

LINNTON MILL RESTORATION SITE
(NWP-2014-477; 58909-RF; 59636-MBI)

AS-BUILT REPORT

MARCH 25, 2020



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- Attachment 1. As-Built/Record Drawings
- Attachment 2. Turbidity Monitoring Log
- Attachment 3. Habitat Design Figures
- Attachment 4. Photo Point Photographs

1 INTRODUCTION

This document has been prepared to present the as-built conditions of the Linnton Mill Restoration Site (Site). As-built conditions will be compared with the design presented in the Habitat Development Plan (HDP; Grette Associates 2018) and 100% drawings attached to the HDP. Construction of the Site was completed in the fall of 2019, and planting was completed in January 2020. This document provides as-built data requested from the following:

- Restoration Plan approved by the Portland Harbor NRD Trustees.
- U.S. Army Corps of Engineers (Corps) permit NWP-2014-477-1 (August 2, 2017; updated October 11, 2019);
- National Oceanic and Atmospheric Administration (NOAA) Fisheries Biological Opinion (May 25, 2017);
- Oregon Department of State Lands Removal/Fill Permit (May 12, 2017; updated November 22, 2019);
- Oregon Department of Environmental Quality (DEQ) Section 404 permit;

This document is organized as follows:

- Chapter 2 describes demolition actions and associated monitoring;
- Chapter 3 describes earthwork and measures to address impacted soil and sediment;
- Chapter 4 describes habitat enhancement measures such as planting and habitat structures;
- Chapter 5 presents performance monitoring measures;
- Chapter 6 addresses the project's goals and objectives.

All elevations presented herein are in NAVD88. Final as-built/record drawings are presented in Attachment 1.

2 DEMOLITION

2.1 BUILDINGS

2.1.1 Proposed

The applicant proposed to remove all buildings on site, including the mill buildings, outbuildings, two docks, and all piles.

2.1.2 Completed

All buildings were removed as proposed, in the summer through winter of 2017. Overwater buildings were removed during the 2017 approved in-water work window (July 1 through October 31), and the buildings entirely above the Ordinary High Water (OHW) line were demolished during the fall of 2017, timed to best avoid both migratory bird nesting and bat hibernation timing constraints. The demolished buildings were removed from the site through the winter of 2017-2018. Piles were removed from the water during the 2020 work window (discussed in Section 2.2 below).

2.1.3 Deviations/Challenges

No deviations or challenges were encountered that prevented completing the demolition as proposed.

2.2 PILE REMOVAL

2.2.1 Proposed

The HDP specified that all piles be removed, and it was thought that approximately 700 piles and pile stubs were present. It was believed that most of these were untreated timber piles/stubs, while the piles supporting the overwater building were creosote-treated. Less than 10 piles were known to be steel piles.

2.2.2 Piles Removed

As part of final construction data gathering, it was discovered that many more piles were present than initially thought. This included many pile stubs that did not project above the water line. The applicant removed all piles that were observed and that projected above the mudline. A total of 1,978 total piles were removed from the area below OHW (Table 1). As anticipated, most of the timber piles were untreated timber. The vast majority (1,488) of piles were fully extracted.

Out of the 1,978 piles removed, 499 piles could not be fully extracted and were cut off. Piles below the wetted channel were cut at the mudline; piles above the wetted channel were cut at a minimum of 3 ft below the final grade. Of the cut-off piles, 40 were treated timber piles and 459 were untreated timber piles (Table 1). The locations of cut-off piles were recorded with GPS and their location coordinates are presented in Attachment 1 Figure 5.

Table 1. Pile removal record

Action		Pile number
Piles fully extracted		1,488
Piles cut at mudline	Untreated	459
	Creosote-treated	40
Total		1,978

2.2.3 Deviations/Challenges

Many more piles were present in the area below the water line than anticipated. All piles that projected above the mudline were removed. Permit modifications were obtained to remove additional piles below OHW. Pile removal efforts were much more successful at removing the piles intact than originally assumed.

2.3 CONSTRUCTION TURBIDITY MONITORING

Per the NMFS’ Biological Opinion (BiOp) and the Oregon Department of Environmental Quality’s Water Quality Certification (WQC), turbidity monitoring was required during pile removal activities. Both monitoring programs require collection of turbidity data up-current of the work as a background level, as well as collection at a compliance location down-current of the work. The two programs’ compliance line and threshold levels differ—the WQC requires a closer compliance line than the BiOp (100 ft versus 1,000 ft), but also requires a lower compliance threshold (see Table 2 below). Samples were required to be taken at 2-hour intervals during work, with details regarding tidal stage recorded as applicable.

Table 2. Turbidity monitoring standards

	BiOp Monitoring Standards	WQC Monitoring Standards
Threshold	10% above background	5 NTUs above background
Response to exceedance	<p>First exceedance: Modify activity, continue to monitor</p> <p>Second consecutive exceedance: Stop work, resume when baseline turbidity is achieved</p> <p>If exceedance continues: Stop work, notify NMFS for a review of BMPs</p>	<p>0-5 NTUs above background: no restrictions</p> <p>5-9 NTUs above background: Work may continue maximum of 4 hours. If turbidity remains 5-29 NTU above background, stop work and modify BMPs. Work may resume when NTU is 0-5 above background.</p> <p>30-49 NTUs above background: Work may continue maximum of 2 hours. If turbidity remains 30-49 NTU above background, stop work and modify BMPs. Work may resume when NTU is 0-5 above background.</p> <p>50 NTUs or more above background: Stop work immediately and inform DEQ.</p>

2.3.1 Monitoring Conducted

Monitoring was conducted 100 ft upstream and downstream of work. Turbidity data at both the background and compliance points were recorded every 2 hours of work, every day that pile removal activities were conducted. Turbidity was logged using a calibrated turbidimeter. Turbidity log data are presented in Attachment 2.

2.3.2 Results

Turbidity levels at the background location ranged from a low of 2.6 NTUs to a high of 9.3 NTUs. Turbidity at the compliance point (100 ft) ranged from a low of 3.4 NTUs to a high of 14.8 NTUs. The mean difference of compliance line turbidity versus background turbidity was +0.78 NTU above background, and the greatest difference was +7.2 NTUs above background.

Compliance point turbidity levels were greater than 5 NTU above background at five readings over four days (7/19, 7/24, 7/25, and 7/26). In each reading but one, levels returned to 5 NTU or less above background by the next reading (within 2 hours). On 7/19, two consecutive readings of 5 NTUs or more above background were recorded, but work ended for the day after the second reading. Since work continued for less than 4 hours after the initial reading of >5 NTUs above background, no exceedances occurred that would have triggered stopping work or notifying DEQ.

