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SUPERFUND &
EMERGENCY
MANAGEMENT DIVISION

MEMORANDUM

SUBJECT: *Portland Harbor Superfund Site – Response to Request for Additional Information for the Endangered Species Act Consultation*

FROM: *Hunter Young, Environmental Protection Agency* HY

TO: *Kathleen Wells, National Marine Fisheries Service*

DATE: *March 2, 2023*

Purpose and Introduction

This memorandum provides additional information requested by the National Marine Fisheries Service (NMFS) in an email dated January 3, 2023. NMFS requested the following information for development of the Programmatic Biological Opinion for the Portland Harbor Superfund Site remedial action (proposed action):

1. Any additional information on potential sequencing of clean-up activities to assist in the determination of the magnitude of impact that might be anticipated at any one time, and how work will generally occur through time
2. Any additional information on management of stormwater runoff associated with a proposed transload facility
3. Any additional information on proposed in situ treatment methods
4. Information on vessel operation best management practices (BMPs)
5. Any additional information on capping and maintenance activities

The requested information is provided in the following attachments.

Attachment 1. Available Sequencing Information

A sequencing scenario was developed for the Portland Harbor Superfund Site (Site) to illustrate the schedule for remedial action (RA) implementation. The Draft RA sequencing scenario is currently based on simplifying assumptions and is expected to evolve and be refined as designs progress. The sequencing scenario takes technical and logistical elements into consideration and does not consider any future legal framework.

As described further below, the sequencing scenario assumes that simultaneous RA can be conducted at three (3) RA areas at a time. It is also assumed that no area shall be capped while (i.e., at the same time) an area directly adjacent, whether upstream or downstream, is completing dredging. Best management practices (BMPs) implemented during dredging are expected to minimize resuspension of contaminated sediment and dispersion of dredge residuals; therefore, the expected impact of remedial activities on Project Areas that are farther apart is minimal. This assumption will be refined based on additional Site- and Project Area-specific analysis through the remedial design (RD) process to accurately determine the impact of recontamination potential, especially for Project Areas in close proximity to each other.

Assumptions used in RA Sequencing

The Portland Harbor Record of Decision (ROD; EPA 2017) estimated the Site-wide RA timeframe to be thirteen years and the sequencing scenario achieves RA within this same timeframe given several assumptions. The following is a list of the assumptions used to develop the sequencing scenario. Each assumption is categorized as Low, Medium, or High, indicating the potential level of impact on the sequencing.

Work Duration Calculations and Assumptions

- In-water work durations are planning level estimates developed using sediment management areas (SMAs) and remedial technology assignments provided in the Explanation of Significant Differences (ESD; EPA 2019) and are subject to change with design information. (High)
- Quantities for work duration calculations are based on ESD Alternative F-Modified dredging and capping quantities calculated by the R-code program developed for use at the Site. (High)
- In-water work durations are calculated using the construction duration assumptions and approach found in Appendix D of the Portland Harbor Feasibility Study (FS) (EPA 2016a) with the following modification:
    - Based on feedback from the Remedial Action Working Group (RAWG), a daily production rate of 3000 cubic yards per day (CY/day) was used. This is equivalent to a full articulated bucket dredge production rate instead of the 55/45 percent mix of cable arm versus articulated bucket dredges assumed in the FS. This assumption will need to be refined when dredging technologies are finalized. (High)
- The total areas used for work durations include the capping and dredging footprints and enhanced natural recovery (ENR) is not included. The ROD's selected remedy only identifies ENR (instead of monitored natural recovery) as an approved remedial technology for the Swan Island Basin and the other Project Areas are not impacted by this assumption. (Low)
- In-water work years are based on the in-water work window of 122 days per year, consistent with the Portland Harbor FS and navigational channel areas (i.e., at depths greater than -20 feet Columbia River Datum) are assumed to undergo RA during the winter in-water work window.

