TECHNICAL MEMORANDUM

Date: October 22, 2015

To: Derrick Eberle, Bruce Dees & Associates

From: Kris Lepine and Ian Mostrenko, Herrera Environmental Consultants

Subject: Planting Revisions and Substitutions for the Second Year of Construction and Planting (Phase 2) at the Upper Clear Creek Mitigation Site

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This memorandum presents revisions proposed by the Port of Tacoma (Port) to the planting plan for the second year of construction and planting (i.e., Phase 2) at the Upper Clear Creek Mitigation Site (UCCMS). Phase 2 plant zones are shown on Figure 1. Revisions include plant species substitutions due to unavailability, adjustments to boundaries of retained native emergent vegetation, a new emergent wetland floodplain plant zone area, and expansion of planting zones into additional site improvement areas and areas of additional reed canarygrass control within the UCCMS property limits. In accordance with the Basis of Design report (BDA et al. 2013), the Phase 2 planting revisions described in this memorandum include adaptive management measures to address post-construction hydrologic conditions. In addition, revisions include an option for plant species substitutions applicable to replacing plants that died since completion of the first year of construction and planting (i.e., Phase 1). Upon review and approval by the EPA, environmental permitting agencies, and the Port's Umbrella Mitigation Bank Co-Chairs and Interagency Review Team, these proposed revisions will be implemented to finish construction and will be documented in the as-built report.

Timing of Seeding and Planting

The lower elevations of the Phase 2 wetland floodplain plant zones along the new channel were seeded between May and August 2015, and the Phase 2 Emergent Stream Edge plant zones were seeded and planted with bare root emergent plants during July 2015 per a memorandum dated May 20, 2015, regarding "Alternative Wetland Seed Mix & Emergent Seed Option." Seeding and planting only occurred after approval of post-grading topography surveys and installation of an automatic irrigation system. Seeded and planted areas were irrigated on a regular basis throughout the summer and early fall of 2015.

Phase 2 planting of live stake, container-grown, and additional bare root plant materials is scheduled to occur after November 1, 2015, and prior to March 1, 2016. Plant replacements for mortality that occurred following completion of Phase 1 planting will also occur during this timeframe. Seeding and planting activities will be described in more detail in the as-built report.

Plant Substitutions

Proposed plant substitutions for Phase 2 planting to address unavailability are presented in this section. As noted above, the Port proposes an option for substituting plant species for those installed during Phase 1 that are in need of replacement due to mortality. This option is an adaptive planting management measure and is discussed further in the subsequent section of this memorandum.

