

THEA FOSS AND WHEELER-OSGOOD WATERWAYS SLOPE AREA MAINTENANCE PLAN

INTRODUCTION

Remedial actions completed on shoreline slopes within the Thea Foss and Wheeler-Osgood Waterways include slope capping, slope rehabilitation, and habitat enhancement. The remedial actions performed in the Thea Foss and Wheeler-Osgood Waterways are shown on Figure 1. As part of the Operations, Maintenance, and Monitoring Plan (OMMP) for the Thea Foss and Wheeler-Osgood Waterways Remediation Project, low tide inspections and subtidal hydrographic surveys of capped shoreline slope areas are performed to ensure the effectiveness of the remedial actions and to identify slope areas that may require maintenance.

The purpose of this Slope Area Maintenance Plan is to present the objectives and procedures for performing all maintenance of remedial actions constructed on shoreline slopes. Specific maintenance activities will be identified based on the results of inspections and surveys and documented in Preliminary Findings Memoranda and annual OMMP monitoring reports. Subsequent maintenance activities will be performed by the City of Tacoma (City) or a City contractor in accordance with the objectives and procedures described in this plan. The scope of this plan includes activities to maintain shoreline slope areas where remedial construction was performed as part of this project. The types of observed features on shoreline slopes that may require maintenance include, but are not limited to, the following:

- Remnant, treated piling protruding through an area of slope cap;
- Cap material sloughing that exposes underlying contaminated material;
- Contaminated debris protruding through an area of slope cap;
- Erosion or damage to stormwater outfall aprons and/or concrete splash pads; and
- Erosion or damage from waterway activities (i.e., marine, commercial, or industrial operations, construction, etc.).

The objectives of maintenance of shoreline slope areas include the following:

- Return the area requiring maintenance to post-remedial construction conditions;
- Maintain containment of underlying contaminated materials;
- Minimize the potential for transport of contamination to the water column or to the surface of adjacent areas through implementation of Best Management Practices (BMPs) during completion of maintenance activities;
- Minimize the potential for down-slope movement of slope materials during completion of maintenance activities; and
- Reuse existing slope area materials (i.e., filter material, rip rap, quarry spalls, etc.) to the extent practicable.

The objectives identified above are the basis for the procedures to be implemented during maintenance of shoreline slope areas.

SLOPE AREA REMEDIATION AND MONITORING

Remedial actions completed in slope areas of the Thea Foss and Wheeler-Osgood Waterways include slope capping, slope rehabilitation, and habitat enhancement. Slope areas are subject to monitoring through completion of low tide slope cap inspections and hydrographic surveys. The following sections summarize the design for remedial actions and describe the monitoring activities to be performed as part of OMMP for the Thea Foss and Wheeler-Osgood Waterways Remediation Project.

Slope Area Remedial Actions

Slope caps (thick slope caps, quarry spall caps, and grout mat caps) were constructed in specific slope areas of the Thea Foss and Wheeler-Osgood Waterways (Figure 1). Slope caps were constructed to contain contaminated sediment and debris; remnant, treated (i.e., creosote treated) piling; and to stabilize shoreline slopes. Thick slope and quarry spall cap components consist of the following design elements:

- 18-inches of slope cap filter material;
- Covered by 18-inches of armor material (riprap or quarry spalls);and
- Habitat mix placed at rates of 25 tons per 1,000 square feet or 15 tons per 1,000 square feet to fill in the voids of the riprap and quarry spalls, respectively.

The remedial design drawings for thick slope and quarry spall caps and specifications for cap materials are provided in Appendix A.

Grout mat caps were constructed in Remedial Area 3 (RA 3) , RA 19A, and 19B (Figure 1). The grout mat caps consist of one (i.e., RA 19A and RA 19B) or two (i.e., RA 3) approximately 6-inch thick layers of concrete placed in limited shoreline slope areas. Grout mat caps were constructed to reduce the required thickness of the cap and to preserve required berthing depths for vessels utilizing these areas in addition to containing contaminated materials and stabilizing shoreline slopes. The remedial design drawings for the grout mat caps constructed in RA 3, RA 19A, and RA 19B are provided in Appendix B.

The slope caps were constructed from the base or toe of the shoreline slope to varying elevations up the slope depending on specific features of a given slope area. In multiple remedial areas, slope caps were constructed from the base of the shoreline slope up to existing bulkheads or shoreline armoring, a previously constructed habitat enhancement area, or new sheet pile walls (i.e., RA 1, RA 8, RA 14, RA 19A, RA 19B, and RA 20). In two remedial areas, slope caps were constructed up to the waterward face of existing buildings and/or structures and quarry spalls and/or habitat mix was placed under the overwater portion of the structure to enhance the substrate (i.e., RA 8 and RA 20). Habitat enhancement was performed on top of or adjacent to the capped areas in several areas (RA 8 and RA 20). Slope caps were also constructed to the top of the slope bank in multiple remedial areas (i.e., RA 3, RA 8, RA 19B, and RA 20). The remedial design for a specific shoreline slope area will be reviewed when determining the scope of maintenance activities for a given area to ensure that they meet the intent of the designed elements and return the shoreline slope to post-construction conditions.

