

# Appendix G

## Vegetation Observations

---

# 1 Introduction

A visual inspection of shoreline vegetation and substrate along the middle reach of the Lower Duwamish Waterway was conducted by boat on July 22, 2024, and from shore on August 18, 2024, as part of the Phase II Pre-Design Investigation (PDI). This inspection built on the information collected during the PDI Phase I visual bank inspection but focused on areas where remediation is anticipated to occur. The inspection included the collection of photographs and detailed observations to document shoreline vegetation within the Phase I remedial action level (RAL) exceedance areas along the middle reach. During the planning phase of the program, periods of predicted daytime moderately low tides (i.e., low enough to observe bank conditions while still being accessible by boat) were identified as potential survey dates, and actual inspection dates were selected based on forecasted weather conditions and team availability. This appendix provides focused information related to vegetation that may be disturbed during remedial action. Methods to collect this information are detailed in the Phase II Quality Assurance Project Plan Addenda (Anchor QEA and Windward 2024a, b).

## 1.1 Vegetation Observation and Photographs

Abbreviated terms for species of trees, shrubs, and grass/herbaceous communities observed are defined in Tables G1-1 and G1-2. At each Phase II RAL exceedance area, photographs were taken, and observations were recorded to document vegetation types. Typically, observations were made for the top of bank, middle of bank, and toe of bank. The vegetation types and shorelines are detailed in Table G1-3. Representative photographs for each segment are included in Attachment G-1.

**Table G1-1**  
**Plant Community Definitions**

Plant Community <sup>1,2</sup>	Species <sup>3</sup>	Notes
<b>Trees</b>		
T1	ACCI, MAFU	Dominated by native species, typically overbank zone
T2	POBA, SASC	Dominated by native species, typically overbank zone
T3	LELA, MAFU, PICO	Ornamental trees in landscaped overbank zone
T4	ARME, MAFU, PICO, PSME, ROPS	Mix of native and non-native species, typically overbank zone
<b>Shrubs</b>		
S1	CYSC, RUAR	Dominated by non-native species
S2	RHMA, RUAR	Mix of native and non-native species
S3	HEHE, RUAR	Dominated by non-native species
S4	POCU, RUAR	Dominated by non-native species
<b>Grass, Ferns, Herbaceous</b>		
GH1	ACMI, TAVU	Dominated by non-native species
GH2	CAOB, TAVU	Dominated by non-native species
GH3	DACA, TAER, TAVU	Dominated by non-native species
GH4	FOVU, LELA	Dominated by non-native species

Notes:

1. Plant community categories represent typically present and dominant species.
2. Categories are not intended to provide a comprehensive list of all species present.
3. Species codes are defined in Table G1-2.

**Table G1-2**  
**Species Codes**

Species Name	Common Name	Native/Non-Native	Code
<b>Native Trees</b>			
<i>Acer circinatum</i>	Vine maple	Native	ACCI
<i>Alnus rubra</i>	Red alder	Native	ALRU
<i>Arbutus menziesii</i>	Madrone	Native	ARME
<i>Malus fusca</i>	Pacific crabapple	Native	MAFU
<i>Pinus contorta</i>	Shore pine	Native	PICO
<i>Picea glauca</i>	White spruce	Native	PIGL
<i>Populus balsamifera</i> syn. <i>Trichocarpa</i>	Black cottonwood	Native	POBA
<i>Pseudotsuga menziesii</i>	Douglas fir	Native	PSME
<i>Salix scouleriana</i>	Scouler willow	Native	SASC
<b>Non-Native Trees</b>			
<i>Cercis canadensis</i>	Merlot redbud	Non-native	CECA
<i>Populus nigra</i>	Lombardy poplar	Non-native	PONI
<i>Prunus domestica</i>	Domestic plum	Non-native	PRDO

