

Appendix E

Bank Inspection Results

1 Introduction

The Phase I bank inspection was conducted primarily by boat around daytime low tides (2 hours before, 2 hours after) on June 11, 16, 18, 23, and 26 and August 4, 2020. The inspection included the collection of videos, photographs, and detailed observations to document eastern and western bank conditions along the upper reach. During the planning phase of the program, periods of predicted daytime extreme low tides (i.e., near or less than 0 ft mean lower low water [MLLW]) were identified as potential survey dates, and actual inspection dates were selected based on forecasted weather conditions and team availability. Inspections also occurred at various times throughout the day to provide varying lighting conditions to capture photographs of both sides of the waterway. A summary of inspection dates, times, and tidal conditions is provided in Table E-1.

Table E-1
Bank Visual Inspection Date and Tide Details

Date	Approximate Time of Inspection	Predicted Low Tide Elevation (ft MLLW)	Time of Predicted Low Tide
June 11, 2020	1340–1715	0.3	1550
June 16, 2020	0730–1115	1.4	0913
June 18, 2020	0800–1150	-0.4	1012
June 23, 2020	1120–1550	-2.6	1316
June 26, 2020	1335–1600	-0.8	1534
August 4, 2020	1445–1545 ¹	-1.6	1215

Notes:

1. An additional bank visual inspection day was included to fill data gaps caused by an equipment issue on an earlier inspection day. The extreme low tide on this additional day made tidal conditions at the time of collection, which were outside the +/- 2-hour low tide time frame, comparable to tidal conditions on other inspection days.

MLLW: mean lower low water

The observations from the Phase I bank visual inspection are included in this appendix in tabular format. Photographs and videos have been provided to the US Environmental Protection Agency (EPA) as part of the Phase I data package (at <http://ldwg.org>). This introduction provides information to facilitate review of the detailed observation table, photographs, and videos. Methods to collect this information are detailed in the Pre-Design Investigation (PDI) Quality Assurance Project Plan (QAPP) (Windward and Anchor QEA 2020).

1.1 Detailed Observation Tables

Detailed observations are documented for each discrete shoreline segment, as defined by a change in bank structure classification, in tables presented in Attachments E-1a and E-1b. The discrete shoreline segments are differentiated from adjacent segments by alternating shading in the tables. The following information describes the various fields presented.

Station: Shoreline station locations can be found on Maps 2-6a through 2-6f of the main Data Evaluation Report (DER). In Attachments E-1a and E-1b, stationing ranges that are left justified and shown in bold in the “Station” column indicate the start and end points of the discrete shoreline segment. Subsequent stationing within a segment (right justified and non-bold) indicates point notes or observations within the segment.

Bank Type: The bank type is defined as one of the following: armored, unarmored (vegetated), unarmored (randomly armored), unarmored (exposed sediment), or bulkheaded.

Above Bank: Area generally above mean higher high water (MHHW).

- **Vegetation:** A “yes” or “no” indication of whether vegetation was observed above the bank

Bank: Area below MHHW to transition to a connection point with sediment, generally accompanied by a change in the slope to a more gradual slope of intertidal sediments.

- **Notes:** General conditions/observations of bank area
- **Vegetation:** A “yes” or “no” indication of whether vegetation was observed in the bank
- **Slope:** Estimated bank slope based on visual inspection and review of bathymetric data
- **Erosion:** A “yes” or “no” indication of whether erosion was observed in the bank

Vegetation Details: These columns may apply to both bank and above-bank areas and include descriptions of vegetation (if present).

- **Vegetation Description (% Cover):** Estimated percent cover of vegetation type (i.e., tree, shrub, grass/herbaceous, aquatic) observed in both the bank and area above the bank
- **Plant Communities:** Abbreviated terms for species of trees, shrubs, and grass/herbaceous communities observed, as defined in Tables E-2 and E-3

**Table E-2
Plant Community Definitions**

Plant Community	Species	Notes
Trees		
T1	ALRU, POBA, PONI, SABA	Dominated by native, typically overbank zone
T2	ALRU, ARME, PONI, POTR	Dominated by native, typically overbank zone
T3	ALRU, ARME, PIMO, POBA, POTR, PSME, THPL	Dominated by native, typically overbank zone
T4	PSME	Landscaping plantings
Shrubs		
S1	BUDA, RUAR	Dominated by non-native species
S2	BUDA, POCU, RUAR	Dominated by non-native species
S3	BUDA, HEHE, RUAR	Dominated by non-native species
S4	BUDA, CYSC, RUAR	Dominated by non-native species
S5	HODI, RONU, SARA	Dominated by native species, mitigation plantings
Grass, Ferns, Herbaceous		
GH1	ACMI, BRRA, CIAR, COAR, EQAR, FERU, HOLA, HYRA, LOCO, PLLA, SOAS, TAOF, TAVU	Dominated by non-native, typically includes a variety of these species
GH2	IRPS, JUEF, PHCO, SCAC	Wetland species, typically at or below OHWM
GH3	IRPS, JUEF, SCAC	Wetland species, typically at or below OHWM
GH4	DECE, PHAR	

