APPENDIX D
GEOTECHNICAL MONITORING DATA AND OBSERVATIONS

GEOTECHNICAL MONITORING DATA AND OBSERVATIONS

AS-BUILT REPORT FOR THE WHATCOM WATERWAY CLEANUP IN PHASE 1 SITE AREAS

Prepared for

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LIST OF ACRONYMS AND ABBREVIATIONS

CDF	controlled density fill
MDCI	Malcom Drilling Company, Inc.
MLLW	mean lower low water
MSB	Maple Street Bulkhead
Project	Whatcom Waterway Cleanup in Phase 1 Site Areas Project
PTI	Post-Tensioning Institute

1 SUMMARY OF GEOTECHNICAL MONITORING AND OBSERVATIONS

This appendix presents the geotechnical monitoring and observations that were completed for the Whatcom Waterway Cleanup in Phase 1 Site Areas Project (Project). The discussion includes Contractor means and methods associated with implementing geotechnical works for the Project, as well as appropriate adaptations to design requirements based on geotechnical elements that were encountered during construction. Elements of Project construction discussed in this appendix include the following:

- Pile installation (sheetpile, king pile, and dolphin and fender piles)
- Tieback anchor installation and testing
- Concrete slab and pavement subgrade evaluation
- Placement and verification of backfill material

Specific as-built information regarding installation of the sheet piles, king piles, dolphin piles, and fender piles is presented in Attachment A. Tieback installation records and testing forms are presented in Attachments B and C, respectively. Results of compaction testing for placement of backfill materials are presented in Attachment D.

2 PILE INSTALLATION

Three types of piles were installed as part of the Project: sheetpiles, king piles, and steel pipe piles. Sheetpile walls (i.e., remediation cutoff walls) were designed to serve as source control structures and were installed along the Central Waterfront Shoreline area. These structures include construction of a tieback bulkhead wall at the former Maple Street Bulkhead (MSB) located within the Colony Wharf lease area. King piles were installed (in connection to sheet pile sections) just west of the MSB to provide support for loading from a replacement barge ramp structure that will be utilized as part of the Port C Street Terminals Facility. Steel pipe piles were used to construct the dolphins and fender piles along the Central Waterfront Shoreline area. The record drawings in Appendix C present the numbering scheme used for the sheetpiles and pipe piles used by the Contractor.

Sheetpiles were advanced primarily using an APE Model 200-6 (i.e., vibratory hammer). The Contractor was unable to reach the design tip elevation for some sheets using this hammer

due to difficult driving conditions and presence of obstructions in some alignment areas. The Contractor decided to terminate installation driving of the sheetpile sections with the APE hammer (with approval provided by the Port's engineer), generally based on a rate of advancement of less than 3 inches per minute. For piles that did not reach the design tip elevation, a larger hammer (ICE 416) provided additional effort to advance the sheetpiles to the design tip elevation. The results varied in these attempts, with some piles being terminated at a tip elevation shallower than the elevation required by the design. Sheetpiles that were terminated above the design tip elevation were reviewed by the structural and geotechnical engineer prior to cutting the piles. The sheetpile section numbering scheme begins with No. 1 at the eastern extent of the alignment and increases to the western termination point. Significant debris was encountered at the eastern portion of the proposed sheetpile wall alignment, which required a minor revision to the alignment to avoid these subsurface obstructions. The record drawings in Appendix C present the alignment revision shown as the as-built condition for the wall.

King piles were advanced using the ICE 416 vibratory hammer. Three of the four king piles were terminated approximately 15 to 17 feet shallower than the design tip elevation. The Contractor decided to terminate the piles (with approval from the Port's engineer), generally based on the rate of advancement. Advancement rates were observed as low as 1 inch per hour of driving before termination. The piles with shallower embedment were reviewed and accepted by the structural and geotechnical engineer prior to cutting the piles.

Steel pipe piles (dolphin and fender piles) were installed using the APE 200-6 vibratory hammer. All piles were advanced to the design tip elevations.

3 TIEBACK ANCHORS

A replacement sheetpile and remediation wall was constructed at the former Maple Street Bulkhead location to support the Phase 1 cleanup activities while also maintaining berthing depths needed for Port operations within this area of Whatcom Waterway. The sheet pile sections were installed waterward of the existing bulkhead prior to commencing dredging activities in the vicinity of the structure. Due to the required berthing elevations (needed for waterway operations) at the face of the replacement wall, tieback anchors were required to

support and stabilize the exposed section of wall. A total of 50 tieback anchors were installed between January 18 and 28, 2016, along the replacement wall alignment.

The drilling of boreholes and installation and testing of tiebacks was performed by Malcom Drilling Company, Inc. (MDCI) as a subcontractor to the American Construction Company (prime Contractor for completion of the Project). The installation and testing of the tieback anchors was observed by an Anchor QEA geotechnical engineer on site during completion of the work. The geotechnical engineer also verified that tieback materials imported to the site and installed by MDCI were consistent with Specification Section 31 68 13 – Soil and Rock Anchors and Submittal 048.02 – Tieback Anchor.

3.1 Tieback Installation

Table D1 summarizes the quantity and design requirements for the tieback anchors.

Table D1
Tieback Anchor Installation Schedule

Quantity	Design Load (kips)	Unbonded Length (feet)	Bonded Length (feet)	Number of Strands	Inclination with Horizontal (degrees)
6[1]	100	79	50	3	15
20	100	48	50	3	25
24[2]	100	60	50	3	20

Notes:
1. Quantity modified from 2 to 6 due to constructability concerns presented to the design team by MDCI
2. Quantity modified from 28 to 24 as per Note 1

The modification to adjust four anchors to a shallower inclination (i.e., 20° to 15°) and associated whaler modifications were coordinated by the Port's structural engineer and the Contractor prior to tieback installation and testing.

The drilling of the boreholes to facilitate tieback anchor installation was performed using a drill rig fixed to an overwater carriage and suspended via crane. Boreholes were drilled through the existing concrete face of the MSB, and the alignment of the drill head was

verified before and after penetration through the bulkhead. The alignment was adjusted as necessary to maintain the proposed inclination (Table D1) within a tolerance of 3 degrees.

Observations of the drill cuttings during the advancement of the boreholes was used to approximate the contact elevation of the clay unit (i.e., Bellingham Drift). The contact was estimated to be present between elevations of -9.8 and -14.8 feet mean lower low water (MLLW) but was variable along the wall alignment. Additionally, contact with wood debris, believed to be timber piles, was noted and an estimate of the contact elevation was made and recorded on the installation logs.

Tieback drilling was generally sequenced and completed to avoid consecutive boreholes being drilled during the same shift. However, five tiebacks (i.e., No. 1 through No. 5) were drilled and installed consecutively on the last day of installation. No exceptions were noted during installation that would indicate communication between these boreholes. The Contractor elected to install adjacent boreholes with a 1- to 2-degree variation for all tiebacks to help mitigate the potential for borehole communication. Boreholes remained cased during the installation and the gravity grouting of the tiebacks. Following the extraction of the drill casings, the boreholes were filled with grout. Post-grouting (via pressure injection) of the anchors was performed 1 to 2 days after the initial gravity grouting was complete. In general, post-grouting was performed until the maximum pressure of the available grouting plant was achieved; this value was observed to be approximately 900 pounds per square inch. Grout cubes were collected for materials testing at the time of grout mixing each day and were taken to a laboratory for strength testing. Results of the grout cube strength tests completed for the Project met the design requirements and are presented in Appendix I – Physical Testing Data.

3.2 Tieback Testing

Testing of the tiebacks for proof, performance, and extended creep was performed consistent with the testing procedures and acceptance criteria presented in the Post-Tensioning Institute (PTI) manual for stressing rock and soil anchors. The acceptance criteria for each test type is demonstrated on the testing records that are included as Attachment C. Anchors to be tested for performance and extended creep were selected at the discretion of

Anchor QEA (based on observations made during installation as discussed above) with input from MDCI and approval from the Port's structural engineer. Table D2 summarizes the anchor testing schedule.

Table D2
Tieback Anchor Testing Schedule

Test Type	Number Tested	Tieback No.	Failed Tieback No.
Proof	43	1-3, 5-13, 16-22, 23, 24, 26-39, 41, 43, 45-50	21, 39, 46
Performance	5	4, 14, 25, 40, 44	N/A
Extended Creep	2	22, 42	N/A

In general, the proof, performance, and extended creep tests performed on the tieback anchors met the requirements of the design, indicating that the anchors will satisfy the loading requirements established for the design life of the structure. The proof testing acceptance criteria was not met for tiebacks No. 21, 39, and 46. For No. 39, the test could not be completed due to an insufficient range of the dial gauge. A larger gauge was used for the retest with acceptable results. No. 46 was retested due to an exceedance of the total displacement during the 10-minute hold at 133% of the design load. It was suspected that wind moved the dial assembly, creating false movements; therefore, the test was reinitiated at 100% of the design load. The test could not be rerun at the alignment load due to an inability to safely remove the strand grabbers at the anchor head; however, the results of the retest were acceptable. It is also noted that No. 21 did not develop the free length recommended by PTI guidance during implementation of the testing, but because the anchor did not exceed displacement during the 10-minute hold of the 133% design load, the anchor was ultimately accepted.

Following completion of proof, performance, and extended creep testing activities, all tiebacks were locked off between a load of 69 and 89 kips per the design requirements. The tieback caps were then filled with Portland cement, placed over the anchor head, and secured via a bolt to the bulkhead waler.

4 SUBGRADE EVALUATIONS

Exposure of subgrades beneath existing pavement and concrete slabs that were present along the shoreline areas resulted from shoreline excavation activities, excavation for earth pressure relief behind sheetpile walls, and other shoreline debris removal activities. In areas where voids were observed beneath the slabs and pavements, the Contractor was instructed to break the concrete slabs and pavement over the void area and fill the voids with structural fill. Replacement of the old concrete slabs and pavement with new slabs or pavement sections was performed at a later date.

The Contractor's means and methods for placing and compacting the structural fill within void areas was visually confirmed at the time work was performed. The Contractor used roller-compacted equipment where possible and hand-operated compaction equipment for smaller areas. Compaction testing was not performed to verify the prepared subgrade because engineered pavement slabs were not being constructed as part of this Project. The subgrade was generally accepted based on visual observations of the Contractor's means and methods and documented condition of the finished subgrade surface.

Additionally, soil subgrade surfaces that were prepared beneath the sheetpile wall concrete cap beams were visually inspected by the on-site inspector or geotechnical engineer prior to concrete placement. No deficiencies were observed regarding the visual appearance of the subgrade surface at the time that the inspections were performed. A summary of subgrade observations are provided in the Daily Field Reports that were prepared by the Port's construction management support inspectors for the Project.

5 BACKFILL MATERIAL PLACEMENT

Backfill material placement was primarily performed within the Central Waterfront area in relation to the completion of construction activities for the remediation/containment walls. Shoreline excavation activities were performed on the upland side of the wall to create earth pressure relief, and backfill material was placed with on-site materials deemed reusable by the field inspector or with import structural fill. At the MSB, a large void was created through the demolition and removal of the barge ramp structure, and was backfilled using quarry spalls and imported structural fill. Also at the MSB, controlled density fill (CDF) was

placed between the old and new MSB walls where the gap between the structures was less than 3 feet in width. Structural fill was placed for void spaces that were observed to be wider than 3 feet. Backfill material was also used for trench backfilling of a storm drain line running from the former clarifier tank foundation to an upland catch basin near the shoreline at the former GP West property.

The Contractor placed and compacted the fill material behind the remediation/containment walls in lifts using hand-operated equipment until the fill area was large enough for a vibratory roller. The field engineer performed a visual inspection to verify compaction.

Prior to placement of backfill material at the MSB, tieback anchors were pre-stressed to 10% to 12% of the design load to limit potential wall deflections during placement of the backfill material. The tieback anchor pre-stressing was performed with oversight by the structural engineer. Where the void space was less than 3 feet, CDF placement was performed in lifts of approximately 6 to 7 feet until final grades were achieved. Where the void was wider than 3 feet, placement and compaction of structural fill was performed in lifts using hand-operated construction equipment and verified using nuclear density tests at an approximate elevation of -2 feet MLLW. For the barge ramp void, structural fill was placed in lifts and compacted using a dozer. Compaction was also verified using nuclear density tests at an approximate elevation of -2 feet MLLW and top of grade (i.e., approximately elevation 12 feet MLLW). The minimum relative compaction requirement of 90% was achieved at all locations tested. A summary of compaction test results is included in Attachment D.

For a replacement storm drain line, running from the former clarifier foundation to an upland catch basin within the former GP West, trench backfilling activities were performed using import backfill material and a hoe-pack for compaction. The field engineer performed a visual inspection to verify compaction.

ATTACHMENT A
PILE INSTALLATION RECORDS

Sheet #	Sheet Length	Top	AB Tip	Design Tip	Alignment Issues	Notes
1.1	35	14.42	-20.58	-20		
1.2	35	14.25	-20.75	-20		
1.3	35	14.06	-20.94	-20		
1	50	12	-38	-37		
2	50	13.5	-36.5	-37		
3	50	14.25	-35.75	-37		
4	50	12	-38	-37		
4.5	50	12	-38	-37		
5	50	12	-38	-37		
6	50	12	-38	-37		
7	50	12	-38	-35		
8	50	12	-38	-35		
9	50	12	-38	-35		
10	50	12	-38	-35		
11	50	12	-38	-35		
12	50	12	-38	-35		
13	50	12	-38	-35		
14	50	12	-38	-35		
15	50	12	-38	-35		
16	50	12	-38	-35		
17	50	12	-38	-35		
18	50	12	-38	-35		
19	50	12	-38	-35		
20	50	12	-38	-35		
21	50	12	-38	-35		
22	50	12	-38	-35		
23	50	12	-38	-35		
24	50	12	-38	-35		
25	50	12	-38	-35		
26	50	12	-38	-35		
26.5	50	12	-38	-35		
27	60	11	-49	-49		
28	60	11	-49	-49		
29	60	11	-49	-49		
30	60	11	-49	-49		

Sheet #	Sheet Length	Top	AB Tip	Design Tip	Alignment Issues	Notes
31	60	11	-49	-49		
32	60	11	-49	-49		
33	60	11	-49	-49		
34 West	60	11.68	-48.32	-49		
34 East	60	11	-49	-49		
35	60	11	-49	-49		
36	60	11	-49	-49		
37	60	11	-49	-49		
38 West	60	11	-49	-49		
38 East	60	12	-48	-49		
39	60	11	-49	-49		
40	60	11	-49	-49		
41	60	11	-49	-49		
42	60	11	-49	-49		
43	60	11	-49	-49		
44	60	11	-49	-49		
45	60	11	-49	-49		
46 West	60	11	-49	-49		
46 East	60	13	-47	-49		
47 West	60	11	-49	-49		Removed and re-sealed
47 East	60	11	-49	-49		
48	60	11	-49	-49		
49	60	11	-49	-49	5 1/4" North	
50 West	60	11.68	-48.32	-49	5" North	
50 East	60	13	-47	-49		
51	60	11	-49	-49		
52 West	60	12.32	-47.68	-49	4 1/2" North	
52 East	60	11.68	-48.32	-49	4" North	
53 West	60	11	-49	-49		
53 East	60	12.32	-47.68	-49	8" North	
54 West	60	13.16	-46.84	-49		
54 East	60	17.25	-42.75	-49		
55 West	60	11.75	-48.25	-49		
55 East	60	12.75	-47.25	-49		
56 West	60	12.08	-47.92	-49		

Sheet #	Sheet Length	Top	AB Tip	Design Tip	Alignment Issues	Notes
56 East	60	12.08	-47.92	-49		
57 West	60	12.33	-47.67	-49		
57 East	60	12.33	-47.67	-49	4 1/4" North	
58 West	60	12.08	-47.92	-49		
58 East	60	11.58	-48.42	-49		
59 West	60	11.25	-48.75	-49		
59 East	60	13.08	-46.92	-49		
60 West	60	13.1	-46.9	-49		
60 East	60	14.16	-45.84	-49		
61 West	60	12.83	-47.17	-49		
61 East	60	13.92	-46.08	-49		
62	59.08	11.68	-47.4	-49	4" South	
63	60	11	-49	-49		
64 West	60	14.75	-45.25	-49		
64 East	60	11.8	-48.2	-49		
65	60	13.67	-46.33	-49		
66	60	13.5	-46.5	-49		
67 West	60	12.5	-47.5	-49	8 1/4" North	
67 East	60	13.5	-46.5	-49	7 1/2" North	
68	59.08	12.89	-46.19	-49		
69	60	11.58	-48.42	-49		
70 West	60	11.92	-48.08	-49		
70 East	60	11	-49	-49		
71	60	11	-49	-49		
72 West	60	11.16	-48.84	-49		
72 East	60	12	-48	-49		
73	60	11	-49	-49		
74	60	11	-49	-49		
75	60	11	-49	-49		
76 West	60	11.16	-48.84	-49		
76 East	60	11	-49	-49		
77 West	60	11.54	-48.46	-49		
77 East	60	11	-49	-49		
78 West	60	13.66	-46.34	-49		
78 East	60	12.5	-47.5	-49		

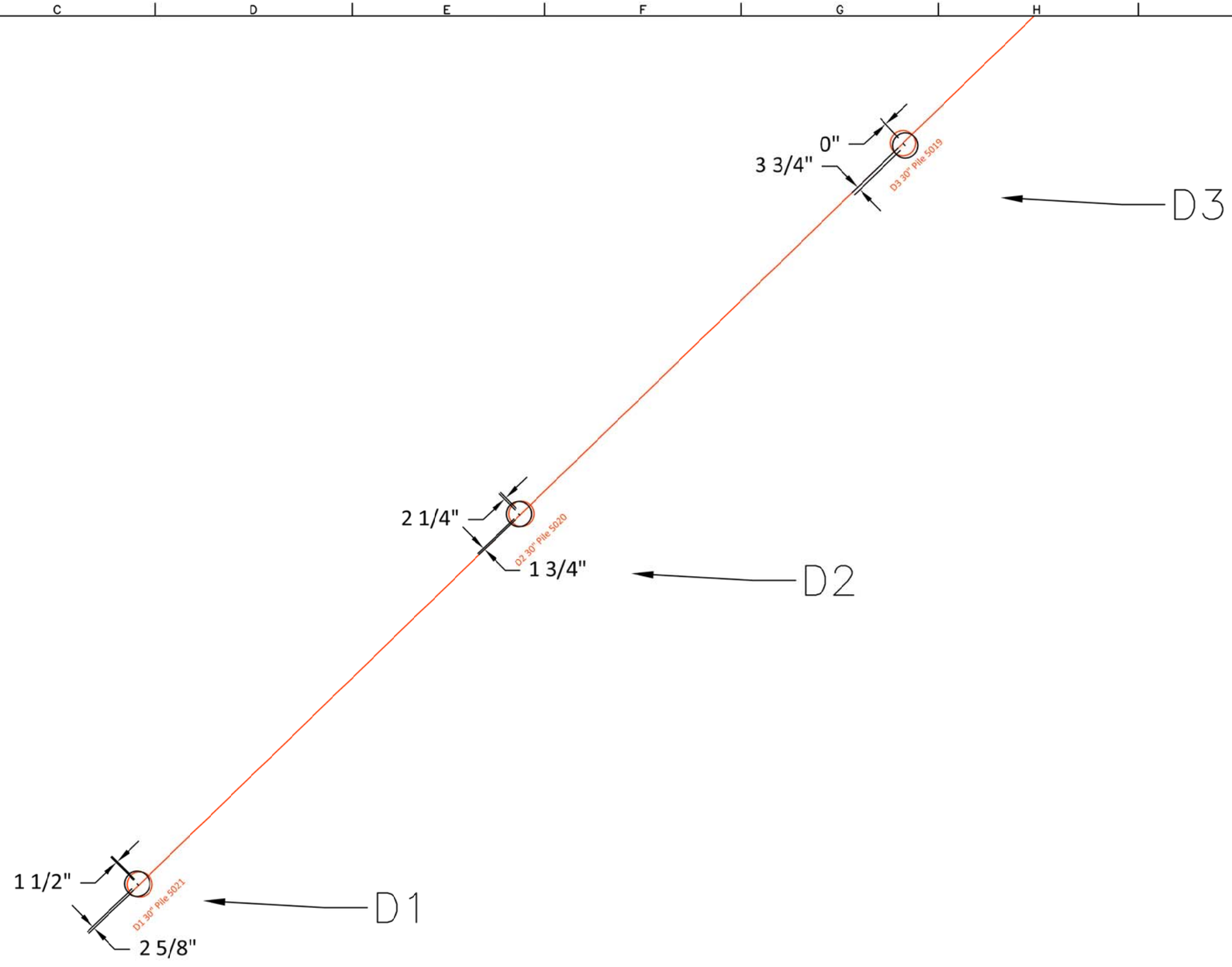
Sheet #	Sheet Length	Top	AB Tip	Design Tip	Alignment Issues	Notes
79	60	11.25	-48.75	-49		
79.5	60	11	-49	-49		
80	45	20.05	-24.95	-22.5		
King#1	115	16.16	-98.84	-100	Advanced 7" in 15 mins of driving with King Kong	
81	45	22.74	-22.26	-22.5		
King #2	115	31.75	-83.25	-100	Advance 4" in 15 mins w/ king kong	
82	45	22.39	-22.61	-22.5		
83	45	22.92	-22.08	-22.5		
King #3	115	31	-84	-100		
84	45	23.71	-21.29	-22.5		
King #4	115	29.7	-85.3	-100	Advanced 1' in 1 hour of driving with King Kong	
85	50	18.78	-31.22	-22.5		
86	50	14.54	-35.46	-34		
87	50	14.65	-35.35	-34		
88	50	15.43	-34.57	-34		
89	50	12.79	-37.21	-34		
90	50	13.75	-36.25	-34		
91 West	50	13	-37	-34		
91 East	50	14.35	-35.65	-34		
92	50	12.1	-37.9	-34		
93	50	14.05	-35.95	-34		
94	50	12.5	-37.5	-34		
95	50	12	-38	-34		
96	50	12.1	-37.9	-34		
97	50	12	-38	-34		
98	50	16	-34	-34		
99 West	50	12.06	-37.94	-34		
99 East	50	12.26	-37.74	-34		
100	50	11.88	-38.12	-34		
101	50	13.4	-36.6	-34		
102 West	50	12.4	-37.6	-34		
102 East	50	12.48	-37.52	-34		
103	50	12.12	-37.88	-34		
104	50	13.02	-36.98	-34		
105	50	14.4	-35.6	-34		

Sheet #	Sheet Length	Top	AB Tip	Design Tip	Alignment Issues	Notes
106	50	12.1	-37.9	-34		
107 West	50	14.45	-35.55	-34		
107 East	50	13.95	-36.05	-34		
108	50	15.83	-34.17	-34		
109 West	50	13	-37	-34		
109 East	50	14.25	-35.75	-34		
110 West	50	12	-38	-34		
110 East	50	13.08	-36.92	-34		
111	50	12.6	-37.4	-34		
112	50	12	-38	-34		
113	50	12.55	-37.45	-34		
114	50	12.7	-37.3	-34		
115 West	50	12	-38	-34		
115 East	49.08	12.2	-36.88	-34		Fresh head
116	50	12	-38	-34		
117	50	14.1	-35.9	-34		
118 West	50	15.5	-34.5	-34		
118 East	50	13	-37	-34		
119 East	50	15.35	-34.65	-34		
120 West	50	12.4	-37.6	-34		
120 East	50	12.6	-37.4	-34		
121 West	50	16	-34	-34		
121 East	50	13.6	-36.4	-34		
122 West	50	12.3	-37.7	-34		
122 East	50	12.8	-37.2	-34		
123 West	50	13.1	-36.9	-34		
123 East	50	13.4	-36.6	-34		
124 West	50	12.3	-37.7	-34		
124 East	50	12.4	-37.6	-34		
125 West	50	12	-38	-34		
125 East	50	12.06	-37.94	-34		
126 West	50	12	-38	-34		
126 East	50	12	-38	-34		
127 West	50	14	-36	-34		
127 East	50	14	-36	-34		

Sheet #	Sheet Length	Top	AB Tip	Design Tip	Alignment Issues	Notes
128	50	16	-34	-34		
129	50	15.85	-34.15	-34		
130 West	50	14.95	-35.05	-34		
130 East	50	14.7	-35.3	-34		
131 West	50	15.46	-34.54	-34		
131 East	50	14.46	-35.54	-34		
132 West	50	13.3	-36.7	-34		
132 East	50	13.65	-36.35	-34		
133 West	50	14.25	-35.75	-34		
133 East	50	14.15	-35.85	-34		
134 West	50	15.55	-34.45	-34		
134 East	50	21.9	-28.1	-34	Hard driving, hit obstruction	
135 West	50	15.7	-34.3	-34		
135 East	50	13.35	-36.65	-34		
136 West	50	13.55	-36.45	-34		
136 East	50	13.65	-36.35	-34		
137 West	50	13.65	-36.35	-34		
137 East	50	21	-29	-34	Hard driving, hit obstruction	
138 West	50	15.3	-34.7	-34		
138 East	50	15.6	-34.4	-34		
139 West	50	14	-36	-34		
139 East	50	13.9	-36.1	-34		
140 West	50	14.15	-35.85	-34		
140 East	50	20	-30	-34	Hard driving, hit obstruction	
141 West	50	15.7	-34.3	-34		
141 East	50	13	-37	-34		
142 West	50	15	-35	-34		
142 East	50	14.15	-35.85	-34		
143 West	50	15.2	-34.8	-34		
143 East	50	15.2	-34.8	-34		
144 West	50	15	-35	-34		
144 East	50	14.9	-35.1	-34		
145	50	16	-34	-34		
146 West	50	17.65	-32.35	-34		
146 East	50	25.45	-24.55	-34		

Sheet #	Sheet Length	Top	AB Tip	Design Tip	Alignment Issues	Notes
147 West	50	14	-36	-34		
147 East	50	14	-36	-34		
148 West	50	15.03	-34.97	-34		
148 East	50	15.1	-34.9	-34		
149 West	50	13.15	-36.85	-34		
149 East	50	13.78	-36.22	-34		
150 West	50	15.6	-34.4	-34		
150 East	50	25.45	-24.55	-34		
151	50	15.9	-34.1	-34		
152	25	15.5	-9.5	-7		
153	25	14.33	-10.67	-7		
153.5	25	13.78	-11.22	-7		
154	25	15.33	-9.67	-7		
155	25	14.5	-10.5	-7		
156	25	17.5	-7.5	-7		
157 South	25	16	-9	-7		
157 North	25	13.37	-11.63	-7		
158 South	25	16.15	-8.85	-7		
158 North	25	15.85	-9.15	-7		
159	25	15.65	-9.35	-7		
160	25	13.5	-11.5	-7		
161	25	14.5	-10.5	-7		

Pile #	Pile length	Top as driven	AB Tip	Design Tip	Desing N	Design E	AB #	AB N	AB E	Top after splice	Date Driven	Hammer	Notes	Column1
D1	85	5.52	-79.48	-80	642741.79	1240983.44	4006	642741.86	1240983.2	20.52	3/24/2016	Ape 200-6	Design location changed in RFI 51.	
D2	85	5.52	-79.48	-80	642778.34	1241021.12	4007	642778.32	1241020.89	20.52	3/24/2016	Ape 200-6	Design location changed in RFI 51.	
D3	85	5.44	-79.56	-80	642814.89	1241058.8	4008	642814.66	1241059.02	20.44	3/24/2016	Ape 200-6	Design location changed in RFI 51.	
D4	85	5.5	-79.5	-80	642851.45	1241096.48	4009	642851.5	1241096.78	20.5	3/24/2016	Ape 200-6	Design location changed in RFI 51.	
D5	85	5.58	-79.42	-80	642888.00	1241134.17	4010	642887.94	1241134.28	20.58	3/24/2016	Ape 200-6	Design location changed in RFI 51.	
D6	85	5.42	-79.58	-80	642924.55	1241171.85	4005	642924.19	1241171.75	20.42	3/25/2016	Ape 200-6	Design location changed in RFI 51.	
D7	85	5.49	-79.51	-80	642961.11	1241209.54	4004	642961.26	1241209.53	20.49	3/25/2016	Ape 200-6	Design location changed in RFI 51.	
D8	85	5.54	-79.46	-80	642997.66	1241247.22	4003	642998.07	1241247.87	20.54	3/23/2016	Ape 200-6	Design location changed in RFI 51, Pile hit obstruction, slid east.	
D09	85	5.6	-79.4	-80	643034.21	1241284.9	4002	643034.19	1241285.08	20.6	3/23/2016	Ape 200-6	Design location changed in RFI 51	
D10	85	5.58	-79.42	-80	643062.047	1241313.6	4001	643061.76	1241313.76	20.58	3/23/2016	Ape 200-6	Design location changed in RFI 51	
~~D11~~	~~85~~	~~5~~	~~-80~~	~~-80~~	~~643203.57~~	~~1241458.62~~	~~5137~~	~~643203.46~~	~~1241458.48~~			Ape 200-6	Design location changed in RFI 51	
D11 RFI51	85	5	-80	-80	643203.14	1241459.05	19	643203.02	1241458.68	20	3/28/2016	Ape 200-6	Design location changed in RFI 51	
~~D12~~	~~85~~	~~5~~	~~-80~~	~~-80~~	~~643238.38~~	~~1241494.52~~	~~5136~~	~~643237.83~~	~~1241494.61~~			Ape 200-6	Design location changed in RFI 51	
D12 RFI51	85	4.93	-80.07	-80	643220.54	1241476.99	18	643220.29	1241477.05	19.93	3/28/2016	Ape 200-6	Design location changed in RFI 51	
D13	101	20.7	-80.3	-80	642838.69	1241605.54	4000	642837.00	1241603.4		3/22/2016	Ape 200-6	Field fit pile for gangway to land on exist dock	
18" pile	74	15	-59	-55	643264.259	1241528.28	15	643264.07	1241527.91		3/18/2016	Ape 200-6		
18" pile	74	15	-59	-55	643245.596	1241546.38	16	643245.91	1241546.69		3/18/2016	Ape 200-6		
18" pile	74	15	-59	-55	643245.068	1241560.72	18	643245.78	1241560.83		3/18/2016	Ape 200-6		
18" pile	74	15	-59	-55	643263.004	1241583.6	14	643264.4	1241583.17		3/18/2016	Ape 200-6		
18" pile	74	15	-59	-55	643254.928	1241537.33	13	643255.05	1241537.43		3/18/2016	Ape 200-6		
F1	45	13.5	-31.5	-29	643088.868	1241343.14	12	643088.88	1241343.04		3/26/2016	Ape 200-6		
F2	45	13.5	-31.5	-29	643097.223	1241351.75	11	643097.15	1241351.83		3/26/2016	Ape 200-6		
F3	45	13.5	-31.5	-29	643105.578	1241360.37	10	643105.75	1241360.33		3/26/2016	Ape 200-6		
F4	45	13.5	-31.5	-29	643113.933	1241368.98	9	643114.09	1241368.89		3/26/2016	Ape 200-6		
F5	45	13.5	-31.5	-29	643122.288	1241377.6	8	643122.44	1241377.69		3/26/2016	Ape 200-6		
F6	45	13.5	-31.5	-29	643130.642	1241386.21	7	643130.88	1241386.3		3/26/2016	Ape 200-6		
F7	45	13.5	-31.5	-29	643138.997	1241394.82	6	643139.00	1241394.85		3/25/2016	Ape 200-6		
F8	45	13.5	-31.5	-29	643147.352	1241403.44	5	643147.28	1241403.35		3/25/2016	Ape 200-6		
F9	45	13.5	-31.5	-29	643155.707	1241412.05	4	643155.78	1241411.97		3/25/2016	Ape 200-6		
F10	45	13.5	-31.5	-29	643164.062	1241420.66	3	643164.08	1241420.65		3/25/2016	Ape 200-6		
F11	45	13.5	-31.5	-29	643172.416	1241429.28	2	643172.58	1241429.33		3/25/2016	Ape 200-6		
F12	45	13.5	-31.5	-29	643180.771	1241437.89	1	643180.68	1241437.87		3/25/2016	Ape 200-6		



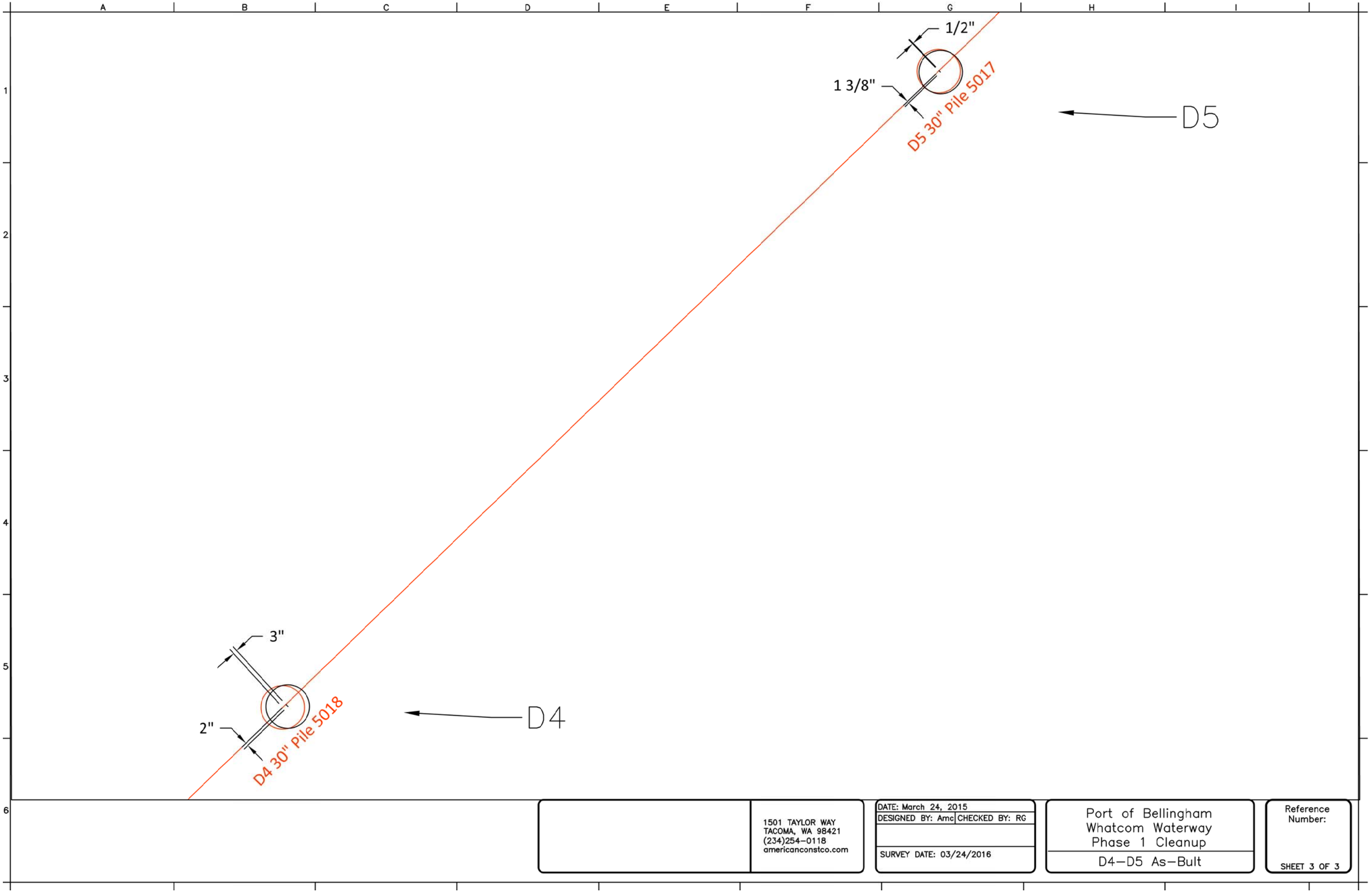
1501 TAYLOR WAY
TACOMA, WA 98421
(234)254–0118
americanconstco.com

DATE: March 24, 2015
DESIGNED BY: Amc | CHECKED BY: RG
SURVEY DATE: 03/24/2016

Port of Bellingham
Whatcom Waterway
Phase 1 Cleanup

D1–D3 As–Built

Reference Number:



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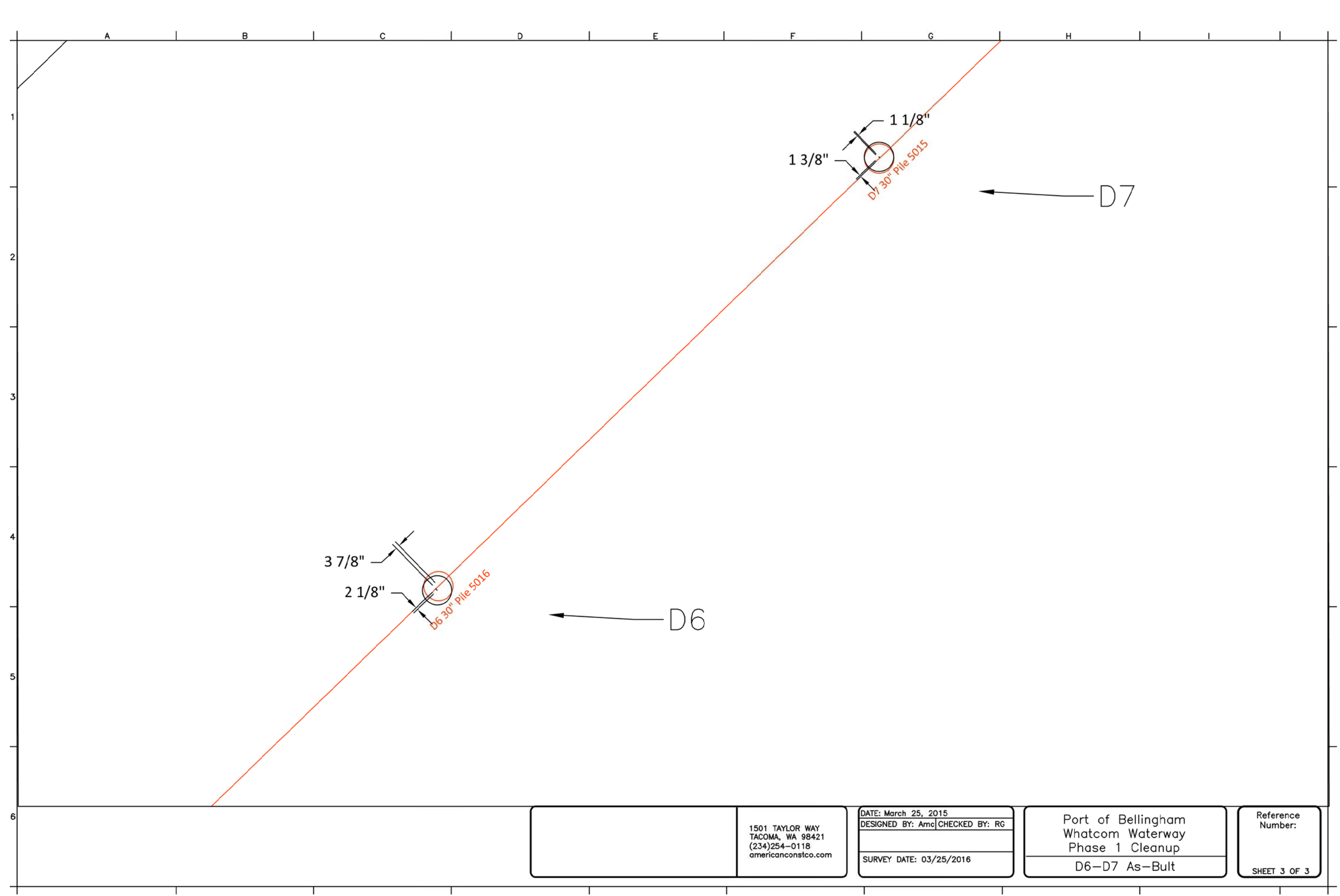
DATE: March 24, 2015
DESIGNED BY: Amc | CHECKED BY: RG
SURVEY DATE: 03/24/2016

Port of Bellingham
Whatcom Waterway
Phase 1 Cleanup

D4–D5 As–Built

Reference Number:



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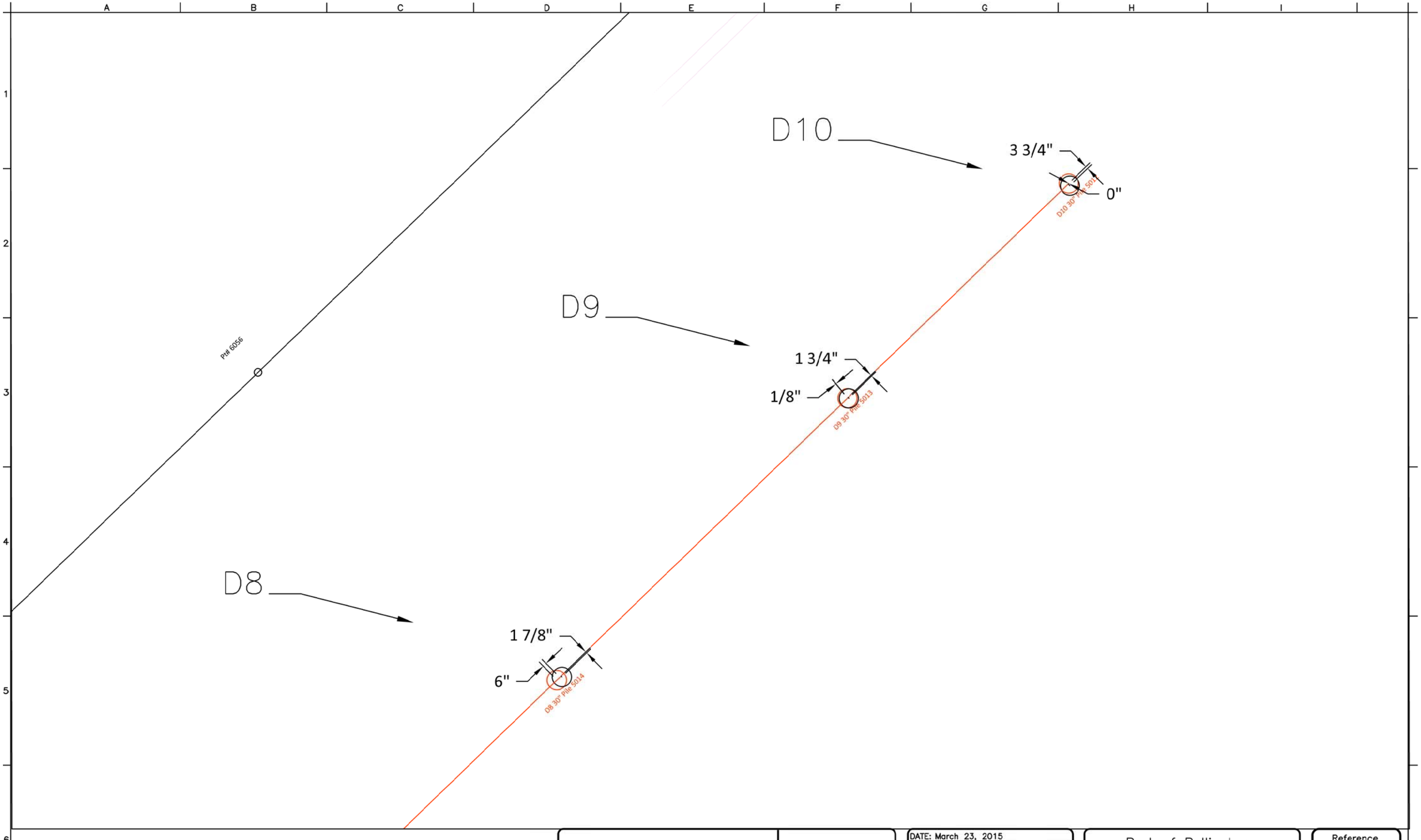
DATE: March 25, 2015
DESIGNED BY: Amc | CHECKED BY: RG
SURVEY DATE: 03/25/2016

Port of Bellingham
Whatcom Waterway
Phase 1 Cleanup

D6–D7 As–Built

Reference Number:



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Port of Bellingham
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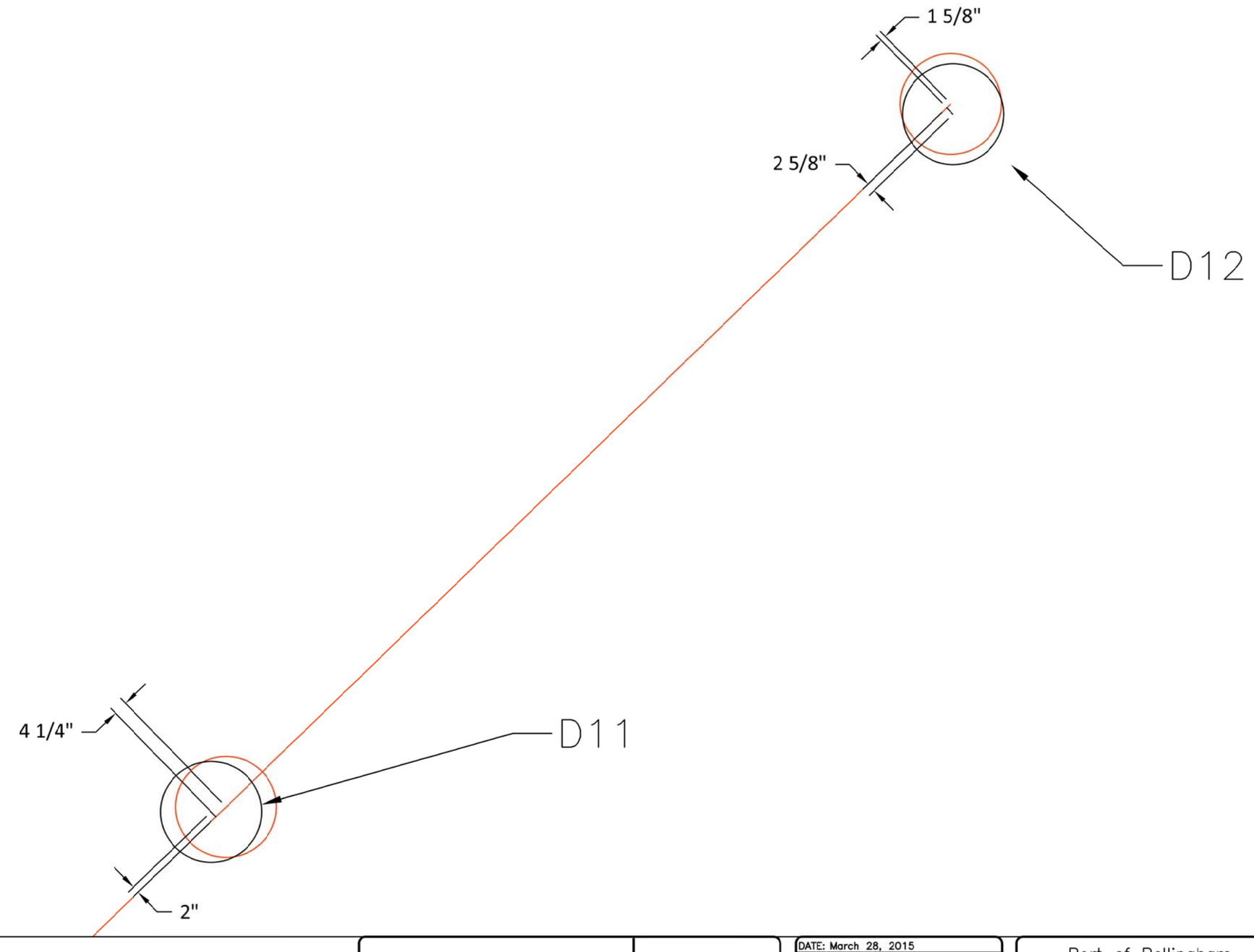
Phase 1 Cleanup

D8–D10 As–Built

Reference Number:

SHEET 1 OF X



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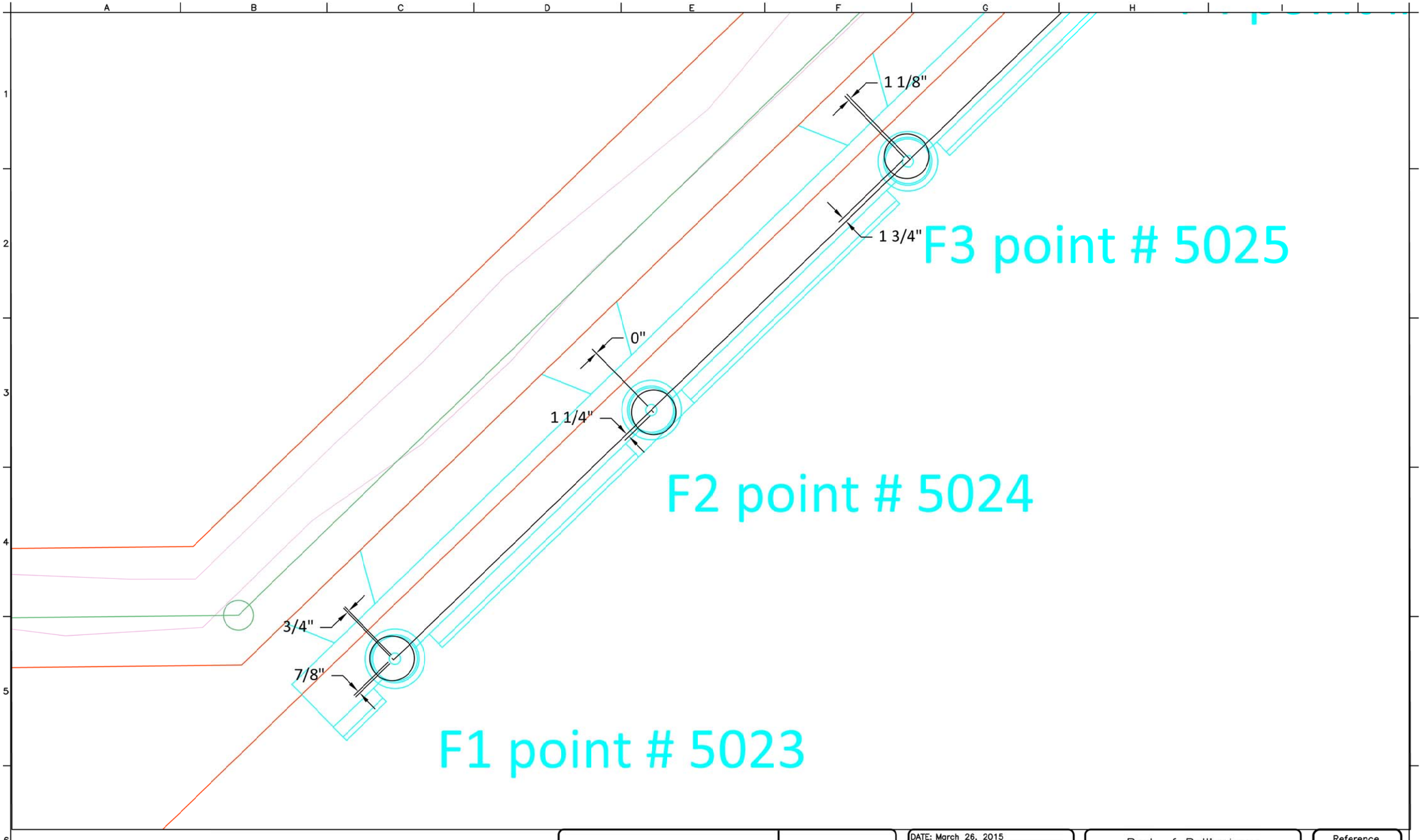
DATE: March 28, 2015
DESIGNED BY: Amc | CHECKED BY: RG
SURVEY DATE: 03/28/2016

Port of Bellingham
Whatcom Waterway
Phase 1 Cleanup

D11–D12 As–Built

Reference Number:



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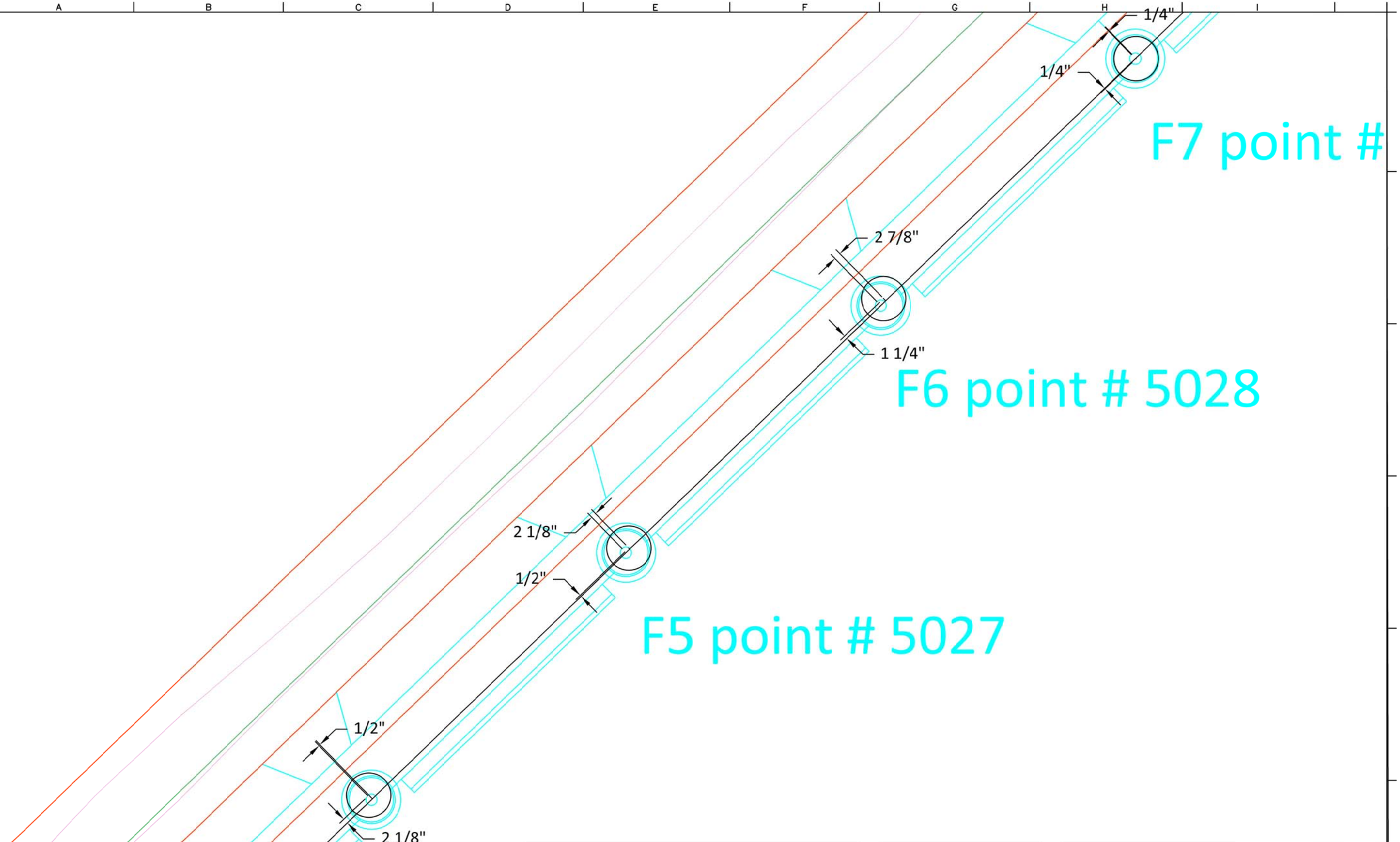
DATE: March 26, 2015
DESIGNED BY: Amc CHECKED BY: RG
SURVEY DATE: 03/26/2016

Port of Bellingham
Whatcom Waterway
Phase 1 Cleanup
F3–F1 As–Built

Reference Number:

SHEET 1 OF X



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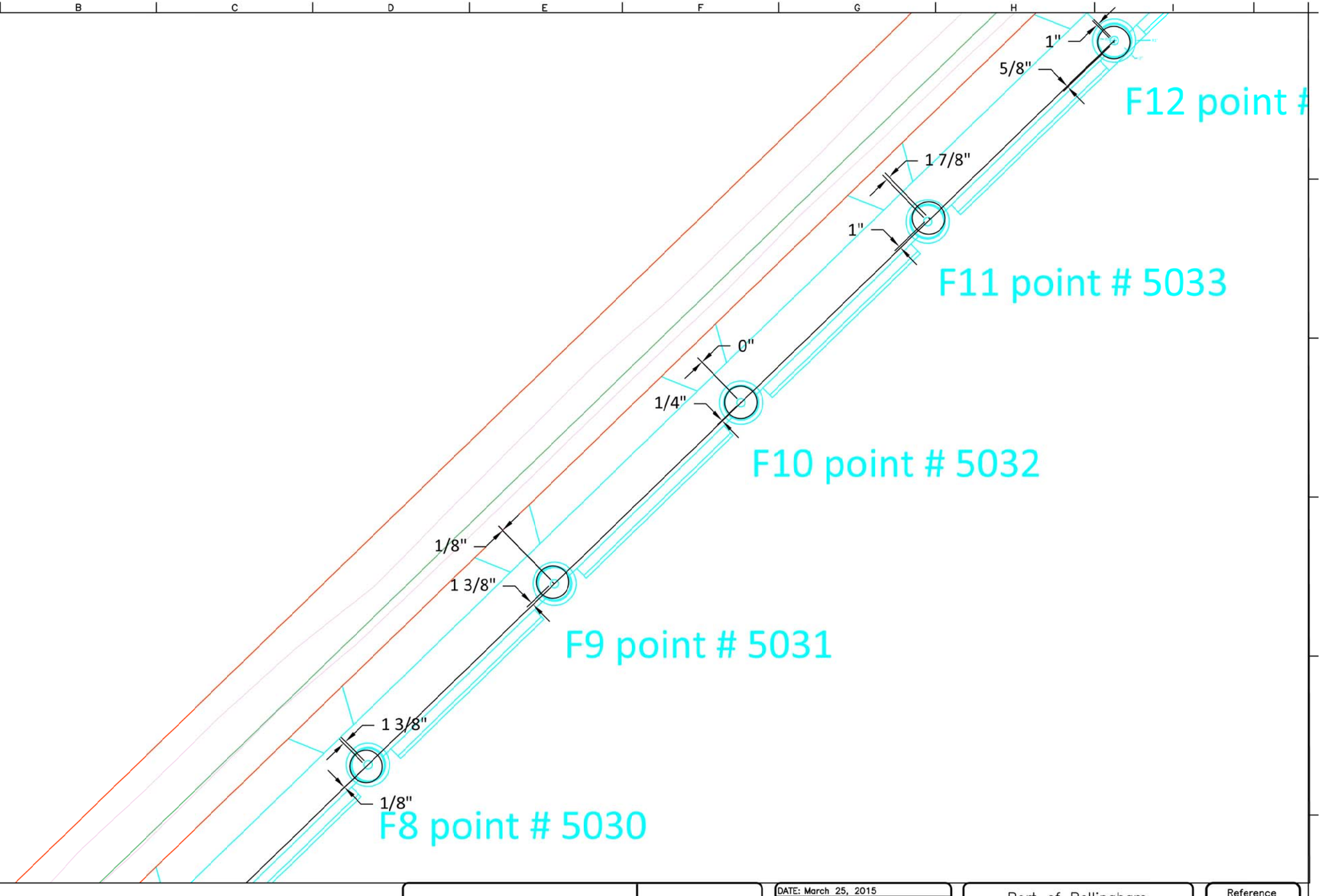
DATE: March 26, 2015
DESIGNED BY: Amc CHECKED BY: RG
SURVEY DATE: 03/26/2016

Port of Bellingham
Whatcom Waterway
Phase 1 Cleanup
F7–F4 As–Built

Reference Number:

SHEET 1 OF X



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DATE: March 25, 2015
DESIGNED BY: Amc | CHECKED BY: RG
SURVEY DATE: 03/25/2016

Port of Bellingham
Whatcom Waterway
Phase 1 Cleanup
F12–F8 As–Built

Reference Number:

SHEET 1 OF X

ATTACHMENT B
TIEBACK INSTALLATION LOGS

(Provided Separately)

ATTACHMENT C
TIEBACK TESTING RECORD FORMS

Tieback Proof Testing

Sheet No.: 1

Tieback Location	Tieback No.	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	1	1/28/2016	1/29/2016			3/24/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	103	50	52.1	0.9	4.450	ZLK	ZLK

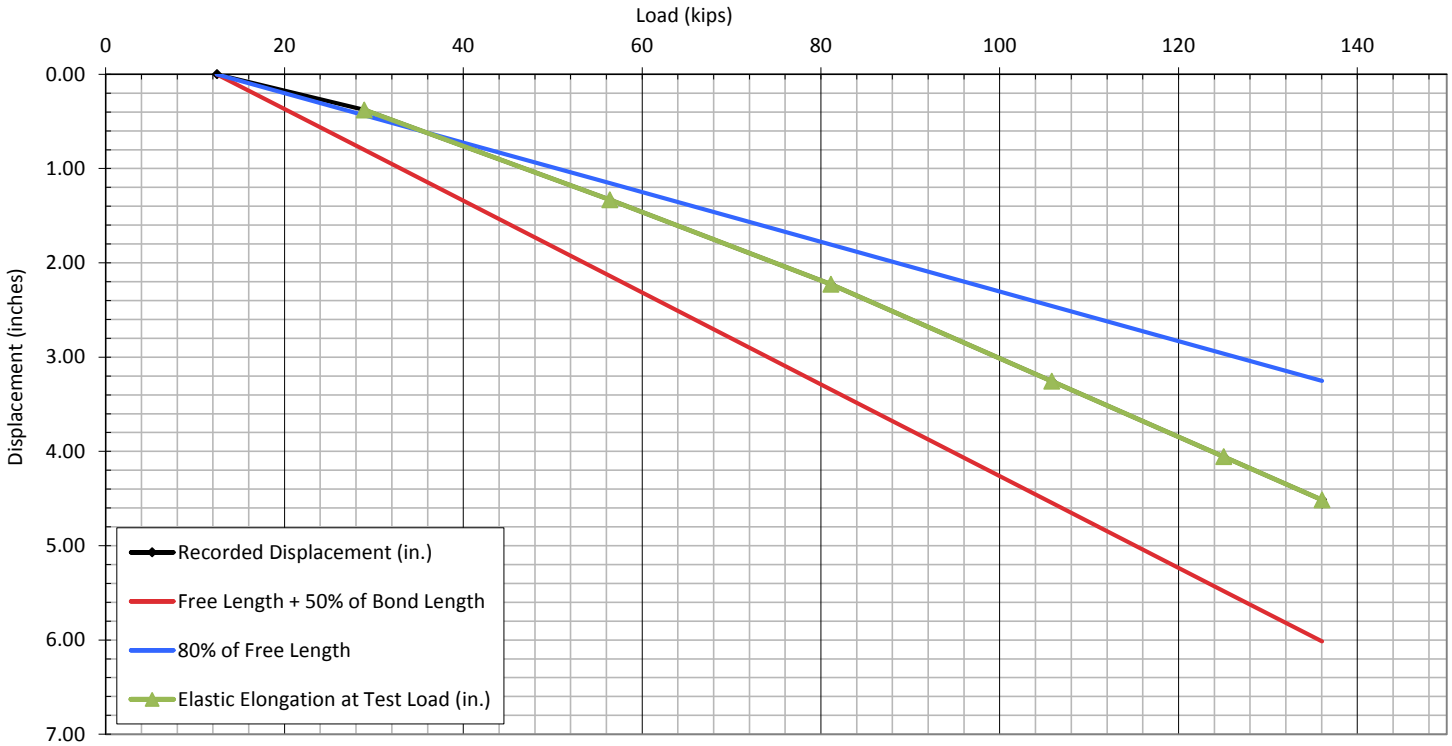
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	12	400	0.000	---	0.000	0.000	---	
---	0.25DL	29	1000	0.378	0.378	0.802	0.434	127.82	
---	0.50DL	56	2000	1.330	1.330	2.139	1.156	47.93	
---	0.75DL	81	2900	2.228	2.228	3.342	1.806	51.39	
---	1.00DL	106	3800	3.256	3.256	4.545	2.457	55.22	
---	1.20DL	125	4500	4.056	4.056	5.481	2.963	57.04	
---	1.33DL	136	4900	4.515	4.515	6.016	3.252	57.86	
1	1.33DL	136	4900	4.515	---	6.016	3.252	---	
2	1.33DL	136	4900	4.515	---	6.016	3.252	---	
3	1.33DL	136	4900	4.549	---	6.016	3.252	---	<-- Laborer
4	1.33DL	136	4900	4.549	---	6.016	3.252	---	moved test
5	1.33DL	136	4900	4.549	---	6.016	3.252	---	beam
6	1.33DL	136	4900	4.551	---	6.016	3.252	---	Pump the jack
10	1.33DL	136	4900	4.552	---	6.016	3.252	---	
---	AL	15	500		---	---	---	---	
---	LOCKOFF	89	3200	---	---	3.743	2.023	---	

Total Movement Between 1 and 10 Minutes (in.)	0.037
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141121
Gauge I.D. 12-4



Note: Test results were recorded by Kameron Peters of Malcolm Drilling, Inc.

Tieback Proof Testing

Sheet No.: 2

Tieback Location	Tieback No.	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	2	1/28/2016	1/29/2016			3/24/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	103	50	54.5	-1.5	4.450	KP (MDCI)	ZLK

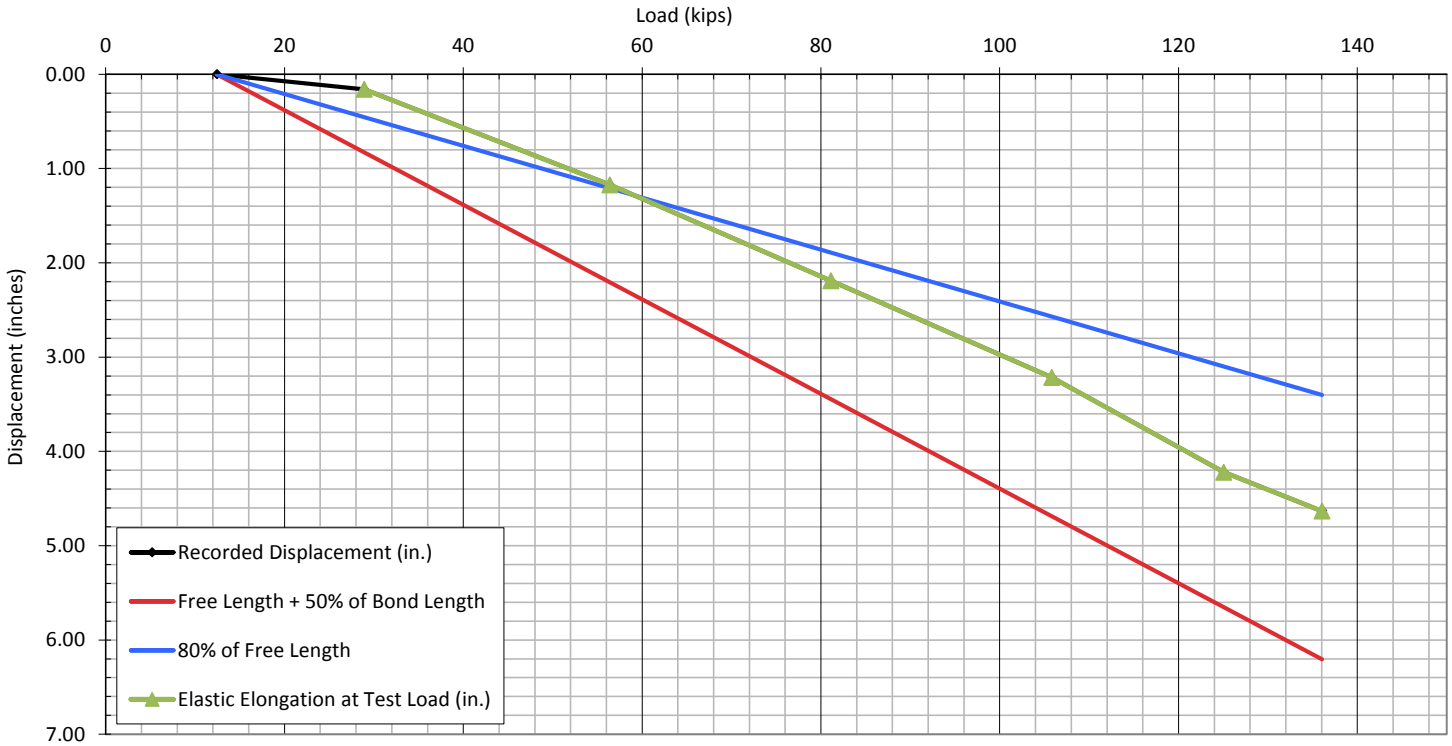
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	12	400	0.000	---	0.000	0.000	---	
---	0.25DL	29	1000	0.160	0.160	0.827	0.454	112.73	
---	0.50DL	56	2000	1.173	1.173	2.206	1.210	42.27	
---	0.75DL	81	2900	2.190	2.190	3.447	1.890	50.51	
---	1.00DL	106	3800	3.215	3.215	4.688	2.571	54.53	
---	1.20DL	125	4500	4.221	4.221	5.653	3.100	59.36	
---	1.33DL	136	4900	4.632	4.632	6.204	3.403	59.35	
1	1.33DL	136	4900	4.632	---	6.204	3.403	---	
2	1.33DL	136	4900	4.632	---	6.204	3.403	---	
3	1.33DL	136	4900	4.632	---	6.204	3.403	---	
4	1.33DL	136	4900	4.632	---	6.204	3.403	---	
5	1.33DL	136	4900	4.632	---	6.204	3.403	---	
6	1.33DL	136	4900	4.632	---	6.204	3.403	---	
10	1.33DL	136	4900	4.645	---	6.204	3.403	---	
---	AL	15	500		---	---	---	---	
---	LOCKOFF	78	2800	---	---	3.309	1.815	---	

Total Movement Between 1 and 10 Minutes (in.)	0.013
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141121
Gauge I.D. 12-4



Note: Test results were recorded by Kameron Peters of Malcolm Drilling, Inc.

Tieback Proof Testing

Tieback Location	Tieback No.	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	3	1/28/2016	1/29/2016			3/24/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	103	50	52.3	0.8	4.450	KP (MDCI)	ZLK

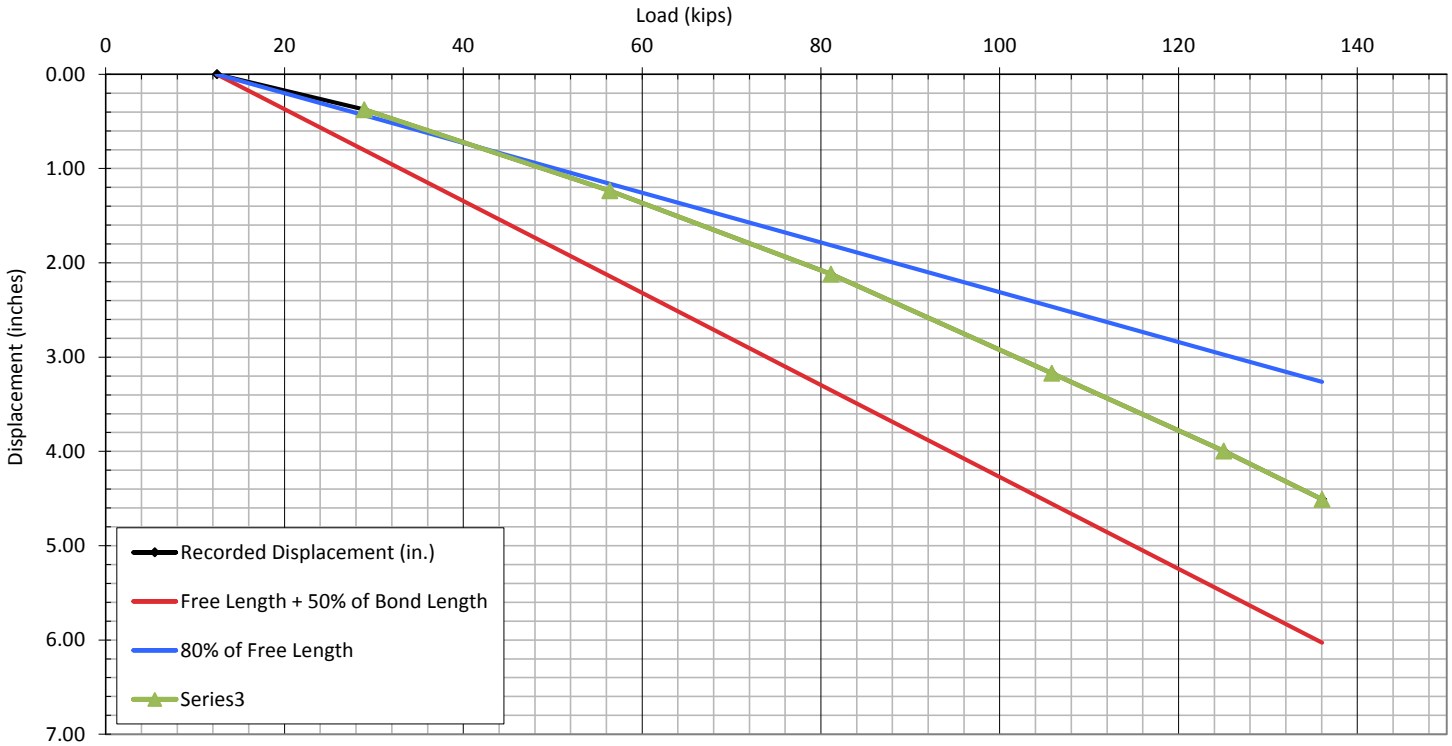
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	12	400	0.000	---	0.000	0.000	---	
---	0.25DL	29	1000	0.375	0.375	0.804	0.435	118.79	
---	0.50DL	56	2000	1.236	1.236	2.143	1.160	44.54	
---	0.75DL	81	2900	2.120	2.120	3.349	1.812	48.90	
---	1.00DL	106	3800	3.172	3.172	4.555	2.465	53.80	
---	1.20DL	125	4500	3.996	3.996	5.493	2.972	56.20	
---	1.33DL	136	4900	4.508	4.508	6.029	3.262	57.77	
1	1.33DL	136	4900	4.508	---	6.029	3.262	---	
2	1.33DL	136	4900	4.508	---	6.029	3.262	---	
3	1.33DL	136	4900	4.508	---	6.029	3.262	---	
4	1.33DL	136	4900	4.508	---	6.029	3.262	---	
5	1.33DL	136	4900	4.508	---	6.029	3.262	---	
6	1.33DL	136	4900	4.508	---	6.029	3.262	---	
10	1.33DL	136	4900	4.540	---	6.029	3.262	---	
---	AL	15	500		---	---	---	---	
---	LOCKOFF	78	2800	---	---	3.215	1.740	---	

Total Movement Between 1 and 10 Minutes (in.)	0.032
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141121
Gauge I.D. 12-4



Note: Test results were recorded by Kameron Peters of Malcolm Drilling, Inc. The pressure for the lock off load was not recorded and is approximated.

