2014 WEDA ENVIRONMENTAL EXCELLENCE AWARDS

Category: Navigation Dredging

Port of Kalama, 2013 TEMCO Berth Maintenance Dredging and In-water Flow-Lane Placement Project

Port of Kalama, Washington

18 April 2014

Summary

The nominated project for WEDA's 2014 Environmental Excellence Award is the 2013 TEMCO Berth Maintenance Dredging and In-water Flow-lane Placement project at the Port of Kalama, Washington. This nomination is for the navigation dredging category.

The Port of Kalama (Port) is located on the north/eastern shoreline of the Columbia River. The Port's in-water facilities, located between River Miles 72 and 77.5, that require regular maintenance dredging work include three terminals (TEMCO [formerly United Harvest], North Port, and Kalama Export) and one public marina. The project includes the successful implementation of placement of dredged material in pile-dike scour holes—a new method of flow-lane disposal on the Columbia River that is environmentally beneficial, innovative, cost-effective, and transferable to other dredging locations. The new scour hole placement method was accepted and supported by regulatory agencies and the necessary permits were obtained in a short period of time despite the new methodology.

Vicinity map.

Periodic maintenance dredging is necessary to keep the Port terminal berths and the public marina actively operating. The Port performs dredging as needed based on sedimentation accumulation resulting from the Columbia River's variable hydrodynamic conditions and tenant needs relative to berthing and loading cargo.

Dredged material has previously been placed at Port-owned upland disposal sites; the material has been used for fill at Port projects and also sold to others for various uses. The quantities dredged are greater than the demand for the material, and the current upland disposal sites do not have the capacity to accept additional material. The Port contracted a consultant team to study sedimentation conditions in the project area, identify alternatives to upland disposal for ongoing/future maintenance dredging work, and

Pile dike photo.

obtain regulatory approvals for changes to the Port's existing dredging and disposal permits to accommodate the new dredged material management approach.

The study resulted in identifying three sites that could be used for in-water beneficial use of the dredged material through data analysis and numerical modeling of river hydrodynamic, sediment transport, and morphologic processes in the project area. Two of the sites are flow-lane disposal sites in Washington and Oregon, which consist of filling deep scour holes formed in the lee of two pile dikes located in the Columbia River. These pile dikes were installed by the U.S. Army Corps of Engineers (USACE) to control flow in the river and minimize maintenance dredging in the Federal Navigation Channel (FNC). The location of the in-water placement sites and methodology of scour hole placement are innovative because this method has not been previously used for in-water flow-lane disposal. The third in-water site involves placement of material to naturally nourish a beach area at a public day-use access park located on Port property (this site was not used during the 2013 project but is expected to be used during the next dredging cycle).

The new scour hole placement method obtained regulatory approvals and was implemented in the fall of 2013 during maintenance dredging operations at the TEMCO terminal. A total volume of approximately 189,000 cubic yards of sediment was dredged to remove accumulated sediment in the navigable approach to the terminal and berth and placed at the two identified scour hole sites (at Pile Dike 75.63 and Pile Dike 77.48). (See Attachment A, Figures.) A monitoring program has been initiated and confirms the success of the new in-water placement method. The Port's implementation of the new dredging and in-water placement techniques have improved the environment of the Columbia River by introducing sediment back into the natural littoral transport system, preserving and/or enhancing the shallow water fish habitat, obtaining sufficient navigable depths within the TEMCO terminal berth, improving safety of navigation at the terminal, and reducing significantly (by more than 2 times) the cost per cubic yard of the maintenance dredging and disposal work.

Project Team

The project team included the following members.

Affiliation	Team Member	Role
Port of Kalama*	Mark Wilson and Tabitha Reeder	Project Director Project Manager
Coast & Harbor Engineering* (nominating entity)	Vladimir Shepsis and John Dawson	Disposal site studies, modeling, outreach, engineering plans and specifications, construction management
BergerABAM	Sally Fisher, Amber Roesler, and Brian Carrico	Project permitting, dredge material characterization, agency coordination

* WEDA members

Environmental Benefits

The project consisted of dredging approximately 189,000 cubic yards of accumulated sediment from the TEMCO terminal berth using a derek barge equipped with mechanical (i.e., clamshell) dredging equipment, a split-hull dump scow, and an assist tug to transport the dredged material to the scour hole placement sites. Filling the scour holes with dredged material provides the following environmental benefits.

