APPENDIX L:

PRELIMINARY MARINE STRUCTURAL AND DREDGING ASSESSMENT

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PORT OF LONGVIEW
MASTER PLAN PHASE I FEASIBILITY STUDY
Preliminary Marine Structural and Dredging Assessment

kpff Engineering Opportunities.

PORT OF LONGVIEW EST. 1921

January 19, 2016

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1.0 INTRODUCTION

In 2010 the Port of Longview (Port) purchased the 275-acre property at Barlow Point for future Port industrial development. The Port acquired an additional 7.5 acres of tidelands in 2012 bringing the site total to 282.5 acres. The property is located downstream of the current developed Port at approximately river mile 64 (RM 64), which is on the west side of the City of Longview, Washington (City). In order to better understand the full potential of the Barlow Point site, the Port determined that a comprehensive master planning process should occur. The first step in that process was to perform a due diligence study to assess the feasibility to develop Barlow Point into a marine terminal.

A market analysis and conceptual site planning exercise were performed in late 2014 through early 2015 to identify possible types of use and site layouts. Specific industry types were identified from the market analysis to be the basis to analyze potential site layout and use at Barlow Point. Two options arose from that evaluation, which focus on production and/or export of dry or liquid bulk commodities/tenants. Both of the options identified would have a site occupied by three bulk commodities. The dry bulk option (Option 1) consists of potash, urea and wood pellets. The liquid bulk option (Option 2) consists of crude oil, methanol and biodiesel. See the Conceptual Site Plans and the Concept Planning and Market Analysis Report located in Appendix A and Appendix B of the main report.

As part of the study, the marine structures and dredging requirements were explored. This included a review of general pier types and locations based on dry and liquid bulk commodity uses, and the associated seismic design criteria for the area. Also reviewed were the dredging needs for the site and how the dredging and structure placement may be affected by the geotechnical conditions of the river bank.

2.0 EXISTING CONDITIONS

The existing site is located downstream of the current developed Port property at RM 64 on the Columbia River. The site is bounded by Mt. Solo Landfill and State Route (SR) 432 to the north, a flood control levee and the Columbia River to the south. Undeveloped fields are located to the west and existing industrial areas are located to the east. The site has historically been and is currently being used for agricultural purposes but is zoned for Heavy Industrial.

A 900-foot-wide high voltage electrical transmission line easement, held by Bonneville Power Administration (BPA), is present on the east side of the property. A drainage ditch and pump station, maintained and operated by the Consolidated Diking Improvement District #1 (CDID#1), are present at the east border of the site and the southeast corner of the site, respectively. A flood control levee, overseen by the CDID#1, is present at the riverfront and runs the entire length of the site.

Upland ground surface elevations are referenced to the NAVD 88 vertical datum for this project. The ground surface in the backland area of the site is generally level to gently rolling with an approximate average ground surface at elevation 10 feet NAVD88. The flood control levee side slopes lie at up to 4H:1V on the upland side of the levee and up to 6H:1V on the river side, with the levee crest at approximate average elevation 30 feet NAVD88.

The KPFF team performed a bathymetric survey in the summer of 2015 to better understand the river bottom conditions at Barlow Point. The bathymetry indicates that submerged slopes on the river side of the levee lie as steep as 1H:1V, but are typically shallower. The Columbia River shipping channel is adjacent to the site and is routinely dredged by the Army Corps of Engineers. Bathymetry indicates the bottom of the Federal Navigation Channel is at approximate elevation -45 to -65 feet CRD at the time of bathymetry measurements (summer of 2015). The navigation dredge depth maintained by the United States Army Corps of Engineers (USACE) is -43 CRD (-45.32 NAVD88). Bathymetry elevations are typically referenced in Columbia River Datum (CRD) but were converted to NAVD88 to compare to upland elevations. For comparison between CRD and NAVD88 at Barlow Point, the CRD is 2.32 above NAVD88 at Barlow Point. This conversion is specific to Barlow Point because the CRD is not a level datum and is sloped with the Columbia River as it flows downriver.

Based on historical geotechnical information from a June 25, 1993 report by GRI prepared for Nucor Steel; the site soils are loosely consolidated silts and sandy silts to a depth of more than 200 feet. During the geotechnical investigation, bed rock was encountered at depths below 220 feet and in some cases near the river, was not encountered to the maximum depth of the borings. As part of this study, additional geotechnical explorations were performed by Hart Crowser. Hart Crowser's work indicates that the site is also subject to liquefaction, down drag forces on marine pile supported structures to a depth of 80 feet below existing ground level and that the river bank is unstable in a seismic event in its current configuration and condition. Although the levee is the most visible earthen structure on the site, the stability of the levee is dependent upon the stability of the river bank on which it sits. Based on the initial analysis of the river bank slope, the existing slope is stable in a static condition but is unstable in a seismic condition. This means that during an earthquake, portions of the river bank have the potential to slough into the river. The potential development described below would be designed to not further reduce the slope stability. See the Preliminary Geotechnical Assessment by Hart Crowser located in Appendix F of the main report for additional information.

3.0 MARINE STRUCTURES

Based on the size of the site and the market analysis, up to three separate tenants/industries could be located at the site. Each potential tenant/industry would access the Columbia River via individual, purpose built near shore marine structures. Near shore marine structures can be generally be classified into two types of structures; quay wall and pier/wharves. Quay wall structures are vertical wall structures where the top of the deck is supported by a vertical wall and earthen fill materials. These structures are normally constructed by driving steel sheet piles into the shoreline while the area on the waterside of the quay wall is dredged and the material is placed behind the quay wall as fill on the landside of the wall. The second type of near shore marine structures are pile supported structures known as piers or wharves. Piers and wharves are normally constructed using an elevated steel or concrete deck supported atop steel or precast concrete piles. The piers and wharves are constructed over water and allow the water to pass beneath the structure and minimize the dredging required to allow larger ships to access the piers and wharves. Piers and wharves are accessed from the land by use of a bridge structure known as a trestle. A trestle is built in a similar manner to the pier it provides access to.

Pier structures, versus a quay wall, are being proposed at Barlow Point for either dry or bulk options. This is based on many factors, including site specific characteristics involving the river geometry, navigational considerations, environmental consideration and impacts on the shoreline, structural requirements of the piers, dredging requirements, and geotechnical recommendations.