Tieback Performance Test

Sheet No.: 4

Tieback Location	Tieback No.	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	4	1/28/2016	1/29/2016			3/24/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	103	50	52	0.7	4.450	KP (MDCI)	ZLK

Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)[1]	Recorded Displacement (in.)[2]	Elastic Elongation at Load Cycle Maximum (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	12	400	0.000	---	0.000	0.000	---	
---	0.25DL	29	1000	0.463	0.231	0.805	0.436	22.20	
---	AL	12	400	0.232	---	0.000	0.000	---	
---	0.25DL	29	1000	0.460	---	0.805	0.436	---	
---	0.50DL	56	2000	1.296	1.014	2.146	1.162	36.54	
---	AL	12	400	0.282	---	0.000	0.000	---	
---	0.25DL	29	1000	0.530	---	0.805	0.436	---	
---	0.50DL	56	2000	1.311	---	2.146	1.162	---	
---	0.75DL	81	2900	2.180	1.860	3.353	1.815	42.90	
---	AL	12	400	0.320	---	0.000	0.000	---	
---	0.25DL	29	1000	0.512	---	0.805	0.436	---	
---	0.50DL	56	2000	1.452	---	2.146	1.162	---	
---	0.75DL	81	2900	2.222	---	3.353	1.815	---	
---	1.00DL	106	3800	3.262	2.857	4.560	2.469	48.45	
---	AL	12	400	0.405	---	0.000	0.000	---	
---	0.25DL	29	1000	0.682	---	0.805	0.436	---	
---	0.50DL	56	2000	1.517	---	2.146	1.162	---	
---	0.75DL	81	2900	2.356	---	3.353	1.815	---	
---	1.00DL	106	3800	3.315	---	4.560	2.469	---	
---	1.20DL	125	4500	4.027	3.432	5.499	2.977	48.27	
---	AL	12	400	0.595	---	0.000	0.000	---	
---	0.25DL	29	1000	0.815	---	0.805	0.436	---	
---	0.50DL	56	2000	1.655	---	2.146	1.162	---	
---	0.75DL	81	2900	2.528	---	3.353	1.815	---	
---	1.00DL	106	3800	3.454	---	4.560	2.469	---	
---	1.20DL	125	4500	4.132	---	5.499	2.977	---	
---	1.33DL	136	4900	4.597	---	6.035	3.267	---	
1	1.33DL	136	4900	4.593	---	---	---	---	
2	1.33DL	136	4900	4.592	---	---	---	---	
3	1.33DL	136	4900	4.591	---	---	---	---	
4	1.33DL	136	4900	4.595	---	---	---	---	
5	1.33DL	136	4900	4.592	---	---	---	---	
6	1.33DL	136	4900	4.590	---	---	---	---	pump jack
10	1.33DL	136	4900	4.590	3.908	---	---	50.08	set dial @ 4"
---	AL	12	400	0.682	---	---	---	---	
---	LOCKOFF	81	2900		---	3.353	1.815	---	

Total Movement Between 1 and 10 Minutes (in.)	-0.003
Maximum Total Movement Allowed (in.):	0.040

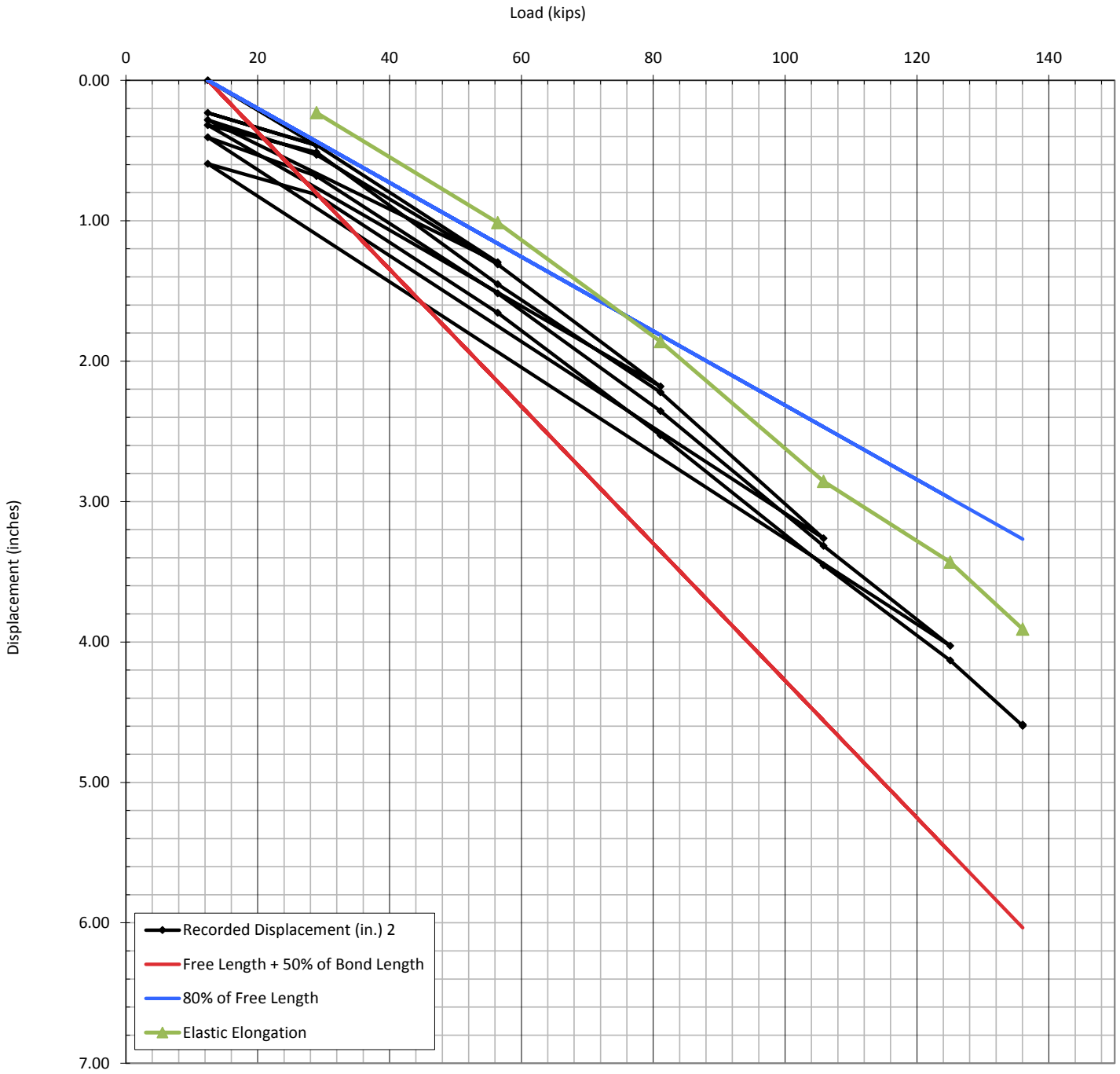
Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141121
Gauge I.D. 12-4

Notes/Additional Comments:
1. Gage pressure must be maintained during testing and be held to within +/- 2%
2. Recorded displacements are to be recorded to the nearest 0.001 in.

Tieback Performance Test



Test Notes:
Note: Test results were recorded by Kameron Peters of Malcolm Drilling, Inc. The pressure for the lock off load was not recorded and is approximated.

Tieback Proof Testing

Sheet No.: 5

Tieback Location	Tieback No.	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	5	1/28/2016	1/29/2016			3/24/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	103	50	52.4	0.6	4.450	KP (MDCI)	ZLK

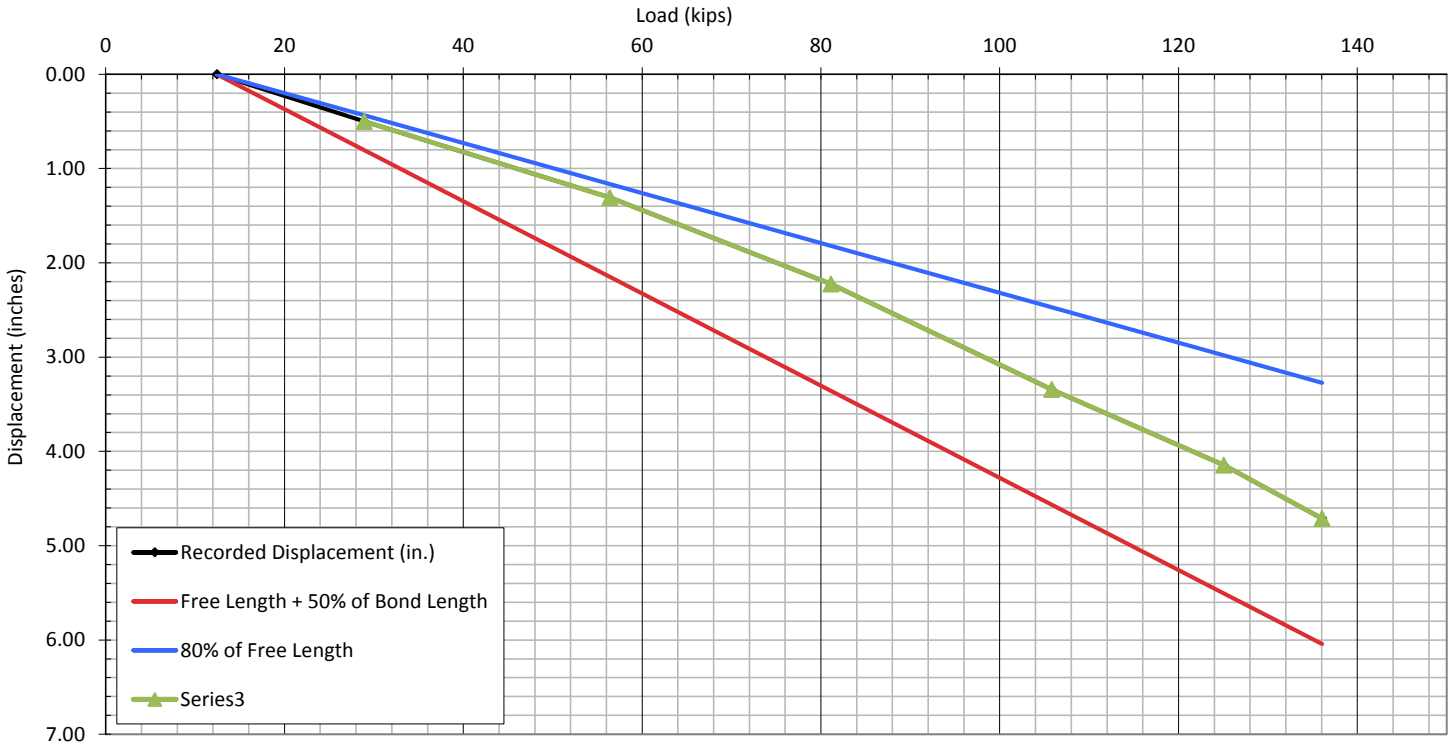
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	12	400	0.000	---	0.000	0.000	---	
---	0.25DL	29	1000	0.500	0.500	0.806	0.436	125.71	
---	0.50DL	56	2000	1.308	1.308	2.148	1.164	47.14	
---	0.75DL	81	2900	2.225	2.225	3.356	1.818	51.32	
---	1.00DL	106	3800	3.342	3.342	4.565	2.473	56.68	
---	1.20DL	125	4500	4.146	4.146	5.505	2.982	58.31	
---	1.33DL	136	4900	4.713	4.713	6.042	3.272	60.39	
1	1.33DL	136	4900	4.713	---	6.042	3.272	---	
2	1.33DL	136	4900	4.713	---	6.042	3.272	---	
3	1.33DL	136	4900	4.713	---	6.042	3.272	---	
4	1.33DL	136	4900	4.713	---	6.042	3.272	---	
5	1.33DL	136	4900	4.713	---	6.042	3.272	---	
6	1.33DL	136	4900	4.713	---	6.042	3.272	---	
10	1.33DL	136	4900	4.725	---	6.042	3.272	---	
---	AL	15	500		---	---	---	---	
---	LOCKOFF	78	2800	---	---	3.222	1.745	---	

Total Movement Between 1 and 10 Minutes (in.)	0.012
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141121
Gauge I.D. 12-4



Note: Test results were recorded by Kameron Peters of Malcolm Drilling, Inc. The pressure for the lock off load was not recorded and is approximated.

Tieback Proof Testing

Sheet No.: 6

Tieback Location	Tieback No.	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	6	1/27/2016	1/29/2016			3/24/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	103	50	51.8	1.3	4.450	KP (MDCI)	ZLK

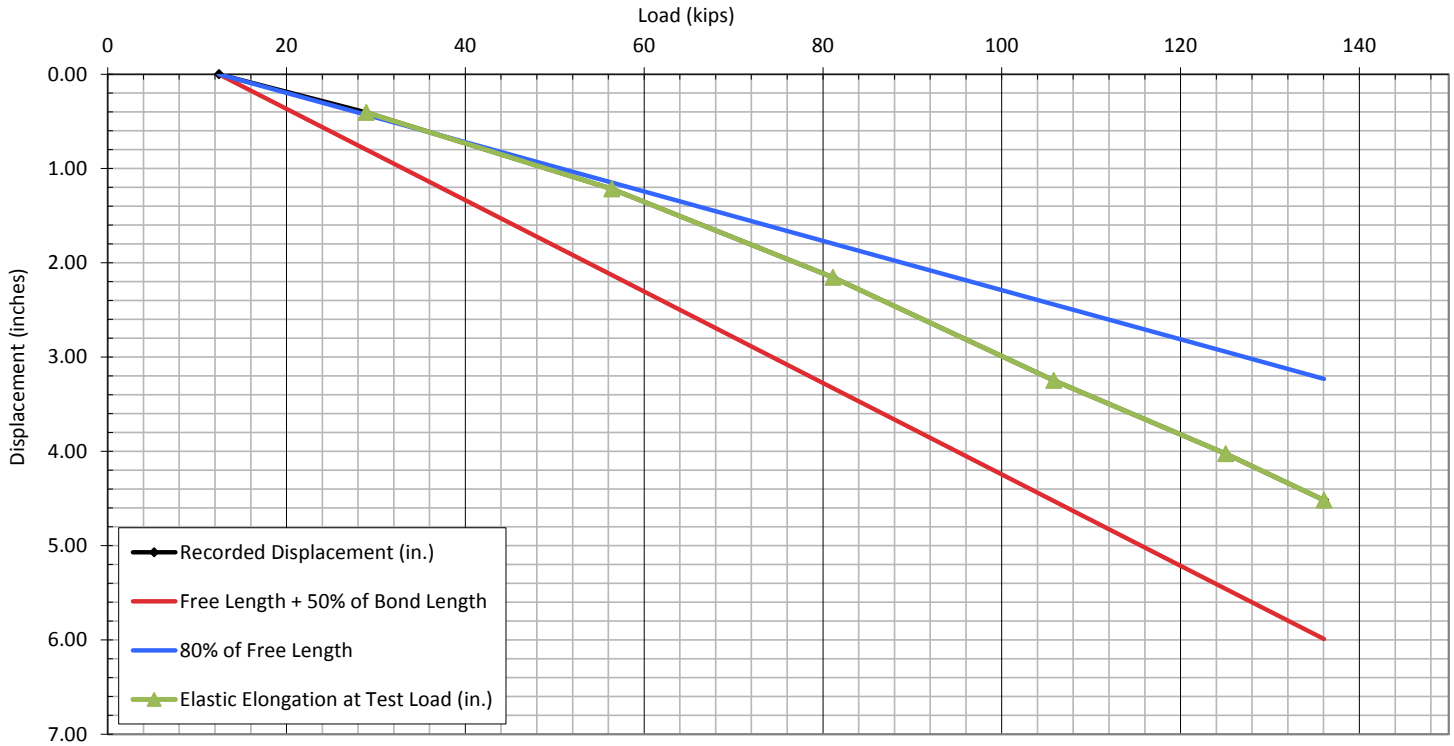
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	12	400	0.000	---	0.000	0.000	---	
---	0.25DL	29	1000	0.405	0.405	0.799	0.431	116.77	
---	0.50DL	56	2000	1.215	1.215	2.130	1.149	43.79	
---	0.75DL	81	2900	2.154	2.154	3.328	1.795	49.68	
---	1.00DL	106	3800	3.247	3.247	4.525	2.441	55.07	
---	1.20DL	125	4500	4.024	4.024	5.457	2.944	56.59	
---	1.33DL	136	4900	4.517	4.517	5.990	3.231	57.88	
1	1.33DL	136	4900	4.517	---	5.990	3.231	---	
2	1.33DL	136	4900	4.517	---	5.990	3.231	---	
3	1.33DL	136	4900	4.517	---	5.990	3.231	---	
4	1.33DL	136	4900	4.517	---	5.990	3.231	---	
5	1.33DL	136	4900	4.517	---	5.990	3.231	---	
6	1.33DL	136	4900	4.517	---	5.990	3.231	---	
10	1.33DL	136	4900	4.528	---	5.990	3.231	---	
---	AL	15	500		---	---	---	---	
---	LOCKOFF	78	2800	---	---	3.194	1.723	---	

Total Movement Between 1 and 10 Minutes (in.)	0.011
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141121
Gauge I.D. 12-4



Note: Test results were recorded by Kameron Peters of Malcolm Drilling, Inc. The pressure for the lock off load was not recorded and is approximated.

Tieback Proof Testing

Sheet No.: 7

Tieback Location	Tieback No.	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	7	1/28/2016	1/29/2016			3/24/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	103	50	52.0	1.0	4.450	KP (MDCI)	ZLK

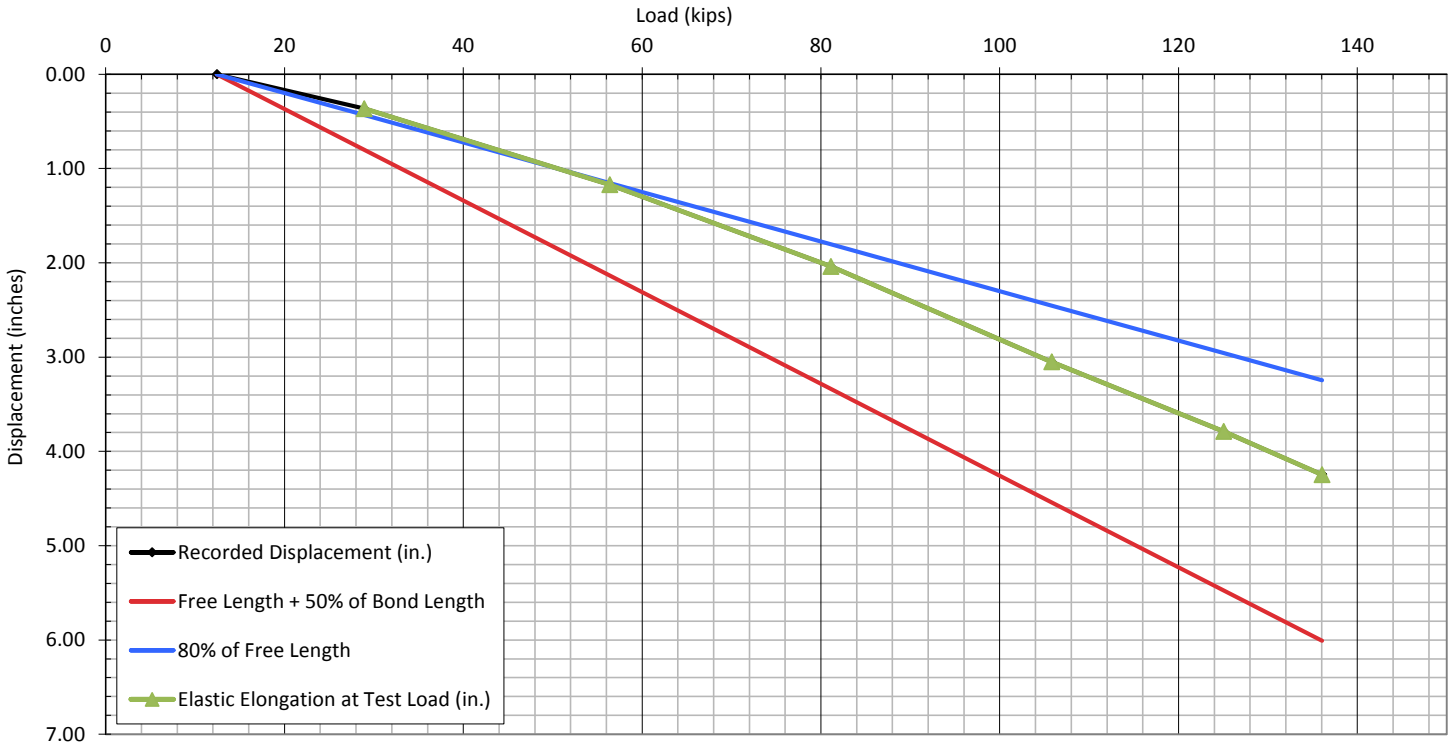
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	12	400	0.000	---	0.000	0.000	---	
---	0.25DL	29	1000	0.365	0.365	0.801	0.433	112.63	
---	0.50DL	56	2000	1.172	1.172	2.137	1.154	42.24	
---	0.75DL	81	2900	2.037	2.037	3.338	1.804	46.98	
---	1.00DL	106	3800	3.051	3.051	4.540	2.453	51.74	
---	1.20DL	125	4500	3.787	3.787	5.475	2.958	53.26	
---	1.33DL	136	4900	4.248	4.248	6.009	3.246	54.43	
1	1.33DL	136	4900	4.248	---	6.009	3.246	---	
2	1.33DL	136	4900	4.248	---	6.009	3.246	---	
3	1.33DL	136	4900	4.248	---	6.009	3.246	---	
4	1.33DL	136	4900	4.248	---	6.009	3.246	---	
5	1.33DL	136	4900	4.248	---	6.009	3.246	---	
6	1.33DL	136	4900	4.248	---	6.009	3.246	---	
10	1.33DL	136	4900	4.254	---	6.009	3.246	---	
---	AL	15	500		---	---	---	---	
---	LOCKOFF	78	2800	---	---	3.205	1.731	---	

Total Movement Between 1 and 10 Minutes (in.)	0.006
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141121
Gauge I.D. 12-4



Note: Test results were recorded by Kameron Peters of Malcolm Drilling, Inc. The pressure for the lock off load was not recorded and is approximated.

Tieback Proof Testing

Tieback Location	Tieback No.	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	8	1/27/2016	1/29/2016			3/24/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	103	50	54.9	-1.9	4.450	KP (MDCI)	ZLK

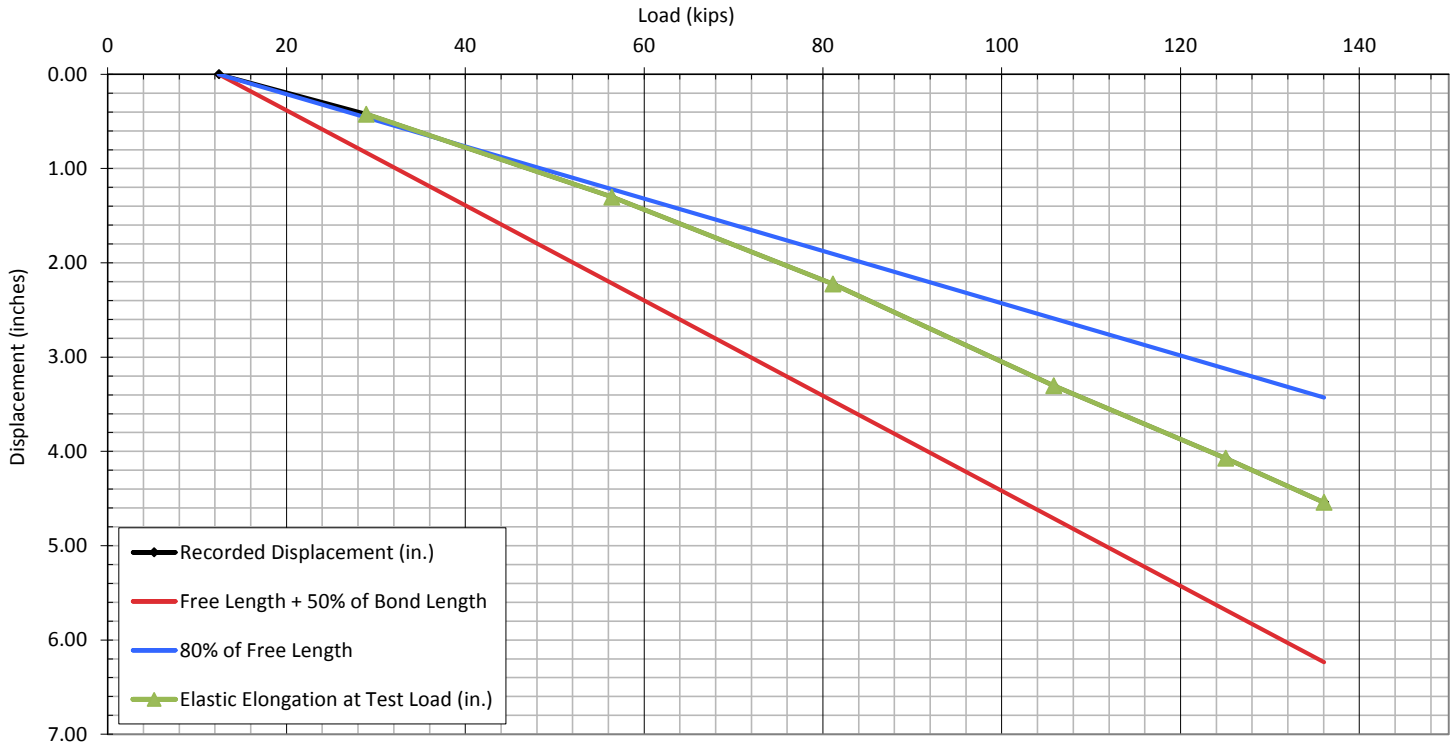
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	12	400	0.000	---	0.000	0.000	---	
---	0.25DL	29	1000	0.423	0.423	0.832	0.457	125.13	
---	0.50DL	56	2000	1.302	1.302	2.217	1.219	46.92	
---	0.75DL	81	2900	2.224	2.224	3.465	1.905	51.30	
---	1.00DL	106	3800	3.302	3.302	4.712	2.590	56.00	
---	1.20DL	125	4500	4.072	4.072	5.682	3.124	57.27	
---	1.33DL	136	4900	4.541	4.541	6.237	3.429	58.19	
1	1.33DL	136	4900	4.541	---	6.237	3.429	---	
2	1.33DL	136	4900	4.541	---	6.237	3.429	---	
3	1.33DL	136	4900	4.541	---	6.237	3.429	---	
4	1.33DL	136	4900	4.541	---	6.237	3.429	---	
5	1.33DL	136	4900	4.541	---	6.237	3.429	---	
6	1.33DL	136	4900	4.541	---	6.237	3.429	---	
10	1.33DL	136	4900	4.556	---	6.237	3.429	---	
---	AL	15	500		---	---	---	---	
---	LOCKOFF	78	2800	---	---	3.326	1.829	---	

Total Movement Between 1 and 10 Minutes (in.)	0.015
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141121
Gauge I.D. 12-4



Note: Test results were recorded by Kameron Peters of Malcolm Drilling, Inc. The pressure for the lock off load was not recorded and is approximated.

Tieback Proof Testing

Tieback Location	Tieback No.	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	9	1/28/2016	1/29/2016			3/24/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	103	50	51.8	1.2	4.450	KP (MDCI)	ZLK

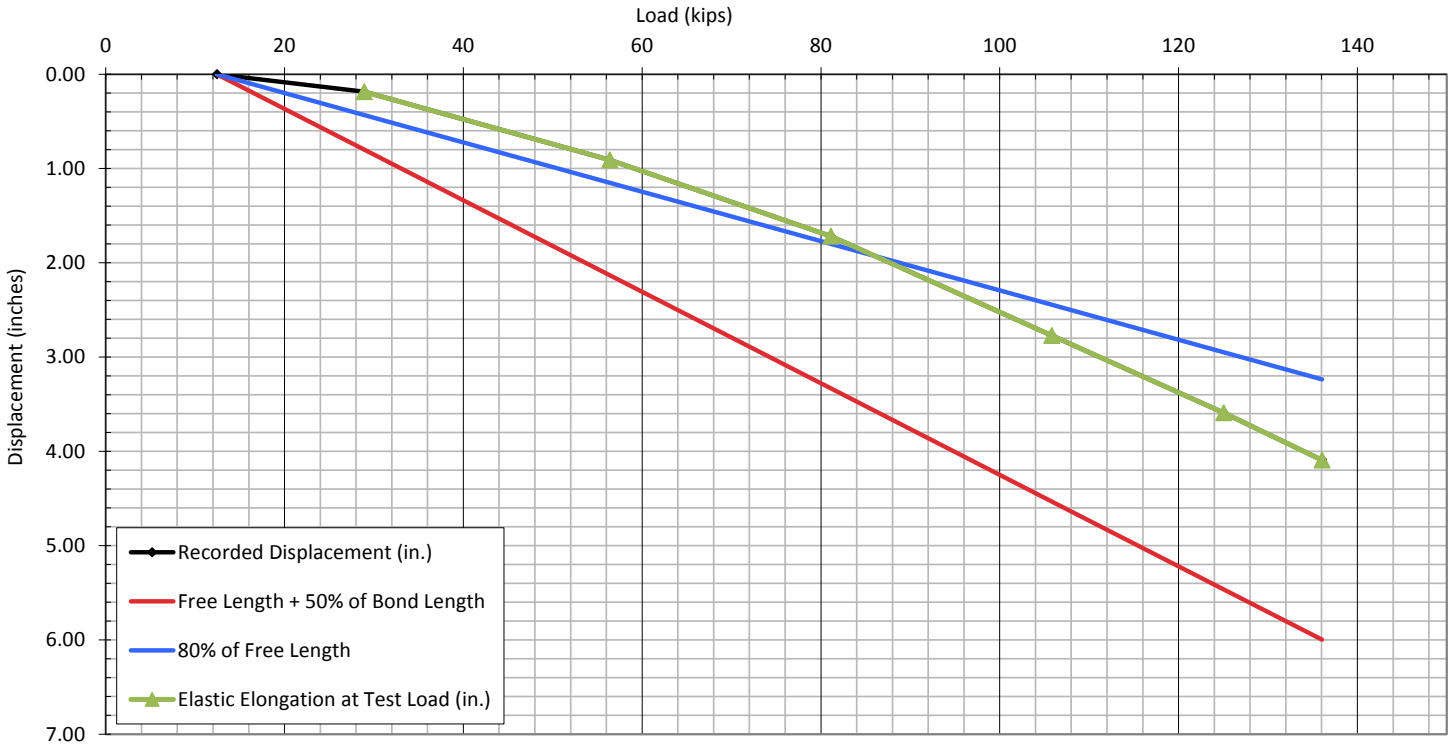
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	12	400	0.000	---	0.000	0.000	---	
---	0.25DL	29	1000	0.185	0.185	0.799	0.431	87.36	
---	0.50DL	56	2000	0.909	0.909	2.132	1.151	32.76	
---	0.75DL	81	2900	1.716	1.716	3.331	1.798	39.58	
---	1.00DL	106	3800	2.771	2.771	4.530	2.445	47.00	
---	1.20DL	125	4500	3.590	3.590	5.463	2.948	50.49	
---	1.33DL	136	4900	4.092	4.092	5.996	3.236	52.43	
1	1.33DL	136	4900	4.092	---	5.996	3.236	---	
2	1.33DL	136	4900	4.092	---	5.996	3.236	---	
3	1.33DL	136	4900	4.092	---	5.996	3.236	---	
4	1.33DL	136	4900	4.092	---	5.996	3.236	---	
5	1.33DL	136	4900	4.092	---	5.996	3.236	---	
6	1.33DL	136	4900	4.092	---	5.996	3.236	---	
10	1.33DL	136	4900	4.098	---	5.996	3.236	---	
---	AL	15	500		---	---	---	---	
---	LOCKOFF	78	2800	---	---	3.198	1.726	---	

Total Movement Between 1 and 10 Minutes (in.)	0.006
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141121
Gauge I.D. 12-4



Note: Test results were recorded by Kameron Peters of Malcolm Drilling, Inc. The pressure for the lock off load was not recorded and is approximated.

Tieback Proof Testing

Sheet No.: 10

Tieback Location	Tieback No.	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	10	1/27/2016	1/29/2016			3/24/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	103	50	50.5	2.5	4.450	KP (MDCI)	ZLK

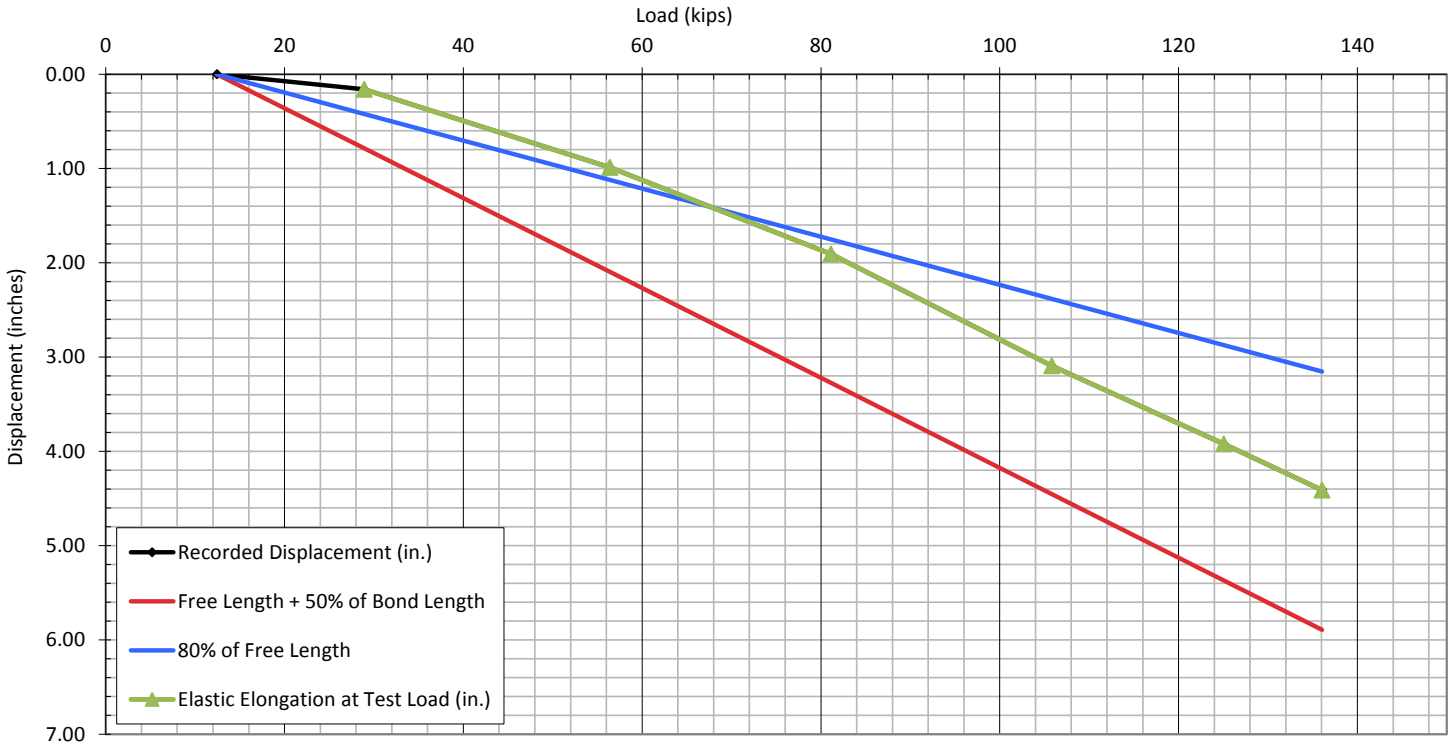
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	12	400	0.000	---	0.000	0.000	---	
---	0.25DL	29	1000	0.160	0.160	0.786	0.420	94.86	
---	0.50DL	56	2000	0.987	0.987	2.095	1.121	35.57	
---	0.75DL	81	2900	1.906	1.906	3.273	1.752	43.96	
---	1.00DL	106	3800	3.091	3.091	4.452	2.382	52.42	
---	1.20DL	125	4500	3.919	3.919	5.368	2.873	55.12	
---	1.33DL	136	4900	4.410	4.410	5.892	3.153	56.51	
1	1.33DL	136	4900	4.410	---	5.892	3.153	---	
2	1.33DL	136	4900	4.410	---	5.892	3.153	---	
3	1.33DL	136	4900	4.410	---	5.892	3.153	---	
4	1.33DL	136	4900	4.410	---	5.892	3.153	---	
5	1.33DL	136	4900	4.410	---	5.892	3.153	---	
6	1.33DL	136	4900	4.410	---	5.892	3.153	---	
10	1.33DL	136	4900	4.420	---	5.892	3.153	---	
---	AL	15	500		---	---	---	---	
---	LOCKOFF	78	2800	---	---	3.142	1.681	---	

Total Movement Between 1 and 10 Minutes (in.)	0.010
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141121
Gauge I.D. 12-4



Note: Test results were recorded by Kameron Peters of Malcolm Drilling, Inc. The pressure for the lock off load was not recorded and is approximated.

Tieback Proof Testing

Sheet No.: 11

Tieback Location	Tieback No.	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	11	1/28/2016	1/29/2016			3/24/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	103	50	52.3	0.7	4.450	KP (MDCI)	ZLK

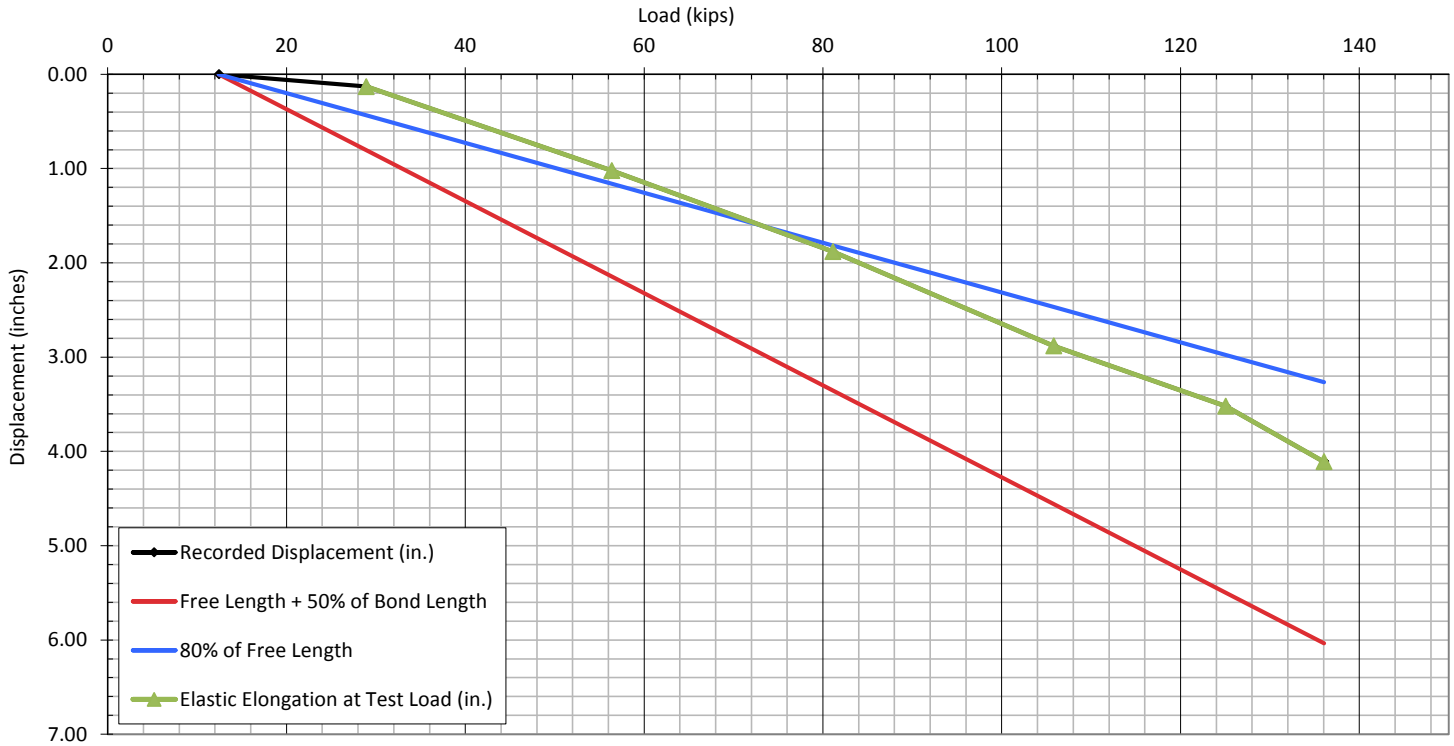
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	12	400	0.000	---	0.000	0.000	---	
---	0.25DL	29	1000	0.130	0.130	0.805	0.436	98.12	
---	0.50DL	56	2000	1.021	1.021	2.146	1.162	36.80	
---	0.75DL	81	2900	1.880	1.880	3.353	1.815	43.36	
---	1.00DL	106	3800	2.881	2.881	4.560	2.469	48.86	
---	1.20DL	125	4500	3.520	3.520	5.499	2.977	49.51	
---	1.33DL	136	4900	4.110	4.110	6.035	3.267	52.67	
1	1.33DL	136	4900	4.110	---	6.035	3.267	---	
2	1.33DL	136	4900	4.110	---	6.035	3.267	---	
3	1.33DL	136	4900	4.110	---	6.035	3.267	---	
4	1.33DL	136	4900	4.110	---	6.035	3.267	---	
5	1.33DL	136	4900	4.110	---	6.035	3.267	---	
6	1.33DL	136	4900	4.110	---	6.035	3.267	---	
10	1.33DL	136	4900	4.115	---	6.035	3.267	---	
---	AL	15	500		---	---	---	---	
---	LOCKOFF	78	2800	---	---	3.219	1.743	---	

Total Movement Between 1 and 10 Minutes (in.)	0.005
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141121
Gauge I.D. 12-4



Note: Test results were recorded by Kameron Peters of Malcolm Drilling, Inc. The pressure for the lock off load was not recorded and is approximated.

Tieback Proof Testing

Sheet No.: 12

Tieback Location	Tieback Number	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	12	1/28/2016	1/29/2016			3/23/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	139	50	92.3	-3.3	7.473	ZLK	ZLK

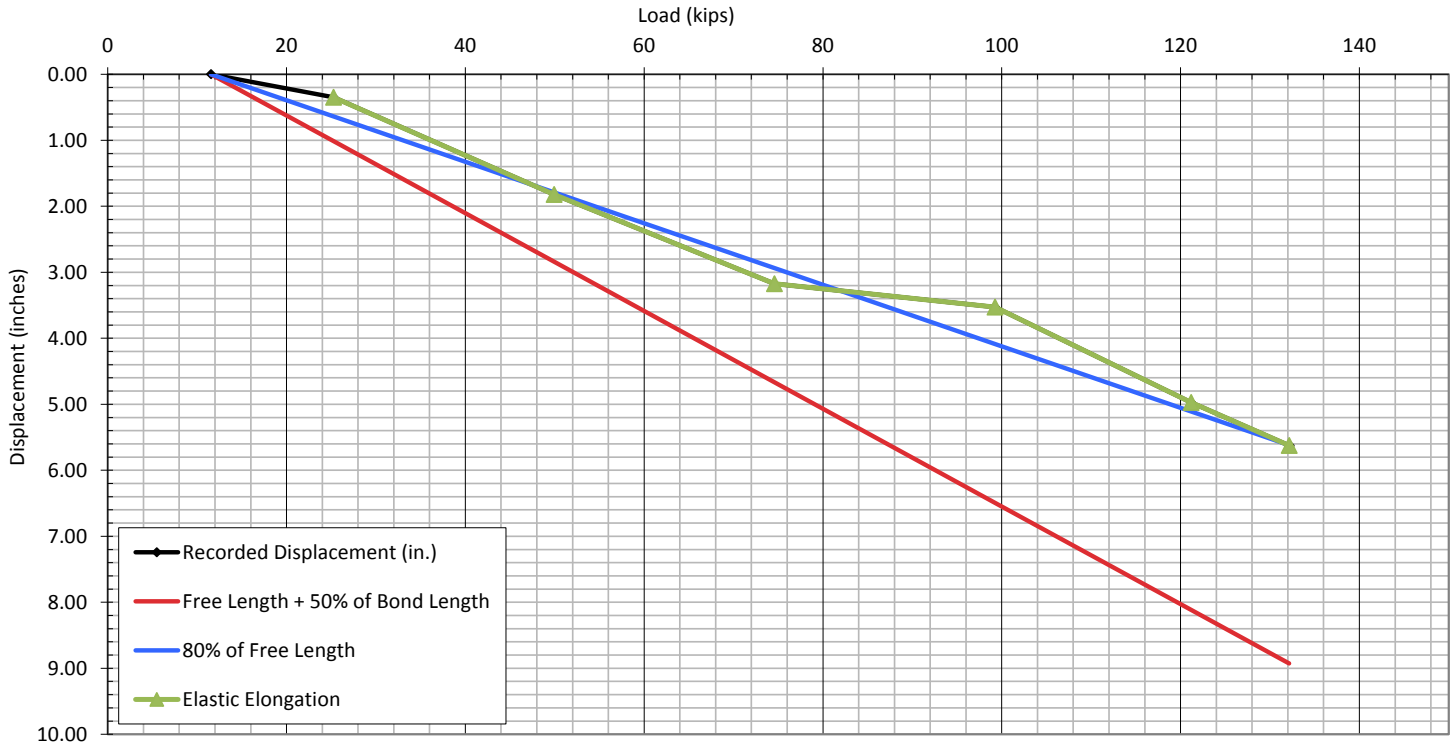
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	12	400	0.000	---	0.000	0.000	---	
---	0.25DL	25	900	0.349	0.349	1.014	0.638	210.37	
---	0.50DL	50	1800	1.820	1.820	2.840	1.788	75.13	
---	0.75DL	75	2700	3.172	3.172	4.666	2.937	79.70	
---	1.00DL	99	3600	3.527	3.527	6.492	4.086	63.70	
---	1.20DL	121	4400	4.972	4.972	8.115	5.108	71.84	
---	1.33DL	132	4800	5.624	5.624	8.927	5.619	73.87	
1	1.33DL	132	4800	5.621	---	8.927	5.619	---	
2	1.33DL	132	4800	5.622	---	8.927	5.619	---	
3	1.33DL	132	4800	5.624	---	8.927	5.619	---	
4	1.33DL	132	4800	5.628	---	8.927	5.619	---	
5	1.33DL	132	4800	5.635	---	8.927	5.619	---	
6	1.33DL	132	4800	5.640	---	8.927	5.619	---	<-- Dial slipped
10	1.33DL	132	4800	5.662	---	8.927	5.619	---	on test plate
---	AL	12	400	0.000	---	---	---	---	
---	LOCKOFF	69	2500	---	---	4.260	2.682	---	

Total Movement Between 1 and 10 Minutes (in.)	0.041	0.022	<-- 6 to 10 min
Maximum Total Movement Allowed (in.)*:	0.040		

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 2681
Gauge I.D. 16-3



Note: False displacements occurred due to high winds that caused movements of the dial on the testing plate particularly for the 1.33DL hold times.

Tieback Proof Testing

Sheet No.: 13

Tieback Location	Tieback Number	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	13	1/27/2016	1/29/2016			3/23/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	139	50	91.3	-2.3	7.473	ZLK	ZLK

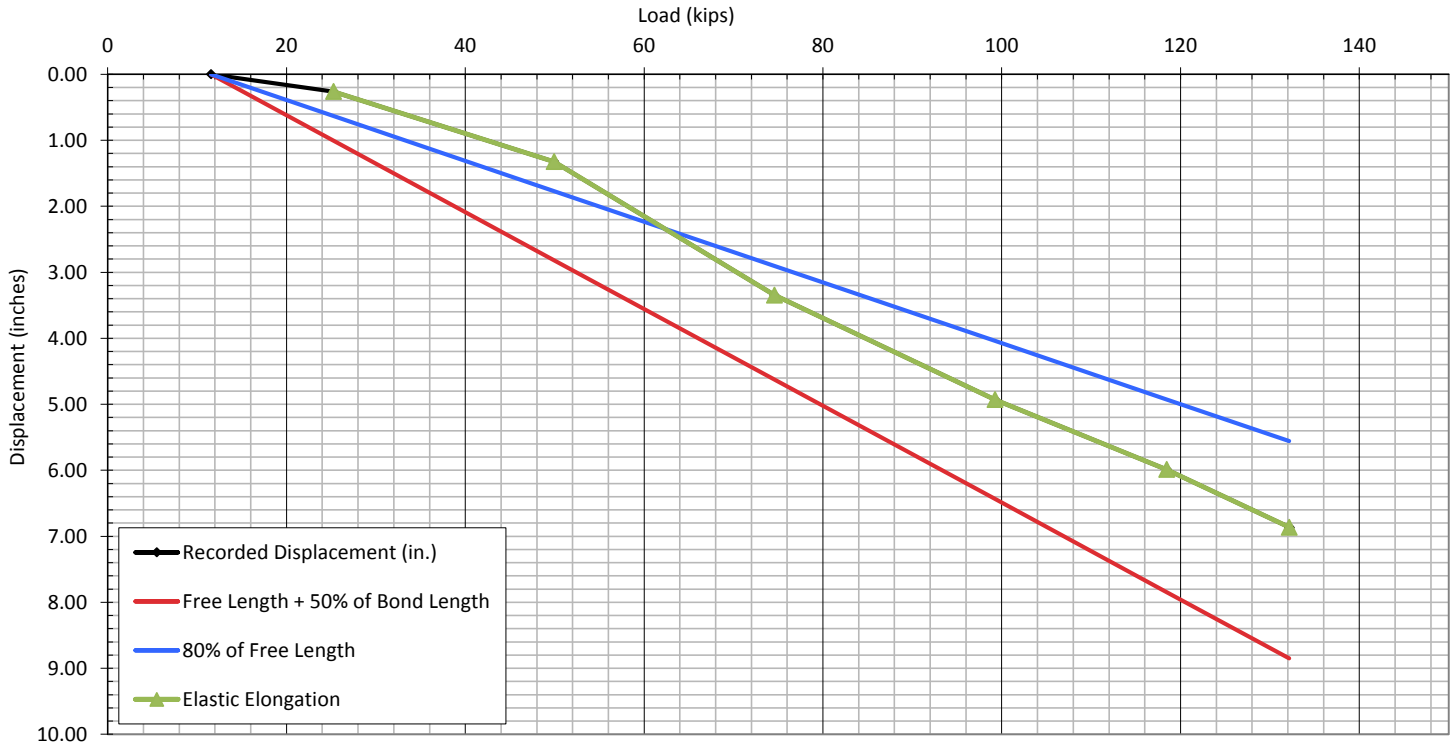
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	12	400	0.000	---	0.000	0.000	---	
---	0.25DL	25	900	0.261	0.261	1.006	0.632	152.81	
---	0.50DL	50	1800	1.322	1.322	2.816	1.768	54.57	
---	0.75DL	75	2700	3.345	3.345	4.626	2.905	84.05	
---	1.00DL	99	3600	4.930	4.930	6.437	4.042	89.04	
---	1.20DL	118	4300	5.988	5.988	7.845	4.926	88.74	
---	1.33DL	132	4800	6.863	6.863	8.851	5.558	90.14	
1	1.33DL	132	4800	6.866	---	8.851	5.558	---	
2	1.33DL	132	4800	6.867	---	8.851	5.558	---	
3	1.33DL	132	4800	6.860	---	8.851	5.558	---	
4	1.33DL	132	4800	6.868	---	8.851	5.558	---	Pump the jack
5	1.33DL	132	4800	6.872	---	8.851	5.558	---	
6	1.33DL	132	4800	6.876	---	8.851	5.558	---	Pump the jack
10	1.33DL	132	4800	6.882	---	8.851	5.558	---	
---	AL	12	400	0.000	---	---	---	---	
---	LOCKOFF	69	2500	---	---	4.224	2.653	---	

Total Movement Between 1 and 10 Minutes (in.)	0.016
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 2681
Gauge I.D. 16-3



Note: False displacements occurred due to high winds that caused movements of the dial on the testing plate particularly for the 1.33DL hold times.

Tieback Performance Test

Sheet No.: 14

Tieback Location	Tieback Number	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	14	1/25/2016	1/27/2016			3/23/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	139	50	88.7	0.3	7.473	ZLK	ZLK

Time (min)	Load Testing Schedule	Actual Test Load (kips)	Gauge Pressure for Test Load (psi)[1]	Recorded Displacement (in.)[2]	Elastic Elongation at Load Cycle Maximum (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	12	400	0.000	---	0.000	0.000	---	
---	0.25DL	25	900	0.673	0.187	0.983	0.614	21.61	
---	AL	12	400	0.486	---	0.000	0.000	---	
---	0.25DL	25	900	0.702	---	0.983	0.614	---	
---	0.50DL	50	1800	2.064	1.589	2.753	1.718	65.60	
---	AL	12	400	0.475	---	0.000	0.000	---	
---	0.25DL	25	900	0.830	---	0.983	0.614	---	
---	0.50DL	50	1800	2.142	---	2.753	1.718	---	
---	0.75DL	75	2700	3.499	2.880	4.524	2.823	72.37	
---	AL	12	400	0.619	---	0.000	0.000	---	
---	0.25DL	25	900	0.929	---	0.983	0.614	---	
---	0.50DL	50	1800	2.258	---	2.753	1.718	---	
---	0.75DL	75	2700	3.565	---	4.524	2.823	---	
---	1.00DL	99	3600	4.970	4.286	6.294	3.928	77.41	
---	AL	12	400	0.684	---	0.000	0.000	---	
---	0.25DL	25	900	1.105	---	0.983	0.614	---	
---	0.50DL	50	1800	2.442	---	2.753	1.718	---	
---	0.75DL	75	2700	3.711	---	4.524	2.823	---	
---	1.00DL	99	3600	5.053	---	6.294	3.928	---	
---	1.20DL	118	4300	6.177	5.320	7.670	4.787	78.84	
---	AL	12	400	0.857	---	0.000	0.000	---	
---	0.25DL	25	900	1.247	---	0.983	0.614	---	
---	0.50DL	50	1800	2.523	---	2.753	1.718	---	
---	0.75DL	75	2700	3.829	---	4.524	2.823	---	
---	1.00DL	99	3600	5.166	---	6.294	3.928	---	
---	1.20DL	118	4300	6.205	---	7.670	4.787	---	
---	1.33DL	132	4800	7.011	---	8.654	5.400	---	
1	1.33DL	132	4800	7.022	---	---	---	---	<-- Movement
2	1.33DL	132	4800	7.022	---	---	---	---	due to wind
3	1.33DL	132	4800	7.023	---	---	---	---	
4	1.33DL	132	4800	7.020	---	---	---	---	
5	1.33DL	132	4800	7.030	---	---	---	---	
6	1.33DL	132	4800	7.030	---	---	---	---	Pump the jack
10	1.33DL	132	4800	7.030	6.018	---	---	72.46	
---	AL	1	0	1.012	---	---	---	---	
---	LOCKOFF	83	3000		---	5.114	3.191	---	

Total Movement Between 1 and 10 Minutes (in.)	0.008
Maximum Total Movement Allowed (in.):	0.040

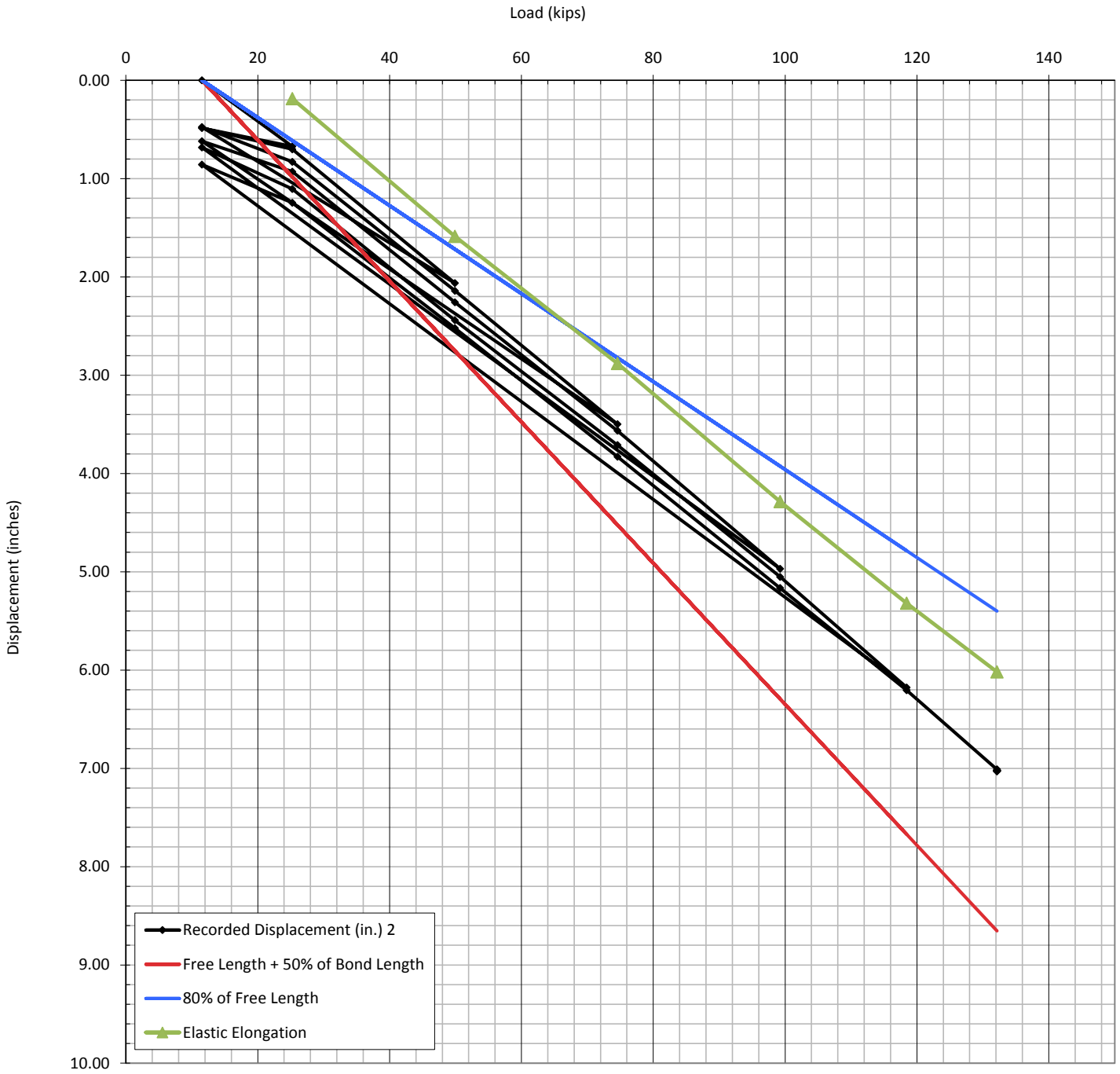
Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 2681
Gauge I.D. 16-3

Notes/Additional Comments:
1. Gage pressure must be maintained during testing and be held to within +/- 2%
2. Recorded displacements are to be recorded to the nearest 0.001 in.

Tieback Performance Test



Test Notes:
1. The larger, 135 ton ram requires set up a riser that results in an additional length added to the tail.
2. False displacements occurred due to high winds that caused movements of the dial on the testing plate particularly for the 1.33DL hold times.

Tieback Proof Testing

Sheet No.: 15

Tieback Location	Tieback Number	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	15	1/26/2016	1/27/2016			3/23/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	115	50	64.1	0.9	5.458	ZLK	ZLK

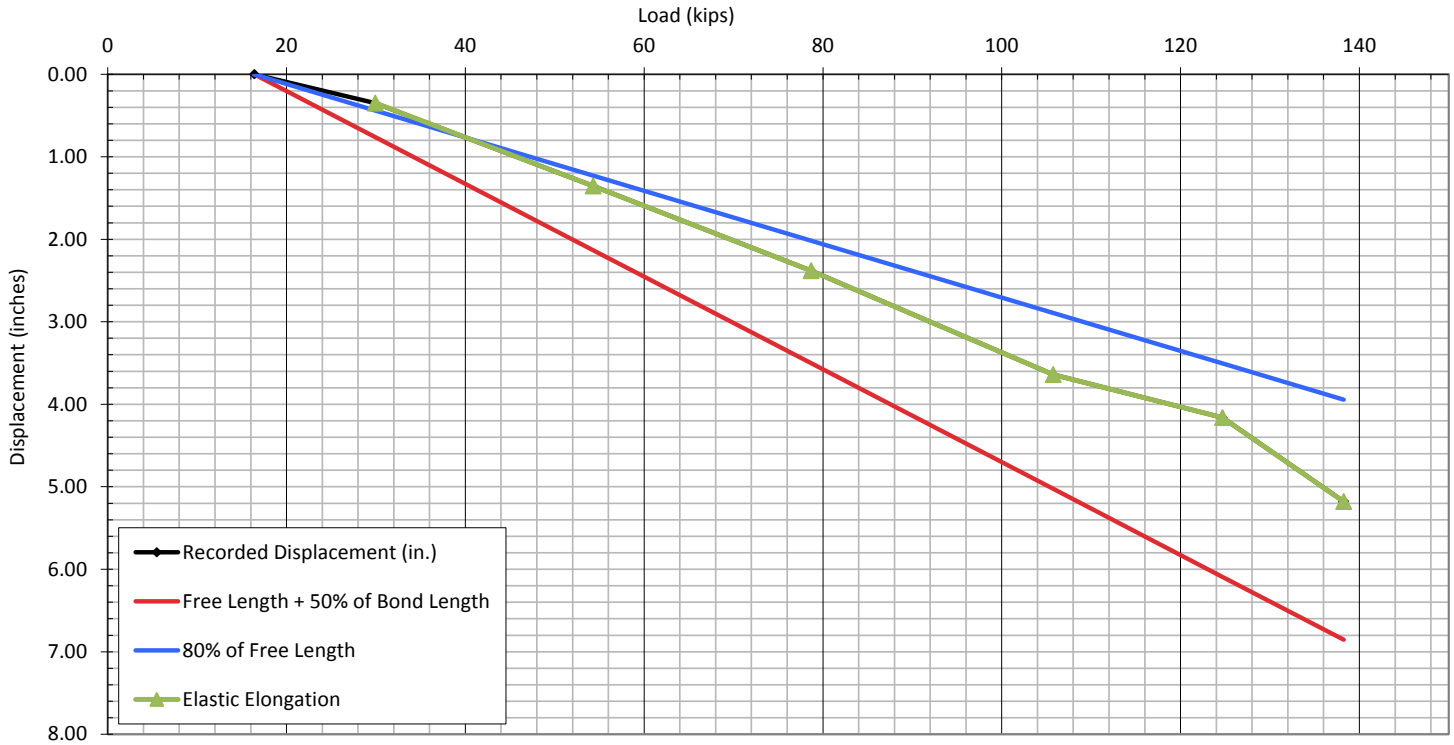
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	16	500	0.000	---	0.000	0.000	---	
---	0.25DL	30	1000	0.348	0.348	0.761	0.438	158.40	
---	0.50DL	54	1900	1.354	1.354	2.132	1.227	56.57	
---	0.75DL	79	2800	2.380	2.380	3.503	2.016	60.53	
---	1.00DL	106	3800	3.641	3.641	5.026	2.892	64.54	
---	1.20DL	125	4500	4.162	4.162	6.092	3.506	60.86	
---	1.33DL	138	5000	5.180	5.180	6.853	3.944	67.33	
1	1.33DL	138	5000	5.180	---	6.853	3.944	---	
2	1.33DL	138	5000	5.185	---	6.853	3.944	---	Pump the jack
3	1.33DL	138	5000	5.178	---	6.853	3.944	---	Pump the jack
4	1.33DL	138	5000	5.182	---	6.853	3.944	---	
5	1.33DL	138	5000	5.182	---	6.853	3.944	---	
6	1.33DL	138	5000	5.185	---	6.853	3.944	---	Pump the jack
10	1.33DL	138	5000	5.185	---	6.853	3.944	---	
---	AL	16	500	0.000	---	---	---	---	
---	LOCKOFF	87	3100	---	---	3.960	2.279	---	

Total Movement Between 1 and 10 Minutes (in.)	0.005
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141120
Gauge I.D. 12-1



Note: False displacements occurred due to high winds that caused movements of the dial on the testing plate particularly for the 1.33DL hold times.

