Newport Commercial Marina Section 107 Navigation Project

Draft Integrated Feasibility Report and Environmental Assessment

Appendix A – Engineering Appendix

US Army Corps of Engineers®
Portland District

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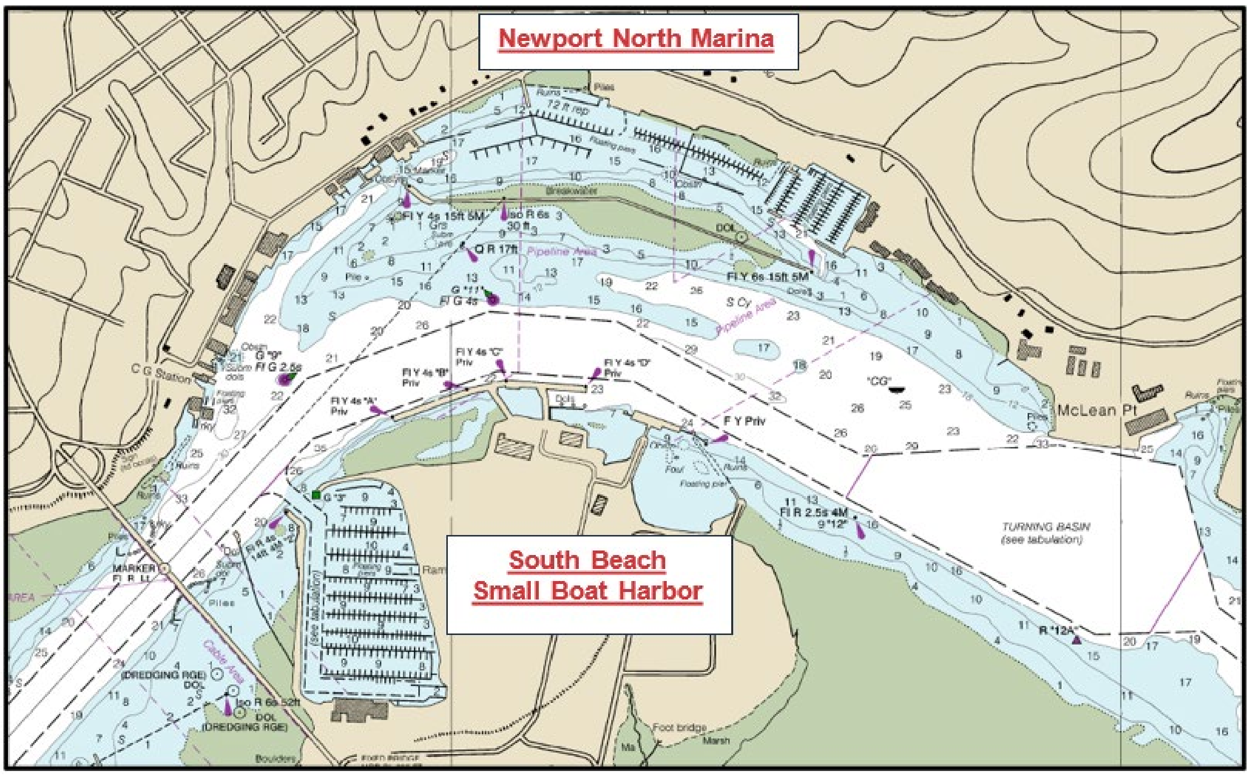
1 Introduction

The Newport North (Commercial) Marina, which is a primarily a commercial fishing harbor, is located within Yaquina Bay approximately 2.1 miles inshore from the Yaquina jetties entrance on the north side of the Yaquina embayment (Figure 1-1). The South Beach Small Boat Harbor is located on the south side of the Yaquina embayment and is primarily a recreational small boat harbor. The U.S. Army Corps of Engineers (USACE) is responsible for maintenance of the structures for these two coastal navigation projects. The Port of Newport manages both the Newport North Marina and the South Beach Marina.

Figure 1-1. Newport North Marina Existing Layout showing harbor structures (NOAA 18-561, 2011)



The USACE Portland District, and the non-Federal sponsor, the Port of Newport, are studying the feasibility of improving navigation in and around the Port of Newport's commercial fisheries marina (Commercial Marina) in Newport, Lincoln County, Oregon. The improvements would increase the Commercial Marina's ability to accommodate safe and efficient vessel operations for a commercial fishing fleet that is consolidating and increasing vessel sizes. Lack of adequate depth and space for safe maneuvering has and will increasingly limit the use of the Commercial Marina by the increasing number of larger vessels. Navigation improvements would alleviate delays and moorage competition for the commercial fishing vessels using the Commercial Marina for offloading catch, servicing, fueling, and provisioning. They would also improve the Commercial Marina's ability to provide safe harbor during storm events.

Appendix A is intended to document the supplemental information and analysis of the engineering aspects of this feasibility study that are not contained within the body of the Integrated Feasibility Report / Environmental Assessment. Geotechnical design and coastal hydraulic design considerations are highlighted in this appendix.

2 Purpose and scope

Appendix A presents features that are included within the scope of the navigation improvement project that require geotechnical and coastal hydraulics analyses. The engineering considerations laid out in this appendix assist in the development of preliminary, feasibility level design, and ensure all applicable design standards are met in accordance with USACE guidance. This project is in collaboration with the Port of Newport as the primary stakeholder/client.

3 References (including previous studies)

- Final Detailed Project Report & Environmental Assessment for Newport North Marina Breakwater (1996)
- EM 1110-2-1615 Hydraulic Design of Small Boat Harbors (1984)
- USACE, 2006. Coastal Engineering Manual, Part 5, Chapter 5, US Army Engineer Waterways Experiment Station, Vicksburg, MS
- USACE, 1984. EM 1110-2-1615, Hydraulic Desing of Small Boat Harbors, Department of the Army, US Army Corps of Engineers, Washington, D.C.
- PIANC, 2014. Harbour Approach Channels Design Guidelines, PIANC Report No 121, Maritime Navigation Commission, Belgium.
- Bottin, Briggs, 1996. Newport North Marina, Yaquina Bay, Oregon, Design for Wave Protection, Technical Report CERC 96-2. US Army Engineer Waterways Experiment Station, Vicksburg, MS.
- USACE. (1996). Newport North Marina Breakwater, Yaquina Bay, Oregon, Final Detailed Project Report & Environmental Assessment. U.S. Army Corps of Engineers. May 1996.
- GRI (2024). Geotechnical Data Report. GRI 6801-B, Prepared for DOWL LLC., Port of Newport, and USACE. Tigard, Oregon. October 2024. from https://www.portofnewport.com/files/d8bc3c74b/2024+GRI+Geotechnical+Data+Report.pdf

4 Existing conditions

4.1 History of Harbor Structures

While the North and South jetties at Yaquina Bay (2.1 miles downstream of the Newport North Marina) were originally constructed in 1889 and 1881, respectively, the embayment harbor structures were constructed more recently. USACE authorized and constructed the Newport North Marina on the north side of the embayment in 1947 and the South Beach Small Boat Harbor in 1978. These structures can be seen in Figure 1-1.

The timber breakwater which protects the Newport North Marina is 2,650 feet long and was constructed in 1947. Also constructed at the same time was a 400-feet timber shorewing which was oriented perpendicular to the shoreline at the east end of the marina.

Figure 4-1 and Figure 4-2 show plan view layout and cross sections of these two structures. Also note in this figure that even prior to the timber breakwater construction, a very large shoal existed in the project area between the marina and the southern part of the bay, referred to as the Middle Ground. The timber breakwater was completely repaired in 1997. An existing shoal around the timber breakwater retains a relatively stable configuration. In 1946, the authorizing document for the original breakwater referred to the shoal as the “middle ground”. Aerial photographs dating back to 1973 indicate that the shoal has not changed significantly in recent history (USAED Portland 1994).

In 1998, USACE constructed a rubblemound extension at the west end of the timber breakwater to protect the marina from storm wave energy transforming easterly from the Yaquina ocean entrance. The breakwater is 180 feet long and the cross section can be seen in Figure 4-3. The length of the rubblemound breakwater was optimized to provide the most acceptable amount of wave reduction given the cost of the structure. The below criteria were used to design the rubblemound breakwater extension, length and alignment.

- To reduce storm wave heights within the marina to no greater than 1.5 feet, for a storm of one percent probability of exceedance.
- To maintain the width of the marina entrance to at least 125 feet.
- To not negatively impact currents and shoaling beyond the existing condition.

Figure 4-1. Construction Layout of Timber Breakwater and Shorewing in 1947. (red lines show timber breakwater and shorewing, blue polygon shows Middle Ground)

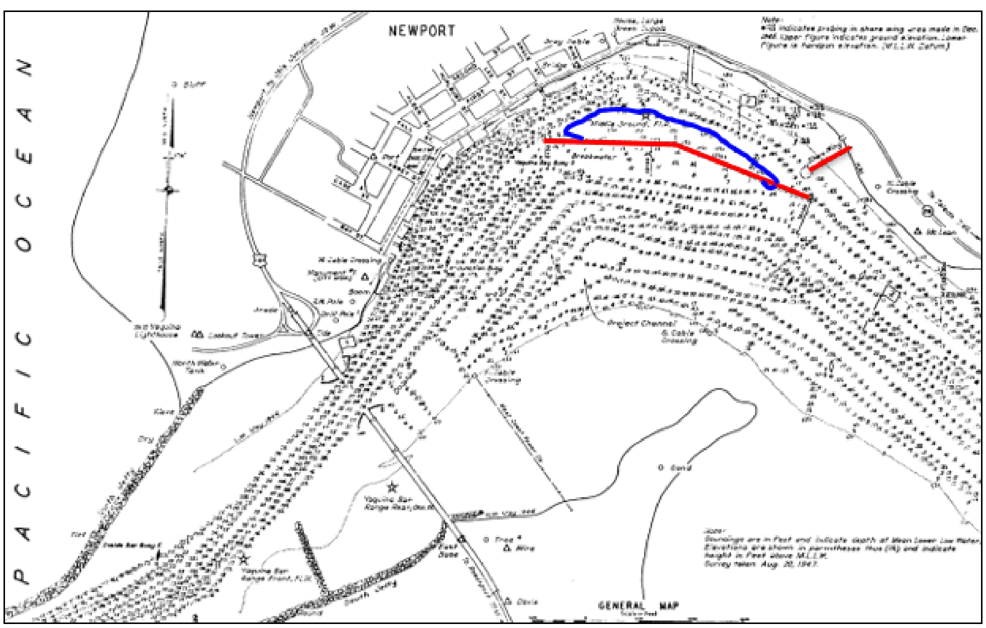


Figure 4-2. Cross section of Original Timber Breakwater and Shorewing

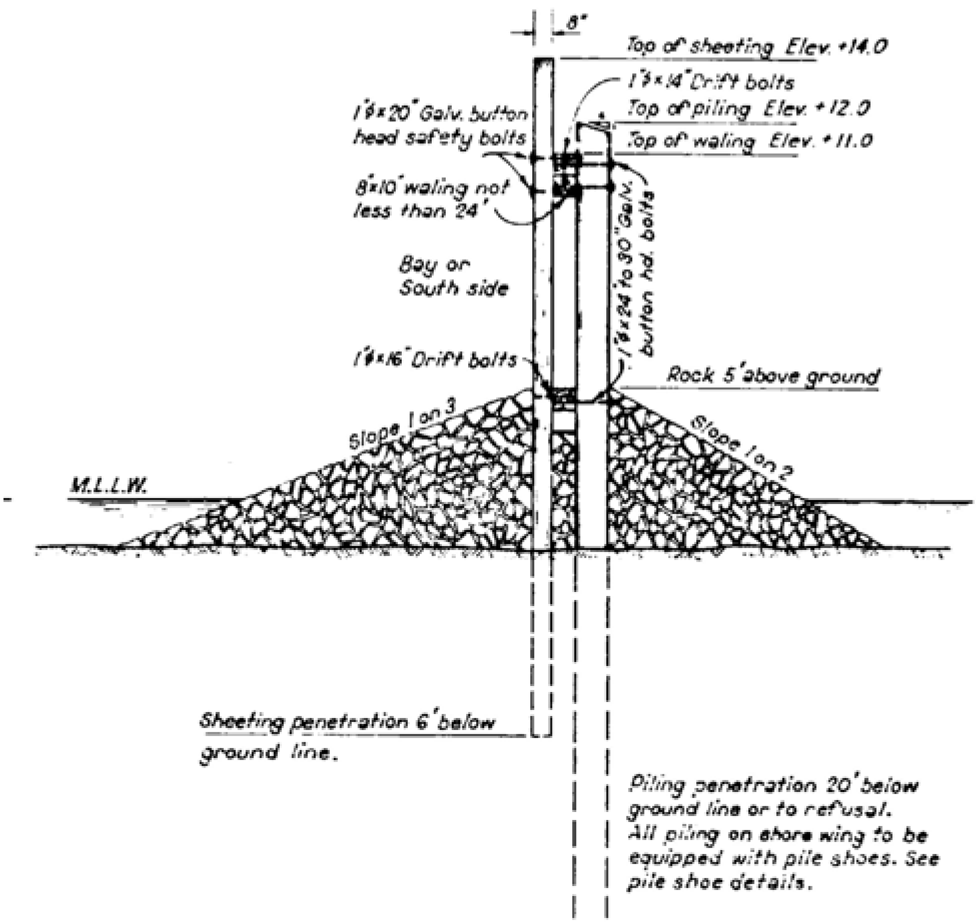


Figure 4-3. Cross section of rubblemound extension constructed in 1998 to reduce wave energy entering the west end of the North Marina from the ocean entrance

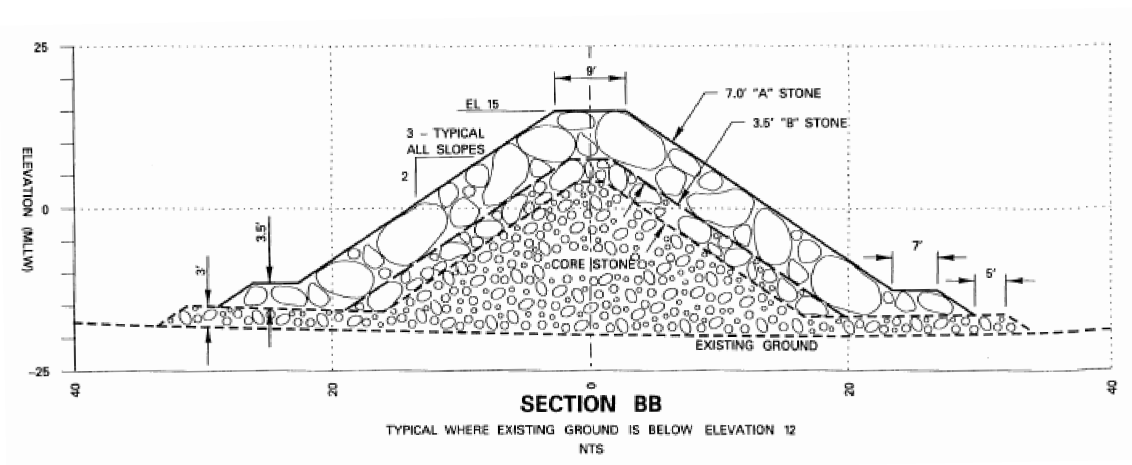
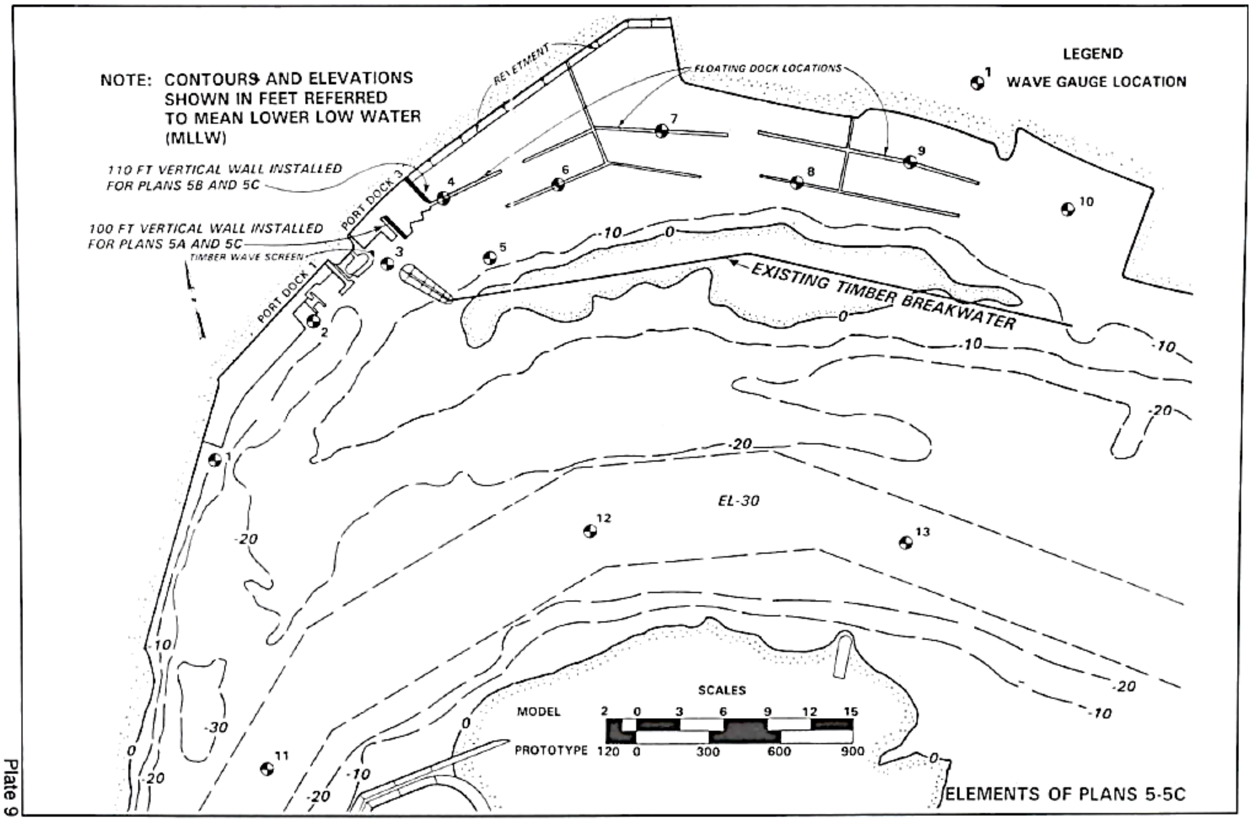


Figure 4-4. Plan view of rubblemound breakwater at the West Entrance.