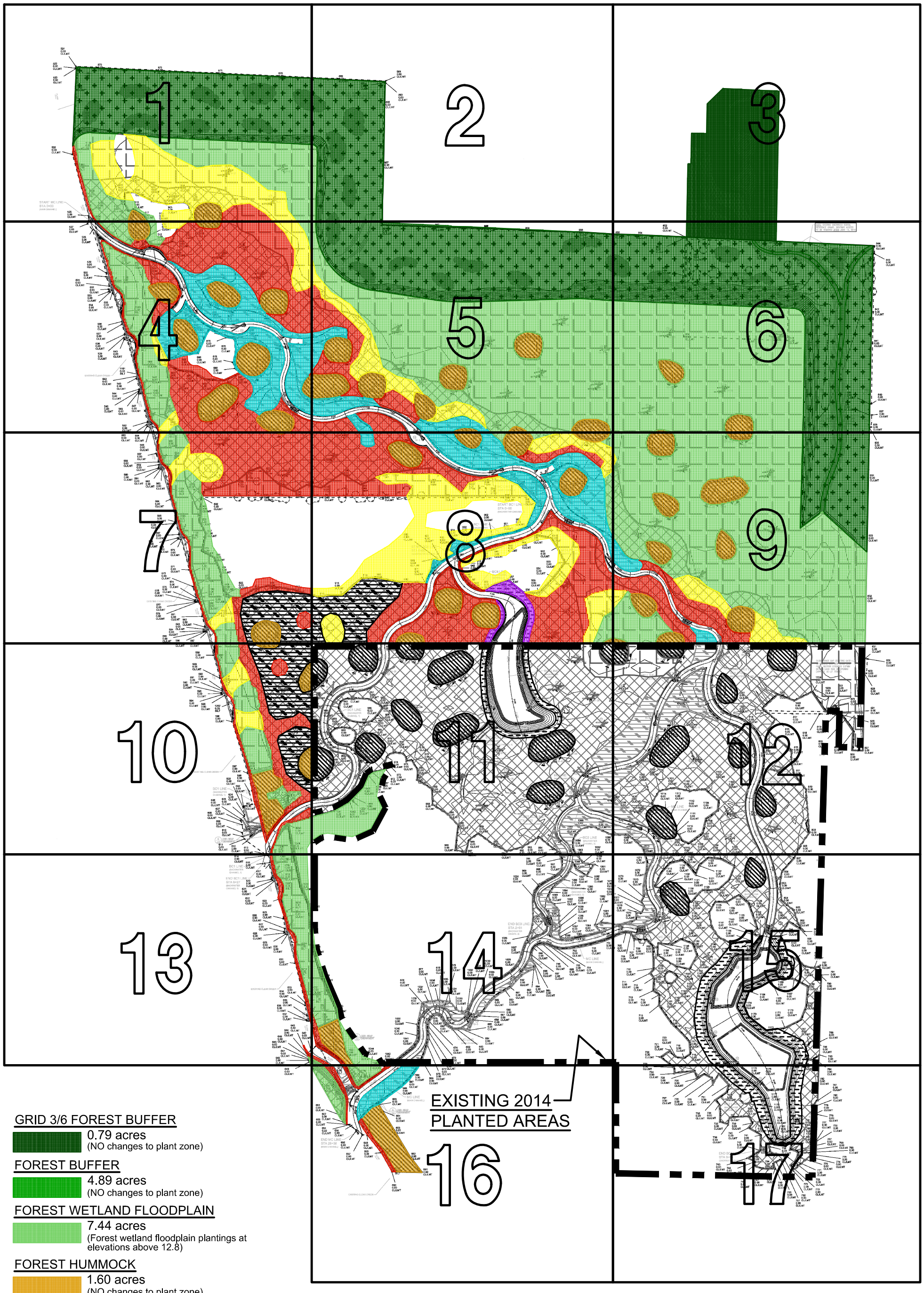
Beaked Sedge

During Phase 2 planting of remaining Emergent Stream Edge plant zones that were not planted in Phase 1, the Port proposes to substitute 4,654 beaked sedge (*Carex utriculata*) with Kellogg's sedge (*Carex lenticularis*). Although beaked sedge was ordered in advance, the landscape subcontractor (Buckley Nursery Company) notified the Port that suppliers cannot provide the necessary quantity due to seed lot issues resulting in poor germination at the nurseries. Multiple nurseries experienced poor seed germination during spring of 2015. The landscape subcontractor stated that other nurseries in Western Washington and Oregon also do not have beaked sedge in stock, which was independently verified by Herrera Environmental Consultants (Herrera). Kellogg's sedge is a suitable substitute because, similar to beaked sedge, it is a functional component of emergent communities throughout the Puget Trough ecoregion and is commonly found in saturated soil and areas of shallow inundation on floodplains along streams. In addition, Kellogg's sedge is typically found in areas of slow moving water and fluctuating water levels characteristic of the UCCMS. Installation of Kellogg's sedge will occur in several higher elevation areas adjacent to stream benches within Grids 4 and 8 that are part of the originally planned Emergent Stream Edge plant zones. Kellogg's sedge is planned for installation during the fall of 2015.

Pacific Blackberry

During Phase 2 planting of buffer plant zones that were expanded into Grid 3 and a small portion of Grid 6, the Port proposes to substitute up to 605 Pacific blackberry (*Rubus ursinus*) with sword fern (*Polystichum munitum*) within designated Shade Buffer plant zones. This substitution will increase the overall quantity of sword fern at the site, and was previously determined to be suitable. Design and implementation of these expanded buffer plant zones was postponed due to an agreement with the prior landowner. As a result, when the Port directed the landscape subcontractor to proceed with ordering plant materials, there was insufficient time to contract-grow the required quantity of Pacific blackberry for Phase 2 planting. In addition, sufficient quantities are not readily available from other nurseries in Western Washington and Oregon because this species is not commonly requested for restoration projects. This was independently verified by Herrera.

FIGURE 1 PHASE 2 - 2015 PLANTING ZONE REVISIONS
10.22.15



GRID 3/6 FOREST BUFFER
0.79 acres
(NO changes to plant zone)

FOREST BUFFER
4.89 acres
(NO changes to plant zone)

FOREST WETLAND FLOODPLAIN
7.44 acres
(Forest wetland floodplain plantings at elevations above 12.8)

FOREST HUMMOCK
1.60 acres
(NO changes to plant zone)

NEW SCRUB-SHRUB WETLAND FLOODPLAIN **(TRANSITION ZONE)**
1.92 acres
(Scrub-shrub wetland floodplain transition plantings (containers) at elevations between 12.8 to 12.5)

NEW SCRUB-SHRUB WETLAND FLOODPLAIN **(FREQUENTLY FLOODED ZONE)**
3.28 acres
(Scrub-shrub wetland floodplain plantings (live stakes) at elevations below 12.5)

NEW EMERGENT WETLAND FLOODPLAIN
0.66 acres
(existing plantings to remain)

EMERGENT STREAM EDGE
1.20 acres
(NO changes to plant zone)

EMERGENT POND EDGE
0.05 acres
(NO changes to plant zone)

0 150' 300'
GRAPHIC SCALE

NORTH

Adaptive Planting Management Measures to Address Post-Construction Hydrologic Conditions

The UCCMS was designed and graded based on an estimated range of long-term sustained base flow (SBF) water surface elevation (WSE) ranging from 11.0 feet to 12.0 feet with an average WSE of 11.5 feet (Port of Tacoma – MLLW datum). Higher than planned SBF WSEs were observed during UCCMS construction in the summer of 2015 in comparison to WSE observations at the site from 2011 to 2014 due to a significant downstream bloom of common waterweed (*Elodea canadensis*). A separate memorandum analyzes planned and observed WSE ranges at the UCCMS (Herrera 2015), concluding that the longer-term average SBF WSE could be as high as 12.0 feet with an upper limit of 12.8 feet based on subsequent evaluation of WSE monitoring data and modeling of the hydraulic effect that common waterweed can have on WSE at the site.