Tieback Proof Testing

Sheet No.: 16

Tieback Location	Tieback Number	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	16	1/25/2016	1/27/2016			3/23/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	115	50	63.8	1.3	5.458	ZLK	ZLK

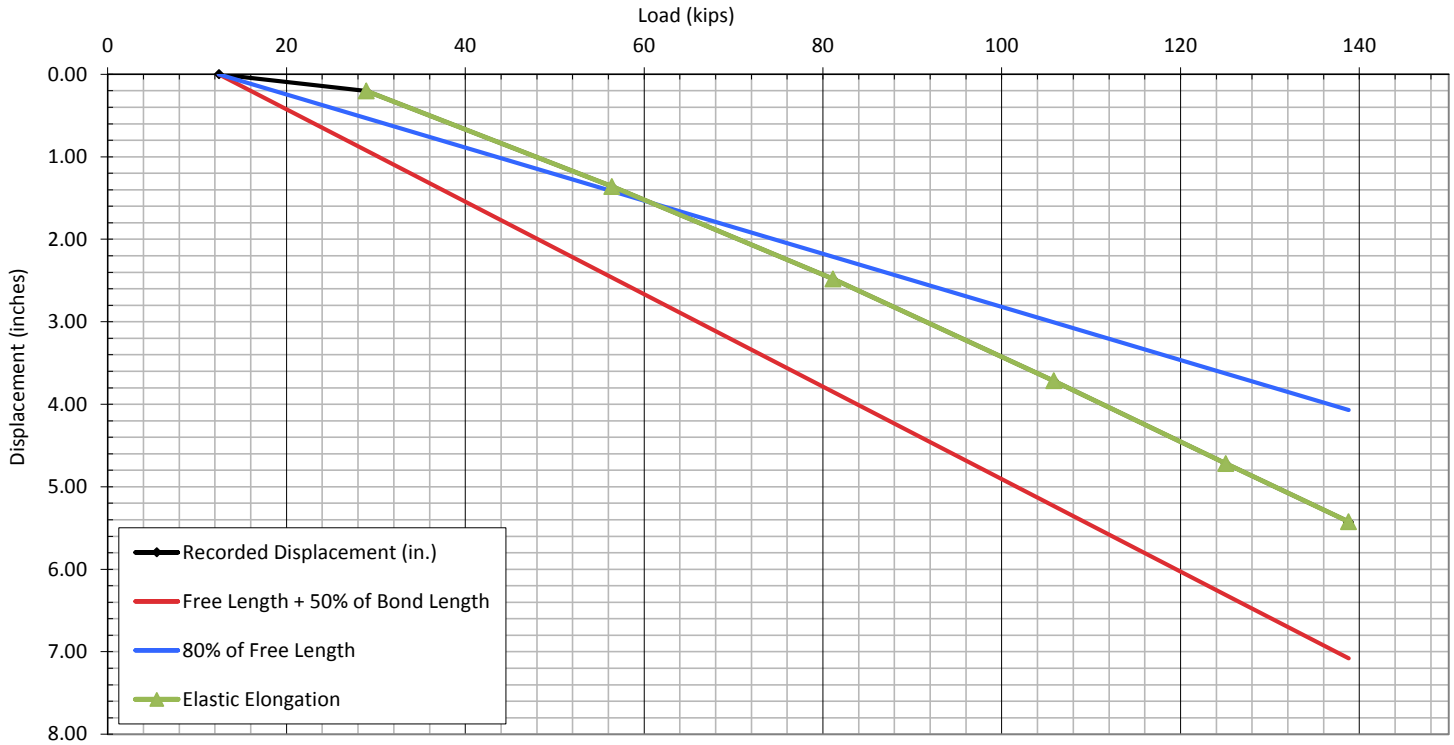
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	12	400	0.000	---	0.000	0.000	---	
---	0.25DL	29	1000	0.202	0.202	0.923	0.531	130.61	
---	0.50DL	56	2000	1.359	1.359	2.463	1.415	48.98	
---	0.75DL	81	2900	2.481	2.481	3.848	2.211	57.22	
---	1.00DL	106	3800	3.715	3.715	5.233	3.007	63.01	
---	1.20DL	125	4500	4.717	4.717	6.310	3.626	66.34	
---	1.33DL	139	5000	5.423	5.423	7.080	4.068	67.98	
1	1.33DL	139	5000	5.424	---	7.080	4.068	---	
2	1.33DL	139	5000	5.438	---	7.080	4.068	---	Pump the jack
3	1.33DL	139	5000	5.438	---	7.080	4.068	---	
4	1.33DL	139	5000	5.438	---	7.080	4.068	---	
5	1.33DL	139	5000	5.438	---	7.080	4.068	---	
6	1.33DL	139	5000	5.441	---	7.080	4.068	---	Pump the jack
10	1.33DL	139	5000	5.441	---	7.080	4.068	---	
---	AL	15	500	0.000	---	---	---	---	
---	LOCKOFF	84	3000	---	---	4.002	2.300	---	

Total Movement Between 1 and 10 Minutes (in.)	0.017
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141121
Gauge I.D. 12-4



Tieback Proof Testing

Sheet No.: 17

Tieback Location	Tieback Number	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	17	1/26/2016	1/27/2016			3/23/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	115	50	63.8	1.3	5.458	ZLK	ZLK

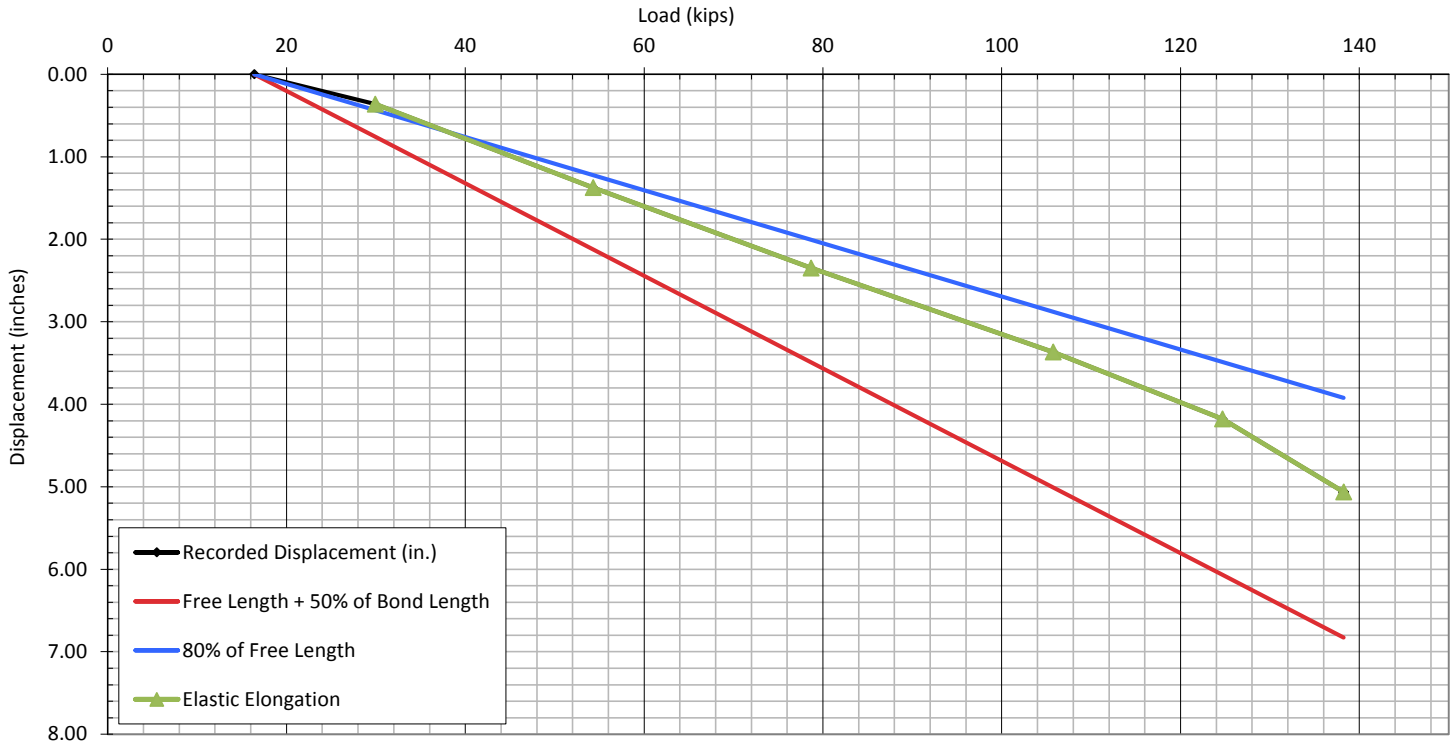
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	16	500	0.000	---	0.000	0.000	---	
---	0.25DL	30	1000	0.362	0.362	0.759	0.436	160.62	
---	0.50DL	54	1900	1.373	1.373	2.124	1.221	57.37	
---	0.75DL	79	2800	2.348	2.348	3.490	2.005	59.71	
---	1.00DL	106	3800	3.367	3.367	5.007	2.877	59.68	
---	1.20DL	125	4500	4.179	4.179	6.069	3.488	61.11	
---	1.33DL	138	5000	5.062	5.062	6.828	3.924	65.80	
1	1.33DL	138	5000	5.062	---	6.828	3.924	---	
2	1.33DL	138	5000	5.062	---	6.828	3.924	---	
3	1.33DL	138	5000	5.062	---	6.828	3.924	---	
4	1.33DL	138	5000	5.062	---	6.828	3.924	---	
5	1.33DL	138	5000	5.062	---	6.828	3.924	---	
6	1.33DL	138	5000	5.068	---	6.828	3.924	---	Pump the jack
10	1.33DL	138	5000	5.074	---	6.828	3.924	---	
---	AL	16	500		---	---	---	---	
---	LOCKOFF	81	2900	---	---	3.641	2.093	---	

Total Movement Between 1 and 10 Minutes (in.)	0.012
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141120
Gauge I.D. 12-1



Tieback Proof Testing

Sheet No.: 18

Tieback Location	Tieback Number	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	18	1/25/2016	1/26/2016			3/23/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	115	50	63.7	1.3	5.458	ZLK	ZLK

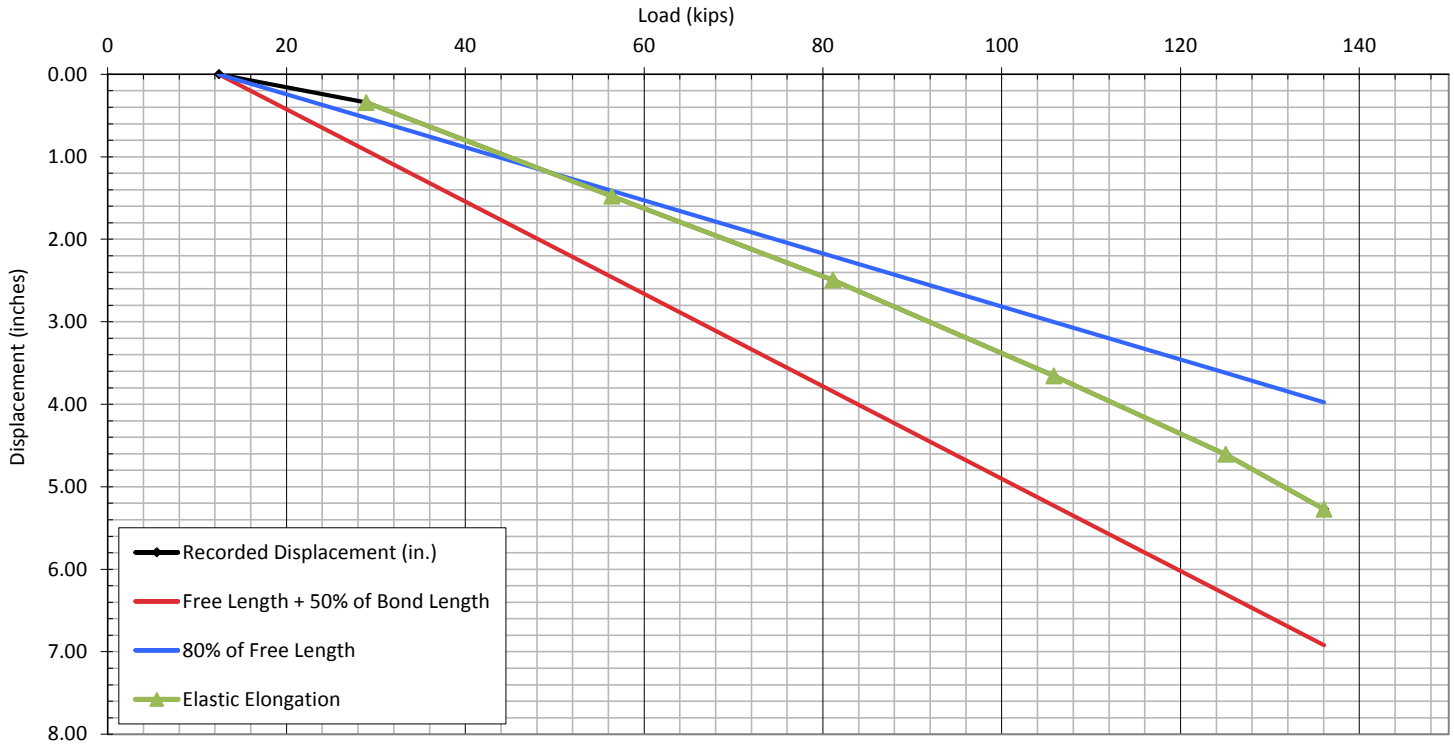
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	12	400	0.000	---	0.000	0.000	---	
---	0.25DL	29	1000	0.343	0.343	0.923	0.530	141.95	
---	0.50DL	56	2000	1.477	1.477	2.460	1.413	53.23	
---	0.75DL	81	2900	2.495	2.495	3.844	2.208	57.55	
---	1.00DL	106	3800	3.656	3.656	5.228	3.003	62.00	
---	1.20DL	125	4500	4.607	4.607	6.304	3.622	64.79	
---	1.33DL	136	4900	5.272	5.272	6.920	3.975	67.56	
1	1.33DL	136	4900	5.272	---	6.920	3.975	---	
2	1.33DL	136	4900	5.272	---	6.920	3.975	---	
3	1.33DL	136	4900	5.275	---	6.920	3.975	---	Pump the jack
4	1.33DL	136	4900	5.275	---	6.920	3.975	---	
5	1.33DL	136	4900	5.276	---	6.920	3.975	---	
6	1.33DL	136	4900	5.276	---	6.920	3.975	---	
10	1.33DL	136	4900	5.277	---	6.920	3.975	---	
---	AL	15	500	0.000	---	---	---	---	
---	LOCKOFF	87	3100	---	---	4.152	2.385	---	

Total Movement Between 1 and 10 Minutes (in.)	0.005
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141121
Gauge I.D. 12-4



Tieback Proof Testing

Sheet No.: 19

Tieback Location	Tieback Number	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	19	1/26/2016	1/27/2016			3/23/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	115	50	64.3	0.8	5.458	ZLK	ZLK

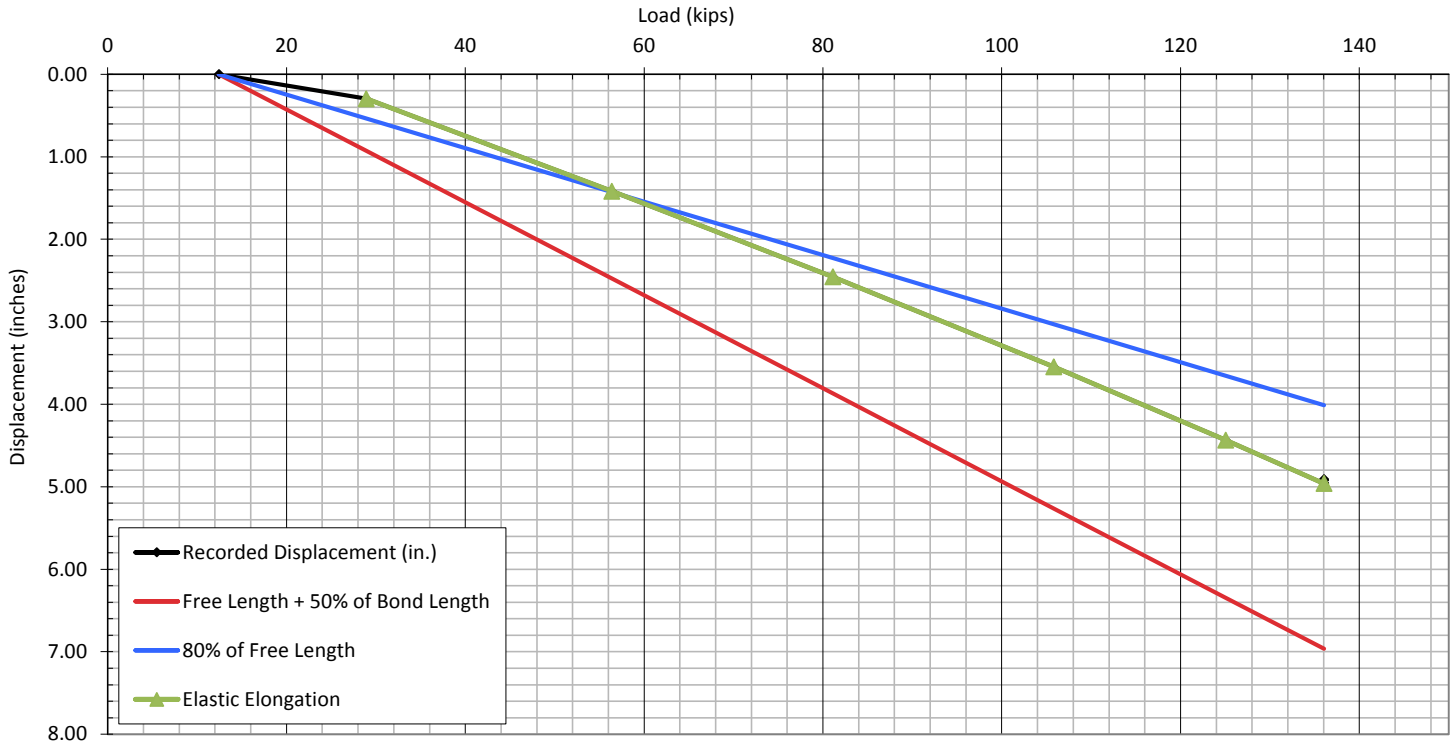
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	12	400	0.000	---	0.000	0.000	---	
---	0.25DL	29	1000	0.297	0.297	0.929	0.535	136.28	
---	0.50DL	56	2000	1.418	1.418	2.476	1.426	51.10	
---	0.75DL	81	2900	2.456	2.456	3.869	2.228	56.65	
---	1.00DL	106	3800	3.547	3.547	5.262	3.031	60.16	
---	1.20DL	125	4500	4.435	4.435	6.346	3.655	62.37	
---	1.33DL	136	4900	4.960	4.960	6.965	4.011	63.56	
1	1.33DL	136	4900	4.960	---	6.965	4.011	---	
2	1.33DL	136	4900	4.960	---	6.965	4.011	---	
3	1.33DL	136	4900	4.960	---	6.965	4.011	---	
4	1.33DL	136	4900	4.960	---	6.965	4.011	---	
5	1.33DL	136	4900	4.960	---	6.965	4.011	---	Pump the jack
6	1.33DL	136	4900	4.920	---	6.965	4.011	---	<--dial moved
10	1.33DL	136	4900	4.910	---	6.965	4.011	---	on pump of
---	AL	15	500	0.000	---	---	---	---	jack
---	LOCKOFF	87	3100	---	---	4.179	2.407	---	

Total Movement Between 1 and 10 Minutes (in.)	-0.050
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141121
Gauge I.D. 12-4



Tieback Proof Testing

Sheet No.: 20

Tieback Location	Tieback Number	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	20	1/25/2016	1/27/2016			3/23/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	115	50	63.9	1.1	5.458	ZLK	ZLK

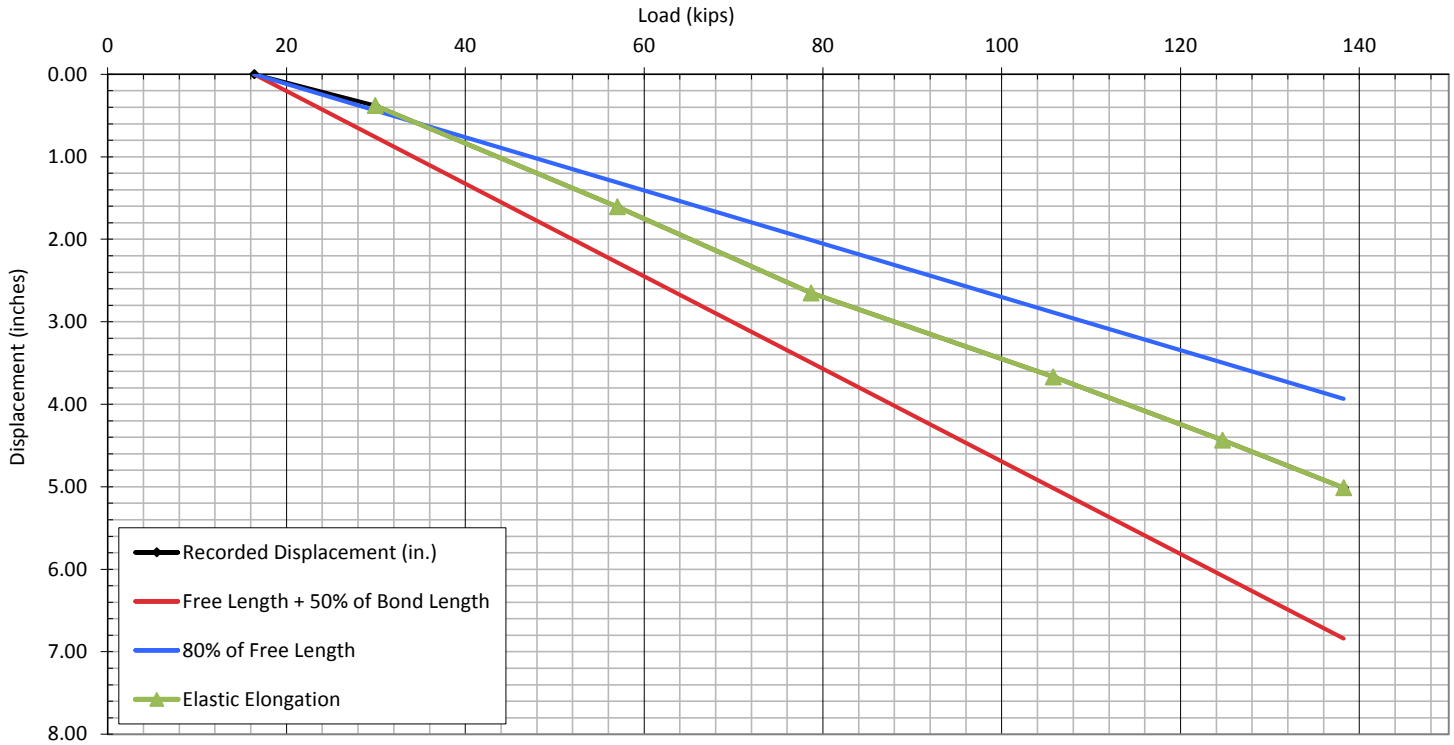
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	16	500	0.000	---	0.000	0.000	---	
---	0.25DL	30	1000	0.380	0.380	0.760	0.437	187.88	
---	0.50DL	57	2000	1.606	1.606	2.280	1.311	62.63	
---	0.75DL	79	2800	2.650	2.650	3.496	2.011	67.39	
---	1.00DL	106	3800	3.668	3.668	5.016	2.885	65.02	
---	1.20DL	125	4500	4.435	4.435	6.080	3.497	64.85	
---	1.33DL	138	5000	5.013	5.013	6.841	3.934	65.16	
1	1.33DL	138	5000	5.013	---	6.841	3.934	---	
2	1.33DL	138	5000	5.013	---	6.841	3.934	---	
3	1.33DL	138	5000	5.013	---	6.841	3.934	---	Pump the jack
4	1.33DL	138	5000	5.014	---	6.841	3.934	---	
5	1.33DL	138	5000	5.014	---	6.841	3.934	---	
6	1.33DL	138	5000	5.014	---	6.841	3.934	---	
10	1.33DL	138	5000	5.014	---	6.841	3.934	---	
---	AL	16	500		---	---	---	---	
---	LOCKOFF	81	2900	---	---	3.648	2.098	---	

Total Movement Between 1 and 10 Minutes (in.)	0.001
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141120
Gauge I.D. 12-1



Tieback Proof Testing

Sheet No.: 21

Tieback Location	Tieback Number	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	21	1/26/2016	1/27/2016			3/23/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	115	50	64.4	0.6	5.458	ZLK	ZLK

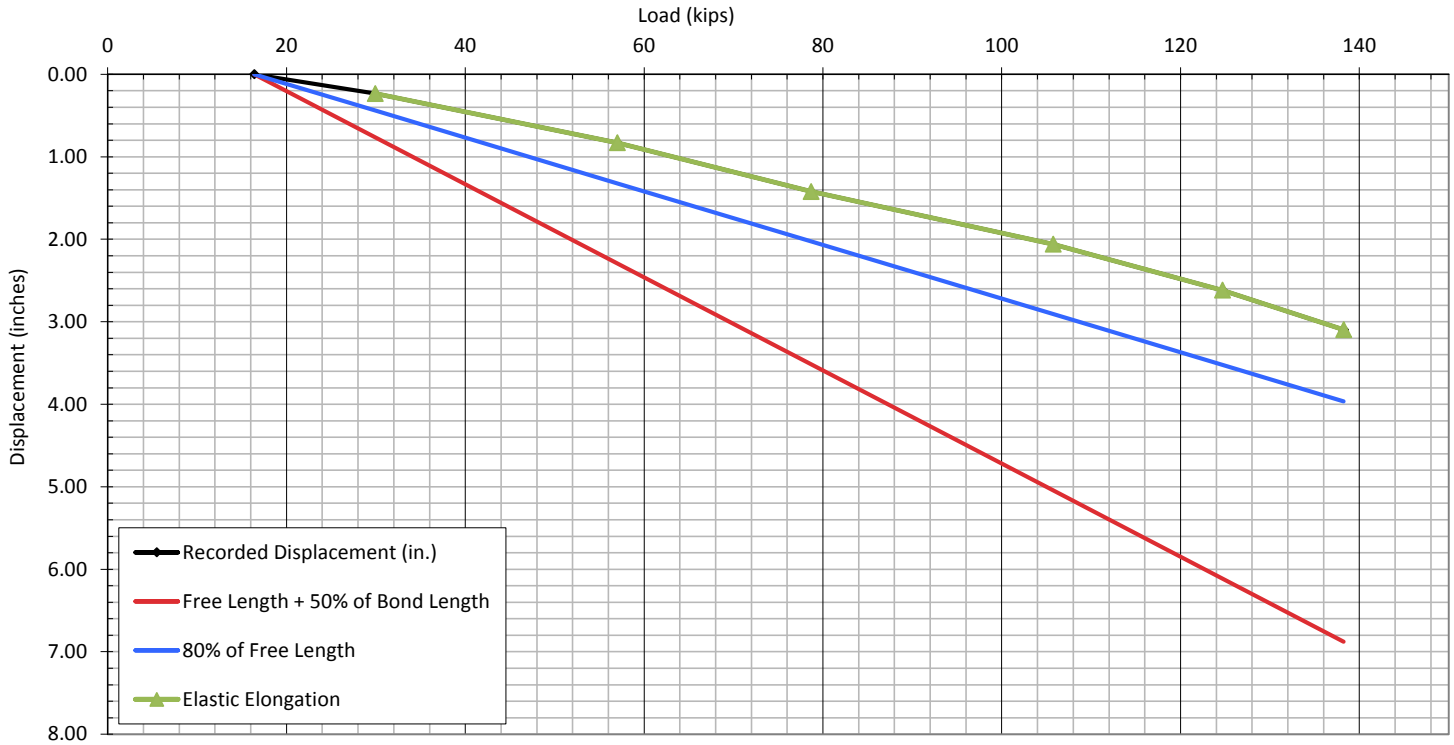
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	16	500	0.000	---	0.000	0.000	---	
---	0.25DL	30	1000	0.235	0.235	0.764	0.441	97.10	
---	0.50DL	57	2000	0.830	0.830	2.293	1.322	32.37	
---	0.75DL	79	2800	1.421	1.421	3.516	2.026	36.14	
---	1.00DL	106	3800	2.060	2.060	5.045	2.907	36.51	
---	1.20DL	125	4500	2.617	2.617	6.115	3.524	38.27	
---	1.33DL	138	5000	3.096	3.096	6.879	3.965	40.24	
1	1.33DL	138	5000	3.096	---	6.879	3.965	---	
2	1.33DL	138	5000	3.102	---	6.879	3.965	---	
3	1.33DL	138	5000	3.102	---	6.879	3.965	---	
4	1.33DL	138	5000	3.120	---	6.879	3.965	---	
5	1.33DL	138	5000	3.122	---	6.879	3.965	---	
6	1.33DL	138	5000	3.122	---	6.879	3.965	---	
10	1.33DL	138	5000	3.124	---	6.879	3.965	---	
---	AL	16	500		---	---	---	---	
---	LOCKOFF	81	2900	---	---	3.669	2.114	---	

Total Movement Between 1 and 10 Minutes (in.)	0.028
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	FAIL
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141120
Gauge I.D. 12-1



Tieback Location	Tieback No.	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	141121	1/20/2016	1/21/2016			3/24/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Jacking Length (L_J; ft)	Max. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	103	50	51.7	1.3	8.760	KH (MDCI)	ZLK

Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Creep Movement	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
Load Cycle 1 (AL = Max Load)									
---	AL (0.10DL)	14	400	0.000	---	0.000	0.000	---	
1	AL	14	400	0.000	0.000	---	---	---	
2	AL	14	400	0.000	0.000	---	---	---	
3	AL	14	400	0.000	0.000	---	---	---	
4	AL	14	400	0.000	0.000	---	---	---	
5	AL	14	400	0.000	0.000	---	---	---	
6	AL	14	400	0.000	0.000	---	---	---	
10	AL	14	400	0.000	0.000	---	---	---	
---	AL	14	400	0.000	---	---	---	---	
Load Cycle 2 (25% DL = Max Load)									
---	AL	14	400	0.000	---	0.000	0.000	---	
---	0.25DL	27	900	0.360	---	0.655	0.353	42.12	
1	0.25DL	27	900	0.360	0.000	---	---	---	
2	0.25DL	27	900	0.360	0.000	---	---	---	
3	0.25DL	27	900	0.360	0.000	---	---	---	
4	0.25DL	27	900	0.360	0.000	---	---	---	
5	0.25DL	27	900	0.360	0.000	---	---	---	
6	0.25DL	27	900	0.365	0.005	---	---	---	
10	0.25DL	27	900	0.365	0.005	---	---	---	
---	AL	14	400	0.290	---	---	---	---	
Load Cycle 3 (50% DL = Max Load)									
---	AL	14	400	0.290	---	0.000	0.000	---	
---	0.25DL	27	900	0.425	---	0.655	0.353	15.79	
---	0.50DL	54	1900	1.490	---	1.966	1.060	46.79	
1	0.50DL	54	1900	1.490	0.000	---	---	---	
2	0.50DL	54	1900	1.490	0.000	---	---	---	
3	0.50DL	54	1900	1.490	0.000	---	---	---	
4	0.50DL	54	1900	1.490	0.000	---	---	---	
5	0.50DL	54	1900	1.490	0.000	---	---	---	
6	0.50DL	54	1900	1.490	0.000	---	---	---	
10	0.50DL	54	1900	1.490	0.000	---	---	---	
15	0.50DL	54	1900	1.490	0.000	---	---	---	
20	0.50DL	54	1900	1.490	0.000	---	---	---	Pump the jack
25	0.50DL	54	1900	1.490	0.000	---	---	---	
30	0.50DL	54	1900	1.490	0.000	---	---	---	
---	AL	14	400	0.365	---	---	---	---	
Load Cycle 4 (75% DL = Max Load)									
---	AL	14	400	0.365	---	0.000	0.000	---	
---	0.25DL	27	900	0.490	---	0.655	0.353	14.62	
---	0.50DL	54	1900	1.420	---	1.966	1.060	41.14	
---	0.75DL	79	2800	2.435	---	3.146	1.696	50.45	
1	0.75DL	79	2800	2.435	0.000	---	---	---	
2	0.75DL	79	2800	2.435	0.000	---	---	---	
3	0.75DL	79	2800	2.433	-0.002	---	---	---	
4	0.75DL	79	2800	2.435	0.000	---	---	---	
5	0.75DL	79	2800	2.435	0.000	---	---	---	
6	0.75DL	79	2800	2.430	-0.005	---	---	---	Pump the jack
10	0.75DL	79	2800	2.430	-0.005	---	---	---	
15	0.75DL	79	2800	2.425	-0.010	---	---	---	
20	0.75DL	79	2800	2.425	-0.010	---	---	---	
25	0.75DL	79	2800	2.425	-0.010	---	---	---	
30	0.75DL	79	2800	2.425	-0.010	---	---	---	

---	AL	14	400	0.430	---	---	---	---	
Load Cycle 5 (100% DL = Max Load)									
---	AL	14	400	0.535	---	0.000	0.000	---	
---	0.25DL	27	900	0.609	---	0.655	0.353	8.66	
---	0.50DL	54	1900	1.690	---	1.966	1.060	45.04	
---	0.75DL	79	2800	2.548	---	3.146	1.696	49.06	
---	1.00DL	103	3700	3.469	---	4.325	2.332	52.01	
1	1.00DL	103	3700	3.465	-0.004	---	---	---	
2	1.00DL	103	3700	3.465	-0.004	---	---	---	
3	1.00DL	103	3700	3.465	-0.004	---	---	---	
4	1.00DL	103	3700	3.465	-0.004	---	---	---	
5	1.00DL	103	3700	3.460	-0.009	---	---	---	
6	1.00DL	103	3700	3.465	-0.004	---	---	---	
10	1.00DL	103	3700	3.470	0.001	---	---	---	
15	1.00DL	103	3700	3.490	0.021	---	---	---	
20	1.00DL	103	3700	3.490	0.021	---	---	---	
25	1.00DL	103	3700	3.490	0.021	---	---	---	
30	1.00DL	103	3700	3.490	0.021	---	---	---	Pump the jack
45	1.00DL	103	3700	3.490	0.021	---	---	---	
---	AL	14	400	0.535	---	---	---	---	
Load Cycle 6 (120% DL = Max Load)									
---	AL	14	400	0.535	---	0.000	0.000	---	
---	0.25DL	27	900	0.609	---	0.655	0.353	8.66	
---	0.50DL	54	1900	1.690	---	1.966	1.060	45.04	
---	0.75DL	79	2800	2.548	---	3.146	1.696	49.06	
---	1.00DL	103	3700	3.588	---	4.325	2.332	54.12	
---	1.20DL	122	4400	4.390	---	5.243	2.827	56.37	
1	1.20DL	122	4400	4.390	0.000	---	---	---	
2	1.20DL	122	4400	4.390	0.000	---	---	---	
3	1.20DL	122	4400	4.390	0.000	---	---	---	
4	1.20DL	122	4400	4.390	0.000	---	---	---	
5	1.20DL	122	4400	4.385	-0.005	---	---	---	
6	1.20DL	122	4400	4.385	-0.005	---	---	---	
10	1.20DL	122	4400	4.385	-0.005	---	---	---	
15	1.20DL	122	4400	4.385	-0.005	---	---	---	
20	1.20DL	122	4400	4.380	-0.010	---	---	---	
25	1.20DL	122	4400	4.380	-0.010	---	---	---	
30	1.20DL	122	4400	4.390	0.000	---	---	---	Pump the jack
45	1.20DL	122	4400	4.400	0.010	---	---	---	Pump the jack
60	1.20DL	122	4400	4.405	0.015	---	---	---	
---	AL	14	400	0.640	---	---	---	---	
Load Cycle 7 (133% DL = Max Load)									
---	AL	14	400	0.640	---	0.000	0.000	---	
---	0.25DL	27	900	0.690	---	0.655	0.353	5.85	
---	0.50DL	54	1900	1.750	---	1.966	1.060	43.29	
---	0.75DL	79	2800	2.705	---	3.146	1.696	50.33	
---	1.00DL	103	3700	3.780	---	4.325	2.332	55.66	
---	1.20DL	122	4400	4.470	---	5.243	2.827	56.01	
---	1.33DL	136	4900	5.020	---	5.898	3.180	56.93	
1	1.33DL	136	4900	5.025	0.005	---	---	---	
2	1.33DL	136	4900	5.025	0.005	---	---	---	
3	1.33DL	136	4900	5.025	0.005	---	---	---	
4	1.33DL	136	4900	5.025	0.005	---	---	---	
5	1.33DL	136	4900	5.025	0.005	---	---	---	
6	1.33DL	136	4900	5.025	0.005	---	---	---	
10	1.33DL	136	4900	5.030	0.010	---	---	---	Pump the jack
15	1.33DL	136	4900	5.030	0.010	---	---	---	
20	1.33DL	136	4900	5.030	0.010	---	---	---	
25	1.33DL	136	4900	5.030	0.010	---	---	---	
30	1.33DL	136	4900	5.035	0.015	---	---	---	Pump the jack
45	1.33DL	136	4900	5.035	0.015	---	---	---	
60	1.33DL	136	4900	5.035	0.015	---	---	---	
75	1.33DL	136	4900	5.035	0.015	---	---	---	
90	1.33DL	136	4900	5.030	0.010	---	---	---	
100	1.33DL	136	4900	5.040	0.020	---	---	---	Pump the jack
120	1.33DL	136	4900	5.035	0.015	---	---	---	
150	1.33DL	136	4900	5.035	0.015	---	---	---	
180	1.33DL	136	4900	5.040	0.020	---	---	---	
210	1.33DL	136	4900	5.040	0.020	---	---	---	

240	1.33DL	136	4900	5.042	0.022	---	---	---	
270	1.33DL	136	4900	5.047	0.027	---	---	---	
300	1.33DL	136	4900	5.047	0.027	---	---	---	
AL	AL	14	400	0.832	---	---	---	---	
---	LOCKOFF	84	3000		---	---	---	---	

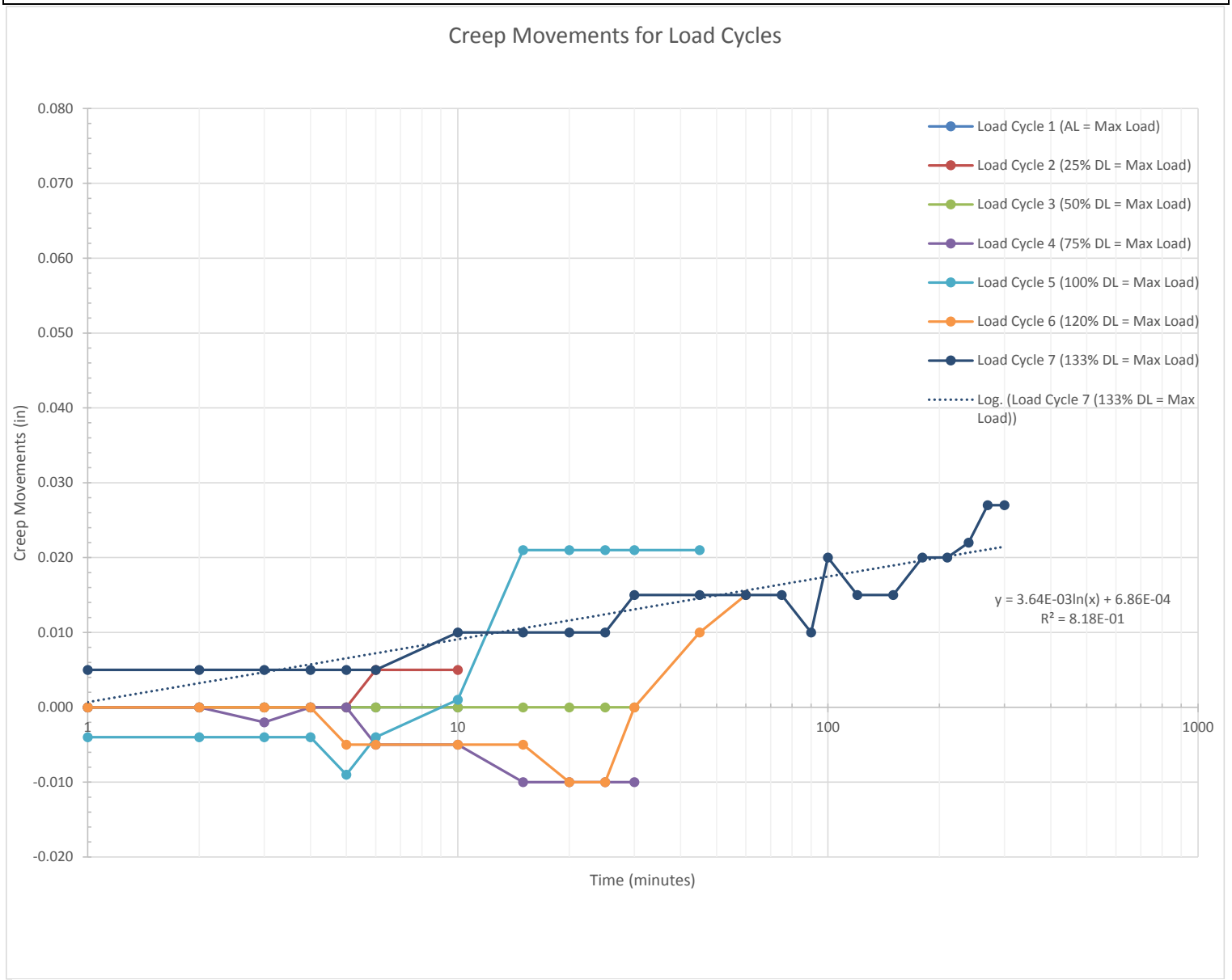
Load Cycles	1	2	3	4	5	6	7
Elastic Elongation at Load Cycle Max (in)	0.000	0.360	1.200	2.070	2.934	3.855	4.380
Residual Movement for Load Cycle (in)	0.000	0.290	0.075	0.065	0.000	0.105	0.192
Creep Rate for Load Cycle (in/log cycle)	0.00000	0.00500	0.00000	-0.00677	0.01512	0.00844	0.00888

Total Movement Between 1 and 10 Minutes (in.)	0.005
Maximum Total Movement Allowed (in.)*:	0.040

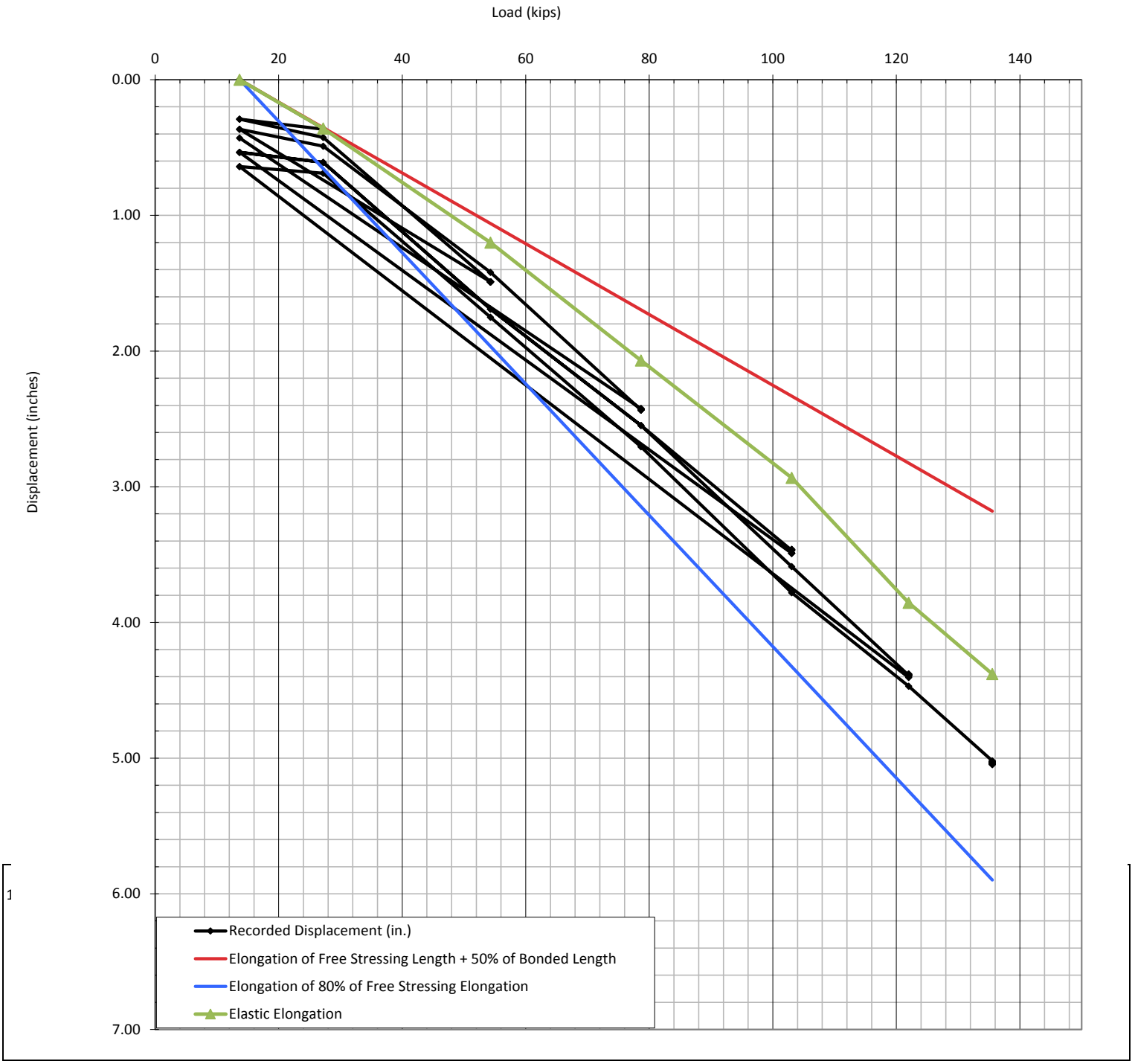
Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Ram I.D. 141120
Gauge I.D. 12-1

Notes/Additional Comments:
1. Gage pressure must be maintained during testing and be held to within +/- 2%
2. Recorded displacements are to be recorded to the nearest 0.001 in.
3. If 0.080 in/log cycle is exceeded, testing will continue to determine if creep rate will diminish below the thresold value.
4. Criteria for total movement of less than 0.04 in between 1 and 10 minutes for final load cycle is statisfied by extended creep holds times



Tieback Extended Creep Testing



Tieback Proof Testing

Sheet No.: 23

Tieback Location	Tieback Number	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	23	1/26/2016	1/27/2016			3/23/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	115	50	63.8	1.2	5.458	ZLK	ZLK

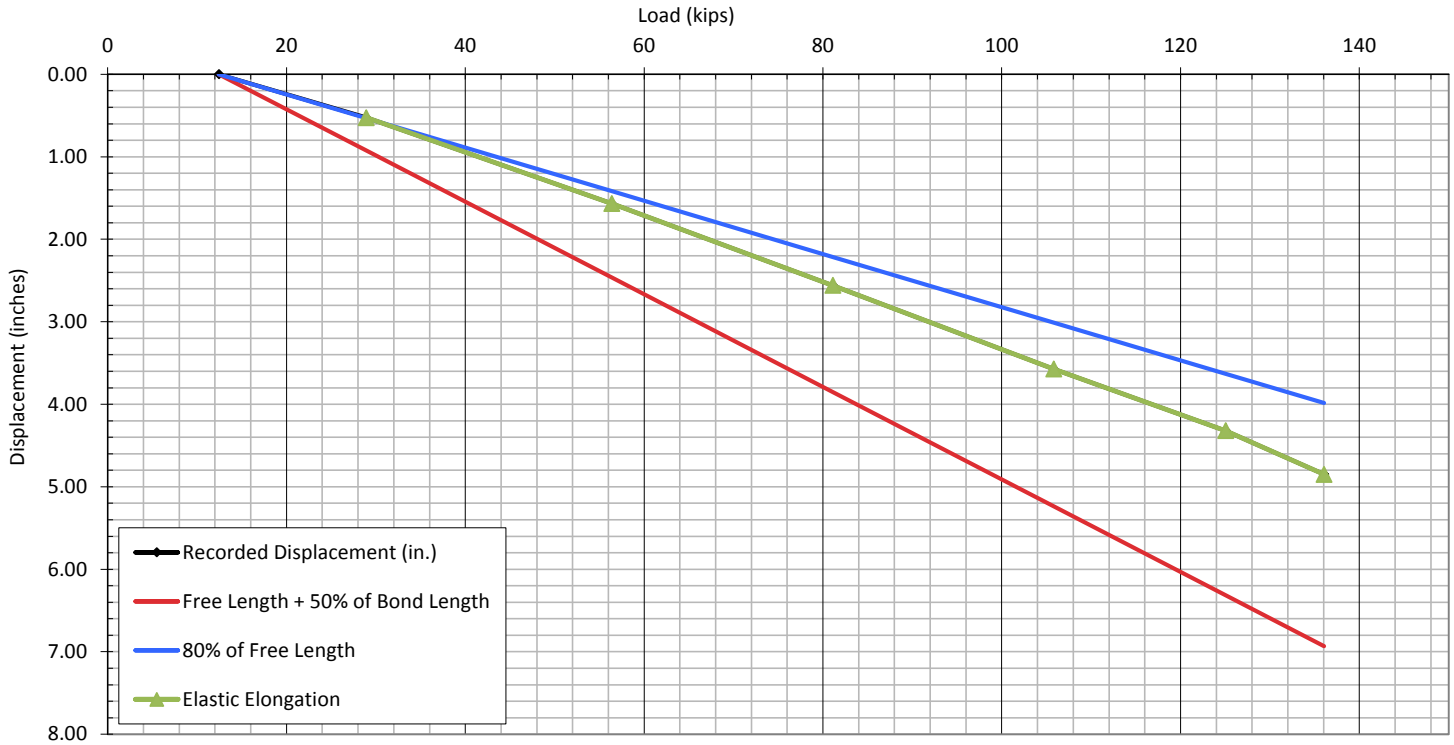
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	12	400	0.000	---	0.000	0.000	---	
---	0.25DL	29	1000	0.525	0.525	0.924	0.531	150.69	
---	0.50DL	56	2000	1.568	1.568	2.465	1.417	56.51	
---	0.75DL	81	2900	2.559	2.559	3.851	2.214	59.02	
---	1.00DL	106	3800	3.572	3.572	5.238	3.011	60.58	
---	1.20DL	125	4500	4.320	4.320	6.316	3.631	60.76	
---	1.33DL	136	4900	4.849	4.849	6.933	3.985	62.13	
1	1.33DL	136	4900	4.849	---	6.933	3.985	---	
2	1.33DL	136	4900	4.849	---	6.933	3.985	---	
3	1.33DL	136	4900	4.849	---	6.933	3.985	---	
4	1.33DL	136	4900	4.849	---	6.933	3.985	---	
5	1.33DL	136	4900	4.851	---	6.933	3.985	---	
6	1.33DL	136	4900	4.852	---	6.933	3.985	---	Pump the jack
10	1.33DL	136	4900	4.852	---	6.933	3.985	---	
---	AL	15	500	0.000	---	---	---	---	
---	LOCKOFF	87	3100	---	---	4.160	2.391	---	

Total Movement Between 1 and 10 Minutes (in.)	0.003
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141121
Gauge I.D. 12-4



Tieback Proof Testing

Sheet No.: 24

Tieback Location	Tieback Number	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	24	1/25/2016	1/26/2016			3/23/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	115	50	63.8	1.2	5.458	ZLK	ZLK

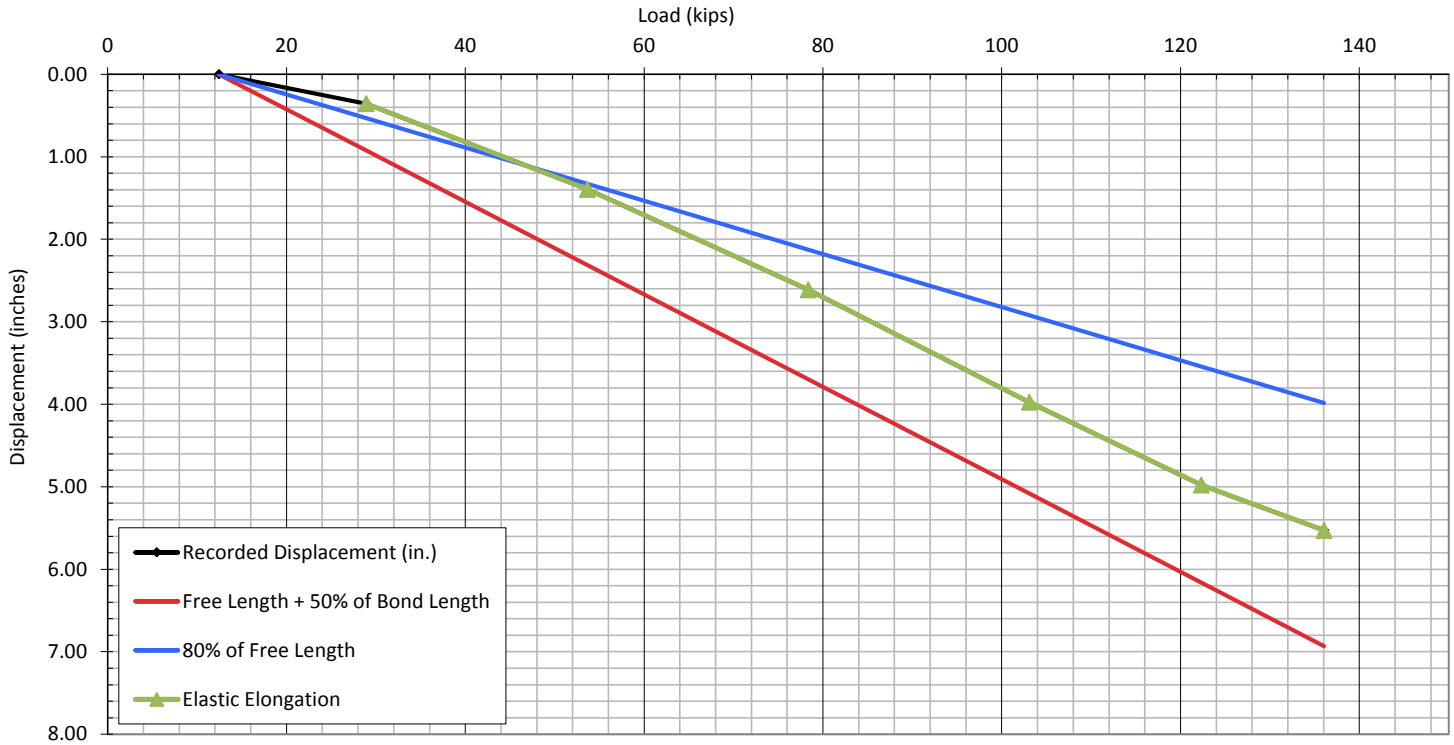
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	12	400	0.000	---	0.000	0.000	---	
---	0.25DL	29	1000	0.357	0.357	0.924	0.531	134.07	
---	0.50DL	54	1900	1.395	1.395	2.311	1.328	53.63	
---	0.75DL	78	2800	2.612	2.612	3.697	2.125	62.76	
---	1.00DL	103	3700	3.975	3.975	5.084	2.923	69.46	
---	1.20DL	122	4400	4.979	4.979	6.162	3.542	71.78	
---	1.33DL	136	4900	5.530	5.530	6.933	3.985	70.86	
1	1.33DL	136	4900	5.530	---	6.933	3.985	---	
2	1.33DL	136	4900	5.530	---	6.933	3.985	---	
3	1.33DL	136	4900	5.530	---	6.933	3.985	---	
4	1.33DL	136	4900	5.530	---	6.933	3.985	---	
5	1.33DL	136	4900	5.540	---	6.933	3.985	---	Pump the jack
6	1.33DL	136	4900	5.545	---	6.933	3.985	---	
10	1.33DL	136	4900	5.565	---	6.933	3.985	---	Pump the jack
---	AL	15	500	0.000	---	---	---	---	
---	LOCKOFF	81	2900	---	---	3.851	2.214	---	

Total Movement Between 1 and 10 Minutes (in.)	0.035
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141121
Gauge I.D. 12-4



Tieback Performance Test

Sheet No.: 25

Tieback Location	Tieback Number	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	25	1/26/2016	1/27/2016			3/23/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	115	50	64.3	0.7	5.458	ZLK	ZLK

Time (min)	Load Testing Schedule	Actual Test Load (kips)	Gauge Pressure for Test Load (psi)[1]	Recorded Displacement (in.)[2]	Elastic Elongation at Load Cycle Maximum (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	16	500	0.000	---	0.000	0.000	---	
---	0.25DL	30	1000	0.590	0.285	0.764	0.440	33.34	
---	AL	16	500	0.305	---	0.000	0.000	---	
---	0.25DL	30	1000	0.570	---	0.764	0.440	---	
---	0.50DL	57	2000	1.678	1.366	2.291	1.320	53.27	
---	AL	16	500	0.312	---	0.000	0.000	---	
---	0.25DL	30	1000	0.605	---	0.764	0.440	---	
---	0.50DL	57	2000	1.682	---	2.291	1.320	---	
---	0.75DL	81	2900	2.757	2.348	3.665	2.112	57.23	
---	AL	16	500	0.409	---	0.000	0.000	---	
---	0.25DL	30	1000	0.725	---	0.764	0.440	---	
---	0.50DL	57	2000	1.768	---	2.291	1.320	---	
---	0.75DL	81	2900	2.763	---	3.665	2.112	---	
---	1.00DL	106	3800	3.864	3.415	5.040	2.904	60.53	
---	AL	16	500	0.449	---	0.000	0.000	---	
---	0.25DL	30	1000	0.745	---	0.764	0.440	---	
---	0.50DL	57	2000	1.901	---	2.291	1.320	---	
---	0.75DL	81	2900	2.862	---	3.665	2.112	---	
---	1.00DL	106	3800	3.905	---	5.040	2.904	---	
---	1.20DL	125	4500	4.764	4.485	6.109	3.519	65.59	
---	AL	16	500	0.279	---	0.000	0.000	---	
---	0.25DL	30	1000	0.784	---	0.764	0.440	---	
---	0.50DL	57	2000	1.920	---	2.291	1.320	---	
---	0.75DL	81	2900	2.936	---	3.665	2.112	---	
---	1.00DL	106	3800	3.952	---	5.040	2.904	---	
---	1.20DL	125	4500	4.767	---	6.109	3.519	---	
---	1.33DL	138	5000	5.129	---	6.873	3.959	---	
1	1.33DL	138	5000	5.129	---	---	---	---	
2	1.33DL	138	5000	5.129	---	---	---	---	
3	1.33DL	138	5000	5.129	---	---	---	---	
4	1.33DL	138	5000	5.129	---	---	---	---	
5	1.33DL	138	5000	5.134	---	---	---	---	
6	1.33DL	138	5000	5.134	---	---	---	---	Pump the jack
10	1.33DL	138	5000	5.132	4.853	---	---	63.08	
---	AL	16	500	0.279	---	---	---	---	
---	LOCKOFF	85	3050		---	3.894	2.244	---	

Total Movement Between 1 and 10 Minutes (in.)	0.003
Maximum Total Movement Allowed (in.):	0.040

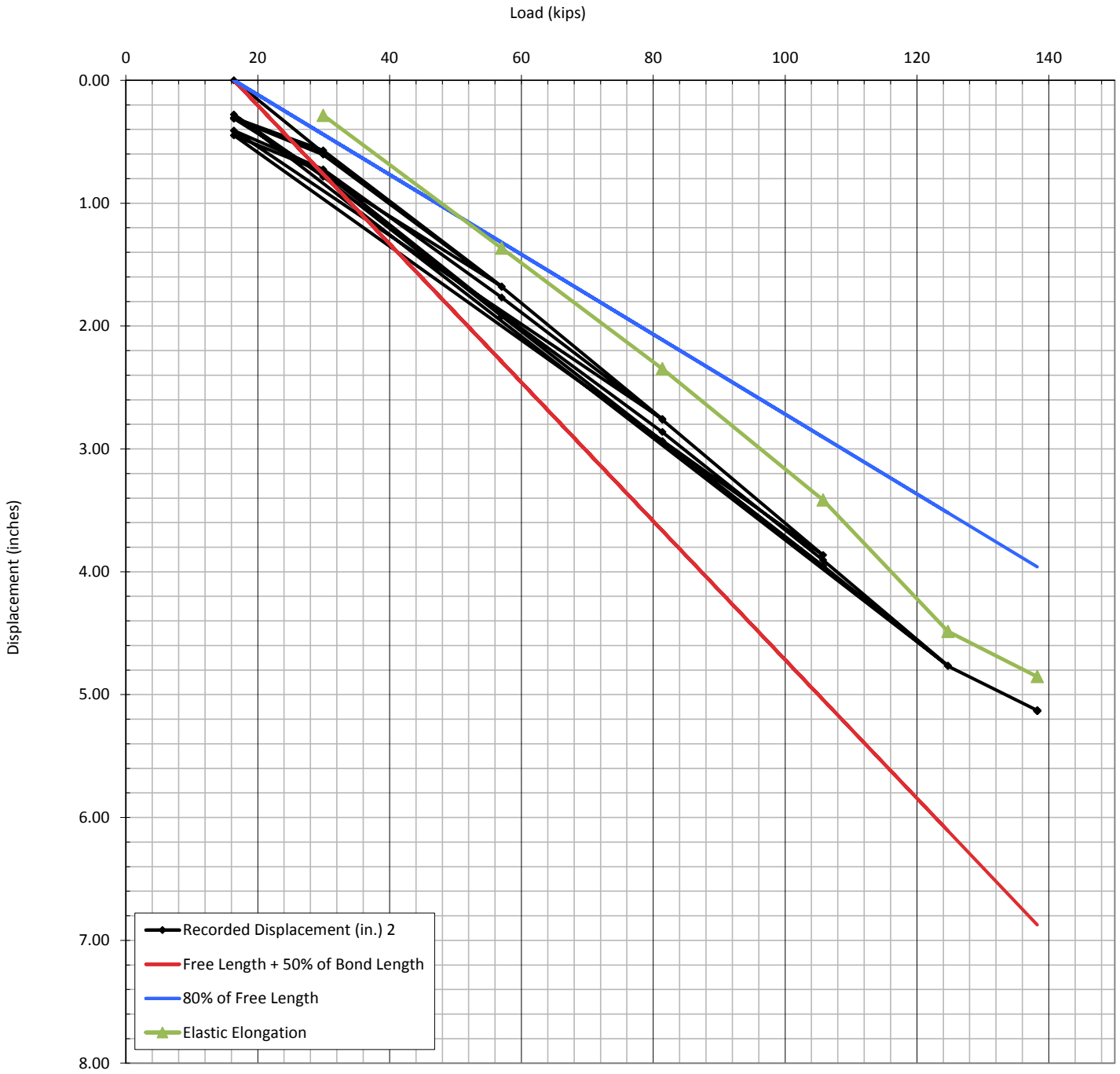
Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141120
Gauge I.D. 16-1

Notes/Additional Comments:
1. Gage pressure must be maintained during testing and be held to within +/- 2%
2. Recorded displacements are to be recorded to the nearest 0.001 in.

Tieback Performance Test



Testing Notes:
1. Final displacement at AL was not recorded. Value recorded for 1.20DL Load Cycle is assumed.

Tieback Proof Testing

Sheet No.: 26

Tieback Location	Tieback Number	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	26	1/22/2016	1/25/2016			3/22/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	115	50	63.5	1.5	5.458	ZLK	ZLK

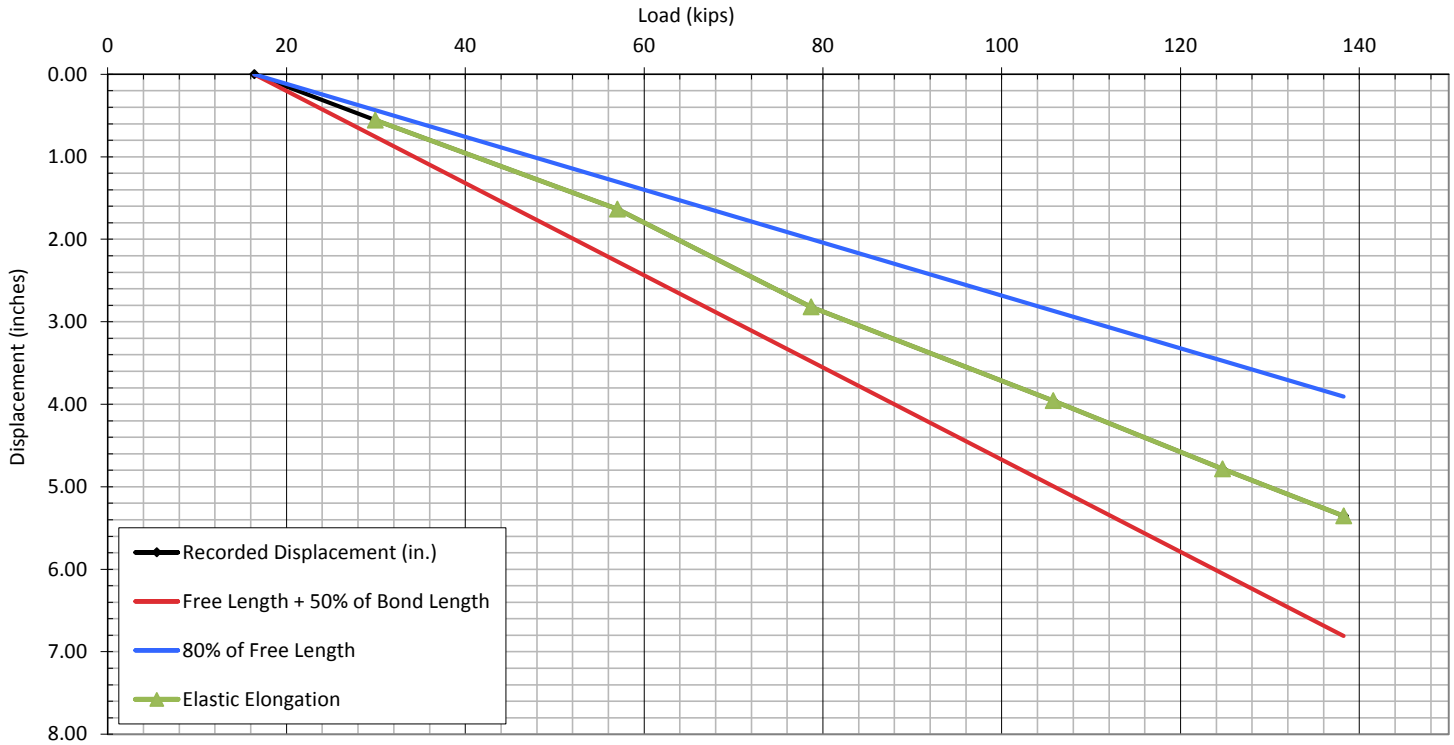
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	16	500	0.000	---	0.000	0.000	---	
---	0.25DL	30	1000	0.555	0.555	0.756	0.434	191.27	
---	0.50DL	57	2000	1.635	1.635	2.269	1.303	63.76	
---	0.75DL	79	2800	2.820	2.820	3.480	1.997	71.72	
---	1.00DL	106	3800	3.957	3.957	4.993	2.866	70.14	
---	1.20DL	125	4500	4.782	4.782	6.052	3.474	69.93	
---	1.33DL	138	5000	5.353	5.353	6.808	3.908	69.58	
1	1.33DL	138	5000	5.353	---	6.808	3.908	---	Pump the jack
2	1.33DL	138	5000	5.353	---	6.808	3.908	---	
3	1.33DL	138	5000	5.353	---	6.808	3.908	---	
4	1.33DL	138	5000	5.353	---	6.808	3.908	---	
5	1.33DL	138	5000	5.353	---	6.808	3.908	---	
6	1.33DL	138	5000	5.353	---	6.808	3.908	---	
10	1.33DL	138	5000	5.353	---	6.808	3.908	---	
---	AL	16	500		---	---	---	---	
---	LOCKOFF	84	3000	---	---	3.782	2.171	---	

Total Movement Between 1 and 10 Minutes (in.)	0.000
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141120
Gauge I.D. 12-1



Tieback Proof Testing

Sheet No.: 27

Tieback Location	Tieback Number	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	27	1/25/2016	1/26/2016			3/22/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	115	50	64.5	0.5	5.458	ZLK	ZLK

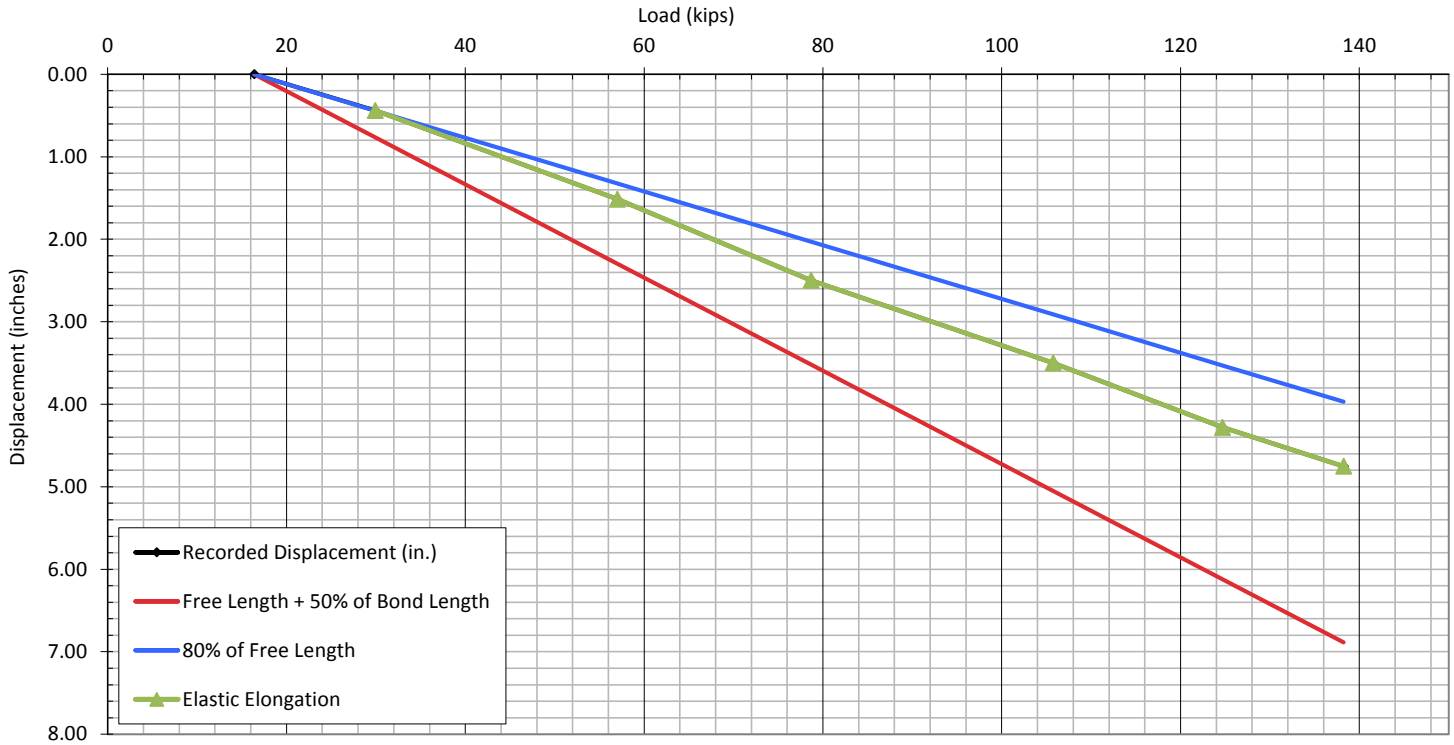
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	16	500	0.000	---	0.000	0.000	---	
---	0.25DL	30	1000	0.440	0.440	0.765	0.441	177.23	
---	0.50DL	57	2000	1.515	1.515	2.295	1.323	59.08	
---	0.75DL	79	2800	2.498	2.498	3.519	2.029	63.53	
---	1.00DL	106	3800	3.498	3.498	5.049	2.911	62.00	
---	1.20DL	125	4500	4.280	4.280	6.120	3.529	62.59	
---	1.33DL	138	5000	4.752	4.752	6.885	3.970	61.77	
1	1.33DL	138	5000	4.753	---	6.885	3.970	---	
2	1.33DL	138	5000	4.769	---	6.885	3.970	---	Pump the jack
3	1.33DL	138	5000	4.771	---	6.885	3.970	---	<-- Movement
4	1.33DL	138	5000	4.783	---	6.885	3.970	---	from wind
5	1.33DL	138	5000	4.784	---	6.885	3.970	---	Pump the jack
6	1.33DL	138	5000	4.784	---	6.885	3.970	---	
10	1.33DL	138	5000	4.784	---	6.885	3.970	---	
---	AL	16	500		---	---	---	---	
---	LOCKOFF	84	3000	---	---	3.825	2.205	---	

Total Movement Between 1 and 10 Minutes (in.)	0.031
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141120
Gauge I.D. 12-1



Tieback Proof Testing

Sheet No.: 28

Tieback Location	Tieback Number	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	28	1/22/2016	1/25/2016			3/22/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	115	50	65.0	0.0	5.458	ZLK	ZLK

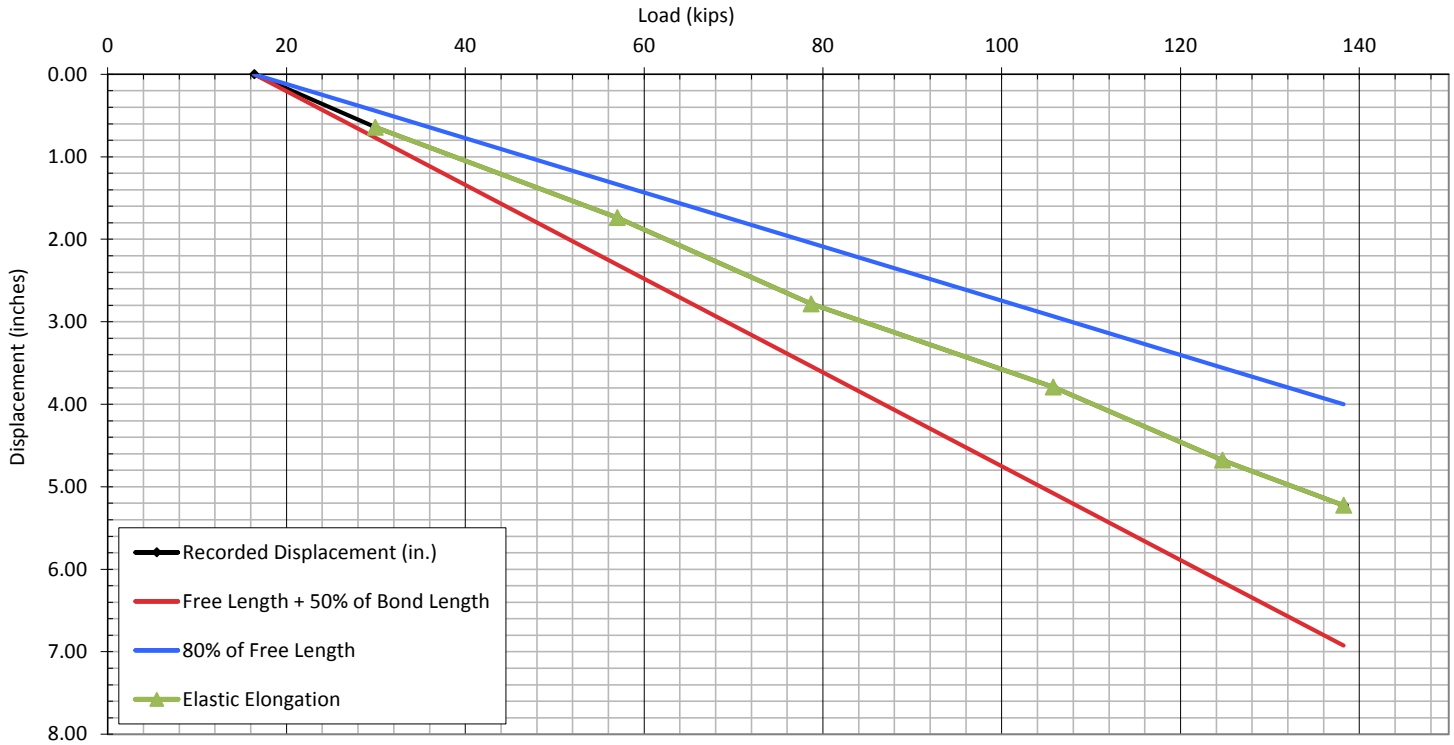
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	16	500	0.000	---	0.000	0.000	---	
---	0.25DL	30	1000	0.642	0.642	0.769	0.444	203.21	
---	0.50DL	57	2000	1.737	1.737	2.308	1.333	67.74	
---	0.75DL	79	2800	2.782	2.782	3.539	2.045	70.75	
---	1.00DL	106	3800	3.791	3.791	5.078	2.934	67.20	
---	1.20DL	125	4500	4.677	4.677	6.155	3.556	68.39	
---	1.33DL	138	5000	5.225	5.225	6.924	4.000	67.92	
1	1.33DL	138	5000	5.225	---	6.924	4.000	---	
2	1.33DL	138	5000	5.225	---	6.924	4.000	---	
3	1.33DL	138	5000	5.245	---	6.924	4.000	---	Pump the jack
4	1.33DL	138	5000	5.245	---	6.924	4.000	---	
5	1.33DL	138	5000	5.245	---	6.924	4.000	---	
6	1.33DL	138	5000	5.245	---	6.924	4.000	---	
10	1.33DL	138	5000	5.245	---	6.924	4.000	---	
---	AL	16	500		---	---	---	---	
---	LOCKOFF	87	3100	---	---	4.000	2.311	---	

Total Movement Between 1 and 10 Minutes (in.)	0.020
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141120
Gauge I.D. 12-1



Tieback Proof Testing

Sheet No.: 29

Tieback Location	Tieback Number	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	29	1/21/2016	1/25/2016			3/22/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	115	50	64.2	0.8	5.458	ZLK	ZLK

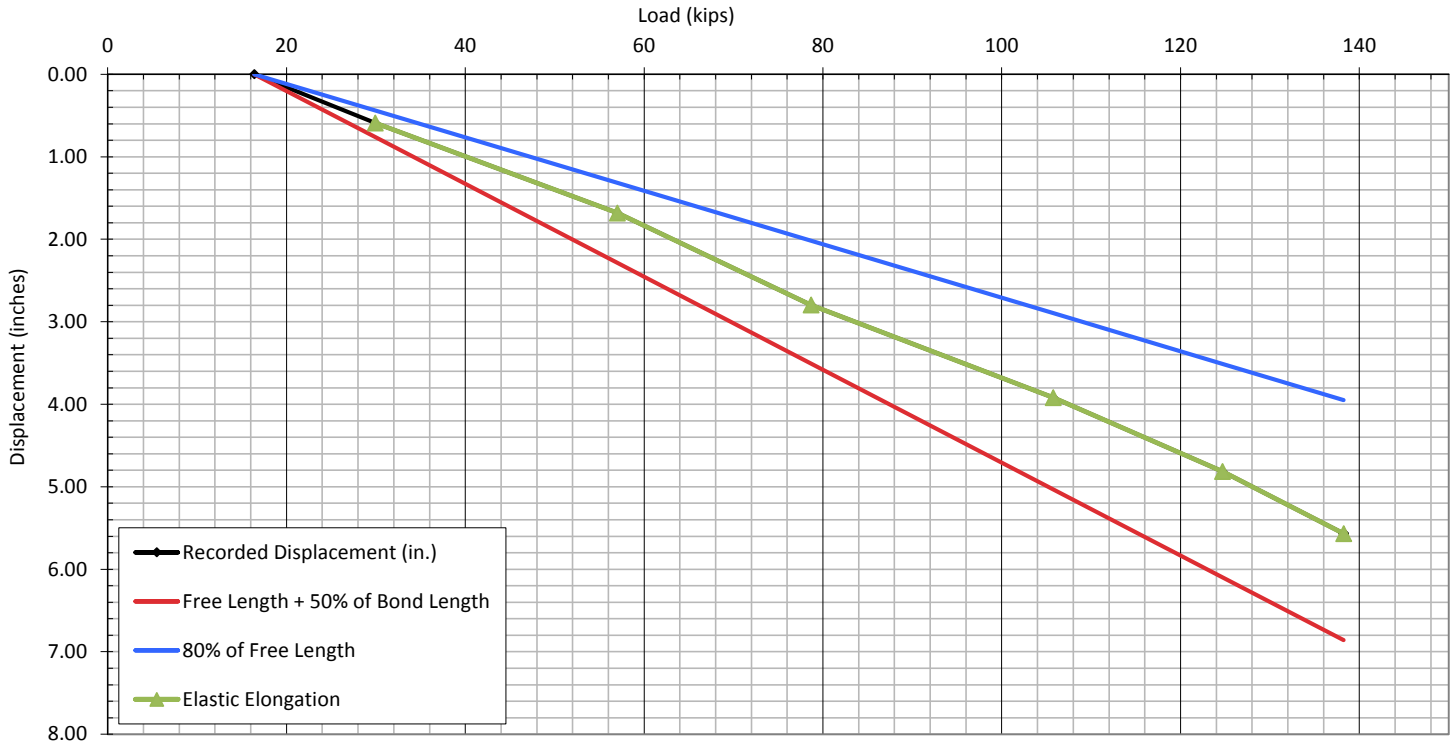
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	16	500	0.000	---	0.000	0.000	---	
---	0.25DL	30	1000	0.590	0.590	0.762	0.439	196.65	
---	0.50DL	57	2000	1.681	1.681	2.287	1.316	65.55	
---	0.75DL	79	2800	2.796	2.796	3.506	2.018	71.11	
---	1.00DL	106	3800	3.919	3.919	5.030	2.896	69.47	
---	1.20DL	125	4500	4.816	4.816	6.098	3.510	70.43	
---	1.33DL	138	5000	5.568	5.568	6.860	3.949	72.38	
1	1.33DL	138	5000	5.568	---	6.860	3.949	---	
2	1.33DL	138	5000	5.568	---	6.860	3.949	---	
3	1.33DL	138	5000	5.568	---	6.860	3.949	---	
4	1.33DL	138	5000	5.568	---	6.860	3.949	---	
5	1.33DL	138	5000	5.568	---	6.860	3.949	---	
6	1.33DL	138	5000	5.568	---	6.860	3.949	---	Pump the jack
10	1.33DL	138	5000	5.568	---	6.860	3.949	---	
---	AL	16	500		---	---	---	---	
---	LOCKOFF	84	3000	---	---	3.811	2.194	---	

Total Movement Between 1 and 10 Minutes (in.)	0.000
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141120
Gauge I.D. 12-1



Tieback Proof Testing

Sheet No.: 30

Tieback Location	Tieback Number	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	30	1/22/2016	1/25/2016			3/22/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	115	50	64.9	0.1	5.458	ZLK	ZLK

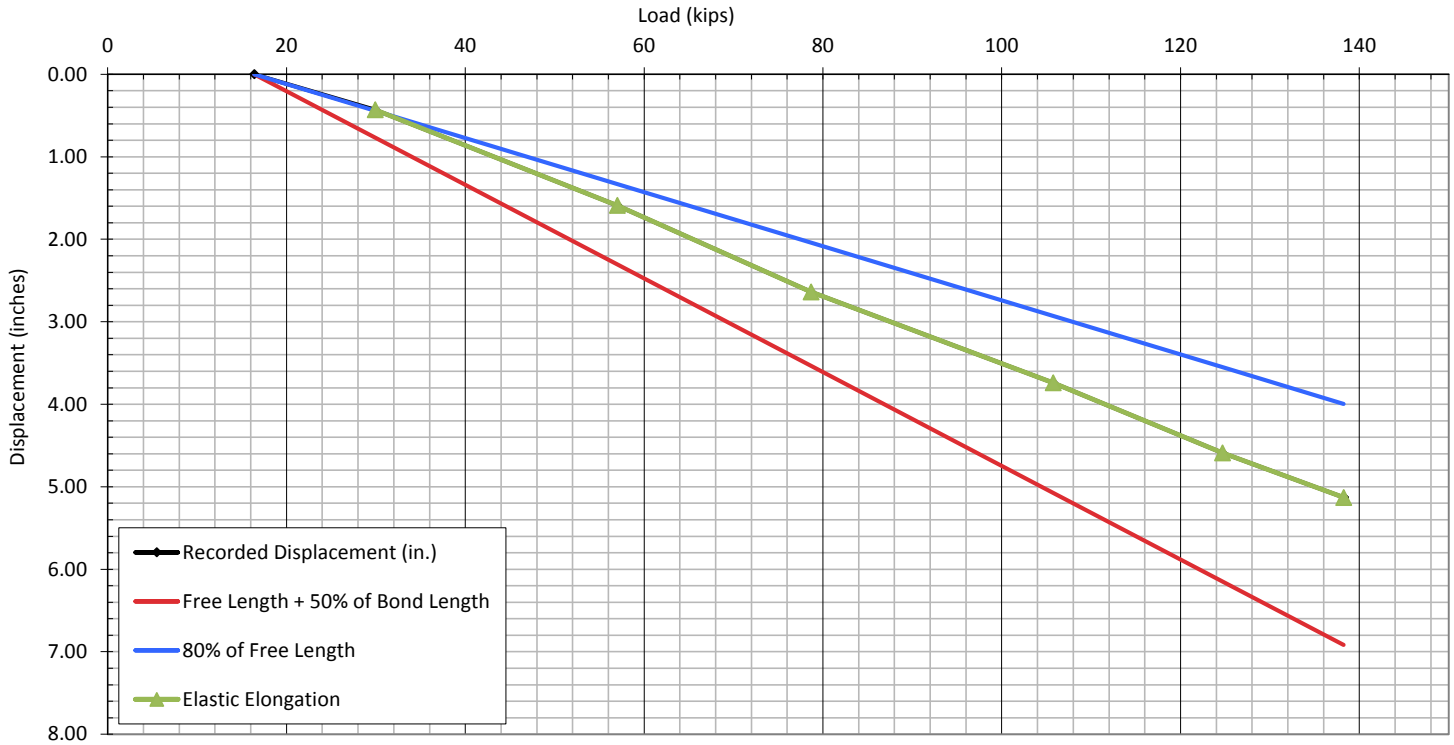
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	16	500	0.000	---	0.000	0.000	---	
---	0.25DL	30	1000	0.431	0.431	0.769	0.444	186.01	
---	0.50DL	57	2000	1.590	1.590	2.306	1.332	62.00	
---	0.75DL	79	2800	2.638	2.638	3.536	2.042	67.09	
---	1.00DL	106	3800	3.741	3.741	5.073	2.930	66.31	
---	1.20DL	125	4500	4.589	4.589	6.149	3.551	67.11	
---	1.33DL	138	5000	5.129	5.129	6.917	3.995	66.67	
1	1.33DL	138	5000	5.129	---	6.917	3.995	---	
2	1.33DL	138	5000	5.130	---	6.917	3.995	---	
3	1.33DL	138	5000	5.130	---	6.917	3.995	---	
4	1.33DL	138	5000	5.130	---	6.917	3.995	---	
5	1.33DL	138	5000	5.130	---	6.917	3.995	---	
6	1.33DL	138	5000	5.156	---	6.917	3.995	---	<-- movement
10	1.33DL	138	5000	5.169	---	6.917	3.995	---	from wind
---	AL	16	500		---	---	---	---	
---	LOCKOFF	79	2800	---	---	3.536	2.042	---	

