

Appendix G

Topographic Survey Data Report and Bank Features

1 Introduction

This appendix presents detailed information related to the topographic surveying activities conducted as part of the Lower Duwamish Waterway upper reach Phase II Pre-Design Investigation (PDI), as described below:

- Attachment G-1 of this appendix is the topographic survey data report prepared by the professional land surveyor.
- Attachment G-2 documents the bank feature identification activities performed by the project engineers to identify features of interest that will be relevant during 30% design. This effort was also performed to communicate these features to the surveyor so that location information would be collected during topographic surveying activities. Table G-1 summarizes the locations where bank features were collected based on the PDI stationing system shown on Maps 2-6a through 2-6f.

This information will be used in 30% design to help understand bank site conditions that may be disturbed during remedial action(s), and how to design the remedial action(s) to minimize impacts at bank locations above mean higher high waters. Topographic data and bank features information will inform habitat inventory, remedial technology design, and slope stability analyses.

Table G-1
Locations Where Bank Features Were Collected

Date	Stationing ¹	Nearest River Mile
6/30/21	492.3–493.3	3.5W
6/30/21	301.0–307.0	3.9E
6/30/21	308.6–315.8	4.1E
7/13/21	291.7–298.7	3.8E
7/13/21	330.2–331.6	4.2E (Slip 6)
7/13/21	361.7–363.0	4.7E
7/13/21	371.0–376.3	4.9E
7/13/21	406.3–417.6	4.7W

Notes:

1. Stationing is included on Maps 2-6a through 2-6f.

2 Attachments

Attachment G-1 Topographic Survey Data Report
Attachment G-2 Bank Features Tables

FINAL

Appendix G
Attachment G-1 Topographic Survey Data
Report

1 Introduction

The topographic survey of the Lower Duwamish Waterway upper reach was performed as part of Pre-Design Investigation Phase II work. The survey supplemented data obtained from previous bathymetric surveys and light detection and ranging (LiDAR) elevation data from King County that provided data for elevation ranges above approximately +2.3 ft above North American Vertical Datum (NAVD) 88, which equals mean lower low water (MLLW). Two types of information that could affect the remedial design and implementation of remedial actions were needed from the remedial action level (RAL) exceedance areas adjacent to banks: detailed elevation contours and extents of features (e.g., structures, bank armoring, woody vegetation). The topographic survey was performed at low tide when necessary to obtain data to overlap with bathymetric survey data and to the top of bank or, for lower banks, to approximately 50 ft landward of mean higher high water (MHHW).

The topographic survey was performed as described in the *Quality Assurance Project Plan Addendum: Pre-Design Surveys of the Lower Duwamish Waterway Upper Reach* (Anchor QEA and Windward 2021). The horizontal datum for this survey is North American Datum of 1983, 2011 adjustment (NAD83/2011), State Plane Coordinate System, Washington North Zone, measured in US Survey Feet, and the vertical datum for this survey is MLLW (NAVD 88 +2.34 ft).

The survey was performed beginning on June 30, 2021, with an overview of the areas and identification of features that needed to be delineated for design. The survey was mostly completed on July 28 with the final remaining items completed on August 10, 2021.

2 Survey Methods

The topographic survey was performed in Phase I RAL exceedance areas adjacent to the banks using global positioning system (GPS) and total station instruments. True North established multiple control points at each RAL exceedance area where topographic surveying was performed using the control network established prior to the 2019 bathymetric survey. The geodetic control survey was conducted using GPS techniques from monuments with published positions and elevations. The monuments are identified in Map G1-1.

The equipment used for the survey and associated precision of each instrument are as follows:

- Leica TS16 (Total Station): precision is 0.5 in. horizontally and vertically.
- Leica GS16 (GPS RTK Unit): precision is 8.0 mm + 1 part per million (ppm) horizontally and 15 mm + 1 ppm vertically.
- Leica LS10 (Digital Level with Bar Code Rod): precision is 0.3 mm vertically.