The potential for a higher than planned range of SBF WSE has the largest effect on the establishment of woody plants proposed on low-lying wetland floodplain areas at ground elevations between 11.5 and 12.8 feet. This range of SBF WSE has potential to occur during the growing season (March through October) when prevailing water levels have the most influence on plant establishment. Previously, plants growing in this ground elevation range were not expected to be inundated during low to average SBF and only plants on ground elevations less than 12.0 feet were expected to be temporarily (i.e., sustained for less than two months during the growing season) inundated during times of high SBF at depths upwards of 0.5 feet. Based on the subsequent evaluation of WSE (Herrera 2015), plants at ground elevations less than 12.0 feet could be frequently inundated for most of the growing season in some years. Plants occurring at ground elevations between 12.0 and 12.8 feet could be temporarily inundated during periods of high SBF.

Plant species were originally selected for plant zones based on their adaptation and tolerance to inundation depth and frequency. For example, plant species with lower tolerance to inundation were selected for the Forest Wetland Floodplain on higher ground elevations, whereas plants species with higher tolerance to inundation were selected for the Scrub-Shrub Wetland Floodplain zone on relatively lower ground elevations. Some of the plant species that were originally selected for wetland floodplain plant zones are not tolerant of inundation associated with a future longer-term average SBF WSE of 12.0 feet and an upper limit SBF WSE of 12.8 feet.

Woody wetland vegetation can persist at the higher than planned range of SBF WSE; however, adaptive planting management measures on the UCCMS are necessary to support success of proposed wetland floodplain vegetation communities. To better assure plant survival and establishment, the Port proposes to make adjustments to the boundaries, locations, and plant species composition of wetland floodplain plant zones such that they are better suited to inundation associated with the greater potential range of longer-term SBF WSE. In addition, prior to installation, a wetland biologist will assist with plant layout within each plant zone including positioning of plant species at varying elevations according to their inundation tolerance.

Phase 2 Planting Plan Revisions

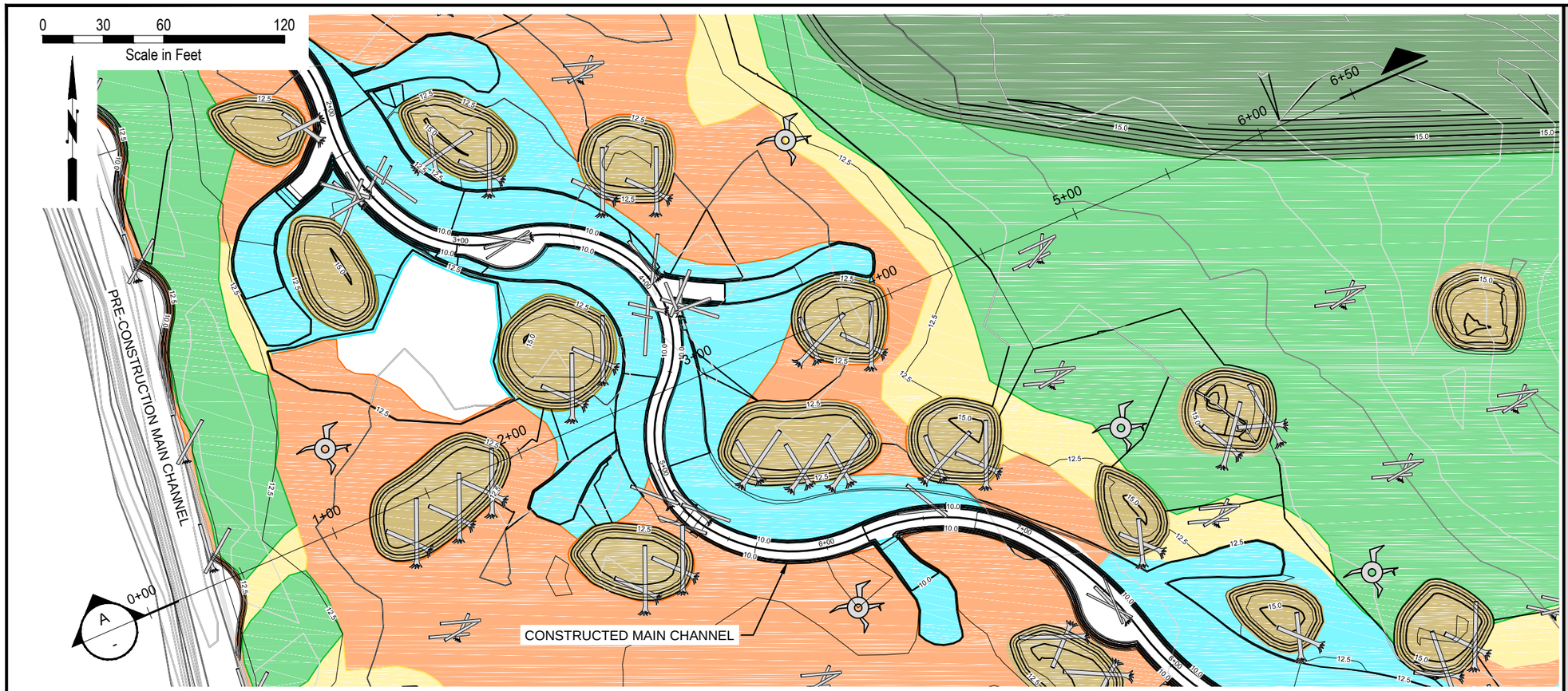
Plant zone adjustments for Phase 2 are summarized below. Figure 1 presents the revised boundaries and locations of Phase 2 plant zones and Table 1 presents the corresponding plant schedule. Figure 2 presents adjusted Phase 2 plant zones in relation to SBF WSEs. Within all of the revised plant zones, plants will be spaced according to originally proposed on-center spacing (12 feet for trees; 5 feet for shrubs; 1.5 or 2.5 feet for groundcover; and 1.5 feet for emergent). As originally proposed, where live stakes are planned, they will be installed as pairs at each on-center planting location.