In general, turbidity was higher at the compliance line than at the background collection point, but several readings at the compliance line were lower than background, by up to 1.1 NTUs. This condition did not correlate with tidal flooding, based on USGS data; i.e., some such readings occurred during a negative current (i.e., incoming tide), but some occurred at normal downstream current with no apparent correlation with tidal direction (USGS station 14211720; USGS 2020).

2.3.3 Deviations/Challenges

To avoid duplication of efforts and in an abundance of caution, monitoring was conducted 100 ft downstream rather than at 1,000 ft downstream. This was done to comply with the more stringent compliance distance, assuming that if turbidity levels were in compliance at 100 ft, they would also be in compliance at 1,000 ft. Even at 100', the BiOp's standard of less than 10% above background was met at 100 ft in 62% of all readings. Thus, it is assumed that NMFS' standards were met. Overall, turbidity generated by pile removal was very minor.

3 EARTHWORK

3.1 ADJACENT HYDROCARBON PLUME INTERIM REMEDIAL ACTION

As described in the HDP, the adjacent property formerly owned by BP/ARCO, now owned by Seaport Midstream Partners (SMP) contains petroleum hydrocarbon contamination in the soil and groundwater which has been a source of a trespass hydrocarbon plume onto the southern portion of the Linnton site. Monitoring wells have been present on the Linnton property to monitor the extent of the trespass plume.

3.1.1 Proposed

The HDP anticipated a source control evaluation for the SMP property that would describe long-term remediation monitoring and a plan to allow decommissioning the monitoring wells on the Linnton site. It was anticipated that timely progress on the source control evaluation could enable removal of the wells prior to habitat construction at the Linnton site.

3.1.2 Implemented

In the spring/summer of 2019, Phase III of the Interim Remedial Action (IRM) was performed by SMP on the Project site. The objectives for Phase III were to prevent future potential migration of light-phase petroleum hydrocarbons and dissolved-phase petroleum contaminants in the shallow groundwater zone beyond the Terminal 22T boundary to the Project site, potential human health and ecological exposure to petroleum contaminants at the Project site, and potential human health exposures to petroleum-impacted soil and groundwater at Terminal 22T. The Phase III scope of work included the following:

- Excavation of 6,500 tons of petroleum-contaminated soil and wood materials from the Linnton site near the property boundary with Terminal 22T in June/July 2019..
- Addition of amendments to the bottom of the excavation to promote aerobic bioremediation of residual petroleum hydrocarbons in soil and groundwater.
- Installation of 155 linear ft of sheet pile wall between the two properties perpendicular to shore to prevent further hydrocarbon migration.
- Abandoning the groundwater monitoring wells on the Linnton site prior to the start of restoration construction activities.

Based on recent conversations with Jeff Schatz, the DEQ project manager for the SMP site and the Linnton Mill, it is anticipated that SMP will submit a source control report to DEQ in 2020. The source control report will summarize the results of remediation related to releases from the SMP site, including but not limited to remediation on the Linnton Mill, describe provisions for future compliance monitoring to evaluate the long-term success of the remediation, and provide a strategy for communicating changes in conditions related to impacts from the SMP trespass plume. If acceptable to DEQ, the provisions and communications strategy described in the source control report will be captured in the DEQ's Source Control Decision for SMP. In the interim, DEQ in its capacity as project manager for SMP and the Linnton Mill will act as an intermediary between SMP and the Owner. Specifically, SMP or the Owner will notify DEQ in the event that changes in conditions are observed, and DEQ will, in turn, inform the Owner or SMP of the notification.

3.1.3 Deviations

These interim remedial actions allowed the habitat construction at Linnton to include the southern shoreline and add additional acreage to the site, as will be described below.

3.2 SITE CONSTRUCTION

3.2.1 Proposed Habitat Types/Acres

The HDP proposed creation of five different habitat categories, aligning with categories described in the Portland Harbor Trustees Habitat Equivalency Analysis (HEA) model. These were as follows:

Table 3. Acres of each Habitat Type, Pre- and Post-Project.

Habitat Type	Pre-Project acres	Post-Project acres
Upland	11.45	4.90
Riparian	8.80	9.60
ACM	1.76	2.90
Shallow Water	4.93	4.93
Off-Channel	0	4.34
Uncredited easements/trail area	--	0.27
Total	26.94	26.94

This total did not take into account 0.89 acre at the southern end of the site that was precluded from development by the presence of the monitoring wells associated with the SMP trespass hydrocarbon plume. The total acreage of the site, including SMP acreage, uncredited easements, and DSL aquatic lease area, is 27.83 acres.

3.2.2 Constructed Habitat Types/Acres

Habitat types were generally constructed to the design acreages, with some variations. Table 4 presents the as-built acreages of the site by habitat type. Figures that present the as-built acreages and compare them with design acreages are presented in Attachment 3.

Table 4. Acres of each Habitat Type, Pre- and Post-Project.

Habitat Type	Proposed acres	Constructed acres	Deviation
Upland	4.90	4.98	+0.08
Upland uncredited easements/trail area	0.17	0.16	-0.01
Riparian	9.60	9.37	-0.23
Riparian uncredited easements/trail area	0.10	0.11	+0.01
ACM	2.90	3.19	+0.29
ACM uncredited BP/ARCO	0.25	Credited as ACM	-0.25
Shallow Water	4.93	5.57	+0.64
Shallow uncredited BP/ARCO	0.64	Credited as Shallow	-0.64
Off-Channel	4.34	4.45	+0.11
Total	27.83	27.83	0

3.2.3 Deviations

In the HDP, the portion of the site proposed to be developed as habitat was limited by a trespass plume of petroleum hydrocarbons from the SMP property adjacent to the south. Groundwater monitoring wells were present in the southern portion of the Linnton site associated with this trespass plume. To preserve the monitoring wells, laying back the shoreline slope was not proposed for the southernmost approximately 225 linear ft of shoreline.

As discussed above, during 2019 SMP performed remediation in this portion of the site that allowed the removal of the monitoring wells, and in turn allowed shoreline layback in this area. This entailed approximately 0.18 acre of additional excavation below OHW. Permit modifications were obtained to cover the additional acreage of excavation below OHW, but the original permits included sufficient excavation volume to cover the changes. As a result, 0.25 acre of ACM and 0.64 acre of Shallow Habitat were added to the habitat acreage.

Additionally, in the initial proposal, no excavation was proposed along the riverbank north/downstream of the off-channel habitat. Upon commencement of construction, it was apparent that shoreline work was needed to ensure this slope would be stable. This required additional excavation below OHW. Permit coverage for this additional area of work below OHW was obtained with the Corps and DSL, and the contractor laid back the slope as necessary to provide stability. This entailed approximately 0.06 acre of additional excavation area below OHW beyond what was proposed in the HDP. As mentioned above, permit modifications were not needed for additional volume. In total, approximately site construction required approximately 0.24 acre of excavation beyond the acreage proposed in the HPD. Total excavation volume below OHW for the entire project was approximately 2,485 cyds, below the approved maximum volume.