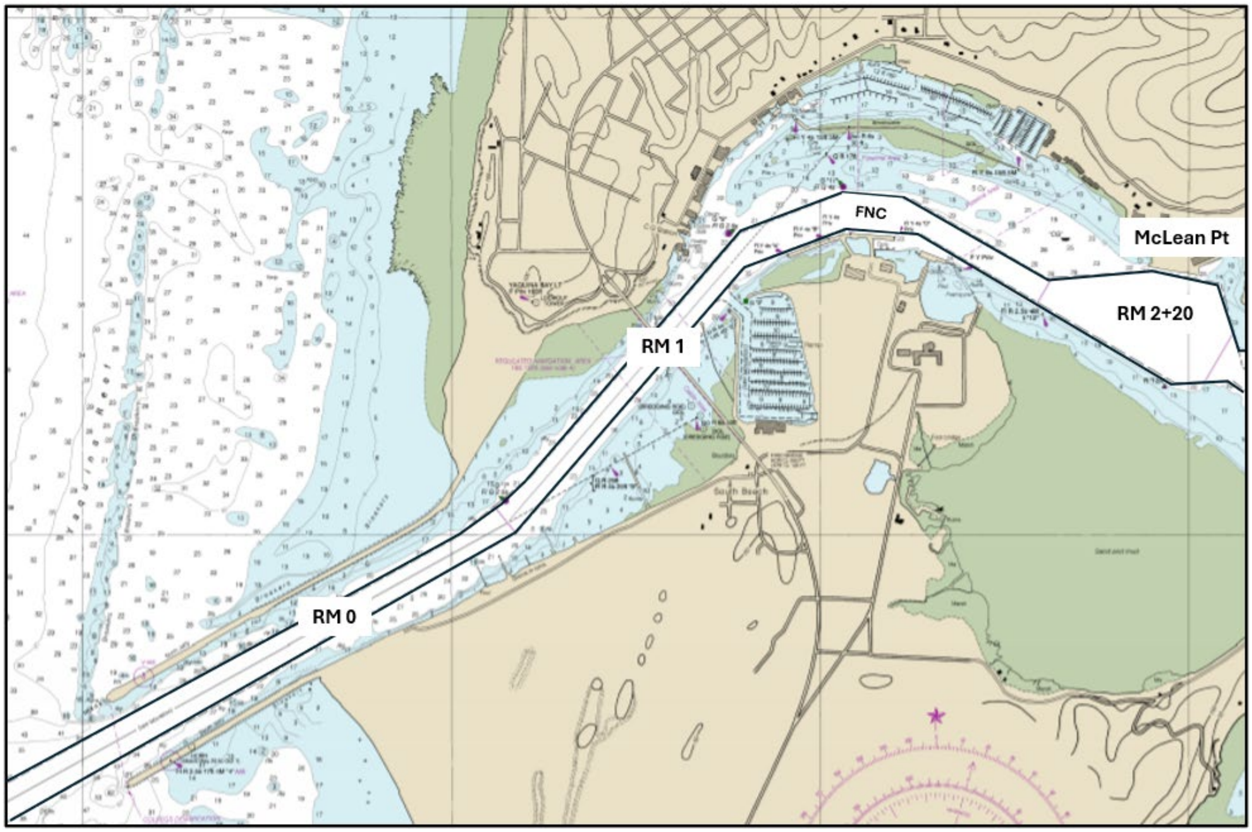
4.2 Historical Channel Description and Location

4.2.1 Federal Navigation Channel

At the Yaquina Project, there is an authorized navigation channel extending from seaward of the jettied entrance into the bay, to McLean Point and further upriver. From River Mile (RM) -1 to 0, the authorized depth is 40 feet. From RM 0 to 2+20 (McLean Point) the channel depth is 30 feet, continuing past that point at an 18 feet depth.

Figure 4-5 displays the configuration of the Federal Navigation Channel (FNC). While there is an access channel extending into the South Beach Small Boat Harbor, the Newport North Marina does not have an authorized access channel connecting it to the FNC.

Figure 4-5. Layout of Federal Navigation Channel at Yaquina Project (NOAA, 2011)



4.2.2 Access Channel and Interior Boat Basin Channels

Figure 4-6 shows the 2021 bathymetric contours in the project area. The bathymetry shown is a compilation of several surveys. Several aspects of the project area can be seen in this figure:

- There is a natural deep channel that extends from the FNC to the Newport North Marina.
- The Middle Ground shoal (as noted in 1947) remains a dominant bathymetric feature, including a significant portion of the shoal on the north side of the timber breakwater interior to the marina.
- The depths interior to the boat basin, particularly on the east side, are relatively shallow.

Figure 4-7 provides the two categories of channel that have been evaluated for this study. The yellow channel shows the access channel which connects the FNC to the North Marina entrance and the orange segments of the channel are intended to provide full interior access to the docks by the larger commercial fishing vessels. These two segments will be designed separately.

Figure 4-6. 2021 bathymetric contours in project area.

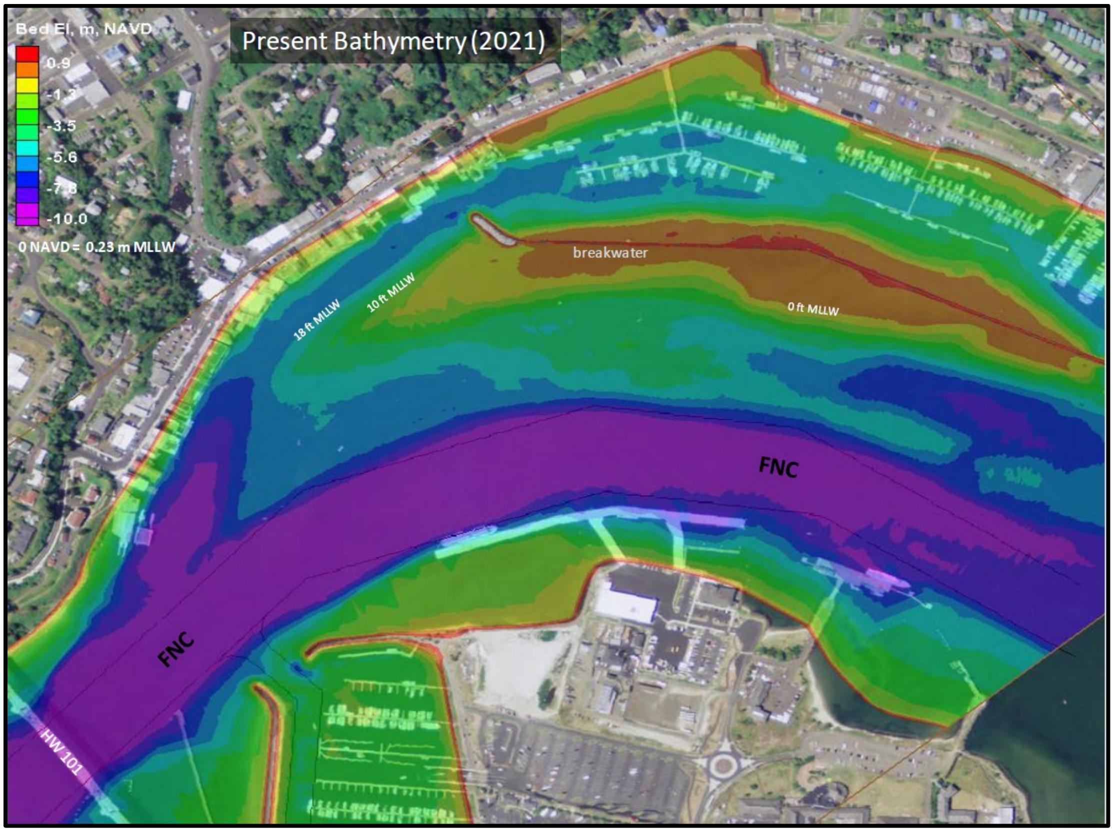


Figure 4-7. Location of North Marina access channel (yellow) and interior boat basin channels (orange).

4.2.3 Maintenance Dredging History

The Port of Newport has been responsible for maintaining the North Marina. The Port has not dredged in the Marina in over 30 years, so it has been a fairly low-maintenance area. The Embarcadero Resort/Marina (which is located at the east end of the North Marina) has applied for a dredging permit, but the quantity to be dredged is very small. On the other side of the bay, the South Beach Marina is typically dredged by USACE approximately 25,000 CY every 5 to 8 years. This comes to about 3,900 CY shoaling per year.

5 Geotechnical design considerations

5.1 Regional and Site Geology

See the main Integrated Feasibility Report/Environmental Assessment.

5.2 Previous Site Investigations

As part of the feasibility study conducted in 1996 for the Newport North Marina Breakwater, investigations were conducted including water jet probing, subsurface drilling, hydrographic surveys, and sub-bottom profiling. Of particular interest was the subsurface drilling and jet probes (Appendix B of USACE, 1996), which supplemented the planning efforts and data collected for this specific phase of development in the Newport Marina (see 5.3 for specific details).

5.3 Project Site Investigation

The Port of Newport employed consultant GRI to conduct a subsurface exploration program with input from USACE on the geotechnical investigation phase of the Section 107 dredging project. The subsurface borings were completed by overwater methods using a barge. Drilling was completed during two separate mobilizations. The first mobilization occurred between February 20 and 23, 2024, and included five rotosonic borings: 3-C, 4-A, 4-B, 5-B, and 5-C. The remaining mud-rotary boring, 5-A, was advanced during the second mobilization on March 13, 2024. The approximate locations of the borings are shown on the site plan included in the Geotechnical Data Report (GRI, 2024).

5.3.1 Laboratory Testing

GRI acquired the serviced of Professional Service Industries (PSI) of Portland, Oregon or Cooper Testing Laboratory of Palo Alto, California. Laboratory testing includes Atterbergs, water content, No. 200 grain size sieve and direct shear which are included in the Geotechnical Data Report (GRI, 2024).

5.3.2 Preliminary Design Parameters

See Section 5.4 Analysis for Preliminary Design Parameters as they related to the scope of work and project features for the CAP 107 project.

5.3.3 Geophysical Investigations

No additional geophysical investigations were reviewed beyond those included as part of previous site investigations discussed in Section 5.2.

5.3.4 Groundwater Studies

No groundwater studies were performed or available for the project site. All project features are within the federal channel and the Newport Marina. None of the CAP related project features extend to the shoreline. The project will be most impacted by tidal changes see 6.1.2 for tidal info.

5.3.5 Earthquake Studies

No previous earthquake studies were available in support of the project, however, a review of data for seismic events was conducted from the records publicly available through the Pacific Northwest Seismic Network which can be accessed at the website https://pnsn.org/

Based on a review of this information from the past 50 years, no seismic events have occurred at the project site. See the tables below for a summary of the data reviewed for the seismic history near the project.

Table 5-1. Seismic History Near the Newport Commercial Marina

Region	**10 miles**	**25 miles**	**50 miles**
Events	4	82	292
Average Depth	16.3	16.5	15.4
Average Magnitude	2.1	2.0	2.0
Most Recent	3/4/2022 – 02:43	12/29/24 – 13:11	1/30/2009 – 05:25
Greatest Event within Region			
Magnitude	2.3	4.7	4.9
Event ID	10383893	10613523	62065737
Date / Time	10/22/95 – 13:29	8/18/04 – 23:06	2/4/25 – 15:59
Location	47.5538°, -124.039°	44.6645°, -124.3°	45.0905°, -123.659°

No seismic activity was recorded at the project site; the nearest location was recorded approximately 2.7 miles from the site:

Table 5-2. Nearest Seismic Event Location

Event ID	Magnitude	Date/Time	Location
61592866	2.1	3/26/20 – 18:01	44.6677°, -124.085°

5.3.6 Excavatability

The Geotechnical Data Report (GRI, 2024) and historical explorations and information have documented the presence of loose to medium dense silty sand with shell fragments and weak (R0-R1) or non-cemented bedrock (Nye Mudstone). Sandy soils within the dredge footprint are suitable for most removal through most methods, although bucket excavation may struggle with retaining material as its placed onto the barge. The underlying mudstone will likely require either bucket excavation or a cutting head to remove the weak bedrock.

5.3.7 Borrow and Disposal Sites

The scope for this project is limited to dredging and excavation activities, no borrow sites are anticipated for this project. See Feasibility Report for identified disposal locations.

5.3.8 Material Sources

The scope for this project is limited to dredging and excavation activities, no materials are anticipated for use in the construction of the project.

5.4 Analyses

5.4.1 Lab Testing Completed and Evaluations Made

Laboratory testing is included Appendix C and D of the Geotech Data Report (GRI, 2024).

Geotechnical testing included as part of the investigation included No. 200 wash sieves, atterbergs and a single direct shear. The results of the testing provided the basis of assumptions (as well as engineering judgement) for the slope stability strength parameters, friction angle and cohesion.

Surficial Sand.

Friction Angle. Although the friction angle based on a direct shear test (remolded) for a sample at a depth of approximate depth of 12 feet was 35 degrees for sand all modeling presumes a friction angle of 25 degrees based as most of the material being dredged is relatively shallow. If during PED further refinement is needed, the PDT may use a greater friction angle to assess reduced standoff distance for dredging. This would likely only be applicable to dredging north of the timber breakwater.

Cohesion. Exploration borings and sampling indicated sand had fine content ranging from 2%-79%. A grab sample (remolded) was tested on a sample of relatively clean sand from a depth of 12 feet indicated a cohesion of 250 psf. However, given that the more surficial silty sands are very loose and fine content varies (some samples would be classified as silts), the material is assumed to behave as cohesionless.

Nye Mudstone.

Unconfined Compressive Strength. The data report generally classified the underlying Nye Mudstone between R0 (extremely weak) and R2 (weak). All modeling presumes the presence of R0 mudstone with a lower end unconfined compressive strength of 35 psi or 5000 psf. For an effective cohesion this is reduced by half to 2500 psf.

5.4.2 Rubblemound Breakwater

Geometry and configuration of the breakwater is based on the design cross sections from the ***Final Detailed Project Report & Environmental Assessment for Newport North Marina Breakwater Yaquina Bay, Oregon*** and the as-built plan sheet. The structure is comprised of multiple materials constructed in a layered manner, A Stone (3 – 5 ton), B Stone (600 to 1000 lbs) and Core Stone (25 to 200 lbs). Design drawings from the report are included in *Exhibit A-2* showing cross sections, geometry and location relative to the existing timber breakwater. Conservatively the slope stability analysis assumes that the structure is built entirely of A Stone and presumes a unit weight requirement of 165 pcf and friction angle of 40 degrees which aligns with USACE and industry standards of practice for similar materials and structures. See cross section A-A' (shown in Figure A.8) in *Exhibit A-1* for the modeled condition and results. Additional description and discussion of the Rubblemound Breakwater can be found in *Section 4.1 History of Harbor Structures*.

5.5 Global Slope Stability

Slope stability analysis was performed in accordance with *EM 1110-2-1902: Slope Stability*; all analyses are held to a minimum required factor of safety of 1.3 given the conditions and consequences of slope failures. Global stability analyses that were performed for soil loading conditions, evaluated for 0 feet MLLW, of the existing structures was assessed based on simplified subsurface conditions and the proposed channel geometry for dredging. This analysis was completed using limit equilibrium modeling software, Slope/W with materials modeled for Mohr-Coulomb. The Factors of Safety reported are calculated using the Morgenstern-Price method which satisfies both moment and force equilibrium and considers both shear and normal interslice forces. Failure surface locations were determined from the Entry and Exit and are only set to seek through areas as modified for dredging and is not set to evaluate internal stability or loading conditions of the existing structures (excluding the Rubblemound Breakwater which does internal stability).

Material properties are based on laboratory testing as presented in *Section 5.4.1 Lab Testing Completed and Evaluations Made* as well as USACE and industry standards of practice for similar materials. See *Exhibit A-1* for properties used in the analysis.

Analyses conducted were in support of this feasibility level assessment, representative of the dredged/constructed condition of the channels, and no evaluations were conducted for erosion or scour over a period of time (beyond initial overdredge depth of -2'). It is assumed based on the discussion is *Section 6 Coastal design considerations* that the marina channels exhibit little change over time.

5.5.1 General Channel Configuration

The proposed channel geometry for the project will be comprised of side slopes at a 3:1 (horizontal: vertical) with the federal access channel at a design depth of 20 feet below MLLW and 18 feet below MLLW for the Newport Commercial Marina. As part of the slope stability analysis, a maximum over-dredge depth of 2 feet is presumed.