- Forest Wetland Floodplain: Originally specified plant species are proposed and will be evenly distributed. However, to support survival and establishment of plants with less tolerance to inundation, the low ground elevation limit of planting will be adjusted to approximately 12.8 feet, thereby minimizing the potential for sustained temporary inundation associated with the modified upper limit of SBF WSE.
- Scrub-Shrub Wetland Floodplain: Two distinct plant subzones within the Scrub-Shrub Wetland Floodplain zone will be designated at different ground elevation ranges corresponding to potential SBF WSE. Originally specified plant species are proposed, but they will be redistributed to each subzone based on relative inundation tolerance.
    - Scrub-Shrub Wetland Floodplain -- Frequently Flooded Zone: Only live stakes will be installed, consisting of originally specified willow plant species on low-lying areas between 11.5 and 12.5 feet elevation. At these elevations, willow plant species are more tolerant of frequent and longer periods of sustained temporary inundation (i.e., up to two months). Live stakes will be installed at a lengths of 48 inches (four feet) instead of the range of 24 inches to 42 inches specified in the Basis of Design report (BDA et al. 2103). The additional length is intended to prevent submersion which can lead to failed establishment or mortality. The live stakes will be installed in the ground at the originally planned two-foot depth, thereby providing at least one foot above the water surface during times of high SBF WSE. Proposed plant species in this subzone include Pacific willow (*Salix lasiandra*), Geyer's willow (*S. geyeriana*), Hooker willow (*S. hookeriana*), and Sitka willow (*S. sitchensis*).
    - Scrub-Shrub Wetland Floodplain -- Transition Zone: Only originally specified container-grown plant materials will be installed on relatively higher ground between 12.5 and 12.8 feet elevation. At these elevations, these originally specified plant species are more suited for shorter periods of sustained temporary inundation (i.e., less than one month). Proposed plant species include red twig dogwood (*Cornus sericea*), black twinberry (*Lonicera involucrata*), crabapple (*Malus fusca*), Pacific ninebark (*Physocarpus capitatus*), and peafruit rose (*Rosa pisocarpa*).