The marine structures are anticipated to be constructed by the Port while commodity conveyance systems and ship loaders will be designed and constructed by the future tenants. All structures are based on the assumption that pier design will be modified to accommodate individual projects and therefore, the basic geometry and loading of the marine structures as discussed here, is focused on typical designs for similar bulk facility ship mooring and berthing, geometry and footprint only.

3.1 MARINE STRUCTURE LOCATION, ORIENTATION AND GEOMETRY

As part of the conceptual planning exercise, the three marine structures were located based on a number of factors including clearance from the Federal navigation line and BPA easement, need for dredging, river bank slope stability and extent of ground improvements, and size of marine structures (e.g. trestle and pile length). For example, the further out into the water the structures are, the less dredging and ground improvements may be needed but the size and cost of the structure increases. Conversely, the closer to the shore the structures are placed, the more dredging and ground improvements may be needed but the size and cost of the structures decreases. Table 1 summarizes the general impacts of the location of the pier head line.

Table 1 - Waterfront Structures/Dredging Alternatives Considerations

Long Pier Alternative	Short Pier Alternative
Decreased Capital Dredging	Increased Capital Dredging
Decrease Maintenance Dredging	Increased Maintenance Dredging
Decreased Ground Improvements	Increased Ground Improvements
Increase Capital Pier Structure	Decreased Capital Pier Structure
Increased Tenant Improvement Cost	Decreased Tenant Improvement Cost

First, a potential pier head line was set based on a minimum clearance from the Federal navigation channel line. A pier head line is the line where a ship and a pier structure interface. For the purposes of this study, a consistent, shared, pier head line was adopted for all three marine structures for both liquid and dry bulk options. In future phases of work, further study of the river currents, winds and vessel traffic is required to determine the optimal pier headline for each structure.

The location and orientation of the pier head line was set based on a minimum clearance of 190 feet from the Federal navigation channel line and a minimum clearance of 250 feet from the BPA easement (see the Conceptual Planning and Market Analysis Report located in Appendix B of the main report). The clear distance of 190 feet to the channel line provides adequate distance to allow Handymax vessels with an average beam width of 105 feet or Aframax vessels with an average beam of 145 feet and a tug to be clear of the channel line. This represents the Long Pier Option as it is the furthest the pier head line can extend toward the channel. The 250 foot clear distance from the BPA easement is a conservative assumption that provides flexibility of the potential site layout and may be decreased with further design. The pier head lines are consistent across the dry and liquid bulk options; therefore, only the potential dry bulk piers are shown in the Preliminary Dredge Assessment exhibits located in Attachment 1.

A Short Pier Option was also considered where the pier head line is located as close to the shore as possible. The levee easement was the controlling factor to how far north, toward the shoreline, the pier head line could be moved as dredging is not allowed within the levee easement boundary. The Short Pier Option can be approximately 80 linear feet closer to the shore without the dredge extents crossing the levee easement.

3.2 GEOMETRY OF PIERS

The marine structure geometry is based on generally accepted industry geometries for the dry bulk and liquid bulk piers. KPFF also compared these geometries to similar piers currently in use at the Port of Longview and elsewhere on the Columbia River area. The marine structures are assumed to be supported on open ended, steel pipe pile measuring 24-inches in diameter and varying in length up to approximately 200 feet long.

As described above, access to the pier is anticipated to be via a trestle with the centerline of the trestle to be located generally perpendicular to the centerline of levee. The use of a trestle to access the pier was chosen based on several factors which include:

- The assumption that pier structure would be used versus a quay wall structure,
- Reducing the overwater shadow area by providing open grating in the near shore area,
- Reduction of the number of supporting abutments and piles and associated environmental mitigation by reducing the impact area of the piles.

The top of pier deck elevation is anticipated to be located at or near elevation +23 feet NAVD88. This pier deck elevation is based on historical river data for the 100-year and 500-year flood events which correspond to elevations 19.6 feet NAVD88 and 22 feet NAVD88 respectively and the need to keep the top of pier deck elevation above the 500 year event with an assumed one foot of freeboard. In addition, similar facilities along the river use a similar top of pier elevation to help facilitate berthing and mooring of similar bulk commodity vessels.

3.3 GRAVITY LOADING OF THE PIERS

The majority of the gravity loading (vertical dead and live loads) on dry and liquid bulk pier is located in the conveying system and the conveying systems will likely be supported on the pier bents. Therefore the loading on the decking is limited to maintenance, service and emergency vehicles (ambulances). Based on preliminary coordination with the City of Longview Fire Marshal, fire truck access will likely not need to be provided on the piers. Gravity loading of the pier deck will be limited to a live load of approximately 150 pounds per square foot and vehicle live loads of 10,000 to 20,000 pounds (H-5 to H-10 truck loading).

3.4 GEOTECHNICAL CONSIDERATIONS

The geotechnical traits of the river bank will affect the size, type and location of the pier structures. According to the preliminary geotechnical analysis by Hart Crowser, the site is subject to liquefaction and drag down forces on marine pile supported structures. As a result, localized in-water ground improvements will likely be required around the structures. Ground improvement techniques vary, but in general, they are geotechnical construction methods that change the characterization of soil, to stabilize for all construction taking place on the soil.

Global stability of the river bank during a seismic event is also a concern at Barlow Point. Initial investigation shows the river bank is stable in a static condition, but is unstable in a seismic condition. More extensive in-water ground improvements may be required to stabilize the river bank during the Operating Level Earthquake (OLE) or higher (see the Preliminary Geotechnical Site Assessment located in Appendix F of the main report for discussions on potential ground improvements).

The ground improvements and pier structures can be designed to withstand up to three different seismic design events. A structure designed to the Design Earthquake (DE) is a minimum life safety design that will sustain heavy damage during the design seismic event. The structure is designed not to collapse, but will likely be a total loss. A structure designed to the Contingency Level Earthquake (CLE) may be moderately damaged during the design seismic event but would require costly repairs to remain serviceable. A structure designed to the OLE may be minimally damaged during the design seismic event and may remain serviceable with minor repairs. For this study, it is assumed that ground improvements and structures will be designed to the OLE which is a conservative assumption.