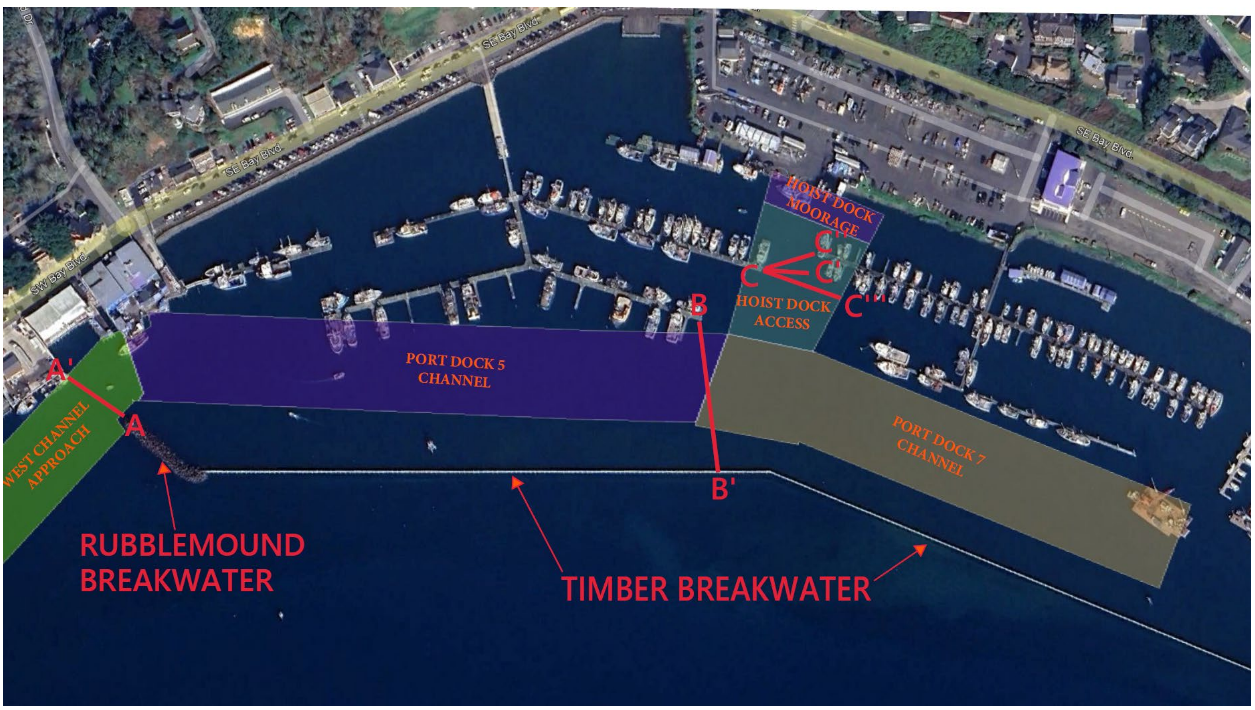
5.5.2 Cross-Sections

The areas that were focused upon (

Figure 5-1) as part of the analysis are:

- West entrance to the Newport Commercial Marina (A-A')
- Existing Port Dock 5 to Timber Breakwater (B-B')
- Existing Port Dock 5 to existing Port Dock 7 (C-C' and C-C'')
- Existing Port Dock 5 to proposed Port Dock 7 (C-C''')

Figure 5-1. Analyzed Cross-Sections



*Note that the channels shown above are general locations and
Slope stability for all cross-sections exceed a factor of safety of 1.3. Where possible, maintaining a minimum standoff distance of 50 feet from the dredging footprint to existing structures is recommended, however, due to the confined space within the marina this is only possible near the timber breakwater. Although preliminary slope stability analyses indicate adequate factors of safety, operation of dredging equipment and accuracy may impact the performance of the structures. See Exhibit A-1 which show the channel geometry and standoff distances from the existing structures.

5.5.3 Additional Cross-Sections

Slope stability analysis was focused on the critical areas where there was a greater level of concern of impact to existing or proposed structures. As part of future design phase analysis should verify no stability impacts in the vicinity of the joist dock and from the proposed Dock 7 and the timber breakwater.

6 Coastal design considerations

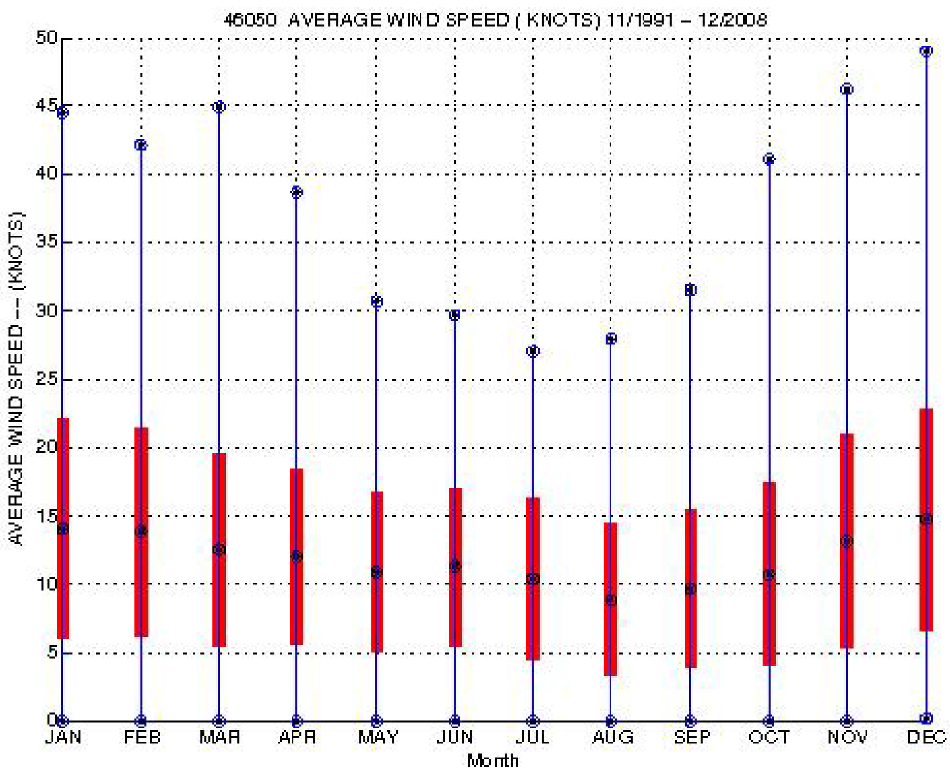
6.1 Coastal Processes

This section provides a summary of the coastal processes important to the project area and relevant to providing a reliable and improved navigation channel.

6.1.1 Winds

The Oregon coast is exposed directly to winds that move onshore off the ocean. Prevailing winds are generally from the west, with a southwesterly component during the winter and a northwesterly component in the summer. Wind velocities average 10 to 15 miles per hour, but higher gusts are not uncommon. The strongest winds ordinarily develop during the winter months, while summer winds are normally lower in velocity. Figure 6-1 provides a plot of the average monthly wind speed as observed just offshore of Newport at NDBC buoy 46050.

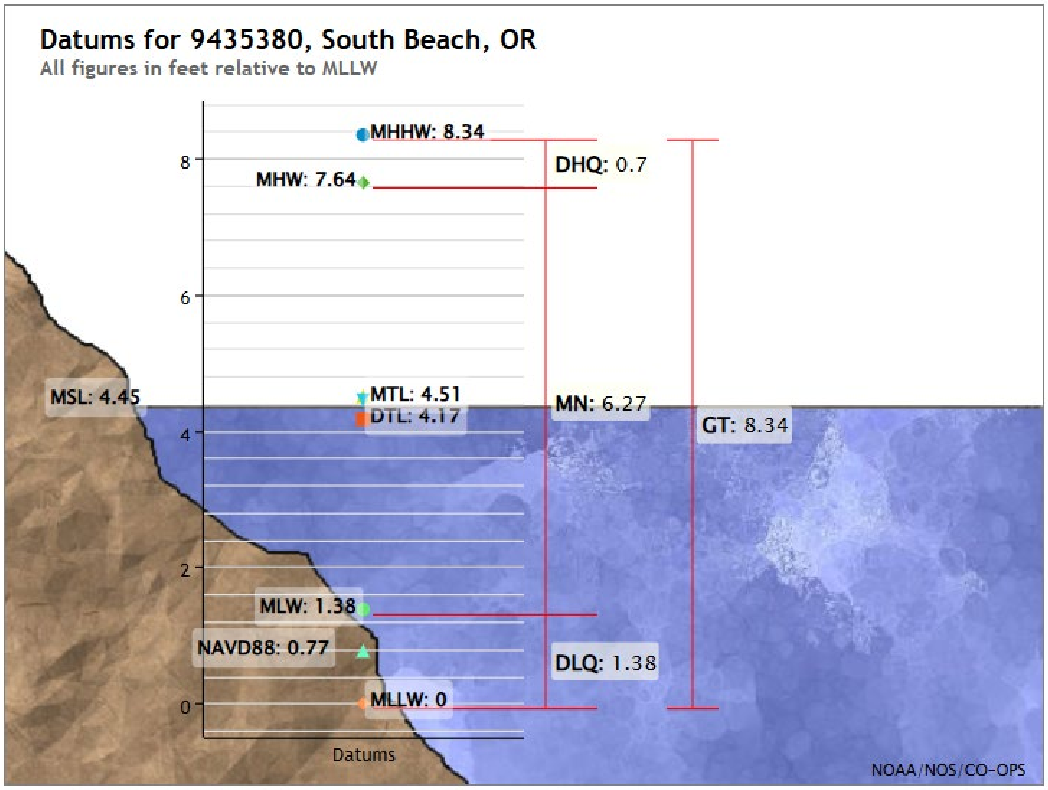
Figure 6-1. Plot of average monthly wind speed offshore of Newport (NDBC.NOAA.gov)



6.1.2 Tide Elevations and Water Level Components

Yaquina Bay experiences tides of the mixed semidiurnal type, with two highs and two lows occurring daily. Tidal elevations at Newport North Marina typically range from 0 feet to +8 feet MLLW, however, extremes can range from -3 feet to +11.5 feet. Figure 6-2 shows the range of tide in the project area based on the NOAA tidal station located at South Beach, Oregon. In addition to tidal fluctuations, storms are accompanied by a storm surge of typically 2 to 3 feet (USACE Portland, 1994).

Figure 6-2. Tidal datums for South Beach, Oregon. (NOAA Water Levels)



6.1.3 Sea Level Change

NOAA has documented the relative sea level trend at South Beach, Oregon at 1.79 (+/-) mm/yr or about 0.59 feet in 100 years – based on monthly mean sea level data from 1967 to 2024. USACE guidance provides that projects should be resilient to the potential range in total water levels over the period of analysis. For this project, the period of analysis extends from 2024 to 2073. **Error! Reference source not found.** shows sea level change projections for the South Beach, Oregon NOAA gage. For this period of analysis, the Low, Intermediate, and High sea level change projections are 0.3 feet, 0.81 feet, and 2.43 feet, respectively. Note that the USACE low sea level change curve tracks the observed sea level change from the NOAA tidal gage. For this project analysis, a sea level change value of 0.81 feet representative of the Intermediate curve was used. The potential impacts of sea level change on the project alternatives and selected plan would result in a greater navigable depth at the marina entrance (Figure 6-5). In this case, existing conditions would control since future sea level change would only improve conditions at the entrance.

Figure 6-3. Figure 6-4. Relative sea level trend as documented at South Beach, Oregon (tidesandcurrents.NOAA.gov)

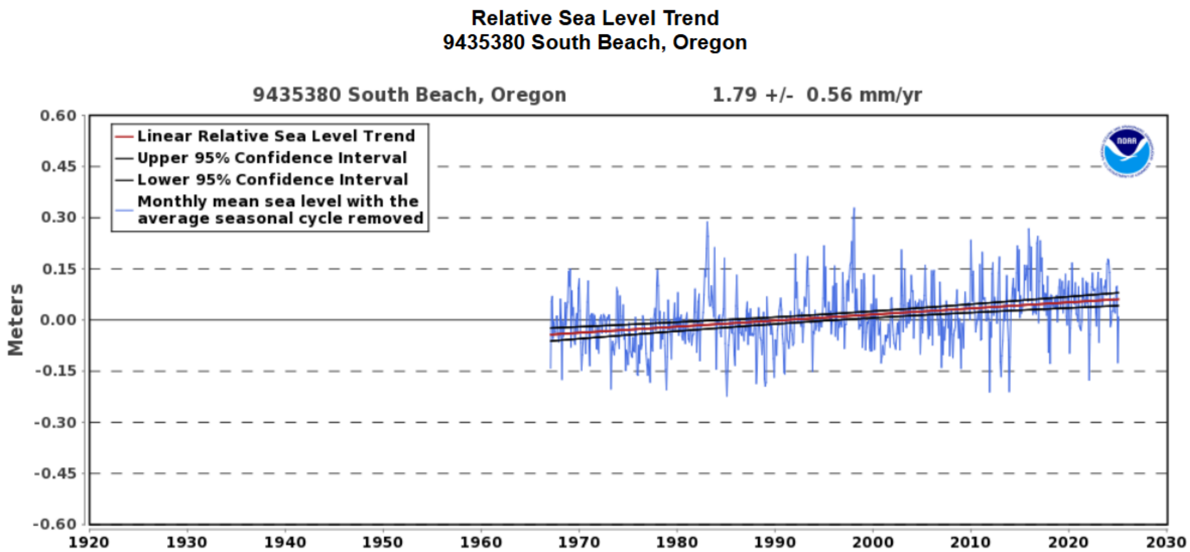
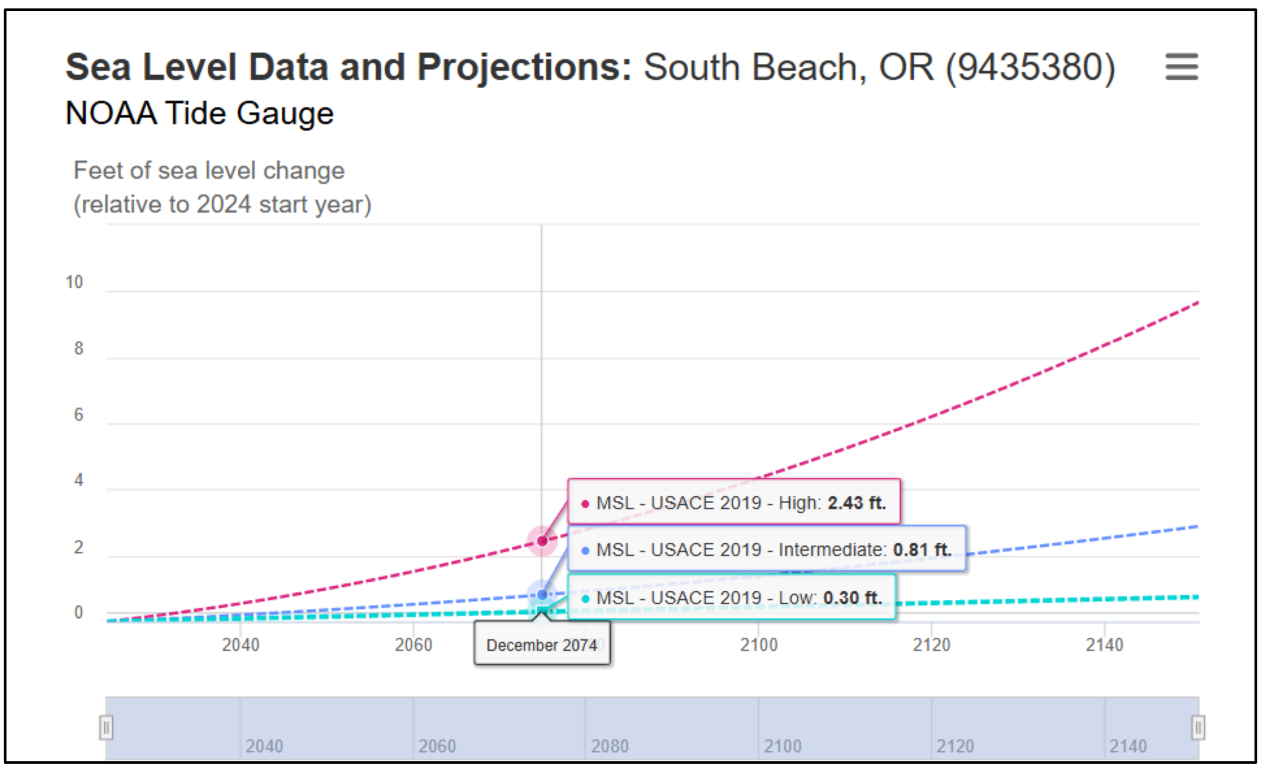


Figure 6-5. Potential range in sea level change over the period of analysis (https://cwbi-int.sec.usace.army.mil/pi/share/iir/portal.html)



6.1.4 Waves and Storms

During previous studies of the Yaquina North Jetty (Grace and Dubose 1988; Briggs, Grace, and Jensen 1989), statistical wave hindcast estimates over a 20-year period (1956-1975) were obtained at the seaward ends of the jetties. The six most severe storms in this hindcast data set had wave periods of 12.5, 14.3, and 16.7 sec and significant wave heights ranged from 15 to 23 feet. In preparation for the 1996 physical model study of the Newport North Marina, a study was conducted by NWP to determine wave and storm conditions inside the Yaquina River incident to Newport North Marina. Historical records, observations, and predictions from a numerical model of wave transformation in a channel bounded by rubblemound breakwaters (Melo and Guza 1991) were used in the conduct of the study. The modified diffraction model reported in Melo and Guza (1991) is based on the linear mild-slope equation and predicts the complex patterns of wave evolution due to dissipation along the jetties and diffraction from the channel interior. The study established wave periods ranging from 12 to 17 sec and significant wave heights interior to the bay ranging from 3 to 8 feet. Data results revealed a 3 foot wave will be exceeded at 10 percent of the time during winter months (October through March). Also, a 6 foot wave can be expected to occur on an average of at least once a year. These wave periods and heights incident to the marina appear reasonable relative to those predicted at the seaward ends of the North Jetty in the previous studies. Incident wave direction for Newport North Marina is controlled by the orientation of the entrance channel through the Yaquina north and south Jetties. Most storms moving onshore are characteristically accompanied by a higher water level due to wind, tide, and storm surge.