It will be noted that the as-built Riparian habitat acreage is 0.23 acre less than the design acreage. This was because the Off-Channel, ACM, and Upland habitats were larger than design.

3.3 OFF-CHANNEL HABITAT DESIGN

3.3.1 Proposed

The HDP required that the elevations of the off-channel habitat be carefully tracked. The design called for the habitat to match the design elevations within 0.67 ft.

To facilitate fish passage, the HDP required that the off-channel habitat avoid jump heights of 6 inches or more, maintain a slope of 4% or flatter through the channel, and ensure no obstacles to fish ingress/egress be present. The HDP also required that a freshwater input (Linnton Creek and/or daylighting groundwater) entering the off-channel habitat from November 1 through June 30 each year; this is addressed in Section 5.2.3.

3.3.2 Constructed

A detailed elevational comparison is presented in Attachment 3, Figures 9-14. All of the channel through the off-channel habitat is less than 4% slope, and no jump heights of 6 inches are present. Cross section comparisons show that the as-built channel has the same elevation at the inlet (approximately +9 ft), highest point (approximately +10 ft), and outlet (approximately +5 ft). In some portions of some of the cross sections, the as-built elevation is more than 0.67 ft higher than

the design elevation (e.g., the lowest points of sections 1-6). In others, the as-built elevation is more than 0.67 ft lower than the design (e.g., sections 9 and 13). Cross sections were up to 1.16 ft higher (Section 1) and 0.93 ft lower (Section 9) based on point measurement comparisons. In general, despite minor location-specific variations, the off-channel habitat meets the overall design concept.

3.3.3 Deviations

As mentioned above, the off-channel habitat differs in elevation by up to 1 ft higher or lower in location-specific comparisons, but meets the overall design and overall target elevations for the inlet, highest point, and outlet.

3.4 POST-CONSTRUCTION CLEAN SAND CAP PLACEMENT

Per discussions with EPA, all piles removed from within the Sediment Management Area (SMA) that has been delineated offshore of the site, as well as all creosote-treated timber piles that were cut off at mudline, were to be covered with a clean sand cap. Additionally per discussions with EPA and the Corps, a clean sand cap was to be placed over any areas of project-related excavation that overlapped the SMA. The Corps permit required that the sand cap material be approved by EPA as clean prior to placement, and that compliance be reported qualitatively, as a placement volume and area.

3.4.1 Proposed

It was proposed that up to 2,500 cyds of clean sand would be needed to cover removed piles and the leave surface after sediment excavation, depending on the success of extraction.

3.4.2 Placed

Forty (40) creosote-treated piles were cut off at the mudline. Additional piles from within the SMA were fully extracted. Any additional creosote-treated piles were fully extracted and thus required no cap. Sand capping for removed piles totaled approximately 500 cyds over approximately 28,000 sq ft, equaling a capping depth of approximately 6 inches. Sand cap placement is depicted in Attachment 1, Figure 4.

Approximately 1,000 cyds of clean sand capping was placed along the shoreline in areas where project-related grading overlapped the SMA. Capping was placed to a depth of 1 ft, over 0.62 acre. Placement location is presented in Attachment 1, Figure 4.

The material report sheet documenting that the cap material was clean was submitted to the EPA via the Corps for approval on 10/2/19, and approved by EPA on 10/3/19 by email.

3.4.3 Deviations/Challenges

No deviations were necessary and no significant challenges were encountered.

3.5 IMPACTED LEAVE SURFACE SOIL AND SEDIMENT MITIGATION

3.5.1 Proposed

Sampling both before and after excavation was to be conducted for the purpose of identifying and mitigating the potential effects of chemicals of concern (COCs) detected at concentrations exceeding relevant screening levels at the final habitat surface.

The Linnton Mill property is adjacent to the Portland Harbor Superfund Site (PHSS). Under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 EPA is the lead environmental agency for investigation and cleanup of the PHSS. However, pursuant to an agreement between DEQ and EPA, DEQ is the lead environmental regulatory agency for the Project site.

The proposed scopes of work for identifying and mitigating the potential effects of COCs detected at concentrations exceeding relevant DEQ and EPA screening levels were described in draft work plans submitted to DEQ for comment. Under the terms of the agreement, DEQ forwarded the work plans to EPA for review and comment. Final versions of the work plans that addressed DEQ and EPA comments were submitted to and approved by DEQ. Copies of the final work plans have been provided to the Trustees.

The proposed scopes of work included the following:

- Collection of soil and sediment samples from portions of the Project site that would become the upland, riparian, off-channel, and ACM habitats;
- Laboratory analysis of the collected samples for COCs;
- Screening the laboratory results against relevant DEQ and EPA screening levels; and
- Performing appropriate mitigation measures determined based on criteria established in agreement with DEQ and EPA.

The proposed scopes of work were based in part on the following results of sampling performed pre-construction:

- COCs were not detected at concentrations exceeding cleanup levels in soil that would form the post-construction leave surface soil in the upland and riparian habitats; therefore, it was determined that post-excavation sampling and/or mitigation was not necessary for the upland and riparian habitats.
- COCs were detected at concentrations exceeding cleanup levels in soil samples collected from the planned leave surface at five locations in the off-channel area. These five locations were identified in the 100% design drawings. The areas were to be addressed by over-excavation to 2 ft below the finished grade and backfilled with clean material.
- Insufficient sampling was performed to evaluate the entirety of the leave surfaces in the off-channel and ACM habitats; therefore, additional sampling was to be conducted post-excavation to evaluate these leave surfaces and appropriate mitigation measures would be performed in coordination with DEQ

3.5.2 Implemented

The implemented sampling and mitigation activities were described in detail in reports submitted to DEQ and EPA, and were made available to the Trustees. These sampling and mitigation activities also have been described in email correspondence from RestorCap and Farallon Consulting, LLC (Farallon) to the Trustees. These sampling and mitigation activities were required for only the off-channel and ACM habitats. The sampling approaches, relevant DEQ and EPA screening levels, and appropriate mitigation strategies for these habitats were based on location relative to the pre-excavation OHW. The entirety of the off-channel habitat is landward of the pre-construction OHW. A portion of the ACM is landward of the pre-construction OHW and a portion of the ACM is waterward of the pre-excavation OHW. The implemented sampling and mitigation activities for the off-channel and ACM habitats are summarized as follows.