3.5 MARINE STRUCTURE ENVIRONMENTAL CONCERNS

There are a number of environmental concerns that may require mitigation or could influence the design of the pier structures. One of which is the requirement to limit Over Water Shading (OWS) of structures near the shore. The Columbia River is a sensitive salmon route for migrating species of salmon. In order to protect salmon, agencies of jurisdiction have requirements to reduce the shadow areas of near shore structures which ultimately reduce the habitat and numbers of predatory invasive species. Measures that may reduce the effects of the project on ESA-listed fish species include configuring docks, piers, and wharves such that the OWS components are located in deep water, as well as using materials that allow for light transmission to reduce shading (e.g., grated decking for walkways or gangways) on near shore marine structures, like access trestles. In addition to structural design considerations, some manner of mitigation will likely be required for river bottom disturbance from pier structures and in-water ground improvements. See the Riverfront Environmental and Other Considerations Report located in Appendix D of the main report for more description on mitigation.

3.6 MEETING WITH COLUMBIA RIVER PILOTS

The Port and KPFF met with a representative from the Columbia River Pilots on August 19, 2015 to discuss possible concerns with marine structures at Barlow Point. Discussed were both operational concerns with Barlow Point and structural design elements. In general, the Columbia River Pilot representative had no concerns about the site or placement of the pier head line that could not be addressed with proper planning and design. The representative stressed that the owner and operator of a pier be aware of passing ship effect on moored vessels. Significant forces can be imparted by a passing ship into vessels moored at piers. These forces increase the closer the passing ship is to the moored vessel. The Columbia River Pilot representative said that moored vessels will be impacted greater by passing ships the closer the pier head line is to the Federal Navigation Channel line. Passing ship effect, similar to wind and current force, is a known design consideration that will need to be fully investigated during future phases of work.

3.7 DRY BULK MARINE STRUCTURES

The preliminary geometry of the dry bulk marine structure investigated was based on a similarly constructed pier at the Port's Berth 9 Export Grain Terminal (EGT) facility and the more unique structure for the potash industry. Dry bulk marine structures are typically comprised of several similar components. These include mooring dolphins, berthing dolphins, trestles and interconnected walkways (see Figure 1). This review will focus on the typical pier components that are to be provided by the Port and not the conveyor and ship loading types that are to be provided by the tenant.

<u>Mooring Dolphins</u>

Mooring dolphins are in-water structures that allow the ship to attach lines to these structures in order to hold the ship in position against river current, wind and waves. These structures do not support the ship at berth but instead hold the ship in place. These structures are located in front and behind the ship and are generally not in line with the side of the ship (pier head line) in order to provide better resisting forces. These structures are anticipated to be constructed of battered steel pipe piles and concrete pile caps. The battered steel piles, which are pile installed at an angle, are better able to resist the loading of the ship on the structure. These structures will be interconnected by use of a pedestrian trestle from the main pier to the mooring dolphins. The ship's lines will be attached to a bollard located on the top of the mooring dolphins. Ideally, the design of the dry bulk pier will allow ships to be loaded without having to be moved along the structure. Under certain circumstances (e.g., out of commission loaders or loader type), ships may be periodically required to move along the face of the berth to facilitate loading. Ship movements can be accomplished in one of two ways. Tugs can be used to reposition the larger ships or mechanical winch capstands can be located on the mooring dolphins in order to facilitate ship movement along the pier head line.

<u>Berthing Dolphins</u>

Berthing dolphins, also known as breasting dolphins, are in-water structures that the ship can attach lines to in order to hold the ship in position against river current, wind and waves and to allow the ship to rest against the pier structure at designated locations. These structures support the ship against the pier structure at specific locations. Berthing fender panels located on the waterside of the berthing dolphins will be the point of contact between the ship hull and the pier structure. The berthing fenders are constructed of low friction, durable materials that allow the ship to move against the panel as the ballast of the ship changes or tidal changes occur. These structures are located along the side of the ship and are in line with each other and the side of the ship in order to provide a uniform hull pressures. These structures are anticipated to be constructed of vertical and battered steel pipe piles and concrete pile caps. The berthing dolphin structures will be connected to the pier decking designed to handle utility vehicle and pedestrian loading. Located on these structures are bollards for attachment of the ship's lines to hold the ship in place. Pipe piles and steel pile caps will be used to support the trestles and pier deck. A general arrangement plan is provided in Figure 1.