- Keeps Columbia River sand in the natural littoral system; helps to maintain and stabilize erosion and sedimentation processes in the placement area.
- Restores the eroded area in the lee of the pile dikes to near-original conditions, providing important shallow water habitat for fish and wildlife.
- Filling of the scour holes protects the pile dikes; the scour holes undermine and could cause future failure of the dikes.
- Provides alternatives to upland disposal, allowing critical maintenance dredging to continue despite the lack of capacity at the historically used upland disposal sites.
- Reduces rehandling efforts associated with previous disposal at Port upland sites or transport to alternative sites in the project area, such as the Ross Island disposal site.

Unique environmental challenges associated with developing, permitting, and implementing this new beneficial use technique included gaining an understanding of the specific riverine system processes in the project area and identifying potential dredged material placement sites suitable for meeting the volumetric capacity of material dredged and presenting the information to the regulatory permitting agencies in a way that could be easily visualized, understood, and accepted to facilitate timely permitting of the project.

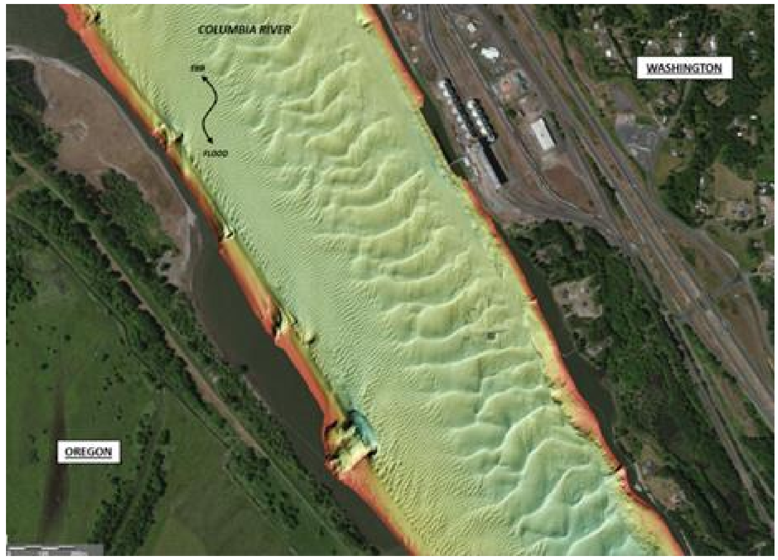
Regulatory Reviews and Approvals

The modeling and animation tools used during the project development and permitting phases were a key component in addressing the environmental challenges of locating new dredged material disposal sites for the Port. The project team demonstrated significant leadership in the industry by developing this new in-water placement technique and presenting it to the regulatory agencies in a way that allowed approval and permitting to be completed in eight months, including