Landward of OHW

Excavation and Backfilling in the Off-Channel Habitat. Based on screening level updates proposed by EPA in October 2018, the number of areas indicating unacceptable levels of COCs potentially on the leave surface was reduced from five to two. These two areas were addressed as proposed by over-excavation to 2 ft below finished surface and backfilled with clean crushed rock. These areas are depicted on Attachment 1, Figure 2.

Post-Excavation Sampling in the Off-Channel and ACM Habitats. Post-excavation sampling identified additional areas landward of the pre-construction OHW with COCs including cPAHs, total DDx, and dioxins and furans that exceed some EPA cleanup levels for the Portland Harbor Superfund Site. However, the shallow grading and presence of plantings at the finished surface reduce the potential for erosion, and thus these areas do not meet the criteria for additional action described in the EPA riverbank guidance. It was therefore proposed to DEQ that these areas have been effectively addressed through the restoration action and future monitoring, and the risk from exposure to these chemicals has been effectively mitigated.

Waterward of OHW

Post-excavation sampling waterward of OHW indicated the presence of cPAHs and total DDx in the sediment finished surface that exceed EPA cleanup levels for the Portland Harbor Superfund Site. With agreement from DEQ, EPA, and the U.S. Army Corps of Engineers, this was addressed by the 1,000 cyds/1-ft thick clean sand cap that was placed on the portion of project grading that overlapped the SMA (described in Section 3.4 above). The sand cap placement is depicted on Attachment 1, Figure 4.

3.5.3 Deviations

As mentioned above, the number areas in the off-channel habitat identified in pre-construction investigations as requiring over-excavation and backfill was reduced from five to two based on revised cleanup levels for the Portland Harbor Superfund Site.

The clean sand cap placed over sediment with COCs exceeding cleanup levels for the Portland Harbor Superfund Site on the finished surface waterward of OHW was not proposed in the design, but the need for such was anticipated in the sediment investigation work plans. Permitted fill volumes were sufficient to accommodate this additional fill.

4 HABITAT ENHAMCEMENT MEASURES

4.1 NATIVE PLANTINGS

4.1.1 Proposed

The HDP proposed native seeding and planting in several zones, with species varying by elevation. Post-earthwork native seeding was to be accomplished in four zones as follows:

- Zone 1A (Off-Channel Shrub/Off-Channel Emergent; 1.3 acres) – emergent species between +8.5 ft and +12 ft;
- Zone 1B (Riparian/Upland Forested; 4.0 acres) – herbaceous species between +11 ft and +20 ft;
- Zone 2 (Riparian/Upland Forested; 2.1 acres) – upland herbaceous species between +20 ft and +31 ft;
- Zone 3 (Riparian/Upland Forested; 11.8 acres) – upland herbaceous species above +31 ft.

Similarly, tree/shrub planting was proposed in four zones, as follows:

- Zone 1A (Off-Channel Shrub/Off-Channel Emergent; 1.6 acres) – emergent plugs/bulbs from +8.5 ft to +10 ft, and hydrophytic shrubs from +10.5 ft to +13 ft;
- Zone 1B (Riparian/Upland Forested; 3.8 acres) – riparian trees and shrubs from +13 ft to +20 ft;
- Zone 2 (Riparian/Upland Forested; 2.1 acres) – upland trees and shrubs from +20 ft to +31 ft;
- Zone 3 (Riparian/Upland Forested; 11.8 acres) – upland trees and shrubs above +31 ft.

Within the Riparian/Upland Forested area (above +13 ft NAVD88), performance standards called for at least three native tree species and five native shrub species, at a minimum density of 2,000 woody stems per acre. Within the Off-Channel Shrub area (+10 ft to +13 ft NAVD88), performance standards called for at least five native shrub species installed at a minimum density of 2,000 woody stems per acre. Within the Emergent area (+8.5 ft to +10 ft NAVD88), performance standards called for at least five native emergent species installed at a minimum density of 5,000 plugs per acre, plus seeding at a minimum of 50 lb/acre from +8.5 ft to +12 ft NAVD88.

4.1.2 Installed

Native seeding was accomplished in November 2019, as soon after the completion of earthwork as practicable. The following modifications were made to the seed mixes presented in the HDP:

- In Zone 1, obtuse spikerush (*Eleocharis obtusa*) was unavailable and rice cut-grass (*Leersia oryzoides*) was not included; to account for this, the relative percentages of

Columbia tickseed (*Coreopsis tinctorial*) and creeping spikerush (*Eleocharis palustris*) in the seed mixture were increased to 20% and 40%, resp.

- The as-built standard for seeding the off-channel emergent area is listed at 50 lb/acre. Seed was placed at 29 lb/acre, which is the rate described in the 100% design in the HDP. 29 lb/ac is an industry standard seeding rate. Further, emergent plugs in the off-channel emergent zone were installed at nearly twice the prescribed density (9,290 per acre, versus 5,000 per acre). With the increased plug density and the seeding rate of 29 lb/ac, establishment and survival is not expected to be affected by the lower seeding rate.
- Pearly everlasting (*Anaphalis margaritaceae*) was unavailable for the Zone 3 seeding mix. The relative percentage of yarrow (*Achillea millefolium*) in the seed mix was increased accordingly.
- All other seeding schedules were met as specified (see Attachment 1, Figure 7).

Planting occurred in the four zones from December 2019 through February 2020. Though acreages of individual planting zones differed slightly from design acreages, no zone was smaller than the design acreage by more than 0.07 acre, and overall acreages exceeded the design total (19.46 acres versus 19.30). All planting as-built performance standards were met or exceeded, as described below.

- Zone 1A (Off-Channel Shrub/Off-Channel Emergent; 1.55 acres) – shrubs and emergent species between +8.5 ft and +13 ft;
 - Within the Off-Channel Shrub Zone, 5 native species were installed, meeting the as-built standard of 5 species. Shrubs were also planted to a lower elevation in the off-channel habitat than specified—the HDP specified shrubs down to +10.5 in the Off-Channel Shrub zone, but shrubs were planted down to +8.5 ft. This will help ensure that shrubs establish at the bottom limit of inundation tolerance.
 - Shrubs were installed at a density of 7,180 stems per acre, exceeding the as-built standard of 2,000 stems per acre.
 - Within the Emergent Zone, 6 native species were installed as plugs in addition to the 4 species installed as seeds (described above), for a total of 10 species, exceeding the as-built standard of 5 species.
 - Plugs were installed at a density of 9,290 plugs per acre, exceeding the as-built standard of 5,000 plugs per acre.
- Zone 1B (Riparian/Upland Forested +13 ft and +20; 3.93 acres); Zone 2 (Riparian/Upland Forested +20 ft and +31 ft; 2.20 acres); Zone 3 (Riparian/Upland Forested above +31 ft; 11.78 acres) – trees and shrubs.
 - 16 tree and 25 shrub species were planted in the Riparian/Upland Forested Zone (zones 1B, 2, and 3), exceeding the as-built standard of 3 tree and 5 shrub species.
 - Woody stems were installed at 3,588 per acre, exceeding the as-built standard of 2,000 stems per acre.