Data were collected on a 25-ft grid-like pattern as well as at break lines (tops and toes of slopes) and significant changes in the existing surfaces. Extents of significant surface bank features (such as

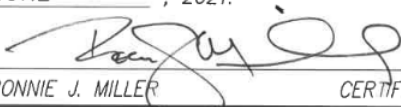

structures, bank armoring, vegetation, utilities, and debris) were determined by taking survey shots at corners of rectilinear features or at changes of curvature for curvilinear features.

The results of the survey in each of the RAL exceedance areas are shown on Maps G1-2 through G1-9. The maps show the proposed and actual limits of the survey, bathymetric and topographic contours, and the locations of surface features. The topographic survey overlapped with the bathymetric survey at all locations.

3 Deliverable

Topographic data were used to develop surface contours for each of the surveyed areas. The results of the topographic survey were provided in a drawing file and a coordinate file. The drawing file displays the topographic contours and the limits of surface features identified as potentially significant during the initial site visit.

4 Signature

SURVEYOR'S CERTIFICATE	
<i>THIS MAP CORRECTLY REPRESENTS A SURVEY MADE BY ME OR UNDER MY DIRECTION IN THE REQUEST OF</i>	
_____ <i>ANCHOR QEA</i>	
IN <u> JUNE </u> , 2021.	
SIGNED 	CERTIFICATE NO. 20118394
	

5 References

Anchor QEA, Windward. 2021. Quality assurance project plan addendum: pre-design surveys of the Lower Duwamish Waterway upper reach. Final. Submitted to EPA June 25, 2021. Anchor QEA and Windward Environmental LLC, Seattle, WA.

FINAL

Annexure 1 to Attachment G-1 Geodetic Control Survey Notes

Duwamish Waterway

CP-1

Start = 10:27
End = 10:42

S. Scribble BM 3765-4302

N: 198133.8310
E: 1272495.4610
EL: 15.662 (MLW)
EL: 19.322 (NAVD88)

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Tacoma, WA, USA • Rich@darling.com

19-24 4-5-19 KH JS S/

Find: COS (BM 3765-4302)
2" brass men w/punch
Point is 15' +/- N. of
the Int mic @ B+F
Ave So. of S. Portland St.
Point is on E conc side
walk, 24' NE of a CB, 35'
W. of a picnic bench.