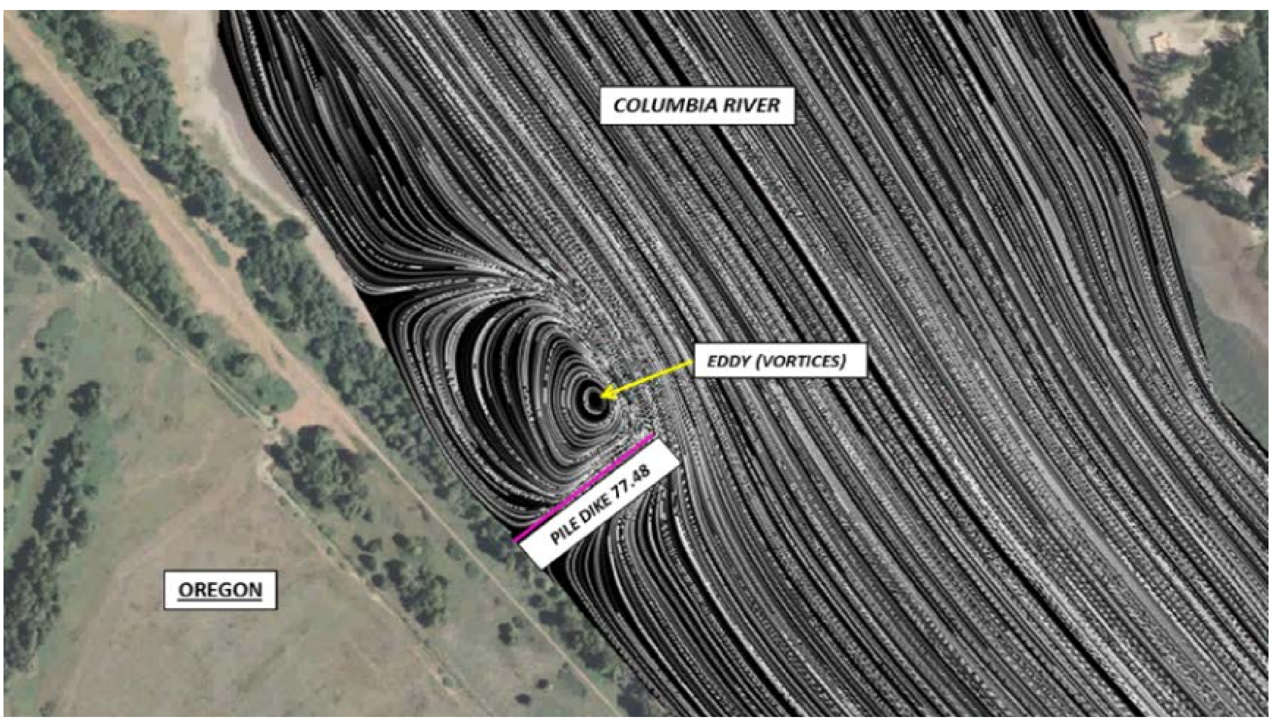
- USACE Section 10/Section 404 Permits (10-year maintenance dredging permit)
- Washington Joint Aquatic Resources Permit Application (JARPA)
- Oregon Joint Permit Application (JPA)
- Washington State Environmental Policy Act (SEPA) Checklist
- Washington Department of Fish and Wildlife (WDFW) Hydraulic Project Approval (HPA)
- Oregon Division of State Lands (DSL) Approval
- Oregon Department of Environmental Quality (DEQ) Approval
- Washington Department of Ecology
- Section 401 Water Quality Certification (WQC)
- Washington Department of Natural Resources (DNR) Coordination
- Endangered Species Act (ESA) Section 7 Consultation
- Cowlitz County Exemption from the Shoreline Management Act
- Cowlitz County Floodplain Permit
- Biological Assessment
- Sampling and Analysis Plan (SAP)
- Sediment Characterization Report

Innovation

The new technique was developed based on understanding the Columbia River local and regional hydraulic, morphologic, and sediment transport processes to assure that the proposed placement of dredged sediment is consistent with the the natural processes of the river enviroment. The new placement technique accounts for extreme complexity of bottom morphology and dynamic of sand waves along the Columbia River bottom and their (sand waves) specifics at the project vicinity. It was determined that dynamics and evolution of sand waves are importent factors controlling bottom and shoreline erosion and sedimentation at the dredging areas. The results of the analysis and numerical modeling also showed that pile dikes installed for maintaining the river flow to minimize sedimentation in the FNC results in dramatic scour of bottom slopes in the lee of the pile dike, forming powerful eddies (vortices). These eddies are capable of scouring the river bottom and side slopes to depths of 100 feet and deeper.



Lidar image of bathymetry in project area.



Modeling snapshot of river flow conditions.

Formation of these scour holes results in unnatural stratification of water density and temperature, accelerated erosion of the river banks and shorelines, and eventual failure of pile dikes and consequential increase of maintenance dredging in FNC. At the same time, extraction of sediment from the river system during maintenance dredging throughout the river system detrimentally impacts the natural littoral transport system and, therefore, the sediment source for the coastal shoreline areas adjacent to the mouth of the Columbia River is currently suffering from sediment deprivation. Placement of sediment into the scour holes, instead of upland disposal, results in natural transition of sediment into the natural system with benefits of restoring natural littoral drift.