- Species were installed in a layout that varies by micro-location, ensuring that the plantings will be well-adapted to the site (see Attachment 1, figures 6 and 7).

A complete list with species and quantities is presented in Attachment 1, figures 6 and 7.

4.1.3 Deviations/Challenges

Upon completion of earthwork, seed was applied to the site. However, seasonal rain created erosion rills on the site and the failure of some of the seeding. Rills were repaired and seeding was supplemented in January/February 2020.

Planting densities were higher than the design, intending to increase survival and out-compete non-native species.

Some species were substituted in the final planting. For example, in the Riparian/Upland Forested Zone, spreading gooseberry (*Ribes diversicum*) was not planted though originally specified, and Oregon white oak (*Quercus garryana*) was planted though not originally specified. Some species were planted in different zones than specified. For example, grand fir (*Abies grandis*) was specified in Zone 2 (20.1 ft to 31 ft), but planted instead in Zone 3 Upper Slope (45 ft to 85 ft). Sitka willow (*Salix sitchensis*) was specified for Zone 1B only, but was planted in Zone 1B and Zone 2. Plant species shifts from the specifications were done by the planting contractor (George Kral, Ash Creek Environmental), based on best professional judgment of species success.

4.2 HABITAT STRUCTURAL FEATURES

4.2.1 Proposed

The HDP proposed to install 65 habitat structural features, including five log structures, 20 habitat logs with rootwads, 15 snag logs, 15 boulder clusters, and 10 debris piles.

4.2.2 Installed

All of the proposed habitat structural features were placed as proposed. Sixty-five (65) features were installed over 18.8 acres¹, for 3.5 per acre (Table 5). Their locations were recorded on the as-built survey and depicted in Figure 3 of Attachment 1.

¹ Per design discussions with the Trustees, habitat structures were placed in the Upland, Riparian, and Off-Channel habitat, but not in the mainstem Willamette River/ACM habitat.

Table 5. Habitat structures placed

	Off-Channel	Upland	Total
Log structures	5	0	5
Habitat log with rootwad	10	10	20
Snag log	0	15	15
Boulder clusters	0	15	15
Debris piles	0	10	10
		Total	65
		Acres	18.8
		Structures per acre	3.5

4.2.3 Deviations/Challenges

No deviations were necessary and no significant challenges were encountered.

4.3 BALD EAGLE AND MINK HABITAT CREATED

4.3.1 Proposed

The HDP required a documentation of the amount of bald eagle and mink habitat that was created, respectively, by the action. This was to be measured by acreage and shoreline length.

4.3.2 Created

Bald eagle habitat was considered all Riparian Zone habitat, plus all ACM habitat in which trees were planted that might be used for perching. This amounts to 13.18 acres and 3,273 linear ft of shoreline.

Mink habitat was considered all ACM habitat plus Off-Channel Habitat. This amounts to 7.64 acres and 2,979 linear ft of habitat.

Both habitats are depicted in Attachment 3, Figure 6.

4.3.3 Deviations/Challenges

The HDP described bald eagle and mink habitat as “shallow water and riparian habitat”. It is assumed that habitat below OLW (-8 ft), which is the upper elevation of the Shallow Water zone, was not intended as this is not mink habitat. Further, it was assumed that any area near the river that includes trees would be bald eagle habitat. Thus, the habitats were measured as defined above.

5 PERFORMANCE MONITORING

5.1 PROPOSED

The monitoring plan was approved by the Trustees in the HDP. Please refer to that document for the full monitoring plan. This section discusses the monitoring transects and equipment that were set up in anticipation of Year 1 (2020) monitoring. The HDP also calls for water data loggers that measure the water level and water temperature within the off-channel habitat. Also, regular visual monitoring will be conducted to ensure fish access to the off-channel habitat is maintained, and to identify any evidence of petroleum hydrocarbons (e.g., sheen) on the southern bank of the off-channel habitat.

5.2 IMPLEMENTED

5.2.1 Monitoring Points Established

Monitoring points were established as depicted in the HDP. This includes:

- 23 photo points (PP1 – PP23)
- Five vegetation monitoring transect start points (V1 – V5)
- 36 topographic monitoring transect start points (T1 – T36)
- Five bird monitoring transect start points (B1 – B5)

Transect start-points and photo points were marked in the field using 2-inch x 2-inch wooden stakes driven into the ground and marked with permanent marker. All stakes were also surveyed by a professional surveyor and added to the site drawings (Attachment 3, Figures 7-8). Vegetation and bird monitoring transects were only marked at one end (NW and SW ends, resp.). Topographic transects that measure the off-channel habitat were marked at two ends—on the SW shoreline of the off-channel habitat, and on the island.

5.2.2 Water Quality Monitoring Equipment Installed

A water level probe was installed at the mouth of the off-channel habitat to measure the level of inundation within the habitat. No location was specified in the HDP for this probe. It has been initially installed within the off-channel habitat, approximately 130 ft upgradient of the cut-off sheet pile wall (Attachment 3, Figure 8). It may be moved to the sheet pile wall once water levels decrease later in the season. It is anticipated that water level data will correspond very closely with stream gauge data collected at nearby USGS stations (e.g., Station 14211720 - Morrison Street Bridge). If it is determined that the Morrison Street Bridge data matches the data collected on site with very little discrepancy, or with a predictable difference, it may be proposed that the on-site water level monitoring be abandoned.

Two water temperature probes were installed—one at the same location as the water level probe, and a second in the plunge pool of Linnton Creek. No location was specified in the HDP for this sensor. The intent of temperature monitoring was to assess the degree to which the site is providing cold water refugia due to freshwater inputs. Since Linnton Creek is the main input of freshwater input, this is a logical installation location. See Attachment 3, Figure 8 for precise locations.

Initial temperature and dissolved oxygen readings are presented in Table 6, and indicate that Linnton Creek water is colder than mainstem Willamette River water, as anticipated. Dissolved oxygen levels were essentially equivalent at both locations.