Species Name	Common Name	Native/Non-Native	Code
<i>Prunus laurocerasus</i>	Cherry laurel	Non-native	PRLA
<i>Robinia pseudoacacia</i>	Black locust	Non-native	ROPS
<b>Native Shrubs</b>			
<i>Holodiscus discolor</i>	Ocean spray	Native	HODI
<i>Rhododendron macrophyllum</i>	Pacific rhododendron	Native	RHMA
<i>Symphoricarpos albus</i>	Snowberry	Native	SYAL
<b>Non-Native Shrubs</b>			
<i>Buddleia davidii</i>	Butterflybush	Non-native	BUDA
<i>Cytisus scoparius</i>	Scotch broom	Non-native	CYSC
<i>Hedera helix</i>	English ivy	Non-native	HEHE
<i>Polygonum cuspidatum</i>	Japanese knotweed	Non-native	POCU
<i>Rubus armeniacus</i>	Himalayan blackberry	Non-native	RUAR
<b>Native Grass, Ferns, Herbaceous</b>			
<i>Achillea millefolium</i>	Yarrow	Native	ACMI
<i>Artemisia suksdorfii</i>	Coastal mugwort	Native	ARSU
<i>Berberus aquifolium</i>	Oregon grape	Native	BEAQ
<i>Carex obnupta</i>	Slough sedge	Native	CAOB
<i>Eschscholzia californica</i>	California poppy	Native	ESCA
<i>Schoenoplectus acutus</i>	Hardstem bulrush	Native	SCAC
<i>Symphyotrichum chilense</i>	Pacific aster	Native	SYCH
<i>Tagetes erecta</i>	American marigold	Native	TAER
<i>Typha latifolia</i>	Cattail	Native	TYLA
<b>Non-Native Grass, Ferns, Herbaceous</b>			
<i>Atriplex hortensis</i>	Orache	Non-native	ATHO
<i>Chamaemelum nobile</i>	Roman chamomile	Non-native	CHNO
<i>Cirsium arvense</i>	Canada thistle	Non-native	CIAR
<i>Daucus carota</i>	Wild carrot	Non-native	DACA
<i>Foeniculum vulgare</i>	Common fennel	Non-native	FOVU
<i>Lathyrus latifolius</i>	Sweet pea	Non-native	LALA
<i>Lepidium latifolium</i>	Perennial pepperweed	Non-native	LELA
<i>Persicaria maculosa</i>	Spotted Lady's Thumb	Non-native	PEMA
<i>Plantago lanceolata</i>	Narrow-leaved plantain	Non-native	PLLA
<i>Solanum dulcamara</i>	Bittersweet nightshade	Non-native	SODU
<i>Sonchus oleraceus</i>	Common sowthistle	Non-native	SOOL
<i>Taraxacum officinale</i>	Common dandelion	Non-native	TAOF
<i>Tanacetum vulgare</i>	Common tansy	Non-native	TAVU
<b>Native Aquatic Vegetation</b>			
<i>Fucus distichus</i>	Rockweed	Native	FUDI
<i>Phyllospadix</i> spp.	Surfgrass	Native	PHYL
<i>Ulva Lactuca</i>	Sea lettuce	Native	ULLA
<b>Non-Native Aquatic Vegetation</b>			
<i>Cladophora columbiana</i>	Green tuft algae	Non-native	CLCO

**Table G1-3  
Phase II Vegetation Data**

Phase I RAL Exceedance Area <sup>1</sup>	RM <sup>2</sup>	Location Along Bank	Substrate/Structure	Species	% of Cover <sup>3</sup>	Notes
33 (35)	1.8E	Top of bank	Ecology block wall and containers.	RUAR*	80	Vegetation only at top of bank that overhangs middle of bank. EA – exceedance area RAL – remedial action area
				ACCI	5	
				MAFU	1	
				LALA*	1	
				ACMI	1	
				TAVU*	1	
				CAOB	1	
		CYSC*	1			
Middle of bank	Large broken concrete; large riprap	-	-	Vegetation overhanging from top of bank.		
Toe of bank	Gravel and fines with brick, broken concrete, and broken creosote wood debris	ULLA	1	Interspersed algae with barnacles on subtidal rock and debris.		
		FUDI	1			
32 (34)	1.85E	Top of bank	Ecology block wall and containers.	RUAR*	80	Vegetation only at top of bank that overhangs middle of bank.
				POCU*	10	
				TAVU*	1	
				CAOB	1	
		Middle of bank	Large broken concrete; large riprap	-	-	Vegetation overhanging from top of bank.
		Toe of bank	Gravel and fines with brick, and broken concrete	ULLA	1	Interspersed algae with barnacles on subtidal rock and debris.
FUDI	1					