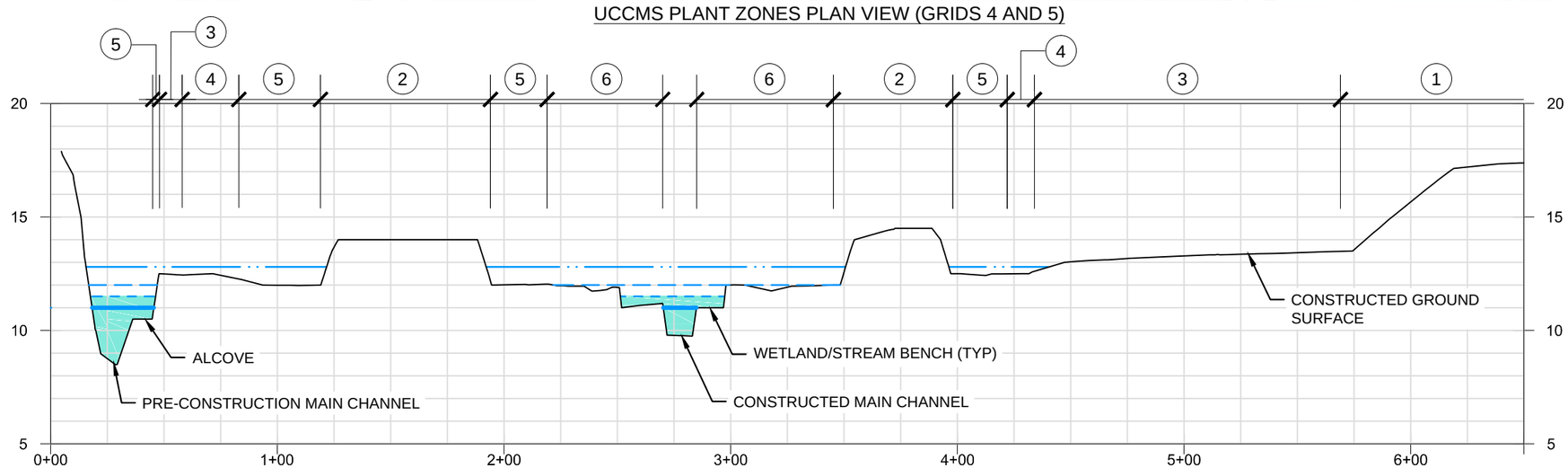
TABLE 1. PHASE 2 (2015-2016) LANDSCAPE PLANT MATERIALS SCHEDULE BY PLANT ZONE

STRATUM	SCIENTIFIC NAME	COMMON NAME	INDICATOR	PLANT MATERIAL	SPACING	PLANT ZONE QUANTITIES												TOTAL PLANT QUANTITIES
						EMERGENT STREAM EDGES	EMERGENT POND EDGES	SCRUB-SHRUB WETLAND FLOODPLAIN -- FREQUENTLY FLOODED	SCRUB-SHRUB WETLAND FLOODPLAIN -- TRANSITION	FOREST WETLAND FLOODPLAIN	FOREST HUMMOCKS	FOREST BUFFER	SUN BUFFER - WEST (GRIDS 3 & 6)	SUN BUFFER - EAST (GRIDS 3 & 6)	SHADE BUFFER - WEST (GRIDS 3 & 6)	SHADE BUFFER - EAST (GRIDS 3 & 6)	BUFFER - DEPRESSION (GRIDS 3 & 6)	
TREE																		
	ACER MACROPHYLLUM	BIG-LEAF MAPLE	FACU	1 GAL. CONT.	12' O.C.							391		13				404
	ALNUS RUBRA	RED ALDER	FAC	1 GAL. CONT.	12' O.C.					290		391	13	13				707
	CRATAEGUS DOUGLASII	BLACK HAWTHORN	FAC	1 GAL. CONT.	12' O.C.					290			13					303
	FRAXINUS LATIFOLIA	OREGON ASH	FACW	1 GAL. CONT.	12' O.C.					290								290
	POPULUS BALSAMIFERA	BLACK COTTONWOOD	FAC	1 GAL. CONT.	12' O.C.					290			13					303
	POPULUS TREMULOIDES	QUAKING ASPEN	FACU	1 GAL. CONT.	12' O.C.					290								290
	PICEA SITCHENSIS	SITKA SPRUCE	FAC	1 GAL. CONT.	12' O.C.					290	266							556
	PINUS MONTICOLA	WESTERN WHITE PINE	FACU	1 GAL. CONT.	12' O.C.							391		13				404
	PSEUDOTSUGA MENZIESII	DOUGLAS FIR	FACU	1 GAL. CONT.	12' O.C.							391		13				404
	RHAMNUS PURSHIANA	CASCARA	FAC	1 GAL. CONT.	12' O.C.					290					29	9		328
	SALIX LASIANDRA	PACIFIC WILLOW	FACW	4' LIVE STAKE	12' O.C.			2286		580								2866
	SALIX SCOULERIANA	SCOULER'S WILLOW	FAC	1 GAL. CONT.	12' O.C.								13					13
	SALIX SCOULERIANA	SCOULER'S WILLOW	FAC	3' LIVE STAKE	12' O.C.												56	56
	THUJA PLICATA	WESTERN RED CEDAR	FAC	1 GAL. CONT.	12' O.C.					290	266				29	9		594
	TSUGA HETEROPHYLLA	WESTERN HEMLOCK	FACU	1 GAL. CONT.	12' O.C.						27	174			29	9		239
SHRUB																		
	ACER CIRCINATUM	VINE MAPLE	FAC	1 GAL. CONT.	5' O.C.						326	1033			59	21		1439
	AMELANCHIER ALNIFOLIA	SERVICEBERRY	FACU	1 GAL. CONT.	5' O.C.						326	1033	36	35				1430
	CORNUS SERICEA	RED TWIG DOGWOOD	FACW	1 GAL. CONT.	5' O.C.				771	2066	326		36					3199
	CORYLUS CORNUTA	BEAKED HAZELNUT	FACU	1 GAL. CONT.	5' O.C.							1033		35	59	21		1148
	HOLODISCUS DISCOLOR	OCEANSPRAY	FACU	1 GAL. CONT.	5' O.C.							1033		35				1068
	LONICERA INVOLUCRATA	BLACK TWINBERRY	FAC	1 GAL. CONT.	5' O.C.				771	2066			36					2873
	MALUS FUSCA	CRABAPPLE	FACW	1 GAL. CONT.	5' O.C.				771	2066								2837
	OEMLERIA CERASIFORMIS	INDIAN PLUM (OSOBERRY)	FACU	1 GAL. CONT.	5' O.C.							1033			59	21		1113
	PHYSOCARPUS CAPITATUS	PACIFIC NINEBARK	FACW	1 GAL. CONT.	5' O.C.				771	2066								2837
	RIBES DIVARICATUM	SPREADING GOOSEBERRY	FAC	1 GAL. CONT.	5' O.C.					2066	326							2392
	ROSA GYMNOCARPA	BALD-HIP ROSE	FACU	1 GAL. CONT.	5' O.C.										59	21		80
	ROSA NUTKANA	NOOTKA ROSE	FAC	1 GAL. CONT.	5' O.C.						326		36	35				397
	ROSA PISOCARPA	PEAFRUIT ROSE	FAC	1 GAL. CONT.	5' O.C.				771									771
	RUBUS PARVIFLORUS	THIMBLEBERRY	FACU	1 GAL. CONT.	5' O.C.							1033	36	35	59			1163
	RUBUS SPECTABILIS	SALMONBERRY	FAC	1 GAL. CONT.	5' O.C.					2066	326							2392
	SALIX GEYERIANA	GEYER'S WILLOW	FACW	4' LIVE STAKE	5' O.C.			3618										3618
	SALIX HOOKERIANA	HOOKER WILLOW	FACW	4' LIVE STAKE	5' O.C.			3618										3618
	SALIX SITCHENSIS	SITKA WILLOW	FACW	4' LIVE STAKE	5' O.C.			3618									28	3646
	SAMBUCUS RACEMOSA	RED ELDERBERRY	FACU	1 GAL. CONT.	5' O.C.						370	1033	36	35	59	21		1554
	SYMPHORICARPOS ALBUS	SNOWBERRY	FACU	1 GAL. CONT.	5' O.C.						326	1033	36	35	59	21		1510
GROUNDCOVER																		
	ATHYRIUM FILIX-FEMINA	LADY FERN	FAC	1 GAL. CONT.	1.5' O.C.				4626						1679	517		6822
	FRAGARIA CHILOENSIS	COAST STRAWBERRY	FACU	1 GAL. CONT.	2.5' O.C.								449	428				877
	POLYSTICHUM MUNITUM	SWORD FERN	FACU	1 GAL. CONT.	2.5' O.C.						9362	14568			945	294		25169
	RUBUS URSINUS	PACIFIC BLACKBERRY	FACU	1 GAL. CONT.	2.5' O.C.							14568	449	428	22	7		15474
EMERGENT																		
	CAREX OBNUPTA	SLOUGH SEDGE	OBL	BARE ROOT	1.5' O.C.	5483	237											5720
	CAREX STIPATA	SAW-BEAK SEDGE	OBL	BARE ROOT	1.5' O.C.	5483												5483
	CAREX LENTICULARIS	KELLOGG'S SEDGE	OBL	BARE ROOT	1.5' O.C.	4654												4654
	ELEOCHARIS PALUSTRIS	CREEPING SPIKERUSH	OBL	BARE ROOT	1.5' O.C.	5483	237											5720
	SCIRPUS SCHOENOPLECTUS	HARDSTEM BULRUSH	OBL	BARE ROOT	1.5' O.C.		237											237
	SCIRPUS MICROCARPUS	SMALL-FRUITED BULRUSH	OBL	BARE ROOT	1.5' O.C.	5483	237											5720
	SPARGANIUM EMERSUM	NARROWLEAF BURREED	OBL	BARE ROOT	1.5' O.C.		237											237