6.1.5 ERDC Physical Model Study for 1998 Breakwater Modification

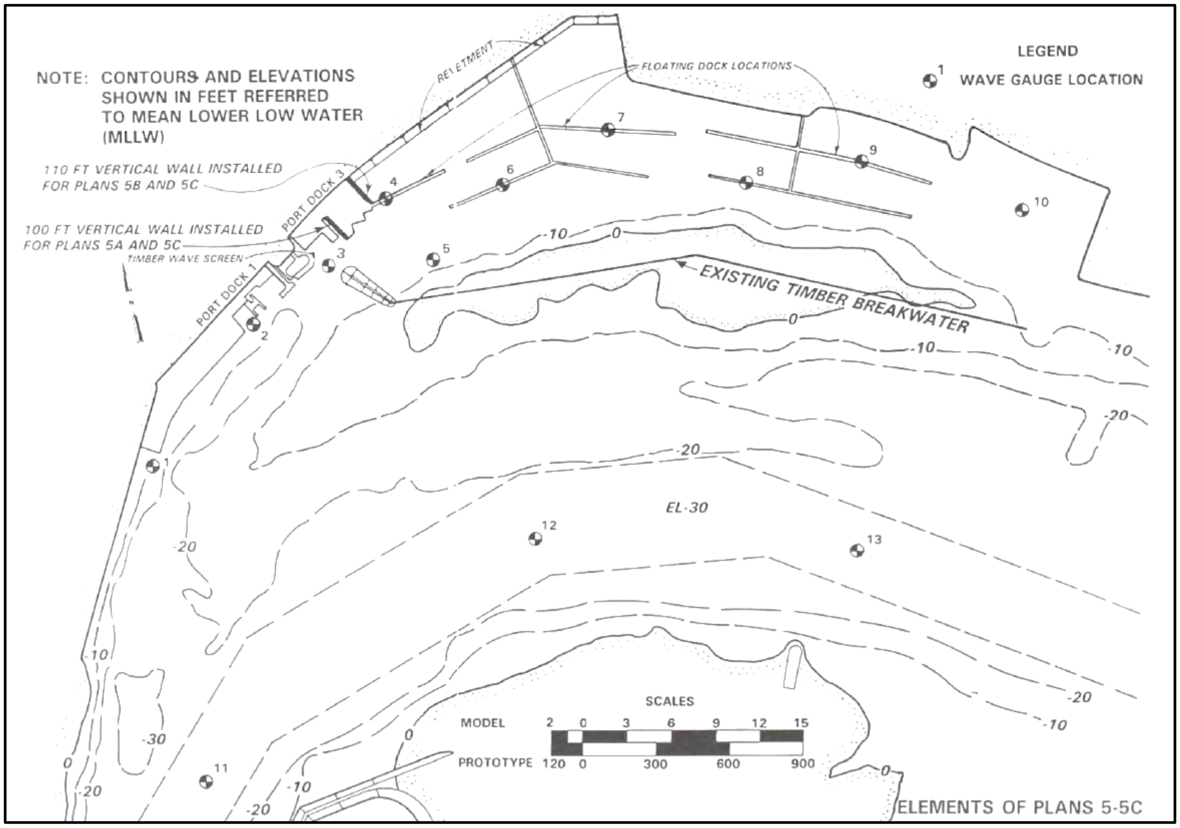
Based on historical hindcast data the test wave characteristics selected to be run in the physical model to evaluate potential improvements to the west entrance of the Newport North Marina are shown in Table 6-1. Storm waves approached the marina from approximately 222 degrees (along the longitudinal axis of the river channel). Incident wave characteristics were measured in the model in the river seaward of the marina at the approximate location of the U.S. Highway 101 bridge. Model contours then transformed the wave characteristics as they approached the marina. The layout of the model with wave gage locations is shown in Figure 6-6.

Table 6-1. Selected test waves and water levels for the 1996 physical model study. Incident wave conditions generated in the river seaward of the marina and measured at the approximate location of the U.S. Highway 101 bridge.

Wave Period (Seconds)	Wave Height (ft)	Still Water Level (ft, MLLW)
12.5	3	0, +5, +8
12.5	6	0, +5, +8
12.5	8	0, +5, +8, +11
13.4	3	0, +5, +8
13.4	6	0, +5, +8
13.4	8	0, +5, +8, +11
16.7	3	0, +5, +8

Wave Period (Seconds)	Wave Height (ft)	Still Water Level (ft, MLLW)
16.7	6	0, +5, +8
16.7	8	0, +5, +8, +11

Figure 6-6. ERDC 1996 Physical Model Layout



Incident wave conditions generated in the river seaward of the marina and measured at the approximate location of the U.S. Highway 101 bridge. Wave heights ranged from 3 to 8 feet with wave periods of 12.5, 14.3, and 16.7 seconds. Still water levels (SWLs) analyzed include 0, +5, +8, and +11 feet MLLW. The 0 and 8 feet SWLs were representative of MLLW and MHHW, respectively. The 5 feet SWL was representative of the tidal elevation in the river when maximum flood and ebb velocities occur. The +11 feet SWL was representative of high tide conditions with a 3 feet storm surge superimposed.

In most cases, it is desirable to select a model SWL that closely approximates the higher water stages which normally occur in the prototype for the following reasons:

- The maximum amount of wave energy reaching a coastal area normally occurs during the higher water phase of the local tidal cycle.
- Most storms moving onshore are characteristically accompanied by a higher water level

due to wind, tide, and storm surge.

The model showed for the range of still water levels and wave heights, the wave heights experienced at Gage 3, in the vicinity of the Newport North Marina entrance ranged from 0.4 feet to 3.2 feet. With a possible sea level change value of 0.8 feet (Intermediate curve) and a conservative estimate of increased wave height equal to the water depth increment, a wave height of 4 feet was used to evaluate the needed design depth for the improved channel. Figure 6-7 and Figure 6-8 illustrate model study results showing wave and current patterns and current magnitudes under improved project conditions with the constructed rubblemound breakwater extension.

Figure 6-7. Model study results showing wave and current patterns and current magnitudes under improved project conditions for a 12.5 sec, 8 ft incident wave at a SWL of +8 ft MLLW. (Bottin, 1996)

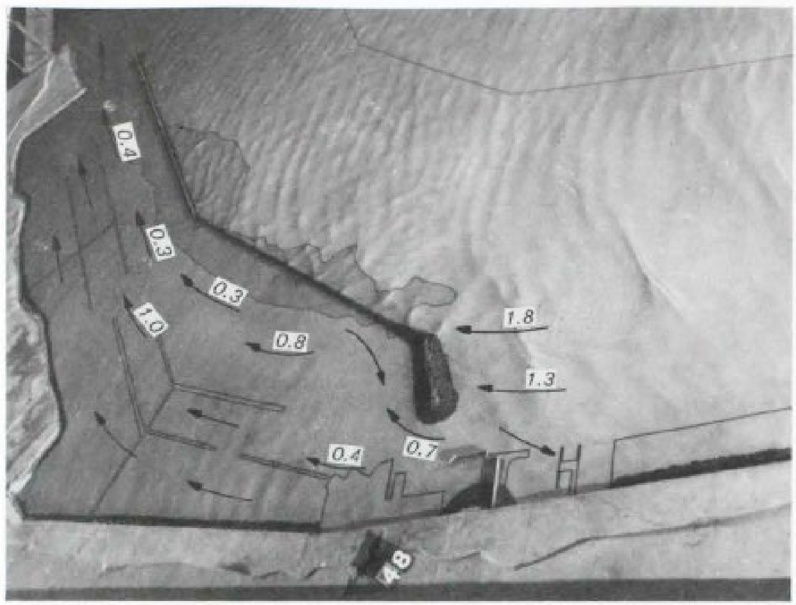


Photo 47. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for Plan 5; 12.5-sec, 8-ft test waves; swl = +8.0 ft

Figure 6-8. Model study results showing wave and current patterns and current magnitudes under improved project conditions for a 12.5 sec, 8 ft incident at a SWL of +11 ft MLLW. (Bottin, 1996)

Photo 49. Typical wave patterns, current patterns, and current magnitudes (prototype feet per second) for Plan 5; 12.5-sec, 8-ft test waves; swl = +11.0 ft

6.1.6 Sedimentation

The Newport North Marina has not typically required dredging and the access channel on the west side of the marina is naturally deep. On the south side of the bay, the South Beach Small Boat Harbor is typically dredged about 25,000 CY every 5 years or about 3,900 CY per year.

6.2 Existing Navigation Conditions and Challenges

The primary driver of navigation challenges within the Newport North Marina is that fishing vessels currently accessing the marina are larger than the fishing vessels for which the marina was originally designed in the 1940s. More detail can be found in the Main Report regarding the evolution of the fishing fleet and its updated requirements. Due to the larger vessels, marina access and maneuverability within the marina have been impacted, particularly the east and north ends of the marina where Port Dock 7 and the Hoist Dock are located. As can be seen in Figure 4-6, while depths approaching the west entrance of the marina are relatively naturally deep, the actual west entrance as well as the interior channels and moorage areas on the east end of the marina are fairly shallow (-10 to -17 feet MLLW), which is too shallow for maneuvering or mooring of the larger vessels. The existing project layout is shown in

Figure 6-9. Figure 6-10 shows the navigation problem areas identified by the vessel pilots.

The commercial fishing fleet has moved toward larger vessels using a vessel modification method called sponsoning. Sponsoning a fishing vessel involves widening the hull of the vessel to increase its capacity and stability. This can be a cost-effective way to upgrade a vessel's capacity without needing to build a new one. For the Newport North Marina to be fully functioning for the existing commercial fishing fleet, the larger vessels need to have access and mooring at Port Dock 7, access to the Hoist Dock, and ability to maneuver within the entire marina.

Figure 6-11 shows an existing example of Automatic Identification System (AIS) tracks for larger vessels within the Newport North Marina. As can be seen in this figure by noting the blue track lines, the larger vessels access the marina using the west entrance and are able to transit to Port Dock 5, but not much further into the marina. Some side-tying of vessels may be possible on the south end of Port Dock 7, as necessary, during storm events.

At this time, there are boats that moor at the international terminal because the Newport North Marina does not have space for them. In general, vessels with lengths greater than 100 feet have difficulty accessing and maneuvering within the marina. Port docks 1 and 3 are available for mooring of the larger vessels, however, Dock 1 is located outside the protected marina and Dock 3 is fairly small. Mooring of the larger vessels is of particular importance during storm events, when the only option available is side-tying of vessels which exposes those vessels to increased damages. Storm conditions represent times when the marina is most congested and the space problems are most severe.

The marina has not been improved since original construction. The larger vessels that cannot access the marina either have to go to other ports or transit to the international dock. However, the international dock is not set up for a moorage facility for a significant number of vessels. The existing access channel on the west is not authorized and follows a naturally deep channel.