Total Movement Between 1 and 10 Minutes (in.)	0.040
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141120
Gauge I.D. 12-1



Tieback Proof Testing

Sheet No.: 31

Tieback Location	Tieback Number	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	31	1/21/2016	1/25/2016			3/22/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	115	50	64.0	1.0	5.458	ZLK	ZLK

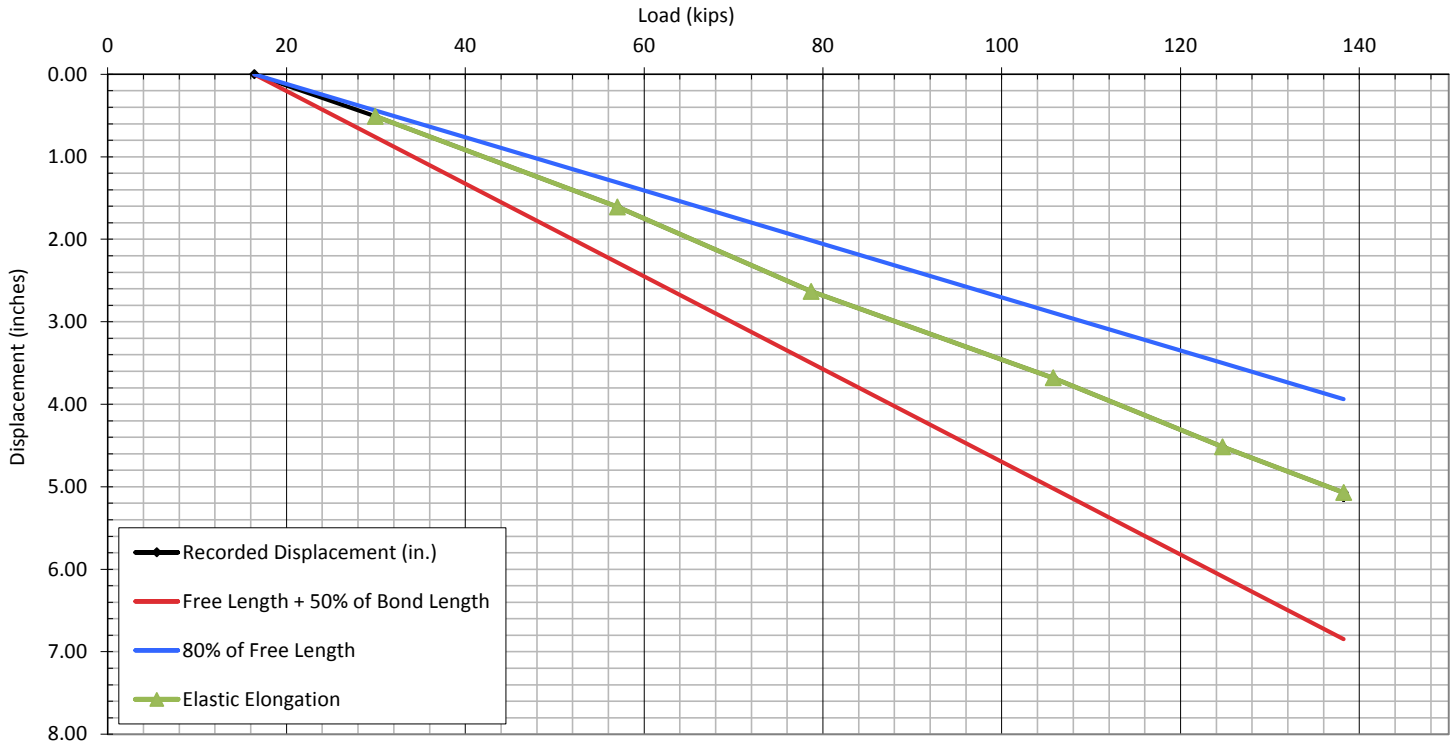
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	16	500	0.000	---	0.000	0.000	---	
---	0.25DL	30	1000	0.509	0.509	0.761	0.438	188.00	
---	0.50DL	57	2000	1.607	1.607	2.282	1.313	62.67	
---	0.75DL	79	2800	2.632	2.632	3.500	2.013	66.94	
---	1.00DL	106	3800	3.680	3.680	5.021	2.889	65.23	
---	1.20DL	125	4500	4.517	4.517	6.086	3.501	66.05	
---	1.33DL	138	5000	5.069	5.069	6.847	3.939	65.89	
1	1.33DL	138	5000	5.124	---	6.847	3.939	---	
2	1.33DL	138	5000	5.124	---	6.847	3.939	---	
3	1.33DL	138	5000	5.124	---	6.847	3.939	---	Pump the jack
4	1.33DL	138	5000	5.124	---	6.847	3.939	---	
5	1.33DL	138	5000	5.124	---	6.847	3.939	---	
6	1.33DL	138	5000	5.124	---	6.847	3.939	---	Pump the jack
10	1.33DL	138	5000	5.124	---	6.847	3.939	---	
---	AL	16	500		---	---	---	---	
---	LOCKOFF	79	2800	---	---	3.500	2.013	---	

Total Movement Between 1 and 10 Minutes (in.)	0.000
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141120
Gauge I.D. 12-1



Tieback Proof Testing

Sheet No.: 32

Tieback Location	Tieback Number	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	32	1/22/2016	1/25/2016			3/22/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	115	50	64.8	0.3	5.458	ZLK	ZLK

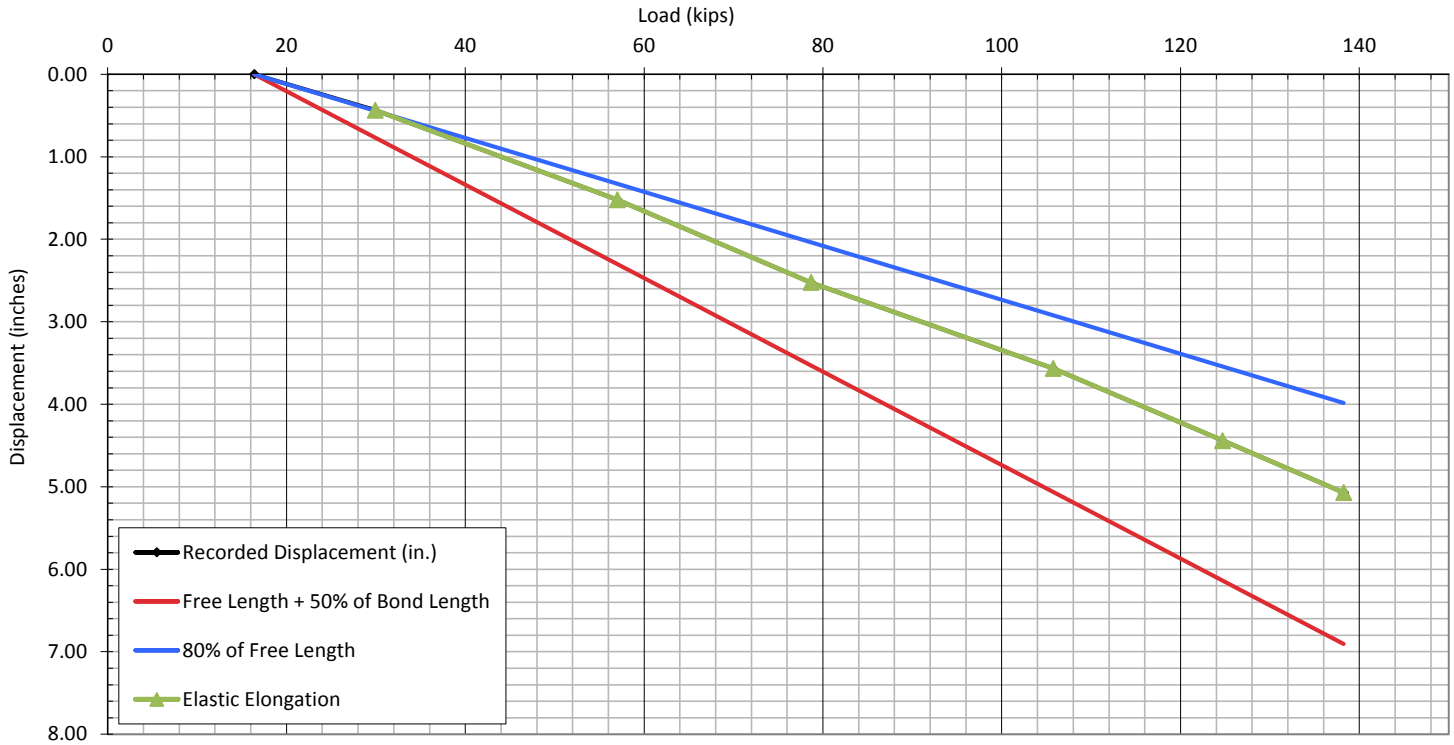
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	16	500	0.000	---	0.000	0.000	---	
---	0.25DL	30	1000	0.436	0.436	0.767	0.443	177.82	
---	0.50DL	57	2000	1.520	1.520	2.302	1.328	59.27	
---	0.75DL	79	2800	2.524	2.524	3.529	2.037	64.19	
---	1.00DL	106	3800	3.567	3.567	5.063	2.922	63.23	
---	1.20DL	125	4500	4.440	4.440	6.137	3.542	64.93	
---	1.33DL	138	5000	5.069	5.069	6.905	3.985	65.89	
1	1.33DL	138	5000	5.074	---	6.905	3.985	---	
2	1.33DL	138	5000	5.074	---	6.905	3.985	---	
3	1.33DL	138	5000	5.075	---	6.905	3.985	---	
4	1.33DL	138	5000	5.095	---	6.905	3.985	---	Pump the jack
5	1.33DL	138	5000	5.095	---	6.905	3.985	---	
6	1.33DL	138	5000	5.095	---	6.905	3.985	---	
10	1.33DL	138	5000	5.103	---	6.905	3.985	---	<-- moved by
---	AL	16	500		---	---	---	---	laborer bump
---	LOCKOFF	79	2800	---	---	3.529	2.037	---	

Total Movement Between 1 and 10 Minutes (in.)	0.029
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141120
Gauge I.D. 12-1



Tieback Proof Testing

Sheet No.: 33

Tieback Location	Tieback Number	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	33	1/21/2016	1/25/2016			3/22/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	115	50	64.8	0.3	5.458	ZLK	ZLK

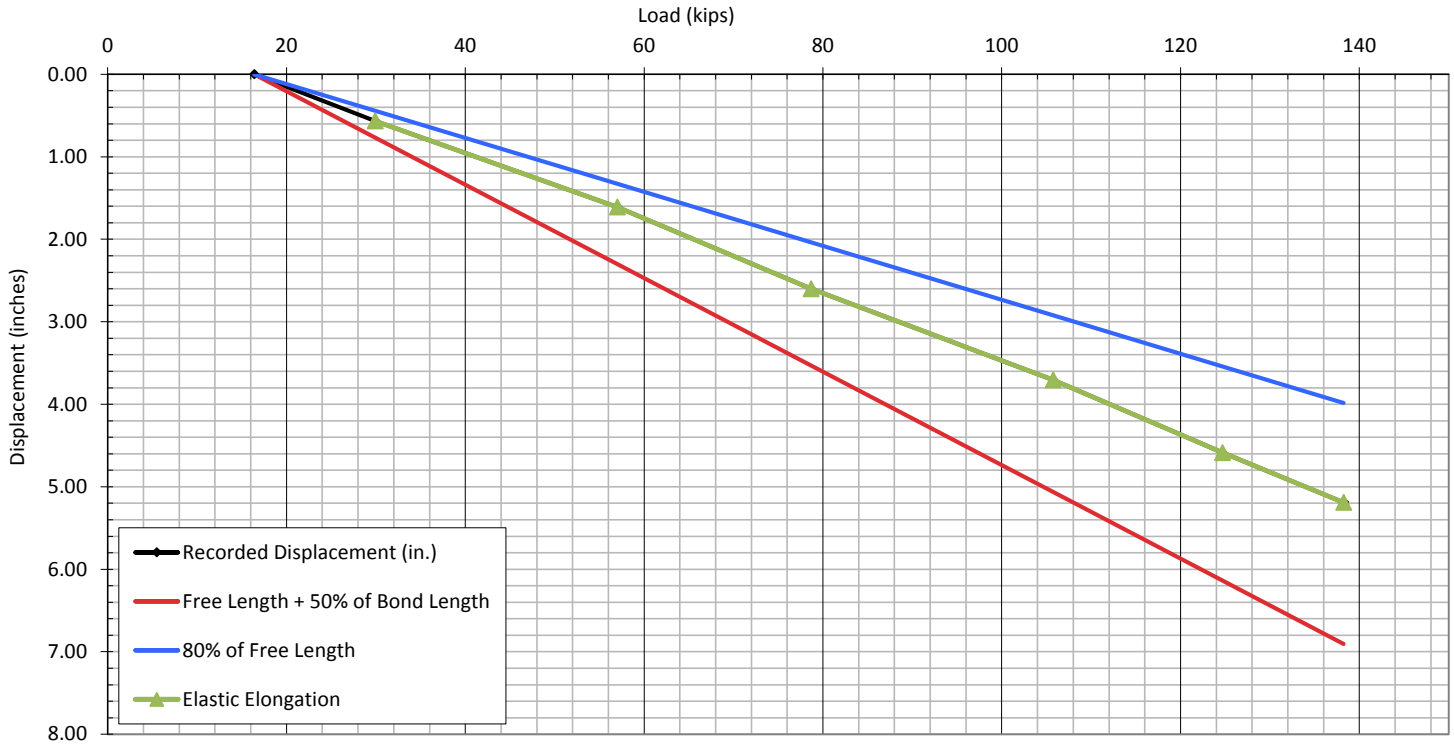
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	16	500	0.000	---	0.000	0.000	---	
---	0.25DL	30	1000	0.566	0.566	0.767	0.443	188.23	
---	0.50DL	57	2000	1.609	1.609	2.302	1.328	62.74	
---	0.75DL	79	2800	2.600	2.600	3.529	2.037	66.12	
---	1.00DL	106	3800	3.705	3.705	5.063	2.922	65.67	
---	1.20DL	125	4500	4.587	4.587	6.137	3.542	67.08	
---	1.33DL	138	5000	5.190	5.190	6.905	3.985	67.46	
1	1.33DL	138	5000	5.190	---	6.905	3.985	---	
2	1.33DL	138	5000	5.190	---	6.905	3.985	---	
3	1.33DL	138	5000	5.190	---	6.905	3.985	---	
4	1.33DL	138	5000	5.190	---	6.905	3.985	---	
5	1.33DL	138	5000	5.190	---	6.905	3.985	---	
6	1.33DL	138	5000	5.219	---	6.905	3.985	---	
10	1.33DL	138	5000	5.223	---	6.905	3.985	---	
---	AL	16	500		---	---	---	---	
---	LOCKOFF	90	3200	---	---	4.143	2.391	---	

Total Movement Between 1 and 10 Minutes (in.)	0.033
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141120
Gauge I.D. 12-1



Tieback Proof Testing

Sheet No.: 34

Tieback Location	Tieback Number	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	34	1/20/2016	1/25/2016			3/22/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	115	50	63.2	1.8	5.458	ZLK	ZLK

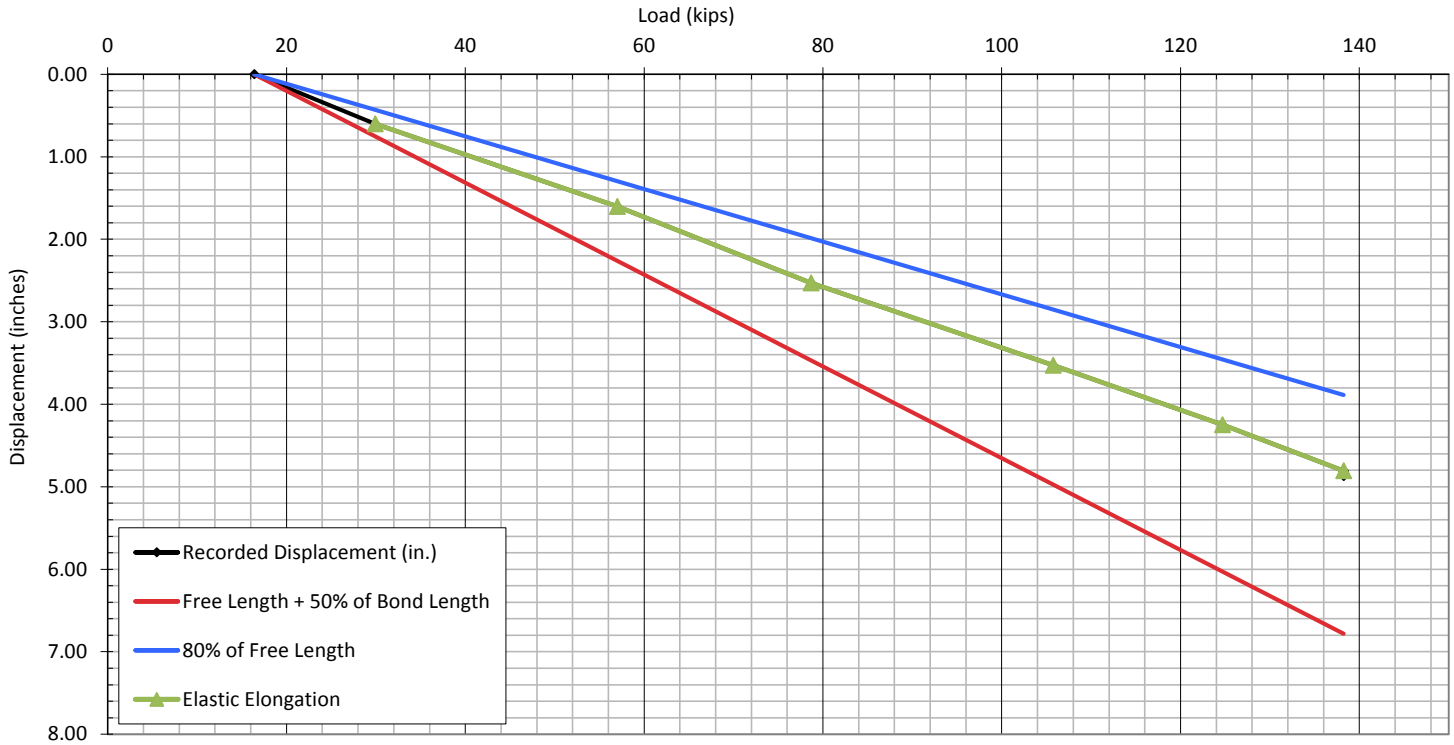
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	16	500	0.000	---	0.000	0.000	---	
---	0.25DL	30	1000	0.602	0.602	0.754	0.432	187.53	
---	0.50DL	57	2000	1.603	1.603	2.261	1.296	62.51	
---	0.75DL	79	2800	2.528	2.528	3.467	1.987	64.29	
---	1.00DL	106	3800	3.528	3.528	4.974	2.851	62.53	
---	1.20DL	125	4500	4.247	4.247	6.029	3.456	62.11	
---	1.33DL	138	5000	4.805	4.805	6.783	3.888	62.46	
1	1.33DL	138	5000	4.810	---	6.783	3.888	---	
2	1.33DL	138	5000	4.810	---	6.783	3.888	---	
3	1.33DL	138	5000	4.815	---	6.783	3.888	---	
4	1.33DL	138	5000	4.830	---	6.783	3.888	---	Pump the jack
5	1.33DL	138	5000	4.865	---	6.783	3.888	---	<-- laborer
6	1.33DL	138	5000	4.865	---	6.783	3.888	---	bumped test
10	1.33DL	138	5000	4.865	---	6.783	3.888	---	apparatus
---	AL	16	500		---	---	---	---	(not tieback
---	LOCKOFF	79	2800	---	---	3.467	1.987	---	movement)

Total Movement Between 1 and 10 Minutes (in.)	0.055
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141120
Gauge I.D. 12-1



Tieback Proof Testing

Sheet No.: 35

Tieback Location	Tieback Number	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	35	1/21/2016	1/25/2016			3/22/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	115	50	67.9	-2.9	5.458	ZLK	ZLK

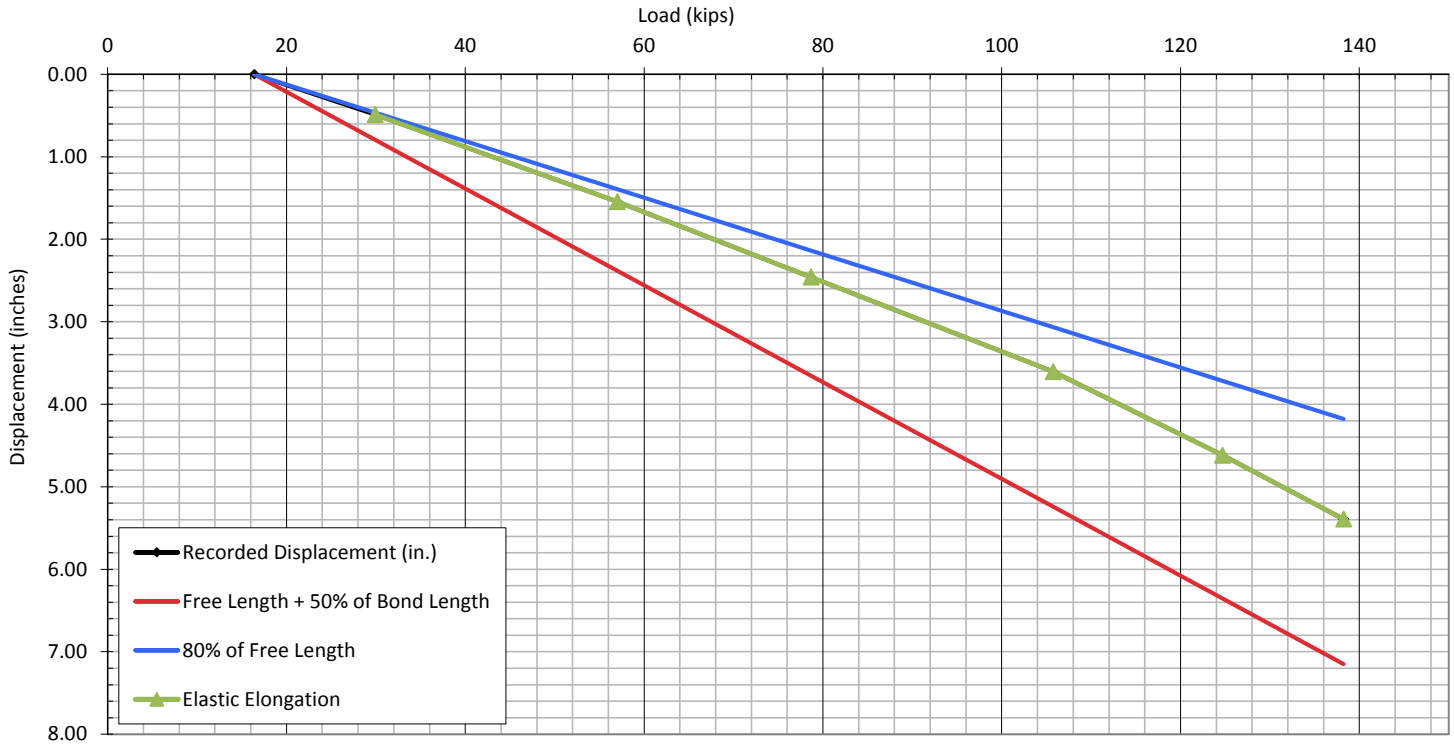
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	16	500	0.000	---	0.000	0.000	---	
---	0.25DL	30	1000	0.488	0.488	0.794	0.464	180.63	
---	0.50DL	57	2000	1.544	1.544	2.383	1.393	60.21	
---	0.75DL	79	2800	2.459	2.459	3.654	2.136	62.54	
---	1.00DL	106	3800	3.603	3.603	5.242	3.065	63.86	
---	1.20DL	125	4500	4.618	4.618	6.354	3.716	67.53	
---	1.33DL	138	5000	5.391	5.391	7.148	4.180	70.08	
1	1.33DL	138	5000	5.391	---	7.148	4.180	---	
2	1.33DL	138	5000	5.391	---	7.148	4.180	---	Pump the jack
3	1.33DL	138	5000	5.391	---	7.148	4.180	---	
4	1.33DL	138	5000	5.395	---	7.148	4.180	---	Pump the jack
5	1.33DL	138	5000	5.395	---	7.148	4.180	---	
6	1.33DL	138	5000	5.395	---	7.148	4.180	---	
10	1.33DL	138	5000	5.395	---	7.148	4.180	---	
---	AL	16	500		---	---	---	---	
---	LOCKOFF	84	3000	---	---	3.971	2.322	---	

Total Movement Between 1 and 10 Minutes (in.)	0.004
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141120
Gauge I.D. 12-1



Tieback Proof Testing

Sheet No.: 36

Tieback Location	Tieback Number	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	36	1/20/2016	1/22/2016			3/22/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	115	50	63.3	1.7	5.458	ZLK	ZLK

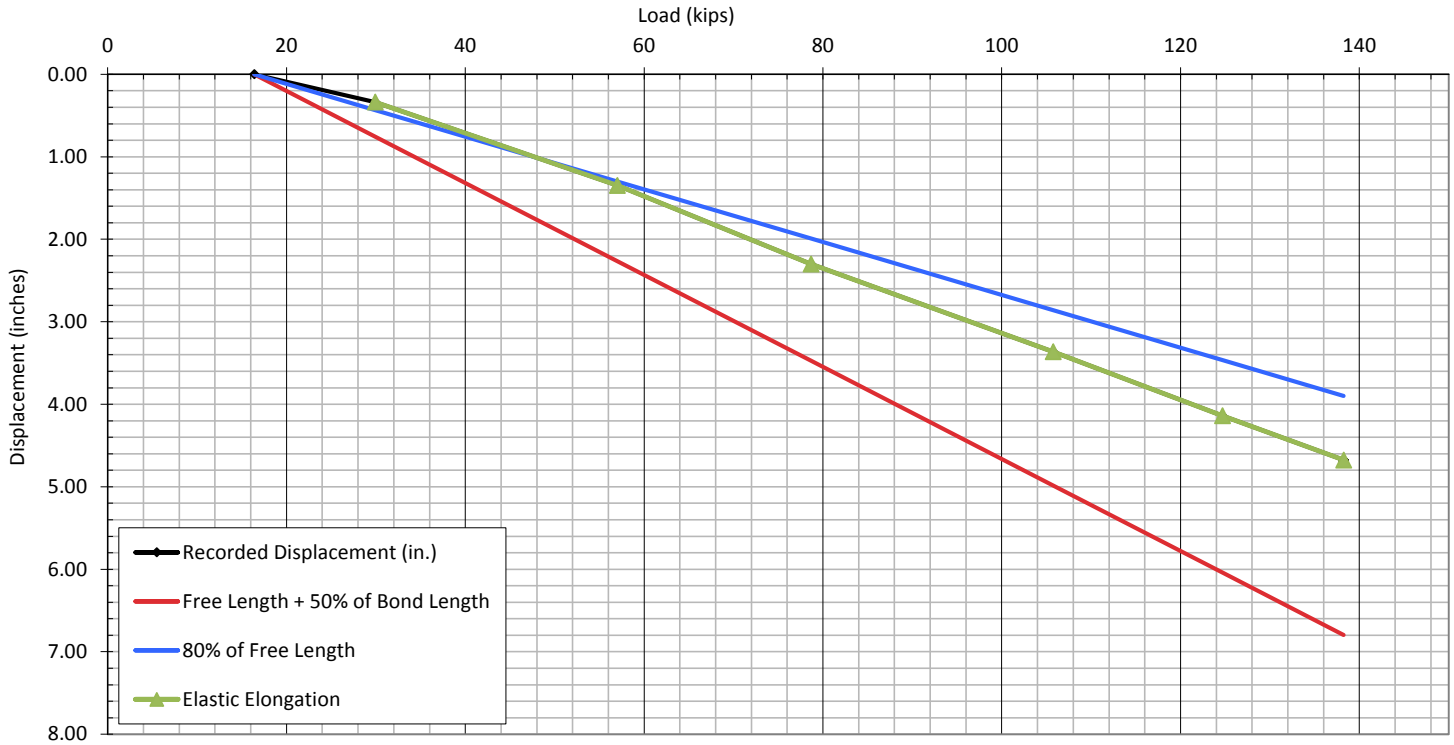
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	16	500	0.000	---	0.000	0.000	---	
---	0.25DL	30	1000	0.338	0.338	0.755	0.433	157.58	
---	0.50DL	57	2000	1.347	1.347	2.265	1.299	52.53	
---	0.75DL	79	2800	2.302	2.302	3.473	1.992	58.54	
---	1.00DL	106	3800	3.364	3.364	4.983	2.858	59.63	
---	1.20DL	125	4500	4.139	4.139	6.041	3.465	60.53	
---	1.33DL	138	5000	4.676	4.676	6.796	3.898	60.78	
1	1.33DL	138	5000	4.676	---	6.796	3.898	---	
2	1.33DL	138	5000	4.676	---	6.796	3.898	---	
3	1.33DL	138	5000	4.676	---	6.796	3.898	---	
4	1.33DL	138	5000	4.693	---	6.796	3.898	---	Pump the jack
5	1.33DL	138	5000	4.695	---	6.796	3.898	---	
6	1.33DL	138	5000	4.695	---	6.796	3.898	---	
10	1.33DL	138	5000	4.695	---	6.796	3.898	---	
---	AL	16	500		---	---	---	---	
---	LOCKOFF	84	3000	---	---	3.775	2.165	---	

Total Movement Between 1 and 10 Minutes (in.)	0.019
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141120
Gauge I.D. 12-1



Tieback Proof Testing

Sheet No.: 37

Tieback Location	Tieback Number	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	37	1/21/2016	1/22/2016			3/22/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	115	50	64.8	0.2	5.458	ZLK	ZLK

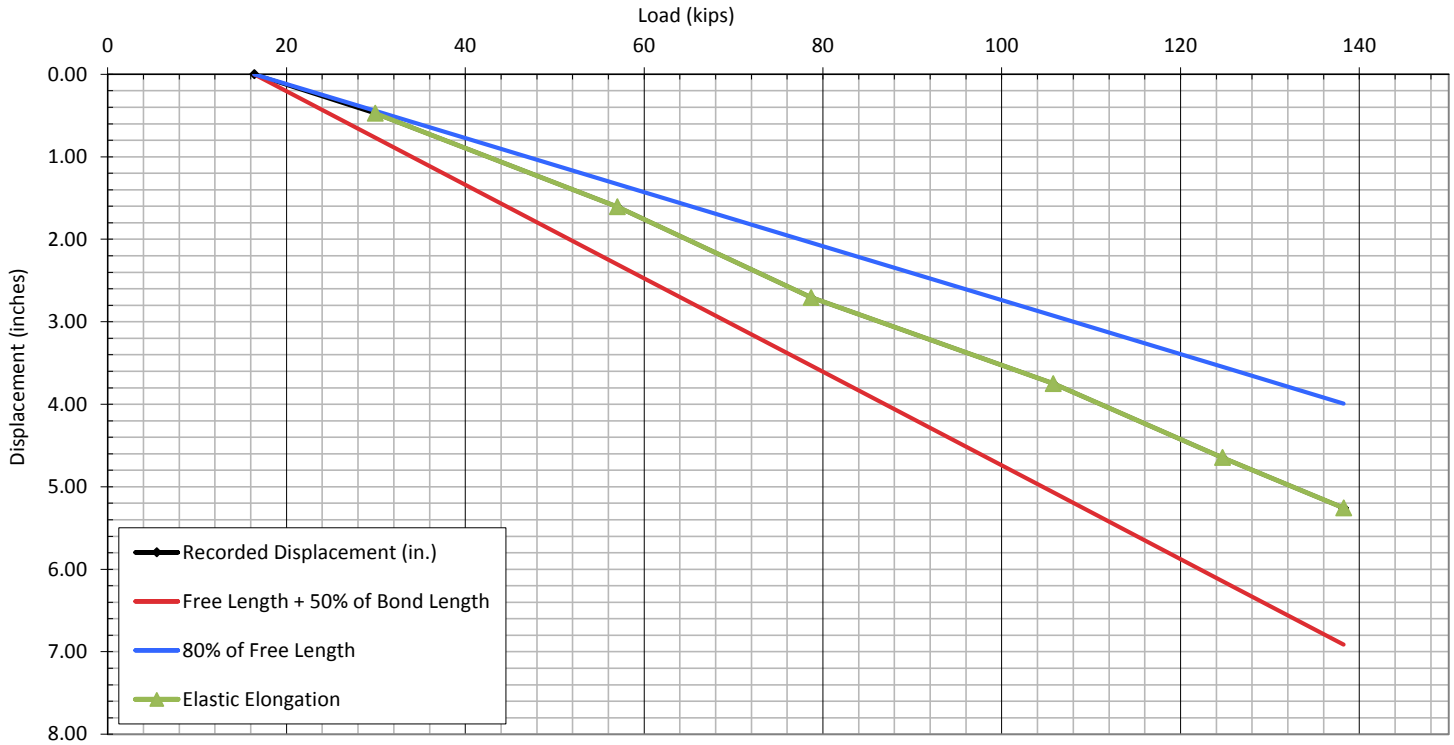
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	16	500	0.000	---	0.000	0.000	---	
---	0.25DL	30	1000	0.473	0.473	0.768	0.443	187.88	
---	0.50DL	57	2000	1.606	1.606	2.304	1.330	62.63	
---	0.75DL	79	2800	2.706	2.706	3.532	2.039	68.82	
---	1.00DL	106	3800	3.748	3.748	5.068	2.926	66.43	
---	1.20DL	125	4500	4.646	4.646	6.143	3.547	67.94	
---	1.33DL	138	5000	5.255	5.255	6.911	3.990	68.31	
1	1.33DL	138	5000	5.255	---	6.911	3.990	---	
2	1.33DL	138	5000	5.257	---	6.911	3.990	---	
3	1.33DL	138	5000	5.258	---	6.911	3.990	---	Pump the jack
4	1.33DL	138	5000	5.258	---	6.911	3.990	---	
5	1.33DL	138	5000	5.258	---	6.911	3.990	---	
6	1.33DL	138	5000	5.258	---	6.911	3.990	---	
10	1.33DL	138	5000	5.258	---	6.911	3.990	---	
---	AL	16	500		---	---	---	---	
---	LOCKOFF	84	3000	---	---	3.839	2.217	---	

Total Movement Between 1 and 10 Minutes (in.)	0.003
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141120
Gauge I.D. 12-1



Tieback Proof Testing

Sheet No.: 38

Tieback Location	Tieback Number	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	38	1/20/2016	1/22/2016			3/22/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	115	50	63.7	1.3	5.458	ZLK	ZLK

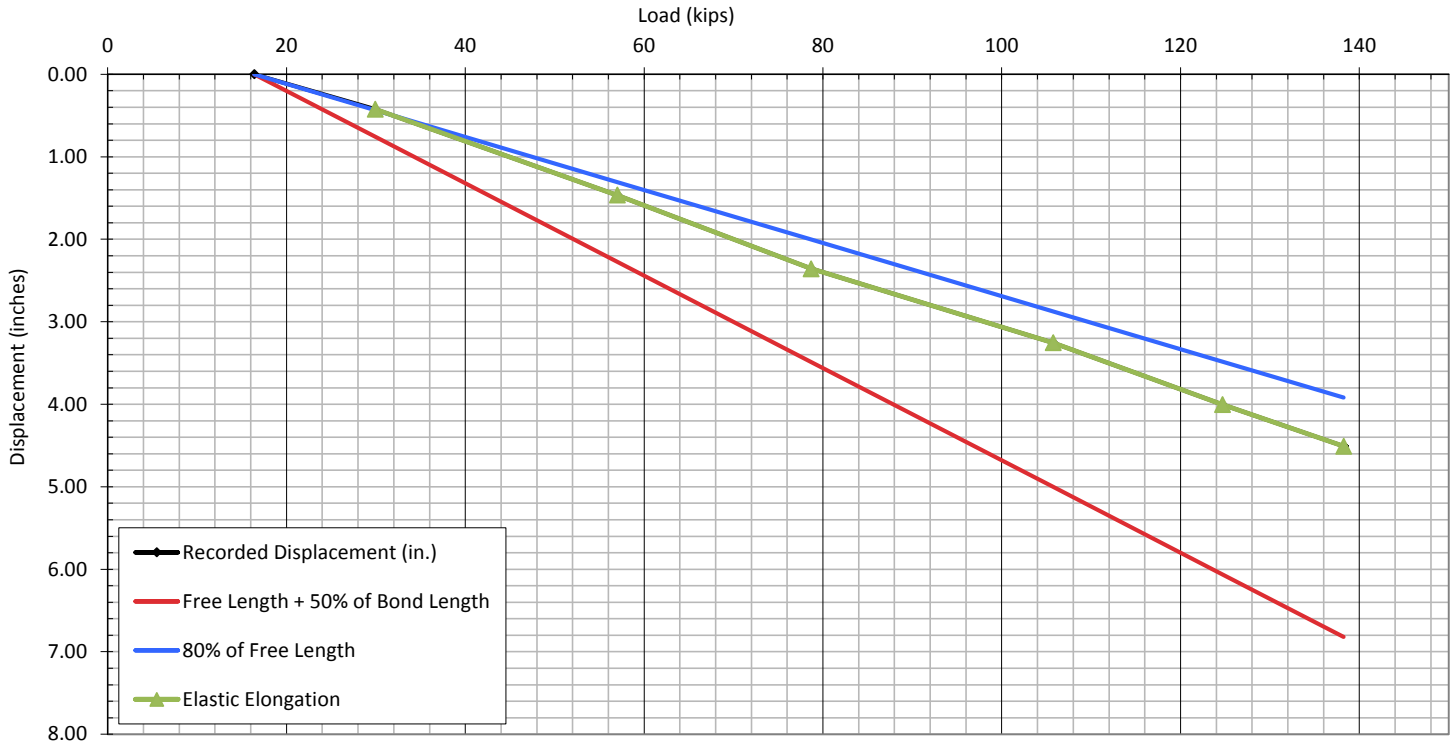
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	16	500	0.000	---	0.000	0.000	---	
---	0.25DL	30	1000	0.423	0.423	0.758	0.435	171.39	
---	0.50DL	57	2000	1.465	1.465	2.274	1.306	57.13	
---	0.75DL	79	2800	2.357	2.357	3.486	2.003	59.94	
---	1.00DL	106	3800	3.255	3.255	5.002	2.873	57.70	
---	1.20DL	125	4500	4.005	4.005	6.063	3.483	58.57	
---	1.33DL	138	5000	4.508	4.508	6.821	3.918	58.60	
1	1.33DL	138	5000	4.508	---	6.821	3.918	---	Pump the jack
2	1.33DL	138	5000	4.508	---	6.821	3.918	---	
3	1.33DL	138	5000	4.508	---	6.821	3.918	---	
4	1.33DL	138	5000	4.508	---	6.821	3.918	---	
5	1.33DL	138	5000	4.508	---	6.821	3.918	---	
6	1.33DL	138	5000	4.508	---	6.821	3.918	---	
10	1.33DL	138	5000	4.508	---	6.821	3.918	---	
---	AL	16	500		---	---	---	---	
---	LOCKOFF	81	2900	---	---	3.638	2.090	---	

Total Movement Between 1 and 10 Minutes (in.)	0.000
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141120
Gauge I.D. 12-1



Tieback Proof Testing

Sheet No.: 39

Tieback Location	Tieback Number	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	39	1/19/2016	1/21/2016			3/22/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	139	50	91.2	-2.2	7.473	ZLK	ZLK

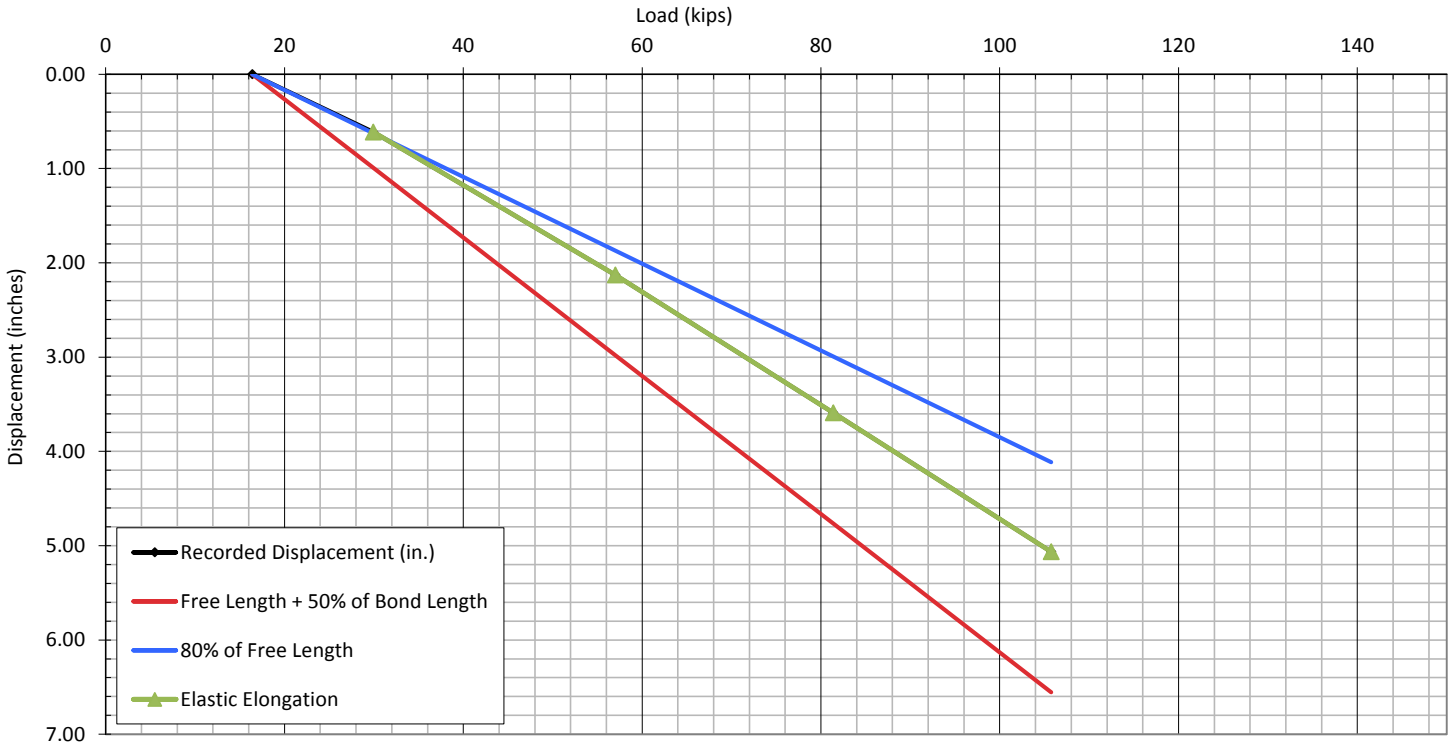
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	16	500	0.000	---	0.000	0.000	---	
---	0.25DL	30	1000	0.612	0.612	0.993	0.623	249.06	
---	0.50DL	57	2000	2.129	2.129	2.979	1.870	83.02	
---	0.75DL	81	2900	3.591	3.591	4.766	2.992	87.52	
---	1.00DL	106	3800	5.064	5.064	6.554	4.115	89.76	
---	1.20DL					-1.202	-0.754		<-- Throw on
---	1.33DL					-1.202	-0.754		ram is maxed
1	1.33DL				---	-1.202	-0.754	---	out
2	1.33DL				---	-1.202	-0.754	---	
3	1.33DL				---	-1.202	-0.754	---	
4	1.33DL				---	-1.202	-0.754	---	
5	1.33DL				---	-1.202	-0.754	---	
6	1.33DL				---	-1.202	-0.754	---	
10	1.33DL				---	-1.202	-0.754	---	
---	AL				---	---	---	---	
---	LOCKOFF			---	---	-1.202	-0.754	---	

Total Movement Between 1 and 10 Minutes (in.)	0.000
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	TEST INCOMPLETE
Retesting Required?	YES
Sheet No. of Retest:	39-1

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141120
Gauge I.D. 12-1



Note: The throw on the ram is maxed out and the test can not be completed. The tieback is locked off and testing will restart with a larger ram.

Tieback Proof Testing

Sheet No.: 39-1

Tieback Location	Tieback Number	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	39	1/19/2016	1/21/2016			3/23/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	139	50	91.2	-2.2	7.473	ZLK	ZLK

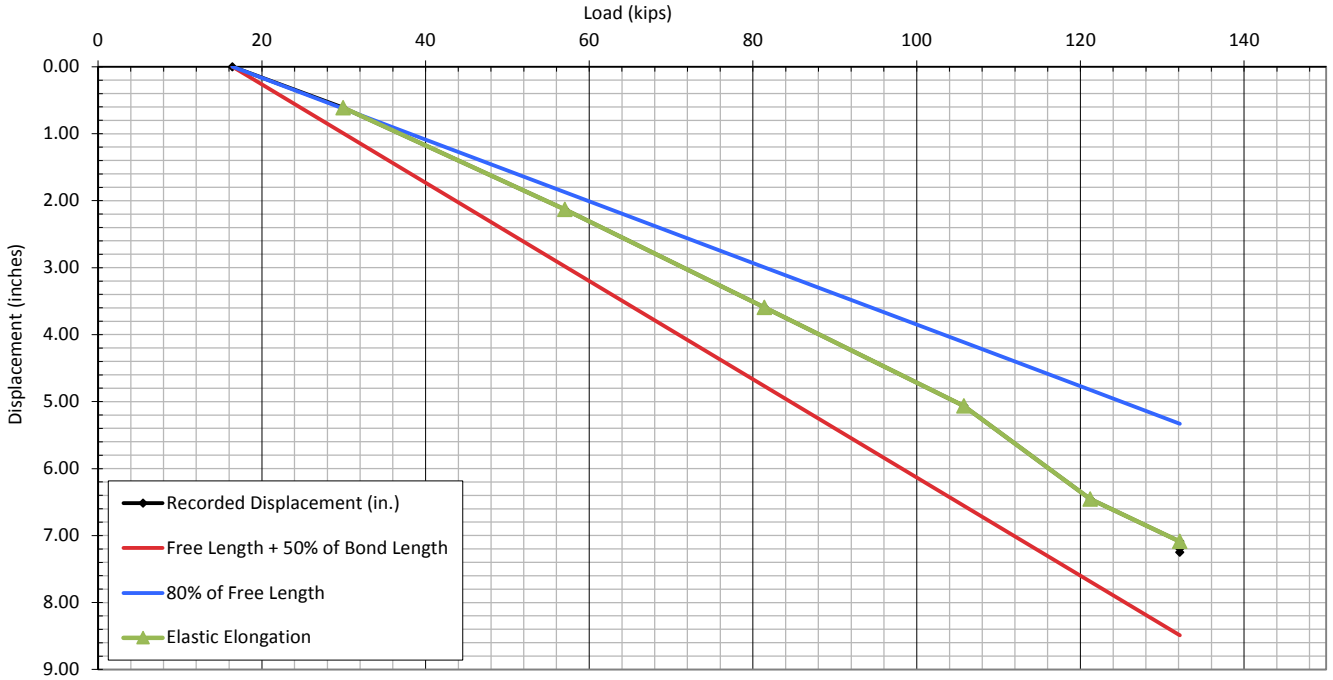
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	16	500	0.000	---	0.000	0.000	---	
---	0.25DL	30	1000	0.612	0.612	0.993	0.623	249.06	3/22/2016
---	0.50DL	57	2000	2.129	2.129	2.979	1.870	83.02	3/22/2016
---	0.75DL	81	2900	3.591	3.591	4.766	2.992	87.52	3/22/2016
---	1.00DL	106	3800	5.064	5.064	6.554	4.115	89.76	3/22/2016
---	1.20DL	121	4400	6.454	6.454	7.685	4.825	97.56	<-- dial set to
---	1.33DL	132	4800	7.087	7.087	8.489	5.330	96.98	0 at 1.00*DL
1	1.33DL	132	4800	7.159	---	8.489	5.330	---	<-- movement
2	1.33DL	132	4800	7.159	---	8.489	5.330	---	from wind
3	1.33DL	132	4800	7.159	---	8.489	5.330	---	
4	1.33DL	132	4800	7.179	---	8.489	5.330	---	<-- movement
5	1.33DL	132	4800	7.174	---	8.489	5.330	---	from wind
6	1.33DL	132	4800	7.194	---	8.489	5.330	---	
10	1.33DL	132	4800	7.250	---	8.489	5.330	---	<-- movement
---	AL	12	400		---	---	---	---	from wind
---	LOCKOFF	86	3100	---	---	5.072	3.184	---	

Total Movement Between 1 and 10 Minutes (in.)	0.091
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 2681
Gauge I.D. 16-3



Note: Test results are added to values from sheet 39. False displacements occurred due to high winds that caused movements of the dial on the testing plate.

Tieback Performance Test

Sheet No.: 40

Tieback Location	Tieback Number	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	40	1/21/2016	1/22/2016			3/23/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	139	50	90.7	-1.7	7.473	ZLK	ZLK

Time (min)	Load Testing Schedule	Actual Test Load (kips)	Gauge Pressure for Test Load (psi)[1]	Recorded Displacement (in.)[2]	Elastic Elongation at Load Cycle Maximum (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	12	400	0.000	---	0.000	0.000	---	
---	0.25DL	23	800	0.095	0.069	0.801	0.502	9.97	
---	AL	12	400	0.026	---	0.000	0.000	---	
---	0.25DL	23	800	0.188	---	0.801	0.502	---	
---	0.50DL	53	1900	1.840	1.769	3.002	1.883	68.16	
---	AL	12	400	0.071	---	0.000	0.000	---	
---	0.25DL	23	800	0.266	---	0.801	0.502	---	
---	0.50DL	53	1900	1.850	---	3.002	1.883	---	
---	0.75DL	75	2700	2.988	2.938	4.603	2.887	73.82	
---	AL	12	400	0.050	---	0.000	0.000	---	
---	0.25DL	23	800	0.340	---	0.801	0.502	---	
---	0.50DL	53	1900	1.915	---	3.002	1.883	---	
---	0.75DL	75	2700	3.062	---	4.603	2.887	---	
---	1.00DL	99	3600	4.157	4.037	6.404	4.016	72.91	
---	AL	12	400	0.120	---	0.000	0.000	---	
---	0.25DL	23	800	0.353	---	0.801	0.502	---	
---	0.50DL	53	1900	1.915	---	3.002	1.883	---	
---	0.75DL	75	2700	3.085	---	4.603	2.887	---	
---	1.00DL	99	3600	4.300	---	6.404	4.016	---	
---	1.20DL	118	4300	5.405	5.123	7.805	4.895	75.92	
---	AL	12	400	0.282	---	0.000	0.000	---	
---	0.25DL	23	800	0.570	---	0.801	0.502	---	
---	0.50DL	53	1900	2.092	---	3.002	1.883	---	
---	0.75DL	75	2700	3.270	---	4.603	2.887	---	
---	1.00DL	99	3600	4.525	---	6.404	4.016	---	
---	1.20DL	118	4300	5.490	---	7.805	4.895	---	
---	1.33DL	132	4800	6.182	---	8.806	5.522	---	
1	1.33DL	132	4800	6.180	---	---	---	---	
2	1.33DL	132	4800	6.180	---	---	---	---	
3	1.33DL	132	4800	6.180	---	---	---	---	
4	1.33DL	132	4800	6.180	---	---	---	---	
5	1.33DL	132	4800	6.180	---	---	---	---	
6	1.33DL	132	4800	6.185	---	---	---	---	
10	1.33DL	132	4800	6.190	5.726	---	---	75.21	
---	AL	12	400	0.464	---	---	---	---	Dial slipped off
---	LOCKOFF	77	2800		---	4.803	3.012	---	test plate at AL

Total Movement Between 1 and 10 Minutes (in.)	0.010
Maximum Total Movement Allowed (in.):	0.040

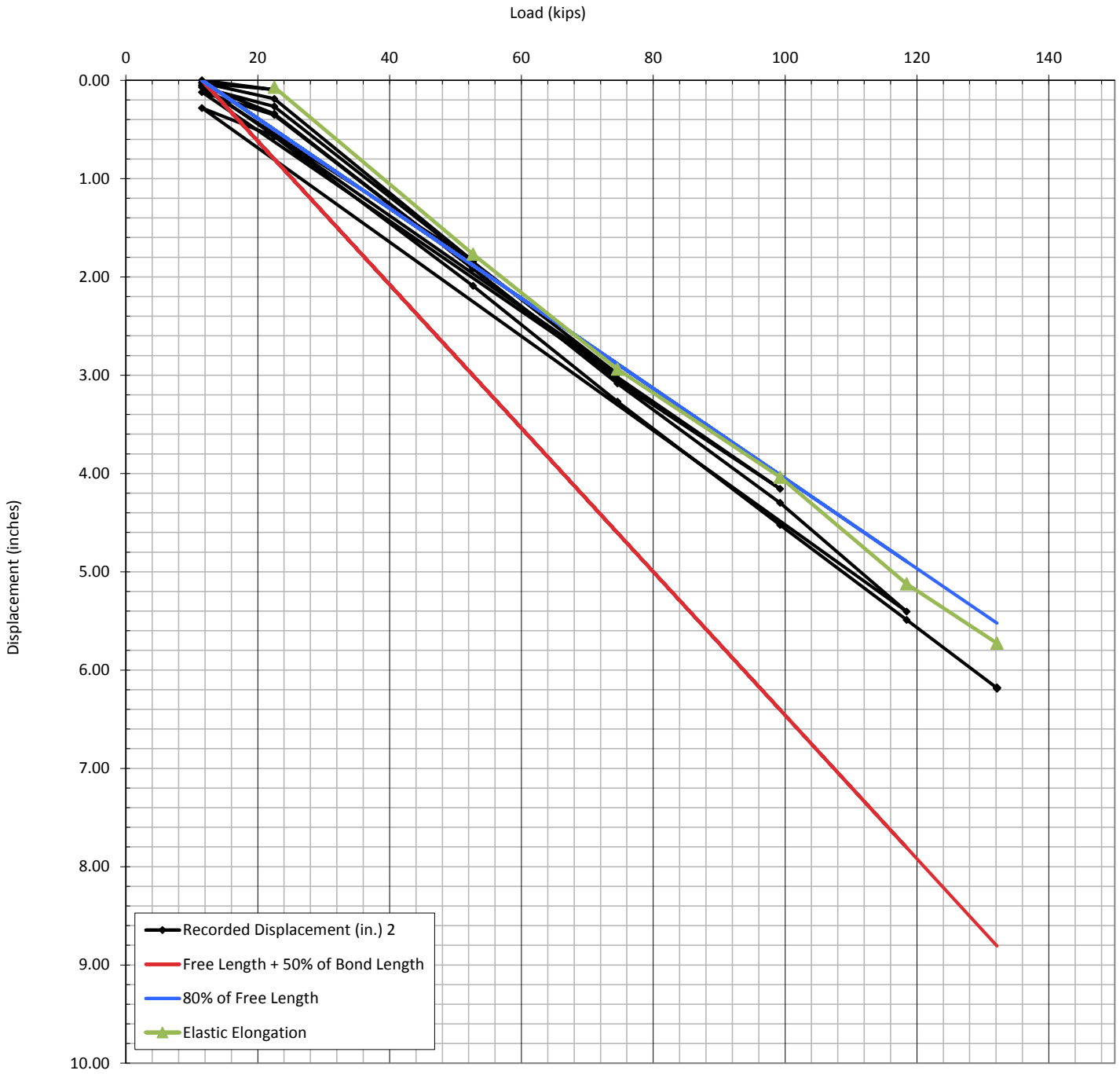
Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 2681
Gauge I.D. 16-3

Notes/Additional Comments:
1. Gage pressure must be maintained during testing and be held to within +/- 2%
2. Recorded displacements are to be recorded to the nearest 0.001 in.

Tieback Performance Test



Test Notes:
1. The larger, 135 ton ram requires set up a riser that results in an additional length added to the tail.

Tieback Proof Testing

Sheet No.: 41

Tieback Location	Tieback Number	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	41	1/21/2016	1/21/2016			3/22/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	139	50	89.0	0.0	7.473	ZLK	ZLK

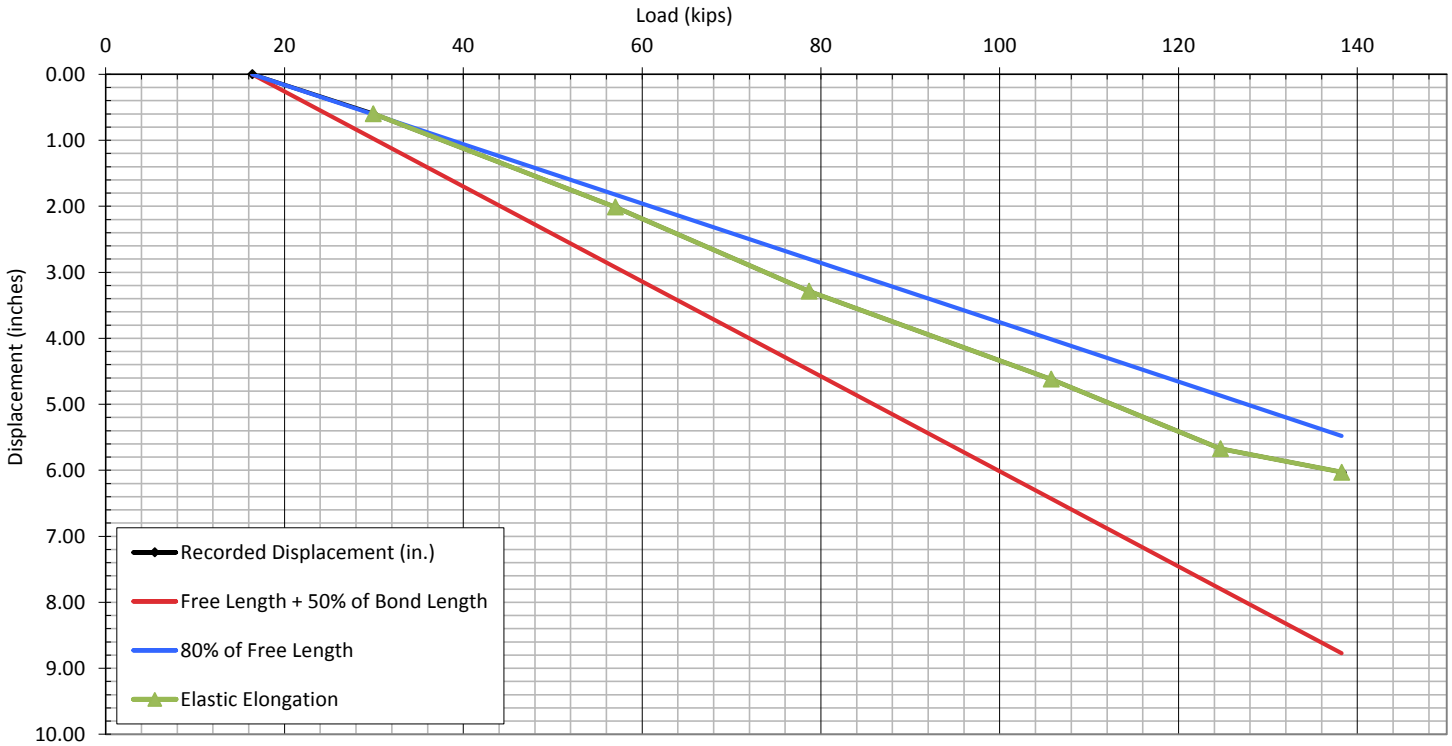
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	16	500	0.000	---	0.000	0.000	---	
---	0.25DL	30	1000	0.596	0.596	0.974	0.609	235.26	
---	0.50DL	57	2000	2.011	2.011	2.923	1.826	78.42	
---	0.75DL	79	2800	3.288	3.288	4.483	2.800	83.62	
---	1.00DL	106	3800	4.620	4.620	6.432	4.017	81.89	
---	1.20DL	125	4500	5.673	5.673	7.796	4.869	82.96	<-- dial maxed
---	1.33DL	138	5000	6.030	6.030	8.770	5.478	78.38	<-- reset dial
1	1.33DL	138	5000	6.034	---	8.770	5.478	---	
2	1.33DL	138	5000	6.037	---	8.770	5.478	---	Pump the jack
3	1.33DL	138	5000	6.037	---	8.770	5.478	---	
4	1.33DL	138	5000	6.044	---	8.770	5.478	---	
5	1.33DL	138	5000	6.044	---	8.770	5.478	---	
6	1.33DL	138	5000	6.043	---	8.770	5.478	---	Pump the jack
10	1.33DL	138	5000	6.041	---	8.770	5.478	---	Pump the jack
---	AL	16	500		---	---	---	---	
---	LOCKOFF	84	3000	---	---	4.872	3.043	---	

Total Movement Between 1 and 10 Minutes (in.)	0.007
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141120
Gauge I.D. 12-1



Tieback Extended Creep Testing

Tieback Location	Tieback No.	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	141121	1/20/2016	1/21/2016			3/22/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Jacking Length (L_J; ft)	Max. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	103	50	52.8	0.3	8.669	KH (MDCI)	ZLK

Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Creep Movement	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e$/ (TL-AL) (ft)	Comments
Load Cycle 1 (AL = Max Load)									
---	AL (0.10DL)	12	400	0.000	---	0.000	0.000	---	
1	AL	12	400	0.000	0.000	---	---	---	
2	AL	12	400	0.000	0.000	---	---	---	
3	AL	12	400	0.000	0.000	---	---	---	
4	AL	12	400	0.000	0.000	---	---	---	
5	AL	12	400	0.000	0.000	---	---	---	
6	AL	12	400	0.000	0.000	---	---	---	
10	AL	12	400	0.000	0.000	---	---	---	
---	AL	12	400	0.000	---	---	---	---	
Load Cycle 2 (25% DL = Max Load)									
---	AL	12	400	0.000	---	0.000	0.000	---	
---	0.25DL	29	1000	0.445	---	0.809	0.439	42.77	
1	0.25DL	29	1000	0.442	-0.003	---	---	---	
2	0.25DL	29	1000	0.445	0.000	---	---	---	
3	0.25DL	29	1000	0.445	0.000	---	---	---	
4	0.25DL	29	1000	0.451	0.006	---	---	---	
5	0.25DL	29	1000	0.451	0.006	---	---	---	
6	0.25DL	29	1000	0.452	0.007	---	---	---	
10	0.25DL	29	1000	0.452	0.007	---	---	---	
---	AL	12	400	0.434	---	---	---	---	
Load Cycle 3 (50% DL = Max Load)									
---	AL	12	400	0.434	---	0.000	0.000	---	
---	0.25DL	29	1000	0.458	---	0.809	0.439	2.31	
---	0.50DL	54	1900	1.430	---	2.023	1.098	38.29	
1	0.50DL	54	1900	1.430	0.000	---	---	---	
2	0.50DL	54	1900	1.430	0.000	---	---	---	
3	0.50DL	54	1900	1.430	0.000	---	---	---	
4	0.50DL	54	1900	1.430	0.000	---	---	---	
5	0.50DL	54	1900	1.430	0.000	---	---	---	
6	0.50DL	54	1900	1.430	0.000	---	---	---	
10	0.50DL	54	1900	1.455	0.025	---	---	---	
15	0.50DL	54	1900	1.446	0.016	---	---	---	
20	0.50DL	54	1900	1.485	0.055	---	---	---	Pump the jack
25	0.50DL	54	1900	1.433	0.003	---	---	---	
30	0.50DL	54	1900	1.434	0.004	---	---	---	
---	AL	12	400	0.525	---	---	---	---	
Load Cycle 4 (75% DL = Max Load)									
---	AL	12	400	0.525	---	0.000	0.000	---	
---	0.25DL	26	900	0.630	---	0.674	0.366	12.11	
---	0.50DL	54	1900	1.420	---	2.023	1.098	34.41	
---	0.75DL	78	2800	2.243	---	3.236	1.756	41.28	
1	0.75DL	78	2800	2.234	-0.009	---	---	---	
2	0.75DL	78	2800	2.240	-0.003	---	---	---	
3	0.75DL	78	2800	2.241	-0.002	---	---	---	
4	0.75DL	78	2800	2.258	0.015	---	---	---	
5	0.75DL	78	2800	2.259	0.016	---	---	---	
6	0.75DL	78	2800	2.250	0.007	---	---	---	Pump the jack
10	0.75DL	78	2800	2.265	0.022	---	---	---	
15	0.75DL	78	2800	2.245	0.002	---	---	---	
20	0.75DL	78	2800	2.222	-0.021	---	---	---	
25	0.75DL	78	2800	2.222	-0.021	---	---	---	change to .2
30	0.75DL	78	2800	2.261	0.018	---	---	---	change to .2

---	AL	12	400	0.803	---	---	---	---	
Load Cycle 5 (100% DL = Max Load)									
---	AL	12	400	0.803	---	0.000	0.000	---	
---	0.25DL	26	900	0.906	---	0.674	0.366	11.88	
---	0.50DL	54	1900	1.663	---	2.023	1.098	33.06	
---	0.75DL	78	2800	2.301	---	3.236	1.756	35.99	
---	1.00DL	103	3700	3.198	---	4.450	2.415	41.85	
1	1.00DL	103	3700	3.200	0.002	---	---	---	Pump the jack
2	1.00DL	103	3700	3.201	0.003	---	---	---	
3	1.00DL	103	3700	3.180	-0.018	---	---	---	
4	1.00DL	103	3700	3.185	-0.013	---	---	---	
5	1.00DL	103	3700	3.183	-0.015	---	---	---	
6	1.00DL	103	3700	3.177	-0.021	---	---	---	
10	1.00DL	103	3700	3.226	0.028	---	---	---	Pump the jack
15	1.00DL	103	3700	3.238	0.040	---	---	---	
20	1.00DL	103	3700	3.238	0.040	---	---	---	
25	1.00DL	103	3700	3.230	0.032	---	---	---	
30	1.00DL	103	3700	3.232	0.034	---	---	---	
45	1.00DL	103	3700	3.234	0.036	---	---	---	Pump the jack
---	AL	12	400	0.920	---	---	---	---	
Load Cycle 6 (120% DL = Max Load)									
---	AL	12	400	0.920	---	0.000	0.000	---	
---	0.25DL	26	900	1.030	---	0.674	0.366	12.69	
---	0.50DL	54	1900	1.772	---	2.023	1.098	32.75	
---	0.75DL	78	2800	2.561	---	3.236	1.756	39.43	
---	1.00DL	103	3700	3.329	---	4.450	2.415	42.09	
---	1.20DL	122	4400	4.096	---	5.393	2.927	45.78	
1	1.20DL	122	4400	4.096	0.000	---	---	---	
2	1.20DL	122	4400	4.108	0.012	---	---	---	
3	1.20DL	122	4400	4.110	0.014	---	---	---	
4	1.20DL	122	4400	4.110	0.014	---	---	---	
5	1.20DL	122	4400	4.110	0.014	---	---	---	
6	1.20DL	122	4400	4.120	0.024	---	---	---	
10	1.20DL	122	4400	4.123	0.027	---	---	---	
15	1.20DL	122	4400	4.124	0.028	---	---	---	
20	1.20DL	122	4400	4.125	0.029	---	---	---	
25	1.20DL	122	4400	4.127	0.031	---	---	---	
30	1.20DL	122	4400	4.134	0.038	---	---	---	
45	1.20DL	122	4400	4.101	0.005	---	---	---	
60	1.20DL	122	4400	4.132	0.036	---	---	---	
---	AL	12	400	1.150	---	---	---	---	
Load Cycle 7 (133% DL = Max Load)									
---	AL	12	400	1.150	---	0.000	0.000	---	
---	0.25DL	26	900	1.267	---	0.674	0.366	13.49	
---	0.50DL	54	1900	2.010	---	2.023	1.098	33.06	
---	0.75DL	78	2800	2.830	---	3.236	1.756	40.36	
---	1.00DL	103	3700	3.630	---	4.450	2.415	43.33	
---	1.20DL	122	4400	4.268	---	5.393	2.927	44.95	
---	1.33DL	136	4900	4.781	---	6.068	3.293	46.53	
1	1.33DL	136	4900	4.780	-0.001	---	---	---	
2	1.33DL	136	4900	4.780	-0.001	---	---	---	
3	1.33DL	136	4900	4.797	0.016	---	---	---	Pump the jack
4	1.33DL	136	4900	4.797	0.016	---	---	---	
5	1.33DL	136	4900	4.797	0.016	---	---	---	
6	1.33DL	136	4900	4.797	0.016	---	---	---	
10	1.33DL	136	4900	4.800	0.019	---	---	---	Pump the jack
15	1.33DL	136	4900	4.800	0.019	---	---	---	
20	1.33DL	136	4900	4.800	0.019	---	---	---	
25	1.33DL	136	4900	4.800	0.019	---	---	---	
30	1.33DL	136	4900	4.781	0.000	---	---	---	Pump the jack
45	1.33DL	136	4900	4.794	0.013	---	---	---	Pump the jack
60	1.33DL	136	4900	4.836	0.055	---	---	---	Pump the jack
75	1.33DL	136	4900	4.807	0.026	---	---	---	
90	1.33DL	136	4900	4.809	0.028	---	---	---	Pump the jack
100	1.33DL	136	4900	4.808	0.027	---	---	---	
120	1.33DL	136	4900	4.808	0.027	---	---	---	
150	1.33DL	136	4900	4.801	0.020	---	---	---	Pump the jack
180	1.33DL	136	4900	4.826	0.045	---	---	---	

210	1.33DL	136	4900	4.817	0.036	---	---	---	
240	1.33DL	136	4900	4.807	0.026	---	---	---	
270	1.33DL	136	4900	4.801	0.020	---	---	---	
300	1.33DL	136	4900	4.795	0.014	---	---	---	
AL	AL	12	400	1.275	---	---	---	---	
---	LOCKOFF	78	2800		---	---	---	---	

Load Cycles	1	2	3	4	5	6	7
Elastic Elongation at Load Cycle Max (in)	0.000	0.445	0.996	1.718	2.395	3.176	3.631
Residual Movement for Load Cycle (in)	0.000	0.434	0.091	0.278	0.117	0.230	0.125
Creep Rate for Load Cycle (in/log cycle)	0.00000	0.01000	0.00271	0.01828	0.02057	0.02025	0.00606

Total Movement Between 1 and 10 Minutes (in.)	0.020
Maximum Total Movement Allowed (in.)*:	0.040

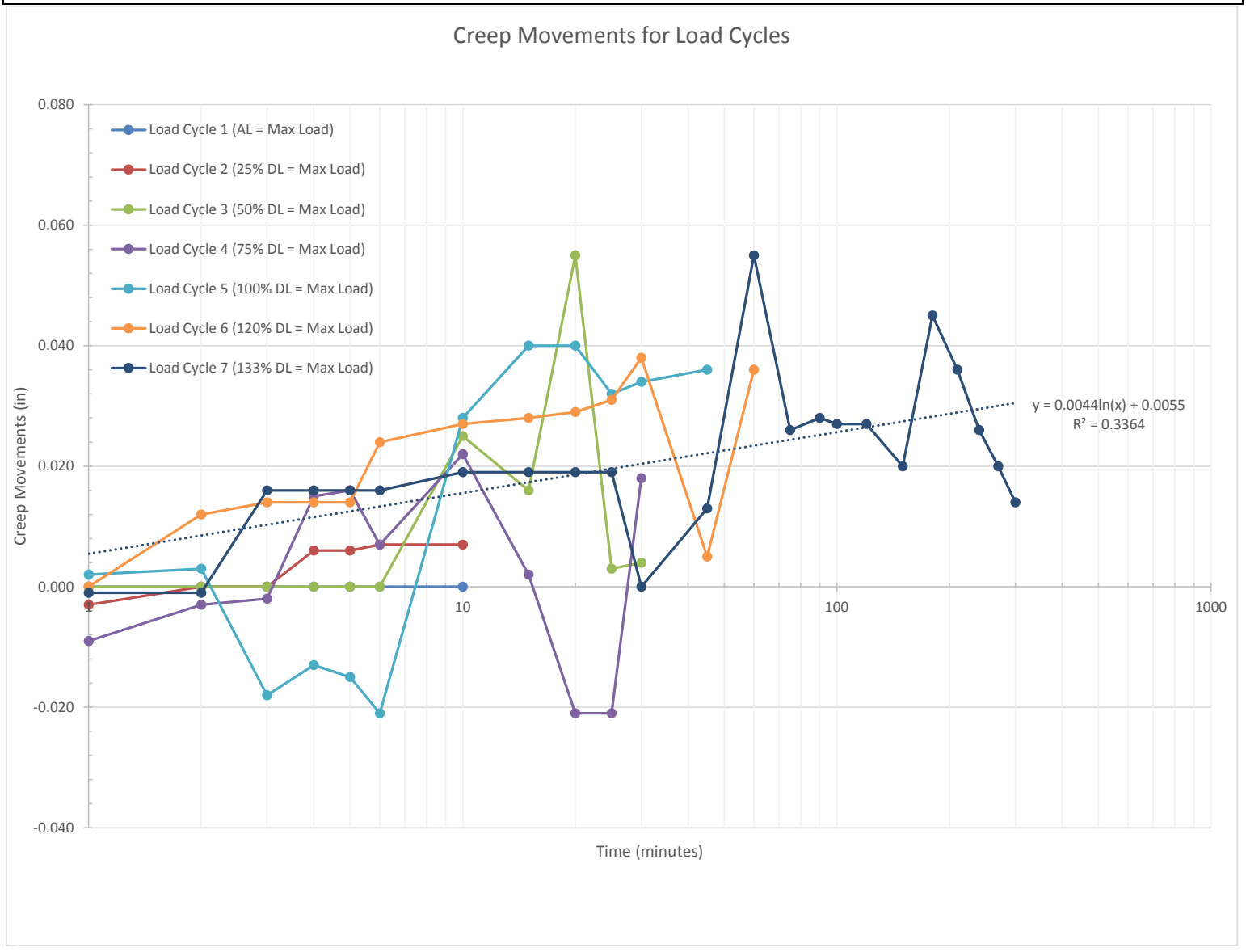
Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Ram I.D. 141121

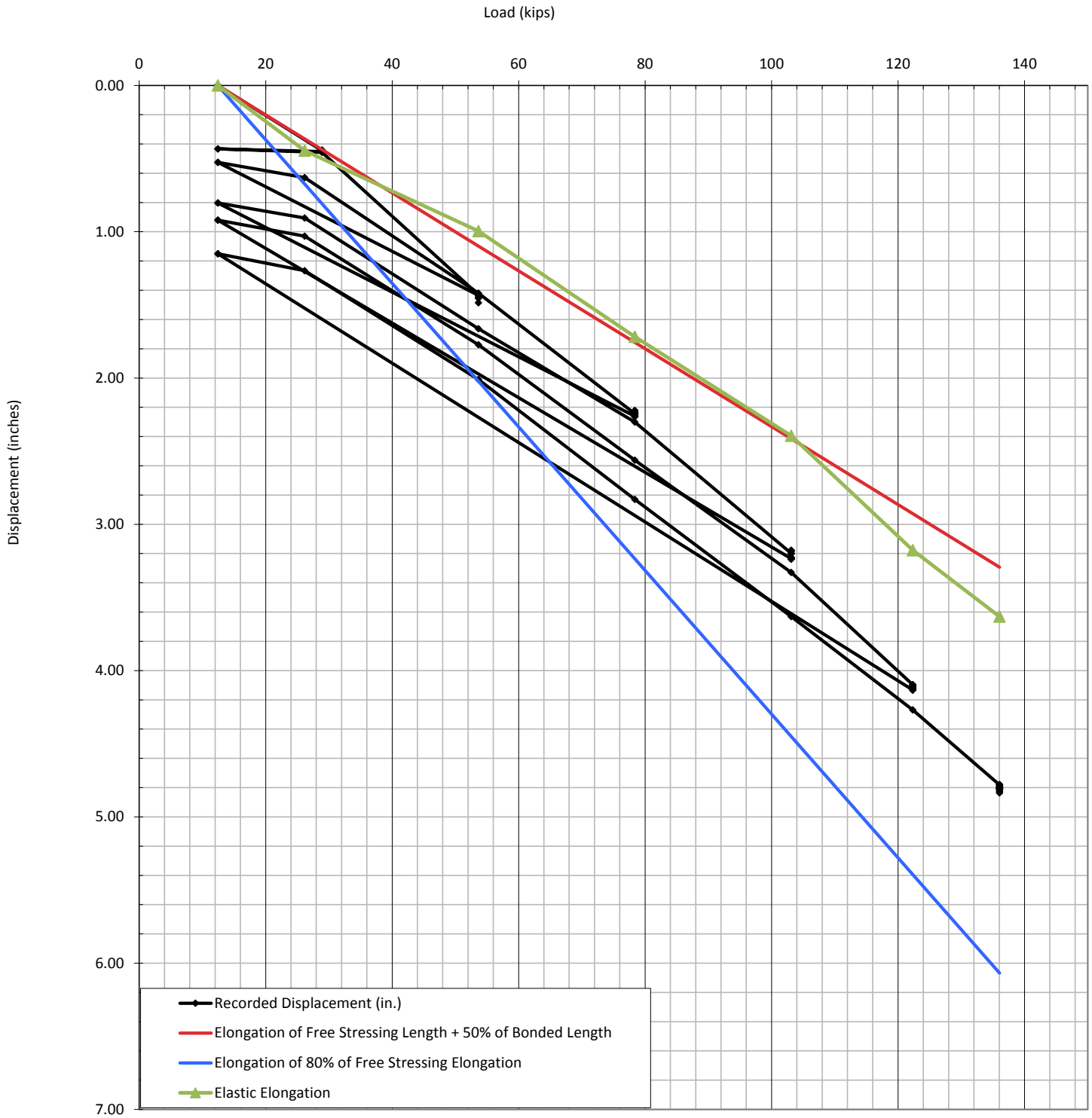
Gauge I.D. 12-4

Notes/Additional Comments:

1. Gage pressure must be maintained during testing and be held to within +/- 2%
2. Recorded displacements are to be recorded to the nearest 0.001 in.
3. If 0.080 in/log cycle is exceeding, testing will continue to determine if creep rate will diminish below the thresold value.
4. Criteria for total movement of less than 0.04 in between 1 and 10 minutes for final load cycle is satisfied by extended creep holds times



Tieback Extended Creep Testing



Testing Notes:
1. Test results were recorded by Kevin Hagen of Malcolm Drilling, Inc.