All work is conducted during currently approved in-water work windows and any exceptions or extensions to in-water work windows will require consultation with EPA and NMFS. (High)

- In-water work days were based on the average of high and low estimates for dredging durations developed using the FS approach. The average work days were further rounded up to the nearest month to provide a conservative estimate and the rounding up is assumed to account for other activities not explicitly included in construction duration estimates, such as construction verification surveys. (Medium)
- EPA extended the RA timelines beyond the calculated work durations for some Project Areas (i.e., Gasco, RM11E, RM9W, Willamette Cove, and Terminal 4) based on input from the parties developing designs in these areas. As performing parties move further into remedial design at their Project Areas the quantities and work durations will need to be updated accordingly. (Medium)
- Mobilization/demobilization activities are each assumed to occur over a 1-month period and these activities are allowed to occur outside the in-water work windows according to the Portland Harbor Programmatic Biological Assessment (EPA 2021). (Medium)

Sequencing Scenario Development Rationale and Assumptions

- Construction of a transload facility is assumed to be completed early in the phase of construction activity for the Site where dredge material will be taken from all other areas under active construction. (High)
- Sequencing assumes that simultaneous RA can be conducted at the Site. While the Willamette River has an overall net downstream flow direction, tidal fluctuations can result in short-term flow reversals at the Site during periods of low river stage and large variation in tide levels, which can occur in late summer to early fall (EPA 2016b). Due to this period of flow reversals coinciding with the in-water work window, it is assumed that no area shall be capped while (i.e., at the same time) an area directly adjacent, whether upstream or downstream, is completing dredging. Based on RAWG feedback, upstream to downstream sequencing has been given greater consideration but it is not the only driving factor for sequencing. BMPs implemented during dredging are expected to minimize resuspension of contaminated sediment and dispersion of dredge residuals; therefore, the expected impact of remedial activities on Project Areas that are further apart is minimal. This assumption will be refined based on additional Site- and Project Area-specific analysis through the RD process to accurately determine the impact of recontamination potential, especially for Project Areas in close proximity to each other. (Medium)
- Dredging and capping equipment is available to dredge or cap in three (3) RA areas at a time with a maximum of approximately 366,000 cubic yards of sediment removal and management per season across the Site based on the 3000 CY/day production rate. This assumption will be refined during design by obtaining information on the exact cubic yards of sediment to be dredged, availability and capacity of dredging equipment, etc. (High)

Future Considerations

There is insufficient information at this time to incorporate all the feedback received from the RAWG and Technical Coordinating Team (TCT). However, EPA will consider recommendations for refinement to

RA sequencing as additional information becomes available during RD and RA. These future considerations will include the following, as needed:

- Refinement of construction durations as and when SMAs, technology assignments, and dredging/capping quantities are further developed.
- Refinement of production rates as additional information on equipment availability and capacity and Project Area considerations (e.g., functional structures, pile removal, upland operations, etc.) becomes available.
- Incorporation of riverbank excavation and capping quantities.
- Refinement of FS assumption of RA operations occurring 24 hours a day, 6 days a week (EPA 2016a) to address any "quality of life" concerns from community.
- Evaluation of equipment, operator, and infrastructure availability over the RA period considering other regional megaprojects.
- Refinement of work sequencing within Project Areas as this information becomes available during design. For example, performing parties will determine whether navigation channel work is completed before or after nearshore areas within their Project Area.
- Refinement based on construction of transload facilities.
- Evaluation of a range of conditions and timelines to bracket RA duration estimates.
- Evaluation of recontamination potential based on final Project Area sufficiency assessments.
- Evaluation of required separation distances to minimize potential for recontamination from nearby operations.
- Refinement based on requirements set forth in Programmatic Biological Opinion.
- Refinement based on community concerns and input.
- Further evaluation of river flows as additional RD data becomes available.
- Refinement based on requirements and anticipated laboratory turnaround times for construction monitoring and confirmation sampling.
- Refinement based on time required for placement of residual management layers.

References

EPA. 2016a. Feasibility Study Report - Appendix D Supporting Information for Alternative Development. Portland Harbor RI/FS. EPA Region 10, Seattle, Washington.

EPA. 2016b. Remedial Investigation Report. Portland Harbor RI/FS. EPA Region 10, Seattle, Washington.

EPA. 2017. Record of Decision, Portland Harbor Superfund Site, Portland, Oregon. EPA Region 10, Seattle, Washington.

EPA. 2019. Explanation of Significant Differences, Portland Harbor Superfund Site, Portland, Oregon. EPA Region 10, Seattle, Washington.

EPA. 2021. Portland Harbor Superfund Site Programmatic Biological Assessment. EPA Region 10, Seattle, Washington.

