EAST WATERWAY HARBOR ISLAND SUPERFUND SITE CLEANUP – CLEANING UP THE ENVIRONMENT, WHILE IMPROVING COMMERCE FOR THE PORT OF SEATTLE

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ABSTRACT

In 2003, the EPA entered into an agreed order with the Port of Seattle (Port) to address sediment contamination in the East Waterway Operable Unit of the Harbor Island Superfund Site in Seattle, Washington, per the process defined by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), or Superfund. Based on a review of preliminary data collected, EPA determined that a non-time critical removal action was warranted for a portion of the East Waterway that covered approximately 8.1 hectares (20 acres) in the southern portion of the waterway. The Port of Seattle conducted the removal action that involved mechanically dredging 208,736 cubic meters (273,000 cubic yards) of sediment to meet cleanup standards and achieve navigation channel depths. Dredged material was disposed of at an open-water disposal site and at an upland landfill, based on characterization data. This removal action covered two dredge seasons and included the following goals, restrictions and controls:

- Achieving State standards for chemical concentrations in the newly exposed surface sediments
- Minimizing sediment re-suspension and recontamination with appropriate Best Management Practices and water quality monitoring
- Restricting dredging during "fish window" closure periods
- Attaining the required depth in the working navigation channel

Following the dredging, a 15.2 cm (6-inch) clean sand layer was placed over those areas where initial post dredge sampling indicated that the post removal surface exceeded cleanup levels. Next steps for a full investigation of the East Waterway will include a remedial investigation and feasibility study that will include the post removal area.

This manuscript includes the cleanup successes, ultimate lessons learned with a removal action that benefited both the environment and day-to-day commerce for the Port, the unique coordination efforts between regulatory agencies (both State and Federal) and the responsible party and the dredge contractors, and finally, next steps for the investigation that will lead to a final cleanup decision for the waterway.

Keywords: Sediment dredging, superfund, NTCRA, agency coordination

INTRODUCTION

The East Waterway sediment operable unit (OU) is the only operable unit of the Harbor Island Superfund Site in Seattle, Washington for which the U.S. Environmental Protection Agency (EPA) has not made an OU cleanup decision for contaminated sediments. A non-time-critical removal action was completed by the Port of Seattle (Port) under EPA authority for this OU in March 2005. This resulted in the removal of 208,736 cubic meters (273,000 cubic yards) of contaminated sediment of which 75% was transported to an upland disposal facility and 25% was permitted for open-water disposal. This action resulted in the removal of a large volume of contaminated sediment as well as improving navigation in the channel to the Federally authorized navigation depth of -15.5 m (-51ft) MLLW.

The success of the removal action was due in large part to the close coordination between EPA and the Port throughout the removal process. Close coordination throughout the design and implementation of this project resulted in the efficient and effective management of issues relating to the dredging operation as well as the post-dredge monitoring data. Specific examples include:

- A contingency action, which involved dredging one additional one foot of material and placing an interim remedy consisting of a six inch sand layer, was developed as part of the project design documents and

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contractor bid package for areas where the sediment chemistry exceeded cleanup standards in the post dredge monitoring (PDM) sampling.

- The presence of EPA and EPA's contractors at weekly construction meetings to monitor project progress and assist in the resolution of issues.
- Daily updates on dredging operations and water quality monitoring provided to EPA and contractors.
- The evaluation of PDM data within 72 hrs of data collection in order to identify areas that required placement of clean sand as an interim remedy. The interim remedy was implemented rapidly. The placement of the clean sand layer was completed within weeks of the completion of the dredging. This rapid implementation resulted in greatly reduced potential for ecological exposure to the contamination in the newly exposed sediment surface.

This paper presents the dual successes of the project that resulted in the removal of a large amount of contaminated material from the environment, while deepening the navigation channel so that access to the waterway for large commercial vessels could continue and increase.