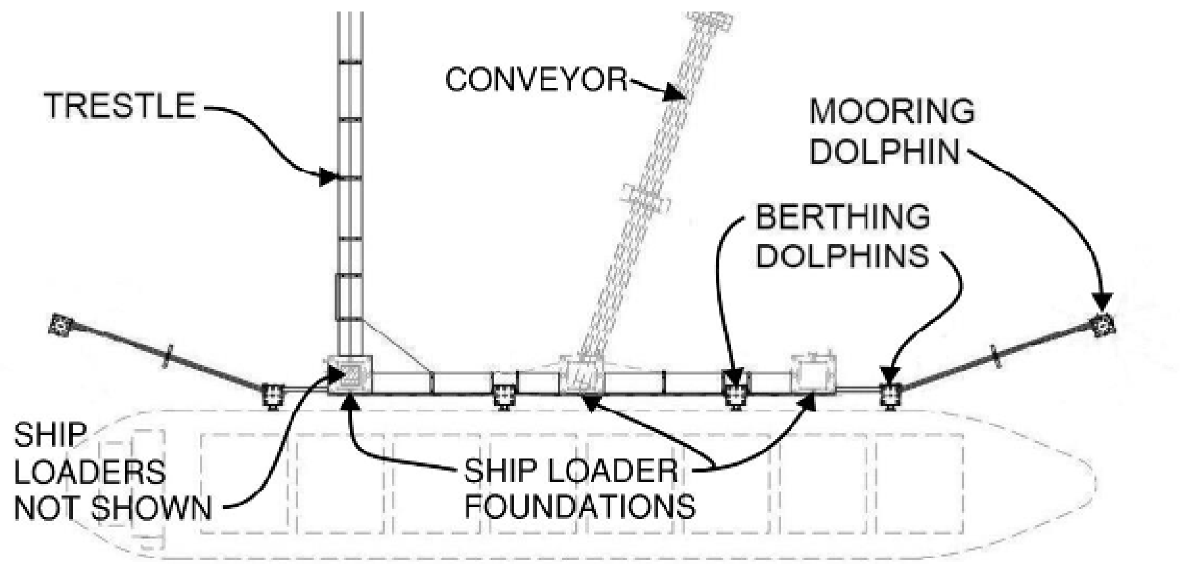

Figure 1- Dry Bulk Marine Structure

3.7.1 POTASH MARINE STRUCTURE

The potash marine structure is slightly different than the typical dry bulk structure due to the nature of how these structures load ships. In the case of potash marine structures, the structure and the conveying system will allow anywhere on the ship to be loaded by the use of two arched conveyor systems, or radial quadrant loaders, supported by two arched conveyor beams. This requires two separate conveyor systems instead of the typical one. Otherwise, the potash marine structure is comprised of similar components to the typical dry bulk structure including mooring dolphins, berthing platform, trestles, and interconnected walkways (see Figure 2).

The continuous concrete arched conveyor beams for the radial quadrant loaders will be constructed over steel pipe piles. This loading method typically allows the entire vessel to be loaded without having to move the vessel once moored. Similar to the other dry bulk ships, the potash ship may need to be moved along the face of the pier in certain circumstances (e.g., out of commission ship loader). Therefore, as an option, mechanical winch capstands can be located on the mooring dolphins in order to facilitate the movement of the ship without the use of tug assistance. Bollards will be located at both the berthing platform and the mooring dolphins for the mooring of the ship. Interconnecting the dolphins will be steel beam supported open grating trestles designed to handle utility vehicle and pedestrian loading. Pipe piles and steel pile caps will be used to support the trestles (see Figure 2).

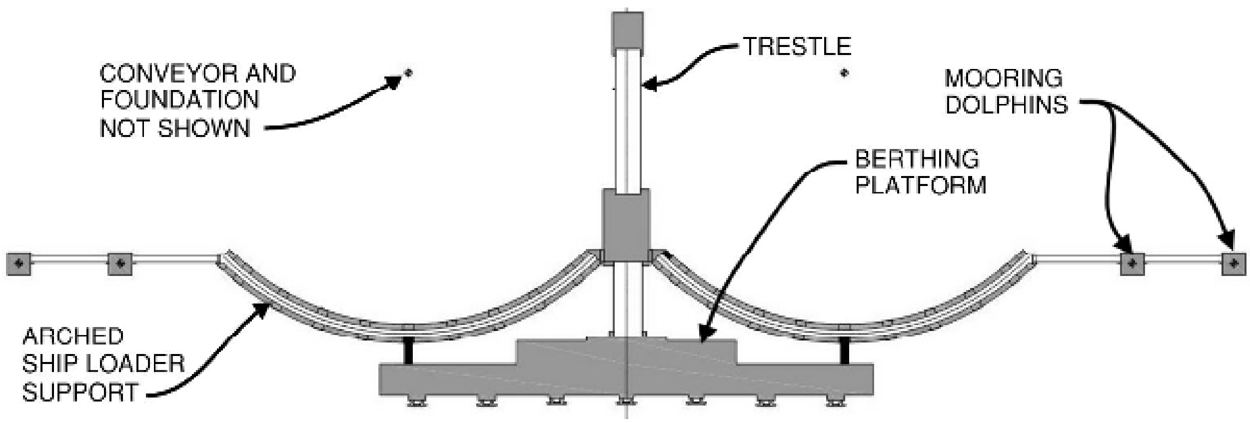

Figure 2 - Potash Marine Structure

3.8 LIQUID BULK MARINE STRUCTURES

Liquid bulk marine structures vary somewhat from dry bulk or potash marine structures by the nature of how these ships are loaded. In the case of liquid bulk marine structures, the structure and the piping system will allow the ship to be loaded at only one point along the ship. The ship is typically loaded at mid-ship through the use of hydrants located on the pier. These hydrants look like steel hoses or pipes attached to articulated arms to allow the piping connection between the land-based pipeline and the ship. The hydrants articulate from the pier to the ship and once connected, allow the transfer of liquid materials to the ship for distribution along the length of the ship into various holds within the ship. This allows liquid bulk ships to be loaded from a single position. The liquid bulk structure is comprised of several components. These include mooring dolphins, berthing platform, trestles, and interconnected walkways (see figure 3). Structure components will be similar to the dry bulk structure with the following exceptions:

- The liquid bulk structural components are generally more substantial due to the mass of the vessel and higher design criteria required for liquid bulk facilities,
- Environmental controls, such as containment around the distribution hydrant deck, typically provided in the form of raised concrete curb, will need to be provided to prevent liquid release.

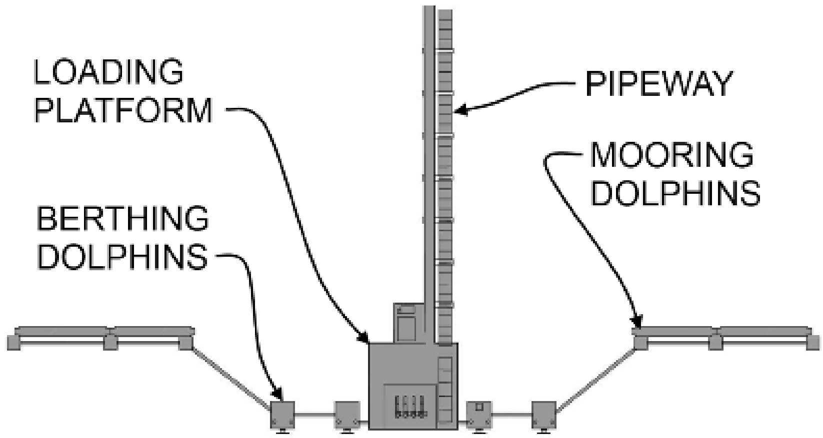

Figure 3- Liquid Bulk Marine Structure

4.0 DREDGING

Conservative dredge requirements were chosen to analyze potential dredging for the Long and Short Pier Options. A dredge depth of -46 CRD (-48.32 NAVD88) was chosen based on the established Columbia River dredge depth, a pre-maintenance dredge, and typical over dredge (see Table 2).