The project demonstrates that scour hole placement can be easily controlled because the placement sites are deep, affected areas are relatively small and require limited adjustments of the placement mechanism during placement of dredged material. The small size of the placement area also simplifies ongoing surveys to monitor placement progress, facilitating faster dredging and placement than previously used methods of discharging to upland locations.

The experience with beneficial use of dredged material to restore the natural littoral transport in complex river systems and coastlines is very limited. Specifically, this experience is critical for the Columbia River that has a number of dams, trapping river sand and generating deficit of sediment transport in the river and along Pacific Coastlines.

The concept and engineering method of reintroducing dredged sediment to the natural littoral transport system in the Columbia River was developed upon detailed data processing, analysis, and numerical modeling of river hydrodynamic, littoral, and morphologic conditions. The engineering application of river hydraulics at the pile dikes using the associated strong eddies to redistribute placement dredged sediment into the natural system is an innovative approach. Data from the implementation and experience from this project will be a valuable source of knowledge for similar dredging projects in the Columbia River, as well as at other river systems. The results of implementation demonstrate simplicity of the proposed placement and the ability to complete using traditional methods of mechanical or hydraulic dredging.

The 2013 implementation of the innovative placement of dredged material in the scour hole sites was very successful. Both scour hole sites were filled to approximately design grade efficiently and met the project goals and specifications. The contractor was able to accurately place the material in the target areas and easily monitor the placement with progress surveys. The efficiency of this method and proximity to the dredging site facilitated the work, resulting in a greater volume of dredging to be achieved during the short permitted dredging period (two months) than in previous years. Pre- and post-placement bathymetry for the sites filled during this project are shown on the figures in Attachment A.

It is important to note that scour hole placement of dredged material at these sites is not permanent due to the ongoing scouring that occurs in these locations and that the material will eventually be assimilated into the natural littoral system. This means that the new in-water placement sites can be reused over time.

Economic Benefits

The economic benefits of using the score hole placement technique were significant, due to the proximity of the placement site to the dredge site, the simplicity of placement and monitoring, the lack of management of upland disposal, dewatering, site control, and lack of demand for material reuses. Ongoing in-water placement could conceivably make former upland disposal sites available for development for other port-related uses, thus increasing revenue for the Port and creating jobs for the community. The cost of dredging 50,000 cubic yards from the TEMCO berth in 2012 with barge transport to the Ross Island disposal site was $871,032 ($17.42 per cubic yard). The cost of dredging 189,000 cubic yards from the TEMCO berth in 2013 using in-water beneficial use was $1,152,000 ($6.09 per cubic yard); a 65 percent savings in dredging costs.

Transferability

The methodology used at the Port is transferable. There are numerous sites on the Columbia River, which require maintenance dredging, and pile dikes are common on the river. The methods used at the Port could be also implemented in these areas. Permitting and successful completion of the Port's 2013 dredging project creates a precedent for other sites in the project area and clearly demonstrates the potential environmental and economic benefits. Permitting of this technique at other sites should also be relatively streamlined now that the science, methodology, and placement techniques have been demonstrated. This technique is likely transferable to other river systems of aquatic areas where ongoing scouring occurs.

Outreach and Education

Outreach and education related to this project included meetings with the USACE along with the state and local permitting agencies prior to submittal of permit applications. Presentations regarding this project have since been provided to the Washington Public Ports Association, as well as federal and state fish and wildlife management agencies, including U.S. Fish and Wildlife Service, National Marine Fisheries, and Washington Department of Fish and Wildlife; 2013 WEDA Pacific Chapter; and will be at the National WEDA Conference in Ottawa, Canada, in June 2014. The outreach and education has been particularly effective because of the animated modeling displays that clearly show the river system erosion and sedimentation processes. The visual representation of these processes facilitated immediate understanding by most viewers and was likely instrumental in achieving timely regulatory approvals.