CITY OF SEATTLE
3765
4302
SURVEY

R. B. ...

Duwamish Waterway

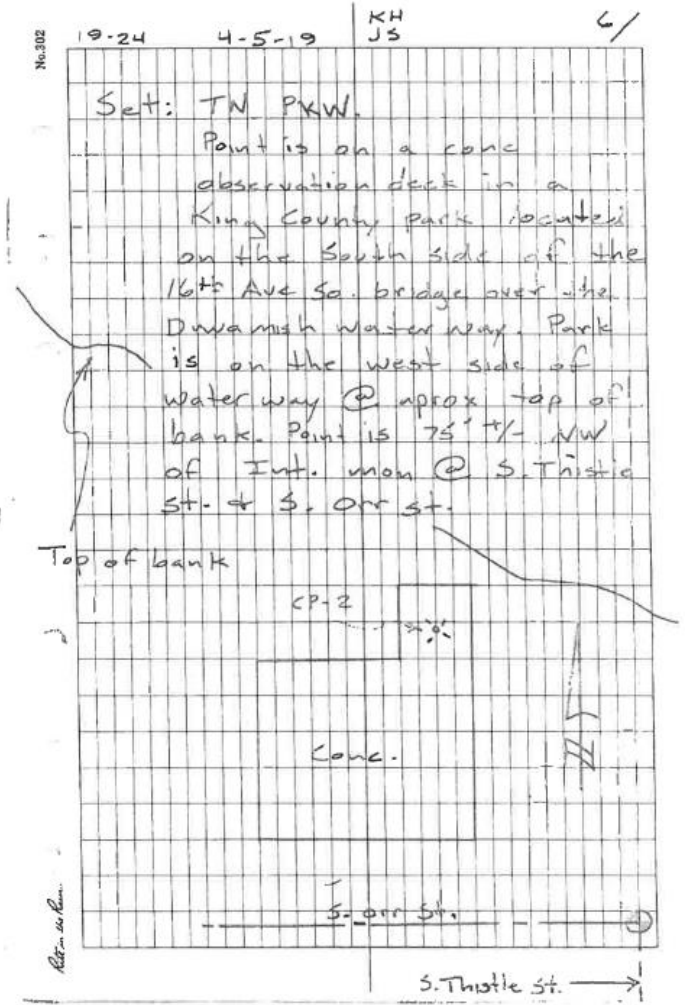
CP-2

Start = 11:08

Remarks to 31924-02
 In = 31924-02

N: 196306.3280
 E: 1274553.8670
 EL: 15.376 (NAVD88)
 EL: 17.716 (MLLW)

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Duwamish Waterway

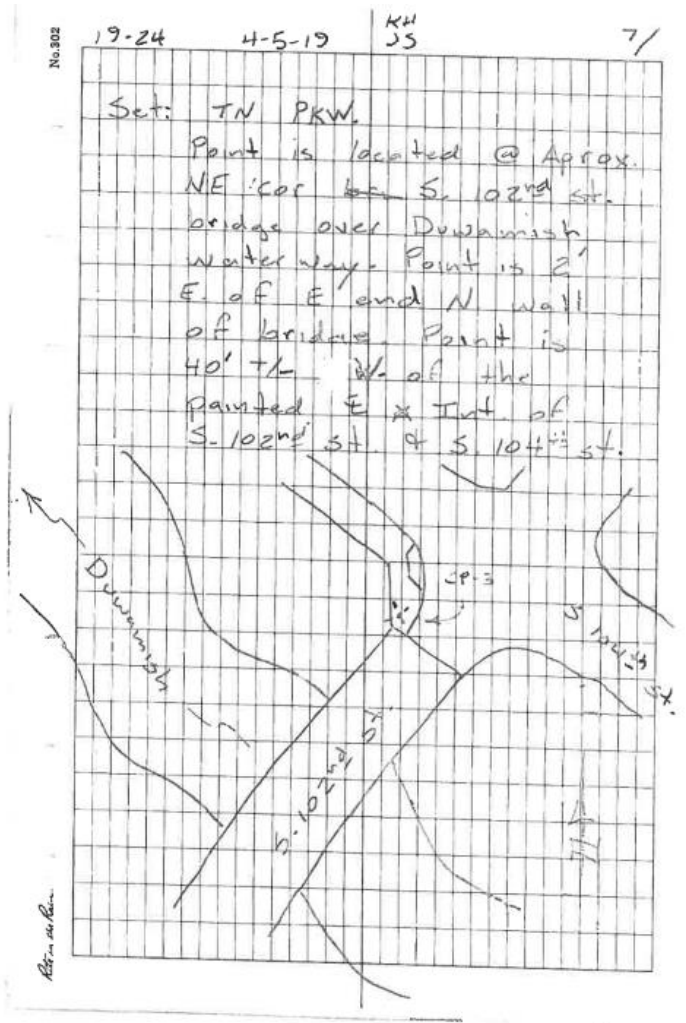
CP-3

Start = 12:13

Personnel: 1924-13
 in S. 102nd St.

N: 189971.2850
 E: 1278959.0970
 EL: 21.316 (NAVD 88)
 EL: 23.656 (MLLW)

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Duwamish Waterway

CP-4

Start = 12:41

GPS

N: 199421.7090
 E: 1278250.4770
 EL: 18.743 (NAVD83)
 EL: 21.083 (MLLW)

9.3

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No. 302

19-24 41-5-19 KH JS 5

Set: TN PKW

Point is on E. Side of East Marginal Way. Approx 100' S. of Phoenix Dr. Point is 12' W. of E BOW opp the N. end of a concrete wall. Point is set on line with So. face BLDG = 3210 to E. Point is 82' W. of PF #1354813