BACKGROUND

Since the early 1900s, the former Duwamish River corridor and the surrounding floodplains were filled and graded to form the present-day topography. Dredging in 1903-1905 created the East and West Waterways of Harbor Island, and dredged material from the river was used to create Harbor Island itself. The present urban and developed shoreline is primarily composed of piers, riprap bank lines, and constructed bulkheads for industrial and commercial use. Harbor Island is a man-made island in the mouth of the Duwamish River—near downtown Seattle—that is home to numerous industrial enterprises, including the Port of Seattle (Port) container terminal. Extensive industrial activity on Harbor Island caused its soil, underlying groundwater, and nearby marine sediments to become contaminated with various industrial contaminants, including lead and other toxic metals, pesticides, petroleum hydrocarbons and polychlorinated biphenyls.

The sediment bed of East Waterway is owned by the State of Washington and managed by the Department of Natural Resources. The East Waterway is channelized, has a south-to-north orientation, and is approximately 1,768 m (5,800 ft) long and 244 m (800 ft) wide. Decades of discharge from storm water outfalls, combined sewer overflows and historical industrial emissions and waterway effluents have contaminated the bottom sediments of the waterway with polychlorinated biphenyls (PCBs), heavy metals and pesticides that exceed the Washington State Department of Ecology (Ecology) Sediment Management Standards (SMS).

PREVIOUS INVESTIGATIONS AND REMOVAL ACTIONS

In 1998 as a prerequisite for the East Waterway Channel Deepening Project, the Port completed sediment characterization that was conducted under the Dredge Materials Management Program (DMMP) an interagency program, including the U.S. Army Corps of Engineers, EPA and the Washington State Department of Ecology and Department of Natural Resources, which oversees the disposal and beneficial use of sediments dredged from the waters of Washington State. The project area was split into two areas and two stages based on the results of the sediment characterization. The Stage 1 area was identified as an area of generally lower contamination in the northern portion of the waterway. The Stage 2 area was located in the southern portion of the proposed dredge area and contained more contaminated sediment. The Port proceeded with the dredging of the Stage 1 area from December 1999- February 2000 under a USACE permit under Section 10/404 of the Clean Water Act. The Stage 2 area was not dredged at that time. A month after the dredging was completed, post-dredge monitoring was conducted to characterize the new sediment surface. The results showed that the chemical concentrations in the sediments had generally decreased, although not as much as expected, and the sediment bioassays showed an increase in toxicity.

In 2003, the Port compiled the existing sediment data for East Waterway, which included the Channel Deepening sediment characterization data and delineated eight areas of potential concern in an Engineering Evaluation/Cost Analysis (EE/CA) (Windward 2003) that was submitted to the EPA. The goal of the EE/CA was to identify any areas with elevated levels of contaminants that could be sufficiently characterized to be dredged as a non-time critical removal action (NTCRA) under the EPA Comprehensive Environmental Response Compensation and Liability Act (CERCLA) authority, where the clean up standards were Ecology's State Sediment Management Standards (SMS). The area identified as containing the highest levels of contamination was a portion of the Stage 2

area from the 1999 Channel Deepening dredging project and was approximately 8.1 hectares (20 acres) in size (Figure 1). Although sufficient data didn't exist to make a CERCLA waterway-wide cleanup decision, the EPA and the Port entered into a subsequent Superfund legal order in order to move forward with the NTCRA to clean up contaminated sediments. The targeted depth of removal was determined based on both the vertical extent of contamination and the use of the waterway for navigation of large container vessels (-15.5 m (-51 ft) MLLW).