Table 6. Initial water sensor data

	Temp	Water elev.	DO level at probe
Mouth ¹	9.7° C	10.6'	11.74 mg/L
Linnton Creek	8.0° C	--	11.73 mg/L

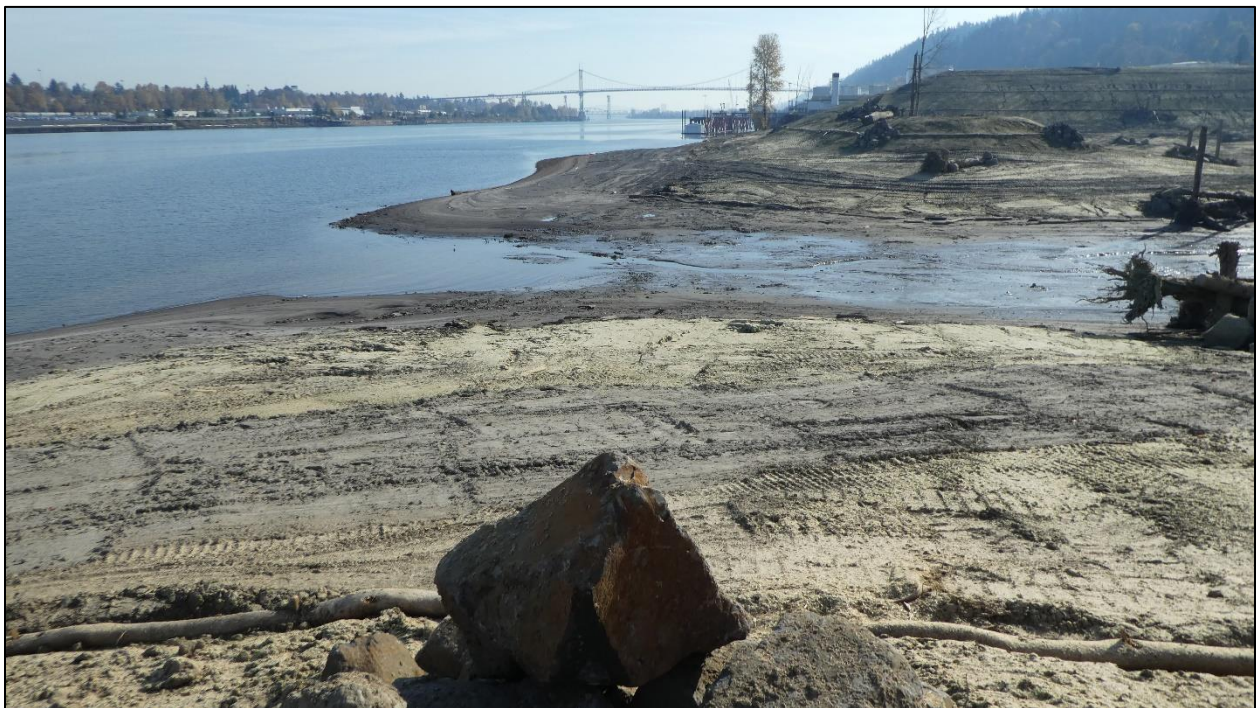
¹Probe elevation +8'

5.2.3 Visual Monitoring Conducted

Visual monitoring to ensure no fish access barriers are present at the mouth and inlet of the off-channel habitat was conducted, and that Linnton Creek is flowing from November 1 through June 30. No fish barriers were observed; see photos 1-7 below.

Also, Linnton Creek was observed to be flowing during two site visits, November 9, 2019, and February 19, 2020. On both days, a steady discharge was issuing from the Linnton Creek culvert. Further, groundwater was observed daylighting on much of the southern hillside, contributing to the flow, as was anticipated (see photos 8-13 below). This hillside discharge was also observed throughout construction during the summer of 2019. Based on these initial observations, there appears to be a high likelihood of year-round freshwater inputs into the off-channel habitat.

Finally, LWC conducted initial visual monitoring on the southern bank of the off-channel habitat for petroleum hydrocarbon sheens; no such sheen was observed.



Photograph 1. View of the downstream end of the off-channel habitat.



Photograph 2. View of the off-channel habitat (1).



Photograph 3. View of the off-channel habitat (2).



Photograph 4. View of the off-channel habitat (3).



Photograph 5. View of the off-channel habitat (4).



Photograph 6. View of the upstream end of the off-channel habitat (1).



Photograph 7. View of the upstream end of the off-channel habitat (2).



Photograph 8. Linnton Creek discharging 11/8/19, as seen from Photo Point 12; groundwater daylighting from the hillside and discharging to the off-channel habitat to the left of the picture.



Photograph 9. Groundwater daylighting from the hillside, from Photo Point 12 11/9/19.



Photograph 10. Groundwater daylighting on the southern hillside, from Photo Point 21, 11/8/19.



Photograph 11. Groundwater daylighting from the hillside and discharging to the off-channel habitat, from Photo Point 12, 2/19/20.



Photograph 12. Linnton Creek discharging 2/19/20, daylighting groundwater to the right, from Photo Point 12.



Photograph 13. Groundwater daylighting on the hillside, from Photo Point 21, 2/19/20.

5.2.4 Photo Points

Photographs were taken at all 23 photo points to document as-built conditions at the site. Photos are included as Attachment 4.

5.3 DEVIATIONS/CHALLENGES

5.3.1 Combined Monitoring Points

In some cases, multiple transect points occurred at essentially the same point, and were marked with a single stake. The following points were combined:

- B3 / PP11
- B4 / PP12
- T24 (SW end point) / PP21
- T24 – T26 (NE end points on the island)
- T16 – T18
- T13 / T36
- T34 / T29 (N end)

5.3.2 Repositioned Monitoring Points

During the process of field-marking monitoring points, consideration was given to whether the monitoring point could provide improved data if repositioned based on site conditions. In some cases, points were relocated slightly. Several photo points were repositioned from their locations in the HDP to provide an improved vantage point—see Attachment 3, Figure 7 for a comparison between proposed and field-marked monitoring points. Additionally, one vegetation monitoring transect start point was moved slightly to avoid obstructions.

5.3.3 Eliminated Photo Points

Photo points were proposed to be installed at the mouth and head of the flow-through channel, respectively. However, these locations are not safely accessible on foot due to inundation and soft mud. It is anticipated that these locations will almost always be inundated and include soft mud, making access difficult and field staking impossible. Further, these locations are redundant, as other photo points (e.g. PP8, PP13, PP16, and PP17) adequately cover the same area those eliminated points would have covered. Thus, those two photo points were not installed.

5.3.4 Added Photo Point

An additional photo point—PP23—was added to capture the area in the southeastern corner of the site. This photo point was located on the southern shoulder of the southern soil placement mound and captures the shoreline bank as well as the area south of the mound. No previously proposed photo point would have adequately captured this area.

5.3.5 Water Quality Probes

The water temperature logger in the plunge pool is a challenge due to the periodic high flows that come through Linnton Creek and also bring significant rock and sediment. This was taken into consideration through careful placement of the probe to provide protection from rock and sediment, and the probe's integrity will be continually monitored and any damage will be repaired/replaced.