Figure 6-9. Existing project layout of Newport North Marina

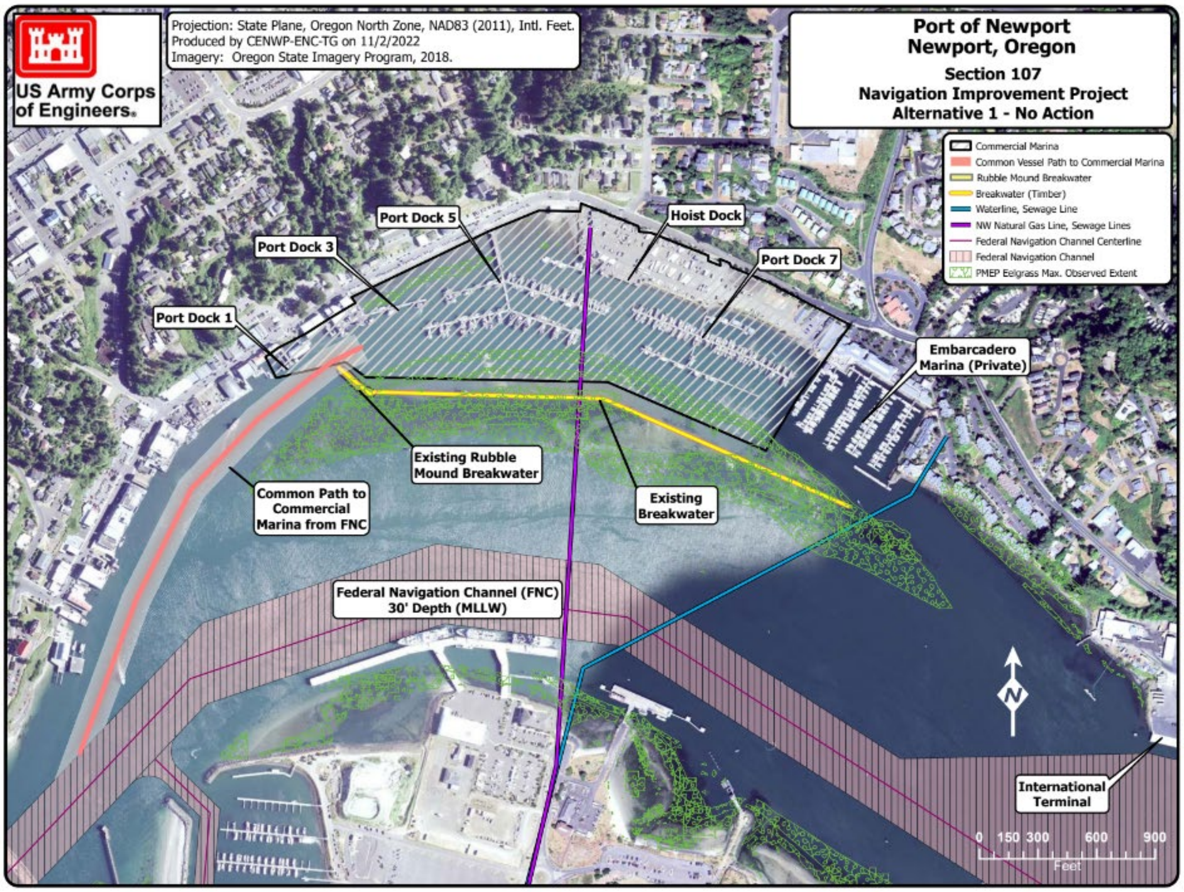


Figure 6-10. Navigation problem areas referenced by vessel pilots

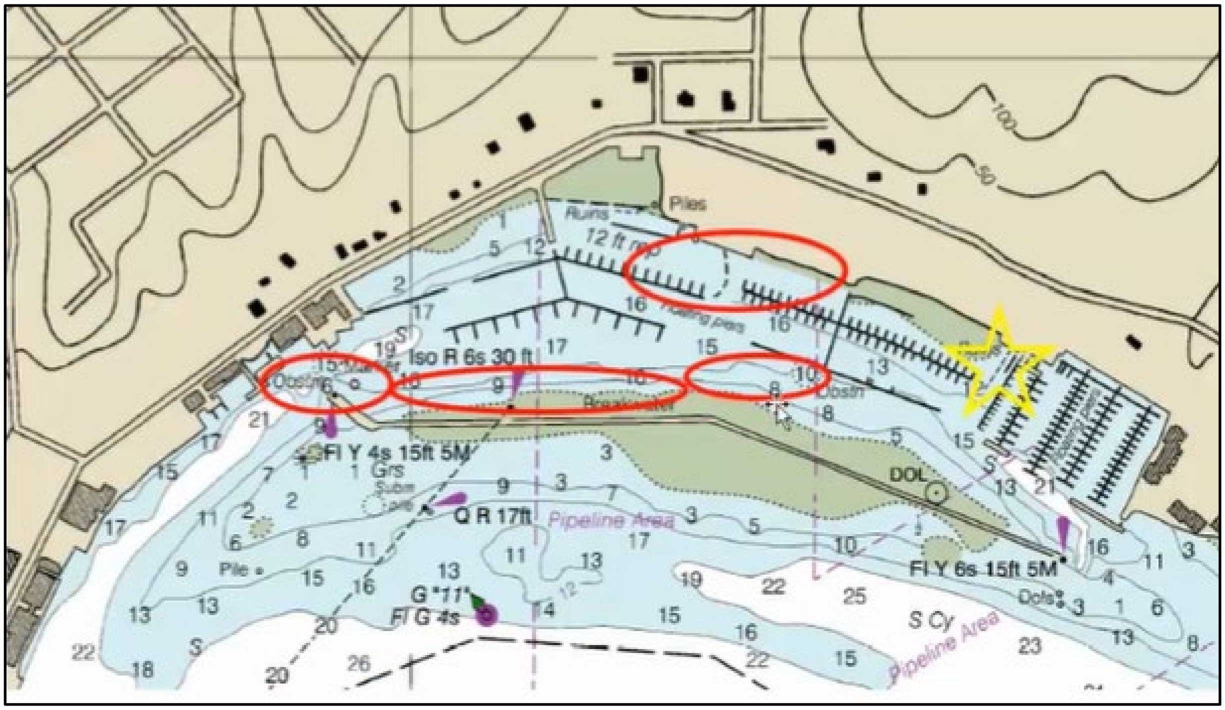
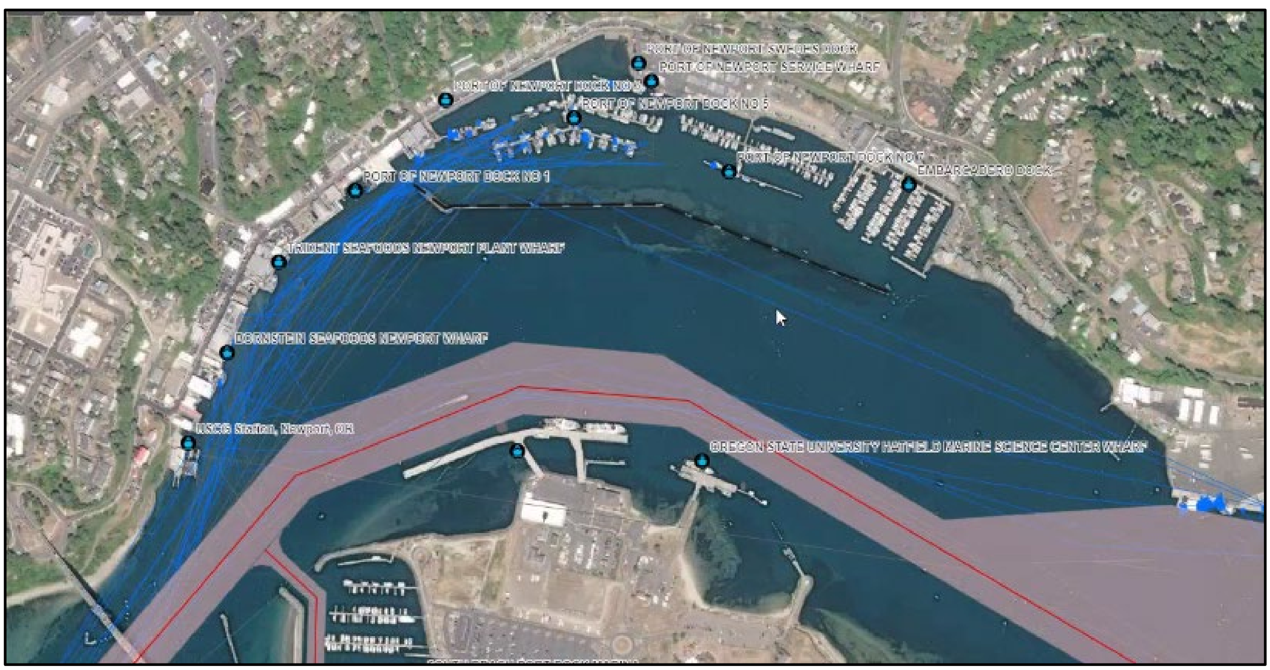


Figure 6-11. Example AIS tracks (blue lines) for larger vessels within the Newport North Marina



6.3 Future Navigation Requirements

6.3.1 Introduction

The primary goals of the suggested channel modifications are intended to provide the following improvements to marina operations:

- Ensure improved marina access to the full range of vessels utilizing the port, smaller to larger vessels.
- Ensure full access and maneuverability to the hoist dock and within the marina for all marina users.
- Provide a more efficient and effective use of the marina space to serve the marina users
- Provide sufficient moorage area for range of vessels, without the necessity of side-tying during storm events.
- Improve the capacity of the marina to act as a safe harbor for the commercial fleet.
- Reduce congestion and pressure on the international dock.
- Minimize dredging and maintenance required.

While the majority of the channel modification design elements discussed in this section are targeted to the larger sizes of vessels due to the existing constraints, channel and access improvements to the marina will benefit all marina users and should relieve traffic and marina usage issues overall.

6.3.2 Docks and Boat Basin Layout

As can be seen in Figure 1-1 and Figure 4-7, the existing bathymetry in the approach to the marina and within the marina varies significantly in depth. Recall that there is no authorized access channel connecting the federal navigation channel to the marina, although the approach to the marina from the west remains naturally deep overall. Depths along the west approach to the marina range from about 18 to 22 feet MLLW. Depths are slightly shallower at the west entrance ranging from about 8 to 15 feet MLLW. Within the marina, Port Dock 5 (on the west end of the marina) is the deepest dock area where depths range from about 12 to 18 feet MLLW. The east end of the marina where Port Dock 7 is located ranges in depth from about 8 to 15 feet MLLW. Finally, the Hoist Dock which is located at the middle north side of the marina has depths ranging from about 12 to 15 feet MLLW.

The Port has an existing plan to rebuild Port Dock 7 to provide for a more efficient use of the east end of the marina.

Figure 6-12 illustrates the proposed new layout of Port Dock 7 which will provide a more efficient berthing layout and will also provide a wider access channel to the Hoist Dock and additional maneuvering area between Port Docks 5 and 7. The Port Manager has stated that channel use will be assumed to be one-way traffic for design purposes. During storm events, the marina serves as a safe harbor where significant side-tying and congestion of vessels may occur.

On the far east of the marina area is the Embarcadero marina, which is used for smaller, recreational vessels and is not part of this project analysis.

Figure 6-12. Proposed new layout of Port Dock 7 (Hoist dock is in lower right of the image.)

6.3.3 Design Vessel

The marina currently serves a wide range of vessel sizes in three general size ranges, based on vessel length: 50 feet or less, 51 to 70 feet, 71 feet and larger. The marina can currently reasonably accommodate the 50 to 70 feet vessels, however, the recent trend in larger vessels, 71 feet and larger, has introduced vessels that cannot be sufficiently accommodated in the marina. Based on an extensive investigation into future fleet characteristics (Appendix C), the design vessel was determined to be 95 feet long, 36 feet wide, 15 feet draft. The designation of design vessel only provides the criteria and upper threshold for which the channel modifications will be established to accommodate. It is still recognized that the vessel fleet covers a broad range of vessel sizes that will also need accommodation within the marina.

6.3.4 Channel Location and Alignment

Channel location and alignment can be influenced by a range of factors but are generally controlled by operational and maintenance criteria. Entrance or access channels will usually follow the shortest route to deep water. The added benefit of this approach is that this alignment typically requires the least initial construction dredging as well as the least expected future maintenance dredging. Another key factor specifically for the access channel which connects the federal navigation channel to the marina is that the alignment of the channel is parallel to the same direction of the primary wind and wave direction, so that vessels are not required to transit broadside to the incoming waves. Particularly relevant to this project is the location and magnitude of existing shoals. A channel that is aligned to cross a shoal often aggrades rapidly which will impact both maintenance and, at times, reliability of access

(USACE, 1984). As noted earlier, the project area has a significant shoal that has existed in that location since prior to any federal project, formerly called Middle Ground. The shoal can be seen in Figure 1-1 and Figure 4-7 and extends along the full length of the timber breakwater, on both the south and north side of the timber breakwater.

Structurally, the navigation channels, both access and interior, need to provide access to the marina facilities and also avoid impacts to harbor and commercial structures. The federal infrastructure that is located at Newport North Marina include the timber breakwater and the rubblemound extension. The commercial structures include shore commercial facilities, the Embarcadero marina floating breakwater, the port docks, and the outfall pipes located along the approach to the marina west of the entrance. The location of the oufall pipes can be seen in Figure 6-13. It was also found that some underground utilities exist interior to the harbor in the eastern half. Those utility lines are relevant when considering an improvement of the east entrance to the marina and are shown in Figure 6-14. The gas line was found to be buried at a depth greater than 50 feet NAVD88, however, the water line and an abandoned sewer line in the eastern half of the marina are expected to be at depths ranging from 10 to 25 feet deep. Additional coordination would be needed regarding those utilities if deepening at the east entrance was required.

In terms of assessing impacts, the shoal around the timber breakwater contained areas of existing eelgrass that were assessed and considered when considering the navigation channel access alternatives.

Figure 6-13. Location of outfall pipes west of the west entrance to the marina (approximate outfall locations noted by red line segments) Channel limits interior to the boat basin in this figure are not the final layout.

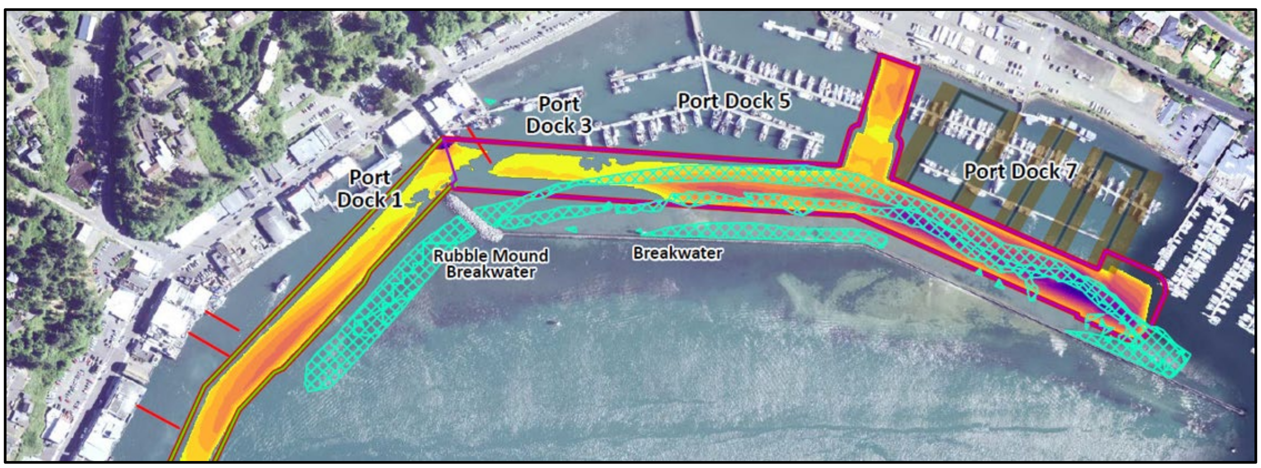
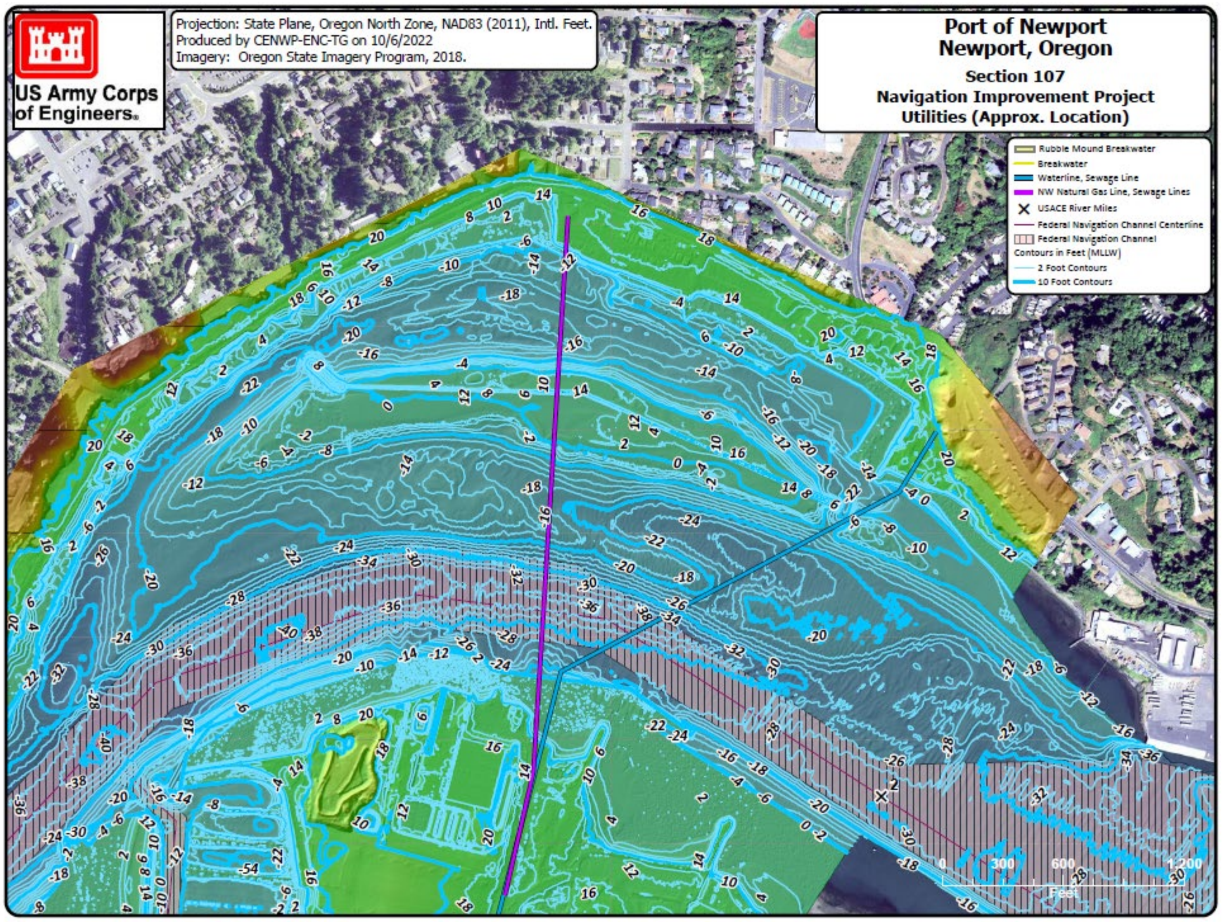


Figure 6-14. Approximate location of utility lines within the marina.



6.3.4.1 Channel Width

USACE navigation projects are classified by depth, and range from deep-draft projects with navigation channel depths greater than -45 feet, to intermediate-depth projects with depths between -20 feet and -45 feet, to shallow-draft projects with depth less than -20 feet. The Newport North Marina borders the transition from shallow-draft to intermediate-depth project (USACE, 2006). The access channel from the existing and authorized federal navigation channel to the west entrance to the Newport North Marina follows naturally deep bathymetry and typically has sufficient depth and width to allow access to the marina, based on the existing vessel fleet, which includes vessels the size of the design vessel and larger. Figure 1-1, Figure 4-6, and

Figure **6-11** illustrate bathymetric contours and vessel transits along the approach channel to the marina. The bathymetry at the west entrance itself and interior to the marina is shallower which limits access to the larger vessels. An added element to the access channel design is related to the installation of the rubblemound breakwater extension in 1998. That structure was modeled at ERDC in 1996 and was designed to reduce the amount of storm wave energy entering the marina transiting from the ocean entrance. The Port has requested that we not modify that structure due to the potential increase in wave energy into the marina if changes are made.

Some factors to consider when considering setting the improved channel width:

- One way or two-way traffic
- Range of vessel characteristics
- Alignment of channel
- Maneuverability of vessels
- Need to maintain length of rubblemound breakwater
- Exposure to cross-beam waves, currents, or winds.

For the improved west entrance to the marina, the port has stated that one-way traffic would apply. The channel entrance is currently being utilized by design size vessels reasonably well, although further transit into and mooring within the marina is more limited due to interior depths. The Port Manager has stated that the existing west entrance condition is reasonable, and they would like to see that extended through the marina for overall improved access. Due to the significant size of the existing shoal in the project area (Figure 4-6) and the alignment of the approach channel, there is little cross-beam exposure to waves, currents, or winds. The available entrance channel is fairly narrow, and the allowable improved depth is controlled by the entrance width, as well as the offset from existing structures.

USACE guidance has generally been focused on deep draft channel design and further research is ongoing regarding shallow draft harbors. Based on deep draft design guidance, the design channel width is defined as the width measured at the bottom of the side slopes on each side of the channel at the design depth. For one-way deep-draft channels, channel width has traditionally been figured as the sum of a maneuvering lane width and bank clearance increments on either side (USACE, 2006). The required width for each increment was given as a factor applied to the design ship beam. Some additional adjustments can be assumed based on ship controllability and judgment. The Coastal Engineering Manual (USACE 2006) also states that: “Experience with ship simulator studies has indicated that traditional channel width design criteria are overly conservative.”