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.
- OHWM: ordinary high water mark

Table E-3
Species Codes

Species Name	Common Name	Native/Non-Native	Code
Trees			
<i>Alnus rubra</i>	Red alder	Native	ALRU
<i>Acer macrophyllum</i>	Big-leaf maple	Native	ACMA
<i>Arbutus menziesii</i>	Madrone	Native	ARME
<i>Betula papyrifera</i>	Paper birch	Native	BEPA
<i>Crataegus douglasii</i>	Douglas' hawthorn	Native	CRDO
<i>Fraxinus latifolia</i>	Oregon ash	Native	FRLA
<i>Malus pumila</i>	Cultivated apple	Non-native	MAPU
<i>Pinus contorta</i>	Shore pine	Native	PICO
<i>Pinus monticola</i>	Western white pine	Native	PIMO
<i>Populus balsamiera</i> <i>syn. trichocarpa</i>	Black cottonwood	Native	POBA
<i>Populus nigra</i>	Lombardy poplar	Native	PONI
<i>Prunus domestica</i>	Domestic plum	Native	PRDO
<i>Pseudotsuga menziesii</i>	Douglas fir	Native	PSME
<i>Quercus rubra</i>	Red oak	Native	QURU
<i>Salix babylonica</i>	Weeping willow	Native	SABA
<i>Salix scouleriana</i>	Scouler willow	Native	SASC
<i>Thuja plicata</i>	Western red cedar	Native	THGPL
Shrubs			
<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>Holodiscus discolor</i>	Oceanspray	Native	HODI
<i>Polygonum cuspidatum</i>	Japanese knotweed	Non-native	POCU
<i>Rosa nutkana</i>	Nootka rose	Native	RONU
<i>Rubus armeniacus</i>	Himalayan blackberry	Non-native	RUAR
<i>Prunus laurocerasus</i>	European laurel	Non-native	PRLA
<i>Rubus ursinus</i>	Trailing blackberry	Native	RUUR
<i>Sambucus racemosa</i>	Red elderberry	Native	SARA
Grass, Ferns, Herbaceous			
<i>Achillea millefolium</i>	Yarrow	Native	ACMI
<i>Brassica rapa</i>	Common mustard	Non-native	BRRA
<i>Bromus tectorum</i>	Cheat grass	Non-native	BRTE
<i>Cirsium arvense</i>	Canada thistle	Non-native	CIAR
<i>Convolvulus arvensis</i>	Field bindweed	Non-native	COAR
<i>Deschampsia cespitosa</i>	Tufted hairgrass	Native	DECE
<i>Digitalis purpurea</i>	Foxglove	Non-native	DIPU
<i>Equisetum arvense</i>	Field horsetail	Native	EQAR
<i>Festuca rubra</i>	Red fescue	Non-native	FERU
<i>Holcus lanatus</i>	Velvet grass	Non-native	HOLA
<i>Hypochaeris radicata</i>	Hairy cat's-ear	Non-native	HYRA
<i>Iris pseudoacorus</i>	Yellow-flag iris	Non-native	IRPS
<i>Juncus effusus</i>	Soft rush	Non-native	JUEF
<i>Lotus corniculatus</i>	Birds-foot trefoil	Non-native	LOCO
<i>Phalaris arundinacea</i>	Reed canarygrass	Non-native	PHAR
<i>Phragmites communis</i>	Reed	Non-native	PHCO

Species Name	Common Name	Native/Non-Native	Code
<i>Plantago lanceolata</i>	Narrow-leaved plantain	Non-native	PLLA
<i>Polystichum munitum</i>	Swordfern	Native	POMU
<i>Pteridium aquilinum</i>	Bracken fern	Native	PTAQ
<i>Ranunculus repens</i>	Creeping buttercup	Non-native	RARE
<i>Rumex crispus</i>	Curly dock	Native	RUCR
<i>Schoenoplectus acutus</i>	Hardstem bulrush	Native	SCAC
<i>Sonchus asper</i>	Prickly lettuce	Non-native	SOAS
<i>Tanacetum vulgare</i>	Common tansy	Non-native	TAVU
<i>Taraxacum officinale</i>	Common dandelion	Non-native	TAOF

Bank Transition Elevation: Estimated transition point between the bank and transition below bank based on review of photographs and bathymetric surveys

Transition Below Bank: Area below bank observed during the low-tide inspections

- **Notes:** General conditions in/observations of area below the bank
- **Vegetation:** A “yes” or “no” indication of whether vegetation was observed below the bank
- **Slope:** Estimated slope of area below the bank based on visual inspection and review of bathymetric survey data
- **Erosion:** A “yes” or “no” indication of whether erosion was observed below the bank

General Notes: General notes that may apply to the entire segment, regardless of location above, on, or below the bank

Photographs: Number of photographs that correspond to segments or point observations. Each photograph in this appendix includes the prefix “DSCN0XXX.” The number included in the detailed observations tables refers to the last three digits of the overall photograph title.