NOTE: PLANT SCHEDULE ONLY APPLIES TO PHASE 2 PLANT ZONES ON FIGURE 1. THE AS-BUILT REPORT WILL DOCUMENT PLANT QUANTITIES INSTALLED ON THE OVERALL UCCMS.



UCCMS PLANT ZONES PLAN VIEW (GRIDS 4 AND 5)



CROSS SECTION - GROUND SURFACE AND WSE (A / -)

Horizontal Scale in Feet
30 0 30 60
3 0 3 6
Vertical Scale in Feet
Vertical Exaggeration X 10

Figure 2.
Phase 2 Plant Zones and Sustained Base Flow Water Surface Elevation (WSE).

Legend

PLANT ZONES

- 1 Forest Buffer
- 2 Forest Hummock
- 3 Forest Wetland Floodplain
- 4 Scrub-Shrub Wetland Floodplain-Transition
- 5 Scrub-Shrub Wetland Floodplain-Frequently Flooded
- 6 Emergent Stream Edge

SUSTAINED BASE FLOW WATER SURFACE ELEVATION (WSE)

- Upper Limit (2015 Data)
- Adjusted High Average (2015 Data) and Former Planned Upper Limit
- Planned Design Average
- Planned Lower Limit
- Permanent Inundation

HERRERA

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Phase 1 Plant Replacement

Plants installed during Phase 1 that have since died will be replaced in accordance with specified Landscaping Period requirements. Plants in need of replacement include those in Scrub-Shrub Wetland Floodplain and Forest Wetland Floodplain plant zones that likely died due to intolerance of sustained base flow inundation. These dead plants typically include species that were installed from one-gallon containers. In this case, to support survival of replaced plants, the Port proposes the option of substituting plant species that died with live stakes of Pacific willow, Geyer's willow, Hooker willow, or Sitka willow. Live stake length and installation will be the same as described previously for the Scrub-Shrub Wetland Floodplain – Frequently Flooded zone.

Additional Phase 2 Planting Revisions – Emergent Vegetation Areas and Expansion of Planting Zones into Additional Site Improvement Areas

In addition to adaptive planting management measures, the Port proposes revisions to the boundaries of retained emergent vegetation, a new emergent wetland floodplain zone, and additional planting associated with expansion of wetland floodplain zones in areas where supplemental reed canarygrass control measures were implemented during construction. These revisions are summarized below and presented in Figure 1.

- During site clearing activities, two areas of existing native emergent vegetation (Grids 1 and 4) that were proposed for retention in the EPA Settlement Area were reduced in size by 0.08 acre to remove additional reed canarygrass around the edges. Scrub-Shrub and Forested Wetland Floodplain plant zones will be expanded into the areas where additional reed canarygrass was removed.
- During site clearing activities, an additional 0.05-acre area of existing native emergent vegetation was discovered in the EPA Settlement Area (Grid 1) that was retained. This area contributes to offsetting the reduction of retained emergent area indicated above and further supports habitat interspersion.
- The Port proposes a new emergent wetland floodplain zone in the Port Umbrella Mitigation Bank Area (Grids 7, 8, and 10). This zone was seeded with the wetland seed mix during the fall of 2014 and was originally planned for planting in Phase 2 as part of a Scrub-Shrub Wetland Floodplain plant zone. Since it was seeded, this zone has established into a dense and diverse emergent plant community colonized by native species from the seed mix and others that established from the existing seed bank (i.e., volunteers). The Port proposes to maintain this new emergent zone with the objective of increasing plant community diversity on the UCCMS. Small patches of Scrub-Shrub Wetland Floodplain zones are proposed within this emergent zone to increase habitat interspersion.
- In support of further enhancing wetlands on the UCCMS, the Port proposes additional planting associated with expanding wetland floodplain zones to establish native

vegetation in sparsely vegetated areas where supplemental reed canarygrass control measures (mowing and herbicide treatments) were implemented during construction.