Table 2 - Potential Dredging Criteria

Criteria	Description
Initial Columbia River Dredge Depth	-43 CRD (-45.32 NAVD88)
Pre-Maintenance Dredge	2 ft
Over Dredge	1 ft
Desired Dredge Depth	-46 CRD (-48.32 NAVD88)
Back Slope[1]	3:1

(1) Back slope for dredging is preliminary. Additional investigation of existing conditions and design associated with river bank stability is required.

A bathymetric survey of the river channel was performed by the KPFF team in early 2015 to determine the current condition of the site. The dredge criteria were compared to the new bathymetric data and the pier head location options to determine if dredging would be required. It was determined that some level dredging will be required for either the Long Pier and Short Pier options. Attachment 1 shows the dredging extents for the two options. The potential dredge quantity for the Long Pier Option is approximately 80,800 cubic yards and the quantity for the Short Pier Option is approximately 234,000 cubic yards. These volumes are preliminary and will likely change with different pier configurations informed by current and wind/wave analysis.

5.0 CONCLUSIONS

Marine structures at Barlow Point are anticipated to be constructed using industry standard design with the structures likely being pile supported pier structures with pile varying in length up to approximately 200 feet long. Two options for the location of the piers were reviewed, the Long Pier Option and the Short Pier Option. The Long Pier Option increases the structural costs but likely decreases the costs for dredging and ground improvements. The Short Pier Option decreases the structural costs, but likely increases the dredging and ground improvement cost. Given the permitting and potential cost issues with in-water ground improvements, the Long Pier alternative is likely the preferred alternative for Barlow Point.

No issues that could not be mitigated through thoughtful design were identified during this review. However, the following design considerations were identified and will need to be taken into account:

- Wind, wave, current and passing ship analysis will need to be performed to further inform site design,
- Environmental mitigation measures associated with the pier construction will need to be considered including OWS coverage and type and extent of in-water ground improvements,
- Localized in-water ground improvements around the marine structures will likely be required,
- In-water ground improvement of the river bank to stabilize the river bank against a global failure during a seismic event will likely be required,
- Dredging will likely be required for any configuration of piers and dredging extent will vary based on the location of the piers,
- Dredge extent will contribute to the amount of in-water ground improvement to the river bank.

6.0 REFERENCES

ASCE/COPRI 61-14. *Seismic Design of Piers and Wharves*, ASCE/COPRI 61-14, American Society of Civil Engineers (ASCE) – Coasts, Oceans, Ports, and Rivers Institute (COPRI), 2014.

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GRI 1993. Preliminary Geotechnical Investigation, Proposed Steel Mill, Barlow Point Site, Longview, Washington, June 25, 1993

"Marine Oil Terminal Engineering and Maintenance Standards" (MOTEMS), published by the California State Lands Commission, January 1, 2014

NOAA (National Oceanic and Atmospheric Administration), 2015. Northwest River Forecast Center, BUOY Meteorological Station LOPW1. Accessed at: http://www.nwrfc.noaa.gov/rfc/.

ATTACHMENT 1:

PRELIMINARY DREDGE ASSESSMENT

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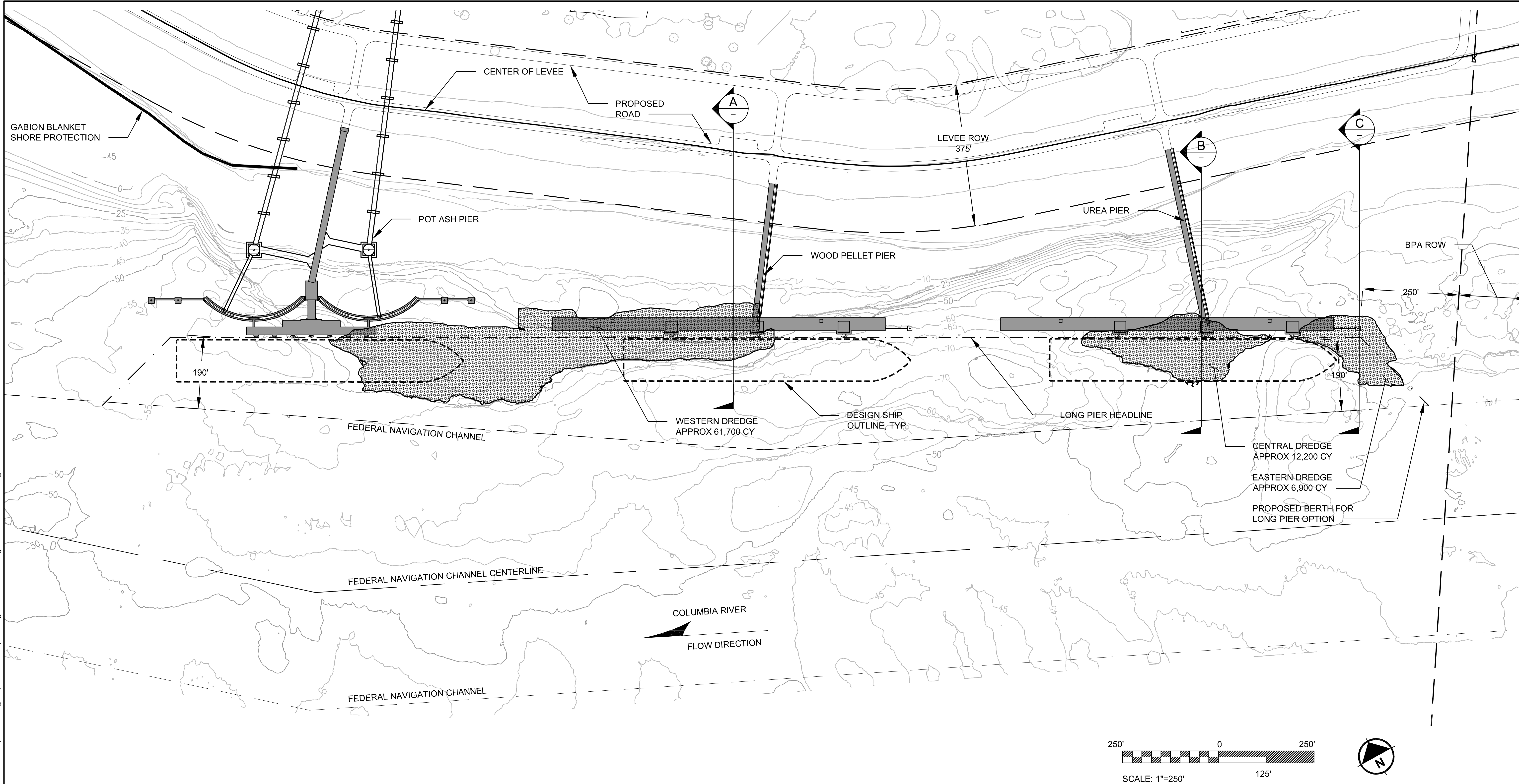