Attachment A: Figures

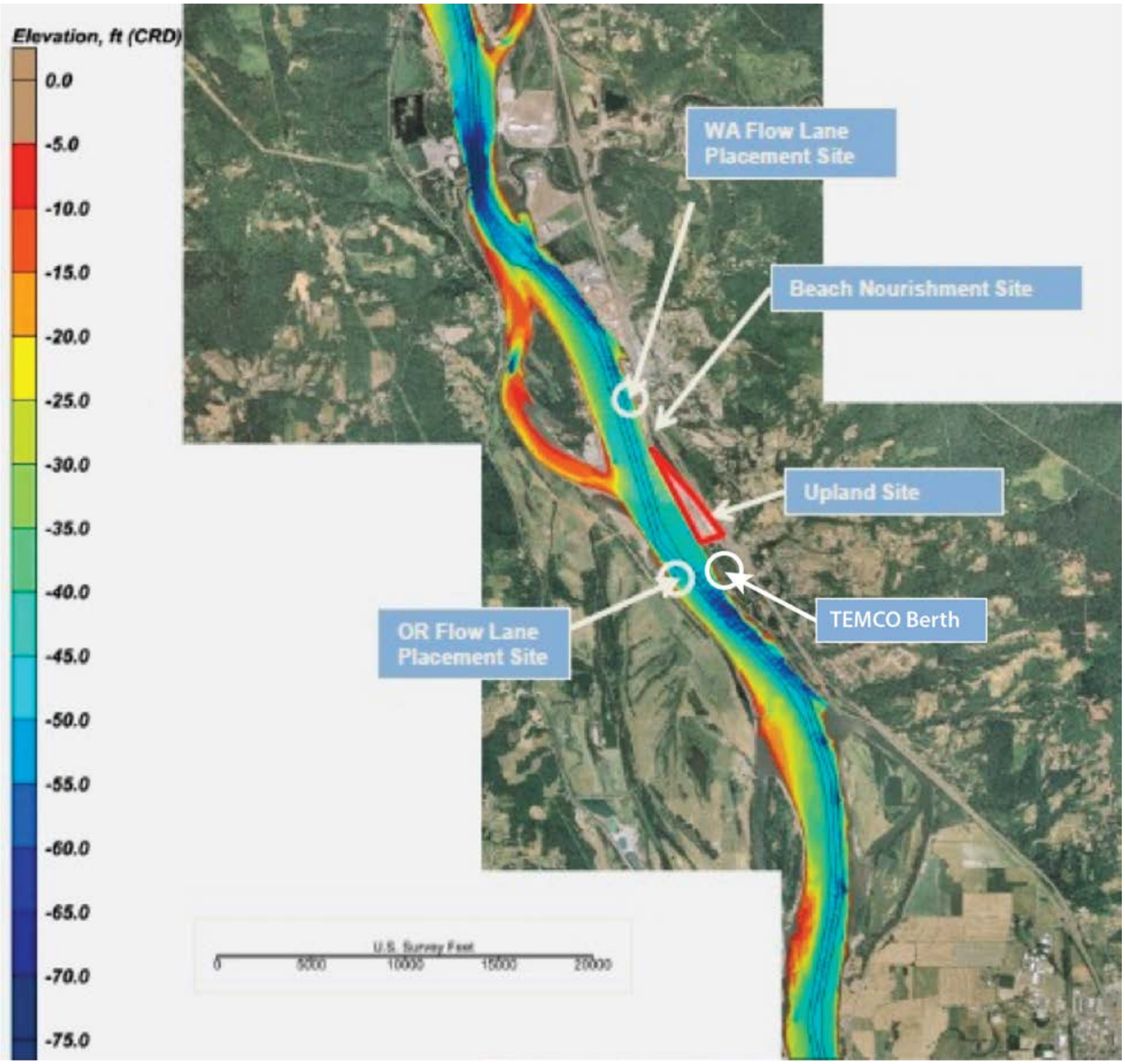


Figure 1. Potential Dredged Material Placement Sites for Port of Kalama 2013 Maintenance Dredging.