6 GOALS AND OBJECTIVES

For a discussion of the Site's goals and objectives as well as a project description, please see the Habitat Development Plan (HDP). In summary, the Site proposed to restore an existing 27.83-acre¹ riverfront industrial site to a suite of river-associated habitats along the Willamette River for the purpose of generating restoration credits that can offset NRDA liabilities for responsible parties to the Portland Harbor Superfund Site. The goals and objective of the project are presented below, with notes regarding whether each objective was met.

Goal 1: Restore 26.67 acres of industrial land by removing existing abandoned infrastructure.

- Objective 1a: Remove existing docks and all piles in the ACM and Shallow Water habitat zones.
 - ***Met? YES: All docks were removed; all piles were removed or cut at mudline.***
- Objective 1b: Remove all buildings on site.
 - ***Met? YES: All buildings were removed.***
- Objective 1c: Remove concrete and asphalt, with the exception of the concrete foundation under the buildings.
 - ***Met? YES: All concrete and asphalt was removed; concrete foundations were buried as proposed.***

Goal 2: Restore 26.67 acres of industrial land into a complex of fully functioning habitats to benefit fish and wildlife species in Portland Harbor.

- Objective 2a: Through grading and excavation, create 5.48 acres of new aquatic habitat, including 4.34 acres of off-channel habitat and 1.14 acres of new ACM habitat.
 - ***Met? YES: In total, 5.63 acres of new aquatic habitat was created, 0.15 acre above the design goal. This included 4.45 acres of new Off-Channel Habitat, and 1.18 acre of new ACM habitat.***
- Objective 2b: Conduct habitat restoration on 1.76 acres of active channel margin habitat to the Willamette River through re-grading, riprap removal, and revegetation.
 - ***Met? YES: 2.01 acres of ACM habitat were restored. This included 0.25 acre of ACM habitat that was not initially counted due to BP/ARCO/SMP monitoring well concerns.***
- Objective 2c: Improve the quality of 4.93 acres of shallow water habitat through piling removal and improvements to adjacent ACM habitat.
 - ***Met? YES: The originally proposed 4.93 acres of shallow water was improved through pile removal and shoreline improvement. In addition, 0.64 acre above this total was improved through the inclusion of the previously excluded BP/ARCO polygon. In total, 5.57 acres of shallow water was improved.***
- Objective 2d: Through grading and excavation, create 9.60 acres of fully-functioning forested riparian habitat and 4.90 acres of fully-functioning forested upland habitat.

¹ This total includes 22.26 acres of land above OLW owned by the applicant, and 5.57 acres of DSL leased aquatic land. Within that 27.83 acres is 0.89 acre within the Linnton Water Credits parcel and the DSL lease that has recently been included for credit based on the removal of the BP/ARCO monitoring wells. The 27.83 acres total also includes 0.27 acre of easements that are not included in the credit-generating area.

- ***Met? PARTIALLY: 9.39 acres of riparian and 4.98 acres of upland habitat have been created. While the as-built upland acreage exceeds the proposed acreage, the riparian acreage is short by 0.21 acre. This difference is accounted for by the increase in ACM and Off-Channel habitat.***
- Objective 2e: Remove approximately 700 piles and pile stubs, including many creosote-treated piles, within 0.77 acres of aquatic habitat.
 - ***Met? YES: All piles present (1,978) piles were removed.***
- Objective 2f: Plant and manage appropriate native vegetation throughout the different habitat types to facilitate the establishment of vegetative cover and minimize nonnative plant establishment.
 - ***Met? YES: Native trees, shrubs, forbs, and grasses were planted throughout the site, with species and form appropriate for the habitat type. Shifts in species and zones were conducted based on best professional of the plant installer. All quantity standards (e.g., plant density, species diversity) were met.***
- Objective 2g: Install 3 to 4 structural habitat features per acre of ACM, Off-Channel, Riparian and Upland habitat to provide complexity for fish and wildlife.
 - ***Met? YES: 65 habitat features have been installed over 18.8 acres, equaling 3.5 per acre, per 100% design plan sheets. Features were installed in the Upland, Riparian, and Off-Channel habitats; they were not installed in the ACM, per 100% designs.***

Goal 3: Ensure the long-term success of the restored habitat through monitoring, maintenance and stewardship.

- Objective 3a: Conduct select pre-construction baseline lamprey and wildlife monitoring.
 - ***Met? YES: Baseline wildlife monitoring was conducted by the applicant's representative prior to construction, and results were included in the HDP. Baseline lamprey monitoring was conducted by USFWS prior to construction.***
- Objective 3b: Implement a site-specific performance plan with performance standards to track the development of the site.
 - ***Met? ON TRACK: A site-specific performance plan was prepared and submitted to the Trustees prior to construction. Year 1 monitoring will be conducted in 2020.***
- Objective 3c: Minimize colonization of the site by noxious species, as defined in the performance standards.
 - ***Met? ON TRACK: Noxious weeds were removed from the site during construction, bare soil was seeded with an approved native seed mix at the earliest opportunity, and ongoing monitoring and maintenance will be conducted to prevent colonization of noxious weeds.***
- Objective 3d: Maintain fish access to the Off-Channel habitat.
 - ***Met? ON TRACK: The as-built site provides fish access, and monitoring will be conducted to ensure access is preserved.***
- Objective 3e: Identify and rectify obstacles to habitat development or use, as defined in the performance standards.
 - ***Met? ON TRACK: Objective 3e will be met through implementation of the post-construction performance plan.***
- Objective 3f: After the Performance Period, implement a long-term stewardship program.

- ***Met? ON TRACK: The Long-Term Stewardship Plan has been approved, and will be implemented after the 10-year monitoring period.***

Goal 4: Support human enjoyment of the site.