1.2 Photographs

Photographs were collected using a global positioning system (GPS)- and compass-enabled camera that recorded direction and position for every photograph taken. Photographs were taken to provide near-complete coverage of the upper reach banks, from river mile (RM) 3.0 to RM 5.0 on the west and east banks. Photographs are provided by 0.2-RM increments as part of the Phase I data package at <http://ldwg.org>. Location information is also included in Attachments E-1a and E-1b.

1.3 Videos

Videos were collected in approximately 0.2-RM increments, as tabulated in Table E1-4 and provided in the Phase I data package at <http://ldwg.org>. The videos were narrated to identify notable features observed along the banks.

Table E-4
Bank Visual Inspection Video Index

Title	Site Coverage	Date	Time
E_Downstream_RM_3.0	Downstream of RM 3.0 (east bank)	6/11/20	1635
E_RM_3.2_3.0	RM 3.2 to RM 3.0 (east bank)	6/11/20	1634
E_RM_3.4_3.2	RM 3.4 to RM 3.2 (east bank)	6/11/20	1629
E_RM_3.6_3.4	RM 3.6 to RM 3.4 (east bank)	6/11/20	1622
E_RM_3.8_3.6	RM 3.8 to RM 3.6 (east bank)	6/11/20	1616
E_RM_4.0_3.8	RM 4.0 to RM 3.8 (east bank)	6/11/20	1611
E_RM_4.2_4.0	RM 4.2 to RM 4.0 (east bank)	6/23/20	1217
E_RM_4.2_Slip 6	Slip 6	6/16/20	0759
E_RM_4.4_4.2	RM 4.4 to RM 4.2 (east bank)	6/23/20	1211
E_RM_4.6_4.4	RM 4.6 to RM 4.4 (east bank)	6/23/20	1205
E_RM_4.8_4.6	RM 4.8 to RM 4.6 (east bank)	6/11/20	1546
E_RM_5.0_4.8	RM 5.0 to RM 4.8 (east bank)	6/11/20	1541
E_Upstream_RM_5.0	Upstream of RM 5.0 (east bank)	6/11/20	1529
W_RM_3.0_3.2	RM 3.0 to RM 3.2 (west bank)	6/11/20	1451
W_RM_3.2_3.4	RM 3.2 to RM 3.4 (west bank)	6/11/20	1503
W_RM_3.4 (South Park Marina - North End)	South Park Marina (north end)	6/23/20	1546
W_RM_3.4 (South Park Marina - South End)	South Park Marina (south end)	6/23/20	1548
W_RM_3.5_3.6	RM 3.5 to RM 3.6 (west bank)	6/11/20	1508
W_RM_3.6_3.8	RM 3.6 to RM 3.8 (west bank)	6/23/20	1130
W_RM_3.8_4.0	RM 3.8 to RM 4.0 (west bank)	6/23/20	1135
W_RM_4.0_Kelly Ryan	National Industrial Holding	6/16/20	1023
W_RM_4.2_4.4	RM 4.2 to RM 4.4 (west bank)	6/23/20	1144
W_RM_4.2_Delta Marine	Delta Marine Industries, Inc.	6/16/20	0953
W_RM_4.4_4.6	RM 4.4 to RM 4.6 (west bank)	6/23/20	1150
W_RM_4.6_4.8	RM 4.6 to RM 4.8 (west bank)	6/23/20	1519
W_RM_4.8_5.0	RM 4.8 to RM 5.0 (west bank)	6/23/20	1523
W_Upstream_RM_5.0	Upstream of RM 5.0 (west bank)	6/23/20	1523

Note:

RM: river mile

2 References

Windward, Anchor QEA. 2020. Lower Duwamish Waterway quality assurance project plan for remedial design of Upper Reach: pre-design investigation. Final. Submitted to EPA May 19, 2020. Windward Environmental LLC and Anchor QEA, Seattle, WA.

3 Attachments

Attachment E-1a LDW Detailed Observation Notes Compilation, East Bank (Stations 250.5–381)
Attachment E-1b LDW Detailed Observation Notes Compilation, West Bank
(Stations 381–521.5)

Appendix E

Attachments E-1a and E-1b

Attachment E-1a

LDW Detailed Observation Notes Compilation, East Bank (Stations 250.5-381)