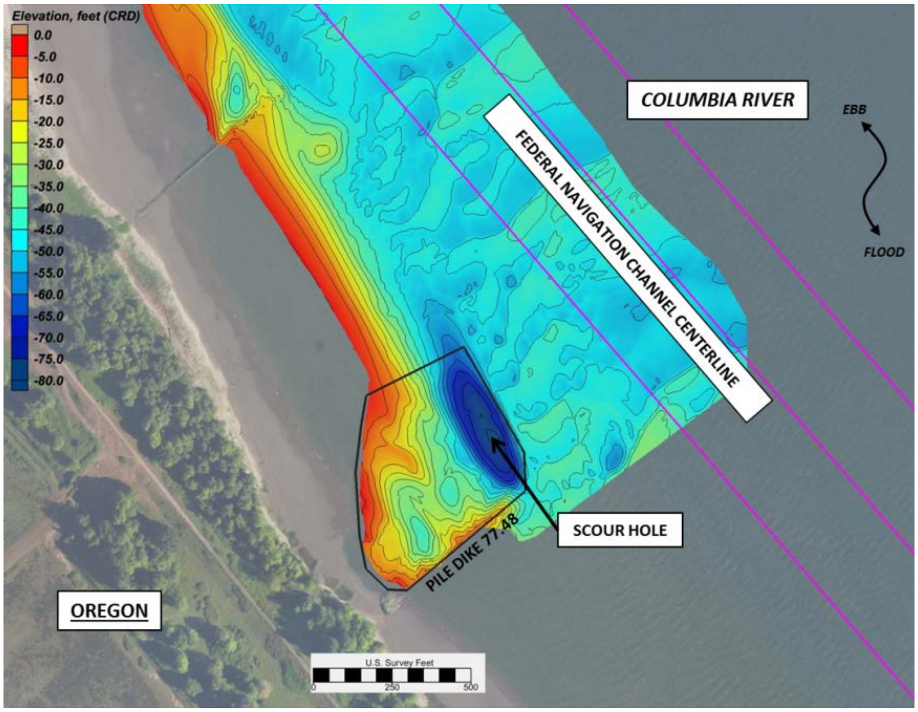


Figure 2A. Pile Dike 77.48 (Oregon flow-lane site) before placement of dredged material.

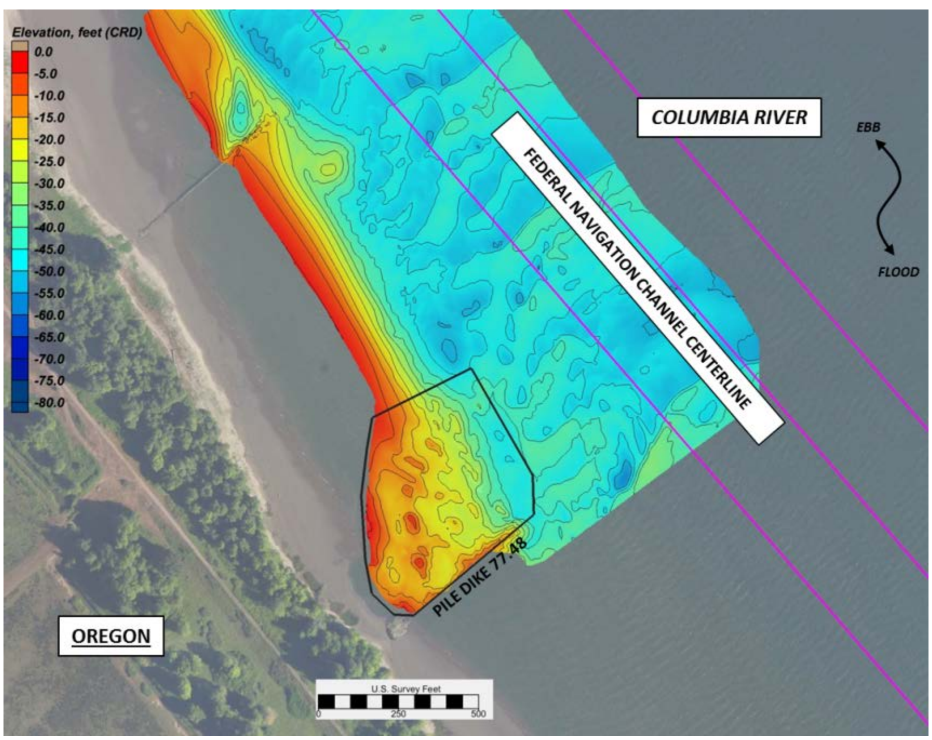


Figure 2B. Pile Dike 77.48 (Oregon flow-lane site) after placement of dredged material.