Tieback Proof Testing

Sheet No.: 43

Tieback Location	Tieback No.	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	43	1/19/2016	1/21/2016			3/21/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	103	50	52.1	0.9	4.450	ZLK	ZLK

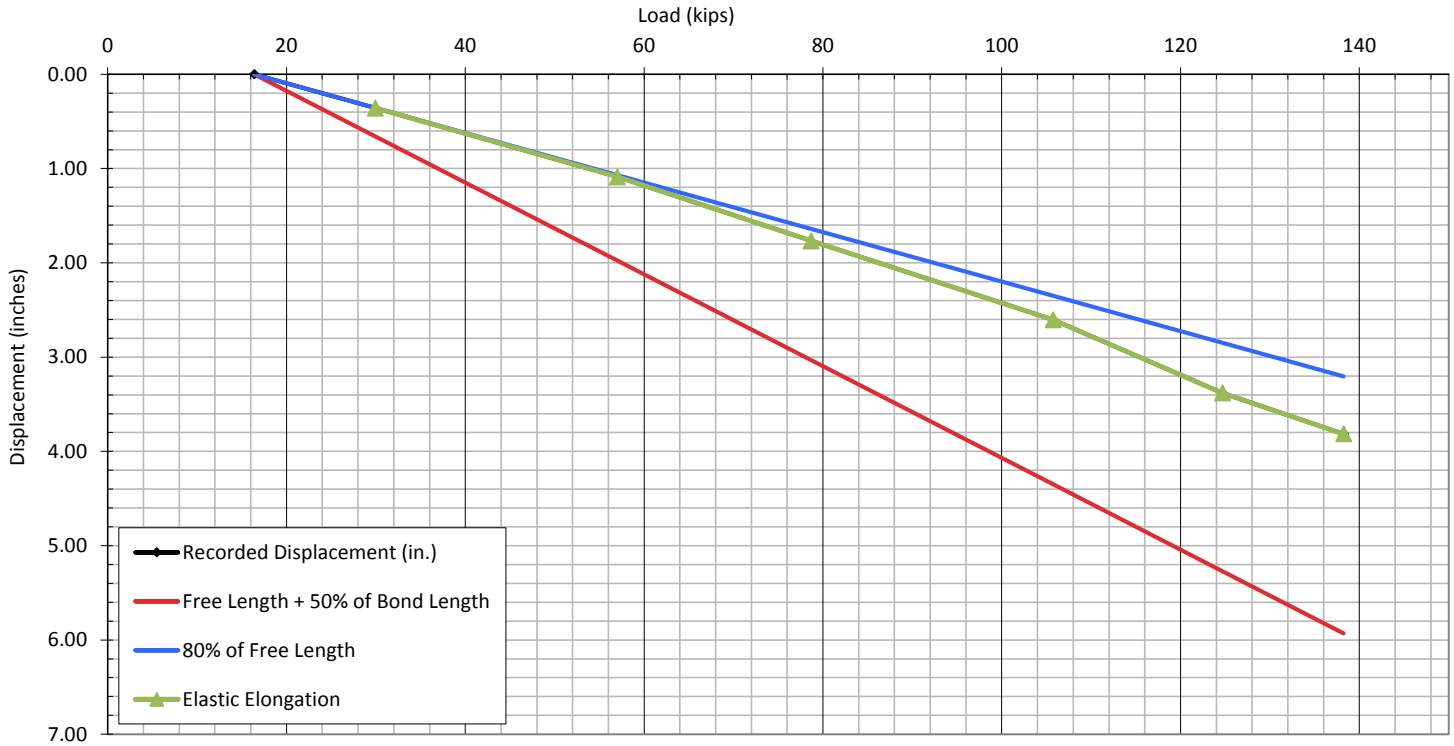
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	16	500	0.000	---	0.000	0.000	---	
---	0.25DL	30	1000	0.358	0.358	0.659	0.356	127.28	
---	0.50DL	57	2000	1.088	1.088	1.977	1.068	42.43	
---	0.75DL	79	2800	1.767	1.767	3.031	1.638	44.94	
---	1.00DL	106	3800	2.605	2.605	4.349	2.351	46.17	
---	1.20DL	125	4500	3.380	3.380	5.271	2.849	49.43	
---	1.33DL	138	5000	3.814	3.814	5.930	3.205	49.58	
1	1.33DL	138	5000	3.814	---	5.930	3.205	---	
2	1.33DL	138	5000	3.817	---	5.930	3.205	---	
3	1.33DL	138	5000	3.818	---	5.930	3.205	---	
4	1.33DL	138	5000	3.818	---	5.930	3.205	---	
5	1.33DL	138	5000	3.818	---	5.930	3.205	---	
6	1.33DL	138	5000	3.818	---	5.930	3.205	---	
10	1.33DL	138	5000	3.818	---	5.930	3.205	---	
---	AL	16	500	0.000	---	---	---	---	
---	LOCKOFF	76	2700	---	---	2.899	1.567	---	

Total Movement Between 1 and 10 Minutes (in.)	0.004
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141120
Gauge I.D. 12-1



Note: No reset of dial needed however, dial was "sticking" during 1.33DL hold times.

Tieback Performance Test

Sheet No.: 44

Tieback Location	Tieback No.	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	25	1/20/2016	1/21/2016			3/21/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	103	50	52	0.7	4.450	ZLK	ZLK

Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)[1]	Recorded Displacement (in.)[2]	Elastic Elongation at Load Cycle Maximum (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	12	400	0.000	---	0.000	0.000	---	
---	0.25DL	29	1000	0.430	0.320	0.805	0.436	30.75	
---	AL	12	400	0.110	---	0.000	0.000	---	
---	0.25DL	29	1000	0.410	---	0.805	0.436	---	
---	0.50DL	56	2000	1.344	1.054	2.146	1.162	37.99	
---	AL	12	400	0.290	---	0.000	0.000	---	
---	0.25DL	29	1000	0.500	---	0.805	0.436	---	
---	0.50DL	56	2000	1.355	---	2.146	1.162	---	
---	0.75DL	81	2900	2.180	1.873	3.353	1.815	43.20	
---	AL	12	400	0.307	---	0.000	0.000	---	
---	0.25DL	29	1000	0.572	---	0.805	0.436	---	
---	0.50DL	56	2000	1.410	---	2.146	1.162	---	
---	0.75DL	81	2900	2.230	---	3.353	1.815	---	
---	1.00DL	106	3800	3.124	2.644	4.560	2.469	44.84	
---	AL	12	400	0.480	---	0.000	0.000	---	
---	0.25DL	29	1000	0.670	---	0.805	0.436	---	
---	0.50DL	56	2000	1.578	---	2.146	1.162	---	
---	0.75DL	81	2900	2.387	---	3.353	1.815	---	
---	1.00DL	106	3800	3.187	---	4.560	2.469	---	
---	1.20DL	125	4500	3.896	3.392	5.499	2.977	47.71	<-- may have
---	AL	12	400	0.504	---	0.000	0.000	---	maxed out dial
---	0.25DL	29	1000	0.772	---	0.805	0.436	---	
---	0.50DL	56	2000	1.638	---	2.146	1.162	---	
---	0.75DL	81	2900	2.469	---	3.353	1.815	---	
---	1.00DL	106	3800	3.292	---	4.560	2.469	---	set dial to 0"
---	1.20DL	125	4500	4.087	---	5.499	2.977	---	
---	1.33DL	136	4900	4.447	---	6.035	3.267	---	
1	1.33DL	136	4900	4.451	---	---	---	---	
2	1.33DL	136	4900	4.451	---	---	---	---	
3	1.33DL	136	4900	4.469	---	---	---	---	pump jack
4	1.33DL	136	4900	4.474	---	---	---	---	
5	1.33DL	136	4900	4.474	---	---	---	---	
6	1.33DL	136	4900	4.480	---	---	---	---	pump jack
10	1.33DL	136	4900	4.478	3.947	---	---	50.58	set dial @ 4"
---	AL	12	400	0.531	---	---	---	---	
---	LOCKOFF	81	2900		---	3.353	1.815	---	

Total Movement Between 1 and 10 Minutes (in.)	0.027
Maximum Total Movement Allowed (in.):	0.040

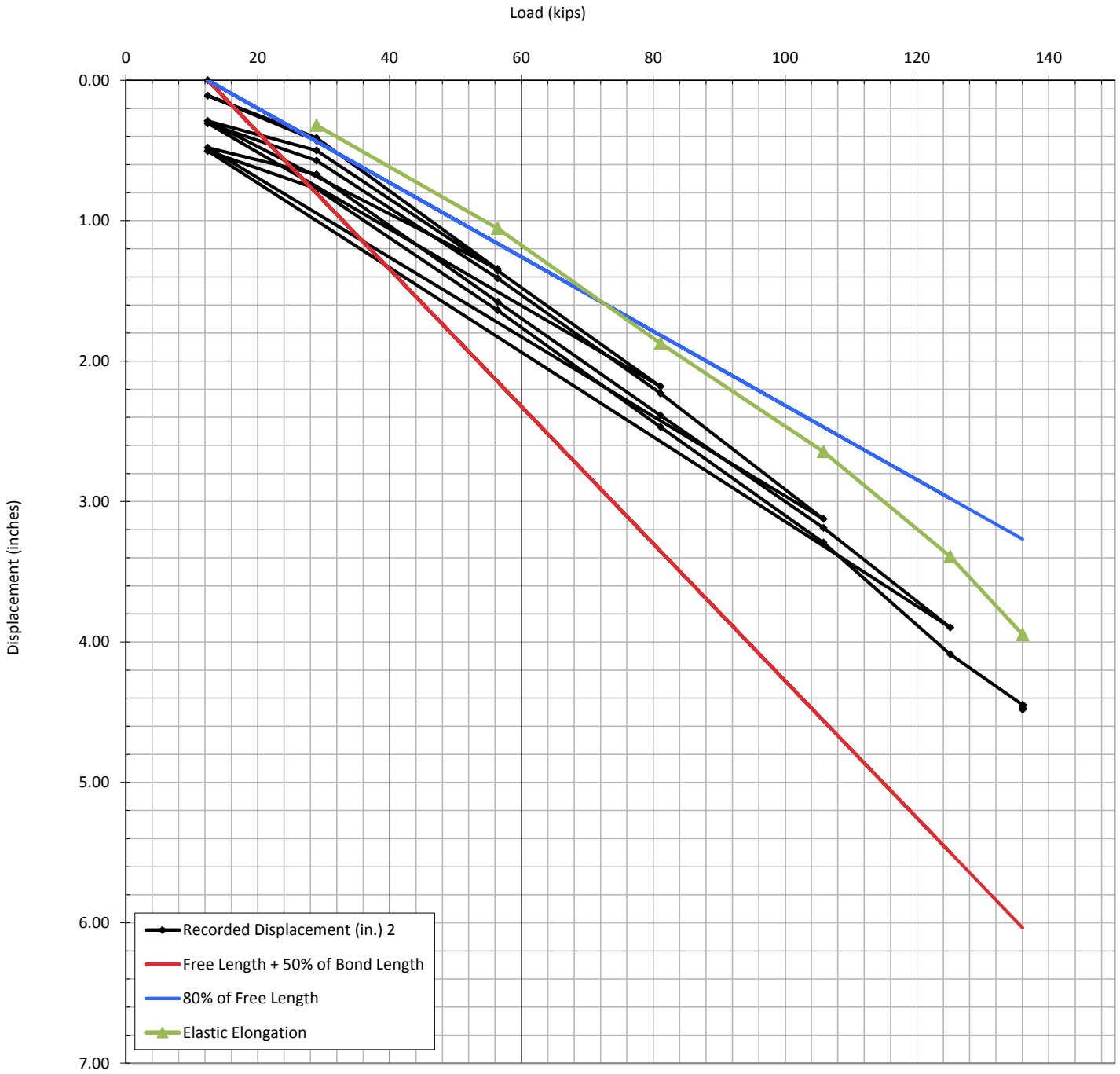
Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141121
Gauge I.D. 12-4

Notes/Additional Comments:
1. Gage pressure must be maintained during testing and be held to within +/- 2%
2. Recorded displacements are to be recorded to the nearest 0.001 in.

Tieback Performance Test



Test Notes:

1. Dial had to be reset for all testing of 1.33DL and to unload to 1.20DL. Dial was set to 0.000" at 3800 psi. Dial was reset to 4.000" at 3800 psi after 1.33DL testing. Final movement was 1.010".

Tieback Proof Testing

Sheet No.: 45

Tieback Location	Tieback No.	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	45	1/19/2016	1/21/2016			3/21/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	103	50	50.5	2.5	4.450	ZLK	ZLK

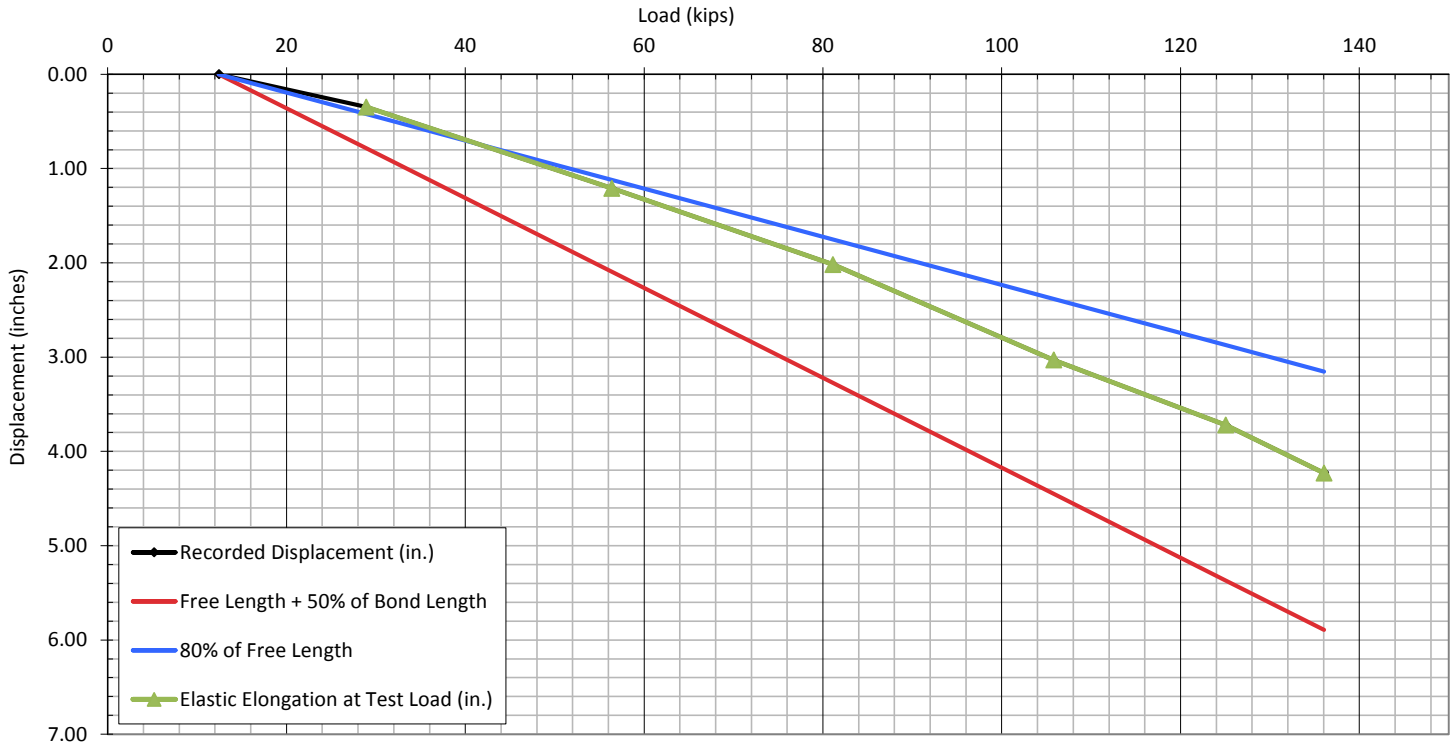
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	12	400	0.000	---	0.000	0.000	---	
---	0.25DL	29	1000	0.348	0.348	0.786	0.420	116.19	
---	0.50DL	56	2000	1.209	1.209	2.095	1.121	43.57	
---	0.75DL	81	2900	2.018	2.018	3.273	1.752	46.55	
---	1.00DL	106	3800	3.030	3.030	4.452	2.382	51.39	
---	1.20DL	125	4500	3.721	3.721	5.368	2.873	52.33	
---	1.33DL	136	4900	4.231	4.231	5.892	3.153	54.22	Rest dial @ 0
1	1.33DL	136	4900	4.229	---	5.892	3.153	---	
2	1.33DL	136	4900	4.229	---	5.892	3.153	---	
3	1.33DL	136	4900	4.227	---	5.892	3.153	---	
4	1.33DL	136	4900	4.225	---	5.892	3.153	---	
5	1.33DL	136	4900	4.229	---	5.892	3.153	---	
6	1.33DL	136	4900	4.233	---	5.892	3.153	---	
10	1.33DL	136	4900	4.235	---	5.892	3.153	---	
---	AL	15	500	0.000	---	---	---	---	
---	LOCKOFF	84	3000	---	---	3.404	1.822	---	

Total Movement Between 1 and 10 Minutes (in.)	0.006
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141121
Gauge I.D. 12-4



Note: At 1.20DL, insufficent throw of the dial remained therefore the dial was reset to 0 @ 1.20DL and displacement differentials were added

Tieback Proof Testing

Sheet No.: 46

Tieback Location	Tieback No.	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	46	1/18/2016	1/21/2016			3/21/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	103	50	51.8	1.2	4.450	ZLK	ZLK

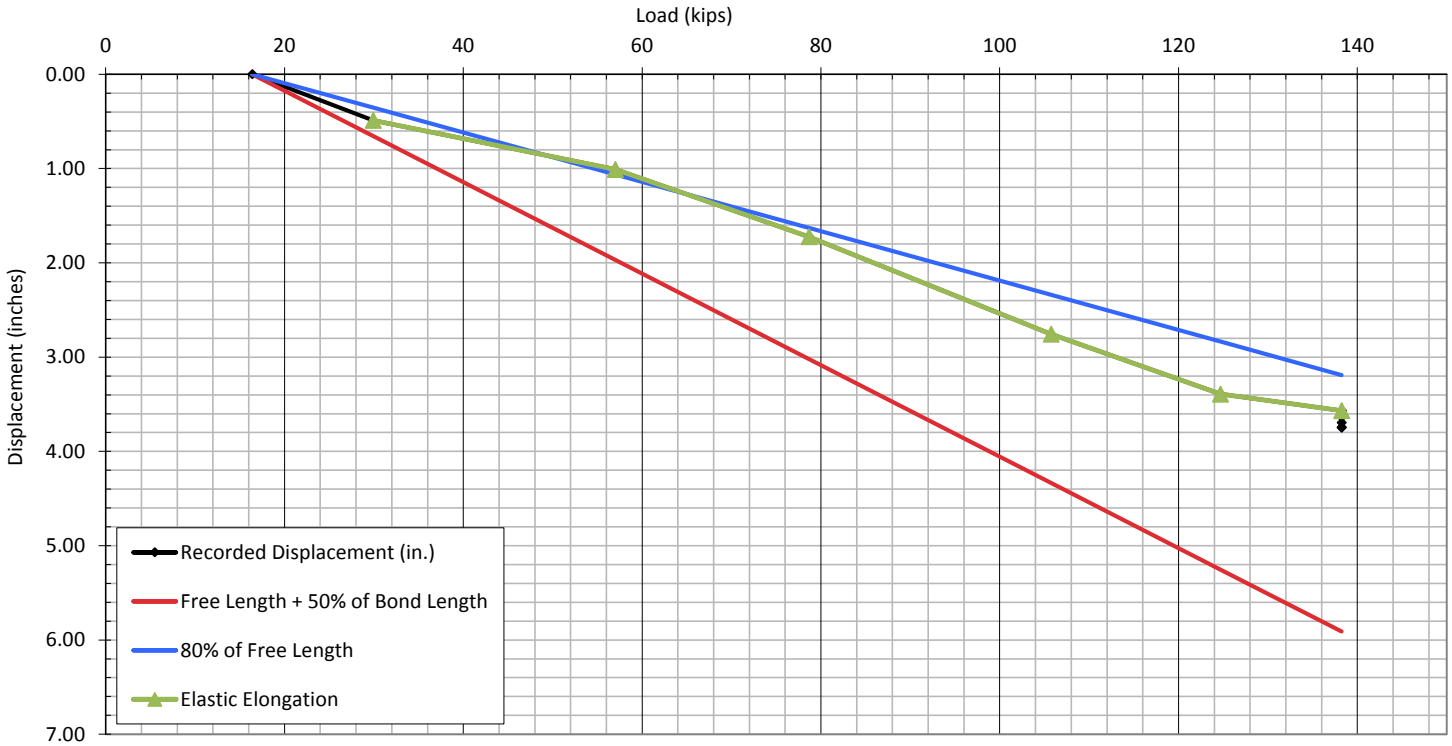
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	16	500	0.000	---	0.000	0.000	---	
---	0.25DL	30	1000	0.490	0.490	0.657	0.354	118.16	
---	0.50DL	57	2000	1.010	1.010	1.970	1.063	39.39	
---	0.75DL	79	2800	1.724	1.724	3.021	1.630	43.84	
---	1.00DL	106	3800	2.757	2.757	4.335	2.339	48.87	
---	1.20DL	125	4500	3.392	3.392	5.254	2.836	49.60	
---	1.33DL	138	5000	3.568	3.568	5.911	3.190	46.38	
1	1.33DL	138	5000	3.569	---	5.911	3.190	---	
2	1.33DL	138	5000	3.569	---	5.911	3.190	---	
3	1.33DL	138	5000	3.602	---	5.911	3.190	---	Pump the jack
4	1.33DL	138	5000	3.636	---	5.911	3.190	---	Pump the jack
5	1.33DL	138	5000	3.695	---	5.911	3.190	---	Pump the jack
6	1.33DL	138	5000	3.744	---	5.911	3.190	---	Pump the jack
10	1.33DL	138	5000	3.748	---	5.911	3.190	---	
---	AL	16	500	0.000	---	---	---	---	
---	LOCKOFF	81	2900	---	---	3.152	1.701	---	

Total Movement Between 1 and 10 Minutes (in.)	0.179
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	FAIL
Retesting Required?	YES
Sheet No. of Retest:	46-1

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141120
Gauge I.D. 12-1



Note: Jack was unable to hold pressure during 1.33DL holds. Malcolm changed out the jack after testing of this tieback.

Tieback Proof Testing

Sheet No.: 46

Tieback Location	Tieback No.	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	46	1/18/2016	1/21/2016			3/24/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	103	50	51.8	1.2	4.450	ZLK	ZLK

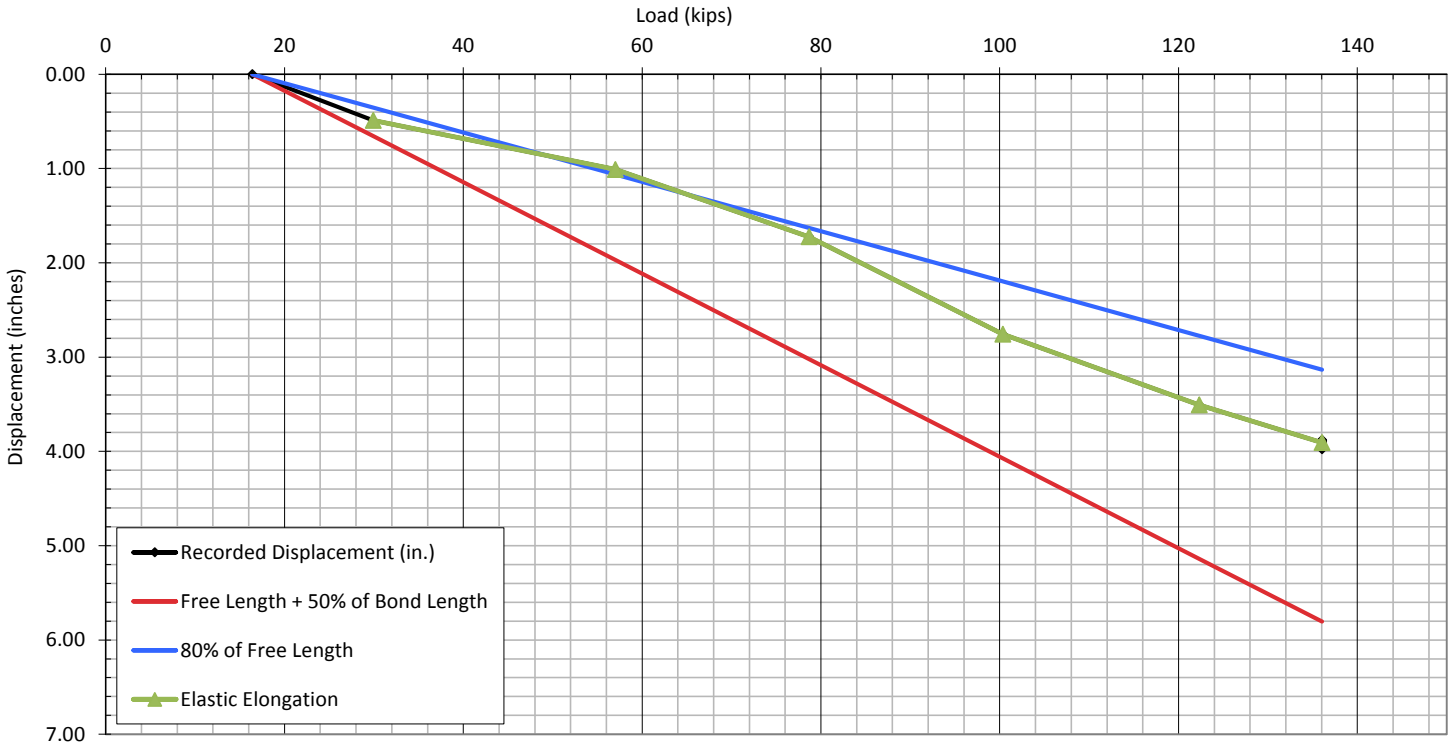
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	16	500	0.000	---	0.000	0.000	---	from 3/21/16
---	0.25DL	30	1000	0.490	0.490	0.657	0.354	118.16	from 3/21/16
---	0.50DL	57	2000	1.010	1.010	1.970	1.063	39.39	from 3/21/16
---	0.75DL	79	2800	1.724	1.724	3.021	1.630	43.84	from 3/21/16
---	1.00DL	100	3600	2.757	2.757	4.072	2.198	52.02	from 3/21/16
---	1.20DL	122	4400	3.507	3.507	5.138	2.773	52.44	
---	1.33DL	136	4900	3.907	3.907	5.804	3.133	51.72	
1	1.33DL	136	4900	3.877	---	5.804	3.133	---	
2	1.33DL	136	4900	3.977	---	5.804	3.133	---	
3	1.33DL	136	4900	3.887	---	5.804	3.133	---	
4	1.33DL	136	4900	3.887	---	5.804	3.133	---	Pump the jack
5	1.33DL	136	4900	3.889	---	5.804	3.133	---	Pump the jack
6	1.33DL	136	4900	3.893	---	5.804	3.133	---	Pump the jack
10	1.33DL	136	4900	3.898	---	5.804	3.133	---	
---	AL	15	500	0.000	---	---	---	---	
---	LOCKOFF	76	2700	---	---	2.873	1.550	---	

Total Movement Between 1 and 10 Minutes (in.)	0.021
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141120 for AL to 1.00DL; 141121 thereafter
Gauge I.D. 12-1; 12-4



Note: Jack was unable to hold pressure during 1.33DL holds. Malcolm changed out the jack after testing of this tieback.

Tieback Proof Testing

Sheet No.: 47

Tieback Location	Tieback No.	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	47	1/19/2016	1/21/2016			3/21/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	103	50	51.0	2.0	4.450	ZLK	ZLK

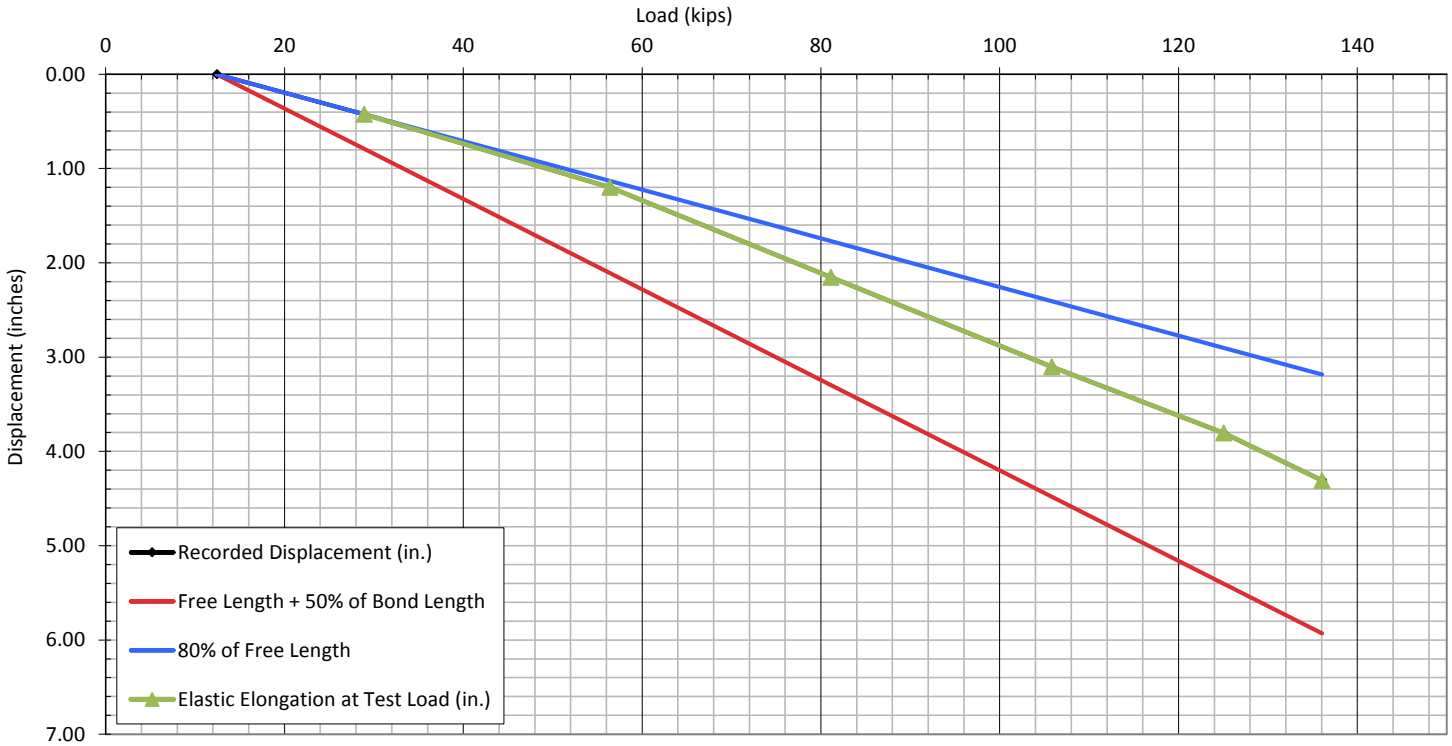
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	12	400	0.000	---	0.000	0.000	---	
---	0.25DL	29	1000	0.425	0.425	0.791	0.425	115.33	
---	0.50DL	56	2000	1.200	1.200	2.109	1.132	43.25	
---	0.75DL	81	2900	2.153	2.153	3.295	1.769	49.66	
---	1.00DL	106	3800	3.102	3.102	4.481	2.406	52.61	
---	1.20DL	125	4500	3.805	3.805	5.404	2.901	53.51	
---	1.33DL	136	4900	4.308	4.308	5.931	3.184	55.20	Rest dial @ 0
1	1.33DL	136	4900	4.308	---	5.931	3.184	---	
2	1.33DL	136	4900	4.308	---	5.931	3.184	---	
3	1.33DL	136	4900	4.301	---	5.931	3.184	---	
4	1.33DL	136	4900	4.306	---	5.931	3.184	---	
5	1.33DL	136	4900	4.306	---	5.931	3.184	---	
6	1.33DL	136	4900	4.306	---	5.931	3.184	---	
10	1.33DL	136	4900	4.306	---	5.931	3.184	---	
---	AL	15	500	0.000	---	---	---	---	
---	LOCKOFF	81	2900	---	---	3.295	1.769	---	

Total Movement Between 1 and 10 Minutes (in.)	-0.002
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141121
Gauge I.D. 12-4



Note: At 1.20DL, insufficent throw of the dial remained therefore the dial was reset to 0 @ 1.20DL and displacement differentials were added

Tieback Proof Testing

Sheet No.: 48

Tieback Location	Tieback No.	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	48	1/18/2016	1/21/2016			3/21/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	103	50	51.0	2.0	4.450	ZLK	ZLK

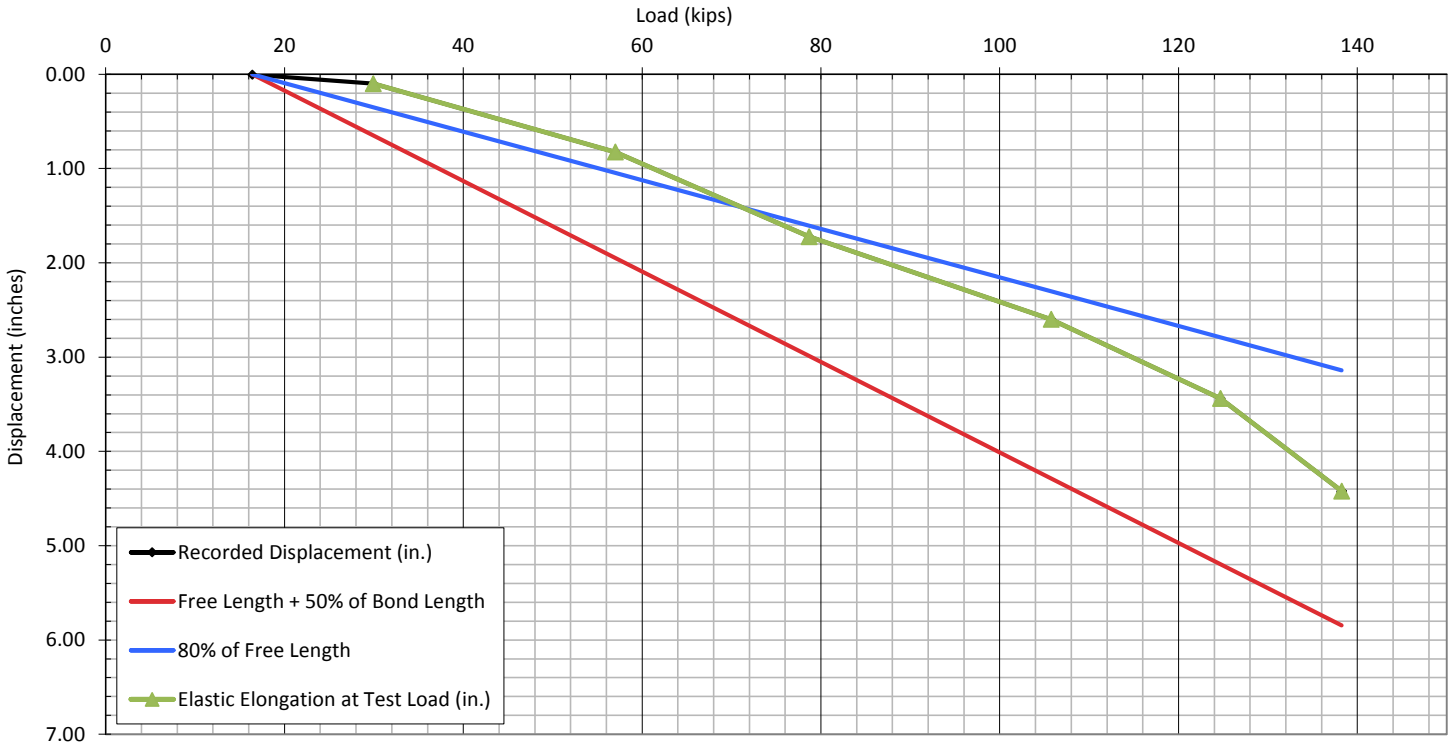
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	16	500	0.003	---	0.000	0.000	---	
---	0.25DL	30	1000	0.100	0.100	0.650	0.349	96.40	
---	0.50DL	57	2000	0.824	0.824	1.949	1.046	32.13	
---	0.75DL	79	2800	1.722	1.722	2.988	1.604	43.79	
---	1.00DL	106	3800	2.600	2.600	4.288	2.302	46.09	
---	1.20DL	125	4500	3.439	3.439	5.197	2.790	50.29	
---	1.33DL	138	5000	4.421	4.421	5.847	3.139	57.47	reset dial @ 0
1	1.33DL	138	5000	4.421	---	5.847	3.139	---	
2	1.33DL	138	5000	4.420	---	5.847	3.139	---	
3	1.33DL	138	5000	4.426	---	5.847	3.139	---	
4	1.33DL	138	5000	4.428	---	5.847	3.139	---	
5	1.33DL	138	5000	4.434	---	5.847	3.139	---	
6	1.33DL	138	5000	4.441	---	5.847	3.139	---	
10	1.33DL	138	5000	4.439	---	5.847	3.139	---	pressure bled
---	AL	16	500		---	---	---	---	
---	LOCKOFF	81	2900	---	---	3.118	1.674	---	

Total Movement Between 1 and 10 Minutes (in.)	0.018
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141120
Gauge I.D. 12-1



Note: At 1.20DL, insufficent throw of the dial remained therefore the dial was reset to 0 @ 1.20DL and displacement differentials were added

Tieback Proof Testing

Sheet No.: 49

Tieback Location	Tieback No.	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	49	1/19/2016	1/21/2016			3/21/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	103	50	51.0	2.0	4.450	ZLK	ZLK

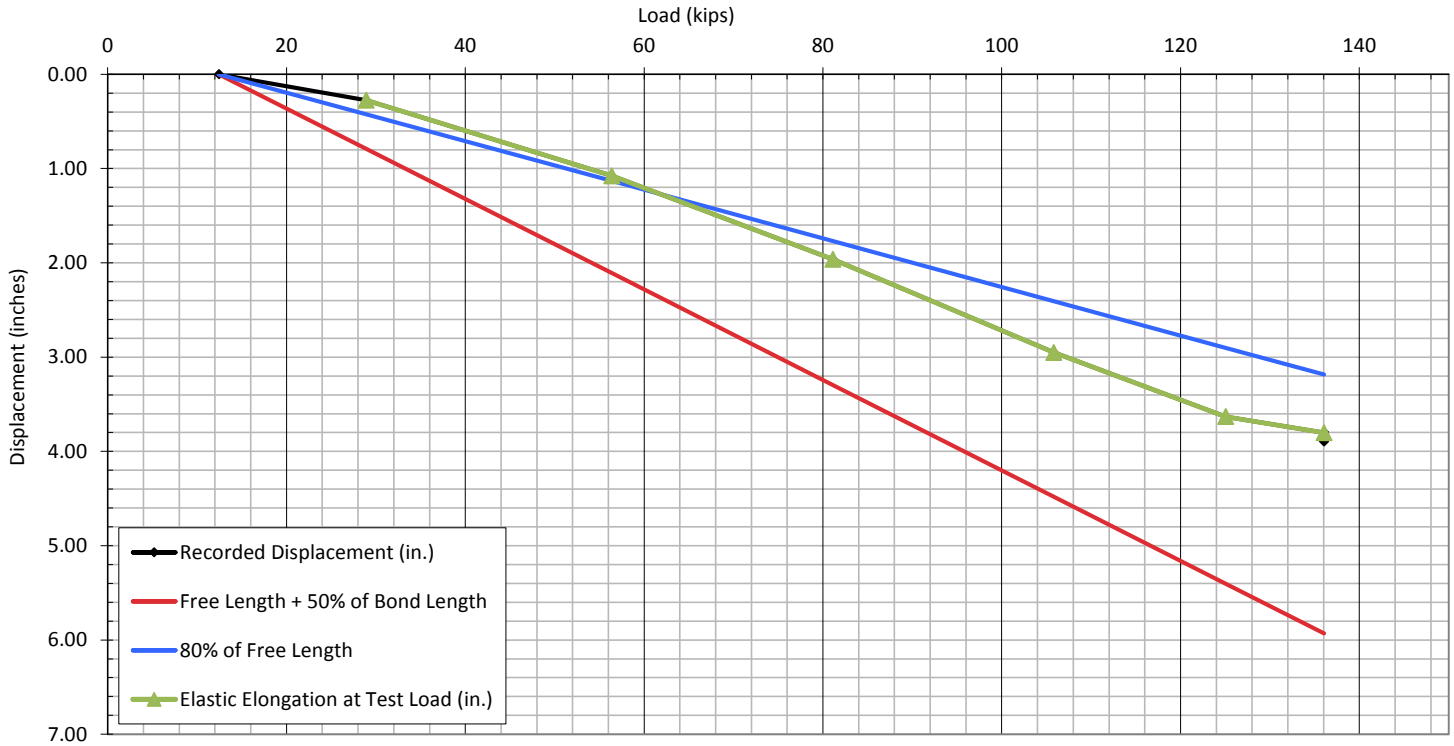
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	12	400	0.000	---	0.000	0.000	---	
---	0.25DL	29	1000	0.274	0.274	0.791	0.425	103.60	
---	0.50DL	56	2000	1.078	1.078	2.109	1.132	38.85	
---	0.75DL	81	2900	1.963	1.963	3.295	1.769	45.28	
---	1.00DL	106	3800	2.951	2.951	4.481	2.406	50.05	
---	1.20DL	125	4500	3.631	3.631	5.404	2.901	51.07	
---	1.33DL	136	4900	3.802	3.802	5.931	3.184	48.72	reset dial @ 0
1	1.33DL	136	4900	3.802	---	5.931	3.184	---	
2	1.33DL	136	4900	3.802	---	5.931	3.184	---	
3	1.33DL	136	4900	3.802	---	5.931	3.184	---	
4	1.33DL	136	4900	3.802	---	5.931	3.184	---	
5	1.33DL	136	4900	3.893	---	5.931	3.184	---	<-- movement
6	1.33DL	136	4900	3.893	---	5.931	3.184	---	in test
10	1.33DL	136	4900	3.893	---	5.931	3.184	---	apparatus
---	AL	15	500	0.000	---	---	---	---	
---	LOCKOFF	89	3200	---	---	3.690	1.981	---	

Total Movement Between 1 and 10 Minutes (in.)	0.091
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141121
Gauge I.D. 12-4



Note: Movement in testing assmebly causes displacement values to jump at 5 min. hold. Was previously holding at a consistent value.

Tieback Proof Testing

Sheet No.: 50

Tieback Location	Tieback No.	Date Installed	Date(s) Post-Grouted			Test Date	Design Load (P; kips)	Lockoff Load (kips)	Elastic Mod. (E; ksi)
Row 1	50	1/18/2016	1/21/2016			3/21/2016	100.0	75.0	28800

Shaft Diameter (in)	Number of Strands	Total Strand Area (A; in^2)	Total Tendon Length (L_T; ft)	Tendon Bond Length (L_B; ft)	Free Stressing Length (L_U; ft)	Tail Length (L_e; ft)	Theo. Elastic Elong. (in)	Recorded By	Reviewed By
6	3	0.660	103	50	51.0	2.0	4.450	ZLK	ZLK

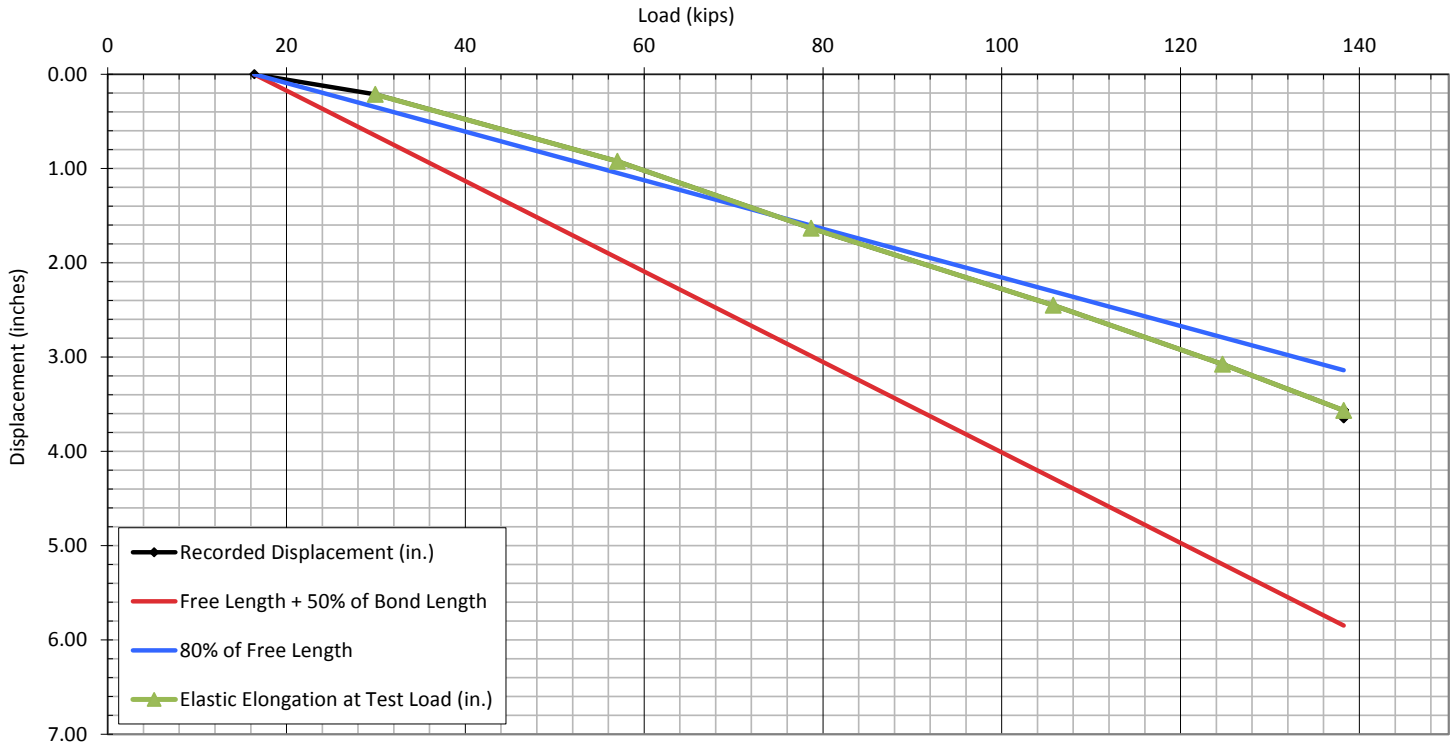
Time (min)	Load Testing Schedule	Test Load (kips)	Gauge Pressure for Test Load (psi)	Recorded Displacement (in.)	Elastic Elongation at Test Load (in.)	Elongation of Free Stressing Length + 50% of Bonded Length $P(0.5L_B+L_u)/AE$ (in.)	Elongation of 80% Free Stressing Length $0.8*P(L_u)/AE$ (in.)	Apparent Free Tendon Length $A_tE_s\delta_e/$ (TL-AL) (ft)	Comments
---	AL (0.10DL)	16	500	0.000	---	0.000	0.000	---	
---	0.25DL	30	1000	0.214	0.214	0.650	0.349	108.10	
---	0.50DL	57	2000	0.924	0.924	1.949	1.046	36.03	
---	0.75DL	79	2800	1.632	1.632	2.988	1.604	41.50	
---	1.00DL	106	3800	2.451	2.451	4.288	2.302	43.44	
---	1.20DL	125	4500	3.076	3.076	5.197	2.790	44.98	
---	1.33DL	138	5000	3.565	3.565	5.847	3.139	46.34	reset dial @ 0
1	1.33DL	138	5000	3.562	---	5.847	3.139	---	
2	1.33DL	138	5000	3.560	---	5.847	3.139	---	
3	1.33DL	138	5000	3.562	---	5.847	3.139	---	
4	1.33DL	138	5000	3.560	---	5.847	3.139	---	
5	1.33DL	138	5000	3.559	---	5.847	3.139	---	<-- Dial slipped
6	1.33DL	138	5000	3.649	---	5.847	3.139	---	on jack pump
10	1.33DL	138	5000	3.645	---	5.847	3.139	---	pressure bled
---	AL	16	500	0.000	---	---	---	---	
---	LOCKOFF	77	2750	---	---	2.923	1.569	---	

Total Movement Between 1 and 10 Minutes (in.)	0.083
Maximum Total Movement Allowed (in.)*:	0.040

Acceptability of Tieback:	PASS
Retesting Required?	NO
Sheet No. of Retest:	N/A

Additional Testing for when Max. Total Movement is Exceeded				
20 min	30 min	40 min	50 min	60 min

Ram I.D. 141120
Gauge I.D. 12-1



Note: At 1.20DL, insufficent throw of the dial remained therefore the dial was reset to 0 @ 1.20DL and displacement differentials were added

ATTACHMENT D
COMPACTION TESTING RESULTS

GeoTest

741 Marine Drive, Bellingham, WA 98225 www.geotest-inc.com
20611 67th Ave. NE. Unit A. Arlington, WA 98223
phone: (360) 733.7318 toll free: (888) 251.5276 fax: (360) 733.7418

FIELD DENSITY/MOISTURE REPORT
Nuclear Gauge * ASTM D6938

PROJECT: Whatcom Waterway Phase I - Strider Construction
JOB #: 16-0015
ADDRESS: Bellingham, WA
REPORT #: FD001
PERMIT #:
DATE: 3/21/2016
CLIENT: Strider Construction Co.
PAGE #: 1 of 1
CONTRACTOR: Strider Construction Co.
INSPECTOR: Sean Rogerson

Compaction Of: Structural Fill for Site Backfill

Field Data:

Test #	Location	Depth/ Elev (ft)	DT/ BS (in)	Wet Density (pcf)	Field Moisture (%)	Dry Density (pcf)	Lab #	Compaction % Attained	Compaction % Required	Pass/ Fail
1	Barge Ramp Backfill	TOG	DT/12	143.3	5.2	136.2	1	**95**	90	P
2	Barge Ramp Backfill	-2	DT/12	140.3	4.2	134.6	1	**94**	90	P
3	Sheet Pile Wall Backfill, East of Barge Ramp	-2	DT/12	139.4	4.7	133.1	1	**93**	90	P
4	Sheet Pile Wall Backfill, South of Barge Ramp	-2	DT/12	138.7	5.3	131.7	1	**92**	90	P
5	Sheet Pile Wall Backfill, North of Barge Ramp	-2	DT/12	139.4	4.8	133.1	1	**93**	90	P

Lab Sample #	Soil Type	Source	Max. Dry Density (pcf)	Optimum Moisture (%)	Retained On #4 (%)	Test Method
1-7412	PGG w/ Sand	Granite - Singer	143.8	6.2	58	ASTM D1557/D4718
2-			0.0			None
3-			0.0			None

Gauge Make/Model/Serial#: Troxler 3440P / 60560 M/D Standard Count: 694 / 2527

Comments: TOG - Top of Grade

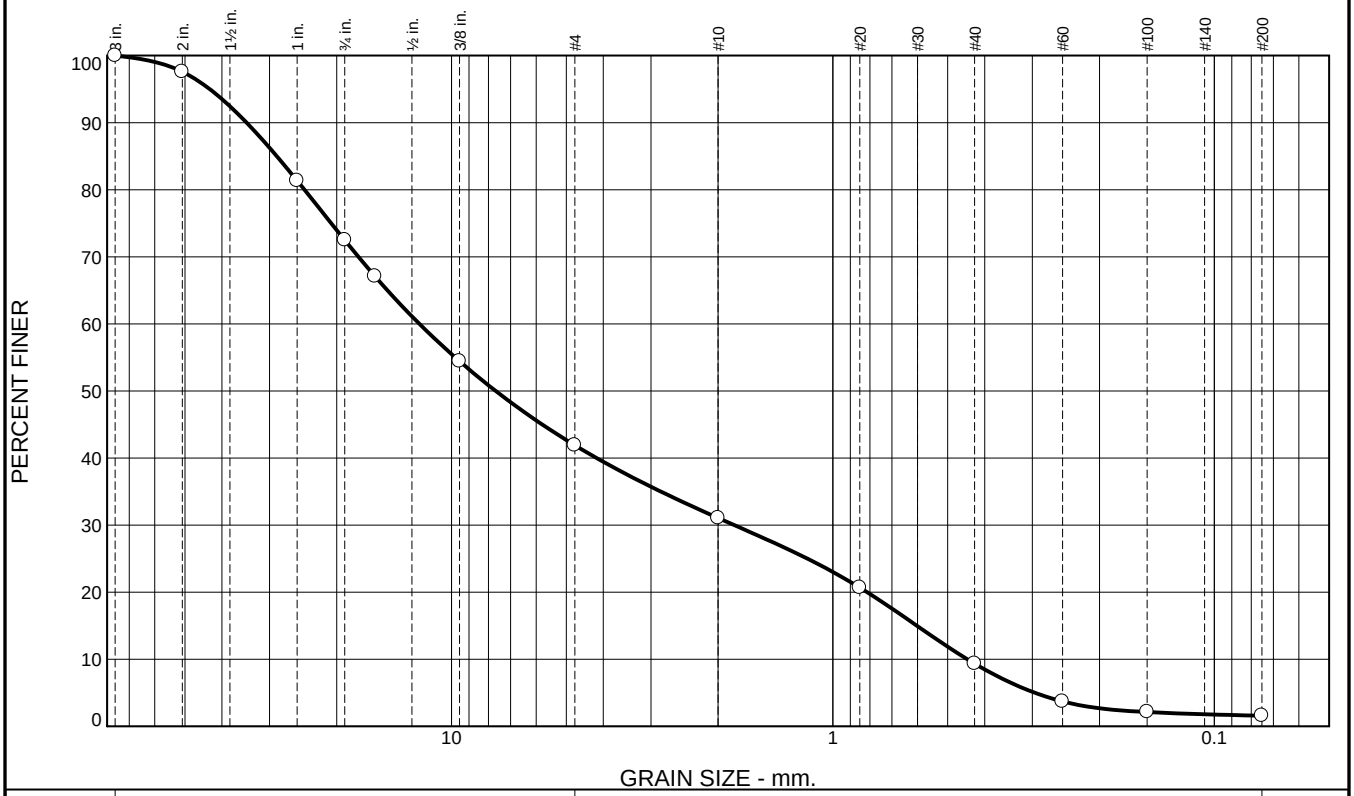
GeoTest was on site as requested to perform compaction testing on structural fill at the above-mentioned locations.

All tests met the compaction requirement of 90% per project specifications division 02 11 00 section 3.04D.

COPIES: Strider Construction Co. Anchor QEA

Reviewed by

Sieve Analysis Test Report - C136/C117



% +3"	% Gravel		% Sand			% Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt
0	28	30	11	22	7	2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100		
2"	98		
1"	81		
3/4"	72		
5/8"	67		
3/8"	54		
#4	42		
#10	31		
#20	21		
#40	9		
#60	4		
#100	2		
#200	1.6		

* (no specification provided)

Material Description

Structural Fill
poorly graded gravel with sand

Atterberg Limits

PL= NP LL= NV PI=

Coefficients

D_{90}= 34.4488 D_{85}= 28.7159 D_{60}= 12.1407
D_{50}= 7.6575 D_{30}= 1.8148 D_{15}= 0.6026
D_{10}= 0.4443 C_u= 27.33 C_c= 0.61

Classification

USCS= GP AASHTO=

Remarks

Specification was not provided by client.

Location: Granite - Singer Pit - sampled at site stockpile
Sample Number: 7412

Date: 3-21-16

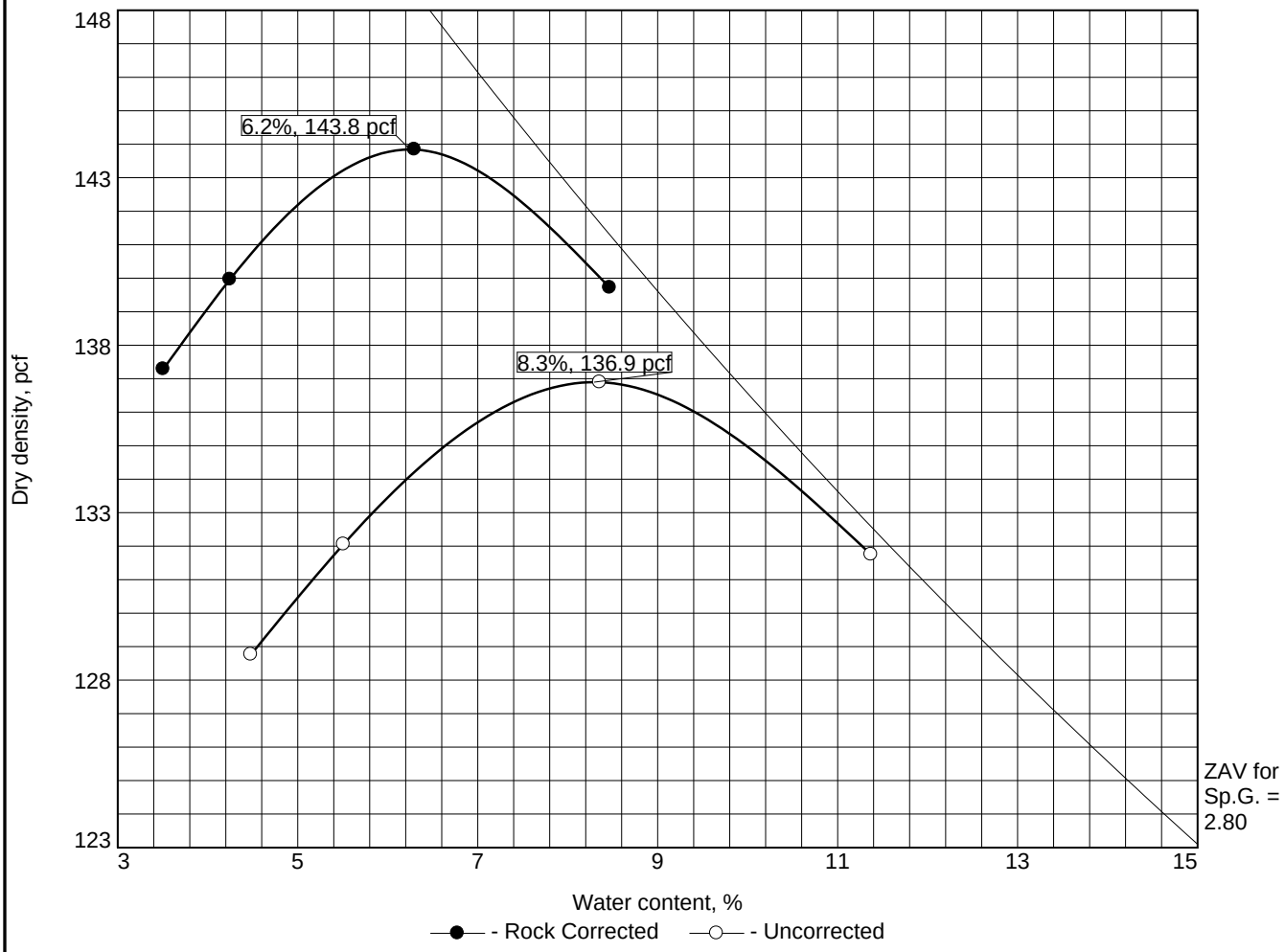
GEOTEST
741 Marine Drive
Bellingham, WA 98225
www.GeoTest-inc.com

Client: Strider Construction Company
Project: Whatcom Waterway Phase I

Project No: 16-0015 **Figure** SP001

Tested By: MC **Checked By:** DL

Moisture-Density (Proctor) Test Report



Test specification: ASTM D 1557-12 Method C Modified
ASTM D 4718-87 Oversize Corr. Applied to Each Test Point

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
	GP				NV		28	1.6

ROCK CORRECTED TEST RESULTS	UNCORRECTED	MATERIAL DESCRIPTION
Maximum dry density = 143.8 pcf	136.9 pcf	Structural Fill poorly graded gravel with sand
Optimum moisture = 6.2 %	8.3 %	

Project No. 16-0015 **Client:** Strider Construction Company
Project: Whatcom Waterway Phase I
Date: 3-22-16
○ **Loc.:** Granite - Singer Pit - sampled at site stockpile **Sample No.:** 7412

GEOTEST 761 Marine Drive Bellingham, WA 98225 www.GeoTest-Inc.com

Remarks:
SPG: assumed

Figure SP001

Tested By: MC **Checked By:** DL

APPENDIX E
WATER QUALITY MONITORING DATA

WATER QUALITY MONITORING DATA AS-BUILT REPORT FOR THE WHATCOM WATERWAY CLEANUP IN PHASE 1 SITE AREAS

Prepared for

Port of Bellingham

Prepared by

Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, Washington 98101

September 2018

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LIST OF ACRONYMS AND ABBREVIATIONS

µg/L	microgram per liter
AS	Acute Compliance Station
BMP	best management practice
BG	background station
CM	Construction Manager
CS	Chronic Compliance Station
DRET	dredging elutriate test
Ecology	Washington State Department of Ecology
mg/L	milligram per liter
NTU	nephelometric turbidity unit
Port	Port of Bellingham
Project	Whatcom Waterway Cleanup in Phase 1 Site Areas Project
TCDD	tetrachlorodibenzo-p-dioxin
WAC	Washington Administrative Code
WQMP	Water Quality Monitoring Plan

1 INTRODUCTION

This appendix documents water quality monitoring performed by the Port of Bellingham (Port) during the Whatcom Waterway Cleanup in Phase 1 Site Areas Project (Project) in Bellingham, Washington. This report describes water quality monitoring that occurred from August 2015 through March 2016 in accordance with the Water Quality Monitoring Plan (WQMP) contained in the Engineering Design Report (EDR; Anchor QEA 2015) approved by the Washington State Department of Ecology (Ecology).

2 WATER QUALITY MONITORING

Monitoring activities were conducted according to the Ecology-approved WQMP. The monitoring activities and results are described in this section.

2.1 Water Quality Criteria

The waters of Bellingham Bay are designated as excellent quality marine waters by the State of Washington (Washington Administrative Code [WAC] 173-201A). Applicable criteria exist for both conventional and chemical parameters as described in Sections 2.2 and 2.3.

2.1.1 Conventional Criteria

Turbidity and dissolved oxygen were monitored as the primary indicators of water quality. For marine waterbodies classified as excellent, turbidity shall not exceed 5 nephelometric turbidity units (NTU) over background turbidity when the background turbidity is 50 NTU or less, or there shall not be more than a 10% increase in turbidity when the background turbidity is more than 50 NTU. The lowest 1-day minimum for dissolved oxygen in marine waterbodies designated as excellent is 6.0 milligrams per liter (mg/L) [WAC 173-201A-200(1)(d) and (e)].

2.1.2 Chemical Criteria

Acute and chronic water quality standards established under the Washington State Surface Water Quality Standards [WAC 173-201A-240(3)] are listed in Attachment 1 of the WQMP along with the findings of the reasonable potential analysis. That analysis compared the findings of the dredging elutriate test (DRET) evaluation to the water quality criteria to

evaluate potential dredging-related chemical concentrations that could occur during Project construction. Though exceedances of water quality criteria were not considered reasonable to expect, contingent chemical monitoring was included for both mercury and dioxin.

During in-water construction activities, the acute criteria were applicable at the 150-foot compliance boundary as measured using an exposure period of 1 hour. Chronic criteria were applied at the 300-foot compliance boundary as measured using an exposure period of 4 days.

For mercury, the acute and chronic criteria were 1.8 micrograms per liter (µg/L) and 0.025 µg/L, respectively. For dioxin, acute and chronic water quality criteria were 0.0001 µg/L and 0.00001 µg/L, respectively.

2.2 Monitoring Locations and Depths

The monitoring locations for water quality measurements were at specific distances from the respective construction activities, measured using radii of 100 feet (Early Warning Station), 150 feet (Acute Compliance Stations [AS]) and 300 feet (Chronic Compliance Stations [CS]). Measurements at the 100-foot distance served as an "early warning" indicator, allowing for modification of the activity to potentially avoid exceedances at the compliance boundary. In addition, monitoring was performed at one or two reference locations located at least 500 feet from the respective construction activities in areas unaffected by the active work. The background station (BG) was selected by the field team after visually observing the water flow direction and taking the tidal stage into account.

Each monitoring event included measuring turbidity and dissolved oxygen at three depths at all stations. The monitoring depths were 3 feet below the water surface (surface), 3 feet above the bottom (bottom), and at the mid-point of the water column (mid-depth). Measurements at stations located near in-water work were compared to those monitored at reference stations.

2.3 Monitoring Methods and Equipment

Monitoring was conducted from Anchor QEA's vessel, and actual sampling locations were determined using a handheld global positioning system unit. Water column depth was

determined at each monitoring location using a lead line or the vessel's fathometer. In situ turbidity and dissolved oxygen were measured with a YSI 6920V2 multi-probe water quality sonde. Station locations, water depth, and water quality data for each monitoring event and respective location were recorded on field logs.

2.4 Monitoring Frequency

Compliance monitoring was conducted at one of two frequencies, depending on in-water work activities and previous monitoring results. As described in the WQMP, monitoring was conducted according to intensive (every 4 hours) or routine (twice daily) frequencies, as summarized below:

- Intensive: Collection of turbidity and dissolved oxygen measurements every 4 hours during in-water work
- Routine: Collection of turbidity and dissolved oxygen measurements twice daily during in-water work, or if turbidity plumes become visually evident

Monitoring was required to be conducted on an intensive schedule for the first 4 days of in-water work. Consistent with the WQMP, if no exceedances occurred during the intensive monitoring, monitoring was reduced to a routine schedule. A confirmed exceedance measured at any time during monitoring triggered the intensive schedule to start over.

2.5 Water Quality Compliance Determination

Sample measurements from each of the three depths at the early warning (100-foot), acute compliance (150-foot), and chronic compliance (300-foot) locations were compared to each of the three corresponding depths at the background station(s). If turbidity or dissolved oxygen at any station failed to meet water quality criteria, measurements were re-collected 10 to 15 minutes afterward to confirm the exceedance. If a confirmed exceedance was measured at a 100-foot early warning station, the Construction Manager (CM) was notified. If turbidity or dissolved oxygen was confirmed to exceed water quality criteria at a 150-foot or 300-foot compliance station, the Port and Ecology were notified and the Contractor was required to implement additional best management practices (BMPs). Water quality measurements were re-measured 30 to 60 minutes following implementation of BMPs.

Water samples were collected for analytical testing following the methods listed in Table E1 if exceedances were measured again.

Table E1
Analytical Methods and Detection Limits for Chemical Testing

Chemical Parameter	Analytical Method	Target Detection Limit
Total Suspended Solids	SM 2540D	1.0 mg/L
Mercury	EPA 7470A	0.02 µg/L
Dioxin	EPA 1613B	0.005 ng/L

Notes:
µg/L = microgram per liter
mg/L = milligram per liter
ng/L = nanogram per liter

3 MONITORING RESULTS

Water quality monitoring was performed between August 10, 2015, and March 21, 2016. Monitoring took place during pile removal, capping, and dredging activities consistent with the requirements of the WQMP.

3.1 Conventional Monitoring Results

During the 8 months of monitoring, over 2,125 compliance measurements of dissolved oxygen and turbidity were taken. Of the 2,125 turbidity readings taken, confirmed exceedances of the background-based total suspended solids limit were observed during only five events (see Table E2):

- Three events (September 21, 25, and 30, 2015) were short-term exceedances of background turbidity levels at the AS-1 station only. At the 1-hour recheck after the Contractor implemented additional BMPs, turbidity returned to background levels.
- One event (September 29, 2015) was a short-term exceedance of background turbidity levels at the AS-1 and CS-1 station. At the 1-hour recheck after the Contractor implemented additional BMPs, turbidity returned to background levels.
- One event (October 27, 2015) included a 2-hour turbidity exceedance at the AS-1 station. Turbidity returned to background levels within 3 hours.

All of the exceedances took place during low tide or slack tide while dredging the Inner Waterway. These exceedances were attributable to the shallow-water conditions and challenging dredging conditions in these areas. However, application of additional BMPs by the Contractor were sufficient to return conditions to required levels.

No confirmed dissolved oxygen criteria exceedances attributable to construction activities were observed during the Project. Low-oxygen conditions were noted at compliance and background stations during 16 monitoring events between August and mid-September. However, all low-oxygen conditions were attributable to low background dissolved oxygen levels, not to construction activities.