Slope Area Monitoring

Slope area monitoring is performed through completion of low tide slope cap inspections and subtidal hydrographic surveys. Data collected during these monitoring events are evaluated and used to identify specific slope areas that may require maintenance.

Low Tide Slope Cap Inspections

The OMMP specifies that low tide slope cap inspections be performed to verify the physical integrity of the intertidal portion of slope caps and containment of underlying contaminated sediment. Low tide slope cap inspections are performed on the exposed shoreline portion of slope caps (including grout mat caps) constructed in RA 1, RA 3, RA 8, RA 14, RA 19A, RA 19B, and RA 20, as well as the Sheen Source Removal Area in the Wheeler-Osgood Waterway, when tidal elevations are at or below 0 feet Mean Lower Lower Water (MLLW). Inspections of the slope caps include documentation of the following:

- Slope cap coverage;
- Areas of exposed sediment due to erosion or sloughing;
- Apparent down-slope movement of cap materials; and
- Presence of debris at the cap surface.

A baseline low tide slope cap inspection was completed in 2006 and subsequent monitoring events will be completed in Year 2 (2008), Year 4 (2010), Year 7 (2013), and Year 10 (2016) according to the schedule presented in the OMMP. Additional slope cap inspections may be completed after any event that could cause a slope failure, such as an earthquake or storm surge.

The results of low tide slope cap inspections are presented in Preliminary Findings Memoranda and annual OMMP monitoring reports. Results of monitoring events will be used as the basis for identifying maintenance activities that may be required in slope areas.

Hydrographic Surveys

The OMMP specifies that hydrographic surveys be completed in slope cap areas to monitor cap integrity of subtidal slope cap areas. Hydrographic surveys are to be performed in subtidal slope cap areas in RA 1, RA 3, RA 5, RA 8, RA 14, RA 19A, RA 19B, and RA 20 to provide survey coverage of slopes below elevation 0 feet MLLW. Results of hydrographic surveys in slope areas will be used to identify subtidal shoreline slope features that may require maintenance.

Baseline hydrographic surveys of remedial actions that were completed in the Thea Foss and Wheeler-Osgood Waterways were performed in 2003 (i.e., RA 1 and RA 3), 2005, and 2006. The post-construction hydrographic survey results performed in 2003, 2005, and 2006 are presented in the Remedial Action Construction Reports (RACRs) prepared for the Thea Foss and Wheeler-Osgood Waterways Remediation Project (City of Tacoma 2003 and 2006) and will be used as the baseline bathymetric conditions for slope cap areas. Subsequent hydrographic surveys will be completed in Years 2, 4, 7, and 10, according to the schedule presented in the OMMP. Additionally, hydrographic surveys may be completed after any event that could cause a slope failure, such as an earthquake or storm surge.

Results of future hydrographic survey monitoring events will be compiled and presented in Preliminary Findings Memoranda and annual OMMP monitoring reports. The results will also be used as the basis for identifying maintenance activities that may be required in specific slope areas.

SLOPE AREA MAINTENANCE

All slope area maintenance activities will be completed to satisfy the objectives described in this plan. Construction activities for the purpose of maintenance will be designed and executed in a manner that protects the environment by minimizing the potential transport of contamination to adjacent areas and ultimately containing contaminated material. Maintenance activities will be completed to restore shoreline slope areas to post-remedial construction conditions.

Slope Features Requiring Maintenance

Results of slope monitoring events will be used to identify slope features that may require maintenance. The slope features that may require maintenance include, but are not limited to, the following:

- **Exposed Piling and Debris.** Remnant, treated piling, or contaminated debris that protrudes through an area of slope cap may expose contaminated material and provide a pathway for underlying contamination to migrate to adjacent areas.
- **Cap Material Sloughing.** Sloughing of cap material may expose underlying contaminated sediment, debris, and piling, and provide a pathway for the underlying contamination to migrate to adjacent areas.
- **Outfall Apron/Splash Pad Damage.** Erosion or damage to stormwater outfall aprons or concrete splash pads may promote erosion of slope area material and expose underlying contaminated sediment, debris, and piling.
- **Waterway Activity Damage.** Waterway activities such as commercial or recreational vessel movement, industrial operations, and upland or in-water construction activities may result in damage to slope areas that could affect containment of underlying contaminated material.
- **Other Slope Features.** Unexpected events such as earthquakes or sudden storm surges may generate additional slope features that require slope maintenance.