Phase I RAL Exceedance Area <sup>1</sup>	RM <sup>2</sup>	Location Along Bank	Substrate/Structure	Species	% of Cover <sup>3</sup>	Notes
26 (NA <sup>4</sup> )	2.05W	Top of bank	Paved and unpaved trail	RUAR*	20	Vegetation only at top of bank. Pine trees appeared stressed or dying with browning needles or leafless branches.
				DACA*	5	
				TAVU*	5	
				TAER	1	
				PLLA*	1	
				BUDA*	1	
				PICO	10	
		Middle of bank	Riprap, broken concrete, and quarry spall	ULLA	1	Interspersed algae with barnacles on subtidal rock and debris.
				FUDI	1	
Toe of bank	Sand, gravel, and fines	-	-	No vegetation		
29 (31)	1.95E	Top of bank	Paved trail and road	CHNO*	1	Narrow vegetated strip between trail and edge of bank. Some native species (e.g., snowberry, SYAL) appear stressed with browning leaves.
				BUDA*	1	
				SYAL	10	
				ROPS*	5	
				LELA*	5	
				FOVU*	10	
		Middle of bank	Broken concrete, riprap, quarry spall	ATHO*	1	Barnacles on subtidal rock and debris. Patchy distribution of orache (ATHO).
		Toe of bank	Sand, gravel, and fines	-	-	No vegetation

Phase I RAL Exceedance Area <sup>1</sup>	RM <sup>2</sup>	Location Along Bank	Substrate/Structure	Species	% of Cover <sup>3</sup>	Notes
27 (29)	2.0E	Top of bank	Fill, pavement	BUDA*	10	Previously restored area at top of bank. Planted vegetation (e.g., snowberry, SYAL, and ocean spray, HODI) appear stressed with browning leaves and bare branches.
				RUAR*	20	
				ARSU	10	
				CHNO*	1	
				SYAL	10	
				HODI	10	
				PRDO*	5	
Middle of bank	Riprap, quarry, concrete poured over timber.	-	-	No vegetation		
Toe of bank	Sand, gravel, and fines	-	-	No vegetation		
21 (24 and 27)	2.2W	Top of bank	Chain link fence and ecology blocks	RUAR*	50	Native vegetation showing signs of stress with two dead black cottonwood trees (POBA). Vegetation along entire shoreline between containers and top of bank.
				SCAC	1	
				LELA*	1	
				ARSU	1	
				BUDA*	10	
				ALRU	1	
				TAVU*	1	
				CYSC*	1	
				POBA	15	
				HEHE*	15	
				SASC	5	
				RHMA	1	
		Middle of bank	Broken concrete (slabs and columns), riprap	ULLA	1	Barnacles on subtidal rock and debris. Patchy distribution of orache (ATHO).
		ATHO*	1			
Toe of bank	Sand, gravel, and fines	PHYL	20	Short surfgrass interspersed throughout upper intertidal of mudflat.		
33 (35)	1.75E	Top of bank	Ecology blocks and eroding concrete slab along top of bank	MAFU	5	Ornamental trees and shrubs interspersed along partially eroding top bank
				PICO	5	
				CECA*	5	

Phase I RAL Exceedance Area <sup>1</sup>	RM <sup>2</sup>	Location Along Bank	Substrate/Structure	Species	% of Cover <sup>3</sup>	Notes
				PRLA*	10	
				RUAR*	10	
				TAOF*	1	
		Middle of bank	Broken concrete and riprap	CLCO*	5	Interspersed filamentous green tuft algae along debris and rocks
Toe of bank	Sand and fines	-	-	No vegetation		
24 (26)	2.1E	Top of bank	Chain link fence and ecology blocks	RUAR*	60	Dominated by blackberry with knotweed overhanging edge of top of bank.
				POCU*	10	
				TAVU*	5	
				SCAC	1	
				LELA*	1	
				DACA*	1	
		Middle of bank	Broken concrete, riprap, debris	CLCO*	5	Interspersed filamentous green tuft algae along debris and rocks
Toe of bank	Sand and fines	-	-	No vegetation		