Phoenix Dr

East Marginal Way

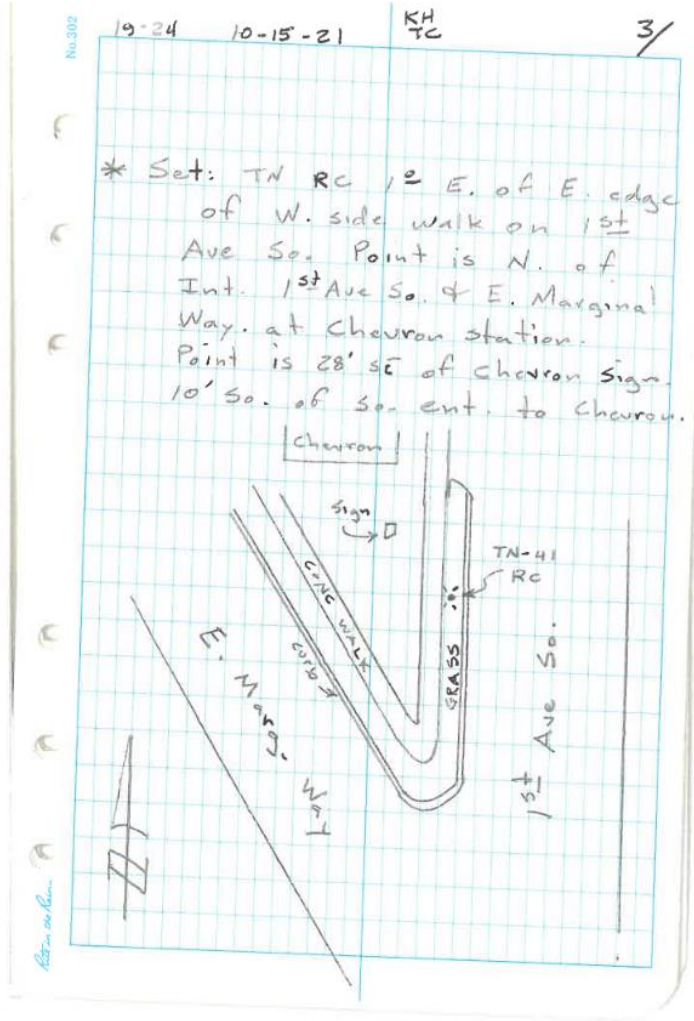
CP-4

PF

BLDG 3210

Return on Run

LDW	New	GPS	Control
PT	Red	Code	Desc.
CP-41	ZM	RC	
<p>N: 203955.2830 E: 1269749.3010 EL: 16.168 (NAVD85) EL: 18.508 (MLLW)</p>			