- An additional 25-square-foot area of live stake planting is proposed on the west bank of the pre-construction Clear Creek channel directly downstream of the deflector structure that diverts flow into the new main channel near the upstream limits of the UCCMS (Grid 13). This additional planting is intended to prevent potential bank erosion during high flows by increasing soil cohesion.

Effect of Adaptive Planting Management Measures and Additional Planting Revisions on Plant Zone Areas and Quantities

Table 2 presents the effect of Phase 2 adaptive planting management measures and additional planting revisions on the areas of the various UCCMS plant zones. Table 1 presents the plant schedule for plant quantities associated with each plant zone. In addition to changes presented in this memorandum, Tables 1 and 2 include the additional buffer planting of Grid 3 and northern portion of Grid 6 that was previously approved for planting. The following sections summarize effects of planting revisions on the EPA Settlement Area, Port Umbrella Mitigation Bank Area, and overall for the UCCMS.

EPA Settlement Area

The overall planting area within the EPA Settlement Area will remain the same. In addition, the sizes of EPA Settlement Area components will remain the same including 7.56 acres of mitigation wetland area, 4.00 acres of forested riparian buffer, and 3,400 linear feet of fisheries enhancement stream channel. The adaptive planting management measures discussed in this memorandum will result in an overall increase of approximately 0.76 acre of Scrub-Shrub Wetland Floodplain plant zones (Frequently Flooded and Transition subzones) and decrease of approximately 0.73 acre of the Forest Wetland Floodplain plant zone. As a result of these changes, additional live stakes (willow species) will be ordered for the Scrub-Shrub Wetland Floodplain – Frequently Flooded subzone and fewer container-grown plants will be planted in the Scrub-Shrub and Forested Wetland Floodplain plant zones. As a result of revisions to retained emergent vegetation zones, there will be a slight decrease (0.03 acre) in the overall area of emergent wetland zones.

Table 2. Effect of Phase 2 Adaptive Planting Management Measures and Additional Planting Revisions on UCCMS Plant Zones.

Plant Zone	EPA Settlement Area			Port Umbrella Mitigation Bank Area			Overall UCCMS		
	Previous Planting Plan Area (acres)	Updated Planting Plan Area (acres)	Difference (acres)	Previous Planting Plan Area (acres)[b]	Updated Planting Plan Area (acres)	Difference (acres)	Previous Planting Plan Area (acres)[b]	Updated Planting Plan Area (acres)	Difference (acres)
Emergent Wetland Zones									
Emergent Stream Edges[a]	0.94	0.94	0	0.89	0.89	0	1.83	1.83	0
Emergent Pond Edges[a]	n/a	n/a	n/a	0.50	0.50	0	0.50	0.50	0
New Emergent Wetland Floodplain	n/a	n/a	n/a	0	0.66	0.66	0	0.66	0.66
Retained Emergent Vegetation	0.23	0.20	-0.03	n/a	n/a	n/a	0.23	0.20	-0.03
Subtotal	***1.17***	***1.14***	***-0.03***	***1.39***	***2.05***	***0.66***	***2.56***	***3.19***	***0.63***
Scrub-Shrub Wetland Zones									
Scrub-Shrub Wetland Floodplain (original zone)	2.27	0	-2.27	7.06	4.57	-2.49	9.33	4.57	-4.76
New Scrub-Shrub Wetland Floodplain -- Frequently Flooded (live stakes)	0	1.97	1.97	0	1.26	1.26	0	3.23	3.23
Expanded to include additional RCG control areas	0	0.03	0.03	0	0.03	0.03	0	0.06	0.06
New Scrub-Shrub Wetland Floodplain -- Transition (containers)	0	1.00	1.00	0	0.46	0.46	0	1.46	1.46
Expanded to include additional RCG control areas	0	0.03	0.03	0	0.44	0.44	0	0.47	0.47
Subtotal	***2.27***	***3.03***	***0.76***	***7.06***	***6.76***	***-0.30***	***9.33***	***9.78***	***0.45***
Forest Wetland Zones									
Forest Wetland Floodplain	3.27	2.51	-0.76	5.04	4.99	-0.05	8.31	7.50	-0.81
Expanded to include additional RCG control areas	0	0.03	0.03	0	0.30	0.30	0	0.33	0.33
Subtotal	***3.27***	***2.54***	***-0.73***	***5.04***	***5.29***	***0.25***	***8.31***	***7.83***	***-0.48***
Forest Hummocks Zones[a]	***0.85***	***0.85***	***0***	***1.57***	***1.57***	***0***	***2.42***	***2.42***	***0***
Forest Buffer Zones									
Forest Buffer[a]	4.00	4.00	0	0.89	0.89	0	4.89	4.89	0
New Grid 3 and 6 Forest Buffer Zones	n/a	n/a	n/a	0	0.79	0.79	0	0.79	0.79
Subtotal	***4.00***	***4.00***	***0***	***0.89***	***1.68***	***0.79***	***4.89***	***5.68***	***0.79***
Total	**11.56**	**11.56**	**0**	**15.97**	**17.35**	**1.40**	**27.51**	**28.91**	**1.40**

RCG: Reed canarygrass

n/a: Not applicable

[a] No changes proposed to Emergent Stream Edges, Emergent Pond Edges, Forest Hummocks, and Forest Buffer plant zones.