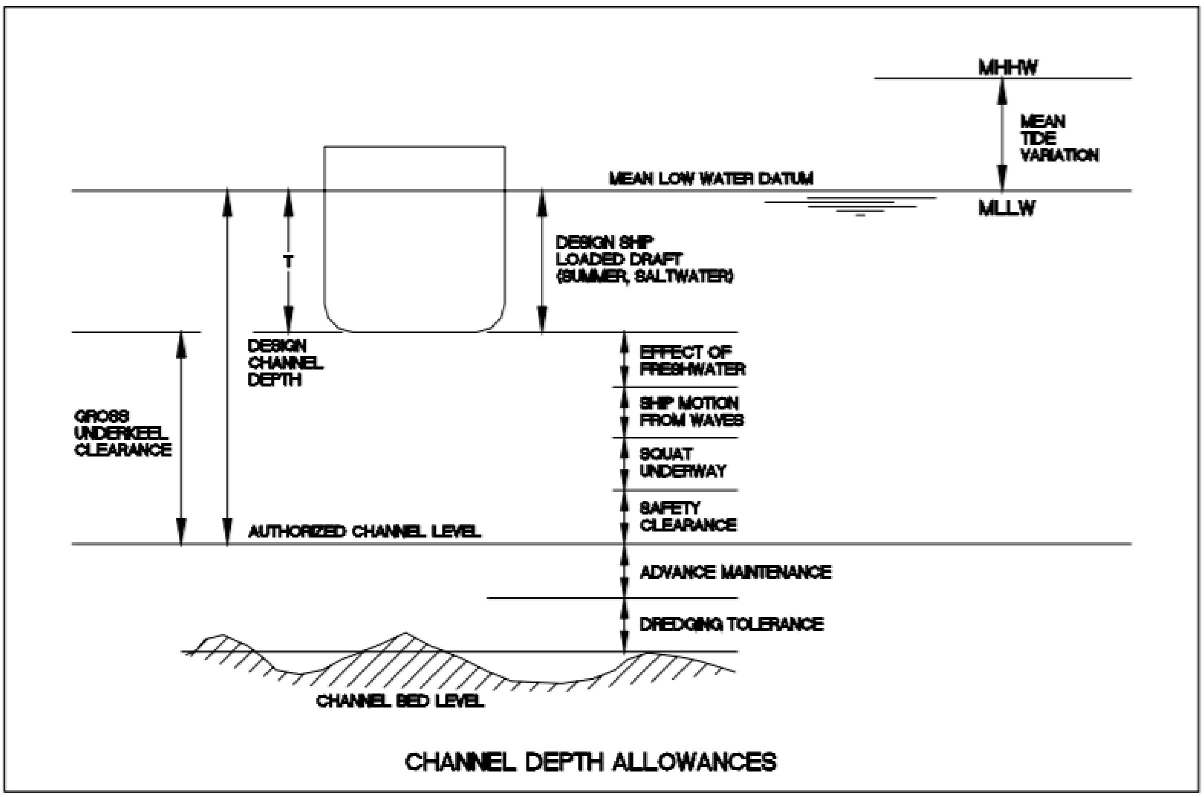
The Coastal Engineering Manual (USACE 2006) states that, “For small-craft harbors, entrance channel width should be a minimum of 23 meters (75 feet) (ASCE 1994). Guidance in Table V-5-8, has traditionally been applied. These factors typically exceed those for interior channels, leading to a widened entrance channel design. Small-craft harbor entrance channel design is the subject of a present research study.” Specifically, the access channel into the marina performs more like an interior channel than an entrance channel due to the limited cross-beam wave/current exposure and the degree to which maneuverability is assessed for this area. Table V-5-8 provides for a maneuvering lane of 1.6 times the vessel beam for very good vessel controllability conditions which would place the maneuvering lane width at 58 feet with buffer distance on either side. The minimum entrance width for this access channel was set at two times the beam of the design vessel or 2 times 36 feet, resulting in a channel width of 72 feet at the new authorized depth.

6.3.4.2 Channel Depth

The existing depth of about 18 feet in the west approach channel has been stated to be reasonably adequate by the Port. They are most interested in extending that depth through the marina and to Port Dock 7 and the Hoist Dock. The Port has stated that no additional access to Port Dock 5 is needed. In the existing condition, pilots have stated that tide riding has never been a concern with the west channel entrance. The pilots did mention tide issues within the marina (where the depths are shallower) that have impacts on maneuverability (particularly as vessels get closer to the breakwater).

The channel depth provided must be adequate for the design vessel draft, trim, squat, sinkage due to freshwater conditions, water level changes and appropriate under keel safety clearance. The minimum under keel clearance is two feet for soft channel bottoms and three feet for hard channels. Additional channel depth may be provided by advanced maintenance dredging based on the economics of dredging intervals and the need to assure appropriate under keel clearance between dredging periods. An additional 1 to 3 feet below the selected channel depth is generally provided as a dredging pay item because of the inability to dredge a uniform depth from a fluctuating water surface. This allowance is called a “dredging tolerance”. Channel depths are referred to a low water datum plane (EM 1110-2-1615). Figure 6-15 illustrates the components of channel depth allowances (USACE 2006).

Figure 6-15. Channel depth allowances (USACE 2006)



For this analysis the following depth components were assumed for the approach channel:

- Loaded vessel draft = 15 ft
- Effect of freshwater = 0 ft (assume salt water)
- Ship motion – ½ wave height = ½ (4 ft) = 2 ft
- Squat = 1 ft
- Safety clearance = 2 ft

- Advanced maintenance plus dredging tolerance = 2 ft.

From the results of the physical model study which was conducted to design the rubblemound breakwater extension, the expected wave height at the entrance during operating conditions was assumed to be 4 feet. Interior to the marina, that wave height will be reduced to 2 feet or less. With the above values, the recommended channel depth in the approach channel equals 20 feet. For the interior channels, the effect of ship motion was reduced to 1 foot and the safety clearance was reduced to 1 foot – resulting in an interior channel depth of 18 feet. Advanced maintenance allowed would increase the dredging depth to 22 feet for the approach channel and 20 feet for the interior channel.

7 Alternatives and Screening

7.1 Navigation Improvement Alternatives and Considerations

As the Main Report has outlined, three general categories of alternatives were considered: (1) East entrance, (2) Center entrance, and (3) West entrance. The information provided to this point in this appendix has been with respect to an improved West entrance. The primary differences between those three alternatives for channel improvement include:

- The estimated amount of initial and maintenance dredging required
- The orientation of the proposed channel to cross-beam waves and currents
- The impact, cost, and disruption to existing infrastructure and utilities
- Potential impacts to existing eel grass beds.

Figure 7-1. Dredging required for three general entrance alternatives

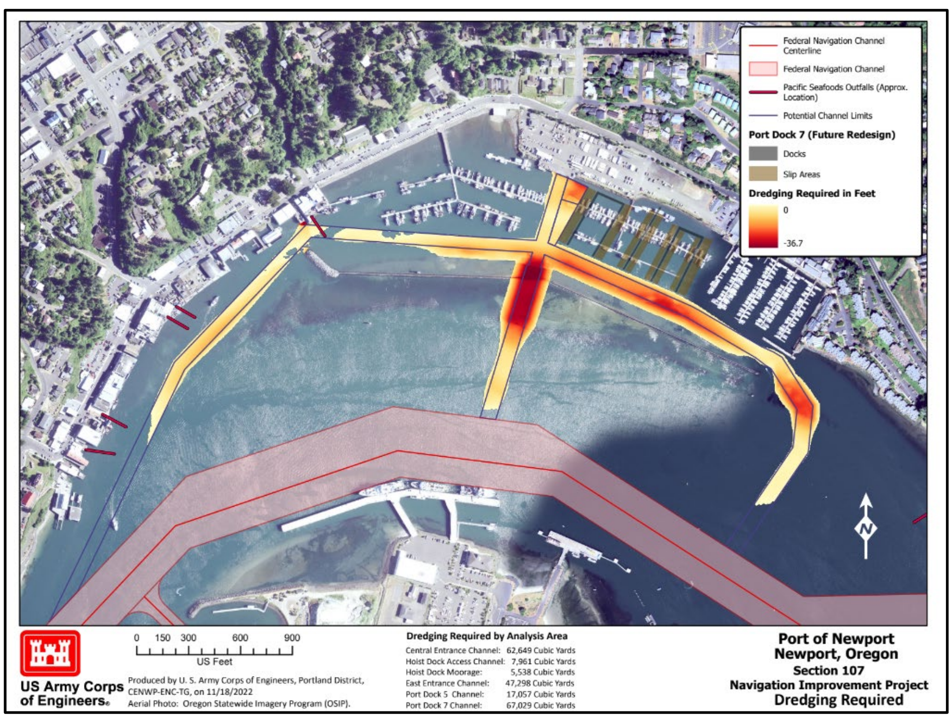


Figure 7-1 shows the initial dredging requirements for the three channel approaches to the marina and Figure 7-2 shows potential impacts to the existing infrastructure and the existing eel grass beds.

As shown in Figure 7-1, due to the large existing sand shoal, a central entrance to the marina would require the largest quantity of initial dredging and would also be expected to have a high annual maintenance dredging requirement due to the expected shoaling rate in that location. The eastern location also is shown to cut through the sand shoal on the east end of the marina. Both of those approaches are also shown to have the largest impacts on existing eel grass beds with the central location having the largest impact. Figure 7-3 shows potential channel plan views for the Central Entrance and the East Entrance. Due to both of these channel alignments being perpendicular to the predominant wave and current direction, an additional channel width of 0.5 times the vessel beam was assumed for these entrances, making those channel widths equal to 90 feet, rather than the 72 feet width assumed for the West Entrance.

Figure 7-2. Potential impacts to the existing infrastructure and eel grass beds

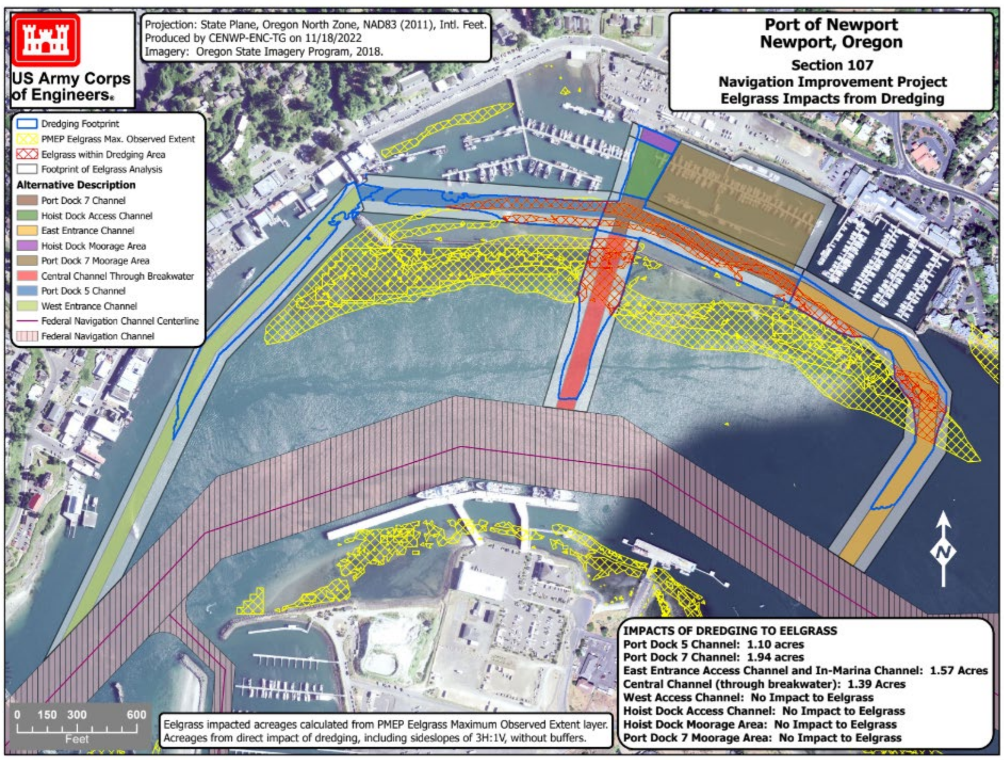
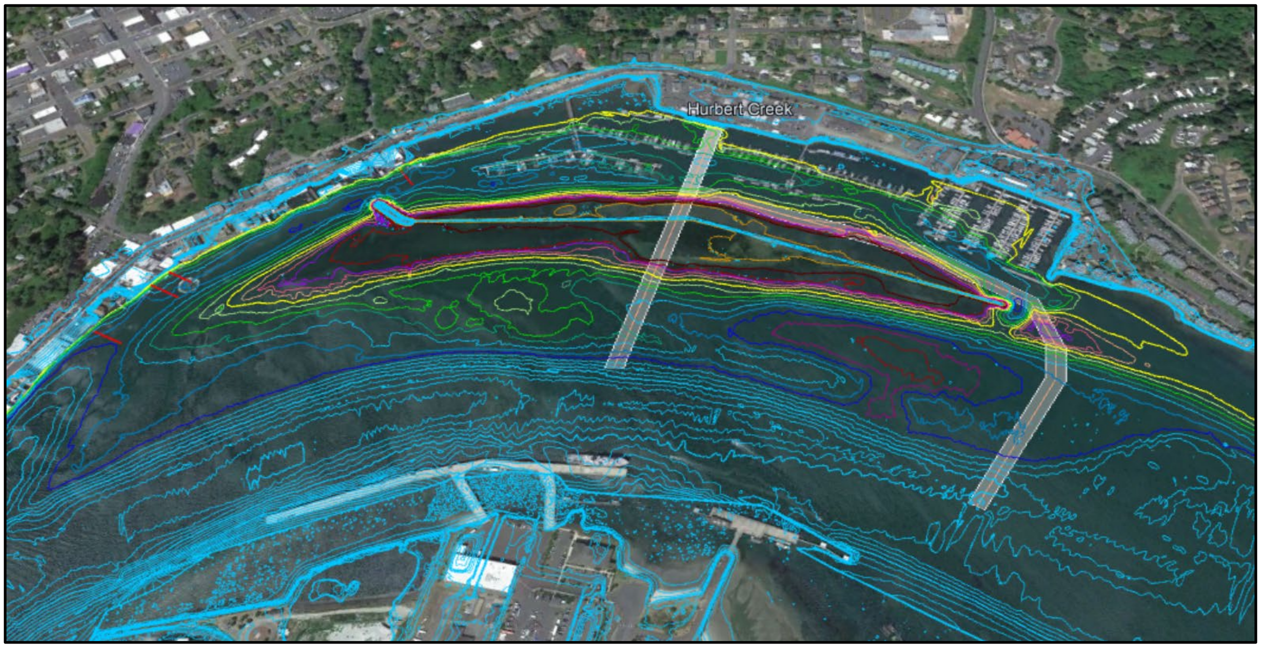


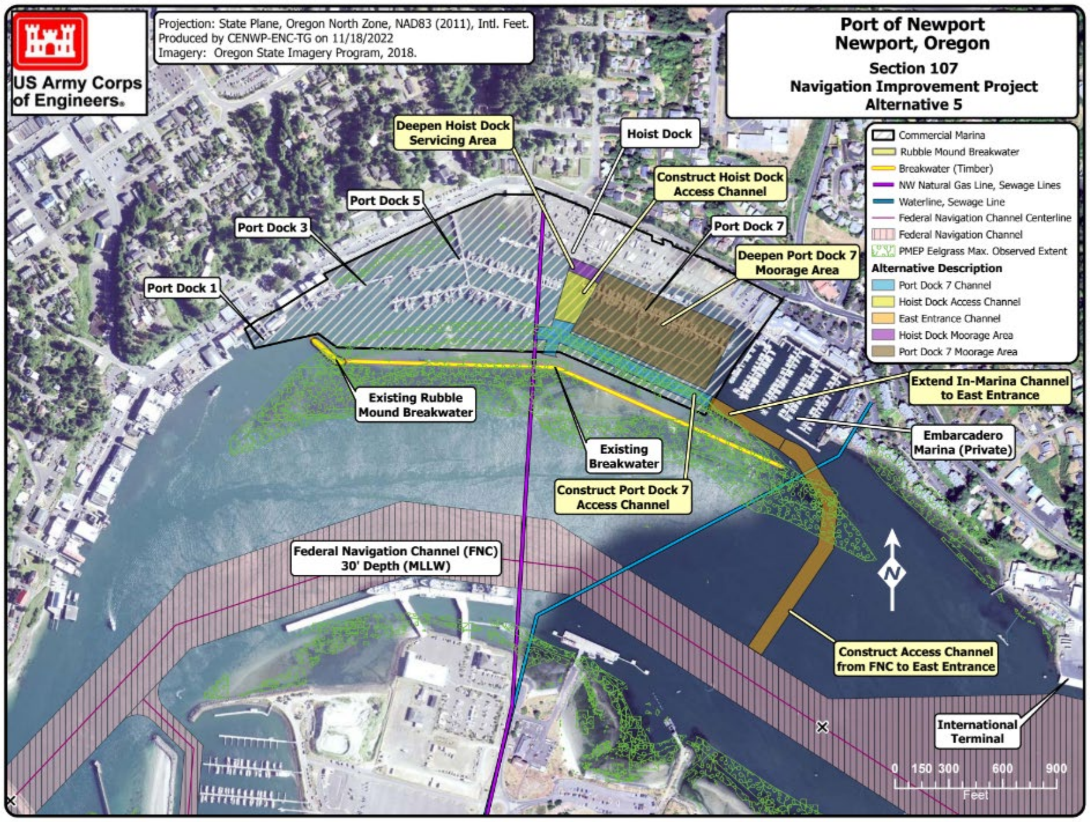
Figure 7-3. Plan view showing potential Central and East entrances.



7.2 Alternative 1: East Entrance

The potential East Entrance alternative is shown in Figure 7-4 and is further evaluated in the Main Report. The main considerations for the East Entrance, in addition, to the wider required channel width, included the larger impacts on dredging quantities and impacts to eel grass beds. In addition, there remains a potential to interfere with the utilities that were found located on the east end of the marina.