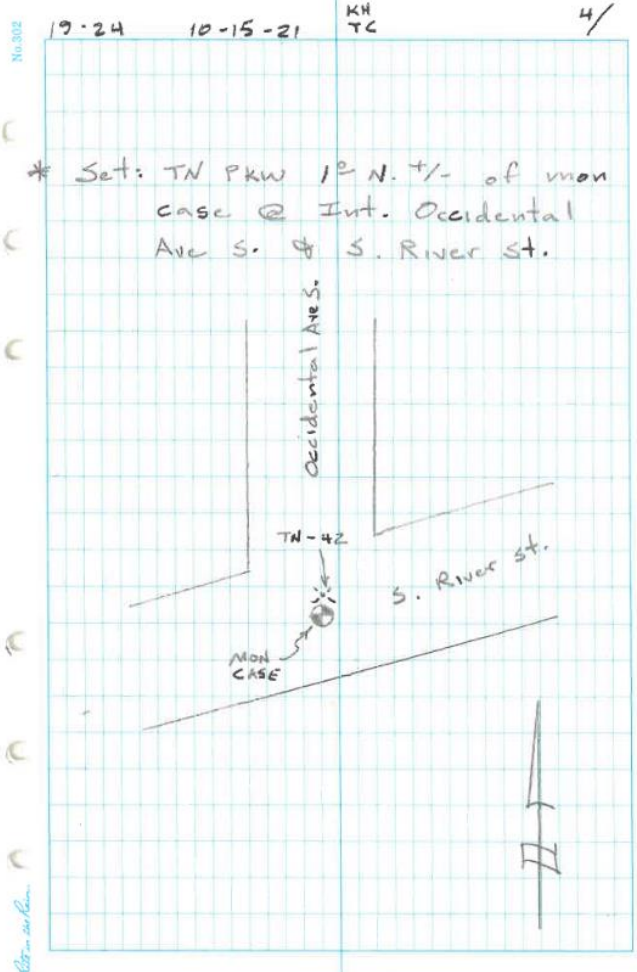


LDW New GPS Control

PT	Rod	Code	Desc
CP-42	ZM	PKW	

N: 201801.3310
 E: 1270041.6060
 EL: 12.365 (NAVD88)
 EL: 14.705 (MLLW)

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Appendix G

Attachment G-2 Bank Features Tables

Bank Features Inspection Field Record

Project	<i>Lower Duwamish Waterway Upper Reach PDI Phase II 180067-02.03 T0702</i>		Date	6/30/21
Stationing	492.3-493.3	Nearest River Mile	3.5 W	Time 1250
Crew	J. Laplante, R. Pickering, J. Pursley, True North, Bright Engineering		Tide	5.5-ft MLLW
Class	Present?	Notes		
Woody Vegetation	Y	Minor in riprap		
Bank Armoring	Y	Riprap (light)		
Above Ground Utilities	Y	Outfall HDPE in bank; two drain lines from top of ecology block		
Underground Utilities	N	n/a		
Debris	N	n/a		
Structures	Y	Ecology block wall not embedded (See FCA report ST-20 in Appendix F for more details)		
Fencing	Y	Top of wall		
Paving	Y	Behind fence		
Other	N	n/a		

Bank Features Inspection Field Record

Project	<i>Lower Duwamish Waterway Upper Reach PDI Phase II 180067-02.03 T0702</i>			Date	7/13/21
Stationing	291.7-298.7	Nearest River Mile	3.8 E	Time	1045
Crew	J. Laplante, K. Gross			Tide	4.1-ft MLLW
Class	Present?	Notes			
Woody Vegetation	Y	Small trees			
Bank Armoring	N	Vertical soil; unshored wood stub piling			
Above Ground Utilities	N	n/a			
Underground Utilities	Y?	None noted; evidence of buried steel pipe showing in bank (stormwater?)			
Debris	Y	Concrete chunks; derelict piling			
Structures	Y	Wood low bulkhead below vertical bank; derelict high bulkhead with panel gaps (See FCA report ST-03 in Appendix F for more details)			
Fencing	Y	Top of bank			
Paving	Y	Top of bank			
Other	Y	Debris near outfall at north end of wall; photos taken			

Bank Features Inspection Field Record

Project	<i>Lower Duwamish Waterway Upper Reach PDI Phase II 180067-02.03 T0702</i>		Date	6/30/21
Stationing	301.0-307.0	Nearest River Mile	3.9 E	Time 1340-1400
Crew	J. Laplante, R. Pickering, J. Pursley, True North, Bright Engineering		Tide	3.3-ft MLLW
Class	Present?	Notes		
Woody Vegetation	N	Bulkhead with vegetation above top of bank		
Bank Armoring	Bulkhead	Light random riprap		
Above Ground Utilities	N	Plugged pipe penetrations through bulkhead		
Underground Utilities	N	Upland buried electrical		
Debris	Y	Concrete scattered		
Structures	Y	Steel sheets, riveted and corroded at mudline (See FCA report ST-03 in Appendix F for more details)		
Fencing	Y	Top of sheetpile and upland		
Paving	Y	Upland paving		
Other	N	n/a		

Bank Features Inspection Field Record

Project	<i>Lower Duwamish Waterway Upper Reach PDI Phase II 180067-02.03 T0702</i>			Date	6/30/21
Stationing	308.6-315.8	Nearest River Mile	4.1 E	Time	1105
Crew	J. Laplante, R. Pickering, J. Pursley, True North, Bright Engineering			Tide	8.1-ft MLLW
Class	Present?	Notes			
Woody Vegetation	Y				
Bank Armoring	Y	Mixed riprap and concrete			
Above Ground Utilities	Y	Potential low voltage line in black plastic conduit noted on riprap			
Underground Utilities	N	n/a			
Debris	Y	Random concrete			
Structures	N	n/a			
Fencing	Y	Top of bank			
Paving	Y	Top of bank			
Other	N	n/a			