Station	Bank Type	Above Bank	Bank				Vegetation Description (Applies to Above Bank and Bank)				Bank Transition Elevation (ft MLLW)		
		Vegetation (Y/N)	Notes ¹	Vegetation (Y/N)	Slope ²	Erosion (Y/N)	% cover						
							Tree	Shrub	Grass/Herbaceous	Aquatic		Plant Communities	
250.5-253 (RM 3.0-3.02)	Armored	Y	Large armor	Y	2H:1V	N	30	80	20	0	T1/S1/GH1	+4	
253			Outfall (Boeing 1)										
253-265 (RM 3.02- 3.25)	Bulkheaded (ST01)	N	Horizontal timber lagging wall with armor at toe and below building	N	Vertical	N	0	0	0	0	GH1	+4	
256.3													
263													
265-268.5 (RM 3.25-3.35)	Armored	N	Armored	Y	2H:1V	N	0	60	40	0	None	+4	
266			Outfall (3031)		-								
266.5-267.5			ST02										
267			Outfall (3032)										
267-268.5		N			Y			0	100	0	0		S1/GH1
268.5-283.3 (RM 3.35-3.55)	Unarmored (Vegetated)		Habitat area, wood debris		5H:1V	N						+6 and above	
268-281		N		Y			30	40	30	10	T4/S5/GH1/GH4		
279-280.1													
281-283	N			Y			0	20	20	0	S1/GH1		
283.3-289.4 (RM 3.55-3.65)	Armored	N	Riprap medium to large, transitioning to gravel at +3' MLLW	Y	2.5H:1V	N	0	20	20	0	S1/GH1	Lower than observed tide level	
284.1			Sheetpile structure										
289.4-298.2 (RM 3.65-3.8)	Bulkheaded (ST03)	Y	Bulkhead of varying composition (steel, concrete, timber, etc.)	N	Vertical	N	10	60	30	0	S1/GH1	Varies (0 to +4)	
289.9			Outfall (2065)										
290.8			Outfall (2064)										
293-294.1			Debris piles										
295.5-298		Y			N			0	10	0	0		S1
296.3			Outfall (2061)										
298.2- 301.5 (RM 3.8-3.88)	Unarmored (Vegetated)	Y	Soil and vegetation behind short, vertical timber pile wall	Y	Vertical	N	20	70	20	0	T3/S1/GH1	+6	
301.5- 306.2 (RM 3.88-3.95)	Bulkheaded (ST03)	Y	Steel sheetpile miscellaneous armor at toe of wall	Y	Vertical	N	20	70	20	0	T3/S1/GH1	+4	
301.1			Outfall (2077)										
306.2-310 (RM 3.95-4.05)	Armored	Y	Riprap with vegetation (possible sheetpile wall above riprap)	Y	2H:1V	N	20	70	20	0	T3/S1/GH1	Varies (+4 to +6)	
306.9			Outfall (2073)										
310-315 (RM 4.05-4.1)	Unarmored (Discontinuous Armoring)	Y	Miscellaneous armor	Y	3H:1V	N						+6	
311													
311.4													
312.2-314				Large concrete debris riprap									
314													

Attachment E-1a

LDW Detailed Observation Notes Compilation, East Bank (Stations 250.5-381)

Station	Transition Below Bank				General Notes	Photographs	
	Notes	Vegetation (Y/N)	Slope ²	Erosion (Y/N)			
250.5-253 (RM 3.0-3.02)	Exposed sediment	N	5H:1V	N		908-912	
253						907	
253-265 (RM 3.02- 3.25)	Unarmored	N	6H:1V	See below	Armor presence and condition varies. Timber bulkhead and timber pile supported building with some riprap and concrete below	876-907	
256.3	Erosion channel			Y		897	
263	Erosion features			Y		879	
265-268.5 (RM 3.25-3.35)	Sediment with more gravel on upper portion of lower slope	N	5H:1V	See below	Vegetation above, transition between bulkhead wall and large riprap slope	871-875	
266	Erosion visible		-	Y		873	
266.5-267.5				N		870-873, 945-950	
267				N		870	
267-268.5		N		N		868-870	
268.5-283.3 (RM 3.35-3.55)	Mixed sand and gravel		5H:1V	N	Boeing Plant 2 Early Action Area (Station 268.5 to 283.3)	853-867	
268-281		Y					
279-280.1	Increased gravel content in surface sediments						624, 625, 854
281-283		N					
283.3-289.4 (RM 3.55-3.65)	Not observed		Not observed	n/a	Jorgensen Forge Early Action Area (Station 283.3 to 291.6)	599-613	
284.1						611	
289.4-298.2 (RM 3.65-3.8)	Unarmored (sand and gravel), miscellaneous debris	N	5H:1V	See below		575-598, 848,963, 964	
289.9				N		598	
290.8				N		595	
293-294.1	Sediments gravel and sand			N		588-589	
295.5-298		N		N			
296.3	Erosion channel			Y		581-582, 851-852	
298.2- 301.5 (RM 3.8-3.88)	Unarmored exposed sand and silt	N	6H:1V	N		841-847	
301.5- 306.2 (RM 3.88-3.95)	Unarmored exposed sand, gravel, and silt	N	6H:1V to flat	N		828-840	
301.1							
306.2-310 (RM 3.95-4.05)	Exposed sediment	N	5H:1V	N	Miscellaneous wood debris	808-823	
306.9						827	
310-315 (RM 4.05-4.1)			6H:1V to flat	N		814-822	
311	Concrete debris						821
311.4	Pile						820
312.2-314							815-819
314	ST04						816