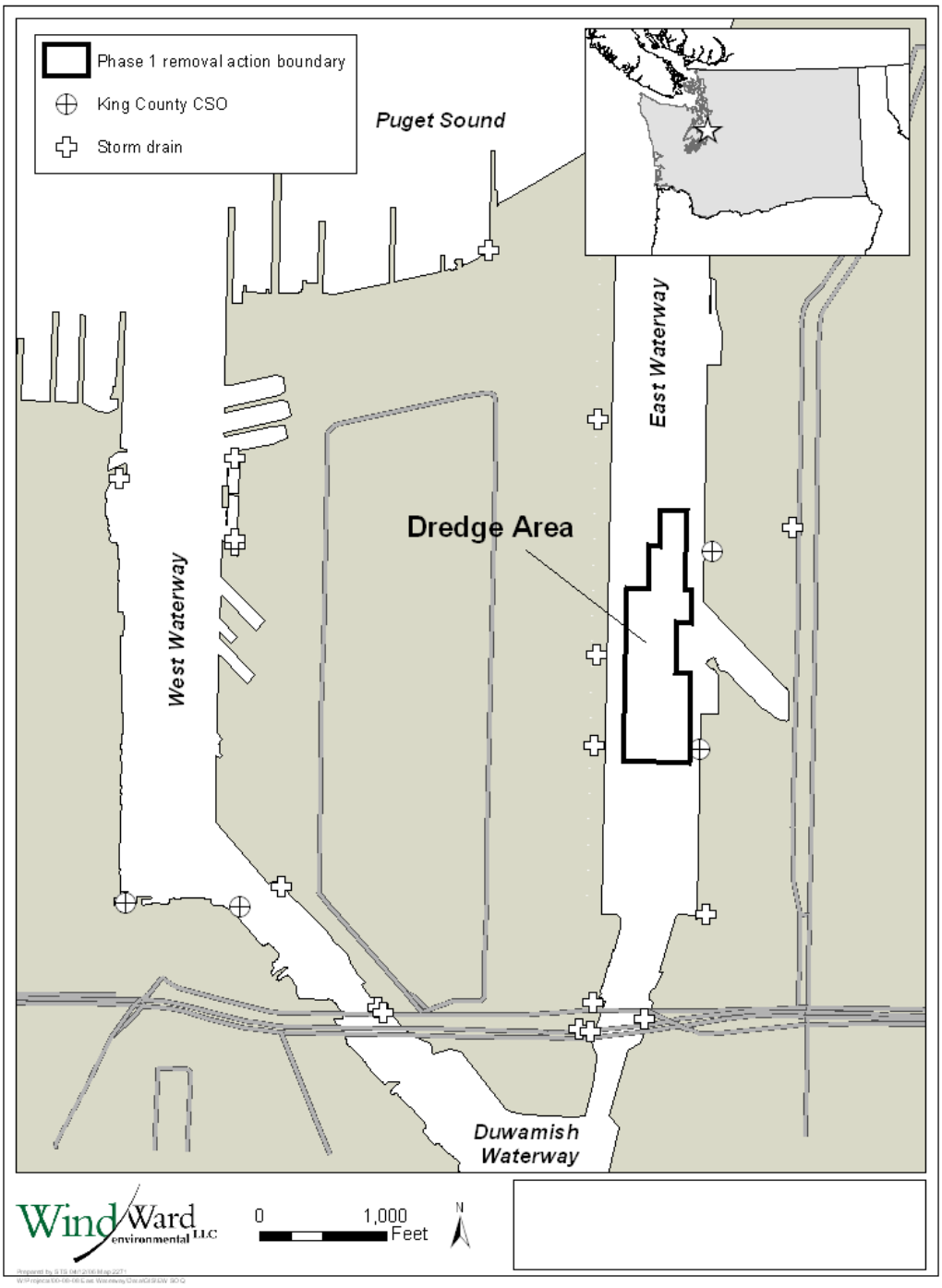

Figure 1. East Waterway with the Stage 1 removal action dredge boundary.

The CERCLA NTCRA process, based on the Superfund Accelerated Cleanup Model (EPA 1993) enabled EPA and the Port to take advantage of the available sediment data to identify an area of concern that could be addressed immediately rather than waiting for the completion of a site-wide RI/FS process that would require the full delineation of human and ecological risk, evaluation of remedial action objectives, remedial alternatives, including treatment and ultimately the feasibility of those alternatives in order to select a waterway-wide final remedy. The NTCRA enabled EPA to provide enforcement direction to the Port for the removal of a large volume of contaminated material from the site and thus improve the environment and protect human-health as well as resulting in the increase of the navigability of the channel in the removal area to the final navigation depth of -15.5 m (-51 ft) MLLW.