NOTES:

1. LONG PIER OPTION IS LOCATED 190 FEET LANDWARD OF THE FEDERAL NAVIGATION CHANNEL LINE AT THE NARROWEST.
2. THE TOTAL DREDGE VOLUME FOR THE LONG PIER OPTION IS 80,800 CY.
3. ELEVATIONS SHOWN ARE IN NAVD88.
4. SEE SHEET 2 FOR SECTIONS.

LEGEND:

- DREDGE AREA
- ROW LINE
- GABION BLANKET
- BERTH BOUNDARY
- CENTER OF DIKE

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PORT OF LONGVIEW - BARLOW POINT
PRELIMINARY DREDGE ASSESSMENT
LONG PIER ALTERNATIVE - PLAN

DATE: 2015-06-24	SCALE: AS SHOWN
DRAWN BY: SJS	SHT 1 OF 2

Plotted: Jun 29, 2015 - 10:38am cprince Layout: OPTION 1
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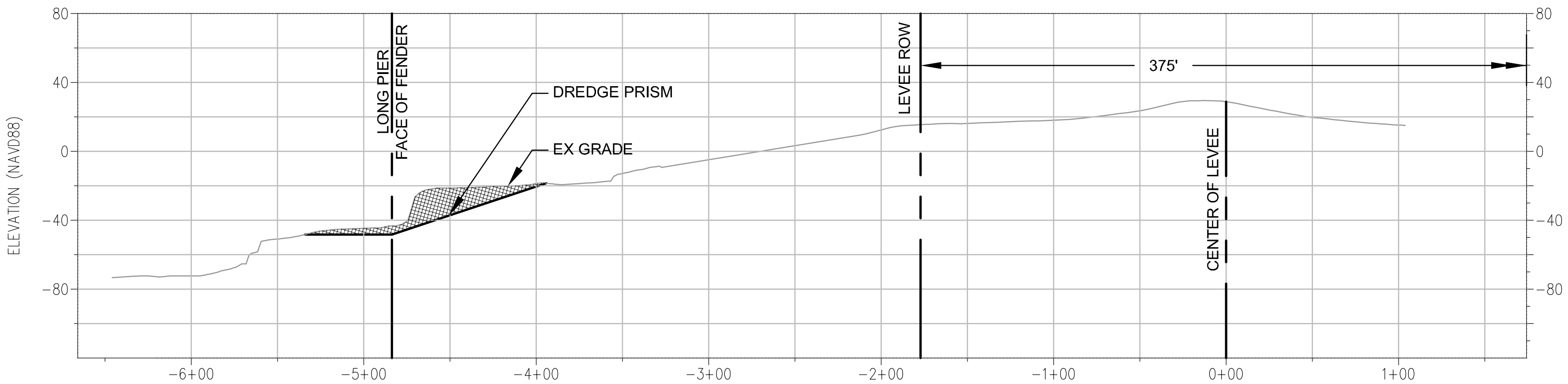
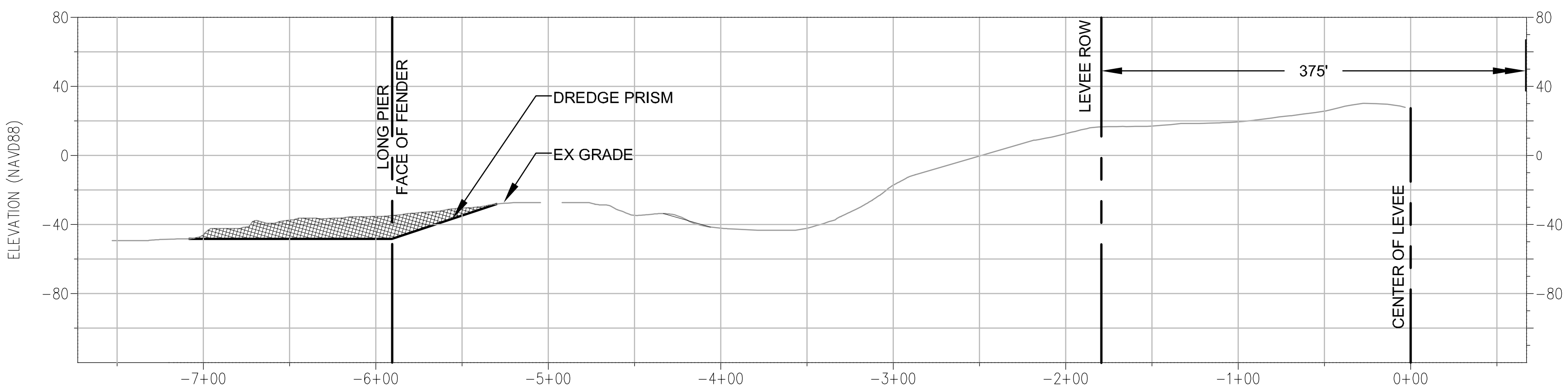
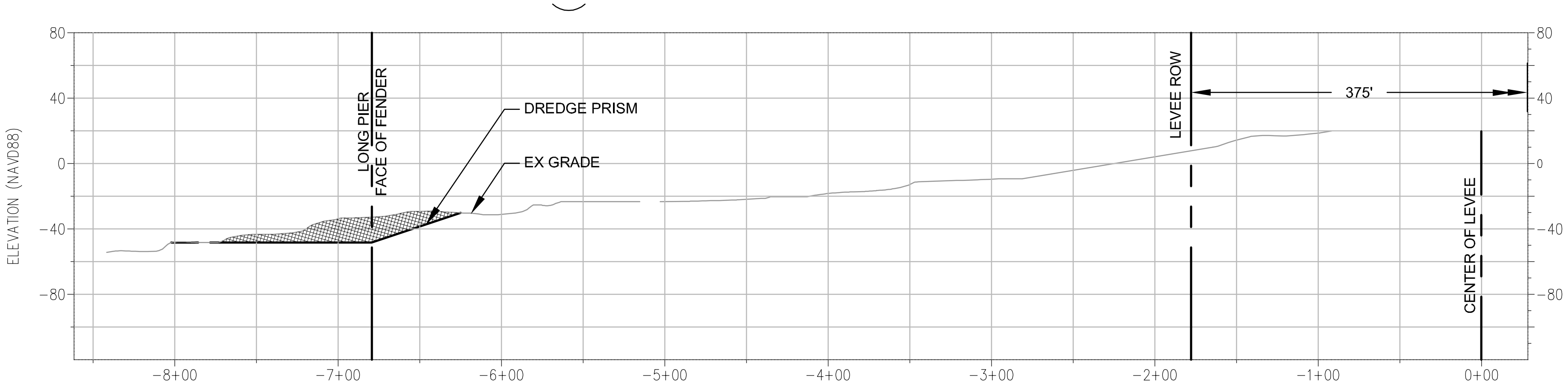