Attachment E-1a

LDW Detailed Observation Notes Compilation, East Bank (Stations 250.5-381)

Station	Bank Type	Above Bank	Bank				Vegetation Description (Applies to Above Bank and Bank)					Bank Transition Elevation (ft MLLW)
		Vegetation (Y/N)	Notes ¹	Vegetation (Y/N)	Slope ²	Erosion (Y/N)	% cover				Plant Communities	
							Tree	Shrub	Grass/Herbaceous	Aquatic		
315-350.5 (RM 4.1-4.4)	Armored		Vegetation over riprap	Y	2H:1V	N						Varies (Lower than observed tide level to +6)
315.6-317.7												
318-325.5		Y		Y			30	70	20	0	T2/S2/GH1	
324.4			Outfall (2080)									
325.5-327.5		N		Y			40	60	30	0	T2/S2/GH1	
327.5-328.5		Y		Y			20	80	20	0	T1/S1/GH1	
326.5												
327.8			Outfall (2081)									
328.6-341			ST05									
337			Outfall (2082)									
341.4-350.5		Y	Uniform slope of medium to large armor with vegetation at top of slope				50	60	20	0	T3/S1/GH1	
344.3- 350.5		Y		Y			50	60	20	0	T3/S1/GH1	
347.4			Outfall (2089)									
349.2			Outfall (2088)									
349.6			Outfall (BDC-1)									
350.5-355.5 (RM 4.4-4.48)	Unarmored (Discontinuous Armoring)	Y	Intermittent/irregular armoring, exposed sand and silt, vegetation at top of slope	Y	4H:1V	N	0	90	10	0	S1	+4
350.4-350.9			ST06									
351.2			Outfall (2087)									
355.5-361 (RM 4.48-4.65)	Armored	N	Intermittent/irregular armoring, exposed sand and silt, vegetation at top of slope	Y	4H:1V	N	10	60	30	0	T2/S3/GH0	Varies (+2 to +4)
356												
357												
358.5												
358.8			Outfall (2090)									
359.8-360.1												
361-369 (RM 4.65-4.82)	Unarmored (Discontinuous Armoring)	Y		Y	2H:1V to 5H:1V	N	10	60	30	0	T2/S3/GH1	Varies (+4 to +6)
361-363.3			Random armoring with vegetation above									
361.2-361.5			ST07									
363.4-364.6			Sparse armor, vegetation above									
364.3												
364.8-366.3			ST07									
365.6												
366.3-369.8		Large concrete debris riprap										
369-371 (RM 4.82-4.85)	Armored		Mix of concrete and large riprap armor		2H:1V	N						Varies (+2 to +6)
369.8-370.2		N	ST08	N			0	0	0	0	None	
370.2-370.7		Y		Y			40	60	25	1	T3/S1/GH1/GH2	
370.7-372.5		Y	Armor in some places	Y			40	60	25	1	T3/S1/GH1/GH2	
370.9		Outfall (2092)										

Attachment E-1a

LDW Detailed Observation Notes Compilation, East Bank (Stations 250.5-381)

Station	Transition Below Bank				General Notes	Photographs
	Notes	Vegetation (Y/N)	Slope ²	Erosion (Y/N)		
315-350.5 (RM 4.1-4.4)	Riprap with sediment accumulation at lower elevations	N	6H:1V to flat; not observed from 318-350.5	See below		62-92, 790-813
315.6-317.7	Large, flat exposed bank			N		807-813
318-325.5		N		N		
324.4				N		69
325.5-327.5		N		N		
327.5-328.5		N		N		
326.5	Erosion at transition to bank zone (vertical bank in tree roots)			Y		66
327.8				N		63
328.6-341				N		30-61, 93-123, 981-982
337				N		40
341.4-350.5	Flat exposed bank	N		N		790-804
344.3- 350.5	Gravel	N		N		790-798
347.4				N		792-793
349.2				N		790
349.6	Dolphin pile			N		789
350.5-355.5 (RM 4.4-4.48)	Flat exposed bank	N	6H:1V	N		491-505, 789
350.4-350.9						986, 989
351.2						501
355.5-361 (RM 4.48-4.65)	Gravel below toe of riprap	N	6H:1V	See below		467-485
356	Erosion channel			N		483
357	Erosion			Y		480
358.5	Erosion			Y		477
358.8				N		475
359.8-360.1	Dolphin piles			N		471
361-369 (RM 4.65-4.82)		N	5H:1V	N		442-467
361-363.3						458-466
361.2-361.5						465-466, 998,1000
363.4-364.6	Large exposed bank, sand and sediment					449- 457
364.3	ST07					455
364.8-366.3	Exposed bank					449-454
365.6	ST07					451
366.3-369.8	ST07					
369-371 (RM 4.82-4.85)	Exposed sediment		3H:1V	See below		436-442
369.8-370.2		N		N		438-441, 1003-1006
370.2-370.7	ST07	Y		N		436-439
370.7-372.5	Erosion, wood debris	Y		Y		434-437
370.9						435