Table E2
Summary of Water Quality Monitoring Observations

Date	Primary Activity	Type of Monitoring[1]	Exceedances Noted? [2,3]		Notes
			150-foot Acute Compliance Station	300-foot Chronic Compliance Station	
8/10/2015	Structure Removal	Intensive	No [2]	No [2]	Background turbidity levels [2]
8/11/2015	Structure Removal	Intensive	No [2]	No [2]	Background turbidity levels [2]
8/12/2015	Structure Removal	Intensive	No [2]	No [2]	Background turbidity levels [2]
8/20/2015	Structure Removal	Routine	No [2]	No [2]	Background turbidity levels [2]
8/27/2015	Dredging	Intensive	No [2]	No [2]	Background turbidity levels [2]
8/28/2015	Dredging	Intensive	No [2]	No [2]	Background turbidity levels [2]
8/29/2015	Dredging	Intensive	No [2]	No [2]	Background turbidity levels [2]
8/31/2015	Dredging	Intensive	No [2]	No [2]	Background turbidity levels [2]
9/9/2015	Structure Removal	Routine	No [2]	No [2]	Background turbidity levels [2]
9/14/2015	Structure Removal	Routine	No [2]	No [2]	Background turbidity levels [2]
9/21/2015	Dredging	Routine	Yes [3]	No [2]	One short-term exceedance of background turbidity levels at 150-foot station (but not at the 300-foot station). Contractor implemented additional BMPs and turbidity returned to background levels at 1-hour recheck.
9/22/2015	Dredging	Intensive	No [2]	No [2]	Background turbidity levels [2]
9/23/2015	Dredging	Intensive	No [2]	No [2]	Background turbidity levels [2]
9/24/2015	Dredging	Intensive	No [2]	No [2]	Background turbidity levels [2]

Date	Primary Activity	Type of Monitoring[1]	Exceedances Noted? [2,3]		Notes
			150-foot Acute Compliance Station	300-foot Chronic Compliance Station	
9/25/2015	Dredging	Intensive	Yes [3]	No [2]	One short-term exceedance of background turbidity levels at 150-foot station (but not at the 300-foot station). Dredging terminated within 1 hour of exceedance. BMPs adjusted for following day of dredging, resulting in no exceedances.
9/26/2015	Dredging	Intensive	No [2]	No [2]	Background turbidity levels [2]
9/28/2015	Dredging	Intensive	No [2]	No [2]	Background turbidity levels [2]
9/29/2015	Dredging	Intensive	Yes [3]	Yes [3]	One short-term exceedance of background turbidity levels at 150-foot station and the 300-foot station (elevated turbidity did not extend to the 500-foot station located near the Roeder Avenue bridge). Contractor terminated dredging shortly after measurement and turbidity returned to background levels at 1-hour recheck.
9/30/2015	Dredging	Intensive	Yes [3]	No [2]	One short-term exceedance of background turbidity levels at 150-foot station (but not at the 300-foot station). Contractor implemented additional BMPs and turbidity returned to background levels before the 1-hour recheck.
10/1/2015	Dredging	Intensive	No [2]	No [2]	Background turbidity levels [2]
10/2/2015	Dredging	Intensive	No [2]	No [2]	Background turbidity levels [2]
10/3/2015	Dredging	Intensive	No [2]	No [2]	Background turbidity levels [2]

Date	Primary Activity	Type of Monitoring[1]	Exceedances Noted? [2,3]		Notes
			150-foot Acute Compliance Station	300-foot Chronic Compliance Station	
10/5/2015	Dredging	Intensive	No [2]	No [2]	Background turbidity levels [2]
10/13/2015	Dredging	Routine	No [2]	No [2]	Background turbidity levels [2]
10/19/2015	Dredging and Capping	Routine/Intensive [4,5]	No [2]	No [2]	Background turbidity levels [2]
10/20/2015	Capping	Intensive [5]	No [2]	No [2]	Background turbidity levels [2]
10/27/2015	Dredging	Routine	Yes [3]	No [2]	One exceedance of background turbidity levels at 150-foot station (but not at the 300-foot station). Water quality testing samples were collected at the 150-foot and background stations and submitted for chemical analysis. Mercury and dioxin not detected. Turbidity returned to background levels within 3 hours.
10/28/2015	Dredging	Intensive	No [2]	No [2]	Background turbidity levels [2]
10/29/2015	Dredging	Intensive	No [2]	No [2]	Background turbidity levels [2]
11/2/2015	Dredging and Capping	Intensive/Intensive[5,6]	No [2]	No [2]	Background turbidity levels [2]
11/3/2015	Dredging and Capping	Intensive/Intensive[5,6]	No [2]	No [2]	Background turbidity levels [2]
11/14/2015	Dredging	Intensive[7]	No [2]	No [2]	Background turbidity levels [2]
11/18/2015	Capping	Routine	No [2]	No [2]	Background turbidity levels [2]
11/19/2015	Dredging	Intensive	No [2]	No [2]	Background turbidity levels [2]
11/20/2015	Dredging	Intensive	No [2]	No [2]	Background turbidity levels [2]
11/21/2015	Dredging	Intensive	No [2]	No [2]	Background turbidity levels [2]
11/30/2015	Dredging	Routine	No [2]	No [2]	Background turbidity levels [2]

Date	Primary Activity	Type of Monitoring[1]	Exceedances Noted? [2,3]		Notes
			150-foot Acute Compliance Station	300-foot Chronic Compliance Station	
12/4/2015	Capping	Routine	No [2]	No [2]	Background turbidity levels [2]
12/7/2015	Dredging	Routine	No [2]	No [2]	Background turbidity levels [2]
12/15/2015	Dredging	Routine	No [2]	No [2]	Background turbidity levels [2]
12/28/2015	Dredging	Routine	No [2]	No [2]	Background turbidity levels [2]
1/5/2016	Dredging and Capping	Routine	No [2]	No [2]	Background turbidity levels [2]
1/11/2016	Dredging	Routine	No [2]	No [2]	Background turbidity levels [2]
1/12/2016	Capping	Routine	No [2]	No [2]	Background turbidity levels [2]
1/20/2016	Dredging and Capping	Routine	No [2]	No [2]	Background turbidity levels [2]
1/26/2016	Capping	Routine	No [2]	No [2]	Background turbidity levels [2]
1/28/2016	Dredging	Routine	No [2]	No [2]	Background turbidity levels [2]
2/3/2016	Capping	Routine	No [2]	No [2]	Background turbidity levels [2]
2/4/2016	Dredging	Routine	No [2]	No [2]	Background turbidity levels [2]
2/8/2016	Dredging and Capping	Routine	No [2]	No [2]	Background turbidity levels [2]
2/9/2016	Capping	Intensive [5]	No [2]	No [2]	Background turbidity levels [2]
2/10/2016	Capping	Intensive [5]	No [2]	No [2]	Background turbidity levels [2]
2/16/2016	Dredging and Capping	Routine	No [2]	No [2]	Background turbidity levels [2]
2/17/2016	Intertidal Capping	Routine	No [2]	No [2]	Background turbidity levels [2]
2/22/2016	Capping	Routine	No [2]	No [2]	Background turbidity levels [2]
2/29/2016	Capping	Routine	No [2]	No [2]	Background turbidity levels [2]
3/7/2016	Capping	Routine	No [2]	No [2]	Background turbidity levels [2]
3/15/2016	Capping	Routine	No [2]	No [2]	Background turbidity levels [2]

Date	Primary Activity	Type of Monitoring[1]	Exceedances Noted? [2,3]		Notes
			150-foot Acute Compliance Station	300-foot Chronic Compliance Station	
3/21/2016	Capping	Routine	No [2]	No [2]	Background turbidity levels [2]

Notes:

1. Water quality monitoring activities were performed using either intensive or routine monitoring schedules as required by the Water Quality Monitoring Plan (WQMP). Intensive monitoring was performed for the first 2 days of structure removal or capping, and for the first 4 days of dredging in each site area (e.g., Inner Waterway, Bellingham Shipping Terminal). Measurements were taken every 4 hours during intensive monitoring. Routine monitoring included two measurements per day. Intensive monitoring was resumed during work in a different site area, or after an exceedance was confirmed during monitoring.
2. Turbidity levels were within 5 nephelometric turbidity units (NTU) of background conditions at each monitoring event on this date.
3. A "Yes" indicates that an exceedance (defined as a turbidity level 5 NTU greater than the measured background turbidity level measured at the 500-foot background stations) was noted during one discrete monitoring event on the indicated day. When an exceedance was confirmed, the contractor was notified to implement additional best management practices (BMPs) to correct the exceedance, and Ecology was notified. Turbidity levels were re-checked within 1 hour of implementing additional BMPs during continued operations.
4. Routine monitoring performed for dredging, and intensive monitoring performed during first 2 days of capping consistent with WQMP requirements.
5. Intensive monitoring performed during first 2 days of capping consistent with WQMP requirements.
6. Intensive monitoring continued for dredging and intensive monitoring performed during first 2 days of in-water capping consistent with WQMP requirements.
7. Change in dredge area from Inner Waterway to Bellingham Shipping Terminal triggered a return to intensive monitoring.

3.2 Chemical Monitoring Results

Consistent with the WQMP, chemistry samples were collected when an exceedance of turbidity criteria was sustained for more than 1 hour. Turbidity exceeded criteria at AS-1 for more than 1 hour during one event (October 27, 2015). Water samples were collected at AS-1 and BG-1 and submitted for chemical testing in accordance with the WQMP. Chemical analysis did not detect any mercury or dioxin (Table E3).

Table E3
Water Chemistry Results and Screening Levels

		Task	WWP1_Construct	WWP1_Construct
		Location ID	AS-1	BG-1
		Sample ID	WW-AS-COMP-20151027	WW-BG-COMP-20151027
		Sample Date	10/27/2015	10/27/2015
		Depth	Composite	Composite
		Sample Type	N	N
		Matrix	WS	WS
		Easting (feet)	1241516	1240921
		Northing (feet)	643036	642477
Parameters		**WQMP Screening Value (Acute)**		
Conventional Parameters (mg/L)				
Total suspended solids	SM2540D	BG + 10	16.9	8.8
Dissolved Metals (µg/L)				
Mercury	SW7470A	1.8	0.02 U	0.02 U
Dioxin Furans (ng/L)				
2,3,7,8-TCDD	E1613B	0.1	0.000434 U	0.000472 U

Notes:
Northings and eastings are provided in NAD83 Washington State Plane North, U.S. feet.
µg/L = microgram per liter
mg/L = milligram per liter
ng/L = nanogram per liter
TCDD = tetrachlorodibenzo-p-dioxin

3.3 Visual Monitoring Results

Visual monitoring for turbidity plumes was conducted by the water quality team and/or CM in accordance with the WQMP. No turbidity plumes were observed from construction activities.

3.4 Fish Monitoring Results

Monitoring for distressed fish was performed by the water quality team, CM, and/or the dredge contractor during construction activities. No dead or distressed fish were observed during the Project.

4 DEVIATIONS FROM THE WATER QUALIY MONITORING PLAN

There were two minor deviations from the WQMP:

- A second background station was added to better represent conditions in the waterway. Whatcom Waterway connects Whatcom Creek to Bellingham Bay. These adjacent waterbodies impact the conditions of the creek, and factors such as tidal conditions (height, strength, and direction), creek flow rate, weather conditions, existing bathymetry, and winds contribute to ambient environment of Whatcom Waterway. A second background station provided better documentation of background conditions.
- Background station nomenclature was updated to facilitate data reduction and interpretation. Background station nomenclature was changed from 'U' (up-current) and 'D' (down-current) to 'N' (north) and 'S' (south) in relation to construction activities.

5 QUALITY ASSURANCE

In accordance with the WQMP, the water quality instrument was calibrated and/or verified against standards of known concentration daily prior to use, and standard instrument operation procedures were followed.

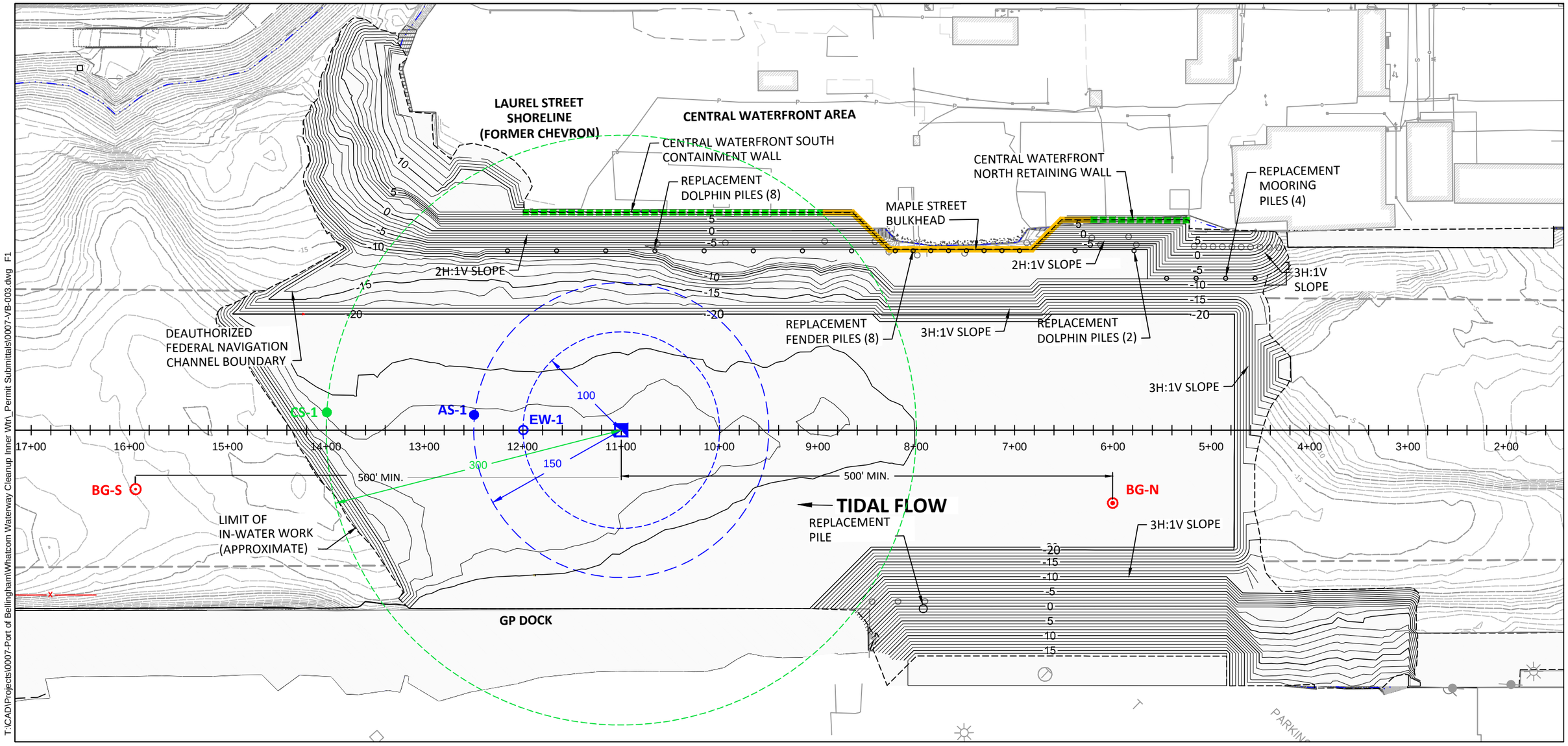
A Stage 2B validation (U.S. Environmental Protection Agency 2009) was performed following National Functional Guidelines for data validation. All data were found to be valid and usable for all purposes.

6 REFERENCES

Anchor QEA, 2015. Water Quality Monitoring Plan, Whatcom Waterway Final Engineering Design Report, Appendix L. Whatcom Waterway Cleanup in Phase 1 Site Areas. February 2015.

U.S. Environmental Protection Agency, 2009. Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use. EPA 540-R-08-005. January 2009.

FIGURE



T:\CAD\Projects\0007-Port of Bellingham\Whatcom Waterway Cleanup Inner Wtr_Permit Submittals\0007-VB-003.dwg F1

Nov 03, 2014 9:50am chewett

SOURCE: Drawing prepared from surveys provided by Wilson Surveying and Engineering.
HORIZONTAL DATUM: Washington State Plane North, North American Datum of 1983, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

NOTES:
1. Water quality monitoring locations are shown relative to location of work and will move with project progress.
2. Capping to be completed throughout in-water limits of work. Bathymetry shown is for post-capping conditions.
3. Contour Interval is 1-foot.

LEGEND:

BG-N/S	Background Station
EW-1	Early Warning Station
AS-1	Acute Compliance Station
CS-1	Chronic Compliance Station

Early Warning Boundary
Compliance Boundary
Chronic Compliance Boundary
Location of Dredging or Capping Activities

0 100
Scale in Feet

ANCHOR QEA

Figure 1
Example Water Quality Monitoring Locations
Appendix E- Water Quality Monitoring
Port of Bellingham, WA

ATTACHMENT A
DATA VALIDATION REPORT

LABORATORY DATA CONSULTANTS, INC.
2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Bus: 760-827-1100 Fax: 760-827-1099

Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, WA 98101
ATTN: Ms. Joy Dunay

December 9, 2015

SUBJECT: Whatcom Waterway, Data Validation

Dear Ms. Dunay,

Enclosed is the final validation report for the fractions listed below. This SDG was received on November 23, 2015. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #35445:

SDG #	Fraction
APK1	Mercury, Total Suspended Solids, Dioxins/Dibenzofurans

The data validation was performed under Stage 2B guidelines. The analyses were validated using the following documents, as applicable to each method:

- USEPA Contract Laboratory National Functional Guidelines for Inorganic Superfund Data Review, January 2010
- USEPA Contract Laboratory Program National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins and Chlorinated Dibenzofurans Data Review, September 2011
- EPA SW 846, Third Edition, Test Methods for Evaluating Solid Waste, update 1, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January 1995; update III, December 1996; update IIIA, April 1998; IIIB, November 2004; Update IV, February 2007

Please feel free to contact us if you have any questions.

Sincerely,

Christina Rink
Project Manager/Chemist

HC

Attachment 1

EDD 2B

LDC #35445 (Anchor Environmental-Seattle WA / Whatcom Waterway)

LDC	SDG#	DATE REC'D	(3) DATE DUE	Total TCDD (1613B)		Diss. Hg (7470A)		TSS (2540D)																											
Matrix: Water/Sediment				W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S
A	APK1	11/23/15	12/16/15	2	0	2	0	2	0																										
Total	A/CR			2	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6

Shaded cells indicate Level IV validation (all other cells are Level III validation). These sample counts do not include MS, MSD, or DUP's.

L:\Anchor\Whatcom\35445ST.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Whatcom Waterway

LDC Report Date: December 1, 2015

Parameters: Mercury

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): APK1

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
WW-AS-COMP-20151027	APK1A	Water	10/27/15
WW-BG-COMP-20151027	APK1B	Water	10/27/15
WW-AS-COMP-20151027MS	APK1AMS	Water	10/27/15
WW-AS-COMP-20151027DUP	APK1ADUP	Water	10/27/15

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines (CLPNFG) for Inorganic Superfund Data Review (January 2010). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Mercury by Environmental Protection Agency (EPA) SW 846 Method 7470A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Instrument Calibration

Initial and continuing calibrations were performed as required by the method.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

III. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

IV. Field Blanks

No field blanks were identified in this SDG.

V. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits.

VI. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

VIII. Field Duplicates

No field duplicates were identified in this SDG.

IX. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

X. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Whatcom Waterway
Mercury - Data Qualification Summary - SDG APK1

No Sample Data Qualified in this SDG

Whatcom Waterway
Mercury - Laboratory Blank Data Qualification Summary - SDG APK1

No Sample Data Qualified in this SDG

LDC #: 35445A4c

SDG #: APK1

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 12-1-15

Page: 1 of 1

Reviewer: MG

2nd Reviewer: a

METHOD: Mercury (EPA SW 846 Method 7470A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	Instrument Calibration	A	
III.	Laboratory Blanks	A	
IV.	Field Blanks	N	
V.	Matrix Spike/Matrix Spike Duplicates	A	MS
VI.	Duplicate sample analysis	A	DUP
VII.	Laboratory control samples	A	LCS
VIII.	Field Duplicates	N	
IX.	Sample Result Verification	N	
X.	Overall Assessment of Data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	WW-AS-COMP-20151027	APK1A	Water	10/27/15
2	WW-BG-COMP-20151027	APK1B	Water	10/27/15
3	WW-AS-COMP-20151027MS	APK1AMS	Water	10/27/15
4	WW-AS-COMP-20151027DUP	APK1ADUP	Water	10/27/15
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15	PBW			

Notes:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Whatcom Waterway

LDC Report Date: December 1, 2015

Parameters: Total Suspended Solids

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): APK1

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
WW-AS-COMP-20151027	APK1A	Water	10/27/15
WW-BG-COMP-20151027	APK1B	Water	10/27/15

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines (CLPNFG) for Inorganic Superfund Data Review (January 2010). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Total Suspended Solids by Standard Method 2540D

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) analyses were not required by the method.

VII. Duplicates

The laboratory has indicated that there were no duplicate (DUP) analyses specified for the samples in this SDG, and therefore duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Whatcom Waterway
Total Suspended Solids - Data Qualification Summary - SDG APK1

No Sample Data Qualified in this SDG

Whatcom Waterway
Total Suspended Solids - Laboratory Blank Data Qualification Summary - SDG APK1

No Sample Data Qualified in this SDG

LDC #: 35445A6 **VALIDATION COMPLETENESS WORKSHEET** Date: 12-1-15
SDG #: APK1 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: MG
2nd Reviewer: a

METHOD: (Analyte) Total Suspended Solids(SM2540D)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	A	PB only
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	not required
VII.	Duplicate sample analysis	N	client specified
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Sample result verification	N	
XI	Overall assessment of data	A	

Note: A = Acceptable
N = Not provided/applicable
SW = See worksheet
ND = No compounds detected
R = Rinsate
FB = Field blank
D = Duplicate
TB = Trip blank
EB = Equipment blank
SB=Source blank
OTHER:

	Client ID	Lab ID	Matrix	Date
1	WW-AS-COMP-20151027	APK1A	Water	10/27/15
2	WW-BG-COMP-20151027	APK1B	Water	10/27/15
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14	PBW			

Notes:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Whatcom Waterway

LDC Report Date: December 8, 2015

Parameters: Dioxins/Dibenzofurans

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): APK1

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
WW-AS-COMP-20151027	APK1A	Water	10/27/15
WW-BG-COMP-20151027	APK1B	Water	10/27/15

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review (September 2011). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B for Total TCDD

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20% for unlabeled compounds and less than or equal to 35% for labeled compounds.

The ion abundance ratios for all PCDDs/PCDFs were within method and validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were within the QC limits for unlabeled compounds and labeled compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled compounds and labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within method and validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Ongoing Precision & Recovery Samples

Ongoing precision and recovery (OPR) samples were reviewed for each matrix as applicable. The percent recoveries (%R) were within the QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Internal Standards

All internal standard recoveries (%R) were within QC limits.

XI. Compound Quantitation

All compound quantitations were within validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
WW-AS-COMP-20151027	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to results reported by the laboratory as EMPCs, data were qualified as estimated in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

Whatcom Waterway
Dioxins/Dibenzofurans - Data Qualification Summary - SDG APK1

Sample	Compound	Flag	A or P	Reason
WW-AS-COMP-20151027	Total TCDD	J (all detects)	A	Compound quantitation (EMPC)

Whatcom Waterway
Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG APK1

No Sample Data Qualified in this SDG

LDC #: 35445A21 **VALIDATION COMPLETENESS WORKSHEET** Date: 12-7-15
SDG #: APK1 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B) - TCDD only

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	≤20/35 ICV QC limits
IV.	Continuing calibration	A	QC limits
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Matrix spike/Matrix spike duplicates	N	C.S.
VIII.	Laboratory control samples	A	OPR
IX.	Field duplicates	N	
X.	Internal standards	A	
XI.	Compound quantitation RL/~~LOQ/LODs~~	SW	
XII.	Target compound identification	N	
XIII.	System performance	N	
XIV.	Overall assessment of data	A	

Note: A = Acceptable ND = No compounds detected D = Duplicate SB=Source blank
N = Not provided/applicable R = Rinsate TB = Trip blank OTHER:
SW = See worksheet FB = Field blank EB = Equipment blank

	Client ID	Lab ID	Matrix	Date
1	WW-AS-COMP-20151027	APK1A	Water	10/27/15
2	WW-BG-COMP-20151027	APK1B	Water	10/27/15
3				
4				
5				
6				
7				
8				
9				
10				

Notes:

	MB-103015						

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

A. 2,3,7,8-TCDD	F. 1,2,3,4,6,7,8-HpCDD	K. 1,2,3,4,7,8-HxCDF	P. 1,2,3,4,7,8,9-HpCDF	U. Total HpCDD
B. 1,2,3,7,8-PeCDD	G. OCDD	L. 1,2,3,6,7,8-HxCDF	Q. OCDF	V. Total TCDF
C. 1,2,3,4,7,8-HxCDD	H. 2,3,7,8-TCDF	M. 2,3,4,6,7,8-HxCDF	R. Total TCDD	W. Total PeCDF
D. 1,2,3,6,7,8-HxCDD	I. 1,2,3,7,8-PeCDF	N. 1,2,3,7,8,9-HxCDF	S. Total PeCDD	X. Total HxCDF
E. 1,2,3,7,8,9-HxCDD	J. 2,3,4,7,8-PeCDF	O. 1,2,3,4,6,7,8-HpCDF	T. Total HxCDD	Y. Total HpCDF

Notes:_____

LDC #: 35445A21

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported RLs

Reviewer: 4th
2nd Reviewer: CL

METHOD: GC/MS Dioxins/Dibenzofurans (Method 1613B) – TCDD only

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N ~~N/A~~ Were the correct internal standard (IS), quantitation ions and relative response factors (RRF) used to quantitate the compound?
Y N ~~N/A~~ Compound quantitation and RLs were adjusted to reflect all sample dilutions and dry weight factors (if necessary).

#	Date	Compound	Finding	Associated Samples	Qualifications
			EMPC results	1	Jdets/A (R)

Comments: ~~See sample calculation verification worksheet for recalculations~~

LDC #: 35495

EDD POPULATION COMPLETENESS WORKSHEET

Anchor

Date: 12/8/15

2nd Reviewer: (U)

The LDC job number listed above was entered by

	EDD Process	Y/N	Init	Comments/Action
I.	EDD Completeness	-		
Ia.	- All methods present?	y		
Ib.	- All samples present/match report?	y		
Ic.	- All reported analytes present?	y		
Id	-10% verification of EDD?	y		
II.	EDD Preparation/Entry	-		
IIa.	- QC Level applied? (~~EPAStage2b~~ or EPAStage4)	y		
IIb.	- Laboratory EMPC qualified results qualified (J with reason code 23)?	y		
III.	Reasonableness Checks	-		
IIIa.	- Do all qualified ND results have ND qualifier (i.e. UJ)?	NA		
IIIb.	- Do all qualified detect results have detect qualifier (i.e. J)?	y		
IIIc.	- If reason codes used, do all qualified results have reason code field populated, and vice versa?	y		
IIId.	- Do blank concentrations in report match EDD, where data was qualified due to blank?	NA		
IIIe.	- Were any results reported above calibration range? If so, were results qualified appropriately?	N/NA		
IIIf.	- Are all results marked reportable "Yes" unless rejected for overall assessment in the data validation report?	y		
IIIg.	-Are there any lab "R" qualified data? / Are the entry columns blank for these results?	N/NA		
IIIh.	- Is the detect flag set to "N" for all "U" qualified blank results?	NA		

Notes: *see readme

The attached zipped file contains two files:

File	Format	Description
1) Readme_Whatcom_120915.doc	MS Word 2003	A "Readme" file (this document).
2) LDC35445_APK1_VEDD_20151130.xlsx	MS Excel 2007	A spreadsheet for the following SDG(s): APK1 35445A

No discrepancies were observed between the hardcopy data packages and the electronic data deliverables during EDD population of validation qualifiers. A 100% verification of the EDD was not performed.

Please contact Christina Rink at (760) 827-1100 if you have any questions regarding this electronic data submittal.

ATTACHMENT B
LABORATORY REPORT

(Provided Separately)

APPENDIX F
AIR QUALITY MONITORING DATA

This appendix documents air quality monitoring activities that were performed during implementation of the Whatom Waterway Cleanup in Phase 1 Site Areas Project (Project).

Air monitoring was not planned for the Project because Whatcom Waterway site contaminants did not include volatile organic compounds and the wet nature of sediment minimizes the potential for dust emissions. However, a limited air monitoring program was implemented during dredging activities in the Inner Waterway out of an abundance of caution, to ensure that safety was maintained for construction workers, Port of Bellingham tenants, or other waterfront users.

Two comprehensive air monitoring events were conducted. The surveys were conducted during dredging and materials handling activities. The first event was conducted on December 30, 2015, and the second was conducted on January 13, 2016. Each event included air quality measurements at 19 stations (AM-1 to AM-19; Figure 1). The stations include locations adjacent to Whatcom Waterway and stations next to stockpile areas and haul routes used during the Project.

Air quality monitoring was performed using a calibrated photo ionization detector (PID). The PID screens volatile organic hydrocarbons.

Results of both rounds of air monitoring are presented in Table F1. All PID readings were below typical ambient levels (0.2 parts per million), confirming that dredging and stockpiling activities were not adversely impacting air quality within or adjacent to the Whatcom Waterway site.

B:\Projects\Port of Bellingham\Whatcom Waterway (0800007-01)\GIS\Maps\2016_01\Air Monitoring Locations.mxd epipkin 1/7/2016 12:02:43 PM

ANCHOR QEA

Figure 1
Whatcom Waterway Air Monitoring Locations

Table F1
Air Monitoring Summary

Station ID	Air Monitoring Location Description	PID Reading (ppm)	
		12/30/2015	1/13/2016
AM-1	GP West Stockpile Area	0.0	**0.2**
AM-2	GP West Stockpile Area	0.0	0.0
AM-3	GP West South Shoreline Cutback	0.0	0.0
AM-4	GP West South Shoreline Cutback	0.0	0.0
AM-5	GP West Bunker C Excavation Area	0.0	0.0
AM-6	GP West Log Pond Shoreline	0.0	0.0
AM-7	GP West Log Pond Shoreline	0.0	0.0
AM-8	Central Waterfront Shoreline/Beach Area	0.0	**0.1**
AM-9	Central Waterfront Stockpiling Area	0.0	0.0
AM-10	Central Waterfront Stockpiling Area	0.0	**0.1**
AM-11	Central Waterfront Shoreline/Ramp Area	0.0	**0.1**
AM-12	Colony Wharf Ramp - Public Access	0.0	**0.1**
AM-13	Colony Wharf Ramp - Public Access	0.0	0.0
AM-14	C Street	0.0	0.0
AM-15	C Street	0.0	0.0
AM-16	Central Avenue (downwind)	0.0	0.0
AM-17	Roeder Avenue Bridge (downwind)	0.0	0.0
AM-18	Cornwall Avenue at Laurel Street Bridge	0.0	0.0
AM-19	Cornwall Avenue	0.0	0.0

Notes:

PID = photo ionization detector

ppm = parts per million

APPENDIX G
ENVIRONMENTAL MONITORING DATA

ENVIRONMENTAL MONITORING DATA AS-BUILT REPORT FOR THE WHATCOM WATERWAY CLEANUP IN PHASE 1 SITE AREAS

Prepared for

Port of Bellingham

Prepared by

Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, Washington 98101

September 2018

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LIST OF ACRONYMS AND ABBREVIATIONS

ASB	aerated stabilization basin
BST	Bellingham Shipping Terminal
cm	centimeter
D/F	dioxin/furan
Ecology	Washington State Department of Ecology
EDR	Final Engineering Design Report
GP West	Georgia-Pacific West, Inc.
mg/kg	milligram per kilogram
mg/L	milligram per liter
MHHW	mean higher high water
ng/kg	nanogram per kilogram
PAH	polycyclic aromatic hydrocarbon
Project	Whatcom Waterway Cleanup in Phase 1 Site Areas Project
PSEP	Puget Sound Estuary Program
QA/QC	quality assurance/quality control
SMS	Sediment Management Standards
SQAPP	Sampling and Quality Assurance Project Plan
SQS	sediment quality standard
TEQ	toxicity equivalent

1 INTRODUCTION

This appendix provides a detailed summary of certain environmental monitoring data collected during the Whatcom Waterway Cleanup in Phase 1 Site Areas Project (Project) in Bellingham, Washington.

The environmental monitoring data described in this appendix were collected between August 2015 and July 2016 in accordance with the Sampling and Quality Assurance Project Plan (SQAPP; Anchor QEA 2016) as approved by the Washington State Department of Ecology (Ecology).

The sections of this appendix present the data collected during the following monitoring activities:

- Chemical testing data for soil and water disposed of during the Project (Section 2)
- Chemical testing data for imported capping materials (Section 3)
- Sediment and residuals monitoring data during construction, and post-construction (Section 4)
- Post-construction monitoring of crab and clam tissue (Section 5)

This appendix does not replicate data presented in other appendices of the As-Built Report for the Project. Data presented in those other appendices include the following:

- Geotechnical monitoring data (Appendix B)
- Water quality monitoring data (Appendix E)
- Air quality monitoring data (Appendix F)
- Supplement coring program data for Unit 1C (Appendix H)
- Physical testing data (Appendix I)

2 TESTING DATA FOR REMOVED MATERIALS

Most sediment and soil requiring landfill disposal, as well as bank cutback soil, were managed in accordance with approved disposal profiles. This section describes supplemental testing data collected for certain soil and groundwater removed during the Project.

Upland soil monitoring activities were conducted to determine soil reuse suitability in accordance with the Final Engineering Design Report (EDR; Anchor QEA 2015) and applicable state and federal laws and regulations. Figure G1 identifies the locations from which the data described in this section were collected.

2.1 Materials from the Central Waterfront Site Shoreline

Testing was performed for soil and water generated during source control activities performed along the Central Waterfront Site shoreline.

2.1.1 Partial Reuse of Relief Trench Soil

Screening of soil for potential reuse was conducted during excavation of relief trenches behind the containment walls installed along the Central Waterfront Site shoreline. Most of the soil generated from these trenches was determined to be unsuitable for reuse due to high silt/clay content, presence of treated wood debris, high debris content, and/or the presence of visual or olfactory indications of petroleum contamination. The unsuitable soil was managed by disposal at an approved Subtitle D landfill in accordance with the EDR.

A small quantity of soil (approximately 200 cubic yards) was generated that was potentially suitable for reuse. This soil was tested for petroleum hydrocarbons in accordance with the EDR. Testing data for the reused soil is summarized in Table G2-1. Petroleum hydrocarbon concentrations were below applicable cleanup levels. Therefore, the soil was reused as relief trench backfill. The soil was placed and compacted, then covered with an orange-colored geotextile, before imported structural fill was placed and compacted to the finish grade.

2.1.2 Reuse of Soil from the C Street Area

Approximately 400 cubic yards of reusable soil was generated during bank cutback activities in the C Street area of the Central Waterfront Site. This soil consisted of clean soil that had been stockpiled at the site by the previous tenant, and soil generated during debris removal and bank cutback for cap placement.

At the time that the soil was generated, additional material was required for backfilling the clarifier foundation on the GP West Site shoreline. After consultation with Ecology, additional soil testing data were collected to document contaminant concentrations in the materials. This included multiple samples tested for petroleum hydrocarbons and a composite sample tested for semivolatile organic compounds and heavy metals.

Results of soil testing data are presented in Table G2-2. Results demonstrated compliance with most GP West Site cleanup levels for unsaturated zone soils. Exceedances were detected for carcinogenic polycyclic aromatic hydrocarbon (PAH) compounds and copper. However, the detected concentrations were within the range of existing subsurface soils adjacent to the clarifier area.

After reviewing soil testing data, Ecology approved use of the soil for backfill of the clarifier foundation. The soil was placed as backfill above mean higher high water (MHHW) elevation (e.g., +8.5 feet MLLW) and was covered with an orange-colored geotextile, which was covered with 2 feet of clean imported structural fill and aggregate ballast to the finish grade.

2.1.3 Waters Generated During Barge Ramp Area Dewatering

Dewatering activities were required during completion of the barge ramp removal and backfill. In accordance with the Ecology Non-Routine Discharge Approval[1], construction dewatering of the barge ramp cavity was pre-treated and discharged into the Port's National Pollutant Discharge Elimination System-permitted aerated stabilization basin (ASB) for final

[1] Ecology approved a request for non-routine discharge of construction-generated water to the Port's ASB, by letter, on June 2, 2015.

treatment and disposal. Prior to generating the dewatering water, water sampling was conducted to verify the composition of the water was consistent with previous groundwater testing data on which the discharge approval was based.[2]

Results of the dewatering water testing are included in Table G2-3. The data were similar to previous findings, with detections of petroleum and related constituents.

2.2 Materials from the GP West Site Shoreline

Testing of soil and other solids was performed during structure removals and bank cutbacks along the south shoreline of the Whatcom Waterway, adjacent to the GP West Site.

2.2.1 Solids Removed from Foam Tank and Associated Piping

A small quantity (less than 10 cubic yards) of historical wastewater solids and recent stormwater solids were identified in the foam tank and associated piping located along the GP West Site shoreline near the clarifier. Removal of the solids was required prior to the demolition and removal of these structures.

Solids from the tank and associated piping were sampled and tested to verify consistency with disposal profiling. Table G2-4 summarizes the results of testing. The removed solids were managed by disposal at an approved Subtitle D landfill.

2.2.2 Soil Removed During Clarifier Area Cutback

During cutback of the shoreline behind the former clarifier area bulkhead, soil was screened for potential reuse. Soil determined to be suitable for reuse as subgrade backfill within the clarifier foundation (i.e., granular soils and gravel free of bricks, plastic or treated wood debris) was placed directly in the clarifier foundation.

Most cutback soil was determined to be unsuitable for reuse due to silt/clay content or presence of treated wood debris. This soil was managed by Subtitle D landfill disposal in accordance with the EDR.

[2] Water sampling occurred during the Central Waterfront Site – Chevron Area Interim Action Project in 2013.

2.2.3 Soil Removed During Log Pond Shoreline Cutback

Approximately 60 cubic yards of soil were removed from the Log Pond shoreline during a bank cutback conducted to optimize cap placement. The soil was generated from the top of slope adjacent to the existing asphalt paving.

This soil was sampled and analyzed for heavy metals, petroleum, and PAHs (Table G2-5 summarizes the results). Ecology approved reuse of the soil as subgrade backfill within the clarifier foundation.

3 TESTING OF IMPORTED CAP MATERIAL

Imported sand and filter materials proposed for use in the construction of the engineered sediment caps were tested, per the requirements of the Contract[3], to verify that they were free of chemical contamination.

Initial testing data were provided by the Contractor. Supplemental testing was performed by Anchor QEA for parameters with raised reporting limits. Results from both sets of tests are summarized in Table G3-1.

All concentrations were less than maximum levels defined in the Contract. Materials were approved for use in the engineered sediment capping work.

[3] Table 35 20 26-2 from the Project Specifications – Section 35 20 26 – Engineered Sediment Capping.

4 CONSTRUCTION AREA SEDIMENT MONITORING DATA

This section describes sediment testing conducted during and immediately following construction activities in portions of the Inner Waterway, and in Unit 1C of the Outer Waterway, located adjacent to the Bellingham Shipping Terminal (BST). Sample locations described in this section are shown in Figure G2.

4.1 Inner Waterway Subsurface Sediments Prior to Capping

Dredging activities in these Inner Waterway areas were not expected to reach clean native sediments. The dredged areas were subsequently capped consistent with the project design.

Following completion of remedial dredging within the Inner Waterway, samples of the remaining undredged subsurface sediments were collected to document the concentrations of contaminants in the sediments to be capped. Sampling locations are shown in Figure G2.

Results of testing are shown in Table G4-1. Analysis showed concentrations similar to previously measured values as documented in the Remedial Investigation/Feasibility Study (RETEC 2006) and in the Pre-Remedial Design Investigation Report (Anchor QEA 2010):

- Mercury concentrations ranged from 0.18 to 3.19 milligrams per kilogram (mg/kg).
- Concentrations of 2,4-dimethylphenol and/or 4-methylphenol exceeded sediment quality standard (SQS) values in four of the five samples.
- PAH concentrations were elevated in two of the five samples.
- Dioxin/furan (D/F) concentrations exceeded surface sediment regional background concentrations (15 ng /kg toxicity equivalent [TEQ]) in four of the five analyzed samples.

4.2 Outer Waterway Testing (Unit 1C)

Surface sediment was collected at six stations in Unit 1C, located adjacent to BST (Figure G2). Testing was performed during two monitoring events. The first event was conducted after completion of dredging, and prior to residuals management. The second event was conducted following completion of residuals management.

4.2.1 Un-dredged Sediments Following Dredging

Samples were collected by Van Veen sampler on February 4, 2016, at six locations in Unit 1C following the completion of dredging activities. These samples were collected prior to management of dredging residuals to verify that dredging had removed all of the contaminated sediments.

Samples of sediment retrieved in the Van Veen sampler were inspected and segregated vertically into the apparent dredging residuals layer (see Section 4.2.2) and the layer of apparent undredged material. This separation was conducted based on visual inspection of the sediment. Dredging residuals were identified as a thin layer of flocculent material. The underlying undredged materials were identified based on their color, texture, and density.

Results of testing of the undredged materials are summarized in Table G4-2. Results confirmed that dredging had reached the layer of clean sediments as defined in the EDR:

- Total solids concentrations ranged from 61% to 79%, compared to 36% to 48% for the overlying dredging residuals layer (see Table G4-3).
- Concentrations of mercury in all six samples were below the SQS (0.41 mg/kg), with concentrations ranging from 0.0088 to 0.19 mg/kg.
- Concentrations of D/F in all six samples were below natural background concentrations (4 ng TEQ/kg), with concentrations ranging from 0.17 to 2.7 nanograms per kilogram (ng/kg).

4.2.2 Post-Dredging Residuals

Samples of dredging residuals were collected using a Van Veen sampler from Unit 1C following the completion of dredging activities as described in Section 4.2.1. The dredging residuals were tested for their thickness and chemical composition to verify that these parameters did not exceed the values contemplated in the EDR. Results are summarized in Table G4-3.

The thickness of the dredging residuals layer was within the anticipated range. The thickness varied from 1 to 7 centimeters (cm) in depth, averaging 3.7 cm.

Chemical concentrations were within expected ranges. Mercury concentrations ranged from 0.75 to 2.3 mg/kg, averaging 1.5 mg/kg. The D/F concentrations ranged from 2.1 to 26.2 ng/kg, with an average of 15.1 ng TEQ/kg.

4.2.3 Surface Sediments Following Residuals Management

Following residuals management activities in Unit 1C (i.e., placement of sand cover materials to mix with the residuals), six surface sediment samples were collected at the testing locations shown in Figure G2.

Chemical testing was performed at six stations, and confirmational bioassay testing was performed at one station in compliance with the SQAPP. Results were used to verify that the final contaminant concentrations in surface sediments of Unit 1C complied with the cleanup levels and other expectations defined in the Consent Decree and EDR.

Results of chemical testing are summarized in Table G4-4.

- At five of six sampling locations, mercury testing results were below the SQS, with concentrations ranging from 0.03 to 0.33 mg/kg.
- At the sixth sampling location (station P1PM-05), the mercury concentration slightly exceeded the SQS (0.41 mg/kg), with a measured concentration of 0.65 mg/kg. Sediment from this station was recollected and analyzed for mercury. Results (0.66 mg/kg) were consistent with the original analysis. The recollected sample was analyzed for confirmational bioassay testing consistent with the SQAPP. Results of that testing are summarized in Tables G4-5 though G4-9. Results confirmed compliance with SQS interpretive criteria for biological testing.
- The average mercury concentration within Unit 1C was 0.22 mg/kg, which is very similar to the natural background concentration of mercury determined by Ecology for Puget Sound sediments (0.2 mg/kg).
- D/F concentrations in the six samples ranged from 0.93 to 16.3 ng TEQ/kg (Table G4-4). The average D/F concentration measured within Unit 1C was 3.9 ng TEQ/kg. This value was well below the regional background concentration of D/F (15 ng/kg) determined by Ecology for Bellingham Bay, and is consistent with the natural

background concentration of D/F determined by Ecology for Puget Sound sediments (15 ng TEQ/kg).

For additional details regarding the bioassay testing performed for station P1PM-05, refer to Tables G4-5 through G4-9. Testing was performed by Ramboll Environ in Port Gamble, Washington, on June 9, 2016. The tests were initiated on August 8, 2013, well within the 56-day holding time. The sediment was tested against a clean reference sample collected by Ramboll Environ from Carr Inlet. Test methods followed guidance provided by the Puget Sound Estuary Program (PSEP 1995), the Sediment Cleanup User's Manual II (Ecology 2015), and the various updates presented during the Sediment Management Annual Review Meeting. The following describes the tests and species used, along with key observations from data validation:

- **10-day amphipod mortality (*Eohaustorius estuaries*):** Water quality conditions were maintained to ensure optimal health of the organisms before and during testing. Temperature, dissolved oxygen, salinity, pH, ammonia, and sulfides were measured in the overlying water of one replicate test container per treatment on days 0 and 10. Temperature, dissolved oxygen, salinity, and pH were also measured daily. Temperature, dissolved oxygen, salinity, pH, ammonia, and sulfides were measured in the porewater from the bulk sediment prior to test initiation. Water quality parameters were within protocol-specified ranges with minor deviations in temperature and salinity. Given the lack of significant mortality observed in all test treatments, these deviations did not negatively affect test results. Interstitial bulk sediment values for ammonia-N ranged from 1.61 to 16.2 milligrams per liter (mg/L). Interstitial bulk sediment values for sulfide ranged from 0.06 to 1.26 mg/L. The test met the survival acceptability criteria specified in the test protocol with 4.0% mean control mortality. The reference toxicant test was conducted using potassium chloride resulting in a 96-hour median lethal concentration (LC50) of 155.0 mg/L. This reference toxicant test was within the control chart warning limit of 69.4 to 242.2 mg/L. No problems were found with the test organisms or the testing procedure, and it was concluded that the test developed fully acceptable data for use in management decisions.
- **20-day juvenile polychaete survival and growth (*Neanthes arenaceodentata*):** The test organisms were obtained from Aquatic Toxicology Support, Bremerton, Washington.

Testing was initiated on August 3, 2016, within the appropriate holding time. Water quality conditions were maintained to ensure optimal health of the test organisms before and during testing. Temperature, dissolved oxygen, salinity, pH, ammonia, and sulfides were measured in the overlying water of one replicate test container per treatment on days 0 and 20. Temperature, dissolved oxygen, salinity, and pH were also measured daily. Temperature, dissolved oxygen, salinity, pH, ammonia, and sulfides were measured in the porewater from the bulk sediment prior to test initiation. Water quality parameters were within acceptable limits. Interstitial bulk sediment values for ammonia-N ranged from less than 0.5 to 8.1 mg/L. Interstitial bulk sediment values for sulfide ranged from 0.02 to 1.26 mg/L. The test met the survival and weight acceptability criteria specified in the test protocol with 0% mean control mortality and a control individual mean ash-free dry weight of 0.781 mg per individual, exceeding the 0.72 mg per individual requirement. The reference toxicant test was conducted using potassium chloride. The reference toxicant (positive control) LC50 result was 130.8 mg/L. This reference toxicant test was within the control chart warning limit of 67.07 to 242.9 mg/L, and the test data were determined to be suitable for making management decisions.

- **48-hour benthic larval development (*Mytilus galloprovincialis*):** The test organisms were shipped to Ramboll Environ from Taylor Shellfish in Shelton, Washington. Testing was initiated on August 3, 2016, within the appropriate holding time. Water quality conditions were maintained to ensure optimal health of the organisms before and during testing. Temperature, dissolved oxygen, salinity, pH, ammonia, and sulfides were measured in the overlying water of one replicate test container per treatment on days 0 and 2. Temperature, dissolved oxygen, salinity, and pH were also measured daily. Water quality parameters were within protocol-specified ranges. Overlying water values for ammonia-N ranged from 0.01 to 0.267 mg/L. Overlying water values for sulfide ranged from 0.0 to 0.05 mg/L. The test met the survival acceptability criteria specified in the test protocol with 104.5 % mean control normal survival. Mean normal survival of the reference sediment was 93.8%, which meets the acceptability criteria of greater than or equal to 65%. A reference-toxicant test was conducted using potassium chloride resulting in a 96-hour median lethal concentration (LC50) of 4.73 mg/L. This reference toxicant test was within the control chart warning limit of 0.34 to 10.16 mg/L. No problems were found with the

test organisms or the testing procedure, and it was concluded that the test developed fully acceptable data for use in management decisions. Mean and percent survival and mean individual growth rate in the reference sediments were not significantly lower than those endpoints in the control sediment. Test sediment did not have a mean percent survival value or mean individual growth rate significantly lower than in the control or in the corresponding reference sediment.

5 POST-CONSTRUCTION TISSUE MONITORING

This section describes post-construction tissue monitoring performed in accordance with the SQAPP (Anchor QEA 2016). This monitoring was conducted during June and July 2016, and included the following activities:

- Testing of tissue mercury levels in adult Dungeness crabs *(Metacarcinus magister)* collected from the Site and from the Samish Bay clean reference area
- Testing of tissue mercury levels in juvenile Dungeness crabs collected from the Log Pond and from a clean reference area
- Testing of tissue mercury levels in caged clams, sediment, and porewater from locations within the Site and collection of corresponding data from the Samish Bay reference area

Locations of samples described in this section are presented in Figure G2 (Site samples) and Figure G3 (reference area samples).

5.1 Adult Crab

Adult crab were collected using crab traps deployed at three locations within the Site (Figure G2) and at two locations within the Samish Bay reference areas (Figure G3). Three adult male Dungeness crabs with a carapace width of 16.5 cm or greater were collected at each station. Two replicate samples for each station were created by homogenizing sternal plate, leg, and claw muscle tissue, resulting in a total of six composite samples from the Site and six composite samples from the Samish Bay reference area.

Table G5-1 summarizes the tissue monitoring data collected for adult crab for both the Site and the reference area stations. These results are discussed in Section 4 of the As-Built Report. As described in that report, tissue mercury levels detected in Site crab were well below those measured previously in 1991 and 1997. However, tissue levels remain slightly higher than those in crab collected from the Samish Bay reference area.

5.2 Juvenile Crab

Juvenile crab were collected using crab traps deployed along the shoreline of the Log Pond (Figure G2) and at a clean reference site located near Brant and Portage Islands (Figure G3).

Juvenile crab tissue from these locations was previously sampled for mercury concentrations during 2001, 2002, and 2005 after completion of the Log Pond Interim Action.

At each location, crab were collected by baited ring traps. Multiple crab were collected at each location and used to form two whole-body composite samples. Five replicate samples from each composite were submitted to the chemical testing laboratory for analysis of total solids, lipids, and mercury concentrations. The reference area was created from whole-body composites prior to analysis at the laboratory. Please see Table G5-2.

Mercury concentration data for the juvenile crab are summarized in Table G5-2. These results are discussed in Section 4 of the As-Built Report. Reference area tissue mercury concentrations (0.024 mg/kg wet weight) were within the range measured historically for the reference area (0.0199 to 0.0365 mg/kg wet weight). The average mercury concentration in crabs from the Log Pond was 0.031 mg/kg, approximately 30% higher than the 2016 reference area samples. However, it was within the range measured in 2005 for the Log Pond (0.0194 to 0.0375 mg/kg wet weight).

5.3 Caged Clams and Associated Testing

Monitoring activities included an in situ bioaccumulation testing using caged clams. Clams were placed at designated Site and reference area test locations. Co-located testing of mercury in porewater and sediment was performed in parallel with the tissue testing.

Five test stations were located within the Site (Figure G2) and five stations were located in the Samish Bay reference area (Figure G3). Two of the test stations established at the Site were located in Phase 1 construction areas, and three were located in Site areas being managed by monitored natural recovery. Sample collection, processing, and analysis were conducted in accordance with the methods described in the SQAPP (Anchor QEA 2016).

Three replicate cages (each containing 30 clams) were deployed at every station. Cages were buried 10 cm into the sediment surface and left in situ for 30 days in accordance with ASTM Method E2122-02. Following retrieval, clams were depurated for 24 hours. Soft body tissue

samples were then composited from each cage separately and then an overall station composite was created for analysis.

Porewater samples were collected from each station using nylon mesh diffusion samplers. These samplers were deployed using a 120 µm mesh size. Samplers were retrieved after 30 days of incubation. Porewater samples were analyzed for total and dissolved mercury.

Surface sediment samples were collected at each deployment area by diver. These samples were tested for total solids, total organic carbon, and total mercury.

Table G5-3 presents the mercury concentrations reported in clam tissue, porewater, and sediment by area type and station. Results of testing demonstrated comparable levels of mercury in clam tissues and porewater collected from the Site and reference areas, despite differences in sediment total mercury concentrations.

6 QUALITY ASSURANCE/QUALITY CONTROL

This section describes quality assurance/quality control (QA/QC) actions and procedures taken by Anchor QEA to ensure quality and usability of all data collected during the Project.

QA/QC requirements included the collection of field samples as well as laboratory testing. Field sampling activities were assessed by rinsate blanks and field duplicates. The quality of laboratory data was assessed by precision, accuracy, representativeness, comparability, completeness, and sensitivity. Chemical laboratory QA/QC samples included method blanks, laboratory control samples, matrix spike/matrix spike duplicates, and matrix duplicates. Toxicity laboratory QA/QC included negative and positive controls, water quality measurements, reference sediments, and reference toxicant tests.

6.1 Field Instruments

In accordance with the SQAPP (Anchor QEA 2016), standard instrument operation procedures were followed for all sampling activities. Field equipment, including all sampling devices and navigation equipment, was inspected for damage/wear by experienced field staff and maintained based on the manufacturer's recommendations and/or previous experience with the equipment.

6.2 Laboratory Instruments

Analytical instrument testing, inspection, maintenance, setup, and calibration was conducted by each laboratory in accordance with the requirements identified in the laboratory's standard operating procedures and manufacturer instructions. In addition, each of the specified analytical methods provides protocols for proper instrument setup, tuning, and critical operating parameters. Instrument maintenance and repair was documented in the maintenance log or record book.

6.3 Data Validation

All chemical and bioassay data were validated prior to use. Data validation reports for each analytical laboratory batch are identified in Table G6-1.

- Attachment A contains data validation reports for the chemical testing data. All chemical testing data generated by Anchor QEA as part of construction monitoring were validated prior to use. Stage 2B validation (U.S. Environmental Protection Agency 2009) was performed following National Functional Guidelines for data validation. Validation was performed by a third-party independent validation company and results were subject to a 10% backcheck of data for accuracy. All data was found to be valid and useable for all purposes.
- Attachment B contains the data validation report for the bioassay testing data. Bioassay data were validated by Anchor QEA against applicable Puget Sound Estuary Program guidance and applicable Ecology guidance.
- Attachment C (available on disk) contains copies of raw laboratory reports and chain of custody documentation.

7 REFERENCES

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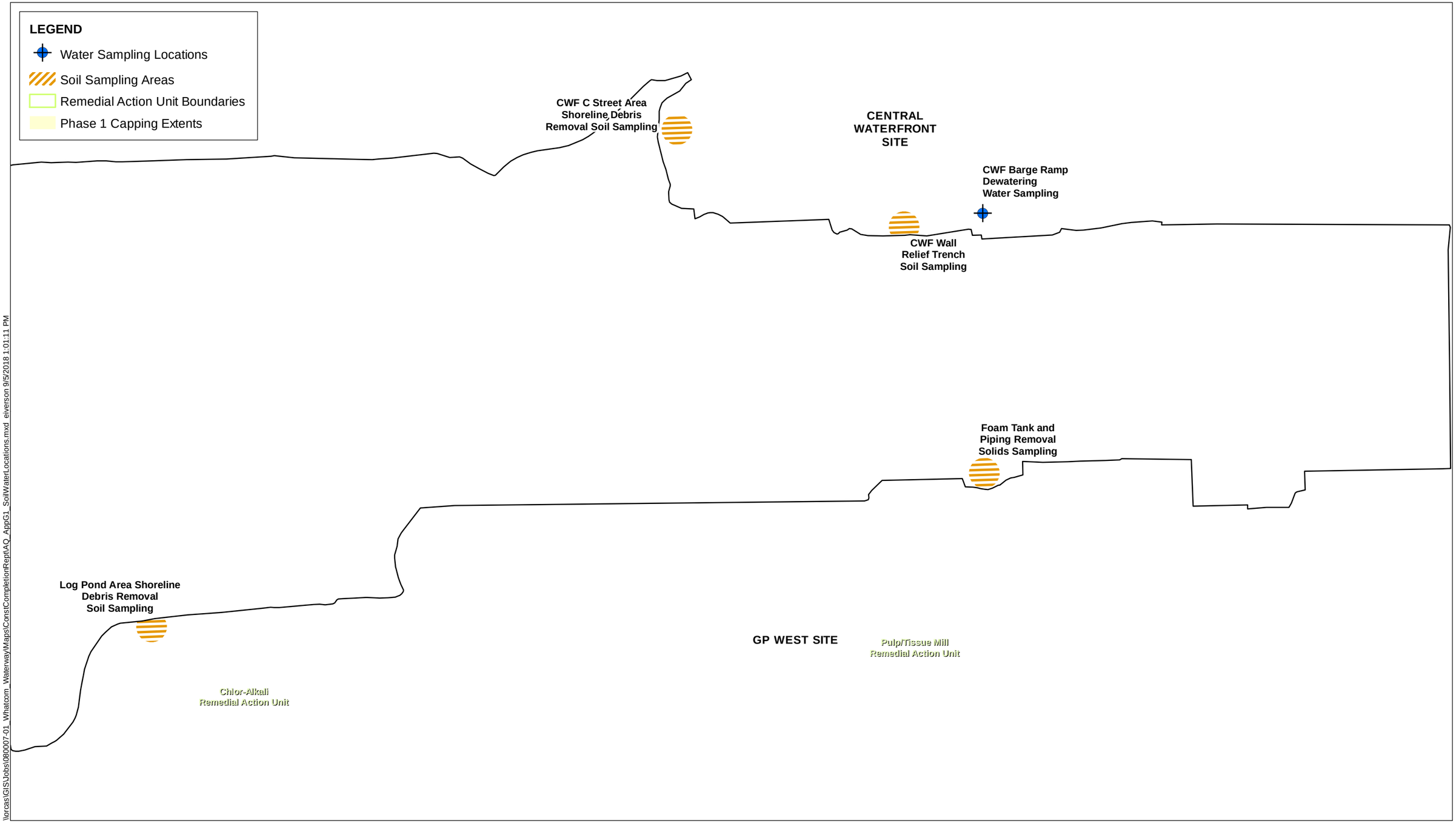
RETEC (The RETEC Group), 2006. Supplemental Remedial Investigation and Feasibility Study for the Whatcom Waterway Site. Prepared for the Port of Bellingham.

U.S. Environmental Protection Agency, 2009. Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use. EPA 540-R-08-005. January 2009.

FIGURES



NOTES:
1. Site units are shown based on those in Figure 2-3 Cleanup Action Plan, Whatcom Waterway Site, September 2007. Unit 9 boundary updated based on PRDI findings.
2. Soil sampling areas (hatches) are approximate in size and location.
3. CWF = Central Waterfront Site
4. Horizontal datum: Washington State Plane North, NAD 83 U.S. Survey Feet.
5. Aerial imagery from National Agriculture Imagery Program (NAIP), September 2, 2017.

0 75 150
Feet

Figure G1
Soil and Water Sampling Locations
Appendix G to the As-built Report
Whatcom Waterway Cleanup in Phase 1 Site Areas

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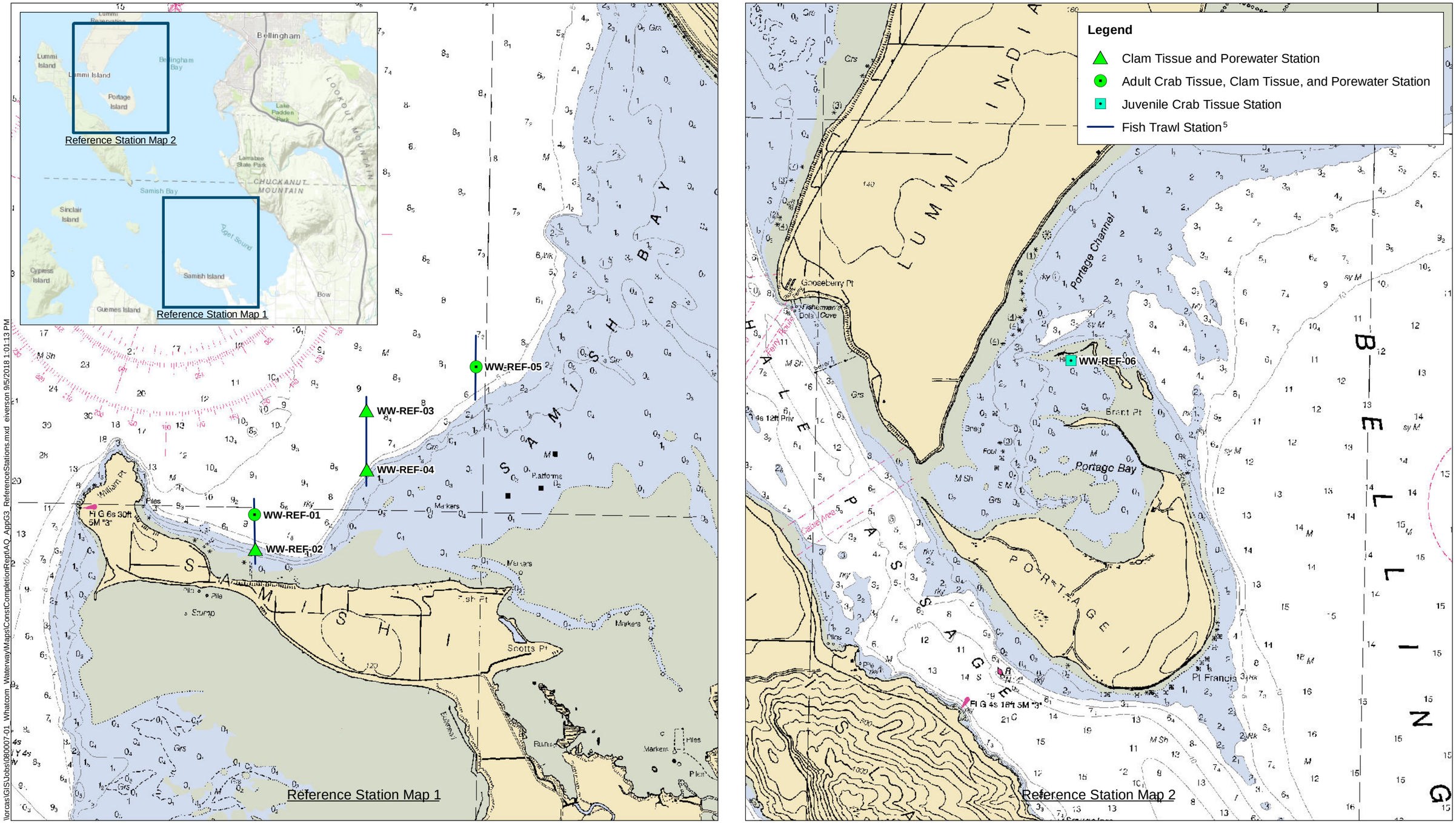
NOTES:
1. Site units are shown based on those in Figure 2-3 Cleanup Action Plan, Whatcom Waterway Site, September 2007. Unit 9 boundary updated based on PRDI findings.
2. Horizontal datum: Washington State Plane North, NAD 83 U.S. Survey Feet.
3. Aerial imagery from National Agriculture Imagery Program (NAIP), September 2, 2017.

0 200 400
Feet

ANCHOR QEA

Figure G2
Sediment and Tissue Environmental Monitoring Stations
Appendix G to the As-built Report
Whatcom Waterway Cleanup in Phase 1 Site Areas



NOTES:
1. Site units are shown based on those in Figure 2-3 Cleanup Action Plan, Whatcom Waterway Site, September 2007. Unit 9 boundary updated based on PRDI findings.
2. Fish trawl locations are approximate. Actual locations will be dependent upon abundances observed during the monitoring effort.
3. Crab station locations may be adjusted based on field conditions encountered.
4. Horizontal datum: Washington State Plane North, NAD 83 U.S. Survey Feet.
5. Vertical datum: Mean Lower Low Water (MLLW).

0 0.5 1 Miles

Figure G3
Reference Area Sampling Locations
Appendix G to the As-built Report
Whatcom Waterway Cleanup in Phase 1 Site Areas

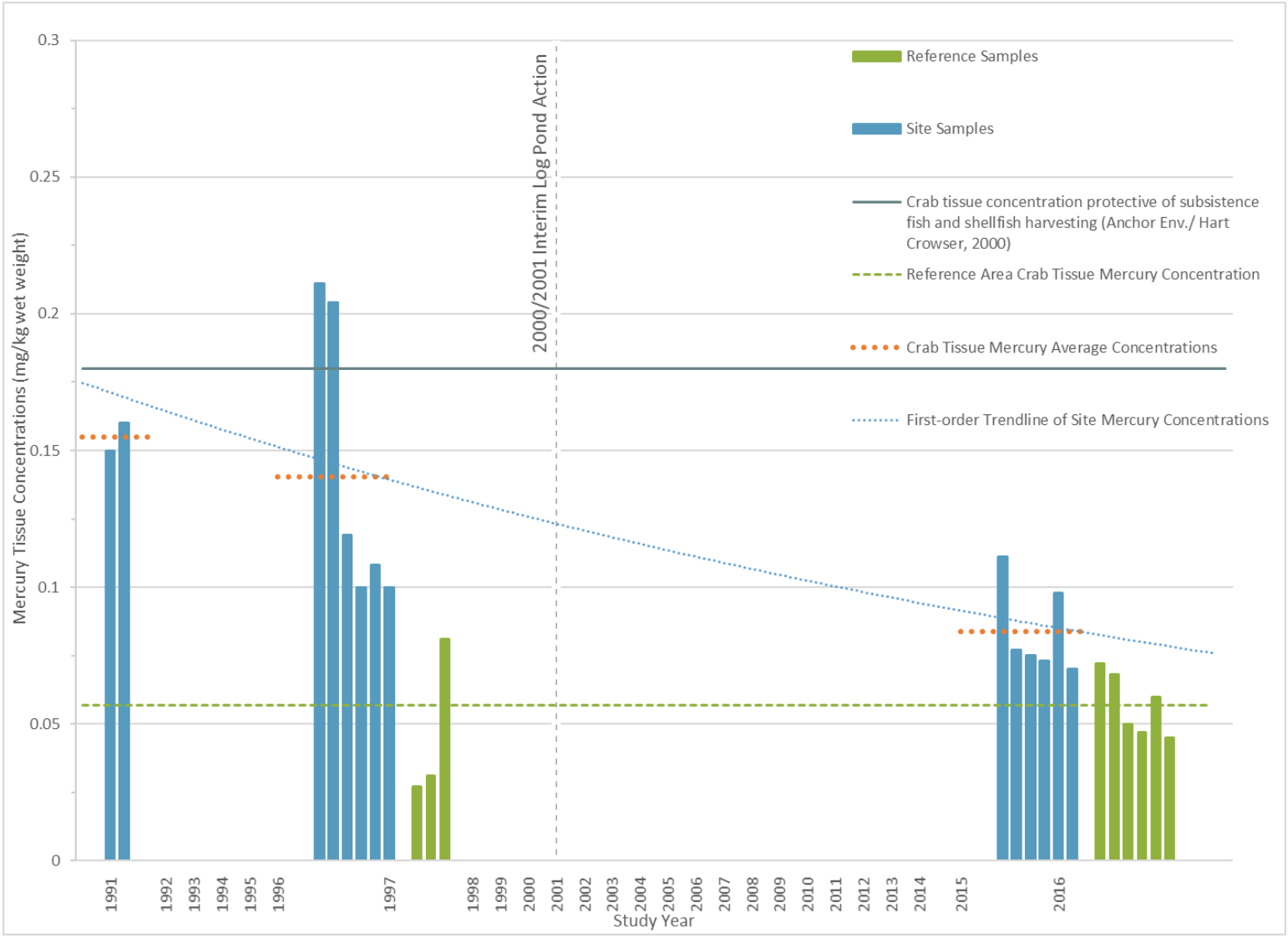
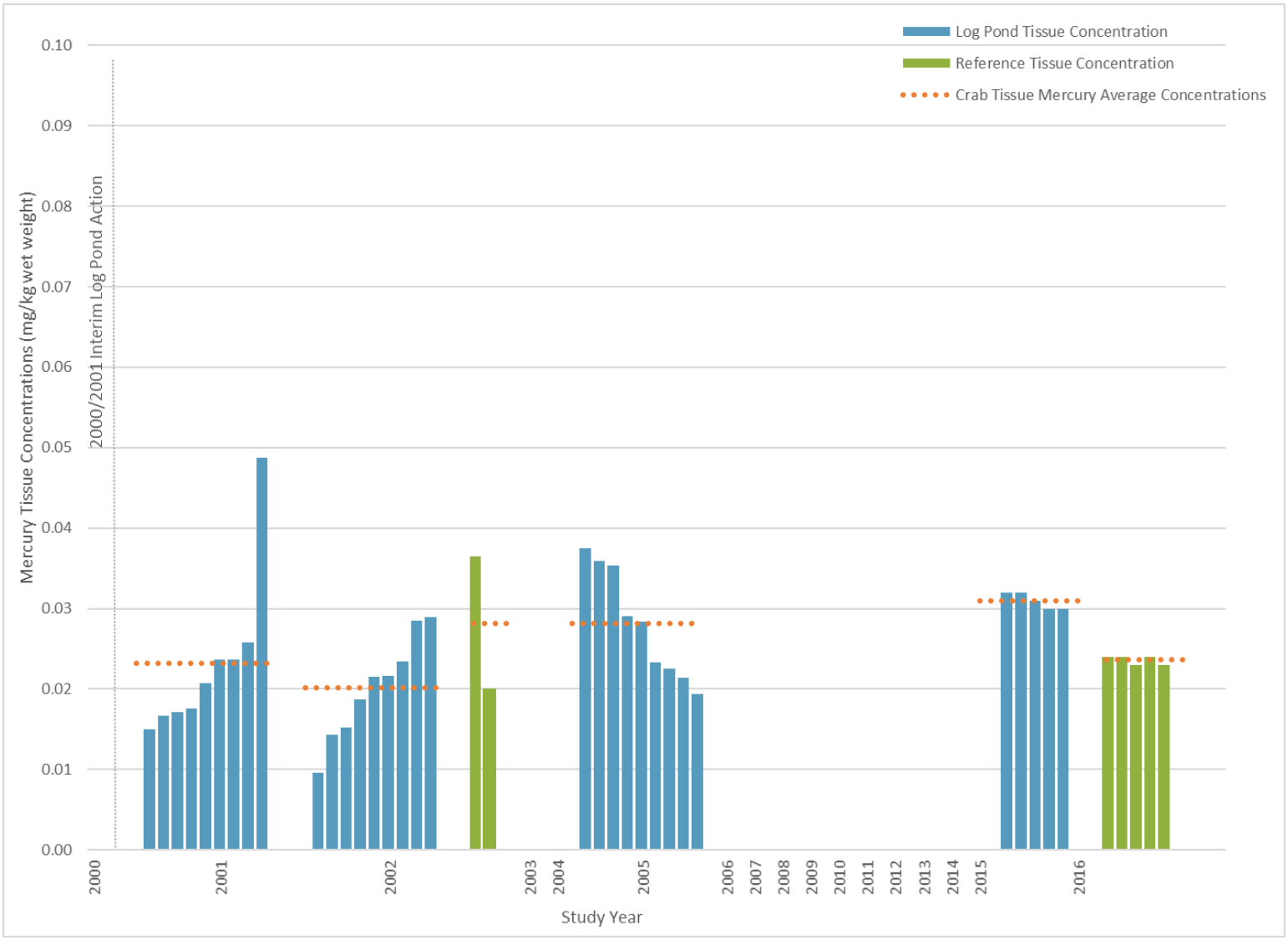


Figure G4
Mercury Concentrations in Adult Dungeness Crab Tissue
Appendix G to the As-Built Report
Whatcom Waterway Cleanup in Phase 1 Site Areas



ANCHOR QEA

Figure G5
Mercury Concentrations in Juvenile Dungeness Crab Tissue
Appendix G to the As-Built Report
Whatcom Waterway Cleanup in Phase 1 Site Areas

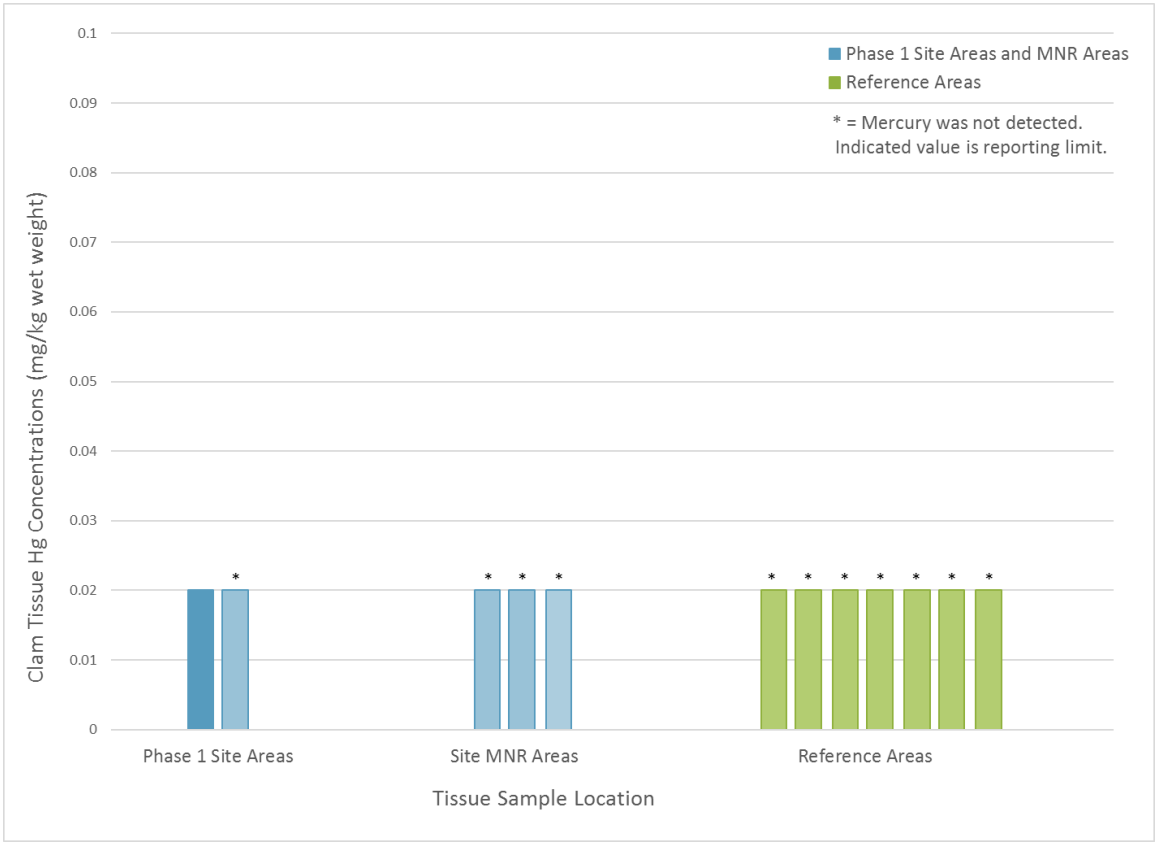


Figure 16a

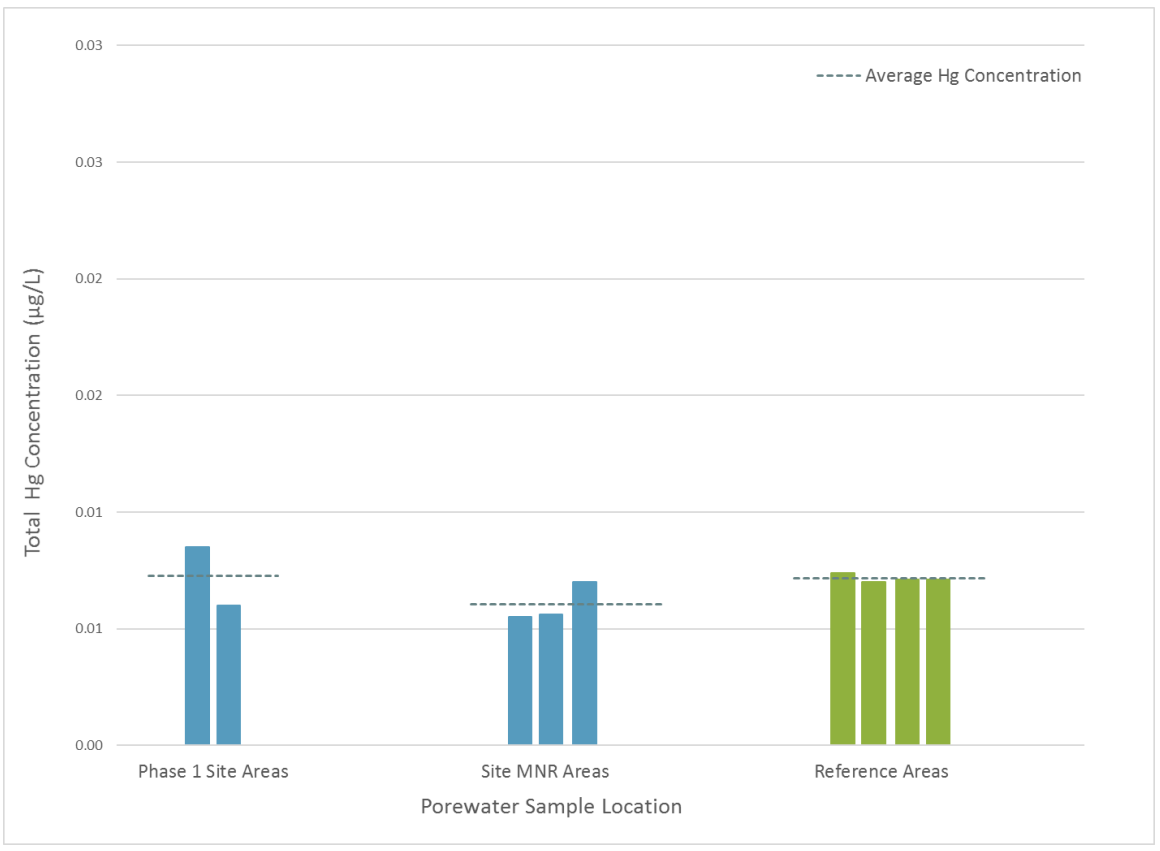


Figure 16b

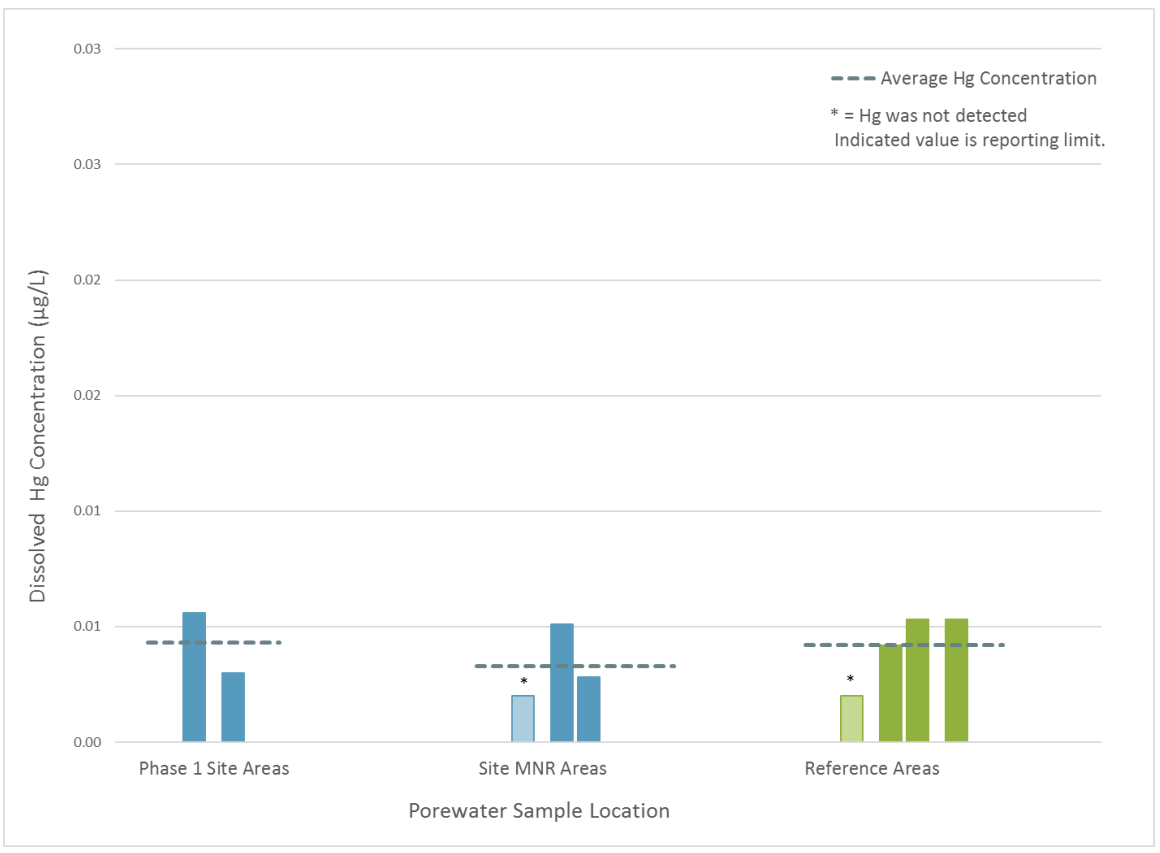


Figure 16c

TABLES

Table G2-1
Central Waterfront Relief Trench Soil Reused as Backfill

		Description	Soil Reused at the Central Waterfront Site
		Sample ID	WW-CWWR-151204
		Sample Date	12/4/2015
		Sample Type	N
		Matrix	SO
Parameter	**Test Method**	**GP West Cleanup Levels for Unsaturated Zone Soils**	
Total Petroleum Hydrocarbons (mg/kg)			
Diesel range hydrocarbons	NWTPHD	2000	**71**
Motor oil range hydrocarbons	NWTPHD	2000	**180**
Total Diesel and Oil (U = 0)	NWTPHD	2000	**251**

Notes:
Detected concentration is greater than WW_GP_West_UnsaturatedSoil screening level

Bold = Detected result

J = Estimated value
U = Compound analyzed, but not detected above detection limit
UJ = Compound analyzed, but not detected above estimated detection limit

ID = identification
kg = kilogram
mg = milligram

Table G2-2
Central Watefront Site C Street Area Soil Reused as Clarifier Subgrade Backfill

		Description	Initial Samples of Reusable Soils						Composite Sample	
		Sample ID	WW-CW-W-150807	WW-CW-W1-1-150819	WW-CW-W2-1-150819	WW-CWF-G1-151229	WW-CWF-G2-151229	WW-CWF-G3-151229	WW-CWF-G-COMP	WW-CWF-COMP1-151229
		Sample Date	8/7/2015	8/19/2015	8/19/2015	12/29/2015	12/29/2015	12/29/2015	12/29/2015	12/29/2015
		Sample Type	N	N	N	N	N	N	N	N
		Matrix	SO	SO	SO	SO	SO	SO	SO	SO
Parameter	**Test Method**	**GP West Cleanup Levels for Unsaturated Zone Soils**								
Conventional Parameters (pct)										
Total solids	SM2540G		--	--	--	--	--	--	--	**87.38**
Metals (mg/kg)										
Arsenic	SW6010C	20	--	--	--	--	--	--	**10**	--
Barium	SW6010C		--	--	--	--	--	--	**93.3 J**	--
Cadmium	SW6010C	1.2	--	--	--	--	--	--	**0.196 J**	--
Chromium	SW6010C	5200	--	--	--	--	--	--	**24.9**	--
Chromium VI	SW7196		--	--	--	--	--	--	--	0.454 UJ
Copper	SW6010C	36	--	--	--	--	--	--	**60.3 J**	--
Lead	SW6010C	250	--	--	--	--	--	--	**37**	--
Mercury	SW7471A	2	--	--	--	--	--	--	**0.23 J**	--
Nickel	SW6010C	48	--	--	--	--	--	--	**26 J**	--
Selenium	SW6010C	7.4	--	--	--	--	--	--	**2.5 J**	--
Silver	SW6010C	0.32	--	--	--	--	--	--	0.3 U	--
Zinc	SW6010C	100	--	--	--	--	--	--	**97 J**	--
Semivolatile Organics (µg/kg)										
1-Methylnaphthalene	SW8270D	35000	--	--	--	--	--	--	**200**	--
2-Methylnaphthalene	SW8270D	320000	--	--	--	--	--	--	**360**	--
Acenaphthene	SW8270D	5200	--	--	--	--	--	--	64 U	--
Acenaphthylene	SW8270D		--	--	--	--	--	--	**43 J**	--
Anthracene	SW8270D	71000	--	--	--	--	--	--	**56 J**	--
Benzo(a)anthracene	SW8270D	1400	--	--	--	--	--	--	**99**	--
Benzo(a)pyrene	SW8270D	140	--	--	--	--	--	--	**110**	--
Benzo(b,j,k)fluoranthenes	SW8270D		--	--	--	--	--	--	**220**	--
Benzo(g,h,i)perylene	SW8270D		--	--	--	--	--	--	**69**	--
Chrysene	SW8270D	2600	--	--	--	--	--	--	**160**	--
Dibenzo(a,h)anthracene	SW8270D	140	--	--	--	--	--	--	64 U	--
Dibenzofuran	SW8270D		--	--	--	--	--	--	**92**	--
Fluoranthene	SW8270D	52000	--	--	--	--	--	--	**280**	--
Fluorene	SW8270D	7400	--	--	--	--	--	--	**43 J**	--
Indeno(1,2,3-c,d)pyrene	SW8270D	1400	--	--	--	--	--	--	**55 J**	--
Naphthalene	SW8270D	32000	--	--	--	--	--	--	**290**	--
Phenanthrene	SW8270D		--	--	--	--	--	--	**320**	--
Pyrene	SW8270D	330000	--	--	--	--	--	--	**240**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		140							**149 J**	

Table G2-2
Central Watefront Site C Street Area Soil Reused as Clarifier Subgrade Backfill

		Description	Initial Samples of Reusable Soils						Composite Sample	
		Sample ID	WW-CW-W-150807	WW-CW-W1-1-150819	WW-CW-W2-1-150819	WW-CWF-G1-151229	WW-CWF-G2-151229	WW-CWF-G3-151229	WW-CWF-G-COMP	WW-CWF-COMP1-151229
		Sample Date	8/7/2015	8/19/2015	8/19/2015	12/29/2015	12/29/2015	12/29/2015	12/29/2015	12/29/2015
		Sample Type	N	N	N	N	N	N	N	N
		Matrix	SO	SO	SO	SO	SO	SO	SO	SO
Parameter	**Test Method**	**GP West Cleanup Levels for Unsaturated Zone Soils**								
Total Petroleum Hydrocarbons (mg/kg)										
Diesel range hydrocarbons	NWTPHD	2000	**52**	**48**	**50**	**57**	**98**	**65**	--	--
Motor oil range hydrocarbons	NWTPHD	2000	**120**	**81**	**260**	**130**	**180**	**160**	--	--
Total Diesel and Oil (U = 0)			**172**	**129**	**310**	**187**	**278**	**225**		

Notes:
Detected concentration is greater than WW_GP_West_UnsaturatedSoil screening level, but were within the range of existing contaminant concentrations in the clarifier area of the GP West Site.