DREDGE SECTION
(A) WESTERN CUT FOR LONG PIER



DREDGE SECTION
(B) CENTRAL CUT FOR LONG PIER



DREDGE SECTION
(C) EASTERN CUT FOR LONG PIER

NOTES:

1. LONG PIER OPTION IS LOCATED 190 FEET LANDWARD OF THE FEDERAL NAVIGATION CHANNEL LINE AT THE NARROWEST.
2. THE TOTAL DREDGE VOLUME FOR THE LONG PIER OPTION IS 80,800 CY.
3. ELEVATIONS SHOWN ARE IN NAVD88.
4. SEE SHEET 1 FOR PLAN VIEW.

LEGEND:

DREDGE AREA

100' 0 100'
50'
SCALE: 1"=100'

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PORT OF LONGVIEW - BARLOW POINT
PRELIMINARY DREDGE ASSESSMENT
LONG PIER ALTERNATIVE - SECTIONS

DATE: 2015-06-24	SCALE: AS SHOWN
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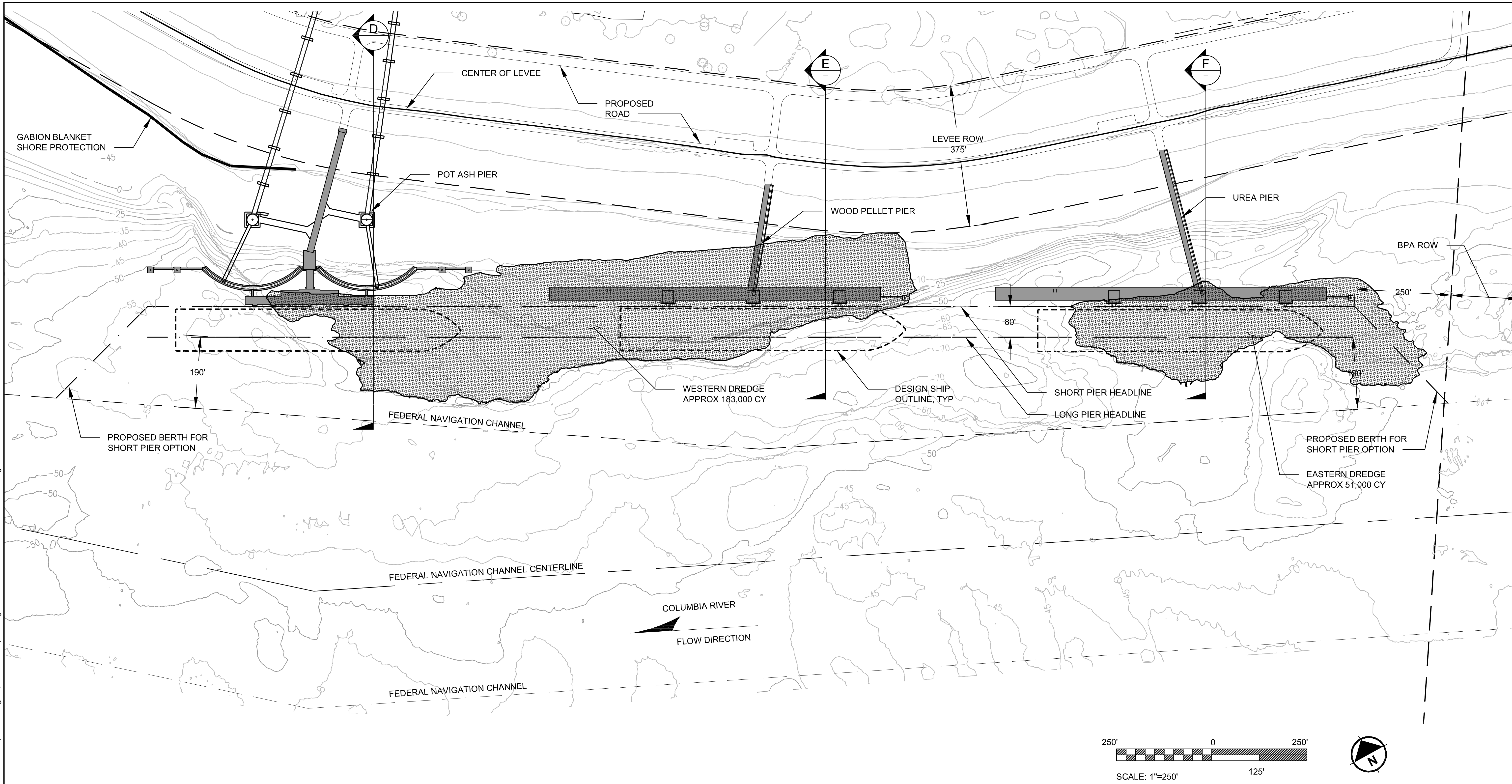

NOTES:

1. SHORT PIER OPTION IS LOCATED 80 FEET LANDWARD OF THE LONG PIER OPTION.
2. THE TOTAL DREDGE VOLUME FOR THE SHORT PIER OPTION IS 234,000 CY.
3. ELEVATIONS SHOWN ARE IN NAVD88.
4. SEE SHEET 2 FOR SECTIONS.