Attachment E-1a

LDW Detailed Observation Notes Compilation, East Bank (Stations 250.5-381)

Station	Bank Type	Above Bank	Bank				Vegetation Description (Applies to Above Bank and Bank)				Bank Transition Elevation (ft MLLW)		
		Vegetation (Y/N)	Notes ¹	Vegetation (Y/N)	Slope ²	Erosion (Y/N)	% cover						
							Tree	Shrub	Grass/Herbaceous	Aquatic		Plant Communities	
371-378 (RM 4.85-4.97)	Unarmored (Discontinuous Armoring)	Y		Y	Vertical to 4H:1V	N	40	60	25	1	T3/S1/GH1/GH2	Varies (+2 to +6)	
371.5-376			Exposed sediment with occasional concrete/rock/wood debris	Y									
372.5-373.4													
373.4-375.8													
375				Outfall (2094)									
376-376.6													
376.3				Outfall (Norfolk CSO/SD [2095])									
376.6-378				Large random armoring (concrete and rock)									
378-380.8 (RM 4.97 to 5.0)	Bulkheaded (ST09)	Y		N	Vertical	N	0	0	0	0	None	+2	
378.8-380			ST09										
380-380.8			Armor at toe of bulkhead										
380.8-381	Unarmored (Discontinuous Armoring)	Y	Random armoring with vegetation above	N	4H:1V	N						+2	

Attachment E-1a

LDW Detailed Observation Notes Compilation, East Bank (Stations 250.5-381)

Station	Transition Below Bank				General Notes	Photographs
	Notes	Vegetation (Y/N)	Slope ²	Erosion (Y/N)		
371-378 (RM 4.85-4.97)			4H:1V to flat	Y		406-436
371.5-376	Exposed sediment	Y		Y	Norfolk Early Action Area (Station 372.8 to 377.4)	421-433
372.5-373.4	ST07			N		428-431
373.4-375.8	Exposed sediment, erosion			Y		421-427
375	Erosion channel			Y		424
376-376.6	Large exposed bank, sand and sediment	Y		Y		419-421
376.3						420
376.6-378	Exposed bank, sand and sediment	Y		N		412-418
378-380.8 (RM 4.97 to 5.0)	Exposed bank	N	6H:1V	N		407-413
378.8-380	Exposed bank, timber debris					408-411
380-380.8	Timber debris					405-406
380.8-381	Exposed bank, timber debris	N	6H:1V	N		407

Attachment E-1b

LDW Detailed Observation Notes Compilation, West Bank (Stations 381.5-521.5)

Station	Bank Type	Above Bank	Bank				Vegetation Description (Applies to Above Bank and Bank)				Bank Transition Elevation (ft MLLW)	
		Vegetation (Y/N)	Notes ¹	Vegetation (Y/N)	Slope ²	Erosion (Y/N)	% cover					
							Tree	Shrub	Grass/Herbaceous	Aquatic		Plant Communities
381.5-393.9 (RM 4.76-5)	Post-Phase I PDI bank construction											
389.5-420.5 (RM 4.65-4.76)	Unarmored (Vegetated)		Vegetation		5H:1V to flat						Varies (+4 to +8)	
390.7-391.2		N	ST08	N			0	0	0	0		None
391.3-406.7		Y		Y			40	70	20	0		T1/S3/GH1
396.4				Derelict vessel								
397-407				Shallow inlet, inspected from a distance								
411				ST10								
407-420.3		Y		Y		N	60	60	20	20	T3/S1/GH1/GH3	
420.5-423.3 (RM 4.62-4.65)	Armored	N	Small armor	Y	3H:1V	N	10	90	30	0	S1/GH1	+6
423.3-431 (RM 4.52-4.62)	Unarmored (Vegetated)	Y	Vegetation	Y	6H:1V to flat		60	60	20	10	T1/S1/GH1/GH3	+6
426.7			Stormdrain; some armor									
429.8			Stormdrain									
430.3-431						N						
431-438.4 (RM 4.4-4.52)	Armored		Armored wall, steep armored shoreline	Y	2H:1V		30	40	30	10	T1/S1/GH1	Varies (Lower than observed tide level to +4)
433.9			Outfall (2098)									
435-436												
437				Large armor								
437.8-438.5				ST06			N					
438.4-447 (RM 4.25-4.4)	Unarmored (Vegetated)	Y	Smaller armoring	Y	4H:1V to flat		80	80	10	10	T3/S1/GH4	+6
438.9-439.8												
440-443						N						
447-452 (RM 4.18-4.25)	Bulkheaded (ST12)	N	Bulkhead of varying composition (steel, concrete)	N	Vertical		0	0	0	0	None	0
450.9			Storm drain in bulkhead									
451.7			ST13			n/a						
452-462.6 (RM 4.03-4.18)	Armored	N	ST15; Vegetation at top of armor slope of various size	Y	2H:1V		30	60	40	0	T3/S2/GH1	Lower than observed tide level
452-452.5			Bulkhead									
454.1			Outfall (2100B)									
455.1-455.9				Bulkhead/ST14			N					
462.6-463.7 (RM 4.01-4.03)	Unarmored (Discontinuous Armoring)	Y	Exposed shallow slope	Y	4H:1V	N	30	80	20	10	T4/S4/GH1/GH4	+4