Bold = Detected result

J = Estimated value
U = Compound analyzed, but not detected above detection limit
UJ = Compound analyzed, but not detected above estimated detection limit

cPAH = carcinogenic polycyclic aromatic hydrocarbon
GP West = Georgia-Pacific West, Inc.
ID = identification
kg = kilogram
mg = milligram
pct = percent
TEQ = toxic equivalents

Table G2-3
Barge Ramp Dewatering Water Managed by ASB Treatment

		Description	Testing Data for Barge Ramp Dewatering Water (Managed by ASB Treatment)
		Sample ID	WW-CW-BR-160115
		Sample Date	1/15/2016
		Sample Type	N
		Matrix	WST
Parameter	**Test Method**	**Central Waterfront Site RI Groundwater Screening Levels**	
Volatile Organics (µg/L)			
1,1,1,2-Tetrachloroethane	SW8260C	7.4	0.2 U
1,1,1-Trichloroethane	SW8260C	11000	0.2 U
1,1,2,2-Tetrachloroethane	SW8260C	4	0.2 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	SW8260C	1100	0.2 U
1,1,2-Trichloroethane	SW8260C	7.9	0.2 U
1,1-Dichloroethane	SW8260C	2300	0.2 U
1,1-Dichloroethene	SW8260C	3.2	0.2 U
1,1-Dichloropropene	SW8260C	-	0.2 U
1,2,3-Trichlorobenzene	SW8260C	-	0.5 UJ
1,2,3-Trichloropropane	SW8260C	-	0.5 U
1,2,4-Trichlorobenzene	SW8260C	0.48	0.5 UJ
1,2,4-Trimethylbenzene	SW8260C	24	**7.9**
1,2-Dibromo-3-chloropropane	SW8260C	-	0.5 U
1,2-Dichlorobenzene	SW8260C	6.1	0.2 U
1,2-Dichloroethane	SW8260C	4.2	0.2 U
1,2-Dichloroethene, cis-	SW8260C	160	0.2 U
1,2-Dichloroethene, trans-	SW8260C	130	0.2 U
1,2-Dichloropropane	SW8260C	15	0.2 U
1,3,5-Trimethylbenzene (Mesitylene)	SW8260C	25	**3**
1,3-Dichlorobenzene	SW8260C	960	0.2 U
1,3-Dichloropropane	SW8260C	-	0.2 U
1,3-Dichloropropene, cis-	SW8260C	-	0.2 U
1,3-Dichloropropene, trans-	SW8260C	-	0.2 U
1,4-Dichloro-2-butene, trans-	SW8260C	-	1 U
1,4-Dichlorobenzene	SW8260C	5	0.2 U
2,2-Dichloropropane	SW8260C	-	0.2 U
2-Chloroethylvinyl ether	SW8260C	-	1 U
2-Chlorotoluene	SW8260C	-	0.2 UJ
2-Hexanone (Methyl butyl ketone)	SW8260C	-	5 U
4-Chlorotoluene	SW8260C	-	0.2 U
4-Methyl-2-pentanone (Methyl isobutyl ketone)	SW8260C	11000	5 U
Acetone	SW8260C	-	5 U
Acrolein	SW8260C	20	5 U
Acrylonitrile	SW8260C	5	1 U
Benzene	SW8260C	2.4	**10**
Bromobenzene	SW8260C	-	0.2 U
Bromochloromethane	SW8260C	-	0.2 U
Bromodichloromethane	SW8260C	0.5	0.2 U
Bromoform (Tribromomethane)	SW8260C	140	0.2 U
Bromomethane (Methyl bromide)	SW8260C	13	1 U
Carbon disulfide	SW8260C	400	**0.2**
Carbon tetrachloride (Tetrachloromethane)	SW8260C	0.5	0.2 U
Chlorobenzene	SW8260C	100	0.2 U
Chloroethane	SW8260C	12	0.2 U
Chloroform	SW8260C	1.2	0.2 U
Chloromethane	SW8260C	5.2	**0.34 J**
Cymene, p- (4-Isopropyltoluene)	SW8260C	-	**0.35**
Dibromochloromethane	SW8260C	0.5	0.2 U
Dibromomethane	SW8260C	-	0.2 U
Dichloromethane (Methylene chloride)	SW8260C	94	1 U
Ethyl bromide (Bromoethane)	SW8260C	-	0.2 U
Ethylbenzene	SW8260C	2100	**26**
Ethylene dibromide (1,2-Dibromoethane)	SW8260C	2	0.2 U
Hexachlorobutadiene (Hexachloro-1,3-butadiene)	SW8260C	0.2	0.5 UJ
Isopropylbenzene (Cumene)	SW8260C	720	**5.7**
m,p-Xylene	SW8260C	-	**11**
Methyl ethyl ketone (2-Butanone)	SW8260C	350000	**8.6**
Methyl iodide (Iodomethane)	SW8260C	-	1 U
Naphthalene	SW8260C	83	**350 J**
n-Butylbenzene	SW8260C	-	**1.6 J**
n-Propylbenzene	SW8260C	-	**15**
o-Xylene	SW8260C	440	**3**
sec-Butylbenzene	SW8260C	-	**1.4**
Styrene	SW8260C	78	0.2 U

Table G2-3
Barge Ramp Dewatering Water Managed by ASB Treatment

		Description	Testing Data for Barge Ramp Dewatering Water (Managed by ASB Treatment)
		Sample ID	WW-CW-BR-160115
		Sample Date	1/15/2016
		Sample Type	N
		Matrix	WST
Parameter	**Test Method**	**Central Waterfront Site RI Groundwater Screening Levels**	
tert-Butylbenzene	SW8260C	-	**0.11 J**
Tetrachloroethene (PCE)	SW8260C	3.3	0.2 U
Toluene	SW8260C	7300	**3.1**
Trichloroethene (TCE)	SW8260C	1.6	0.2 U
Trichlorofluoromethane (Fluorotrichloromethane)	SW8260C	120	0.2 U
Vinyl acetate	SW8260C	7800	0.2 U
Vinyl chloride	SW8260C	0.5	0.2 U
Total Petroleum Hydrocarbons (mg/L)			
Gasoline range hydrocarbons	NWTPHG	0.8	**2.5**
Diesel range hydrocarbons	NWTPHD	0.5	**1.5**
Motor oil range hydrocarbons	NWTPHD	0.5	**1.4**
Total Diesel, and Oil (U = 0)		0.8	**5.4**

Notes:

Detected concentration is greater than the groundwater screening levels from the draft Central Waterfront Remedial Investigation

Bold = Detected result

J = Estimated value
U = Compound analyzed, but not detected above detection limit
UJ = Compound analyzed, but not detected above estimated detection limit

µg = microgram
ASB = aerated stabilization basin
ID = identification
L = liter
mg = milligram
RI = Remedial Investigation

Table G2-4
Stormwater/Wastewater Solids
Removed from Foam Tank and Associated Piping

			Testing Data for Wastewater Solids (Managed by Landfill Disposal)	
		Description		
		Sample ID	WW-FMTK-S02-160105-160307	WW-FMTK-SO1-160105
		Sample Date	3/7/2016	1/5/2016
		Sample Type	N	N
		Matrix	SO	SO
Parameter	**Test Method**	**GP West Cleanup Levels for Unsaturated Soils**		
Conventional Parameters (pct)				
Total organic carbon	Plumb 1981		**26.2**	--
Total solids	SM2540G		**38.84**	--
Metals (mg/kg)				
Arsenic	SW6010C	20	**20**	**40**
Barium	SW6010C		**470**	**46**
Cadmium	SW6010C	1.2	**3.3**	**0.37 J**
Chromium	SW6010C	5200	**101 J**	**306 J**
Lead	SW6010C	250	**55**	**340 J**
Mercury	SW7471A	2	**1**	**6.8**
Selenium	SW6010C	7.4	**4 J**	**6 J**
Silver	SW6010C	0.32	**0.28 J**	**1.4 J**
Metals (SW1311) (µg/L)				
Arsenic	SW6010C		200 U	200 U
Barium	SW6010C		**670**	**480**
Cadmium	SW6010C		10 U	10 U
Chromium	SW6010C		20 U	20 U
Lead	SW6010C		100 U	100 U
Mercury	SW7470A		0.1 U	0.1 U
Selenium	SW6010C		200 U	200 U
Silver	SW6010C		20 U	20 U
Semivolatile Organics (µg/kg)				
1,2,4-Trichlorobenzene	SW8270D		--	19 U
1,2-Dichlorobenzene	SW8270D		--	19 U
1,3-Dichlorobenzene	SW8270D		--	19 U
1,4-Dichlorobenzene	SW8270D		--	19 U
1-Methylnaphthalene	SW8270D	35000	--	**120**
2,2'-Oxybis (1-chloropropane)	SW8270D		--	19 U
2,4,5-Trichlorophenol	SW8270D		--	97 U
2,4,6-Trichlorophenol	SW8270D		--	97 U
2,4-Dichlorophenol	SW8270D		--	97 U
2,4-Dimethylphenol	SW8270D		--	97 U
2,4-Dinitrophenol	SW8270D		--	190 UJ
2,4-Dinitrotoluene	SW8270D		--	97 U
2,6-Dinitrotoluene	SW8270D		--	97 U
2-Chloronaphthalene	SW8270D		--	19 U
2-Chlorophenol	SW8270D		--	19 U
2-Methylnaphthalene	SW8270D	320000	--	**130**
2-Methylphenol (o-Cresol)	SW8270D		--	**14 J**
2-Nitroaniline	SW8270D		--	97 U
2-Nitrophenol	SW8270D		--	19 U
3,3'-Dichlorobenzidine	SW8270D		--	97 UJ
3-Nitroaniline	SW8270D		--	97 U
4-Bromophenyl-phenyl ether	SW8270D		--	19 U
4-Chloro-3-methylphenol	SW8270D		--	97 U
4-Chloroaniline	SW8270D		--	97 U
4-Chlorophenyl phenyl ether	SW8270D		--	19 U
4-Methylphenol (p-Cresol)	SW8270D		--	**24**
4-Nitroaniline	SW8270D		--	97 U
4-Nitrophenol	SW8270D		--	97 U
Acenaphthene	SW8270D	5200	--	**640**
Acenaphthylene	SW8270D		--	**92**
Anthracene	SW8270D	71000	--	**350**
Benzo(a)anthracene	SW8270D	1400	--	**590**
Benzo(a)pyrene	SW8270D	140	--	**460**
Benzo(b,j,k)fluoranthenes	SW8270D		--	**1200**
Benzo(g,h,i)perylene	SW8270D		--	**160**
Benzoic acid	SW8270D		--	**150 J**
Benzyl alcohol	SW8270D		--	19 UJ
bis(2-Chloroethoxy)methane	SW8270D		--	19 U
bis(2-Chloroethyl)ether	SW8270D		--	19 U
bis(2-Ethylhexyl)phthalate	SW8270D		--	**790**
Butylbenzyl phthalate	SW8270D		--	19 U
Carbazole	SW8270D		--	**100**
Chrysene	SW8270D	2600	--	**1100**
Dibenzo(a,h)anthracene	SW8270D	140	--	**75**
Dibenzofuran	SW8270D		--	**440**
Diethyl phthalate	SW8270D		--	19 U
Dimethyl phthalate	SW8270D		--	**72**

Table G2-4
Stormwater/Wastewater Solids
Removed from Foam Tank and Associated Piping

			Testing Data for Wastewater Solids (Managed by Landfill Disposal)	
		Description		
		Sample ID	WW-FMTK-S02-160105-160307	WW-FMTK-SO1-160105
		Sample Date	3/7/2016	1/5/2016
		Sample Type	N	N
		Matrix	SO	SO
Parameter	**Test Method**	**GP West Cleanup Levels for Unsaturated Soils**		
Di-n-butyl phthalate	SW8270D		--	19 U
Dinitro-o-cresol (4,6-Dinitro-2-methylphenol)	SW8270D		--	190 U
Di-n-octyl phthalate	SW8270D		--	19 U
Fluoranthene	SW8270D	52000	--	**1500**
Fluorene	SW8270D	7400	--	**450 J**
Hexachlorobenzene	SW8270D		--	19 U
Hexachlorobutadiene (Hexachloro-1,3-butadie	SW8270D		--	19 U
Hexachlorocyclopentadiene	SW8270D		--	97 U
Hexachloroethane	SW8270D		--	19 U
Indeno(1,2,3-c,d)pyrene	SW8270D	1400	--	**160**
Isophorone	SW8270D		--	19 U
Naphthalene	SW8270D	32000	--	**670**
Nitrobenzene	SW8270D		--	19 U
n-Nitrosodi-n-propylamine	SW8270D		--	19 U
n-Nitrosodiphenylamine	SW8270D		--	19 U
Pentachlorophenol	SW8270D		--	**84 J**
Phenanthrene	SW8270D		--	**890**
Phenol	SW8270D		--	**24**
Pyrene	SW8270D	330000	--	**2500**
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		140		**673.5**

Notes:
Detected concentration is greater than WW_GP_West_UnsaturatedSoil screening level

Bold = Detected result

J = Estimated value
U = Compound analyzed, but not detected above detection limit
UJ = Compound analyzed, but not detected above estimated detection limit

µg = microgram
cPAH = carcinogenic polycyclic aromatic hydrocarbon
GP West = Georgia-Pacific West, Inc.
ID = identification
kg = kilogram
L = liter
mg = milligram
pct = percent
TEQ = toxic equivalents

Table G2-5
Log Pond Shoreline Cutback Soil Reused as Clarifier Subgrade Backfill

			Testing Data for Log Pond Shoreline Cutback Soil (Reused as Clarifier Subgrade Backfill)	
		Description		
		Sample ID	WW-LP-COMP1-151229	WW-LP-151204
		Sample Date	12/29/2015	12/4/2015
		Sample Type	N	N
		Matrix	SO	SO
Parameter	**Test Method**	**GP West Cleanup Levels for Unsaturated Soils**		
Metals (mg/kg)				
Arsenic	SW6010C	20	**8.5 J**	10 U
Barium	SW6010C		**60.4 J**	**79.1**
Cadmium	SW6010C	1.2	**0.366 J**	0.5 U
Chromium	SW6010C	5200	**27 J**	**30**
Lead	SW6010C	250	**11**	**26 J**
Mercury	SW7471A	2	**0.28 J**	**1.39 J**
Selenium	SW6010C	7.4	**2 J**	10 U
Silver	SW6010C	0.32	0.8 U	0.8 U
Semivolatile Organics (µg/kg)				
2-Methylnaphthalene	SW8270D	320000	**5.4 J**	--
Acenaphthene	SW8270D	5200	18 U	--
Acenaphthylene	SW8270D		18 U	--
Anthracene	SW8270D	71000	18 U	--
Benzo(a)anthracene	SW8270D	1400	**14 J**	--
Benzo(a)pyrene	SW8270D	140	**12 J**	--
Benzo(b,j,k)fluoranthenes	SW8270D		**36**	--
Benzo(g,h,i)perylene	SW8270D		**20**	--
Chrysene	SW8270D	2600	**40**	--
Dibenzo(a,h)anthracene	SW8270D	140	18 U	--
Fluoranthene	SW8270D	52000	**42**	--
Fluorene	SW8270D	7400	18 U	--
Indeno(1,2,3-c,d)pyrene	SW8270D	1400	**11 J**	--
Naphthalene	SW8270D	32000	**9.8 J**	--
Phenanthrene	SW8270D		**27**	--
Pyrene	SW8270D	330000	**36**	--
Total cPAH TEQ (7 minimum CAEPA 2005) (U = 0)		140	**18.5 J**	
Total Petroleum Hydrocarbons (mg/kg)				
Diesel range hydrocarbons	NWTPHD	2000	**8.4**	--
Motor oil range hydrocarbons	NWTPHD	2000	**94**	--

Notes:

Detected concentration is greater than WW_GP_West_UnsaturatedSoil screening level

Bold = Detected result

J = Estimated value
U = Compound analyzed, but not detected above detection limit

µg = microgram
cPAH = carcinogenic polycyclic aromatic hydrocarbon
GP West = Georgia-Pacific West, Inc.
ID = identification
kg = kilogram
mg = milligram
TEQ = toxic equivalents

Table G3-1
Summary of Cap Material Testing Data

Parameter	Contract-Specified Maximum Level	Contractor-Provided Testing Data				Supplemental Testing Data		
		Sample ID	Backfill Material 10/28/2014	Backfill Material 11/13/2014	Sandy Fill/Cover Material 4/21/2015	Sample ID	S-02-150819-A	S-02-150819-D
		Sample Date	N	N	N	Sample Date	8/19/2015	8/19/2015
		Sample Type	SO	SO	SO	Sample Type	N	N
		Matrix				Matrix	SO	SO
		Test Method				Test Method		
Metals (mg/kg)						--	--	--
Arsenic	57	SW6020B	**3.2**	--	--	--	--	--
Cadmium	5.1	SW6020B	0.50 U	--	--	--	--	--
Chromium	260	SW6020B	**17**	--	--	--	--	--
Copper	390	SW6020B	**34**	--	--	--	--	--
Lead	450	SW6020B	**3.6**	--	--	--	--	--
Mercury	0.1	SW7471B	**0.028**	--	--	--	--	--
Silver	6.1	SW6020B	0.50 U	--	--	--	--	--
Zinc	410	SW6020B	**72**	--	--	--	--	--
Semivolatile Organics (µg/kg)						--	--	--
1,2,4-Trichlorobenzene	31	SW8270D	100 U	--	--	SW8270DSIM	4.7 U	4.7 U
1,2-Dichlorobenzene	35	SW8270D	100 U	--	--	SW8270DSIM	**1.7 J**	4.7 U
1,4-Dichlorobenzene	110	SW8270D	100 U	--	--	SW8270DSIM	**1.9 J**	4.7 U
2,4-Dimethylphenol	29	SW8270D	100 U	24 U	--	SW8270DSIM	24 U	24 U
2-Methylnaphthalene	670	SW8270D	250 U	--	--	SW8270D	19 U	19 U
2-Methylphenol (o-Cresol)	63	SW8270D	100 U	--	--	SW8270DSIM	4.7 U	4.7 U
4-Methylphenol (p-Cresol)	670	SW8270D	--	--	--	SW8270DSIM	4.7 U	4.7 U
Acenaphthene	500	SW8270D	100 U	--	--	SW8270D	19 U	19 U
Acenaphthylene	560	SW8270D	100 U	--	--	SW8270D	19 U	19 U
Anthracene	960	SW8270D	100 U	--	--	SW8270D	19 U	19 U
Benzo(a)anthracene	1300	SW8270D	100 U	--	--	SW8270D	19 U	19 U
Benzo(a)pyrene	1600	SW8270D	100 U	--	--	SW8270D	19 U	19 U
Benzo(b,j,k)fluoranthenes			--	--	--	SW8270D	38 U	38 U
Benzo(g,h,i)perylene	670	SW8270D	100 U	--	--	SW8270D	**7.6 J**	19 U
Benzoic acid	650	SW8270D	1000 U	190 U	--	SW8270D	190 U	190 U
Benzyl alcohol	57	SW8270D	100 U	--	--	SW8270D	19 U	19 U
bis(2-Ethylhexyl)phthalate	1300	SW8270D	100 U	--	--	SW8270D	47 U	47 U
Butylbenzyl phthalate	63	SW8270D	100 U	--	--	SW8270DSIM	**2.4 J**	4.7 U
Chrysene	1400	SW8270D	100 U	--	--	SW8270D	**5.7 J**	19 U
Dibenzo(a,h)anthracene	230	SW8270D	100 U	--	--	SW8270D	19 U	19 U
Dibenzofuran	540	SW8270D	100 U	--	--	SW8270D	19 U	19 U
Diethyl phthalate	200	SW8270D	100 U	--	--	SW8270D	30 U	45 U
Dimethyl phthalate	71	SW8270D	100 U	--	--	SW8270DSIM	**3.1 J**	**2.3 J**
Di-n-butyl phthalate	1400	SW8270D	100 U	--	--	SW8270D	**11 J**	**8.5 J**
Di-n-octyl phthalate	6200	SW8270D	100 U	--	--	SW8270D	19 U	19 U
Fluoranthene	1700	SW8270D	100 U	--	--	SW8270D	19 U	19 U
Fluorene	540	SW8270D	100 U	--	--	SW8270D	19 U	19 U
Indeno(1,2,3-c,d)pyrene	600	SW8270D	100 U	--	--	SW8270D	19 U	19 U
Naphthalene	2100	SW8270D	100 U	--	--	SW8270D	19 U	19 U
n-Nitrosodiphenylamine	28	SW8270D	100 U	--	--	SW8270DSIM	4.7 U	4.7 U
Pentachlorophenol	400	SW8270D	500 U	--	--	SW8270D	95 U	94 U
Phenanthrene	1500	SW8270D	100 U	--	--	SW8270D	**11 J**	**12 J**
Phenol	420	SW8270D	100 U	--	--	SW8270D	**12 J**	19 U
Pyrene	2600	SW8270D	100 U	--	--	SW8270D	19 U	19 U
Total Benzofluoranthenes (U = 0)	3200		--	--	--		38 U	38 U
Total HPAH (9 of 16) (U = 0)	12000		--	--	--		**13.3 J**	38 U
Total LPAH (7 of 16) (U = 0)	5200		--	--	--		**11 J**	**12 J**
Pesticides (µg/kg)			--	--	--	--	--	--
Hexachlorobenzene	22	SW8081B	100 U	--	--	--	--	--
Hexachlorobutadiene	11	SW8081B	10 U	--	--	--	--	--
PCB Aroclors (µg/kg)			--	--	--	--	--	--
Aroclor 1016		SW8082A	100 U	--	--	--	--	--
Aroclor 1221		SW8082A	100 U	--	--	--	--	--
Aroclor 1232		SW8082A	100 U	--	--	--	--	--
Aroclor 1242		SW8082A	100 U	--	--	--	--	--
Aroclor 1248		SW8082A	100 U	--	--	--	--	--
Aroclor 1254		SW8082A	100 U	--	--	--	--	--
Aroclor 1260		SW8082A	100 U	--	--	--	--	--
Total PCB Aroclors (U = 0)	130	130	--	--	--	--	--	--
Dioxins and Furans (ng/kg)						--	--	--
Total 2,3,7,8-TCDD TEQ (ND=0)	1 ng/kg TEQ	SW8315	--	--	0.01	--	--	--
Total 2,3,7,8-TCDD TEQ (ND=1/2 EDL)	1 ng/kg TEQ	SW8316	--	--	0.11	--	--	--

Notes:

Non-detected concentration is above one or more identified screening levels

Bold = Detected result

J = Estimated value
U = Compound analyzed, but not detected above detection limit

µg = microgram
PCB = polychlorinated biphenyl
ID = identification
kg = kilogram
mg = milligram
TEQ = toxic equivalents
ng = nanogram
HPAH = high molecular weight polycyclic aromatic hydrocarbon
LPAH = low molecular weight polycyclic aromatic hydrocarbon

Table G4-1
Inner Waterway Post-Dredge Samples in Areas Subsequently Capped

				Data Set	Inner Waterway Subsurface Sediments Following Completion of Dredging and Prior to Capping				
				Location ID	WW-P1PM-07_20160113	WW-P1PM-08_20160113	WW-P1PM-09_20160113	WW-P1PM-10_20160113	WW-P1PM-11_20151023
				Sample ID	WW-P1PM-07-UD-20160113	WW-P1PM-08-UD-20160113	WW-P1PM-09-UD-20160113	WW-P1PM-10-UD-20160113	WW-P1PM-11-UD-20151023
				Sample Date	1/13/2016	1/13/2016	1/13/2016	1/13/2016	10/23/2015
				Depth	2 - 13 cm	2 - 11 cm	2 - 12 cm	2 - 13 cm	2 - 13 cm
				Sample Type	N	N	N	N	N
				Matrix	SE	SE	SE	SE	SE
				X	1241513	1241349	1241145	1241713	1241568
				Y	642835	642984	642795	643030	643180
		SQS	Other Reference Values						
Conventional Parameters (pct)									
Total organic carbon	Plumb 1981				**104**	**5.1**	**6.4**	**7.4**	**0.6 J**
Total solids	SM2540G				**30.2**	**42.7**	**33.4**	**36.0**	**66.9**
Metals (mg/kg)									
Copper	E200.8	390			**92 J**	**77 J**	**80 J**	**111 J**	**47.5**
Mercury	SW7471A	0.41	1.2 (BSL)		**3.19**	**1.66**	**1.88**	**2.19**	**0.18 J**
Zinc	E200.8	410			**240**	**172**	**180**	**200**	**82**
Semivolatile Organics (µg/kg)									
2,4-Dimethylphenol	SW8270D	29			490 U	97 U	99 U	**110**	96 UJ
2,4-Dimethylphenol	SW8270DSIM	29			**77 J**	**37**	**21 J**	**120**	24 UJ
2-Methylnaphthalene	SW8270D				**1200**	**620**	**400**	**3900**	**70**
2-Methylphenol (o-Cresol)	SW8270D	63			99 U	**14 J**	**22**	**84**	19 U
4-Methylphenol (p-Cresol)	SW8270D	670			**14000**	**3400**	**6000**	**8100**	**210**
Acenaphthene	SW8270D				**800**	**590**	**330**	**6700**	**45**
Acenaphthylene	SW8270D				**250**	**77**	**60**	**240**	**14 J**
Anthracene	SW8270D				**470**	**390**	**560**	**3200**	**25**
Benzo(a)anthracene	SW8270D				**440**	**380**	**360**	**3200**	**45**
Benzo(a)pyrene	SW8270D				**240**	**240**	**250**	**1300**	**30**
Benzo(b,j,k)fluoranthenes	SW8270D				**680**	**580**	**590**	**3600**	**83**
Benzo(g,h,i)perylene	SW8270D				**260**	**170**	**140**	**390**	**28**
Chrysene	SW8270D				**700**	**530**	**580**	**3800**	**59**
Dibenzo(a,h)anthracene	SW8270D				**64 J**	**48**	**54**	**210**	19 U
Fluoranthene	SW8270D				**2100**	**1500**	**1000**	**15000**	**150**
Fluorene	SW8270D				**670 J**	**630 J**	**470 J**	**6900 J**	**49**
Indeno(1,2,3-c,d)pyrene	SW8270D				**150**	**130**	**110**	**370**	**17 J**
Naphthalene	SW8270D				**6700**	**1900**	**730**	**8400**	**110**
Pentachlorophenol	SW8270D	360			**320 J**	**73 J**	**52 J**	**130**	96 UJ
Phenanthrene	SW8270D				**3400**	**2200**	**1400**	**24000**	**200**
Phenol	SW8270D	420			**450**	**180**	**180**	**390**	**34**
Pyrene	SW8270D				**2900**	**1300**	**1700**	**11000**	**120**
Semivolatile Organics (mg/kg-OC)									
2-Methylnaphthalene	SW8270D	38			**18**	**12**	**6**	**53**	**11**
Acenaphthene	SW8270D	16			**12**	**12**	**5**	**91**	**7**
Acenaphthylene	SW8270D	66			**4**	**2**	**1**	**3**	**2 J**
Anthracene	SW8270D	220			**7**	**8**	**9**	**43**	**4**
Benzo(a)anthracene	SW8270D	110			**7**	**7**	**6**	**43**	**7**
Benzo(a)pyrene	SW8270D	99			**4**	**5**	**4**	**18**	**5**

Table G4-1
Inner Waterway Post-Dredge Samples in Areas Subsequently Capped

				Data Set	Inner Waterway Subsurface Sediments Following Completion of Dredging and Prior to Capping				
				Location ID	WW-P1PM-07_20160113	WW-P1PM-08_20160113	WW-P1PM-09_20160113	WW-P1PM-10_20160113	WW-P1PM-11_20151023
				Sample ID	WW-P1PM-07-UD-20160113	WW-P1PM-08-UD-20160113	WW-P1PM-09-UD-20160113	WW-P1PM-10-UD-20160113	WW-P1PM-11-UD-20151023
				Sample Date	1/13/2016	1/13/2016	1/13/2016	1/13/2016	10/23/2015
				Depth	2 - 13 cm	2 - 11 cm	2 - 12 cm	2 - 13 cm	2 - 13 cm
				Sample Type	N	N	N	N	N
				Matrix	SE	SE	SE	SE	SE
				X	1241513	1241349	1241145	1241713	1241568
				Y	642835	642984	642795	643030	643180
		SQS	Other Reference Values						
Benzo(g,h,i)perylene	SW8270D	31		4	3	2	5	4
Chrysene	SW8270D	110		10	10	9	52	9
Dibenzo(a,h)anthracene	SW8270D	12		1 J	1	1	3	3 U
Fluoranthene	SW8270D	160		31	29	16	203	24
Fluorene	SW8270D	23		10 J	12 J	7 J	94 J	8
Indeno(1,2,3-c,d)pyrene	SW8270D	34		2	3	2	5	3 J
Naphthalene	SW8270D	99		99	37	11	114	18
Phenanthrene	SW8270D	100		50	43	22	326	32
Pyrene	SW8270D	1000		43	25	27	149	19
Total Benzofluoranthenes (b,j,k) (U = 0)		230		10	11	9	49	13
Total HPAH (SMS) (U = 0)		960		112 J	95	75	528	85 J
Total LPAH (SMS) (U = 0)		370		182 J	113 J	56 J	672 J	71 J
Dioxin Furans (ng/kg)								
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	E1613B			10.9	4.7	9.2	5.4	0.38 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	E1613B			58.7	20.8	13.3	23.9	1
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B			174	55	27.1	36.7	1.9
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B			417	196	132	254	9
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B			277	96.9	54.9	109	3.3
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	E1613B			5830	3190	3120	7170	215
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	E1613B			49600 J	25300	31100	69800 J	2330
Total Tetrachlorodibenzo-p-dioxin (TCDD)	E1613B			13300 J	2980 J	1060 J	1640 J	75.4 J
Total Pentachlorodibenzo-p-dioxin (PeCDD)	E1613B			13200 J	3170 J	1100	1750 J	80.7 J
Total Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B			16400 J	4980 J	1860 J	4000 J	171
Total Heptachlorodibenzo-p-dioxin (HpCDD)	E1613B			11100	6330	6290	20700	541
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	E1613B			124	46.2	54.3	75	1.9
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	E1613B			26.9 J	14.4	12.7	25.3 J	0.6 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	E1613B			28.1	16.3	14.1	19.1	0.6 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B			68.8 J	40.4 J	44.7 J	60.4 J	2.3 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B			28.6	16.6	15.4	19.1	0.9 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	E1613B			19.5	13.2	11.7	19.2 J	0.7 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B			24.6	14.8	11.9	12.7	1.7
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	E1613B			762	408	470	680	54.6
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	E1613B			49.2	25.4	31.7	33	2.73 J
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	E1613B			3030	1130	2120	1750	161
Total Tetrachlorodibenzofuran (TCDF)	E1613B			855 J	326 J	235 J	321 J	16.7 J
Total Pentachlorodibenzofuran (PeCDF)	E1613B			578 J	290 J	247 J	293 J	26.8 J
Total Hexachlorodibenzofuran (HxCDF)	E1613B			1440 J	867 J	889 J	1270 J	72.9 J

Table G4-1
Inner Waterway Post-Dredge Samples in Areas Subsequently Capped

			Data Set	Inner Waterway Subsurface Sediments Following Completion of Dredging and Prior to Capping				
			Location ID	WW-P1PM-07_20160113	WW-P1PM-08_20160113	WW-P1PM-09_20160113	WW-P1PM-10_20160113	WW-P1PM-11_20151023
			Sample ID	WW-P1PM-07-UD-20160113	WW-P1PM-08-UD-20160113	WW-P1PM-09-UD-20160113	WW-P1PM-10-UD-20160113	WW-P1PM-11-UD-20151023
			Sample Date	1/13/2016	1/13/2016	1/13/2016	1/13/2016	10/23/2015
			Depth	2 - 13 cm	2 - 11 cm	2 - 12 cm	2 - 13 cm	2 - 13 cm
			Sample Type	N	N	N	N	N
			Matrix	SE	SE	SE	SE	SE
			X	1241513	1241349	1241145	1241713	1241568
			Y	642835	642984	642795	643030	643180
		SQS	Other Reference Values					
Total Heptachlorodibenzofuran (HpCDF)	E1613B			**3080 J**	**1460**	**1820 J**	**2150 J**	**209 J**
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 1/2)				**274 J**	**123 J**	**108 J**	**195 J**	**7 J**
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 0)				**274 J**	**124 J**	**109 J**	**196 J**	**8 J**

Notes:

Detected concentration is greater than SMS_Marine_SCO_SCUMII screening level

Detected concentration is greater than WhatcomWW_Other_BSL screening level

Non-detected concentration is above one or more identified screening levels

Bold = Detected result

J = Estimated value

U = Compound analyzed, but not detected above detection limit

UJ = Compound analyzed, but not detected above estimated detection limit

Total LPAH are the total of acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene. 2-Methylnapthalene is not included in the sum of LPAHs.

Total HPAH are the total of benzo(a)anthracene, benzo(a)pyrene, benzo(x)fluoranthenes, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-c,d)pyrene, and pyrene.

Table G4-2
Unit 1C Post-Dredging Samples of Un-Dredged Sediments

			Data Set	Samples of Undredged Materials - Unit 1C Following Completion of Dredging					
			Location ID	WW-P1PM-01_20160204	WW-P1PM-02_20160204	WW-P1PM-03_20160204	WW-P1PM-04_20160204	WW-P1PM-05_20160204	WW-P1PM-06_20160204
			Sample ID	WW-P1PM-01-US-20160204	WW-P1PM-02-US-20160204	WW-P1PM-03-US-20160204	WW-P1PM-04-US-20160204	WW-P1PM-05-US-20160204	WW-P1PM-06-US-20160204
			Sample Date	2/4/2016	2/4/2016	2/4/2016	2/4/2016	2/4/2016	2/4/2016
			Depth	7 - 23 cm	4 - 22 cm	3 - 28 cm	2 - 22 cm	5 - 30 cm	1 - 27 cm
			Sample Type	N	N	N	N	N	N
			Matrix	SE	SE	SE	SE	SE	SE
			X	1239589	1239698	1239735	1239839	1239875	1239984
			Y	641257	641148	641390	641280	641527	641421
		SQS	Other Reference Values						
Conventional Parameters (pct)									
Total solids	TANash_solids			**79.1**	**71.3**	**73.9**	**77.4**	**68.2**	**61.6**
Metals (mg/kg)									
Mercury	SW7471A	0.41	1.2 (BSL)	**0.0088 J**	**0.055 J**	**0.19 J**	**0.03 J**	**0.036 J**	**0.077 J**
Dioxin Furans (ng/kg)									
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	E1613B			0.097 U	0.142 U	0.0987 U	0.1 U	0.0767 U	0.0926 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	E1613B			0.0876 U	0.11 U	**0.282 J**	0.123 U	0.106 U	**0.36 J**
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B			0.0868 U	0.0846 U	**0.616 J**	0.1 U	0.0975 U	**0.652 J**
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B			0.0883 U	**0.125 J**	**3.18**	0.0977 U	**0.171 J**	**0.633 J**
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B			0.0953 U	0.0977 U	**1.15 J**	0.109 U	0.113 U	**0.571 J**
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	E1613B			**1.48 J**	**1.86 J**	**72.3**	**1.06 J**	**2.31 J**	**8.7**
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	E1613B			**16.5**	**13.7**	**710**	**10.1**	**19.5**	**42.6**
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	E1613B			0.0835 U	**0.134 J**	**1.15**	0.0858 U	0.103 U	**1.35**
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	E1613B			0.0581 U	0.09 U	**0.619 J**	0.0625 U	0.0805 U	**0.628 J**
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	E1613B			0.0586 U	0.0838 U	**1.09 J**	0.0533 U	0.0702 U	**1.01 J**
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B			0.0536 U	0.0538 U	**1.93 J**	0.0502 U	0.0477 U	**0.395 J**
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B			0.0522 U	0.0574 U	**0.53 J**	0.0509 U	0.0483 U	**0.333 J**
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	E1613B			0.0815 U	0.0827 U	**0.623 J**	0.0784 U	0.0726 U	**0.188 J**
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B			0.0546 U	0.0586 U	**0.731 J**	0.0531 U	0.051 U	**0.353 J**
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	E1613B			**0.239 J**	**0.296 J**	**16.7**	0.089 U	**0.51 J**	**1.3 J**
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	E1613B			0.106 U	0.0808 U	**1.07 J**	0.11 U	0.0993 U	0.0682 U
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	E1613B			**0.832 J**	**0.836 J**	**47.2**	**0.483 J**	**1.37 J**	**2.14 J**
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 1/2)			4 (Nat Backgd)	**0.2 J**	**0.2 J**	**2.7 J**	**0.17 J**	**0.2 J**	**1.3 J**
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 0)			4 (Nat Backgd)	**0.02 J**	**0.05 J**	**2.7 J**	**0.01 J**	**0.05 J**	**1.2 J**

Notes:

Detected concentration is greater than SMS_Marine_SCO_SCUMII screening level

Detected concentration is greater than WhatcomWW_Other_BSL screening level

Non-detected concentration is above one or more identified screening levels

Bold = Detected result

BSL = Whatcom Waterway bioaccumulation screening level (1.2 mg mercury/kg dry weight)

Nat Backgd = Natural background levels for sediments in Puget Sound

J = Estimated value

U = Compound analyzed, but not detected above detection limit

cm = centimeter

ID = identification

mg = milligram

ng = nanogram

pct = percent

SQS = sediment quality standard

TEQ = toxic equivalents

Table G4-3
Unit 1C Post-Dredging Samples of Dredging Residuals Layer

			Data Set	Unit 1C Post-Dredging Residuals					
			Location ID	WW-P1PM-01_20160204	WW-P1PM-02_20160204	WW-P1PM-03_20160204	WW-P1PM-04_20160204	WW-P1PM-05_20160204	WW-P1PM-06_20160204
			Sample ID	WW-P1PM-01-RE-20160204	WW-P1PM-02-RE-20160204	WW-P1PM-03-RE-20160204	WW-P1PM-04-RE-20160204	WW-P1PM-05-RE-20160204	WW-P1PM-06-RE-20160204
			Sample Date	2/4/2016	2/4/2016	2/4/2016	2/4/2016	2/4/2016	2/4/2016
			Depth	0 - 7 cm	0 - 4 cm	0 - 3 cm	0 - 2 cm	0 - 5 cm	0 - 1 cm
			Sample Type	N	N	N	N	N	N
			Matrix	SE	SE	SE	SE	SE	SE
			X	1239589	1239698	1239735	1239839	1239875	1239983.950
			Y	641257	641148	641390	641280	641527	641421.034
		SQS	Other Reference Values						
Residuals Thickness (cm)									
Thickness	Field Measurement			**7**	**4**	**3**	**2**	**5**	**1**
Conventional Parameters (pct)									
Total solids	TANash_solids			**39.4**	**41.7**	**48.4**	**41.3**	**36.1**	**39.6**
Metals (mg/kg)									
Mercury	SW7471A	0.41	1.2 (BSL)	**1.6 J**	**0.75 J**	**2.3 J**	**0.92 J**	**2.2 J**	**1.2 J**
Dioxin Furans (ng/kg)									
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	E1613B			0.0908 U	**0.428 J**	**0.95**	**0.487 J**	**1.08**	**0.61**
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	E1613B			**0.31 J**	**1.82 J**	**2.43 J**	**1.32 J**	**3.17**	**2.37 J**
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B			**0.865 J**	**5.39**	**5.32**	**3.33**	**7.58**	**5.91**
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B			**2.45 J**	**18.9**	**24.9**	**9.16**	**29.4**	**19.2**
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B			**1.09 J**	**8.35**	**8.74**	**3.96**	**11.90**	**8.59**
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	E1613B			**52.6**	**508**	**596**	**160**	**664**	**385**
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	E1613B			**497**	**4240**	**5320**	**1090**	**7500 J**	**3100**
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	E1613B			**1.47**	**6.65**	**11**	**5.92**	**12.7**	**9.32**
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	E1613B			**0.467 J**	**2.26 J**	**5.29**	**1.74 J**	**4.83**	**2.95**
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	E1613B			**0.664 J**	**4.03**	**8.59**	**3.22**	**9.21**	**5.18**
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B			**0.888 J**	**5.67**	**12**	**4.34**	**11.5**	**6.21**
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B			**0.318 J**	**2.16 J**	**3.76**	**1.42 J**	**3.89**	**2.32 J**
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	E1613B			**0.359 J**	**2.03 J**	**3.7**	**1.44 J**	**3.89**	**2.33 J**
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B			**0.403 J**	**2.91**	**4.88**	**1.75 J**	**5.63**	**3.12**
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	E1613B			**8.65**	**63.9**	**130**	**24.7**	**129**	**53.2**
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	E1613B			**0.579 J**	**3.93**	**8.07**	**2.52**	**8.46**	**3.95**
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	E1613B			**27**	**202**	**642**	**76.4**	**471**	**166**
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 1/2)				**2.1 J**	**15.8 J**	**22.7J**	**8.2 J**	**26.2 J**	**15.7 J**
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 0)				**2.1 J**	**15.8 J**	**22.7 J**	**8.2 J**	**26.2 J**	**15.7 J**

Notes:

Detected concentration is greater than SMS_Marine_SCO_SCUMII screening level

Detected concentration is greater than WhatcomWW_Other_BSL screening level

Detected concentration is greater than Interpretive Framework screening level

Non-detected concentration is above one or more identified screening levels

Bold = Detected result

J = Estimated value

U = Compound analyzed, but not detected above detection limit

BSL = bioaccumulation site level

cm = centimeter

ID = identification

mg = milligram

ng = nanogram

pct = percent

SQS = sediment quality standard

TEQ = toxic equivalents

Table G4-4
Unit 1C Surface Sediment Testing After Residuals Management

				Data Set	Unit 1C Surface Sediments Following Residuals Management								Area-Wide Average Concentration [2]
				Location ID	P1PM-01_201604	P1PM-02_201604	P1PM-03_201604	P1PM-04_201604	P1PM-05_201604	WW-P1PM-05_20160608	P1PM-06_201604	P1PM-06_201604	
				Sample ID	P1PM-01-SS-160401	P1PM-02-SS-160401	P1PM-03-SS-160401	P1PM-04-SS-160406	P1PM-05-SS-160406	WW-P1PM-05-060816	P1PM-06-SS-160406	P1PM-56-SS-160406	
				Sample Date	4/1/2016	4/1/2016	4/1/2016	4/6/2016	4/6/2016	6/8/2016	4/6/2016	4/6/2016	
				Depth	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 8 cm	0-10 cm	0 - 10 cm	0 - 10 cm	
				Sample Type	N	N	N	N	N	N	N	FD	
				Matrix	SE	SE	SE	SE	SE	SE	SE	SE	
				X	1239601	1239699	1239734	1239831	1239874	1241344	1239980	1239980	
				Y	641269	641147	641393	641283	641526	642989	641431	641431	
		SMS_Marine_SCO_SCUMI	Other Reference Values										
Conventional Parameters (pct)													
Total organic carbon	Plumb 1981			**0.52 J**	**0.595 J**	**0.425 J**	**0.343 J**	**2.15 J**	**1.4 J**	**1.02 J**	**0.893 J**		
Total solids	SM2540G			**86.04**	**78.16**	**81.59**	**90.67**	**66.58**	**71.8**	**79.25**	**77.33**		
Metals (mg/kg)													
Mercury	SW7471A	0.41	1.2	**0.23**	**0.33**	**0.1**	**0.03**	**0.65 [1]**	**0.66 [1]**	**0.11**	**0.08**	**0.22**	
Dioxin Furans (ng/kg)													
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	E1613B			**0.219 J**	**0.281 J**	**0.145 J**	**0.112 J**	**0.687 J**	--	**0.172 J**	**0.222 J**		
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	E1613B			0.336 U	**0.721 J**	0.181 U	0.0518 U	**4.95**	--	0.355 U	0.396 U		
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B			0.358 U	**1.08 J**	0.279 U	0.0677 U	**3.81**	--	**0.583 J**	**0.686 J**		
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B			**2.05**	**4.91**	**1.28**	**0.122 J**	**17.3**	--	**2.16**	**2.22 J**		
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B			**0.937 J**	**2.28 J**	0.572 U	0.12 U	**7.07**	--	**1.1**	**1.35**		
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	E1613B			**41.4**	**138**	**29.2**	2.57 U	**403**	--	**50.6**	**46.5**		
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	E1613B			**370**	**1360**	**265**	25 U	**3540**	--	**485**	**448**		
Total Tetrachlorodibenzo-p-dioxin (TCDD)	E1613B			**13.3 J**	**35.7 J**	**10.6 J**	**0.973 J**	**116 J**	--	**17.8 J**	**19.6 J**		
Total Pentachlorodibenzo-p-dioxin (PeCDD)	E1613B			**13.3 J**	**36.9 J**	**10.2 J**	**0.538 J**	**173**	--	**17.3 J**	**21 J**		
Total Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B			**23.1 J**	**68.4 J**	**18.1 J**	**1.92 J**	**673 J**	--	**28.8**	**36.9 J**		
Total Heptachlorodibenzo-p-dioxin (HpCDD)	E1613B			**84.8 J**	**333 J**	**60.5 J**	**6.39 J**	**1880**	--	**110**	**100 J**		
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	E1613B			**0.734 J**	**1.61**	**0.467 J**	**0.0199 J**	**4.04**	--	**0.597 J**	**0.552 J**		
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	E1613B			**0.509 J**	**0.725 J**	**0.227 J**	0.0319 U	**1.6 J**	--	**0.255 J**	**0.236 J**		
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	E1613B			**0.29 J**	**0.527 J**	**0.167 J**	0.0319 U	**1.26**	--	**0.198 J**	**0.19 J**		
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B			**1.01 J**	**1.82**	**0.512 J**	**0.0558 J**	**4.47**	--	**0.875 J**	**0.625 J**		
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B			**0.324 J**	**0.645 J**	**0.165 J**	0.0498 U	**1.56**	--	**0.327 J**	**0.259 J**		
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	E1613B			**0.341 J**	**0.668 J**	**0.179 J**	**0.0717 J**	**1.38**	--	**0.291 J**	**0.272 J**		
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B			**0.39 J**	**0.91 J**	**0.217 J**	0.0518 U	**2.4**	--	**0.422 J**	**0.344 J**		
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	E1613B			**8.92**	**24.4**	**6.1**	**0.33 J**	**83.1**	--	**9.07**	**7.28**		
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	E1613B			**0.684 J**	**1.34**	**0.414 J**	0.0538 U	**3.58**	--	**0.495 J**	**0.425 J**		
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	E1613B			**30.3**	**91.8**	**19.1**	**0.981 J**	**224**	--	**25.8**	**23.1**		
Total Tetrachlorodibenzofuran (TCDF)	E1613B			**2.78 J**	**11.3 J**	**2.35 J**	**0.0759 J**	**23.8 J**	--	**3.27 J**	**3.19 J**		
Total Pentachlorodibenzofuran (PeCDF)	E1613B			**4.33 J**	**9.78 J**	**2.54 J**	**0.0562 J**	**23.8 J**	--	**3.15 J**	**3.03 J**		
Total Hexachlorodibenzofuran (HxCDF)	E1613B			**13.8 J**	**30.6 J**	**8.29 J**	**0.564 J**	**84.6 J**	--	**12.9 J**	**11.4 J**		
Total Heptachlorodibenzofuran (HpCDF)	E1613B			**33.5 J**	**95.6 J**	**22.1 J**	**1.09**	**285**	--	**30.6 J**	**25.5 J**		
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 1/2)			15 [2]	**1.7 J**	**4.6 J**	**1.1 J**	**0.2 J**	**16.3 J**	--	**1.8 J**	**1.8 J**	**3.93**	
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 0)				**1.5 J**	**4.6 J**	**0.93 J**	**0.1 J**	**16.3 J**	--	**1.6 J**	**1.6 J**		

Notes:
Bold = Detected result

1. Confirmational bioassays were performed at location P1PM-05. Results demonstrated compliance with SMS interpretive criteria. Therefore, detected mercury levels do not represent an exceedance of the Site cleanup level.
2. Surface-weighted average concentrations were calculated for bioaccumulative compounds (mercury and dioxin/furans). Average concentrations for mercury and dioxin/furans were approximately equal to the respective natural background levels of these two compounds (0.2 mg/kg and 4 ng/kg) respectively.

J = Estimated value
U = Compound analyzed, but not detected above detection limit
cm = centimeter
ID = identification
mg = milligram
ng = nanogram
pct = percent
SMS = Sediment Management Standards

Table G4-5

SMS Bioassay Testing Interpretive Criteria [1]

Biological Test Endpoint	Performance Standard		SQS	Cleanup Screening Level
	Control	Reference		
Eohaustorius estuarius				
10-day mortality	M_C < 10%	M_R < 25%	$M_T - M_C$ > 25% and M_T vs. M_R SD (p = 0.05)	$M_T - M_C$ > 30% and M_T vs. M_R SD (p = 0.05)
Neanthes arenaceodentata				
20-day growth and mortality	M_C < 10% and MIG_F > 0.72 mg/individual·day	MIG_R/MIG_C > 0.80	MIG_T/MIG_R < 0.85 and MIG_T/MIG_R SD (p = 0.05)	MIG_T/MIG_R < 0.50 and MIG_T/MIG_R SD (p = 0.05)
Mytilus galloprovincialis				
Larval Development	N_C/I > 0.70	$N_R/N_C \geq 0.65$	N_T/N_R < 0.85 and N_T vs. N_R SD (p = 0.10)	N_T/N_R > 0.70 and N_T vs. N_R SD (p = 0.10)

Notes:

Source: Ecology 2015

1. These tests and parameters were developed based on SCUM II (2015) protocols.

C = control

F = final

I = stocking density

M = mortality

mg = milligram

MIG = mean individual growth at time final

R = reference

SD = significant difference

T = test

Table G4-6
Results of Sediment Confirmational Bioassays (Station P1PM-05)

	Eohaustorius estuarius		*Neanthes arenaceodentata*				*Mytilus galloprovincialis*	
	10-Day Mortality (%)		20-Day Mortality (%)		20-Day Growth (mg/individual/day)[1]		Mean Normal Survival (%)	
Control	3	Pass QA	0	Pass QA	0.45	Pass QA	104.8	Pass QA
Reference	3	Pass QA	0	Pass QA	0.44	Pass QA	98.2	Pass QA
P1PM-05	4	Pass SCO	0	Pass SQS	0.43	Pass SQS	90.3	Pass SQS

Notes:
Bioassay results were evaluated using SQS and/or CSL criteria, as defined in the *Sediment Management Standards, Chapter 173-204 WAC* and underlying guidance.
A summary of bioassay results, including all supporting laboratory reports and a QA summary, are included in this Appendix.
1. Growth as measured by ash-free dry weight. See bioassay lab report for full details.

CSL = cleanup screening level
mg = milligram
N/A = not applicable
QA = quality assurance
SCO = sediment cleanup objective
SQS = sediment quality standard

Table G4-7
Results of Confirmational Bioassay Testing (*E. estuarius*)

Sample	Replicate	Number Initiated	Number Surviving	Number Missing or Dead	Percentage Survival	Mean Survival (%)	SD	Mean Mortality (%)*	Mortality Comparison to Reference M_T - $M_{R\ (\%)}$	Statistically Different than Reference (p = 0.05)	Fails SQS?[1] >25%	Fails CSL?[2] >30%
Positive Control	1	20	20	0	100	97.0	2.7	3.0				
	2	20	19	1	95							
	3	20	19	1	95							
	4	22	22	0	100							
	5	20	19	1	95							
Carr Inlet Reference Area	1	20	19	1	95	96.0	2.2	4.0				
	2	20	20	0	100							
	3	20	19	1	95							
	4	20	19	1	95							
	5	20	19	1	95							
WW-P1PM-05	1	20	18	2	90	96.0	4.2	4.0	0.0	No	No	No
	2	20	20	0	100							
	3	20	19	1	95							
	4	20	19	1	95							
	5	22	22	0	100							

Notes:
Test was performed according to PSEP with SCUM II and SMARM revision
Species used was *Eohaustorius estuarius*
1. SQS: Statistical Significance and M_T >25%
2. CSL: Statistical Significance and M_T -M_R >30%
CSL = cleanup screening level
M_C = Control Mortality
M_R = Reference Mortality
M_T = Treatment Mortality
PSEP = Puget Sound Estuary Program
SCUM II = Sediment Cleanup User's Manual II
SD = standard deviation
SMARM = Sediment Management Annual Review Meeting
SQS = sediment quality standard

Table G4-8
Results of Confirmational Bioassay Testing (*N. arenaceodentata*)

					Individual Growth (mg/ind/day)												
Sample	**Replicate**	**Number Initiated**	**Number Surviving**	**Mean Mortality**	**Dry Weight**	**Mean**	**Standard Deviation**	**Statisically Less than Reference? (p=0.05)**	**MIG Relative to Reference MIG_T/MIG_R**	**Fails SCO?[1] <0.70**	**Fails CSL?[2] <0.50**	**AFDW**	**Mean**	**Standard Deviation**	**Statisically Less than Reference? (p=0.05)**	**MIG[1] Relative to Reference MIG_T/MIG_R**	**Fails SQS?[2] <0.70**	**Fails CSL?[3] <0.50**
Positive Control	1	5	5	0	0.710	0.781	0.117					0.349	0.450	0.088				
	2	5	5		0.736							0.443						
	3	5	5		0.699							0.398						
	4	5	5		0.983							0.580						
	5	5	5		0.779							0.480						
Carr Inlet Reference Area	1	5	5	0	0.592	0.651	0.116					0.394	0.444	0.072				
	2	5	5		0.780							0.540						
	3	5	5		0.768							0.501						
	4	5	5		0.522							0.373						
	5	5	5		0.593							0.413						
WW-P1PM-05	1	5	5	0	0.628	0.591	0.073	No	0.907	No	No	0.444	0.430	0.032	No	0.967	No	No
	2	5	5		0.516							0.382						
	3	5	5		0.516							0.415						
	4	5	5		0.683							0.464						
	5	5	5		0.610							0.443						

Notes:
Test was performed according to PSEP with SCUM II and SMARM revision
Test was performed using *Neathes arenaceodentata*

1. SQS: Statistical Significance and MIG_T/MIG_R <70%
2. CSL: Statistical Significance and MIG_T/MIG_R <50%

AFDW = Ash Free Dry Weight
CSL = cleanup screening level
ind = individual
mg = milligrams
MIG = Mean Individual Growth
MIG_R = Reference Mean Individual Growth
MIG_T = Treatment Mean Individual Growth
PSEP = Puget Sound Estuary Program
SCUM II = Sediment Cleanup User's Manual II
SD = significant difference
SMARM = Sediment Management Annual Review Meeting
SQS = sediment quality standard

Table G4-9
Results of Confirmational Bioassay Testing (*M. gallaprovincialis*)

Sample	Replicate	Number Normal	Number Abnormal	Mean Normal (N)	Standard Deviation	N_T / N_R	Statistically Less than Reference? (p=0.10)	Fails SQS?[1] <0.85	Fails CSL?[2] <0.70
Positive Control	1	289	7	271.0	21.3				
	2	296	5						
	3	268	2						
	4	256	6						
	5	246	1						
Carr Inlet Reference Area	1	255	3	254.2	22.5				
	2	281	2						
	3	219	2						
	4	262	4						
	5	254	10						
WW-P1PM-05	1	253	2	233.6	18.3	0.92	No	No	No
	2	214	9						
	3	214	9						
	4	243	8						
	5	244	7						

Notes:
Test was performed according to PSEP with SCUM II and SMARM revision
Test was performed using *Mytilus galloprovincialis*

1. SQS: Statistical Significance and N_T /N_R <0.85
2. CSL: Statistical Significance and N_T /N_R <0.70

CSL = cleanup screening level
I = Mean initial count (stocking density); 258.6
N = Number Normal
N_C = Mean Control Normal
N_R = Mean Reference Normal
PSEP = Puget Sound Estuary Program
SCUM II = Sediment Cleanup User's Manual II
SMARM = Sediment Management Annual Review Meeting
SQS = sediment quality standard

Table G5-1
Results of Tissue Testing (Adult Dungeness Crab)

	Testing Area	Whatcom Waterway Site Area					
	Location ID	WW-MNR-03_20160610	WW-MNR-03_20160610	WW-MNR-04_20160610	WW-MNR-04_20160610	WW-MNR-07_20160610	WW-MNR-07_20160610
	Sample ID	WW-MNR-03-CM-COMP1-160610	WW-MNR-03-CM-COMP2-160610	WW-MNR-04-CM-COMP1-160610	WW-MNR-04-CM-COMP2-160610	WW-MNR-07-CM-COMP1-160610	WW-MNR-07-CM-COMP2-160610
	Sample Date	6/10/2016	6/10/2016	6/10/2016	6/10/2016	6/10/2016	6/10/2016
	Sample Type	N	N	N	N	N	N
	Matrix	TA	TA	TA	TA	TA	TA
	X	1237324	1237324	1237148	1237148	1238791	1238791
	Y	643042	643042	639909	639909	641464	641464
Conventional Parameters (pct)							
Lipids	BLIGH&DYER	**0.339 J**	**0.329 J**	**0.48 J**	**0.319 J**	**0.4 J**	**0.408 J**
Total solids	SM2540G	**21.4**	**21.1**	**21.52**	**21.38**	**22.46**	**21.96**
Metals (mg/kg wet weight)							
Mercury	SW7471A	**0.07**	**0.077**	**0.075**	**0.073**	**0.098**	**0.111**

Notes:
Bold = Detected result
J = Estimated value

ID = identification
kg = kilogram
mg = milligram
pct = percent

Table G5-1
Results of Tissue Testing (Adult Dungeness Crab)

	Testing Area	Samish Bay Reference Area					
	Location ID	WW-REF-01_20160610	WW-REF-01_20160610	WW-REF-01_20160610	WW-REF-05_20160610	WW-REF-05_20160610	WW-REF-05_20160610
	Sample ID	WW-REF-01-CM-COMP1-160610	WW-REF-01-CM-COMP2-160610	WW-REF-01-CM-COMP3-160610	WW-REF-05-CM-COMP1-160610	WW-REF-05-CM-COMP2-160610	WW-REF-05-CM-COMP3-160610
	Sample Date	6/10/2016	6/10/2016	6/10/2016	6/10/2016	6/10/2016	6/10/2016
	Sample Type	N	N	N	N	N	N
	Matrix	TA	TA	TA	TA	TA	TA
	X	1228732	1228732	1228732	1236803	1236803	1236803
	Y	581841	581841	581841	587227	587227	587227
Conventional Parameters (pct)							
Lipids	BLIGH&DYER	**0.418 J**	**0.378 J**	**0.41 J**	**0.419 J**	**0.479 J**	**0.359 J**
Total solids	SM2540G	**21.98**	**22.2**	**22.22**	**19.8**	**20.38**	**19.1**
Metals (mg/kg wet weight)							
Mercury	SW7471A	**0.045**	**0.05**	**0.047**	**0.068**	**0.06**	**0.072**

Notes:
Bold = Detected result
J = Estimated value

ID = identification
kg = kilogram
mg = milligram
pct = percent

Table G5-2
Results of Tissue Testing (Juvenile Dungeness Crab)

		Task	WWP1_PostConstruct	WWP1_PostConstruct	WWP1_PostConstruct	WWP1_PostConstruct	WWP1_PostConstruct
		Location ID	WW-P1CM-12_20160610	WW-P1CM-12_20160610	WW-P1CM-12_20160610	WW-P1CM-12_20160610	WW-P1CM-12_20160610
		Sample ID	P1CM-12-CM-COMP1-160610	P1CM-12-CM-COMP2-160610	P1CM-12-CM-COMP3-160610	P1CM-12-CM-COMP4-160610	P1CM-12-CM-COMP5-160610
		Sample Date	6/10/2016	6/10/2016	6/10/2016	6/10/2016	6/10/2016
		Sample Type	N	N	N	N	N
		Matrix	TA	TA	TA	TA	TA
		X	1240847	1240847	1240847	1240847	1240847
		Y	642753	642753	642753	642753	642753
Conventional Parameters (pct)							
Lipids	BLIGH&DYER		**1.53**	**1.55**	**1.47**	**1.35**	**1.25**
Total solids	SM2540G		**29.86**	**25**	**26.09**	**26.38**	**26.54**
Metals (mg/kg)							
Mercury	SW7471A		**0.032**	**0.031**	**0.03**	**0.032**	**0.03**

Notes:
Bold = Detected result

ID = identification
kg = kilogram
mg = milligram
pct = percent

Table G5-2
Results of Tissue Testing (Juvenile Dungeness Crab)

	Task	WWP1_PostConstruct	WWP1_PostConstruct	WWP1_PostConstruct	WWP1_PostConstruct	WWP1_PostConstruct
	Location ID	WW-RE-06_20160610	WW-RE-06_20160610	WW-RE-06_20160610	WW-RE-06_20160610	WW-RE-06_20160610
	Sample ID	WW-RE-06-CM-COMP1-160610	WW-RE-06-CM-COMP2-160610	WW-RE-06-CM-COMP3-160610	WW-RE-06-CM-COMP4-160610	WW-RE-06-CM-COMP5-160610
	Sample Date	6/10/2016	6/10/2016	6/10/2016	6/10/2016	6/10/2016
	Sample Type	N	N	N	N	N
	Matrix	TA	TA	TA	TA	TA
	X	1207176	1207176	1207176	1207176	1207176
	Y	634851	634851	634851	634851	634851
Conventional Parameters (pct)						
Lipids	BLIGH&DYER	**0.448**	**0.499**	**0.469**	**0.466**	**0.498**
Total solids	SM2540G	**26.34**	**26.35**	**26.67**	**26.55**	**26.65**
Metals (mg/kg)						
Mercury	SW7471A	**0.024**	**0.024**	**0.023**	**0.024**	**0.023**

Notes:
Bold = Detected result

ID = identification
kg = kilogram
mg = milligram
pct = percent

Table G5-3
Results Summary for Co-Located Caged Clam Tissue, Porewater, and Surface Sediment Grabs

	Data Type	**Clam Tissue Data**						
	Data Set	**Initial Clam Tissue**	**Site MNR Areas**			**Phase 1 Construction Areas**		
	Location ID	**T0_REF**	**WW-MNR-03**	**WW-MNR-04**	**WW-MNR-07**	**WW-P1CM-01**	**WW-P1CM-07**	**WW-P1CM-07**
	Sample ID	**WW-CLAM-T0-060616**	**WW-MNR-03-CL-160707**	**WW-MNR-04-CL-160707**	**WW-MNR-07-CL-160707**	**WW-P1CM-01-CL-160707**	**WW-P1CM-07-CL-160707**	**-**
	Sample Date	**6/6/2016**	**7/7/2016**	**7/7/2016**	**7/7/2016**	**7/7/2016**	**7/7/2016**	**-**
	Sample Type	**N**	**N**	**N**	**N**	**N**	**N**	**-**
	X	-	**1237324**	**1237148**	**1238791**	**1239694**	**1241344**	**1241344**
	Y	-	**643042**	**639909**	**641464**	**641212**	**642989**	**642989**
Conventional Parameters (pct)								
Lipids	BLIGH&DYER	**0.814**	**1.19**	**1.29**	**1.1**	**0.857**	**0.797**	-
Total solids	SM2540G	**12.69**	**15**	**15.66**	**14.59**	**12.58**	**12.48**	-
Metals (mg/kg wet weight)								
Mercury	SW7471A	0.02 U	0.02 U	0.02 U	0.02 U	**0.02**	0.02 U	-

	Data Type	**Co-Located Sediment Data**						
	Data Set	**Initial Clam Tissue**	**Site MNR Areas**			**Phase 1 Construction Areas**		
	Sample ID	-	**WW-MNR-03-SS-160602**	**WW-MNR-04-SS-160602**	**WW-MNR-07-SS-160602**	**WW-P1CM-01-SS-160602**	- [2]	-
	Sample Date	-	**6/2/2016**	**6/2/2016**	**6/2/2016**	**6/2/2016**	-	-
	Depth	-	**0 - 10 cm**	**0 - 10 cm**	**0 - 10 cm**	**0 - 10 cm**	-	-
	Sample Type	-	**N**	**N**	**N**	**N**	-	-
Conventional Parameters (pct)								
Total organic carbon	Plumb 1981	-	**1.95**	**2.2**	**2.02**	**1.39**	-	-
Total solids	SM2540G	-	**51.58**	**44.39**	**47.75**	**68.99**	-	-
Metals (mg/kg wet weight)								
Mercury	SW7471A	-	**0.26**	**0.19**	**0.64 [1]**	**0.18**	-	-

	Data Type	**Co-Located Sediment Data**					
	Data Set	**Initial Clam Tissue**	**Site MNR Areas**		**Phase 1 Construction Areas**		
	Sample ID	-	**WW-MNR-03-160613**	**WW-MNR-04-160613**	**WW-MNR-07-160613**	**WW-P1CM-01-160613**	**WW-P1CM-07-160613**	**WW-P1CM-57-160613**
	Sample Date	-	**6/14/2016**	**6/14/2016**	**6/14/2016**	**6/14/2016**	**6/14/2016**	**6/14/2016**
	Sample Type	-	**N**	**N**	**N**	**N**	**N**	**FD**
Metals (porewater) (µg/L)								
Mercury	SW7470A	-	**0.0055 J**	**0.0056 J**	**0.007 J**	**0.0085 J**	**0.006 J**	**0.0058 J**
Metals, Dissolved (porewater) (µg/L)								
Mercury	SW7470A	-	0.02 U	**0.0051 J**	**0.0028 J**	**0.0056 J**	**0.003 J**	**0.0038 J**

Notes:
Bold = Detected result

1. Mercury levels at this station exceeded the SCO (0.41 mg/kg) but were lower than previous sediment mercury concentrations measured in this area during the RIFS. Samples collected from these areas have been previously shown to pass confirmational bioassay testing.
2. Surface sediment sample at location P1PM-07 was comprised of subangular gravel, presumptively capping material. Because of surface composition, gravel was caught in the jaws of the sampler and no sample was collected after multiple attempts.
3. Porewater was not collected at stations REF-02 and REF-04 because NMDS sampler screens were damaged while in-situ.