Attachment 2. Management of Stormwater at the Transload Facility

The Programmatic Biological Assessment (PBA, EPA 2021) Section 2.4.5.3.3 Stormwater and Dredge Liquid Management describes how stormwater and dredge liquid would be managed at the transload facility. Construction of the on-site transload facility would result in new impervious surfaces that would increase stormwater runoff. Management of stormwater at the transload facility will require a stormwater pollution prevention plan (SWPPP). The SWPPP requirements are described in PBA Section 2.5.7.2 Transload Operations.

During implementation of RA on riverbanks, upland staging areas and access roads will be needed for equipment and materials staging. Many of these staging areas and access roads will be located within existing paved lots; however, RA at some Project Areas may require staging on unpaved land and creation of new unpaved access roads. There is potential for erosion of soil from ground disturbance. As with the transload facility, EPA will require a SWPPP be prepared and implemented during RA on riverbanks. The SWPPP will describe the BMPs required to prevent the erosion of soil and stormwater transport of pollutants to the river from the riverbank construction area as well as from staging areas and access roads. This requirement is described in PBA Section 2.5.5 Riverbank Construction Activities, which states:

- Any action that will require earthwork and may increase soil erosion and cause runoff with visible sediment into surface water, or that will require the use of materials that are hazardous or toxic to aquatic life (such as motor fuel, oil, or drilling fluid), must have a pollution and erosion control plan.
- The plan must include practices to minimize erosion and sedimentation associated with all aspects of the project (e.g., staging areas, stockpiles, grading) to prevent construction debris from dropping or otherwise entering any stream or waterbody and prevent and control hazardous material spills.

Attachment 3. In Situ Treatment

As described in the Programmatic Biological Assessment (PBA) (EPA 2021) Section 2.4.3 In Situ Treatment, in situ treatment of sediments refers to chemical, physical, or biological techniques for reducing contaminant concentrations, toxicity, bioavailability, or mobility while leaving the contaminated sediment in place. Typically, in situ treatment entails adding amendments, such as activated carbon, to modify chemical and/or physical properties of the sediment. In situ treatment options selected in the remedy include amendments to caps, residual layers, and in situ stabilization and solidification (ISS). In situ treatment will be used to address contamination underneath and around pilings, docks, berthing or mooring dolphins, and other structures servicing active wharfs or shore-based facilities that will remain intact. In-situ treatment may also be applied to areas where principal threat waste (PTW) that cannot be reliably contained or nonaqueous phase liquid (NAPL) is left in place or where residual groundwater plumes may discharge to the river.

At the Gasco Sediments Site Project Area, located on the west side of the river at River Mile 6, ISS is being proposed for a portion of the project area (Anchor QEA 2022). ISS is a method for remediating contaminated sediments through a physical modification and chemical reaction to bind the target compounds (i.e., solidification) and/or transform them into a less mobile form (i.e., stabilization). Through the physical process of solidification, the contaminated material is encapsulated and thus stabilized. ISS is proposed at the Gasco Project Area due to the presence of dense nonaqueous phase liquid (DNAPL), which is particularly complicated to remove or contain, and is considered principal threat waste under the framework of the National Contingency Plan and the Portland Harbor ROD. In addition, ISS would address ebullition-facilitated transport (i.e., via gas bubbles) of DNAPL due to anaerobic generation of methane in subsurface sediments because methane release to the surface of the riverbed would be prevented. Below is additional information regarding specifically ISS.

ISS Construction Methods

ISS would entail the addition of cementitious materials (e.g., Portland cement and slag), which react with the contaminated sediment to significantly reduce permeability and leachability. ISS grout injection and mixing occurs within columns constructed by drilling into the sediment using a rotating auger that is advanced in a single location from the mudline. The only place where suspension of contaminated sediments could occur would be at the surface. Deeper subsurface sediment contamination would be mixed in situ with no exposure to the water column (Anchor QEA 2022). The grout mixture will be pumped within each column through ports in the drilling auger. No sediment is removed from the column during grout injection. Injection columns would overlap with each other to assure treatment of all impacted sediment. The required number of columns are advanced to depths below the sediment surface down to the deepest depth of Remedial Action Level exceedance and/or NAPL presence.