EPA will be notified of the identification of issues that may require maintenance in Preliminary Findings Memoranda and annual OMMP monitoring reports. The information presented in these reports will be used to identify slope features requiring maintenance and facilitate contracting for maintenance activities.

Objectives of Maintenance Activities

The objectives of slope area maintenance activities include the following:

- **Return Shoreline Slope Areas to Post-Remedial Construction Conditions.** The RACRs present the post-remedial construction conditions for slope areas in the Thea Foss and Wheeler-Osgood Waterways that were performed in accordance with the remedial design. Maintenance activities will be designed to re-establish the post-

remedial construction conditions at all slope areas requiring maintenance identified during slope cap inspections or hydrographic surveys.

- **Provide Containment of Underlying Contaminated Materials.** At a minimum, a three-foot thick slope cap must be present over contaminated materials within the slope areas. Contaminated materials include contaminated sediment and debris and creosote-treated piling. Maintenance activities will be designed to ensure that the minimum cap material thickness is restored upon completion of specific maintenance activities.
- **Minimize the Potential Transport of Contamination.** Best Management Practices (BMP) will be implemented during all maintenance activities to minimize the potential transport of contamination to adjacent areas. The BMPs that will be performed during slope area maintenance are discussed in the BMPs section of this plan.
- **Minimize the Potential for Down-Slope Transport of Slope Material.** Maintenance activities will be performed in a manner that minimizes down-slope movement of slope cap material during construction so that existing water depths required for harbor area and channel use (i.e., vessel navigation and berthing) are not affected.
- **Reuse Existing Slope Cap Materials.** Slope cap filter material and slope armoring will be reused to the extent practicable during completion of maintenance activities.

Maintenance Activities

Maintenance of shoreline slope areas will include one or more of the following construction activities:

- **Capping of Exposed Contaminated Materials.** In areas where contaminated sediment, debris, or remnant treated piling are exposed due to sloughing or otherwise protrude above the surface of a slope cap, maintenance activities will be designed to cap over the contaminated material or protrusion with a minimum thickness of three feet of cap material (i.e., slope cap filter material, armoring, and habitat mix). The area of cap repair will be constructed as described in the remedial design to return the area to post-remedial construction conditions.
- **Remove Contaminated Material.** If capping of contaminated material protruding through a capped area is not feasible or stable slopes cannot be maintained, a portion of the protrusion (i.e., treated piling or debris) may be removed to allow for placement and maintenance of the required thickness of cap material necessary to ensure containment.
- **Contaminated Material Disposal.** Contaminated material removed from shoreline slope areas will be transported to an approved landfill facility for disposal as part of maintenance construction activities.
- **Stabilize Areas of Erosion or Sloughing.** Shoreline slope areas that are identified to have significant erosion or sloughing will be stabilized by placement of additional cap and/or armor material within the slope area to enhance existing slope stability and prevent future erosion or sloughing. If significant erosion is observed at an outfall apron and/or splash pad, additional armor material will be placed to disperse erosive forces associated with high flow events at the outfall.
- **Implement Best Management Practices (BMPs).** BMPs will be implemented during all maintenance activities as described in the BMP section of this plan in order to protect

adjacent remedial areas and prevent transport of contamination as a result of maintenance work.

Methods of Maintenance

Slope area maintenance activities will generally be performed using upland/shoreside equipment (i.e., backhoe/track hoe, crane, vactor truck, etc.) or over-water equipment (i.e., derrick barge, material barge, backhoe/track hoe, etc.) staged adjacent to a specific slope area, depending on site access and construction equipment constraints.

The general approach to performing maintenance of identified slope features (i.e., protruding piling or debris, cap material sloughing, and damaged outfall aprons or splash pads) will involve the following procedures:

- Stage construction equipment and materials in the uplands adjacent to the slope area feature requiring maintenance or on the water if access by water-based equipment facilitates maintenance activities.
- Temporarily relocate armor material as necessary around the slope feature to expose protruding piling or debris, stabilize areas of sloughing, or facilitate access to a damaged stormwater outfall apron or splash pad.
- For slope features where containment is not feasible because treated piling or debris would protrude through the cap surface and direct placement of slope cap materials would not produce a stable slope or would affect site facilities (i.e., marina floats, etc.), remove a portion of the feature so that placement of filter material and slope armoring can be achieved and a stable slope can be constructed.
- Cover remaining piling, debris, or exposed sediment in areas of sloughing with a minimum of 18 inches of filter material. Use sediment stakes or surveying techniques to confirm placement of the 18 inches of filter material. For damaged outfall apron or splash pad slope features, place 18 inches of filter material only in areas where underlying contaminated sediment is exposed at the slope surface.
- Place a minimum of 18 inches of armor material over the filter material so that a stable slope is constructed. Placement of armor material may include reuse of existing armor material temporarily relocated at the slope feature. For damaged outfall apron or splash pad slope features, place additional armor material in a configuration that provides added protection from erosional forces during high flow events at the outfall.
- Verify completed cap thickness meets the previously constructed conditions using sediment stakes or surveying techniques.
- Place habitat mix over the area of slope cap maintenance at the appropriate rate based on the type of armoring material present.