- Objective 4a: Construct a view platform and path, which connects to the City of Portland Greenway Trail that is mapped as passing by the site.
 - ***Met? ON TRACK: This overlook is planned and accounted for, but not yet constructed.***
- Objective 4b: Discourage human use of the habitat site through fences and signage.
 - ***Met? ON TRACK: A fence has been partially installed around the site, and will be completed in 2020. Signage will be installed in 2020.***
- Objective 4c: Place educational signage on site that informs the public about the habitat site, as well as the history of the site as a lumber and plywood mill.
 - ***Met? ON TRACK: The educational signage will be installed coincidentally with the overlook described in Objective 4a above.***

Table 7. As-built performance standard comparison

Monitoring Element	Monitoring Question	Performance Standards	Proposed	Constructed	Met Performance Standard?
Geomorphic/ Structural Habitat Elements	<ul style="list-style-type: none"> Did the constructed restoration project create the quantity and quality of fish and wildlife habitat that were proposed? Was the project constructed according to its final design? Are any adjustments necessary to achieve desired site conditions as described in the restoration plan for the site? Were as many habitat elements placed on site as proposed in designs? Are the fish able to enter and exit the site? 	A1. Constructed acreage within 10% of proposed acreage in all habitat categories	Upland: 4.90 Riparian: 9.60 ACM: 2.90 Off-Channel: 4.34 Shallow: 4.93	Upland: 4.98 Riparian: 9.37 ACM: 3.19 Off-Channel: 4.45 Shallow: 5.57	Upland: +2%; yes Riparian: -6%; yes ACM: +10%; yes ¹ Off-Channel: +2.5%; yes Shallow: +13%; yes ³
		A2. Elevations of the Off-Channel habitat are within 0.67 ft of proposed elevation;	Mouth elev: +5' High point elev: +10' Inlet elev: ~+9'	Mouth elev: +5' High point elev: +10' Inlet elev: ~+9'	Yes. In location-specific comparisons (Attachment 3, Figures 9-13), as-built elevations vary between up to 1.16' higher and 0.93' lower than the design elevation at the bottom of the channel. However, the inlet, high point, and mouth elevations are the same.
		A3. Elevations of the bottom of the flow-through channel at the upstream and downstream ends are within 0.67 ft of proposed elevation.	Mouth elev: +5' High point elev: +10' Inlet elev: ~+9'	Mouth elev: +5' High point elev: +10' Inlet elev: ~+9'	Yes.
		A4. Presence of 100% of the installed structural habitat elements.	Log structures: 5 Habitat log w/ rootwad: 20 Snag logs: 15 Boulder clusters: 15 Debris piles: 10	Log structures: 5 Habitat log w/ rootwad: 20 Snag logs: 15 Boulder clusters: 15 Debris piles: 10	Yes (Attachment 1, Figure 3)
		A5. Fish passage/accessibility to the site maintained.	<ul style="list-style-type: none"> No obstructions to fish ingress/ egress No jump heights >6" No slopes >4% 	<ul style="list-style-type: none"> No obstructions to fish ingress/ egress No jump heights >6" No slopes >4% 	<ul style="list-style-type: none"> Yes (see photos in Section 5.2.3; Attachment 3, Figures 9-13)

¹ This increase is due to the inclusion of the SMP polygons that were not included in the design due to uncertainty about their availability. Without considering those polygons, the acreage comparisons would be +1% for ACM and 0% for Shallow.

			<ul style="list-style-type: none"> Linnton culvert discharging 11/1-6/30. 	<ul style="list-style-type: none"> Linnton culvert discharging 11/discharging 11/1-6/30. 	<ul style="list-style-type: none"> Yes; see photos 8-13 above
Vegetation	<ul style="list-style-type: none"> Was the project constructed according to its final design? Are any adjustments necessary to achieve desired site conditions as described in the restoration plan for the site? 	<p>Riparian/Upland Forested</p> <p>C1. Riparian/Upland Forested – woody stem density</p> <p>C2. Riparian/Upland Forested – species diversity</p> <p>Off-Channel Shrub</p> <p>C3. Off-Channel Shrub – woody stem density</p> <p>C4. Off-Channel Shrub – species diversity</p> <p>Off-Channel Emergent</p> <p>C5. Off-Channel Emergent – species diversity</p> <p>C6. Off-Channel Emergent – plug density</p> <p>C7. Off-Channel Emergent – seeding rate</p>	<p>Riparian/Upland Forested</p> <ul style="list-style-type: none"> A minimum of 2,000 native woody stems planted per acre. At least 3 native tree species and 5 native shrub species. <p>Off-Channel Shrub</p> <ul style="list-style-type: none"> A minimum of 2,000 native woody stems planted per acre. At least 5 native shrub species. <p>Off-Channel Emergent</p> <ul style="list-style-type: none"> At least 5 native emergent species. A minimum of 5,000 plugs per acre from +8.5 to +10 ft (Off-Channel Emergent Zone only) A minimum of 50 lbs of grass/emergent seed mix per acre from +8.5 ft to +12 ft NAVD88 (Off-Channel Emergent Zone only) 	<p>Riparian/Upland Forested</p> <ul style="list-style-type: none"> 3,588 woody stems planted per acre (trees plus shrubs) 16 tree species, 25 shrub species <p>Off-Channel Shrub</p> <ul style="list-style-type: none"> 7,180 woody stems planted per acre (trees plus shrubs) 5 native species (2 tree, 3 shrub species) <ul style="list-style-type: none"> 10 native species planted (4 seeded, 6 as plugs) 9,290 plugs per acre <ul style="list-style-type: none"> 29 lbs/acre 	<ul style="list-style-type: none"> Yes Yes Yes Yes Yes Yes No – There was a discrepancy between this standard and the rate specified in the 100% design (29 lb/ac). 29 lb/ac is a standard seed rate, and combined with the installation of nearly twice the density of plugs, this seeding rate is not expected to affect survival or plant establishment.

Portland Harbor NRDA Restoration Goals Questions					Notes
Geomorphic/ Structural Habitat Elements	<ul style="list-style-type: none"> How much mink and bald eagle habitat was restored? 	N/A	Pre-Const., Year 0, Year 10	Any time	<u>Bald eagle</u> : and 13.18 acres (Riparian and Off-Channel areas planted with trees—above +13 ft NAVD88) and 3,273 linear ft of shoreline; <u>Mink</u> : 7.64 acres (ACM plus Off-Channel) and 2,979 linear ft of mink habitat.
Fish and Wildlife	<ul style="list-style-type: none"> What birds are using the site? Do changes in the bird assemblage, diversity and abundance at the site indicate that habitat quantity and quality have improved? 	N/A	Years 0, 1, 3, 5, 10	3x, Apr-Jun	Due to timing of construction, 2020 monitoring will combine Year 0 and Year 1 monitoring.
Photo Monitoring	<ul style="list-style-type: none"> Is vegetation developing in a way that will ultimately generate a native assemblage of appropriate vegetation types? 	N/A	Years 0-10	Jul-Oct	Photo points were set and photos were taken; see Attachment 4

7 REFERENCES CITED

- Grette Associates. 2018. Linnton Mill Restoration Site. Restoration Plan (Final HDP – December 4, 2018).
- USGS. 2020. USGS 14211720 Willamette River at Portland, OR. URL: https://waterdata.usgs.gov/nwis/uv?site_no=14211720.

Attachment 1. As-Built/Record Drawings

Attachment 2. Turbidity Monitoring Log

Attachment 3. Habitat Design Figures

Attachment 4. Photo Point Photographs