LEGEND:

- DREDGE AREA
- ROW LINE
- GABION BLANKET
- BERTH BOUNDARY
- CENTER OF DIKE

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PORT OF LONGVIEW - BARLOW POINT
PRELIMINARY DREDGE ASSESSMENT
SHORT PIER ALTERNATIVE - PLAN

DATE: 2015-06-24	SCALE: AS SHOWN
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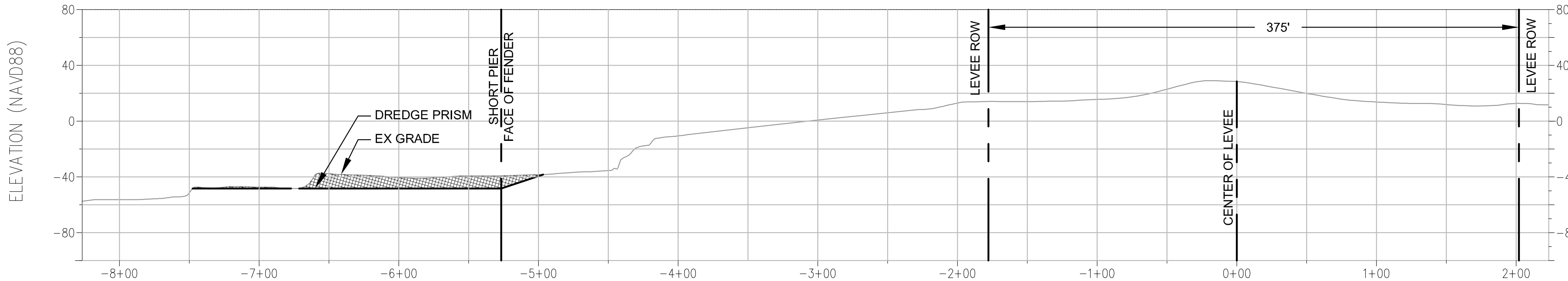
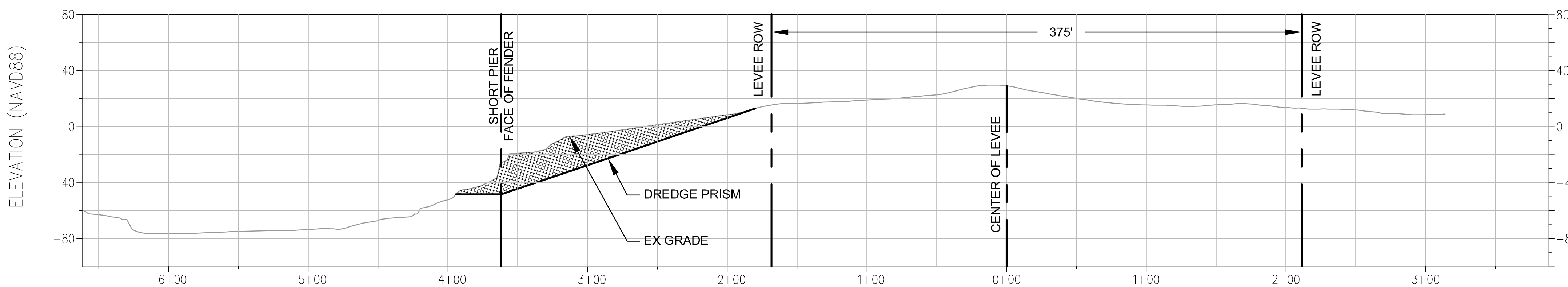
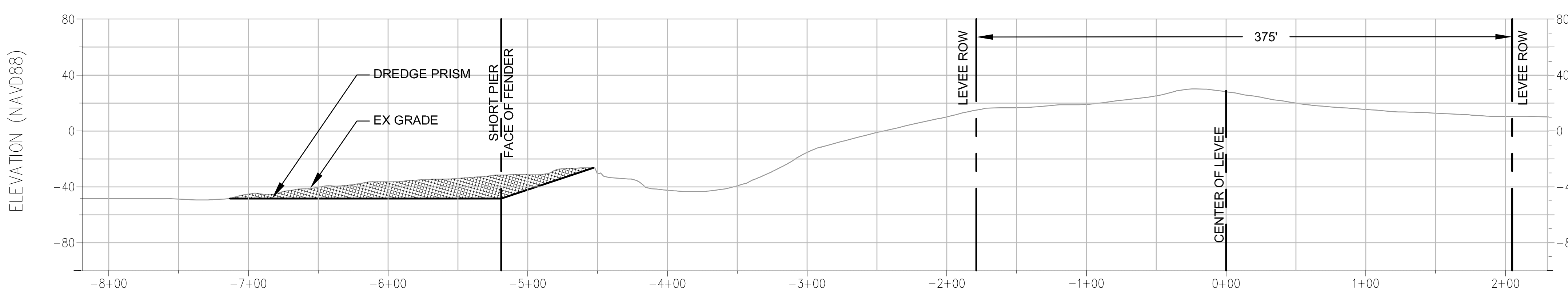


DREDGE SECTION
(D) WESTERN CUT FOR SHORT PIER



DREDGE SECTION
(E) CENTRAL CUT FOR SHORT PIER



DREDGE SECTION
(F) EASTERN CUT FOR SHORT PIER

NOTES:

1. SHORT PIER OPTION IS LOCATED 80 FEET LANDWARD OF THE LONG PIER OPTION.
2. THE TOTAL DREDGE VOLUME FOR THE SHORT PIER OPTION IS 234,000 CY.
3. ELEVATIONS SHOWN ARE IN NAVD88.
4. SEE SHEET 1 FOR PLAN VIEW.

LEGEND:

DREDGE AREA

100' 0 100'
50'
SCALE: 1"=100'

DRAFT

PORT OF LONGVIEW

kpff

PORT OF LONGVIEW - BARLOW POINT
PRELIMINARY DREDGE ASSESSMENT
SHORT PIER ALTERNATIVE - SECTIONS

DATE: 2015-06-24	SCALE: AS SHOWN
DRAWN BY: SJS	SHT 2 OF 2