Attachment E-1b

LDW Detailed Observation Notes Compilation, West Bank (Stations 381.5-521.5)

Station	Transition Below Bank			General Notes	Photographs
	Notes	Vegetation (Y/N)	Slope ²		
381.5-393.9 (RM 4.76-5)					
389.5-420.5 (RM 4.65-4.76)	Exposed sandy silt		Flat		356-381
390.7-391.2		N			375-376,1002-1008
391.3-406.7		N			
396.4					367, 369
397-407					366-369
411					364
407-420.3		Y		N	
420.5-423.3 (RM 4.62-4.65)	Exposed sediment, small erosion channels	N	Flat	N	356
423.3-431 (RM 4.52-4.62)	Sand and silt beach	Y	Flat		346-355
426.7					347
429.8					345
430.3-431	Exposed sediment, undulating			N	345-346
431-438.4 (RM 4.4-4.52)		Y	2H:1V to flat		320-344
433.9					335-336
435-436	Smaller gravel				330-333
437	Exposed sediment				325-326
437.8-438.5				Y	322, 988
438.4-447 (RM 4.25-4.4)	Exposed sand and silt	Y	4H:1V to flat	See below	300-319
438.9-439.8	Erosion feature			Y	319
440-443	ST11			N	300-302, 306-312, 315-316
447-452 (RM 4.18-4.25)	Not observed	N	Not observed		124-137, 298, 978-980, 983-984
450.9					126-127
451.7				n/a	978
452-462.6 (RM 4.03-4.18)	Not observed	Y	Not observed		276-297, 970-971, 974-975,
452-452.5					
454.1					296
455.1-455.9				N	294
462.6-463.7 (RM 4.01-4.03)	Sediment with debris	Y	4H:1V	N	Miscellaneous debris, including old barge at 462.7 138-140

Attachment E-1b

LDW Detailed Observation Notes Compilation, West Bank (Stations 381.5-521.5)

Station	Bank Type	Above Bank	Bank				Vegetation Description (Applies to Above Bank and Bank)					Bank Transition Elevation (ft MLLW)
		Vegetation (Y/N)	Notes ¹	Vegetation (Y/N)	Slope ²	Erosion (Y/N)	% cover				Plant Communities	
							Tree	Shrub	Grass/Herbaceous	Aquatic		
463.7-465.1 (RM 3.98-4.01)	Armored	N	Armored slope under dock	N	2H:1V		0	0	0	0	None	0
463.7			Dolphin pile									
464.1-465.1				ST16		Vertical	N					
465.1-471.6 (RM 3.91-3.98)	Unarmored (Discontinuous Armoring)		Intermittent armor		4H:1V to 5H:1V							Varies (+4 to +6)
465.1-471.3			Vegetation									
465.1-468.5		Y			Y		20	90	20	0	T4/S4/GH1	
468.5-471.3		Y		ST17	Y		40	80	10	0	T1/S3/GH1	
471.6-483.7 (RM 3.68-3.91)	Post-Phase I PDI bank construction											
483.7-486.1 (RM 3.63-3.68)	Armored		Medium to small armor		2H:1V							+2
483.7-486.1		Y			Y		0	20	70	0	T1/S1/GH1	
486.1-489.3 (RM 3.56-3.63)	Bulkheaded (ST19)	Y	Steel sheetpile wall with Armored toe	N	Vertical		10	10	0	0	T1/S1	+2
489.3						n/a						
489.3-499.7 (RM 3.36-3.56)	Armored		Steep armor, pockets of vegetation		2H:1V							Lower than observed tide level
489.3-492.2			Vegetation/pavement									
489.3-490.5		Y			Y		10	10	40	0	T1/S1/GH1	
492.2				Outfall (2214)								
492.2-499.7				Ecology block wall								
490.5-499.5		Y		ST20	Y		5	5	15	0	T1/S1/GH1	
497.2				Newer ecology block wall								
499.7			Boat launch			N						
499.7-502.5 (RM 3.32-3.36)	Unarmored (Discontinuous Armoring)		Habitat area, wood debris		3H:1V to 5H:1V							+6
499.7-502		Y		Y		10	50	40	1	T3/S3/GH1		
500				Outfall (2215)								
501.1-502			ST02			N						
502.5-503.4 (RM 3.30-3.32)	Armored	Y	Riprap slope	Y	3H:1V	N	10	50	40	1	T3/S3/GH1	+6
503.4-505 (RM 3.26-3.30)	Unarmored (Discontinuous Armoring)	Y		Y	3H:1V		10	50	40	1	T3/S3/GH1	+6
503-520.5				ST21								
505			Exposed soil at top of slope			N						
505-506.7 (RM 3.25-3.26)	Armored			Y	2H:1V		10	50	40	1	T3/S3/GH1	Varies (lower than observed tide level to +2)
506-507				Concrete bulkhead above armor			N					
506.7-512.5 (RM 3.15-3.25)	Unarmored (Discontinuous Armoring)				2H:1V							Lower than observed tide level
507			Boat launch									
507.1			Debris wall above armor									
508			Outfall (3037)									
508-509.2			Rock wall above armor			N						
512.5-518 (RM 3.05-3.15)	Armored	Y	Large armor	Y	2H:1V		10	50	40	1	T3/S3/GH1	Lower than observed tide level
512.9				Brick wall above armor			N					
518-521.5 (RM 3-3.05)	Unarmored (Discontinuous Armoring)	Y	Aquatic vegetation	Y	4H:1V to flat		50	40	30	0	T3/S1/GH4	Varies (+4 to +8)
520-520.8				Small armor			N					