Figure 7-4. East Entrance Alternative



7.3 Alternative 2: Center Entrance

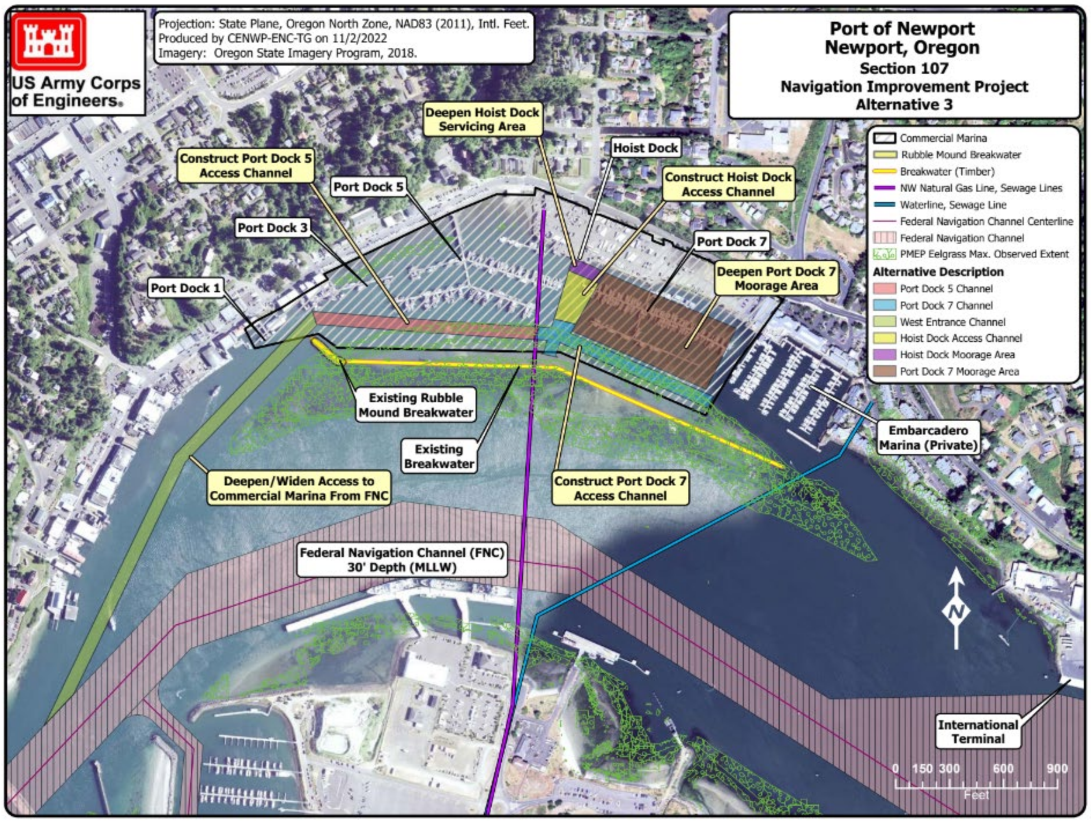
The Central Entrance was eliminated from further consideration due to the additional costs expected from removing a portion of the timber breakwater and the significantly higher initial and maintenance dredging costs. In addition, opening a gap in the timber breakwater would expose the marina to waves and currents from the bay.

7.4 Alternative 3: West Entrance

The West Entrance alternative is shown in

Figure 7-5 and is evaluated further in the Main Report. The West Entrance provides the shortest channel to the marina along an existing natural deep alignment and would not require significant sand shoal dredging. Vessels entering the marina currently use this entrance although in its present configuration, it is less reliable for the larger vessels.

Figure 7-5. West Entrance Alternative



8 Construction Considerations

Considerations for construction should primarily focus on methodologies that provide accuracy of dredging activities and minimizing water quality issues and sediment mobilization. Employing sonar and other GPS technologies can assist in accuracy and method of containment for moving materials from the channel excavation to the barge.

9 Recommended Engineering and Design Phase Investigations

Based on the data collected for the project and the current footprint and scope of the TSP, no further investigations are recommended at this time. Any changes made to the geometry or footprint to the channel configuration made during PED should verify and reevaluate slope stability to reflect modifications.

No seismic loading was included as part of the feasibility level study. From EM 1110-2-1100 Chapter 6:

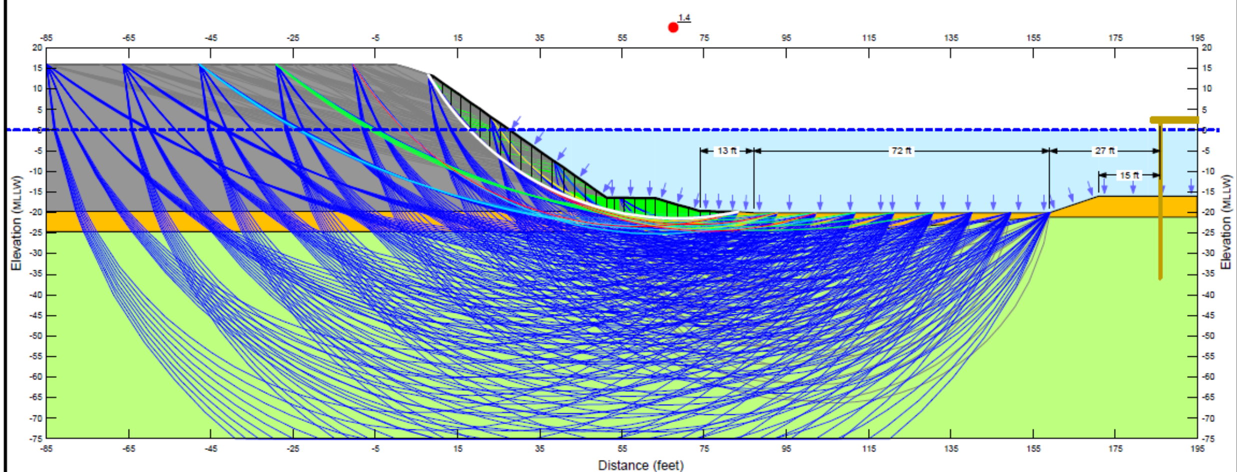
“Seismic loadings in coastal project design should be made on a case-by-case basis. When loss of life and interruption of vital services are not considerations, the decision to design for seismic loadings may hinge on such factors are estimated repair costs versus replacement costs, or the risk of damage versus increased initial construction costs”

As the intent of the project is to improve berth clearance for greater vessel size, limiting or reducing the channel geometry based on the anticipated seismic performance for the changes imposed by the dredging of materials would be contrary to the intent of the project mission. Original design of these structures did not include seismic loading, as failure or poor performance would not cause loss of life or interruption of vital services. For these reasons no seismic stability was evaluated for the feasibility level design and analysis. However, as part of the engineering and design phase it is recommended to evaluate the conditions to assess the overall risk and develop operations and maintenance plans for these conditions. It is anticipated that any damages caused by seismic loading, will be less costly to repair than to include design features to mitigate for deformations.

Based on the conservative strength parameters, slope stability is not anticipated to significantly impact the project alignment. Instead, considerations should be made to maintenance and operations as some of the standoff distances between the dredging footprint and adjacent structures are minimal.

Exhibit A-1

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Loose Sand	Mohr-Coulomb	110	0	25
	Nye Mudstone	Mohr-Coulomb	130	2,500	0
	Rubblemound	Mohr-Coulomb	165	0	40



Model Notes:
-Factor of Safety shown is associated with the critical slip surface (white line)
-Slip surfaces shown demonstrate range evaluated.
-Red circle represents centroid of searched slip surfaces

-20 MLLW for Overdredge (Failure Left to Right)

A-A' West Entrance.gsz

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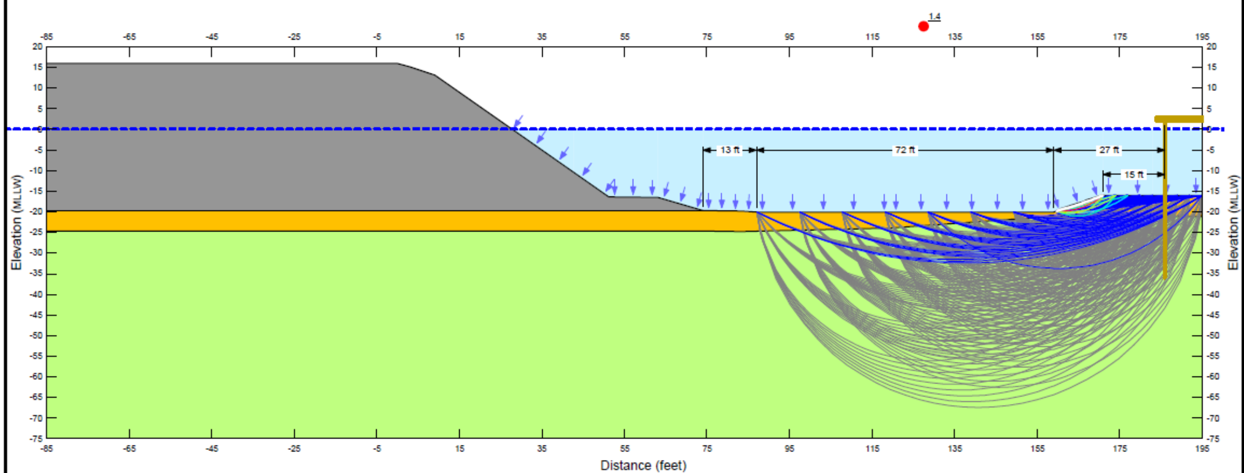
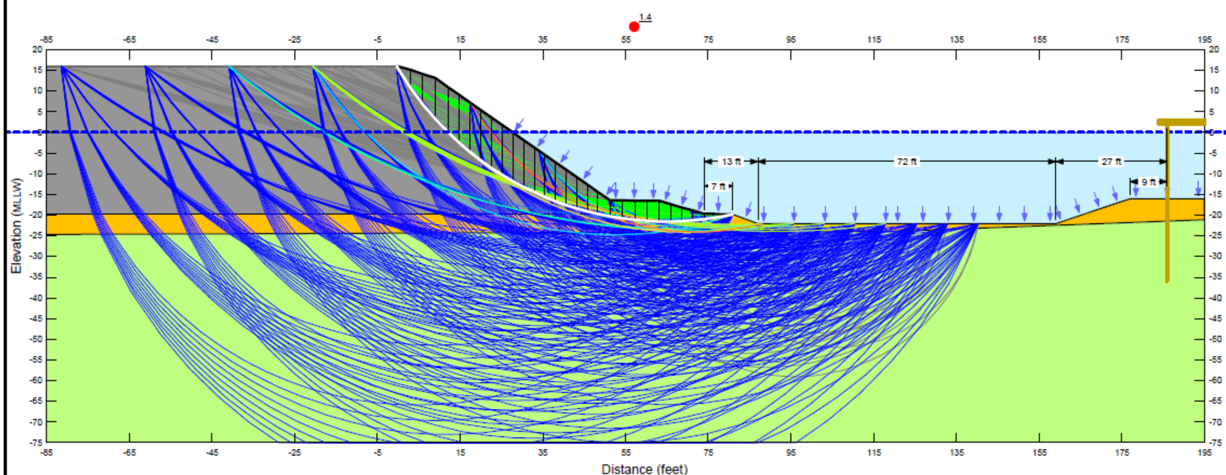
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Loose Sand	Mohr-Coulomb	110	0	25
	Nye Mudstone	Mohr-Coulomb	130	2,500	0
	Rubblemound	Mohr-Coulomb	165	0	40



Model Notes:
-Factor of Safety shown is associated with the critical slip surface (white line)
-Slip surfaces shown demonstrate range evaluated.
-Red circle represents centroid of searched slip surfaces

-20 MLLW for Overdredge (Failure Right to Left)	
A-A' West Entrance.gsz	
06/04/2025	1:360

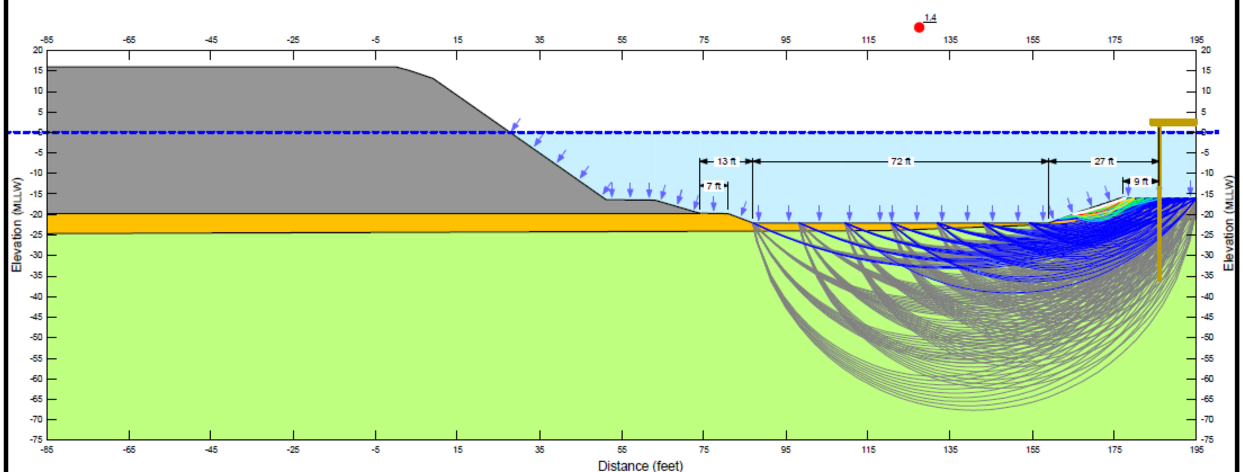
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Loose Sand	Mohr-Coulomb	110	0	25
	Nye Mudstone	Mohr-Coulomb	130	2,500	0
	Rubblemound	Mohr-Coulomb	165	0	40



Model Notes:
-Factor of Safety shown is associated with the critical slip surface (white line)
-Slip surfaces shown demonstrate range evaluated.
-Red circle represents centroid of searched slip surfaces

-22 MLLW for Overdredge (Failure Left to Right)	
A-A' West Entrance.gsz	
06/04/2025	1:360

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Loose Sand	Mohr-Coulomb	110	0	25
	Nye Mudstone	Mohr-Coulomb	130	2,500	0
	Rubblemound	Mohr-Coulomb	165	0	40



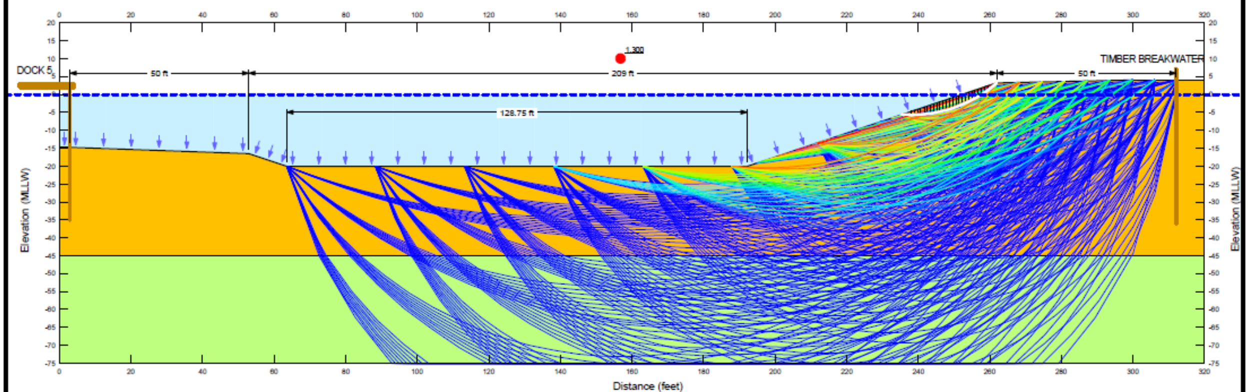
Model Notes:
-Factor of Safety shown is associated with the critical slip surface (white line)
-Slip surfaces shown demonstrate range evaluated.
-Red circle represents centroid of searched slip surfaces

-22 MLLW for Overdredge (Failure Right to Left)

A-A' West Entrance.gsz

06/04/2025 1:360

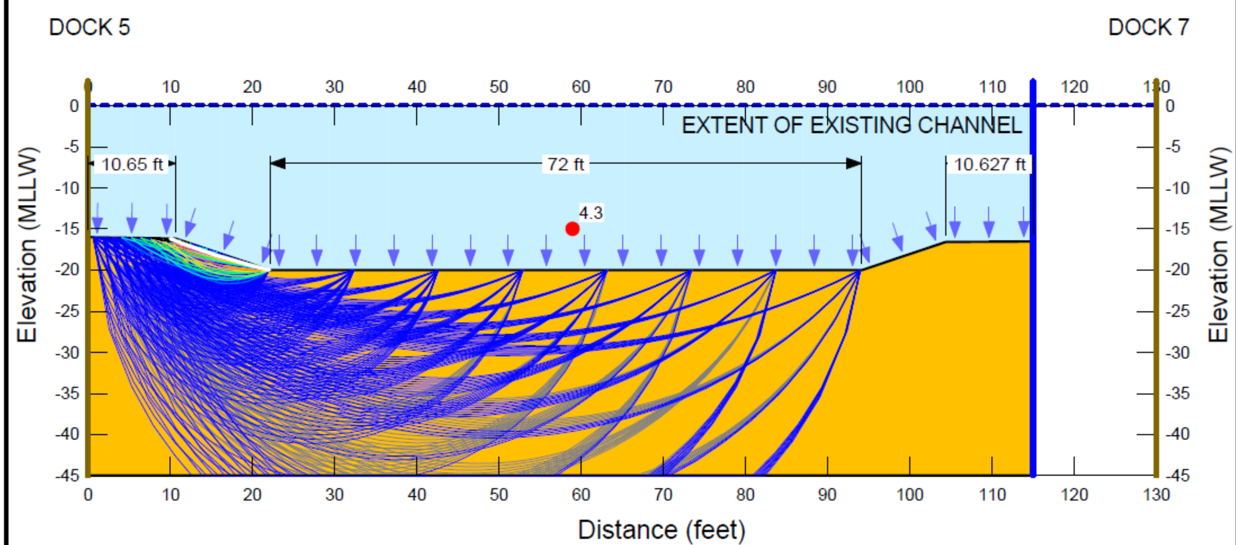
Color	Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Loose Sand	110	0	25
	Nye Mudstone	130	2,500	0