Phase I RAL Exceedance Area <sup>1</sup>	RM <sup>2</sup>	Location Along Bank	Substrate/Structure	Species	% of Cover <sup>3</sup>	Notes
18/19/22 (23)	2.25E	Top of bank	Chain link fence along portion; vegetation in narrow strip between pavement and top of bank.	PSME	5	Sparse vegetation between trees, possibly maintained for landscaping along portions.
				ARME	5	
				ROPS*	5	
				RUAR*	10	
				BUDA*	10	
				DACA*	1	
				ESCA	1	
				TAOF*	1	
				PICO	10	
				RHMA	5	
				MAFU	5	
		SASC	5			
		POBA	5			
Middle of bank	Broken concrete	ULLA	1	Interspersed algae along debris and rocks		
		FUDI	1			
		PHYL	10			
Toe of bank	Fines	-	-	No vegetation		
15 (20)	2.35E	Top of bank	Fill, pavement	RUAR*	50	Vegetation in narrow space between pavement and top of bank.
				DACA*	5	
				CAOB	1	
				BUDA*	5	
				PICO	10	
				HEHE*	30	
				TAVU*	1	
				PIGL	1	
		Middle of bank	Broken concrete, riprap	ULLA	1	Interspersed algae along debris and rocks
				PHYL	5	
Toe of bank	Fines	-	-	No vegetation		
14 (NA)	2.45E	Top of bank	Fill, pavement	RUAR*	70	Narrow space for vegetation between industrial property use and top of bank.
				BUDA*	10	
				TAVU*	1	
				LELA*	5	
		ACCI	1			
	Broken concrete	ULLA	1			

Phase I RAL Exceedance Area <sup>1</sup>	RM <sup>2</sup>	Location Along Bank	Substrate/Structure	Species	% of Cover <sup>3</sup>	Notes
		Middle of bank		PHYL	5	Interspersed algae along debris and rocks
		Toe of bank	Sand, gravel, and fines	-	-	No vegetation
12 (17)	2.5W	Top of bank	Fill, pavement	ROPS*	80	Shoreline dominated by invasive tree with minimal other vegetation
				CIAR*	1	
				ARSU	1	
		Middle of bank	Broken concrete	PHYL	5	Algae along rocky substrate and debris
		Toe of bank	Fines	-	-	No vegetation
11 (13, 16)	2.55E	Top of bank	Fill, pavement	POCU*	10	Sparse vegetation along top of bank
				RUAR*	5	
				DACA*	1	
				PONI*	5	
		Middle of bank	Broken concrete	PHYL	5	Algae along rocky substrate and debris
		Toe of bank	Sand and fines	-	-	No vegetation
9 (9)	2.7E	Top of bank	Fill, pavement	ARME	5	Narrow band of vegetation along the shoreline until reaching the Georgetown Pump Station in Gateway Park North, which has a wider buffer containing a mix of native and non-native trees, shrubs, and ground cover.
				BUDA*	10	
				RUAR*	15	
				TAVU*	1	
				DACA*	5	
				PONI*	20	
				Middle of bank	Broken concrete, riprap	-
		Toe of bank	Sand, gravel, and fines	-	-	No vegetation
5 (6 and 8)	2.75W	Top of bank	Chain-link fence along downstream end; fill, pavement along entire surveyed portion	RUAR*	20	Previously restored area at top of bank along upstream portion of surveyed area that has
				ROPS*	10	
				PONI*	5	
				HEHE*	5	

Phase I RAL Exceedance Area <sup>1</sup>	RM <sup>2</sup>	Location Along Bank	Substrate/Structure	Species	% of Cover <sup>3</sup>	Notes
				POCU*	5	several non-native species present throughout. Downstream portion has narrow vegetated area between industrial use and top of bank.
				ARSU	1	
				PSME	1	
				ALRU	5	
				TAVU*	1	
				SCAC	10	
				CAOB	10	
				PIGL	1	
				SASC	5	
		POBA	5			
		Middle of bank	Broken concrete columns, riprap, quarry spall, and creosote wood debris	PHYL	5	Algae along rocky substrate and debris
		Toe of bank	Sand and fines	-	-	No vegetation
20 North (24 North)	2.2W	Top of Bank	pavement, chain-link fence, concrete wall	RUAR*	80	Shoreline dominated by invasive species with other minimal vegetation
				HEHE*	5	
				Unknown grass	1	
				BUDA*	5	
				PICO	1	
				ARME	1	
				PEMA*	1	
				TYLA	1	
				SYCH	1	
				SOOL*	1	
		POBA	5			
				Middle of bank	Broken concrete, cobble	-
		Toe of bank	Sand, mud	-	-	No vegetation
20 South (24 South)	2.2W	Top of bank	pavement, chain-link fence, concrete wall	RUAR*	80	Shoreline dominated by invasive species with other minimal vegetation
				HEHE*	10	
				CIAR*	1	
				SODU*	1	
				BUDA*	1	

Phase I RAL Exceedance Area <sup>1</sup>	RM <sup>2</sup>	Location Along Bank	Substrate/Structure	Species	% of Cover <sup>3</sup>	Notes
				TAVU*	1	
				unknown grass	1	
				ARME	5	
				BEAQ	1	
		Middle of bank	Broken concrete, cobble	-	-	No vegetation
		Toe of bank	Sand, mud	-	5	No vegetation

Notes:

\* Indicates non-native species.