The ISS grout mixture is expected to consist primarily of Portland cement and blast furnace slag and will be based on performance of a site-specific laboratory bench-scale treatability study prior to construction. The volume of grout injected depends on the column volume, sediment bulk density, grout mass and density, and design material characteristics for the final sediment/grout mixture. After injection occurs, the auger mixes the grout and sediment until the mixture meets homogenization and field sampling objectives. While the mixing occurs, the auger remains in the column and moves up and down through the column as needed to complete the mixing. Field sampling objectives are based on the site-specific laboratory bench-scale treatability study. When mixing is complete, the auger is extracted and moved to the next column location (Anchor QEA 2023).

As the cement mixture is curing, it increases in volume, which is referred to as “swell”. Because the ISS application beneath the mudline will raise the mudline elevation above the original mudline elevation, the swell will need to be dredged to an elevation that maintains shallow water habitat. The dredged swell material would be transported, offloaded, and disposed of at a permitted landfill using the same waste characterization procedures and disposal requirements as dredged material (Anchor QEA 2023).

In-water ISS is expected to be constructed using a hydraulic drill rig equipped with an auger on a barge. Support equipment includes a grout plant, a long-stick excavator with GPS, and a haul barge for transporting dredged swell materials, all contained on barges (Anchor QEA 2023).

ISS BMPs, Avoidance, Minimization, and Conservation Measures

In-water ISS results in disturbance to the riverbed and riverbank habitat and can cause resuspension and dispersion of sediment and contaminants. In addition, binding agents, such as cement, have high pH and can raise the pH of surrounding surface water (Anchor QEA 2023). Water quality monitoring will be required during ISS application, consistent with a Water Quality Monitoring Plan approved by EPA.

In-water ISS activities would be conducted during the in-water work window to avoid both peak smolt outmigration and peak adult migration for both Chinook salmon and steelhead in the PHSS.

Physical, mechanical, and operational controls and BMPs will be employed to avoid and minimize impacts on water quality and benthic habitat. Physical barriers that could be employed during ISS are the same as those typically used during dredging, including silt curtains and mobile moon pool containment systems, and steel sheet piling.

Mechanical and operational control techniques are available for the auger mixing tool and cement grout batch mixing plant. The batch mixing plant and dredged material will be contained on separate water-tight barges. To minimize spillage between the haul barge and transload facility, cantilevered spill aprons may be used to direct spilled material back into the barges and out of the river. Relevant dredging BMPs will also apply to ISS swell management/removal. Parameters such as auger diameter, auger rotation speed, penetration depth, grout flow, and number of mixing passes can be adjusted as needed to account for variable site conditions and to minimize any identified water quality issues. For example, varying the entrance and exit speeds of the auger at the sediment-water interface can be done to reduce turbidity (Anchor QEA 2023). Impact avoidance and minimization measures for ISS would be consistent with those described in the Portland Harbor Superfund Site (PHSS) Programmatic BA.

Additional mechanical and operational measures specific to ISS activities are described in the attached memorandum (Anchor QEA 2023).

ISS Potential Effects on Aquatic Resources

ISS activities could result in effects on water quality related to contaminants, turbidity, and pH, as described below and shown in Table 1 in the attached memorandum (Anchor QEA 2023). In addition, ISS will disturb the benthic community and thus impact food resources for salmonids.

Contaminants

Fish have the potential to be exposed to contaminants from resuspended sediment during ISS operations. However, exposure to contaminants is less likely to occur during ISS than during dredging. Because the only sediment being removed is treated swell materials (if required to achieve the remedial design post-construction elevations), less contaminated sediment is resuspended in the water column. However, temporary increases in dissolved and particulate phase concentrations of some chemicals in the vicinity of auger mixing activities at the sediment surface could occur, resulting from resuspension of contaminated surface sediments by the auger, desorption of the contaminants from sediment particles to the water column, or release of contaminated porewater into surface water. The potential for increased contaminant concentration in the water column is low compared to dredging because injection and mixing occurs in the lowest sections of the ISS column below the sediment surface, where the material will be contained by the surrounding sediment (Anchor QEA 2023).

Turbidity

As discussed for contaminants above, exposure to turbidity is less likely to occur during ISS than during dredging. However, some increases in turbidity above background river conditions near the sediment surface could occur when the auger begins drilling into the sediment surface.