Model Notes:
-Factor of Safety shown is associated with the critical slip surface (white line)
-Slip surfaces shown demonstrate range evaluated.
-Red circle represents centroid of searched slip surfaces

B - B'	
B-B' Dock 5 to Breakwater.gsz	
04/15/2025	1:415

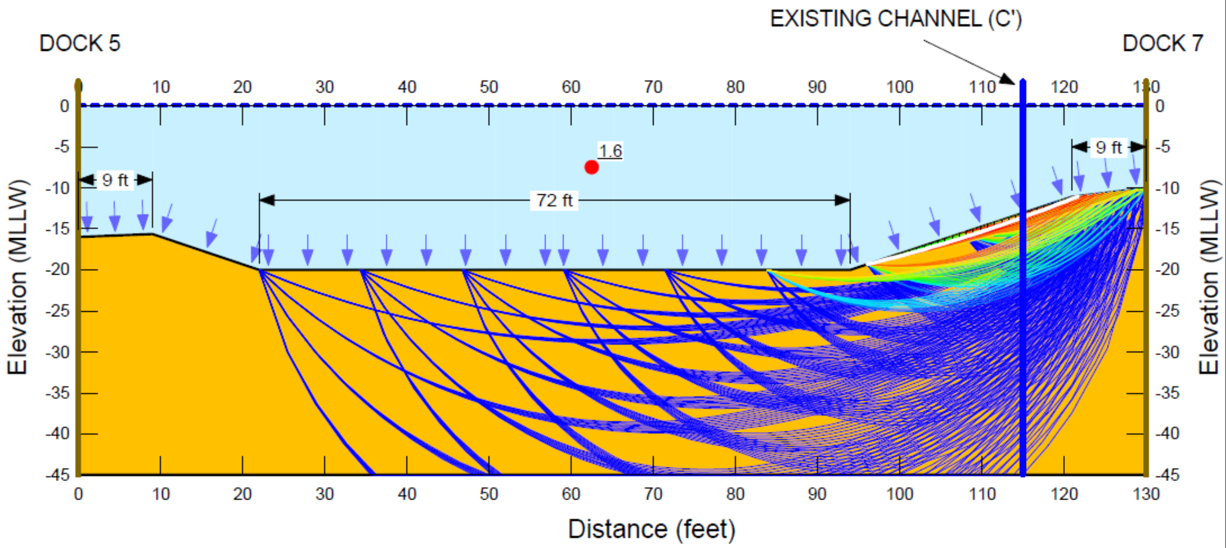
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Loose Sand	Mohr-Coulomb	110	0	28



Model Notes:
-Factor of Safety shown is associated with the critical slip surface (white line)
-Slip surfaces shown demonstrate range evaluated.
-Red circle represents centroid of searched slip surfaces

-20 feet (C-C')	
C-C' and C'' Existing Dock 5 to Existing Dock 7.gsz	
04/15/2025	1:180

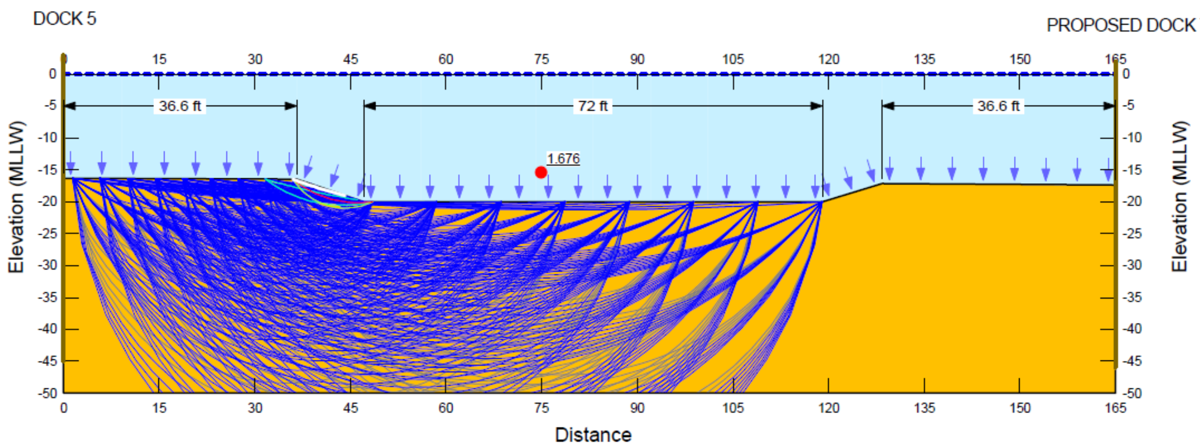
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Loose Sand	Mohr-Coulomb	110	0	28



Model Notes:
-Factor of Safety shown is associated with the critical slip surface (white line)
-Slip surfaces shown demonstrate range evaluated.
-Red circle represents centroid of searched slip surfaces

-20 feet (C-C")	
C-C' and C" Existing Dock 5 to Existing Dock 7.gsz	
04/15/2025	1:180

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Loose Sand	Mohr-Coulomb	110	0	28



Model Notes:
-Factor of Safety shown is associated with the critical slip surface (white line)
-Slip surfaces shown demonstrate range evaluated.
-Red circle represents centroid of searched slip surfaces

-20 MLLW (C-C''')	
C-C''' Existing Dock 5 to Proposed Dock 7.gsz	
04/15/2025	1:230

Exhibit A-2

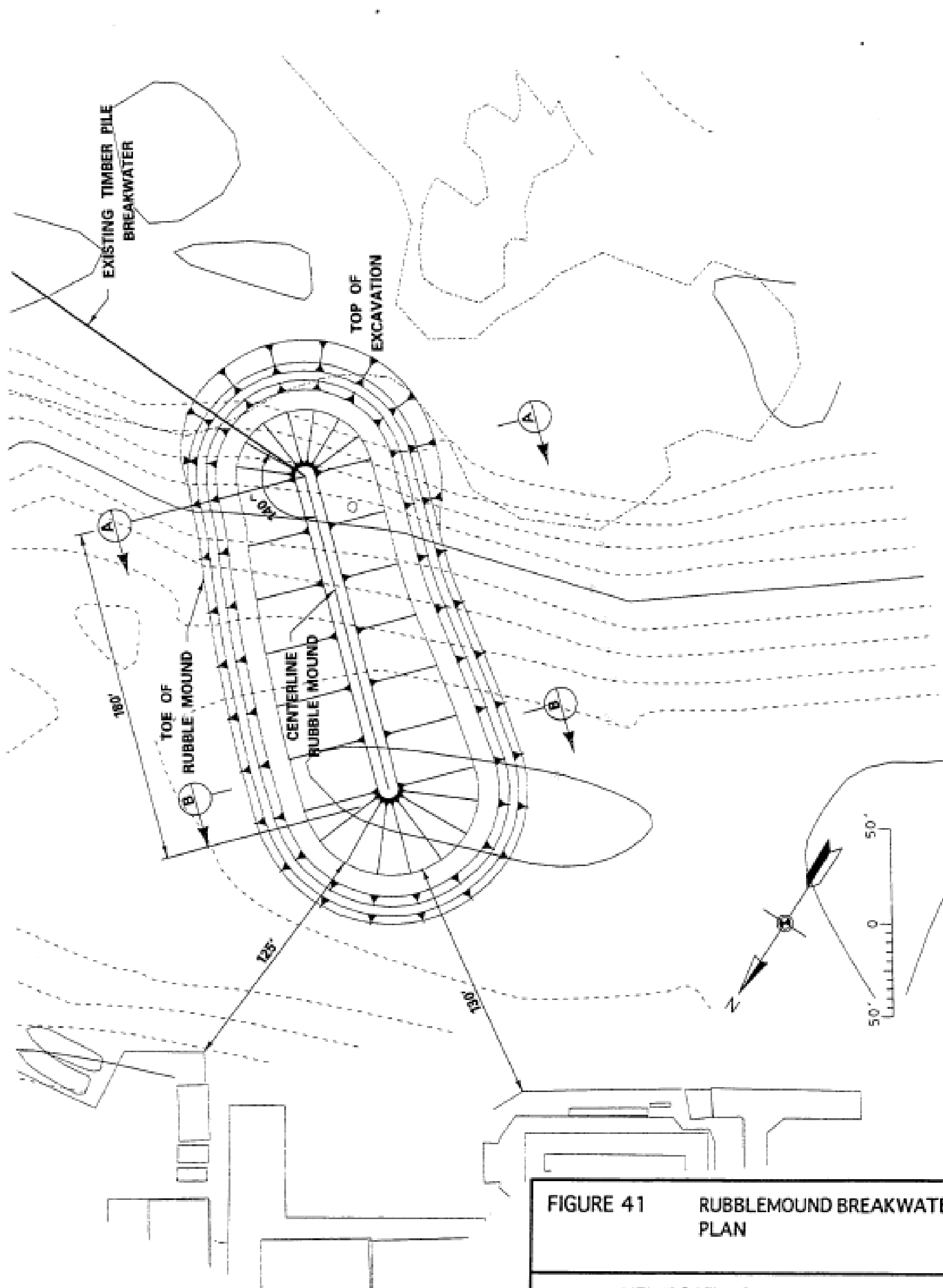
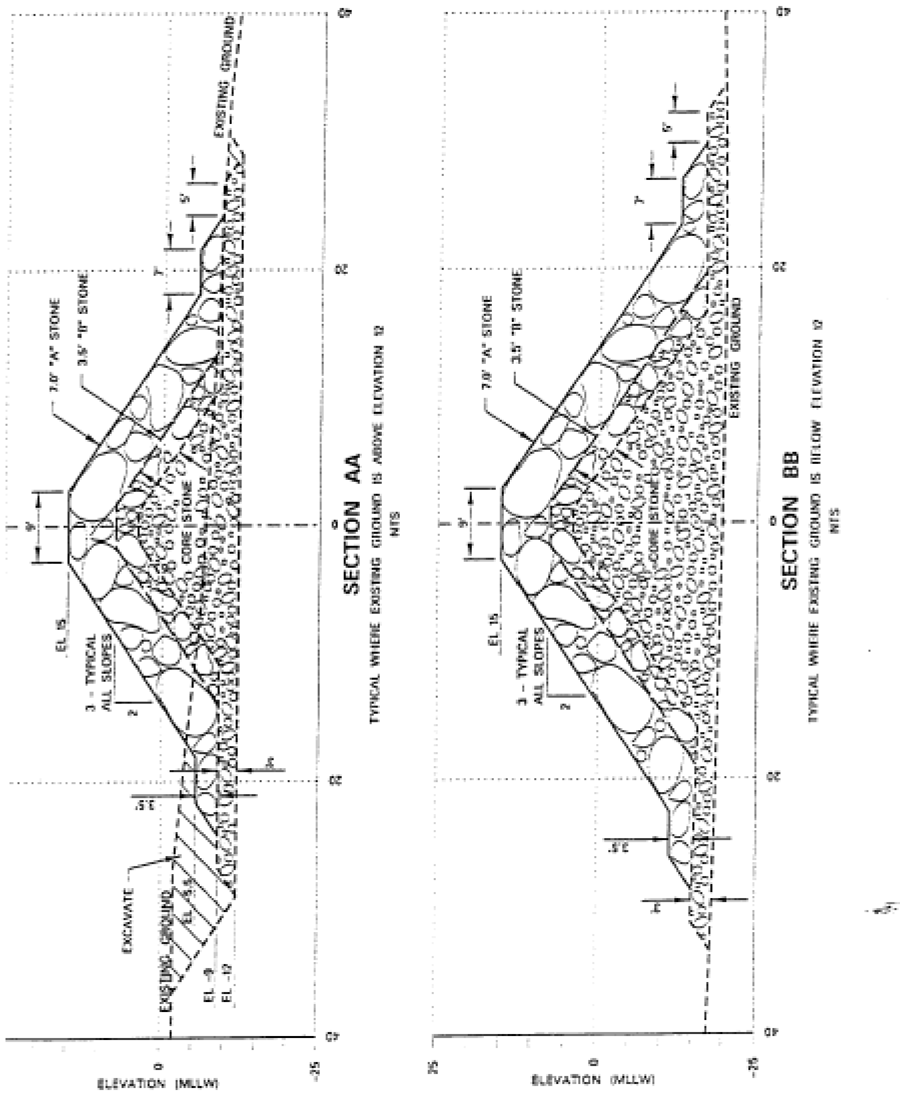
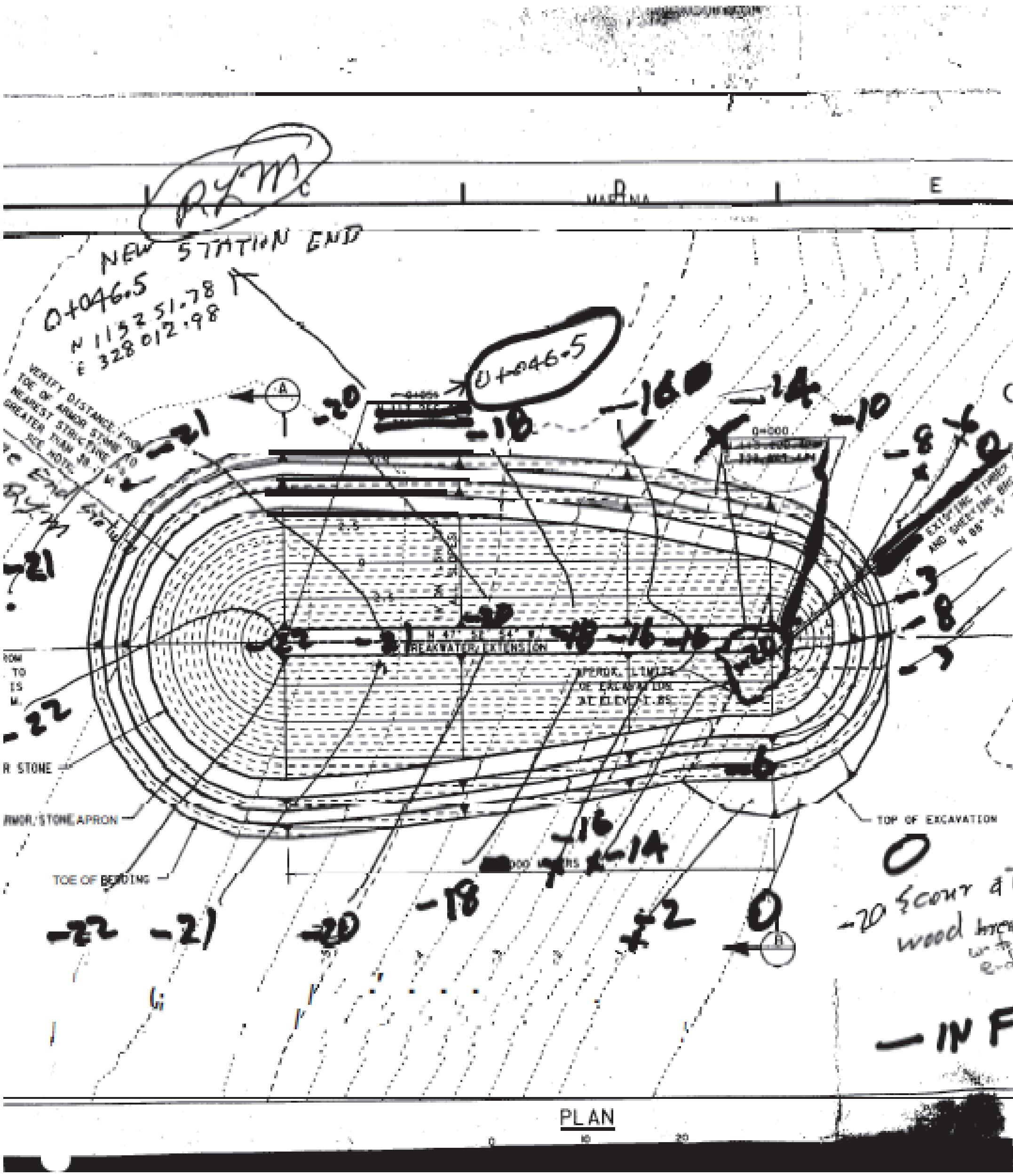


FIGURE 41	RUBBLEMOUND BREAKWATER PLAN	
NEWPORT NORTH MARINA SECTION 107 STUDY		
CENPP-PE-HY	HPM	NOV 95



"A" STONE = 3 TON TO 5 TON
"B" STONE = 600 LB TO 1000 LB
CORE STONE = 25 LB TO 200 LB

FIGURE 40	RUBBLEMOUND BREAKWATER CROSS SECTION	
NEWPORT NORTH MARINA SECTION 107 STUDY		
CENPP-PE-HY	HPM	NOV 95


NEW STATION END
0+046.5
N 113251.78
E 328012.98
0+046.5
BREAKWATER EXTENSION
TOP OF EXCAVATION
TOE OF BEDDING
-20 scour at
wood
PLAN