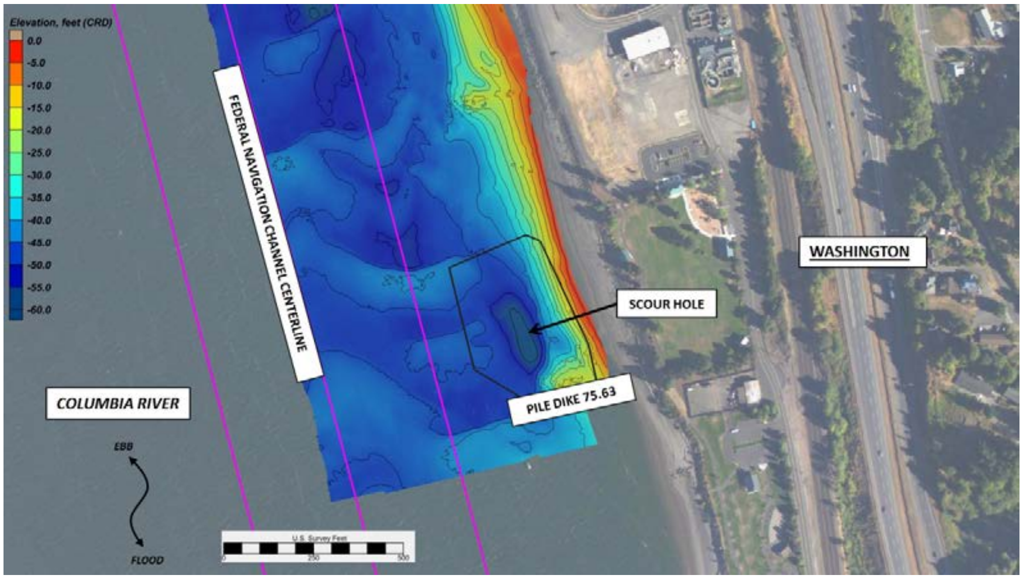


Figure 3A. Pile Dike 75.63 (Washington flow-lane site) before placement of dredged material.

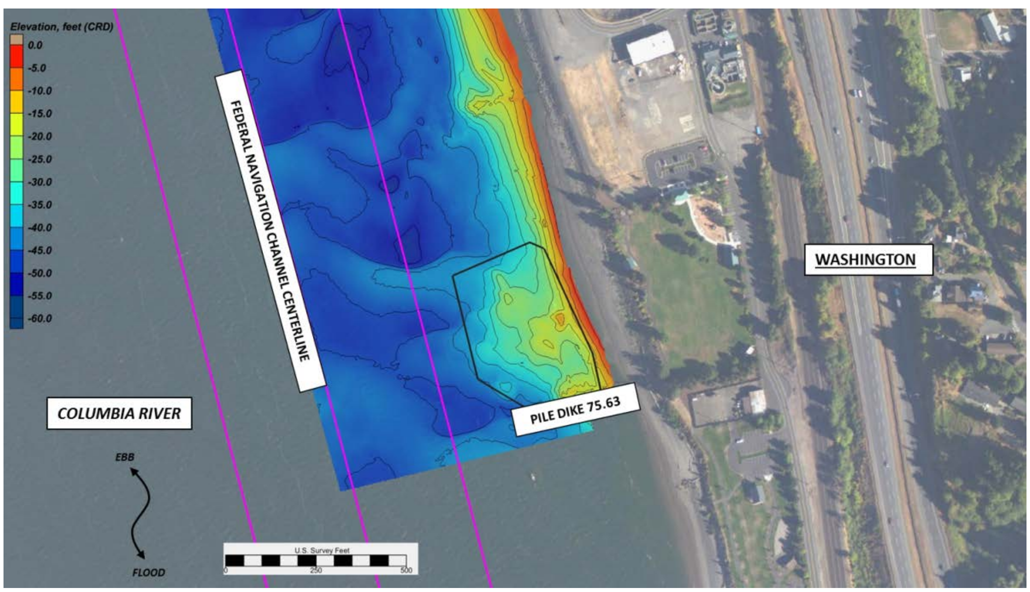


Figure 3B. Pile Dike 75.63 (Washington flow-lane site) after placement of dredged material.