[b] Reflects original planting plan and previously approved revision to Emergent Pond Edges.

Note: Plant zone areas are not reflective of habitat areas presented in the Basis of Design report (BDA et al. 2013).

Port Umbrella Mitigation Bank Area

The overall planting area within the Port Umbrella Mitigation Bank Area will increase by about 1.40 acres. This is attributed to the additional buffer planting in Grids 3 and 6 and expanded wetland floodplain zones in Grids 8 and 11. The overall area of the Scrub-Shrub Wetland Floodplain plant zone will decrease by about 0.30 acre. This is attributed to designating 0.66 acre of a new emergent wetland floodplain that was previously designated as Scrub-Shrub Wetland Floodplain plant zone. The overall area of the Forest Wetland Floodplain plant zone will increase by approximately 0.25 acre which is attributed to expanding this zone into areas of additional reed canarygrass control during construction.

As a result of these changes, additional live stakes (willow species) will be planted in the Scrub-Shrub Wetland Floodplain zone, specifically associated with designation of the new frequently flooded subzone. Also, additional container-grown plants will be planted in the Forest Wetland Floodplain and new forest buffer zones in Grids 3 and 6.

Overall UCCMS

The overall planting area on the UCCMS will increase by about 1.40 acres. As a result of planting revisions in the EPA Settlement Area and Port Umbrella Mitigation Bank Area, the following changes in planting areas will occur:

- Emergent wetland floodplain plant zones will increase by approximately 0.63 acre
- Scrub-shrub wetland floodplain plant zones will increase by approximately 0.45 acre
- Forest wetland floodplain plant zones will decrease by approximately 0.48 acre
- Forest Buffer plant zones will increase by approximately 0.79 acre

Effect of Adaptive Planting Management Measures and Additional Planting Revisions on Basis of Design Assumptions

Implementation of Phase 2 adaptive planting management measures and the planting revisions described herein are expected to achieve proposed project targets, standards, success criteria, and ecosystem area and functions as described in the Basis of Design (BOD) Report prepared for the UCCMS (BDA et al. 2013).

Project Targets, Standards and Success Criteria

The objective of proposed adaptive management measures affecting wetland vegetation communities between elevations 11.5 and 12.8 feet is to provide more robust, resilient, and sustainable vegetation that can accommodate the higher anticipated range of BSF WSEs. Implementation of adaptive management measures is intended to increase plant survival rates and support healthy plant establishment which will increase likelihood of success in achieving

project cover standards for planted forested and scrub-shrub floodplain wetlands and plant survival (Target 5, Standards A, B, and F -- Tables 4 and 5 in the BOD report). As a result, these measures are expected to increase likelihood of success in achieving the project target of creating/restoring a functioning mosaic of diverse floodplain wetland plant communities on the UCCMS (Target 5, Tables 4 and 5 in the BOD report).

Overall, the acreage of wetland and buffer plant zones will remain the same (EPA Settlement Area) or increase (Port Umbrella Mitigation Bank Area) relative to the original design. Proposed adjustments to the boundaries of emergent, scrub-shrub, and forest wetland plant zones will result in slight increases and decreases (difference of an acre or less) in the areas of those plant zones. However, the total sizes of these wetland plant zones will remain robust and therefore continue to support achieving standards for number of wetland classes and strata for planted communities across the UCCMS (Target 5, Standards D and E; and Target 7, Standard A -- Tables 4 and 5 in the BOD report).

Ecosystem Area and Function

Proposed planting revisions will continue to increase the functions provided by the site at a similar level documented in the BOD report, including habitat quality, complexity, structure, and function. Slightly higher than anticipated WSE during the growing season on low-lying portions of the UCCMS will provide additional habitat for wetland associated macroinvertebrate, fish, and amphibian species. By implementing the proposed planting revisions, vegetation is expected to support habitat for these species by providing habitat structure, regulating water temperature by shading surface water, and contributing leaf litter. Wetland vegetation is expected to persist at the higher anticipated range of BSF WSEs; therefore, proposed acreages of future habitat types are expected to be similar for created wetland, restored wetland, and enhanced forested wetland habitat types presented in Table 11 of the BOD report. Any changes in acreages of these habitat types will be documented in the as-built report.

Proposed planting revisions will continue to support increases in ecosystem functions summarized in the BOD report including:

- Improved water quality functions by increasing forest and shrub vegetation to further slow water velocities
- Improved hydrologic functions by increasing native vegetation cover
- Improved habitat functions by increasing structural vegetation diversity, complexity, plant community diversity, and habitat interspersion.

References

Bruce Dees & Associates (BDA), Grette Associates, and Herrera Environmental Consultants. 2013. Basis of Design Report – Upper Clear Creek Mitigation Site. Prepared for the Port of Tacoma. April 22, 2013.

Herrera. 2015. Evaluation of Planned and Post-Construction Observed Water Surface Elevations for the Upper Clear Creek Mitigation Site Project. Memorandum prepared for Derrick Eberle, Bruce Dees & Associates by Kris Lepine and Ian Mostrenko, Herrera Environmental Consultants. October 21, 2015.