The ISS grout mixture is designed for site-specific submerged sediments during bench-scale testing to optimize the ratio of grout to sediment and the consistency of the grout-sediment mixture (Anchor QEA 2023). This will limit the potential of the mixture to flow into the adjacent water column, ensure that no free grout remains in the blend following mixing, and reduce the generation of turbidity during mixing at each auger location. Anti-washout additives may be considered to minimize the cement mixture from being “washed away” during application (Anchor QEA 2022).

pH

During ISS, placement of cement grout material into the columns has the potential to increase pH in water at the sediment surface where the grout material is exposed to the surrounding water column. Water pH would also increase if any of the grout material leaks or is spilled into the water column. This is because commonly used ingredients in the grout mixture, such as Portland cement, have inherently high alkalinity. The potential for elevated pH is highest during injection and mixing of the grout close to the sediment surface during construction. The potential is lowest when injection and mixing occurs in the lowest sections of the ISS column below the surface because the material will be contained by the surrounding sediment. Elevated pH levels are caused when uncured Portland cement, which is highly alkaline, dissolves in water (WDFW 2009, as cited in Anchor QEA 2023).

An increase in pH in the water column could impact listed salmonid species if the increase occurred outside of containment systems (e.g., moon pool or similar system). Fish species tend to have very narrow ranges of pH tolerance, and levels outside this range will impact their health. The optimal range for most freshwater aquatic organisms, including fish, is between 6.5 and 8 (EPA 2017b, as cited in Anchor QEA 2023). EPA water quality criteria for pH in freshwater allow for a range of 6.5 to 9 (EPA 2017b, as cited in Anchor QEA 2023); however, Oregon state water quality standards for the Willamette River require pH values between 6.5 and 8.5 (OARD 2023, as cited in Anchor QEA 2023). Temporary or long-term pH outside this range can result in decreased reproduction, decreased growth, disease, or death for aquatic species (EPA 2017b, as cited in Anchor QEA 2023).

During bench-scale testing, the grout-sediment mixture will be evaluated for its ability to achieve flow and consistency characteristics that limit the potential for leaking into the adjacent water column. Bench-scale testing will also optimize grout dosage so that no free grout remains in the blend following mixing (Anchor QEA 2023). This means that if elevated pH occurs, it would be expected to remain localized to the remedial work area. Once mixed, the grout-sediment mixture cures over a 28-day period, and as it cures, there is a greatly reduced likelihood of elevated pH levels in the water column. Therefore, the highest potential for elevated pH in the water column is during construction while the grout material is being injected and mixed into the ISS columns, particularly near the surface sediments (Anchor QEA 2023).

Water pH levels will be monitored at the compliance boundary, and activities will be suspended, and corrective actions implemented if pH levels increase above applicable water quality standards. Injection and mixing operations will be managed carefully to minimize pH effects according to the applicable requirements for the proposed action, including conditions imposed by the forthcoming NMFS PHSS Programmatic Biological Opinion or additional site-specific consultation and compliance with Clean Water Act Section 401 requirements.

ISS Benthic Community Disturbance

ISS will disturb, injure, or kill existing benthic organisms and disturb benthic habitat. However, the existing benthic habitat is highly degraded and unsuitable for a healthy benthic community. The benthic habitat will be altered in areas where the grout mixture is injected and mixed to stabilize and solidify the contaminants. This alteration would impact foraging habitat for listed salmonid species because the benthic community would be permanently displaced, unless appropriate habitat layers can be incorporated into the constructed remedy. However, this is only one source of prey for salmonid species because they also eat prey species found in the water column. It is expected that over time sediment would deposit on the ISS surface, allowing for recolonization by benthos within one year post-construction. However, in areas that are not depositional, the benthic community may be permanently lost. Placement of a habitat layer over the top of the ISS surface during construction would accelerate the recolonization process. Monitoring will be required to determine if the habitat layer remains in place and if compensatory mitigation is required to offset permanent loss of the forage base.

Proposed Gasco Project Area Pilot Study and Construction Schedule

ISS laboratory studies are planned for early 2023. The field pilot study would be completed during the in-water construction window between July through October 2023. The field pilot study would cover up to 5 acres of the 11.7-acre proposed ISS treatment footprint at the Gasco Project Area.

Based on results of the field and pilot studies, ISS is proposed for application to the depth of contamination in sediments to cover up to 11.7 acres of the river bottom at the Gasco Project Area. In addition, ISS would be applied to the riverbank to create a deep treatment barrier. The deep ISS treatment barrier would address advective flux, provide seismic structural resiliency, and control potential future upland DNAPL migration (Anchor 2022).