Alternate methods of construction may also be required to complete slope area maintenance activities where equipment access has significant restrictions. These methods may include, but are not limited to, the following;

- Removal of piling or debris from the uplands using crane-based equipment to reach over wharf structures or access slope areas that cannot accommodate upland or water-based excavation equipment;

- Manual removal of piling or debris during low tide periods using shovels, chainsaws, pick axes, etc.;
- Repair of underwater slope cap sloughing features through placement of additional filter and armor material using conventional derrick-barge equipment such as over-water cranes and cable arm material placement buckets; and
- Reforming and construction of new outfall aprons or splash pads to prevent future erosion of slope areas during high flow events at the outfall.

BEST MANAGEMENT PRACTICES

The following Best BMPs will be implemented during slope area maintenance:

- **Work in the Dry.** To the extent possible, maintenance activities will be completed in the dry during periods of low tide to avoid potential impacts to surface water and the potential for transport of contaminated materials.
- **Debris Containment and Sorbent Booms.** Continuous debris containment and/or sorbent booms will be deployed around slope areas undergoing maintenance. When all components of slope maintenance work at a specific location can be performed in the dry in one tidal cycle, continuous sorbent booms will be deployed around the work area at a minimum to contain possible petroleum releases (i.e., creosote from piling, etc.) to surface water. For work that is completed in the dry over multiple tide cycles or is entirely in-water work, slope surfaces undergoing maintenance will be fully enclosed with continuous debris containment and sorbent booms.

Debris containment booms will be constructed with silt curtains five to six feet in depth attached to contain debris and suspended sediment. Sorbent booms will be continuous within but adjacent to the debris containment boom and will contain petroleum sheens or spills. Booms will be maintained throughout the duration of maintenance activities. Additionally, floating debris will be removed from within all boom areas on a regular basis or as needed, so that debris does not escape containment.

- **Visual Water Quality Monitoring.** Visual water quality monitoring will be performed during all maintenance work to be performed on slope areas to ensure that construction activities do not impact adjacent surface water. Visual water quality monitoring will include the following:
 - Observations of the condition of debris containment and/or sorbent booms;
 - Observations of the presence of debris inside and outside containment boom areas;
 - Observations of persistent turbidity within or outside of a boomed area;
 - Observations of petroleum sheen within or outside of a boomed area; and
 - Observations of the presence of fish or wildlife within the boomed area.

The following actions will be taken if persistent turbidity or petroleum sheen emanating from the project area is observed outside of the boomed area or fish and wildlife are observed within the boomed area:

- Maintenance activities will cease;
- Appropriate measures will be taken to correct the problem or situation; and
- The EPA project manager will be notified of the occurrence and the measures taken to correct the situation.

Visual water quality observations and any necessary corrective actions will be documented on the water quality monitoring form provided in Appendix C.

- **Fish Window.** All work in slope areas will be completed within agency-defined fish windows to minimize potential impacts to aquatic life.

Additional BMPs may be implemented during maintenance activities, as necessary, to avoid potential impacts to surface water, potential for transport of contaminated materials, and impact on fish and wildlife.

CONSTRUCTION MANAGEMENT

Oversight and inspection of maintenance activities will be performed by a representative of the City of Tacoma. The inspector will be present during all maintenance activities to perform the following activities:

- Document construction progress;
- Verify that construction activities are being performed according to design and that the slope area is returned to post-remedial construction conditions; and
- Ensure that BMPs have been implemented and are performed in accordance with this Slope Area Maintenance Plan.

Construction progress will be documented with photographs and preparation of a daily inspection log.

PERFORMANCE OF WORK

EPA and any affected property owners will be notified 30 days prior to performance of maintenance activities. After completion of construction activities, a memorandum will be prepared and submitted to EPA to document the work performed in each slope area. The memorandum will also be incorporated into the subsequent year's annual OMMP monitoring report. Slope area monitoring will be resumed in accordance with the OMMP to ensure that areas of maintenance are effectively containing contaminated materials.

FIGURES

Figure 1 – Completed Remedial Actions

Appendix A

Thick Slope and Quarry Spall Cap Plans and Material Specifications

Appendix B

Grout Mat Cap Plans

Appendix C

Visual Water Quality Monitoring Form