PORT OF SEATTLE AND AGENCY COORDINATION SUCCESS

Water quality monitoring

Water quality exceedances due to elevated turbidity in the water column were measured throughout both seasons of dredging. Water quality exceedances have often been assumed to result from dredging operations such as cycle time or dredging speed or the nature of the dredging equipment used by the contractor (e.g., open bucket or closed bucket). Because an attempt was made during this project to correlate operational factors with measured water quality exceedences, the Port and EPA designed a three-day hydroacoustic monitoring study. The goals of the study were to observe the behavior of the turbidity plume under a range of tidal conditions and to determine if specific changes in dredging operations (e.g., decreasing and increasing the speed of the dredging operations) resulted in changes in the observed turbidity. The hydroacoustic data collected indicated that varying these changes in dredging operations had little effect on the magnitude and extent of the turbidity plume. However, due to the difficulty in scheduling the survey to coincide with both optimal tide cycles and dredging of the most silty and contaminated material, the results of this study were not conclusive. The hydroacoustic data did clearly document plume movement upstream on the flood tide.

The physical characteristics of the dredged material appeared to be the determining factor in the occurrence and intensity of the observed turbidity exceedances. In several areas, the material was consistently fine-grained with high organic carbon content. Highly organic and flocculent material was observed in the water column when dredging occurred in these areas, and turbidity plumes were observed at distances up to 300 and 400 meters from the dredging operation. Modifications to dredging operations were not observed to demonstrably affect the extent of the turbidity plume when this fine-grained material was encountered. However, the application of dredging BMPs was critical to minimizing overall turbidity at the site.

Extensive coordination occurred between the Port, EPA and the dredge contractors that included immediate notification to EPA of water turbidity exceedances, which facilitated timely and efficient resolution of water quality issues.

Protection of listed salmonid species

In-water construction in East Waterway and the Duwamish corridor is not permitted during the outmigration period for juvenile salmonids. Dredging is generally not permitted from March through August. Monitoring for the presence of juvenile chinook salmon was required by the U.S. Fish and Wildlife service and the Washington State Department of Fish and Wildlife at the beginning and end of each dredging season. Fish data was reported to EPA and the agencies on a weekly basis. The monitoring results remained in compliance with the requirements of the biological opinion issued for the project by the U.S. National Marine Fisheries Service.

Post-dredge monitoring of sediment surface

EPA and the Port developed a post-dredge monitoring plan as part of the project design documents. Following the post-dredge monitoring plan approval, by EPA, sediment samples were collected from the 1-10 cm interval and analyzed in order to characterize the final dredged surface immediately following the completion of dredging. Analytical data was provided within 24 hours and EPA and the Port met within 72 hrs to identify areas that required contingency dredging and the placement of a clean sand layer as an interim remedy to reduce potential exposure to sediment contamination that still exceeded cleanup standards. Following the contingency dredging of one additional foot of sediment and prior to the placement of the sand layer, additional post dredge monitoring was performed. This data will prove useful with cleanup decisions for the entire waterway that will include reassessing the removal action footprint. The placement of a layer of sand was determined to be an appropriate interim remedy for approximately two thirds of the total project area (Figure 2). The interim remedy was completed within weeks of the completion of

the dredging due to the fact that the post-dredge monitoring plan and the interim remedy design were completed as part of the project design document which resulted in rapid implementation and completion of the interim remedy.

