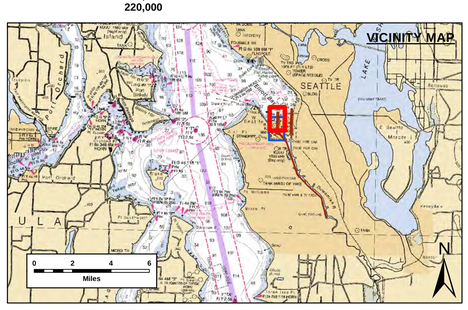
SUBMITTED: JOHN A. HICKS
CHIEF NAVIGATION SECTION

SEATTLE HARBOR
WEST WATERWAY
E-12-6.2-46

Sheet Number
2 of 2

Revison Date:
3.6.1-20140429





LEGEND

- Federal Navigation Channel
- Federal Navigation Center Line
- Cable Submarine
- Cable Overhead
- Contour Line
- Cable Area
- Placement Area
- Anchorage Area
- Obstruction Point
- Wrecks-Submerged
- Shoaling Area
- Shoalest Sounding**
- Beacon, General
- Red Navigation Buoy
- Green Navigation Buoy

Feet
0 200 400 600 800 1,000

** Shoalest sounding per quarter, per each reach.

DU_01_WWW_20140602_E_12_6_2_46

N E S W

NOTES:

The channel alignment shown on this map is Alignment 2014

The following equipment was used for this survey:

Reson 7125 Multibeam, 140 degree swath, 1.5 x 1.5 individual beam. 400 khz transducer.

Survey Vessel, NWS 1-16-32

The following surveys were used to create this drawing set:

Condition, 2 JUN 2014, 2014se014 (Sta. 0+00 to Sta. 61+00)

NOTES:

Sounding and elevations are in feet and refer to the plane of NOS Mean Lower Low Water (MLLW). Epoch 1983-2001. Tide correction Based on Geoid03 using Real Time Kinematic (RTK).

Horizontal Datum: WGS-84. Projected coordinate system: Lambert Grid Projection, State Plane, Washington North Zone, 4601, North American Datum of 1983 (NAD 83/91).

Horizontal units are U.S. Survey Feet.

The information depicted on this map represents the results of surveys made on the date indicated and can only be considered as indicating the general conditions existing at that time.

Soundings taken above the datum plane are prefixed with a (+) sign.

The location of navigation aids are provided by the U.S. Coast Guard or the Corps of Engineers.

Base imagery prepared from natural color four band imagery provided by the National Agriculture Imagery Program (NAIP) taken by United States Department of Agriculture (2013).

(Project Depth, Stations, Width): (34', 0+00 to 61+09, 750').

US Army Corps of Engineers
Seattle District

CAUTION: NOT INTENDED FOR NAVIGATIONAL OR RELATED PURPOSES. The information on this map results from hydro surveys performed on the dates indicated. Although the U.S. Army Corps of Engineers strives to maintain accurate and precise maps, the information on this map may not be accurate, may not be current, and/or may be incomplete or containing omissions. It may be in error. The U.S. Army Corps of Engineers and its suppliers makes no warranties, express or implied, as to the accuracy of conditions depicted except as described above, including no warranties as to the usability or suitability for any particular purpose.

U.S. ARMY CORPS OF ENGINEERS
SEATTLE DISTRICT

Surveyed By: KHK
Plotted By: LKT
Checked By: LMR

PREPARED: JOHN L. PELL
PROJECT MANAGER, NAVIGATION SECTION

SUBMITTED: JOHN A. HICKS
CHIEF, NAVIGATION SECTION

SEATTLE HARBOR
WEST WATERWAY
E-12-6.2-46

Sheet Number
1 of 2

Revison Date:
3.6.1-20140429

APPENDIX 2

Non-Federal Sponsor Letter of Intent

Port of Seattle

P.O. Box 1209
Seattle, WA 98111-1209
Tel: (206) 787-3000

www.portseattle.org

Date: 7/14/2014

Colonel John G. Buck, District Engineer
U.S. Army Corps of Engineer
Seattle District – CENPS-EN-PL
P.O. Box 3755
Seattle, WA 98124-3755

Dear Colonel Buck:

The purpose of this letter is to express the Port of Seattle's support for the Seattle Harbor General Investigation Study for Navigation Channel Deepening and to express our intent to enter into a cost-sharing agreement to pursue a Feasibility Study and ultimately for project construction.

We have reviewed the reconnaissance 905(b) report and are in agreement with the findings. We understand there is a federal interest in pursuing a cost-shared Feasibility Study to further investigate the viability of implementing a project to deepening the navigation channel. As conveyed by this letter, there is also a strong non-federal interest in moving forward with this study and ultimately project construction. The Port is willing to act as the lead non-federal sponsor. In this role the Port will work with Corps of Engineers staff over the next several months to refine the scope of necessary studies to be conducted during the cost-shared Feasibility Study phase. We understand that once the Feasibility Study is defined, agreed to and documented in a Project Management Plan (PMP), we will be asked to sign a Feasibility Cost Sharing Agreement (FCSA). We understand that the preliminary feasibility study cost, as reported in the 905(b), has been estimated at approximately $3 million dollars over a three year period. We further understand that the non-federal cost share is 50%. The Port intends to meet this requirement through a provision of in-kind services and a cash contribution. We are excited about the opportunity to resolve navigation channel issues, which will have multiple benefits to both our jurisdiction and the region as a whole.

We look forward to working in partnership with the Corps of Engineers on this high priority navigation project. Please contact Bari Bookout at 206-787-3361/bookout.b@portseattle.org if you have any questions.

Sincerely,

Linda Styrk
Managing Director
Port of Seattle Seaport