References

Anchor QEA. 2022. Preferred Alternative Report. Gasco Sediments Cleanup Action. Prepared on Behalf of NW Natural for US EPA.

Anchor QEA. 2023. ISS Remedial Technology Information for Portland Harbor Superfund Site Programmatic Biological Assessment. Memorandum to Hunter Young, EPA Region 10, from Elizabeth Greene and Sydney Gonsalves, Anchor QEA, LLC., dated February 22, 2023.

Jansen, P., M. Sabulis, and J. Clock, 2016. "In Situ Solidification (ISS) of River Sediments: Pilot Demonstration and Discussion of ISS as a Remedial Alternative to Dredging and Capping." Remediation Journal, 26(2):25–49.

Attachment 4. Vessel Operation BMPs

The following BMPs for operating and maneuvering vessels and equipment on water will be implemented to minimize sediment resuspension:

- Limiting boat traffic in the work area
- Conducting boat operations in locations and manner to minimize prop wash, such as trimming up outboard/inboard motors where possible
- Limiting boat motor revolutions per minute (RPMs) in shallower water as well as percent thrust for sea chests
- Optimizing the size and configuration of boats utilized within specific Project Areas
- Educate boat operators to understand the importance of throttle control and implications of too much thrust to move a barge, scow, or while operating a vessel
- Positioning and directing prop wash to deeper waters, when possible

Attachment 5. Capping Repair and Maintenance Activities

Capping technologies require monitoring and maintenance in perpetuity to ensure containment measures are performing successfully because contaminated sediment is left in place. Sediment caps will be designed such that the armor layer will be physically stable under flow conditions associated with a 100-year flood event, reasonably anticipated wind- and vessel-generated waves, and propeller scour. In addition, caps will be designed to avoid unacceptable flood rise or diminished flood storage consistent with Executive Orders for Floodplain Management (Executive Orders 11988 and 13690) and Federal Emergency Management Agency regulations. Caps will also be designed for climate change resiliency and seismic impacts.

Construction monitoring will include hydrographic surveys (e.g., multibeam bathymetry, single beam bathymetry, lidar) to confirm the thickness of sediment caps and other placed materials. The lateral extents of capped areas will be confirmed to ensure as-built conditions conform with the design and to support Project Area institutional control data needs. For cap and backfill placement, physical (e.g., small-diameter sediment cores, catch pans or stakes, sediment profile image surveys, bucket surveys, dive surveys, and/or mass balance approaches) and hydrographic surveys will be performed to verify the material placed meets the design specifications, including minimum cap/backfill thickness. Cap performance will be evaluated by measuring porewater concentrations immediately above the chemical isolation layer, and below the armor layer for armored caps. Sampling ports may need to be installed to allow reoccupation of the same sampling locations for each sampling event during five-year reviews. Porewater sampling will be conducted at time zero immediately post-construction and repeated in support of five-year reviews.

Cap performance monitoring will also include measuring the cap surface elevations using hydrographic surveys and/or diver surveys. The surveys will target the elevation of the top of the cap or armor layer surface and not the deposited sediment. Techniques such as probing/poling or sub bottom profilers may be used to determine thickness of deposited sediments and inform evaluation of cap elevations. Cap performance monitoring will be conducted at time zero immediately after cap construction and then once during every five-year review period. Additional time steps will be considered on a Project Area-specific basis to inform the first five-year review or as otherwise required. Project Area-specific situations may require more or less monitoring for capping. In addition to the frequency mentioned, monitoring may also be required following a significant event such as flood, earthquake, or vessel/debris grounding.

Cap maintenance and repairs would be described in the Project Area-specific Operations and Maintenance Plan and Operations and Maintenance Manual. The Operations and Maintenance Plan would establish cap monitoring and inspection frequency and methods and the proposed triggers for post-event cap inspections and repair following a significant flood, earthquake, or vessel/debris grounding event. Any required repair and maintenance activities would generally be implemented in the same manner as the initial construction of the cap, which is described in PBA Section 2.4.2 Capping (EPA 2021). BMPs would be implemented as described in PBA Section 2.5.3 Placement of Materials for Capping, In Situ Treatment, ENR, and Residual Management and Section 2.5.5 Riverbank Construction Activities for in-water caps and riverbank caps, respectively.

References

EPA. 2021. Portland Harbor Superfund Site Programmatic Biological Assessment. EPA Region 10, Seattle, Washington.