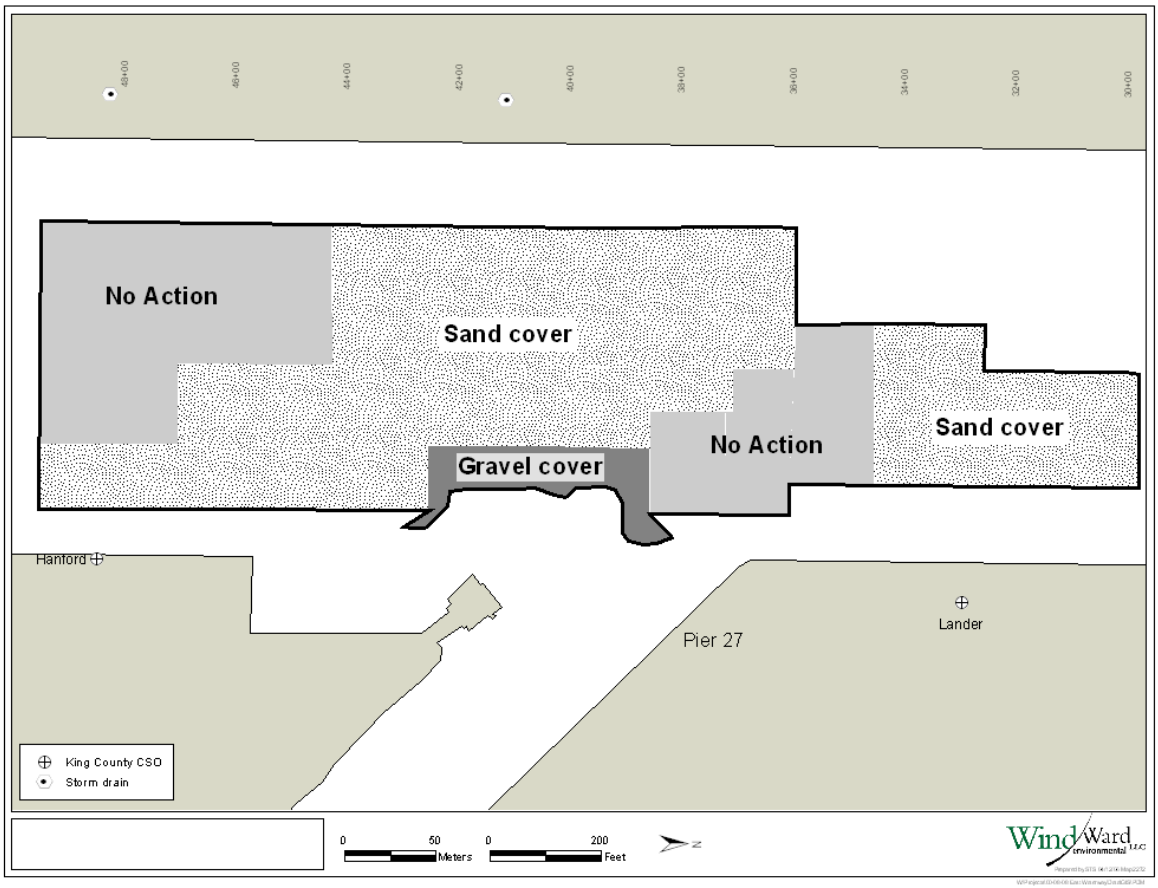

Figure 2. The selected interim remedies for areas within the dredge outline.

This dredging project resulted in both the removal of a large volume of contaminated sediment as well as the achievement of a deeper navigational depth. What was unique with this cleanup was the high level of coordination between agencies, responsible parties and dredge contractors. The success of this project was due largely to the unique and exemplary coordination efforts by all participants that included weekly project team meetings with EPA, the Port and the dredge contractor and associated technical consultants. All parties became aware of issues, as they arose, such as turbidity exceedances from water quality monitoring, dredging areas with harder substrate and equipment failures. This allowed the Regulatory and private sectors to work together to reach resolutions expeditiously, allowing the cleanup schedule to be met.

NEXT STEPS

The East Waterway operable unit supplemental remedial investigation and feasibility study (RI/FS) will begin in 2006. This RI/FS will include additional investigations specific to the East Waterway as well as human and ecological risk assessments, studies on the fate and transport of sediments and an analysis of feasible remedial alternatives that will be incorporated into a Record of Decision for a waterway-wide cleanup. EPA intends to accelerate the next phase of the waterway wide investigation in the hopes that a cleanup decision can be reached as expeditiously as possible.

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