Attachment E-1b

LDW Detailed Observation Notes Compilation, West Bank (Stations 381.5-521.5)

Station	Transition Below Bank			General Notes	Photographs	
	Notes	Vegetation (Y/N)	Slope ²			Erosion (Y/N)
463.7-465.1 (RM 3.98-4.01)	Not observed	N	Not observed	National Industrial Holding facility (also referred to as Kelly Ryan Inc.)	140-141, 150-154	
463.7					140	
464.1-465.1	Lightly armored bank up to bulkhead				N	150-154, 969
465.1-471.6 (RM 3.91-3.98)		N	4H:1V to 5H:1V		145-149, 245-275	
465.1-471.3	Exposed sand and gravel				145-149, 273-275	
465.1-468.5		N				
468.5-471.3		N			N	272
471.6-483.7 (RM 3.68-3.91)						
483.7-486.1 (RM 3.63-3.68)	Exposed sand and silt		5H:1V	T-117 Early Action Area (Station 483.2 to 492.3)	237-242	
483.7-486.1		N			N	
486.1-489.3 (RM 3.56-3.63)	Exposed sand and silt	N	3H:1V		, 958, 960	
489.3	Piles				N	227
489.3-499.7 (RM 3.36-3.56)	Not observed		Not observed	South Park Marina	215-225, 767-787	
489.3-492.2	Armored slope					219-226
489.3-490.5		N				
492.2						219
492.2-499.7	Steep armor, pockets of vegetation					767-787
490.5-499.5		N				778, 767-787, 952, 956-957
497.2						772
499.7					N	215, 951
499.7-502.5 (RM 3.32-3.36)	Exposed bank, gravel		4H:1V		206-214	
499.7-502		Y				
500						213
501.1-502					N	South Park Bridge 208-210
502.5-503.4 (RM 3.30-3.32)	Exposed bank, some scattered small riprap		6H:1V	N	202-205	
503.4-505 (RM 3.26-3.30)			6H:1V		199-201	
503-520.5						167-205
505					N	Brick armor
505-506.7 (RM 3.25-3.26)		Y	Not observed in areas; 3H:1V		194-198	
506-507					N	194-196
506.7-512.5 (RM 3.15-3.25)	Not observed		Not observed		178-193	
507						162-193
507.1						191-192
508						189
508-509.2					N	184-190
512.5-518 (RM 3.05-3.15)	Not observed	Y	Not observed			Large riprap used as armoring 160-177
512.9	-		-	N		176
518-521.5 (RM 3-3.05)	Exposed sediment	N	4H:1V to 6H:1V	See below	Park habitat area in embayment 155-159	
520-520.8	Exposed sediment, Erosion visible			Y	Armored with a mix of rock, concrete slab, and cinder blocks 155-157	

Notes and Legend for Tables F-1a and F-1b

Notes:

1. Refer to Appendix F for detailed information on structures and outfalls (identified in this table as STXX and Outfall). Outfalls are reported using the Ecology outfall inventory ID.
2. All slopes are estimated.
3. All transition elevations between upper and lower slopes are estimated.
4. The only observed utility crossing in the upper reach was an overwater powerline near RM 4.4.
5. Access points for future sampling events (including nature and condition) can be identified in the videos and photographs collected during this field investigation.
6. Navigation obstructions or nearby structures that could indicate waterway traffic or current flow patterns that could affect the stability of the armoring or bank were noted where observed. More information on navigation obstructions and structures is available in separate structures forms.

Abbreviations:

MLLW: mean lower low water

RM: river mile