Bank Features Inspection Field Record

Project	<i>Lower Duwamish Waterway Upper Reach PDI Phase II 180067-02.03 T0702</i>			Date	7/13/21
Stationing	330.2-331.6	Nearest River Mile	4.2 E (Slip 6)	Time	1135
Crew	J. Laplante, K. Gross			Tide	2.2-ft MLLW
Class	Present?	Notes			
Woody Vegetation	Y	Trees beyond top of bank			
Bank Armoring	Y	Rock riprap			
Above Ground Utilities	N	2 outfalls at head of Slip 6 (none in bank area)			
Underground Utilities	N	n/a			
Debris	N	n/a			
Structures	Y	Concrete finger piers; wood fender piles in derelict condition; concrete bulkhead (See FCA report ST-05 in Appendix F for more details)			
Fencing	Y	Top of bank (Boeing security)			
Paving	Y	Top of bank			
Other	N	n/a			

Bank Features Inspection Field Record

Project	<i>Lower Duwamish Waterway Upper Reach PDI Phase II 180067-02.03 T0702</i>			Date	7/13/21
Stationing	361.7-363.0	Nearest River Mile	4.7 E	Time	1020
Crew	J. Laplante, K. Gross			Tide	5.4-ft MLLW
Class	Present?	Notes			
Woody Vegetation	Y	Some trees			
Bank Armoring	Y	Sparse, many unarmored oversteepened slopes with vegetation			
Above Ground Utilities	N	n/a			
Underground Utilities	N	n/a			
Debris	Y	Sparse concrete			
Structures	Y	Creosote pile supported concrete deck with wooden bulkhead (See FCA report ST-07 in Appendix F for more details)			
Fencing	Y	Low fence by Boeing covered walkway			
Paving	Y	Concrete walkway top of slope			
Other	N	n/a			

Bank Features Inspection Field Record

Project	<i>Lower Duwamish Waterway Upper Reach PDI Phase II 180067-02.03 T0702</i>			Date	7/13/21
Stationing	406.3-417.6	Nearest River Mile	4.7 W	Time	1230
Crew	J. Laplante			Tide	-0.1-ft MLLW
Class	Present?	Notes			
Woody Vegetation	Y	Habitat area, significant woody vegetation			
Bank Armoring	N	Small cobble scattered, but not enough to armor			
Above Ground Utilities	N	n/a			
Underground Utilities	Y	Irrigation line head seen at top of bank			
Debris	N	n/a			
Structures	N	n/a			
Fencing	N	n/a			
Paving	N	n/a			
Other	Y	No water access, inspected by land			

Bank Features Inspection Field Record

Project	<i>Lower Duwamish Waterway Upper Reach PDI Phase II 180067-02.03 T0702</i>			Date	7/13/21
Stationing	371.0-376.3	Nearest River Mile	4.9 E	Time	0940
Crew	J. Laplante, K. Gross			Tide	6.1-ft MLLW
Class	Present?	Notes			
Woody Vegetation	Y	Large deciduous and evergreen trees top of bank			
Bank Armoring	Y	Concrete block; riprap, concrete slab			
Above Ground Utilities	Y	Several outfalls (Norfolk, 18" outfall, abandoned outfall)			
Underground Utilities	N	n/a			
Debris	Y	Broken concrete			
Structures	Y	Wood piling stubs; concrete wing wall; outfall gate; debris deflectors (See FCA report ST-07 and ST-08 in Appendix F for more details)			
Fencing	Y	Low pedestrian fence by walkway			
Paving	Y	Walkway			
Other	Y	Signs of lower slope movement (geotech), tension cracks in spots; exposed geotextile on bank, no riprap at north end			