1. RAL exceedance areas numbering updates from Phase II are listed in parentheses for reference. See Section 3.4 of the DER for more information on Phase II RAL exceedance areas.

2. This represents the closest river mile to the midpoint of the transects. The side of the bank (i.e., east or west) is included for reference.

3. The percent coverages of native and non-native trees, shrubs, and grass/herbaceous communities along the bank, per species, were estimated from visual observations.

4. Based on bioassay data collection during Phase II, the area is no longer a RAL exceedance area. See Section 2.1.4 of the DER for additional discussion.

DER: data evaluation report

EF: exceedance factor

NA: not applicable

RAL: remedial action level

RM: river mile

## 2 References

- Anchor QEA, Windward. 2024a. Pre-Design Investigation Quality Assurance Project Plan Addendum No. 1 for the Lower Duwamish Waterway Middle Reach - Phase II Sampling. Final. Anchor QEA and Windward Environmental LLC, Seattle, WA.
- Anchor QEA, Windward. 2024b. Quality assurance project plan addendum No. 2 for the Lower Duwamish Waterway middle reach - Phase II sampling for the Inlet at RM 2.2W. Draft. Submitted to the US Environmental Protection Agency April 19, 2024. Anchor QEA and Windward Environmental LLC, Seattle, WA.

FINAL

# Attachment G-1

## Photographs

---

**Photograph G-1**  
**Representative Vegetation Conditions at Phase I RAL exceedance area 33**  
**(Slip 2/RM 1.8E)**



**Photograph G-2**  
**Representative Vegetation Conditions at Phase I RAL exceedance area 31**  
**(Slip 2/RM 1.8E)**



**Photograph G-3**  
**Representative Vegetation Conditions at Phase I RAL exceedance area 30 (RM 1.8E)**



**Photograph G-4**  
**Representative Vegetation Conditions at Phase I RAL exceedance area 29 (RM 1.9-2.0E)**



**Photograph G-5**  
**Representative Vegetation Conditions at Phase I RAL exceedance area 27 (RM 2.0E)**



**Photograph G-6**  
**Representative Vegetation Conditions at Phase I RAL exceedance area 26 (RM 2.0W)**



**Photograph G-7**  
**Representative Vegetation Conditions at Phase I RAL exceedance area 24**  
**(Slip 3/RM 2.1E)**



**Photograph G-8**  
**Representative Vegetation Conditions at Phase I RAL exceedance area 21**  
**(RM 2.1-2.2W)**



**Photograph G-9**  
**Representative Vegetation Conditions at Phase I RAL exceedance area 21**  
**(RM 2.1-2.2W)**



**Photograph G-10**  
**Representative Vegetation Conditions at Phase I RAL exceedance area 18/19/22**  
**(RM 2.2-2.3E)**



**Photograph G-11**  
**Representative Vegetation Conditions at Phase I RAL exceedance area 18/19/22**  
**(RM 2.2-2.3E)**



**Photograph G-12**  
**Representative Vegetation Conditions at Phase I RAL exceedance area 15**  
**(Myrtle Bay/RM 2.3E)**



**Photograph G-13**  
**Representative Vegetation Conditions at Phase I RAL exceedance area 14 (RM 2.4E)**



**Photograph G-14**  
**Representative Vegetation Conditions at Phase I RAL exceedance area 12 (RM 2.5W)**



**Photograph G-15**  
**Representative Vegetation Conditions at Phase I RAL exceedance area 9**  
**(RM 2.6-2.8E)**



**Photograph G-16**  
**Representative Vegetation Conditions at Phase I RAL exceedance area 9**  
**(RM 2.6-2.8E)**



**Photograph G-15**  
**Representative Vegetation Conditions at Phase I RAL exceedance area 5 (RM 2.7W)**



**Photograph G-16**  
**Representative Vegetation Conditions at Phase I RAL exceedance area 5 (RM 2.7W)**