J = Estimated value
U = Compound analyzed, but not detected above detection limit

µg = microgram ID = identification L = liter MNR = monitored natural recovery
cm = centimeter kg = kilogram mg = milligram pct = percent

Table G5-3
Results Summary for Co-Located Caged Clam Tissue, Porewater, and Surface Sediment Grabs

	Data Type	Clam Tissue Data				
	Data Set	Samish Bay Reference Area				
	Location ID	WW-REF-01	WW-REF-02	WW-REF-03	WW-REF-04	WW-REF-05
	Sample ID	WW-REF-01-CL-160711	WW-REF-02-CL-160711	WW-REF-03-CL-160711	WW-REF-04-CL-160711	WW-REF-05-CL-160711
	Sample Date	7/11/2016	7/11/2016	7/11/2016	7/11/2016	7/11/2016
	Sample Type	N	N	N	N	N
	X	1228732	1228772	1232815	1232822	1236803
	Y	581841	580603	585638	583483	587227
Conventional Parameters (pct)						
Lipids	BLIGH&DYER	**0.929**	**1.36**	**0.959**	**1.06**	**0.984**
Total solids	SM2540G	**13.13**	**15.98**	**13.39**	**13.94**	**14.05**
Metals (mg/kg wet weight)						
Mercury	SW7471A	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U

	Data Type	Co-Located Sediment Data				
	Data Set	Samish Bay Reference Area				
	Sample ID	WW-REF-01-SS-060816	WW-REF-02-SS-160601	WW-REF-03-SS-060816	WW-REF-04-SS-160601	WW-REF-05-SS-060816
	Sample Date	6/8/2016	6/1/2016	6/8/2016	6/1/2016	6/8/2016
	Depth	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm	0 - 10 cm
	Sample Type	N	N	N	N	N
Conventional Parameters (pct)						
Total organic carbon	Plumb 1981	**1.78 J**	**0.408**	**2.14 J**	**0.774**	**1.7 J**
Total solids	SM2540G	**43.91**	**75.42**	**40.21**	**70.46**	**44.93**
Metals (mg/kg wet weight)						
Mercury	SW7471A	**0.09**	0.03 U	**0.1**	0.04 U	**0.1**

	Data Type	Co-Located Sediment Data				
	Data Set	Samish Bay Reference Area				
	Sample ID	WW-REF-01-160628	- [3]	WW-REF-03-160628	- [3]	WW-REF-05-160628
	Sample Date	6/28/2016	-	6/28/2016	-	6/28/2016
	Sample Type	N	-	N	-	N
Metals (porewater) (µg/L)						
Mercury	SW7470A	**0.0074 J**	-	**0.007 J**	-	**0.0071 J**
Metals, Dissolved (porewater) (µg/L)						
Mercury	SW7470A	0.02 U	-	**0.0042 J**	-	**0.0053 J**

Table G6-1
Summary of Laboratory Testing Data Packages and Completed Data Validation

Sample Date(s)	Matrix Type	Task Name	Laboratory Name	Lab Report Number	Lab Report Location	Validator Name	Validation Number	Validation Location	Validation Level
Soil and Water Testing									
10/28/2014	Soil	Cap sediment testing (imported source material)	ALS Environmental	EV14100185	Attachment C (Disk)	Note 1		--	--
11/13/2014	Soil	Cap sediment testing (imported source material)	Analytical Resources Inc.	ZK23	Attachment C (Disk)	Note 1	--	--	--
4/21/2015	Soil	Cap sediment testing (imported source material)	Analytical Resources Inc.	AES8	Attachment C (Disk)	Note 1	--	--	--
8/7/2015	Soil	Soil sampling from shoreline debris removal at Laurel Street Area	Analytical Resources Inc.	AKL4	Attachment C (Disk)	LDC	36153B	Attachment A	Stage2A/2B
8/19/2015	Soil	Soil sampling from shoreline debris removal at Laurel Street Area	Analytical Resources Inc.	ALC4	Attachment C (Disk)	LDC	36153E	Attachment A	Stage2A/2B
8/19/2015	Soil	Cap sediment testing (imported source material)	Analytical Resources Inc.	ALC4	Attachment C (Disk)	LDC	36153E	Attachment A	Stage2A/2B
12/4/2015	Soil	Soil sampling from shoreline areas of Central Waterfront site	Analytical Resources Inc.	ASF1	Attachment C (Disk)	LDC	35571	Attachment A	EPAStage2B
12/4/2015	Soil	Soil sampling from shoreline areas of Log Pond Area	Analytical Resources Inc.	ASF1	Attachment C (Disk)	LDC	35571	Attachment A	EPAStage2B
12/29/2015	Soil	Soil sampling from shoreline areas of Central Waterfront site	Analytical Resources Inc.	ATM7	Attachment C (Disk)	LDC	36153G	Attachment A	Stage2A/2B
12/29/2015	Soil	Soil sampling from shoreline areas of Log Pond Area	Analytical Resources Inc.	ATM7	Attachment C (Disk)	LDC	36153G	Attachment A	Stage2A/2B
12/29/2015	Soil	Soil sampling from shoreline areas of Central Waterfront site	Analytical Resources Inc.	AUG3	Attachment C (Disk)	LDC	36153I	Attachment A	Stage2A/2B
1/5/2016	Soil	Soil sampling from Foam Tank demolition and removal	Analytical Resources Inc.	ATT7	Attachment C (Disk)	LDC	36153H	Attachment A	Stage2A/2B
1/15/2016	Water	Water sampling from Barge Ramp dewatering	Analytical Resources Inc.	AUH8	Attachment C (Disk)	LDC	36153L	Attachment A	Stage2A/2B
3/7/2016	Soil	Soil sampling from Foam Tank demolition and removal	Analytical Resources Inc.	AXD6	Attachment C (Disk)	LDC	36153N	Attachment A	Stage2A/2B
Sediment Sampling									
10/23/2015	Sediment	Inner Waterway Sediment Sampling	Analytical Resources Inc.	API0	Attachment C (Disk)	LDC	36153F	Attachment A	Stage2A/2B
1/13/2016	Sediment	Inner Waterway Sediment Sampling	Analytical Resources Inc.	AUC7	Attachment C (Disk)	LDC	35882	Attachment A	EPAStage2B
2/4/2016	Sediment	Post-Dredge Sediment Sampling in BST (D/F only)	Vista Analytical Laboratory	1600098	Attachment C (Disk)	LDC	36153X	Attachment A	Stage2A/2B
2/4/2016	Sediment	Post-Dredge Sediment Sampling in BST (D/F only)	Vista Analytical Laboratory	1600099	Attachment C (Disk)	LDC	36153Y	Attachment A	Stage2A/2B
2/4/2016	Sediment	Post-Dredge Sediment Sampling in BST	Test America	580-57120-1	Attachment C (Disk)	LDC	36153W	Attachment A	Stage2A/2B
4/1/2016	Sediment	Post-Cap Sediment Sampling in BST	Analytical Resources Inc.	AYV2	Attachment C (Disk)	LDC	36382	Attachment A	EPAStage2B
6/8/2016	Sediment	P1PM-05 Sediment Grab	Analytical Resources Inc.	BBT9	Attachment C (Disk)	LDC	37027	Attachment A	EPAStage2B
6/9/2016	Sediment	P1PM-05 Sediment Grab Bioassay Data	Ramboll Environ	90716.01	Attachment C (Disk)	AQ	-	Attachment B	Other
2/2/2016	Water	Rinse Blank for Post-Dredge Sediment Sampling in BST (D/F only)	Test America	580-57024-2	Attachment C (Disk)	LDC	36153T	Attachment A	Stage2A/2B
Crab Tissue Testing									
6/10/2016	Tissue	Adult Dungeness Crab Tissue	Analytical Resources Inc.	BBW0	Attachment C (Disk)	LDC	36690	Attachment A	EPAStage2B
6/10/2016	Tissue	Juvenile Dungeness Crab Tissue	Analytical Resources Inc.	BCB2	Attachment C (Disk)	LDC	36690	Attachment A	EPAStage2B
Co-located Porewater, Sediment, and Clam Tissue Testing									
6/13/2016	Porewater	Co-located Porewater Sampling	Analytical Resources Inc.	BBY4	Attachment C (Disk)	LDC	37027	Attachment A	EPAStage2B
6/13/2016	Porewater	Co-located Porewater Sampling	Analytical Resources Inc.	BCS7	Attachment C (Disk)	LDC	36716	Attachment A	EPAStage2B
6/8/2016	Sediment	Co-located Sediment Sampling	Analytical Resources Inc.	BBS7	Attachment C (Disk)	LDC	36703	Attachment A	EPAStage2B
6/1/2016-6/2/2016	Sediment	Co-located Sediment Sampling	Analytical Resources Inc.	BBO6	Attachment C (Disk)	LDC	37027	Attachment A	EPAStage2B
7/11/2016	Tissue	Co-located Clam Tissue from Reference Areas	Analytical Resources Inc.	BDG1	Attachment C (Disk)	LDC	36859	Attachment A	EPAStage2B
6/6/2016	Tissue	Clam Tissue Time Zero	Analytical Resources Inc.	BDH4	Attachment C (Disk)	LDC	36859	Attachment A	EPAStage2B
7/7/2016	Tissue	Co-located Clam Tissue from Site and MNR Areas	Analytical Resources Inc.	BDH5	Attachment C (Disk)	LDC	36859	Attachment A	EPAStage2B

Note
1. Contractor submittal; not subject to data validation requirements.

ATTACHMENT A
DATA VALIDATION REPORTS

LABORATORY DATA CONSULTANTS, INC.
2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Bus: 760-827-1100 Fax: 760-827-1099

Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, WA 98101
ATTN: Ms. Joy Dunay

August 2, 2016

SUBJECT: Whatcom Waterway, Data Validation

Dear Ms. Dunay,

Enclosed is the final validation report for the fractions listed below. This SDG was received on July 18, 2016. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #36703:

SDG #	Fraction
BBS7	Mercury, Wet Chemistry

The data validation was performed under Stage 2B guidelines. The analyses were validated using the following documents, as applicable to each method:

- USEPA Contract Laboratory National Functional Guidelines for Inorganic Superfund Data Review, January 2010
- EPA SW 846, Third Edition, Test Methods for Evaluating Solid Waste, update 1, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January 1995; update III, December 1996; update IIIA, April 1998; IIIB, November 2004; Update IV, February 2007; Update V, July 2014

Please feel free to contact us if you have any questions.

Sincerely,

Christina Rink
Project Manager/Chemist

HC

Attachment 1

EDD Stage 2B

LDC #36703 (Anchor Environmental-Seattle WA / Whatcom Waterway)

LDC	SDG#	DATE REC'D	(3) DATE DUE	Hg (7471A)		TOC (Plumb)		Total Solids (2540G)																													
Matrix:	Water/Sediment			W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S
A	BBS7	07/18/16	08/08/16	0	3	0	4	0	4																												
Total	J/CR			0	3	0	4	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11

Shaded cells indicate Stage 4 validation (all other cells are Stage 2B validation). These sample counts do not include MS, MSD, or DUP's.

L:\Anchor\Whatcom\36703ST.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Whatcom Waterway

LDC Report Date: August 2, 2016

Parameters: Mercury

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): BBS7

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
WW-REF-01-SS-060816	BBS7C	Sediment	06/08/16
WW-REF-03-SS-060816	BBS7D	Sediment	06/08/16
WW-REF-05-SS-060816	BBS7E	Sediment	06/08/16
WW-REF-01-SS-060816MS	BBS7CMS	Sediment	06/08/16
WW-REF-01-SS-060816DUP	BBS7CDUP	Sediment	06/08/16

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines (CLPNFG) for Inorganic Superfund Data Review (January 2010). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Mercury by Environmental Protection Agency (EPA) SW 846 Method 7471A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Instrument Calibration

Initial and continuing calibrations were performed as required by the method.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

III. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Analyte	Maximum Concentration	Associated Samples
PB (prep blank)	Mercury	0.0025 mg/Kg	All samples in SDG BBS7

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated laboratory blanks.

IV. Field Blanks

No field blanks were identified in this SDG.

V. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits.

VI. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

VIII. Field Duplicates

No field duplicates were identified in this SDG.

IX. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

X. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Whatcom Waterway
Mercury - Data Qualification Summary - SDG BBS7

No Sample Data Qualified in this SDG

Whatcom Waterway
Mercury - Laboratory Blank Data Qualification Summary - SDG BBS7

No Sample Data Qualified in this SDG

LDC #: 36703A4c

SDG #: BBS7

Laboratory: Analytical Resources, Inc

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 7/22/16

Page: 1 of 1

Reviewer: CA

2nd Reviewer: OMA

METHOD: Mercury (EPA SW 846 Method 7471A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	Instrument Calibration	A	
III.	Laboratory Blanks	SW	
IV.	Field Blanks	N	
V.	Matrix Spike/Matrix Spike Duplicates	A	MS
VI.	Duplicate sample analysis	A	DUP
VII.	Laboratory control samples	A	LCS
VIII.	Field Duplicates	N	
IX.	Sample Result Verification	N	
X	Overall Assessment of Data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	WW-REF-01-SS-060816	BBS7C	Sediment	06/08/16
2	WW-REF-03-SS-060816	BBS7D	Sediment	06/08/16
3	WW-REF-05-SS-060816	BBS7E	Sediment	06/08/16
4	WW-REF-01-SS-060816 MS	BBS7C MS	J	J
5	WW-REF-01-SS-060816 DUP	BBS7C DUP	J	J
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				

Notes:

LDC #: 36703A4c

VALIDATION FINDINGS WORKSHEET
PB/ICB/CCB QUALIFIED SAMPLES

Reviewer: G
2nd Reviewer: mg

METHOD: Trace metals (EPA SW 864 Method 6010B/6020/7000) Soil preparation factor applied: ____
Sample Concentration units, unless otherwise noted: mg/Kg Associated Samples: All

				Sample Identification										
Analyte	Maximum PB[a] (mg/Kg)	Maximum ICB/CCB[a] (ug/l)	Action Level	No qualifiers (≥5x)										
Hg	0.0025		0.0125											

Samples with analyte concentrations within five times the associated ICB, CCB or PB concentration are listed above with the identifications from the Validation Completeness Worksheet. These sample results were qualified as not detected, "U".
Note : a - The listed analyte concentration is the highest ICB, CCB, or PB detected in the analysis of each element.

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Whatcom Waterway

LDC Report Date: July 29, 2016

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): BBS7

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
WW-P1PM-05-060816	BBS7B	Sediment	06/08/16
WW-REF-01-SS-060816	BBS7C	Sediment	06/08/16
WW-REF-03-SS-060816	BBS7D	Sediment	06/08/16
WW-REF-05-SS-060816	BBS7E	Sediment	06/08/16
WW-P1PM-05-060816MS	BBS7BMS	Sediment	06/08/16
WW-P1PM-05-060816DUP	BBS7BDUP	Sediment	06/08/16
WW-P1PM-05-060816TRP	BBS7BTRP	Sediment	06/08/16

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines (CLPNFG) for Inorganic Superfund Data Review (January 2010). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Total Solids by Standard Method 2540G
Total Organic Carbon by Plumb Method

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	%R (Limits)	Flag	A or P
WW-P1PM-05-060816MS (All samples in SDG BBS7)	Total organic carbon	68.9 (75-125)	J (all detects)	A

VII. Triplicate Sample Analysis

Triplicate (TRP) sample analysis was performed on an associated project sample. Results were within QC limits with the following exceptions:

TRP ID (Associated Samples)	Analyte	%RSD (Limits)	Difference (Limits)	Flag	A or P
WW-P1PM-05-060816TRP (All samples in SDG BBS7)	Total organic carbon	21.4 (≤20)	-	J (all detects)	A

VIII. Laboratory Control Samples/ Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the methods. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

Due to MS %R and TRP %RSD, data were qualified as estimated in four samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

Whatcom Waterway
Wet Chemistry - Data Qualification Summary - SDG BBS7

Sample	Analyte	Flag	A or P	Reason
WW-P1PM-05-060816 WW-REF-01-SS-060816 WW-REF-03-SS-060816 WW-REF-05-SS-060816	Total organic carbon	J (all detects)	A	Matrix spike (%R)
WW-P1PM-05-060816 WW-REF-01-SS-060816 WW-REF-03-SS-060816 WW-REF-05-SS-060816	Total organic carbon	J (all detects)	A	Triplicate sample analysis (%RSD)

Whatcom Waterway
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG BBS7

No Sample Data Qualified in this SDG

LDC #: 36703A6 **VALIDATION COMPLETENESS WORKSHEET** Date: 7/22/16

SDG #: BBS7 Stage 2B Page: 1 of 1

Laboratory: Analytical Resources, Inc Reviewer: a

2nd Reviewer: SMK

METHOD: (Analyte) TOC (Plumb), Total Solids (SM 2540G)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	A	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	SW	
VII.	~~Duplicate~~ Triplicate sample analysis	SW	
VIII.	Laboratory control samples	A/A	LCS, SRM
IX.	Field duplicates	N	
X.	Sample result verification	N	
XI	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	WW-P1PM-05-060816	BBS7B	Sediment	06/08/16
2	WW-REF-01-SS-060816	BBS7C	Sediment	06/08/16
3	WW-REF-03-SS-060816	BBS7D	Sediment	06/08/16
4	WW-REF-05-SS-060816	BBS7E	Sediment	06/08/16
5	#1 MS	#1 MS	↓	↓
6	#1 DUP	DUP		
7	#1 TRP	TRP		
8				
9				
10				
11				
12				
13				
14				

Notes:

LDC #: 3670346

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

Reviewer: CR
2nd reviewer: MG

All circled methods are applicable to each sample.

Sample ID	Parameter
1-4	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN (TOC) Cr6+ ClO_4 (TS)
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
QC:5	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN (TOC) Cr6+ ClO_4
6,7	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN (TOC) Cr6+ ClO_4 (TS)
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4

omments:

LDC #: 36203A6

VALIDATION FINDINGS WORKSHEET
Matrix Spike Analysis

Reviewer: a
2nd Reviewer: amy

METHOD: Inorganics, Method see cover

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was a matrix spike analyzed for each matrix in this SDG?

Y N N/A Were matrix spike percent recoveries (%R) within the control limits of 75-125 (85-115% for Method 300.0)? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.

LEVEL IV ONLY:

Y N N/A Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

#	Date	Matrix Spike ID	Matrix	Analyte	%R	Associated Samples	Qualifications
		5	S	TOC	68.9	All	J/UJ/A (DET)

Comments:

LDC #: 36203A6

VALIDATION FINDINGS WORKSHEET
Duplicate Analysis

Reviewer: G
2nd Reviewer: amg

METHOD: Inorganics, Method see cover

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Was a duplicate sample analyzed for each matrix in this SDG?

Y (N) N/A Were all duplicate sample relative percent differences (RPD) ≤ 20% for water and ≤ 35% for soil samples (≤ 10% for Method 300.0)? If no, see qualification below. A control limit of ±CRDL (±2X CRDL for soil) was used for samples that were ≤5X the CRDL, including when only one of the duplicate sample values were ≤5X the CRDL. If field blanks were used for laboratory duplicates, see overall assessment.

LEVEL IV ONLY:

Y N (N/A) Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

#	Date	Duplicate ID	Matrix	Analyte	~~RPD~~ RSD (Limits)	Difference (Limits)	Associated Samples	Qualifications
		7		TOC	21.4 (≤20)		All	J/UJ/A (Det)

Comments:

LDC #: 36703

EDD POPULATION COMPLETENESS WORKSHEET

Date: 7/20

2nd Reviewer:

The LDC job number listed above was entered by KK.

	EDD Process		Comments/Action
I.	EDD Completeness	-	
Ia.	- All methods present?	Y	
Ib.	- All samples present/match report?	Y	
Ic.	- All reported analytes present?	Y	
Id.	-10% or 100% verification of EDD?	Y	
II.	EDD Preparation/Entry	-	
IIa.	- Carryover U/J?	—	
IIb.	- Reason Codes used? If so, note which codes	Y	LDC
IIc.	-Additional Information (QC Level, Validator, Date, Validated Y/N, etc.)	Y	QC Level
III.	Reasonableness Checks	-	
IIIa.	- Do all qualified ND results have ND qualifier (i.e. UJ)?	—	
IIIb.	- Do all qualified detect results have detect qualifier (i.e. J)?	Y	
IIIc.	- If reason codes used, do all qualified results have reason code field populated?	Y	
IIId.	-Does the detect flag require changing for blank qualifiers? If so, are all U results marked ND?	Y / —	
IIIe.	- Do blank concentrations in report match EDD, where data was qualified due to blank?	—	
IIIf.	- Were any results rejected for overall assessment? If so, were results changed to nonreportable?	N / —	
IIIg.	- Is the readme complete? If applicable, were edits or discrepancies listed in the readme?	Y —	

Notes: _____

LABORATORY DATA CONSULTANTS, INC.
2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Bus: 760-827-1100 Fax: 760-827-1099

Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, WA 98101
ATTN: Ms. Joy Dunay

August 2, 2016

SUBJECT: Whatcom Waterway, Data Validation

Dear Ms. Dunay,

Enclosed is the final validation report for the fraction listed below. This SDG was received on July 20, 2016. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #36716:

SDG #	Fraction
BCS7	Mercury

The data validation was performed under Stage 2B guidelines. The analyses were validated using the following documents, as applicable to each method:

- USEPA Contract Laboratory National Functional Guidelines for Inorganic Superfund Data Review, January 2010
- EPA SW 846, Third Edition, Test Methods for Evaluating Solid Waste, update 1, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January 1995; update III, December 1996; update IIIA, April 1998; IIIB, November 2004; Update IV, February 2007; Update V, July 2014

Please feel free to contact us if you have any questions.

Sincerely,

Christina Rink
Project Manager/Chemist

HC

Attachment 1

EDD Stage 2B

LDC #36716 (Anchor Environmental-Seattle WA / Whatcom Waterway)

LDC	SDG#	DATE REC'D	(3) DATE DUE	Hg (7470A)		Diss. Hg (7470A)																													
Matrix:	Water/Sediment			W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S
A	BCS7	07/20/16	08/10/16	3	0	3	0																												
Total	T/CR			3	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6

Shaded cells indicate Stage 4 validation (all other cells are Stage 2B validation). These sample counts do not include MS, MSD, or DUP's.

L:\Anchor\Whatcom\36716ST.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Whatcom Waterway

LDC Report Date: August 2, 2016

Parameters: Mercury

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): BCS7

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
WW-REF-01-160628	BCS7A	Water	06/28/16
WW-REF-03-160628	BCS7B	Water	06/28/16
WW-REF-05-160628	BCS7C	Water	06/28/16
WW-REF-01-160628F	BCS7D	Water	06/28/16
WW-REF-03-160628F	BCS7E	Water	06/28/16
WW-REF-05-160628F	BCS7F	Water	06/28/16
WW-REF-01-160628MS	BCS7AMS	Water	06/28/16
WW-REF-01-160628DUP	BCS7ADUP	Water	06/28/16
WW-REF-01-160628FMS	BCS7DMS	Water	06/28/16
WW-REF-01-160628FDUP	BCS7DDUP	Water	06/28/16

Samples appended with "F" were analyzed as dissolved

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines (CLPNFG) for Inorganic Superfund Data Review (January 2010). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Mercury by Environmental Protection Agency (EPA) SW 846 Method 7470A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Instrument Calibration

Initial and continuing calibrations were performed as required by the method.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

III. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

IV. Field Blanks

No field blanks were identified in this SDG.

V. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits.

VI. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

VIII. Field Duplicates

No field duplicates were identified in this SDG.

IX. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

X. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Whatcom Waterway
Mercury - Data Qualification Summary - SDG BCS7

No Sample Data Qualified in this SDG

Whatcom Waterway
Mercury - Laboratory Blank Data Qualification Summary - SDG BCS7

No Sample Data Qualified in this SDG

LDC #: 36716A4c

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 7/22/16

SDG #: BCS7

Page: 1 of 1

Laboratory: Analytical Resources, Inc

Reviewer: a

2nd Reviewer: mh

METHOD: Mercury (EPA SW 846 Method 7470A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A, A	
II.	Instrument Calibration	A	
III.	Laboratory Blanks	A	
IV.	Field Blanks	N	
V.	Matrix Spike/Matrix Spike Duplicates	A	MS
VI.	Duplicate sample analysis	A	DUP
VII.	Laboratory control samples	A	LCS
VIII.	Field Duplicates	N	
IX.	Sample Result Verification	N	
X	Overall Assessment of Data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

Samples appended with "F" were analyzed as dissolved.

	Client ID	Lab ID	Matrix	Date
1	WW-REF-01-160628	BCS7A	Water	06/28/16
2	WW-REF-03-160628	BCS7B	Water	06/28/16
3	WW-REF-05-160628	BCS7C	Water	06/28/16
4	WW-REF-01-160628F	BCS7D	Water	06/28/16
5	WW-REF-03-160628F	BCS7E	Water	06/28/16
6	WW-REF-05-160628F	BCS7F	Water	06/28/16
7	WW-REF-01-160628MS	BCS7AMS	Water	06/28/16
8	WW-REF-01-160628DUP	BCS7ADUP	Water	06/28/16
9	WW-REF-01-160628FMS	BCS7DMS	Water	06/28/16
10	WW-REF-01-160628FDUP	BCS7DDUP	Water	06/28/16
11				
12				
13				
14				
15				
16				

Notes:

LDC #: 36716

EDD POPULATION COMPLETENESS WORKSHEET

Date: 7/21

2nd Reviewer:

The LDC job number listed above was entered by KK.

	EDD Process		Comments/Action
I.	EDD Completeness	-	
Ia.	- All methods present?	Y	
Ib.	- All samples present/match report?	Y	
Ic.	- All reported analytes present?	Y	
Id.	-10% or 100% verification of EDD?	10	
II.	EDD Preparation/Entry	-	
IIa.	- Carryover U/J?		
IIb.	- Reason Codes used? If so, note which codes	Y	LDC
IIc.	-Additional Information (QC Level, Validator, Date, Validated Y/N, etc.)	Y	QC Level
III.	Reasonableness Checks	-	
IIIa.	- Do all qualified ND results have ND qualifier (i.e. UJ)?	—	
IIIb.	- Do all qualified detect results have detect qualifier (i.e. J)?	Y	
IIIc.	- If reason codes used, do all qualified results have reason code field populated?	—	
IIId.	-Does the detect flag require changing for blank qualifiers? If so, are all U results marked ND?	Y / —	
IIIe.	- Do blank concentrations in report match EDD, where data was qualified due to blank?	—	
IIIf.	- Were any results rejected for overall assessment? If so, were results changed to nonreportable?	N / —	
IIIg.	- Is the readme complete? If applicable, were edits or discrepancies listed in the readme?	Y —	

Notes: _____

LABORATORY DATA CONSULTANTS, INC.
2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Bus: 760-827-1100 Fax: 760-827-1099

Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, WA 98101
ATTN: Ms. Joy Dunay

August 31, 2016

SUBJECT: Whatcom Waterway, Data Validation

Dear Ms. Dunay,

Enclosed is the final validation report for the fractions listed below. This SDG was received on August 11, 2016. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #36859:

SDG #	Fraction
BDG1/BDH4/BDH5	Mercury, Wet Chemistry

The data validation was performed under Stage 2B guidelines. The analyses were validated using the following documents, as applicable to each method:

- USEPA Contract Laboratory National Functional Guidelines for Inorganic Superfund Data Review, January 2010
- EPA SW 846, Third Edition, Test Methods for Evaluating Solid Waste, update 1, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January 1995; update III, December 1996; update IIIA, April 1998; IIIB, November 2004; update IV, February 2007; update V, July 2014

Please feel free to contact us if you have any questions.

Sincerely,

Christina Rink
Project Manager/Chemist

HC

Attachment 1

EDD Stage 2B

LDC #36859 (Anchor Environmental-Seattle WA / Whatcom Waterway)

LDC	SDG#	DATE REC'D	(3) DATE DUE	Hg (7471A)		Total Solids (2540G)		% Lipids (BD)																											
Matrix: Water/Tissue				W	T	W	T	W	T	W	T	W	T	W	T	W	T	W	T	W	T	W	T	W	T	W	T	W	T	W	T	W	T	W	T
A	BDG1/BDH4/BDH5	08/11/16	09/01/16	0	11	0	11	0	11																										
Total	T/CR			0	11	0	11	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33

Shaded cells indicate Stage 4 validation (all other cells are Stage 2B validation). These sample counts do not include MS, MSD, or DUP's.

L:\Anchor\Whatcom\36859ST.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Whatcom Waterway

LDC Report Date: August 31, 2016

Parameters: Mercury

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): BDG1/BDH4/BDH5

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
WW-REF-01-CL-160711	BDG1A	Tissue	07/11/16
WW-REF-02-CL-160711	BDG1B	Tissue	07/11/16
WW-REF-03-CL-160711	BDG1C	Tissue	07/11/16
WW-REF-04-CL-160711	BDG1D	Tissue	07/11/16
WW-REF-05-CL-160711	BDG1E	Tissue	07/11/16
WW-CLAM-T0-060616	BDH4A	Tissue	06/06/16
WW-MNR-03-CL-060707	BDH5A	Tissue	07/07/16
WW-MNR-04-CL-060707	BDH5B	Tissue	07/07/16
WW-MNR-07-CL-060707	BDH5C	Tissue	07/07/16
WW-P1CM-01-CL-060707	BDH5D	Tissue	07/07/16
WW-P1CM-07-CL-060707	BDH5E	Tissue	07/07/16
WW-REF-01-CL-160711MS	BDG1AMS	Tissue	07/11/16
WW-REF-01-CL-160711DUP	BDG1ADUP	Tissue	07/11/16

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines (CLPNFG) for Inorganic Superfund Data Review (January 2010). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Mercury by Environmental Protection Agency (EPA) SW 846 Method 7471A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Instrument Calibration

Initial and continuing calibrations were performed as required by the method.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

III. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

IV. Field Blanks

No field blanks were identified in this SDG.

V. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits.

VI. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

VIII. Field Duplicates

No field duplicates were identified in this SDG.

IX. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

X. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Whatcom Waterway
Mercury - Data Qualification Summary - SDG BDG1/BDH4/BDH5

No Sample Data Qualified in this SDG

Whatcom Waterway
Mercury - Laboratory Blank Data Qualification Summary - SDG BDG1/BDH4/BDH5

No Sample Data Qualified in this SDG

LDC #: 36859A4c

SDG #: BDG1/BDH4/BDH5

Laboratory: Analytical Resources, Inc

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 8/16/16

Page: 1 of 1

Reviewer: AM

2nd Reviewer: AV

METHOD: Mercury (EPA SW 846 Method 7471A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A, A	
II.	Instrument Calibration	A	
III.	Laboratory Blanks	A ~~A, SW~~ a	
IV.	Field Blanks	N	
V.	Matrix Spike/Matrix Spike Duplicates	A	~~MS/D~~ a MS
VI.	Duplicate sample analysis	~~N~~ a A	DUP
VII.	Laboratory control samples	A	LCS
VIII.	Field Duplicates	N	
IX.	Sample Result Verification	N	
X.	Overall Assessment of Data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	WW-REF-01-CL-160711	BDG1A	Tissue	07/11/16
2	WW-REF-02-CL-160711	BDG1B	Tissue	07/11/16
3	WW-REF-03-CL-160711	BDG1C	Tissue	07/11/16
4	WW-REF-04-CL-160711	BDG1D	Tissue	07/11/16
5	WW-REF-05-CL-160711	BDG1E	Tissue	07/11/16
6	WW-CLAM-T0-060616	BDH4A	Tissue	06/06/16
7	WW-MNR-03-CL-060707	BDH5A	Tissue	07/07/16
8	WW-MNR-04-CL-060707	BDH5B	Tissue	07/07/16
9	WW-MNR-07-CL-060707	BDH5C	Tissue	07/07/16
10	WW-P1CM-01-CL-060707	BDH5D	Tissue	07/07/16
11	WW-P1CM-07-CL-060707	BDH5E	Tissue	07/07/16
12	WW-REF-01-CL-160711MS	BDG1AMS	Tissue	07/11/16
13	WW-REF-01-CL-160711DUP	BDG1ADUP	Tissue	07/11/16
14				
15				
16				

Notes:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Whatcom Waterway

LDC Report Date: August 31, 2016

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): BDG1/BDH4/BDH5

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
WW-REF-01-CL-160711	BDG1A	Tissue	07/11/16
WW-REF-02-CL-160711	BDG1B	Tissue	07/11/16
WW-REF-03-CL-160711	BDG1C	Tissue	07/11/16
WW-REF-04-CL-160711	BDG1D	Tissue	07/11/16
WW-REF-05-CL-160711	BDG1E	Tissue	07/11/16
WW-CLAM-T0-060616	BDH4A	Tissue	06/06/16
WW-MNR-03-CL-060707	BDH5A	Tissue	07/07/16
WW-MNR-04-CL-060707	BDH5B	Tissue	07/07/16
WW-MNR-07-CL-060707	BDH5C	Tissue	07/07/16
WW-P1CM-01-CL-060707	BDH5D	Tissue	07/07/16
WW-P1CM-07-CL-060707	BDH5E	Tissue	07/07/16
WW-REF-02-CL-160711DUP	BDG1BDUP	Tissue	07/11/16
WW-MNR-07-CL-060707DUP	BDH5CDUP	Tissue	07/07/16

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines (CLPNFG) for Inorganic Superfund Data Review (January 2010). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Percent Lipids by Bligh and Dyer Method
Total Solids by Standard Method 2540G

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Analyte	Maximum Concentration	Associated Samples
PB (prep blank)	Percent lipids	0.07 %	All samples in SDG BDG1/BDH4/BDH5

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) analysis were not required by the method.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Laboratory Control Samples

Laboratory control samples were not required by the method.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Whatcom Waterway
Wet Chemistry - Data Qualification Summary - SDG BDG1/BDH4/BDH5

No Sample Data Qualified in this SDG

Whatcom Waterway
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG BDG1/BDH4/BDH5

No Sample Data Qualified in this SDG

LDC #: 36859A6 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/16/16
SDG #: BDG1/BDH4/BDH5 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: am
2nd Reviewer: a

METHOD: (Analyte) Percent Lipds (Bligh&Dyer), Total Solids (SM2540G)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	Not ~~applicable~~ required
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	N	Not ~~applicable~~ required
IX.	Field duplicates	N	
X.	Sample result verification	N	
XI	Overall assessment of data	A	

Note: A = Acceptable ND = No compounds detected D = Duplicate SB=Source blank
N = Not provided/applicable R = Rinsate TB = Trip blank OTHER:
SW = See worksheet FB = Field blank EB = Equipment blank

	Client ID	Lab ID	Matrix	Date
1	WW-REF-01-CL-160711	BDG1A	Tissue	07/11/16
2	WW-REF-02-CL-160711	BDG1B	Tissue	07/11/16
3	WW-REF-03-CL-160711	BDG1C	Tissue	07/11/16
4	WW-REF-04-CL-160711	BDG1D	Tissue	07/11/16
5	WW-REF-05-CL-160711	BDG1E	Tissue	07/11/16
6	WW-CLAM-T0-060616	BDH4A	Tissue	06/06/16
7	WW-MNR-03-CL-060707	BDH5A	Tissue	07/07/16
8	WW-MNR-04-CL-060707	BDH5B	Tissue	07/07/16
9	WW-MNR-07-CL-060707	BDH5C	Tissue	07/07/16
10	WW-P1CM-01-CL-060707	BDH5D	Tissue	07/07/16
11	WW-P1CM-07-CL-060707	BDH5E	Tissue	07/07/16
12	WW-REF-02-CL-160711DUP	BDG1BDUP	Tissue	07/11/16
13	WW-MNR-07-CL-060707DUP	BDH5CDUP	Tissue	07/07/16
14				
15				
16				

Notes:

LDC #: 36859A6

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

Reviewer: am
2nd reviewer: a

All circled methods are applicable to each sample.

Sample ID	Matrix	Parameter
1-11	Tissue	pH ~~TDS~~ Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 Lipids% TS
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
QC 12	Tissue	pH ~~TDS~~ Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ TS
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
QC13	Tissue	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 Lipids% ~~TS~~
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4 ____ ____
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4

Comments:

LDC #: 36859A56

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: AM
2nd Reviewer: [illegible]

METHOD: Inorganics, Method See Cover

Conc. units: % **Associated Samples:** All

Analyte	Blank ID	Blank ID	Blank Action Limit									
[redacted]	PB	ICB/CCB (mg/L)		No Qualifiers								
% Lipids	0.07%		0.0035									

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
All contaminants within five times the method blank concentration were qualified as not detected, "U".

The attached zipped file contains two files:

File	Format	Description
1) Readme_Whatcom_083116.doc	MS Word 2003	A "Readme" file (this document).
2) LDC36859_BDG1,BDH4,BDH5_VEDD_20160822.xlsx	MS Excel 2007	A spreadsheet for the following SDG(s): BDG1/BDH4/BDH5 36859A

No discrepancies were observed between the hardcopy data packages and the electronic data deliverables during EDD population of validation qualifiers. A 100% verification of the EDD was not performed.

Please contact Christina Rink at (760) 827-1100 if you have any questions regarding this electronic data submittal.

LDC #: 36858

EDD POPULATION COMPLETENESS WORKSHEET

Anchor

Date: 8/31

2nd Reviewer:

The LDC job number listed above was entered by KK.

	EDD Process	Y/N	Init	Comments/Action
I.	EDD Completeness	-		
Ia.	- All methods present?	Y	KK	
Ib.	- All samples present/match report?	Y	KK	
Ic.	- All reported analytes present?	Y	KK	
Id	-10% verification of EDD?	Y	KK	
II.	EDD Preparation/Entry	-		
IIa.	- QC Level applied? (EPAStage2B or EPAStage4)	Y	KK	EPAStage 2B only
IIb.	- Laboratory EMPC qualified results qualified (J with reason code 23)?	—	KK	
III.	Reasonableness Checks	-		
IIIa.	- Do all qualified ND results have ND qualifier (i.e. UJ)?	Y	KK	
IIIb.	- Do all qualified detect results have detect qualifier (i.e. J)?	Y	KK	
IIIc.	- If reason codes used, do all qualified results have reason code field populated, and vice versa?	Y	KK	
IIId.	- Do blank concentrations in report match EDD, where data was qualified due to blank?	NA	KK	
IIIe.	- Were any results reported above calibration range? If so, were results qualified appropriately?	N/A	KK	
IIIf.	- Are all results marked reportable "Yes" unless rejected for overall assessment in the data validation report?	Y	KK	
IIIg.	-Are there any lab "R" qualified data? / Are the entry columns blank for these results?	N/A	KK	
IIIh.	- Is the detect flag set to "N" for all "U" qualified blank results?	Y	KK	

Notes: *see readme

LABORATORY DATA CONSULTANTS, INC.
2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Bus: 760-827-1100 Fax: 760-827-1099

Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, WA 98101
ATTN: Ms. Joy Dunay

September 30, 2016

SUBJECT: Whatcom Waterway, Data Validation

Dear Ms. Dunay,

Enclosed are the final validation reports for the fractions listed below. These SDGs were received on September 8, 2016. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #37027:

SDG #	Fraction
BBO6, BBT9, BBY4	Mercury, Wet Chemistry

The data validation was performed under Stage 2B guidelines. The analyses were validated using the following documents, as applicable to each method:

- USEPA Contract Laboratory National Functional Guidelines for Inorganic Superfund Data Review, January 2010
- EPA SW 846, Third Edition, Test Methods for Evaluating Solid Waste, update 1, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January 1995; update III, December 1996; update IIIA, April 1998; IIIB, November 2004; update IV, February 2007; update V, July 2014

Please feel free to contact us if you have any questions.

Sincerely,

Christina Rink

Christina Rink
Project Manager/Chemist

171 pages-SF

Attachment 1

EDD Stage 2B

LDC #37027 (Anchor Environmental-Seattle WA / Whatcom Waterway)

LDC	SDG#	DATE REC'D	(3) DATE DUE	Hg (7470A /7471A)		Diss Hg (7470A)		TOC (Plumb)		Total Solids (2540G)																									
Matrix:	Water/Sediment			W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S
A	BBO6	09/08/16	09/30/16	0	6	-	-	0	6	0	6																								
B	BBT9	09/08/16	09/30/16	0	1	-	-	-	-	-	-																								
C	BBY4	09/08/16	09/30/16	6	0	6	0	-	-	-	-																								
Total	T/CR			6	7	6	0	0	6	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31

Shaded cells indicate Stage 4 validation (all other cells are Stage 2B validation). These sample counts do not include MS, MSD, or DUP's.

L:\Anchor\Whatcom\37027ST.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Whatcom Waterway

LDC Report Date: September 27, 2016

Parameters: Mercury

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): BBO6

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
WW-P1CM-01-SS-160602	BBO6A	Sediment	06/02/16
WW-MNR-07-SS-160602	BBO6B	Sediment	06/02/16
WW-MNR-03-SS-160602	BBO6C	Sediment	06/02/16
WW-MNR-04-SS-160602	BBO6D	Sediment	06/02/16
WW-REF-02-SS-160601	BBO6E	Sediment	06/01/16
WW-REF-04-SS-160601	BBO6F	Sediment	06/01/16
WW-P1CM-01-SS-160602MS	BBO6AMS	Sediment	06/02/16
WW-P1CM-01-SS-160602DUP	BBO6ADUP	Sediment	06/02/16

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines (CLPNFG) for Inorganic Superfund Data Review (January 2010). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Mercury by Environmental Protection Agency (EPA) SW 846 Method 7471A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Instrument Calibration

Initial and continuing calibrations were performed as required by the method.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

III. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Analyte	Maximum Concentration	Associated Samples
PB (prep blank)	Mercury	0.0100 mg/Kg	All samples in SDG BBO6

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Final Concentration
WW-REF-02-SS-160601	Mercury	0.03 mg/Kg	0.03U mg/Kg
WW-REF-04-SS-160601	Mercury	0.04 mg/Kg	0.04U mg/Kg

IV. Field Blanks

No field blanks were identified in this SDG.

V. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits.

VI. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

VIII. Field Duplicates

No field duplicates were identified in this SDG.

IX. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

X. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to laboratory blank contamination, data were qualified as not detected in two samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Based upon the data validation all other results are considered valid and usable for all purposes.

Whatcom Waterway
Mercury - Data Qualification Summary - SDG BBO6

No Sample Data Qualified in this SDG

Whatcom Waterway
Mercury - Laboratory Blank Data Qualification Summary - SDG BBO6

Sample	Analyte	Modified Final Concentration	A or P
WW-REF-02-SS-160601	Mercury	0.03U mg/Kg	A
WW-REF-04-SS-160601	Mercury	0.04U mg/Kg	A

LDC #: 37027A4c

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9-26-16

SDG #: BBO6

Page: 1 of 1

Laboratory: Analytical Resources, Inc

Reviewer: MG

2nd Reviewer:

METHOD: Mercury (EPA SW 846 Method 7471A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	Instrument Calibration	A	
III.	Laboratory Blanks	SW	
IV.	Field Blanks	N	
V.	Matrix Spike/Matrix Spike Duplicates	A	MS
VI.	Duplicate sample analysis	A	DUP
VII.	Laboratory control samples	A	LCS
VIII.	Field Duplicates	N	
IX.	Sample Result Verification	N	
X	Overall Assessment of Data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	WW-P1CM-01-SS-160602	BBO6A	Sediment	06/02/16
2	WW-MNR-07-SS-160602	BBO6B	Sediment	06/02/16
3	WW-MNR-03-SS-160602	BBO6C	Sediment	06/02/16
4	WW-MNR-04-SS-160602	BBO6D	Sediment	06/02/16
5	WW-REF-02-SS-160601	BBO6E	Sediment	06/01/16
6	WW-REF-04-SS-160601	BBO6F	Sediment	06/01/16
7	WW-P1CM-01-SS-160602MS	BBO6AMS	Sediment	06/02/16
8	WW-P1CM-01-SS-160602DUP	BBO6ADUP	Sediment	06/02/16
9				
10				
11				
12				
13				
14				
15				
16	PBS			

Notes:

LDC #: 37027A4c
SDG #: See Cover
METHOD: Trace metals (EPA SW 864 Method 7471A)
Sample Concentration units, unless otherwise noted: mg/kg

VALIDATION FINDINGS WORKSHEET
PB/ICB/CCB QUALIFIED SAMPLES
Soil preparation factor applied: 250x
Associated Samples: all

Reviewer: MG
2nd Reviewer: R

Analyte	Maximum PB[a] (mg/Kg)	Maximum PB[a] (ug/L)	Maximum ICB/CCB[a] (ug/L)	Action Limit	5	6								
Hg	0.0100			0.0500	0.03U	0.04U								

Samples with analyte concentrations within five times the associated ICB, CCB or PB concentration are listed above with the identifications from the Validation Completeness Worksheet. These sample results were qualified as not detected, "U".
Note : a - The listed analyte concentration is the highest ICB, CCB, or PB detected in the analysis of each element.

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Whatcom Waterway

LDC Report Date: September 27, 2016

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): BBO6

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
WW-P1CM-01-SS-160602	BBO6A	Sediment	06/02/16
WW-MNR-07-SS-160602	BBO6B	Sediment	06/02/16
WW-MNR-03-SS-160602	BBO6C	Sediment	06/02/16
WW-MNR-04-SS-160602	BBO6D	Sediment	06/02/16
WW-REF-02-SS-160601	BBO6E	Sediment	06/01/16
WW-REF-04-SS-160601	BBO6F	Sediment	06/01/16
WW-P1CM-01-SS-160602MS	BBO6AMS	Sediment	06/02/16
WW-P1CM-01-SS-160602DUP	BBO6ADUP	Sediment	06/02/16
WW-PICM-01-SS-160602TRP	BB06ATRP	Sediment	06/02/16

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines (CLPNFG) for Inorganic Superfund Data Review (January 2010). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Total Organic Carbon by Plumb Method
Total Solids by Standard Method 2540G

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits.

VII. Triplicate Sample Analysis

Triplicate (TRP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Laboratory Control Samples/Standard Reference Materials

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Standard reference materials (SRM) were analyzed as required by the method. The results were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Whatcom Waterway
Wet Chemistry - Data Qualification Summary - SDG BBO6

No Sample Data Qualified in this SDG

Whatcom Waterway
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG BBO6

No Sample Data Qualified in this SDG

LDC #: 37027A6 **VALIDATION COMPLETENESS WORKSHEET** Date: 9-26-16
SDG #: BBO6 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: MG
2nd Reviewer:

METHOD: (Analyte) TOC (Plumb), Total Solids (SM2540G)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	A	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A	MS
VII.	Duplicate sample analysis	A	Trip
VIII.	Laboratory control samples	A	LCS / SRM
IX.	Field duplicates	N	
X.	Sample result verification	N	
XI	Overall assessment of data	A	

Note: A = Acceptable ND = No compounds detected D = Duplicate SB=Source blank
N = Not provided/applicable R = Rinsate TB = Trip blank OTHER:
SW = See worksheet FB = Field blank EB = Equipment blank

	Client ID	Lab ID	Matrix	Date
1	WW-P1CM-01-SS-160602	BBO6A	Sediment	06/02/16
2	WW-MNR-07-SS-160602	BBO6B	Sediment	06/02/16
3	WW-MNR-03-SS-160602	BBO6C	Sediment	06/02/16
4	WW-MNR-04-SS-160602	BBO6D	Sediment	06/02/16
5	WW-REF-02-SS-160601	BBO6E	Sediment	06/01/16
6	WW-REF-04-SS-160601	BBO6F	Sediment	06/01/16
7	WW-P1CM-01-SS-160602MS	BBO6AMS	Sediment	06/02/16
8	WW-P1CM-01-SS-160602DUP	BBO6ADUP	Sediment	06/02/16
9	WW-P1CM-01-SS-160602TRP	BBO6A TRP	Sediment	6/2/16
10				
11				
12				
13				
14				
15	PBS			

Notes:

LDC #: 37027A6

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

Reviewer: MG
2nd reviewer: [illegible]

All circled methods are applicable to each sample.

Sample ID	Matrix	Parameter
1 → 6	Sed	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN (TOC) CR^{6+} ClO_4 (TS)
QC 7	↓	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN (TOC) CR^{6+} ClO_4
↓ 8,9	↓	pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN (TOC) CR^{6+} ClO_4 (TS)
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4
		pH TDS Cl F NO_3 NO_2 SO_4 PO_4 ALK CN^- NH_3 TKN TOC CR^{6+} ClO_4

Comments:

METHODS.6

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Whatcom Waterway

LDC Report Date: September 27, 2016

Parameters: Mercury

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): BBT9

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
WW-P1PM-05-060816	BBT9A	Sediment	06/08/16
WW-P1PM-05-060816MS	BBT9AMS	Sediment	06/08/16
WW-P1PM-05-060816DUP	BBT9ADUP	Sediment	06/08/16

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines (CLPNFG) for Inorganic Superfund Data Review (January 2010). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Mercury by Environmental Protection Agency (EPA) SW 846 Method 7471A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Instrument Calibration

Initial and continuing calibrations were performed as required by the method.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

III. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Analyte	Maximum Concentration	Associated Samples
PB (prep blank)	Mercury	0.0075 mg/Kg	All samples in SDG BBT9

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated laboratory blanks.

IV. Field Blanks

No field blanks were identified in this SDG.

V. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits.

VI. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

VIII. Field Duplicates

No field duplicates were identified in this SDG.

IX. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

X. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Whatcom Waterway
Mercury - Data Qualification Summary - SDG BBT9

No Sample Data Qualified in this SDG

Whatcom Waterway
Mercury - Laboratory Blank Data Qualification Summary - SDG BBT9

No Sample Data Qualified in this SDG

LDC #: 37027B4c

SDG #: BBT9

Laboratory: Analytical Resources, Inc

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9-26-16

Page: 1 of 1

Reviewer: MG

2nd Reviewer:

METHOD: Mercury (EPA SW 846 Method 7471A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	Instrument Calibration	A	
III.	Laboratory Blanks	SW	
IV.	Field Blanks	N	
V.	Matrix Spike/Matrix Spike Duplicates	A	MS
VI.	Duplicate sample analysis	A	DUP
VII.	Laboratory control samples	A	LCS
VIII.	Field Duplicates	N	
IX.	Sample Result Verification	N	
X	Overall Assessment of Data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	WW-P1PM-05-060816	BBT9A	Sediment	06/08/16
2	WW-P1PM-05-060816MS	BBT9AMS	Sediment	06/08/16
3	WW-P1PM-05-060816DUP	BBT9ADUP	Sediment	06/08/16
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16	PBS			

Notes:

LDC #: 37027B4c
SDG #: See Cover
METHOD: Trace metals (EPA SW 864 Method 7471A)
Sample Concentration units, unless otherwise noted: mg/kg

VALIDATION FINDINGS WORKSHEET
PB/ICB/CCB QUALIFIED SAMPLES
Soil preparation factor applied: 250x
Associated Samples: all (>5x)

Analyte	Maximum PB[a] (mg/Kg)	Maximum PB[a] (ug/L)	Maximum ICB/CCB[a] (ug/L)	Action Limit	No Qual's.									
Hg	0.0075			0.0375										

Samples with analyte concentrations within five times the associated ICB, CCB or PB concentration are listed above with the identifications from the Validation Completeness Worksheet. These sample results were qualified as not detected, "U".
Note : a - The listed analyte concentration is the highest ICB, CCB, or PB detected in the analysis of each element.

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Whatcom Waterway

LDC Report Date: September 27, 2016

Parameters: Mercury

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): BBY4

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
WW-P1CM-07-160613	BBY4A	Water	06/14/16
WW-P1CM-57-160613	BBY4B	Water	06/14/16
WW-P1CM-01-160613	BBY4C	Water	06/14/16
WW-MNR-07-160613	BBY4D	Water	06/14/16
WW-MNR-03-160613	BBY4E	Water	06/14/16
WW-MNR-04-160613	BBY4F	Water	06/14/16
WW-P1CM-07-160613F	BBY4G	Water	06/14/16
WW-P1CM-57-160613F	BBY4H	Water	06/14/16
WW-P1CM-01-160613F	BBY4I	Water	06/14/16
WW-MNR-07-160613F	BBY4J	Water	06/14/16
WW-MNR-03-160613F	BBY4K	Water	06/14/16
WW-MNR-04-160613F	BBY4L	Water	06/14/16
WW-MNR-07-160613MS	BBY4DMS	Water	06/14/16
WW-MNR-07-160613DUP	BBY4DDUP	Water	06/14/16
WW-P1CM-01-160613MS	BBY4IMS	Water	06/14/16
WW-P1CM-01-160613DUP	BBY4IDUP	Water	06/14/16

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines (CLPNFG) for Inorganic Superfund Data Review (January 2010). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Mercury by Environmental Protection Agency (EPA) SW 846 Method 7470A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Instrument Calibration

Initial and continuing calibrations were performed as required by the method.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

III. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

IV. Field Blanks

No field blanks were identified in this SDG.

V. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits.

VI. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

VIII. Field Duplicates

Samples WW-P1CM-07-160613 and WW-P1CM-57-160613 and samples WW-P1CM-07-160613F and WW-P1CM-57-160613F were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (ng/L)		RPD
	WW-P1CM-07-160613	WW-P1CM-57-160613	
Mercury	6.00	5.80	3

Analyte	Concentration (ng/L)		RPD
	WW-P1CM-07-160613F	WW-P1CM-57-160613F	
Mercury	3.00	3.80	24

IX. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

X. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Whatcom Waterway
Mercury - Data Qualification Summary - SDG BBY4

No Sample Data Qualified in this SDG

Whatcom Waterway
Mercury - Laboratory Blank Data Qualification Summary - SDG BBY4

No Sample Data Qualified in this SDG

LDC #: 37027C4c

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 9-26-16

SDG #: BBY4

Page: 1 of 1

Laboratory: Analytical Resources, Inc

Reviewer: MG

2nd Reviewer:

METHOD: Mercury (EPA SW 846 Method 7470A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	Instrument Calibration	A	
III.	Laboratory Blanks	A	
IV.	Field Blanks	N	
V.	Matrix Spike/Matrix Spike Duplicates	A	MS
VI.	Duplicate sample analysis	A	DUP
VII.	Laboratory control samples	A	LCS
VIII.	Field Duplicates	SW	D1= 1+2, D2= 7+8
IX.	Sample Result Verification	N	
X.	Overall Assessment of Data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

Samples appended with F were analyzed as dissolved.

		Client ID	Lab ID	Matrix	Date
1	1	WW-P1CM-07-160613 D1	BBY4A	Water	06/14/16
2	1	WW-P1CM-57-160613 D1	BBY4B	Water	06/14/16
3	1	WW-P1CM-01-160613	BBY4C	Water	06/14/16
4	1	WW-MNR-07-160613	BBY4D	Water	06/14/16
5	1	WW-MNR-03-160613	BBY4E	Water	06/14/16
6	1	WW-MNR-04-160613	BBY4F	Water	06/14/16
7	2	WW-P1CM-07-160613F D2	BBY4G	Water	06/14/16
8	2	WW-P1CM-57-160613F D2	BBY4H	Water	06/14/16
9	2	WW-P1CM-01-160613F	BBY4I	Water	06/14/16
10	2	WW-MNR-07-160613F	BBY4J	Water	06/14/16
11	2	WW-MNR-03-160613F	BBY4K	Water	06/14/16
12	2	WW-MNR-04-160613F	BBY4L	Water	06/14/16
13	1	WW-MNR-07-160613MS	BBY4DMS	Water	06/14/16
14	1	WW-MNR-07-160613DUP	BBY4DDUP	Water	06/14/16
15	2	WW-P1CM-01-160613MS	BBY4IMS	Water	06/14/16
16	2	WW-P1CM-01-160613DUP	BBY4IDUP	Water	06/14/16
17					
18	1	PBW1			
19	2	PBW2			

LDC#: 37027C4c

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: MG
2nd Reviewer:

METHOD: Metals (EPA Method 7470A)

(Y) N NA Were field duplicate pairs identified in this SDG?
(Y) N NA Were target analytes detected in the field duplicate pairs?

Analyte	Concentration (ng/L)		RPD	
	1	2		
Mercury	6.00	5.80	3	

V:\FIELD DUPLICATES\FD_inorganic\37027C4c.WPD

Analyte	Concentration (ng/L)		RPD	
	7	8		
Mercury	3.00	3.80	24	

V:\FIELD DUPLICATES\FD_inorganic\37027C4c.WPD

The attached zipped file contains two files:

File	Format	Description
1) Readme_Whatcom_093016.doc	MS Word 2003	A "Readme" file (this document).
2) LDC37027_BBO6,BBT9,BBY4_VEDD_20160930_rev.xlsx	MS Excel 2007	A spreadsheet for the following SDG(s): BBO6, BBT9, BBY4 37027A

No discrepancies were observed between the hardcopy data packages and the electronic data deliverables during EDD population of validation qualifiers. A 100% verification of the EDD was not performed.

Please contact Christina Rink at (760) 827-1100 if you have any questions regarding this electronic data submittal.

LDC #: 37027

EDD POPULATION COMPLETENESS WORKSHEET

Anchor

Date: 9/30

2nd Reviewer: [illegible]

The LDC job number listed above was entered by KK.

	EDD Process	Y/N	Init	Comments/Action
I.	EDD Completeness	-		
Ia.	- All methods present?	Y	KK	
Ib.	- All samples present/match report?	Y	KK	
Ic.	- All reported analytes present?	Y	KK	
Id	-10% verification of EDD?	Y	KK	
II.	EDD Preparation/Entry	-		
IIa.	- QC Level applied? (EPAStage2B or EPAStage4)	Y	KK	
IIb.	- Laboratory EMPC qualified results qualified (J with reason code 23)?	NA	KK	
III.	Reasonableness Checks	-		
IIIa.	- Do all qualified ND results have ND qualifier (i.e. UJ)?	Y	KK	
IIIb.	- Do all qualified detect results have detect qualifier (i.e. J)?	Y	KK	
IIIc.	- If reason codes used, do all qualified results have reason code field populated, and vice versa?	Y	KK	
IIId.	- Do blank concentrations in report match EDD, where data was qualified due to blank?	Y	KK	
IIIe.	- Were any results reported above calibration range? If so, were results qualified appropriately?	N/_	KK	
IIIf.	- Are all results marked reportable "Yes" unless rejected for overall assessment in the data validation report?	Y	KK	
IIIg.	-Are there any lab "R" qualified data? / Are the entry columns blank for these results?	N/_	KK	
IIIh.	- Is the detect flag set to "N" for all "U" qualified blank results?	Y	KK	

Notes: *see readme

ATTACHMENT B
BIOASSAY DATA VALIDATION

ANCHOR QEA

720 Olive Way
Seattle, WA 98101
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MEMORANDUM

To:	Brian Gouran Port of Bellingham	**Date:**	June 30, 2017
From:	Sara Potter, Anchor QEA, LLC	**Project:**	Whatcom Waterway
Re:	2016 Sediment Bioassay Validation		

INTRODUCTION

This memorandum provides a quality assurance/quality control (QA/QC) review of the bioassay analysis results for tests conducted by Anchor QEA, LLC, in August 2016 at the Whatcom Waterway Site (Site) in Bellingham, Washington. The sampling was conducted on behalf of the Port of Bellingham as part of the Whatcom Waterway Phase 1 Cleanup.

The purpose of the 2016 sampling and analysis was to characterize sediment quality post-capping in Unit 1C. The goals of the study[1] were as follows:

- Meet the sediment monitoring requirements established by the Washington State Department of Ecology (Ecology) that support the Consent Decree
- Assess the overall quality of the surface sediments, as defined by the Ecology Sediment Management Standards (SMS; Chapter 173-204 Washington Administrative Code [WAC])

The contents and structure of this report follow guidance provided in the Sediment Cleanup User's Manual II (SCUM II; Ecology 2015) and are consistent with the *Sampling and Quality Assurance Project Plan* (SQAPP; Anchor QEA 2016) approved by Ecology prior to sampling.

Station P1PM-05 was sampled for analytical chemistry as part of the initial Unit 1C post-capping sampling effort on April 6, 2016. Sample P1PM-05 did not meet SMS standards for mercury, and was consequently resampled June 8, 2016, and submitted for analytical chemistry results. An archived sediment sample from this sampling event was submitted to Ramboll Environ (Ramboll) in Port Gamble, Washington, for potential bioassay testing,

[1] The complete scope of sampling and analyses is described in the *Sampling and Quality Assurance Project Plan* (SQAPP; Anchor QEA 2016), which was approved by Ecology in 2016.

which was triggered on the basis of analytical chemistry results. Standard chain-of-custody procedures were followed for sample transfers.

Details on sediment sampling, handling, and analysis are provided in Appendix G of the As-built Report. Briefly, the bioassay sample was stored in a cooler with ice to keep samples at 4 degrees Celsius (°C) plus or minus (±) 2 °C prior to delivery to the laboratories.

Bioassay testing was performed by Ramboll in Port Gamble, Washington, on a surface sediment sample collected from the 0- to 10-centimeter (cm) interval at a single location (P1PM-05). This station exceeded the SMS freshwater cleanup screening levels (CSLs) for total mercury, triggering bioassay testing based on a collaborative evaluation with Ecology. This sample did not exceed the site-specific bioaccumulation screening level (BSL) for mercury. To evaluate the impacts to the benthic invertebrate community, the following three types of bioassay tests were performed:

- 10-day amphipod (*Eohaustorius estuarius*) mortality test
- 20-day juvenile polychaete (*Neanthes arenacedentata*) mortality and growth test
- 48-hour bivalve (*Mytilus galloprovincialis*) larval development test

Test methods followed guidance provided by the Puget Sound Estuary Program (PSEP 1995), SCUM II (Ecology 2015), and the various updates presented during the Sediment Management Annual Review Meeting (SMARM). General biological testing procedures and specific procedures for each sediment bioassay are summarized in the associated laboratory report.

BIOLOGICAL TESTING RESULTS

Test samples were received on June 9, 2016, and the tests were initiated on August 8, 2013, which meets the 56-day holding time. Sample material was collected and stored in accordance with SCUM II. Surface sediments from the 0- to 10-cm interval were tested at Station P1PM-05, where an SMS CSL was exceeded for mercury, triggering confirmation bioassay testing based on evaluation of the data with Ecology.

Three bioassays, a 10-day amphipod test, 20-day juvenile polychaete survival and growth test, and the 48-hour benthic larval development test, were performed on the sediment. The results of the bioassay testing were received in report form on October 24, 2016. Biological testing was performed in compliance with the Puget Sound Estuary Program (PSEP 1995), SCUM II (Ecology 2015), and the various updates presented during the SMARM.

The test interpretive criteria are shown in Table 1. The results of the three tests are summarized in Table 2 and in the following subsections.

Amphipod Mortality Bioassay

The purpose of this test was to characterize sediment toxicity to amphipods using a 10-day exposure. At the conclusion of the test, P1PM-05 was determined to have no significant biological effect. Results are summarized in Table 2.

Water quality conditions were maintained to ensure optimal health of the organisms before and during testing. Temperature, dissolved oxygen, salinity, pH, ammonia, and sulfides were measured in the overlying water of one replicate test container per treatment on days 0 and 10. Temperature, dissolved oxygen, salinity, and pH were also measured daily. Temperature, dissolved oxygen, salinity, pH, ammonia, and sulfides were measured in the porewater from the bulk sediment prior to test initiation. Water quality parameters were within protocol-specified ranges with minor deviations in temperature and salinity. Given the lack of significant mortality observed in all test treatments, these deviations did not negatively affect test results. Interstitial bulk sediment values for ammonia-N ranged from 1.61 to 16.2 milligrams per liter (mg/L). Interstitial bulk sediment values for sulfide ranged from 0.06 to 1.26 mg/L.

The test met the survival acceptability criteria specified in the test protocol with 3.0% mean control mortality. The reference toxicant test was conducted using potassium chloride, resulting in a 96-hour median lethal concentration (LC_{50}) of 155.0 mg/L. This reference toxicant test was within the control chart warning limit of 69.4 to 242.2 mg/L. No problems were found with the test organisms or the testing procedure, and it was concluded that the test developed fully acceptable data for use in management decisions.

Juvenile Polychaete Mortality and Growth Bioassay

The purpose of this test was to characterize chronic sediment toxicity to juvenile polychaetes using a 20-day exposure. At the conclusion of the 20-day test, Station P1PM-05 was determined to have no significant biological effects. Results are summarized in Table 2.

Water quality conditions were maintained to ensure optimal health of the test organisms before and during testing. Temperature, dissolved oxygen, salinity, pH, ammonia, and sulfides were measured in the overlying water of one replicate test container per treatment on days 0 and 20. Temperature, dissolved oxygen, salinity, and pH were also measured daily. Temperature, dissolved oxygen, salinity, pH, ammonia, and sulfides were measured in the porewater from the bulk sediment prior to test initiation. Water quality parameters were within acceptable limits. Interstitial bulk sediment values for ammonia-N ranged from less than 0.5 to 8.1 mg/L. Interstitial bulk sediment values for sulfide ranged from 0.02 to 1.26 mg/L.

The test met the survival and weight acceptability criteria specified in the test protocol with 0 percent mean control mortality and a control individual mean ash-free dry weight (AFDW) of 0.781 milligrams (mg) per individual, exceeding the 0.72 mg per individual requirement.

The reference toxicant test was conducted using potassium chloride. The reference toxicant (positive control) LC_{50} result was 130.8 mg/L. This reference toxicant test was within the control chart warning limit of 67.07 to 242.9 mg/L, and the test data were determined to be suitable for making management decisions.

Benthic Larval Development Test

The purpose of this test was to characterize sediment toxicity to benthic larvae using a 48-hour exposure. At the conclusion of the test, Station P1PM-05 was determined to have no significant biological effect. Results are summarized in Table 2.

Water quality conditions were maintained to ensure optimal health of the organisms before and during testing. Temperature, dissolved oxygen, salinity, pH, ammonia, and sulfides were

measured in the overlying water of one replicate test container per treatment on days 0 and 2. Temperature, dissolved oxygen, salinity, and pH were also measured daily. Water quality parameters were within protocol-specified ranges. Overlying water values for ammonia-N ranged from 0.01 to 0.267 mg/L. Overlying water values for sulfide ranged from 0.0 to 0.05 mg/L.

The test met the survival acceptability criteria specified in the test protocol with 104.5 percent mean control survival. Mean normal survival of the reference sediment was 93.8%, which meets the acceptability criteria of greater than or equal to 65%. A reference-toxicant test was conducted using potassium chloride, resulting in a 96-hour median lethal concentration (LC_{50}) of 4.73 mg/L. This reference toxicant test was within the control chart warning limit of 0.34 to 10.16 mg/L. No problems were found with the test organisms or the testing procedure, and it was concluded that the test developed fully acceptable data for use in management decisions.

SUMMARY

One sediment sample was collected in June 2016 from P1PM-05 in Unit 1C as a follow up to analytical chemistry results from post-cap material placement monitoring in that area. Based on the analytical test results, the CSL was exceeded for mercury. This chemical criteria exceedance triggered bioassay testing to confirm sediment quality. Biological testing was performed in compliance with PSEP 1995, SCUM II, and the various updates presented during the SMARM, and met all QA/QC requirements. The data generated by both tests were determined to be suitable for making management decisions. Biological criteria were met for the 20-day juvenile polychaete survival and growth test, and the 48-hour benthic larval development test. Based on these data, sediment from station P1PM-05 is of acceptable quality post-construction.

REFERENCES

Anchor QEA, 2016. Sampling and Quality Assurance Project Plan for Compliance Monitoring, Whatcom Waterway Cleanup in Phase 1 Site Areas. Prepared for the Port of Bellingham. March 2016.

Ecology (Washington State Department of Ecology), 2015. Sediment Cleanup Users Manual II: Appendices. Guidance for Implementing the Sediment Management Standards, Chapter 173-204 WAC. March 2015.

PSEP (Puget Sound Estuary Program), 1995. Recommended guidelines for conducting laboratory bioassays on Puget Sound sediments. Interim Final Report. Puget Sound Estuary Program, U.S. Environmental Protection Agency Region 10, Seattle, Washington.

TABLES

Table 1
Summary of Sediment Management Performance Standards and Biological Effects Criteria

Biological Test Endpoint	Performance Standard		Sediment Cleanup Objective[3]	Cleanup Screening Level[3]
	Control[1]	Reference[2]		
Eohaustorius estuarius				
10-day mortality	$M_C < 10\%$	$M_R < 25\%$	$M_T - M_C > 25\%$ and M_T vs. M_R SD (p = 0.05)	$M_T - M_C > 30\%$ and M_T vs. M_R SD (p = 0.05)
Neanthes arenaceodentata				
20-day growth and mortality	$M_C < 10\%$ and $MIG_F > 0.72$ mg/individual·day	$MIG_R/MIG_C > 0.80$	$MIG_T/MIG_R < 0.85$ and MIG_T/MIG_R SD (p = 0.05)	$MIG_T/MIG_R < 0.50$ and MIG_T/MIG_R SD (p = 0.05)
Mytilus galloprovincialis				
Larval Development	$N_C/I > 0.70$	$N_R/N_C \geq 0.65$	$N_T/N_R < 0.85$ and N_T vs. N_R SD (p = 0.10)	$N_T/N_R > 0.70$ and N_T vs. N_R SD (p = 0.10)

Notes:
1 = These tests and parameters were developed based on SCUM II (2015) protocols.
Source: Ecology 2015
C = control
F = final
I = stocking density
M = mortality
mg = milligram
MIG = mean individual growth at time final
R = reference
SD = significant difference
T = test

Table 2
Results of Sediment Confirmational Bioassays

	Eohaustorius estuarius		*Neanthes arenaceodentata*				*Mytilus galloprovincialis*	
	10-Day Mortality (%)		**20-Day Mortality (%)**		**20-Day Growth (mg/individual/day)[1]**		**Mean Number Normal (%)**	
Control	3	Pass QA	0	Pass QA	0.45	Pass QA	104.8	Pass QA
Reference	3	Pass QA	0	Pass QA	0.44	Pass QA	98.2	Pass QA
P1PM-05	4	Pass SCO	0	Pass SCO	0.43	Pass SCO	90.3	Pass SCO

Notes:

Bioassay results were screened using SCO and/or CSL criteria, as defined in the *Sediment Management Standards, Chapter 173-204 WAC, Final Rule.*

A summary of bioassay results, including all supporting laboratory reports and a QA summary, are included in this Appendix.

1 = Growth as measured by ash-free dry weight. See bioassay laboratory report for full details.

CSL = cleanup screening level

mg = milligram

N/A = not applicable

QA = quality assurance

SCO = sediment cleanup objective

ATTACHMENT C
LABORATORY DATA PACKAGES

(Provided separately on DVD)

APPENDIX H
SUPPLEMENTAL CORING PROGRAM FOR BST

SUPPLEMENTAL CORING PROGRAM FOR BST

AS-BUILT REPORT FOR THE WHATCOM WATERWAY CLEANUP IN PHASE 1 SITE AREAS

Prepared for

Port of Bellingham

Prepared by

Anchor QEA, LLC

720 Olive Way, Suite 1900

Seattle, Washington 98101

September 2018

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Figure 2 2016 Dredge Prism Refinement Analytical Data

Figure 3 Refined Dredge Prism Contours

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Attachment A Sediment Core Logs

Attachment B Analytical Data Packages

Attachment C Data Validation Memos

LIST OF ACRONYMS AND ABBREVIATIONS

BST	Bellingham Shipping Terminal
EDR	Engineering Design Report
Ecology	Washington State Department of Ecology
mg/kg	milligram per kilogram
MLLW	mean lower low water
TEQ	toxic equivalents quotient

1 INTRODUCTION

During dredging activities in a portion of the Outer Waterway adjacent to the Bellingham Shipping Terminal (BST), American Construction (the Whatcom Waterway dredge operator) encountered a hard layer of native (i.e., not previously dredged) sediment in a portion of Unit 1C. The native material was located within the northwestern quadrant of the Unit 1C dredging prism (Figure 1).

Target neat-line elevations for dredging in this northwest portion of Unit 1C were set at -36 feet mean lower low water (MLLW) in the Engineering Design Report (EDR). The native sediments were found at elevations of approximately -34 feet MLLW.

The presence of the shallow native material was discussed with the Washington State Department of Ecology (Ecology) on January 11. The area of hard material was delineated during dredge operations and extended approximately 30 feet to the east of the boundary of the planned -36 feet MLLW dredge prism based on Progress Survey 16 (Figure 1). A supplemental sediment coring program was then implemented to verify the contact elevation between clean and contaminated sediments. This appendix describes the findings of that testing program.

2 INVESTIGATION METHODS

Proposed sediment coring locations and methods were provided to Ecology on January 12, 2016. Ecology subsequently approved the coring methods and locations.

The coring program included a total of ten vibracore locations as shown in Figure 2:

- Four core locations were placed in the northwestern quadrant of Unit 1C, where the hard native material was encountered.
- Six core locations were placed in the adjacent northeastern portion of Unit 1C.

Sediment coring was conducted on January 13 and 14, 2016. Vertical control was established using lead-lines at the time of coring, and tidal elevation corrections were conducted using an on-site tide gauge established as part of the dredging activities. Cores were compaction-corrected, and cores were segmented into 1-foot intervals (in situ basis) for chemical analysis.

Sediment samples from the cores were submitted for chemical analysis of mercury and dioxin/furans. Results were compared against cleanup levels for the Whatcom Waterway Cleanup in Phase 1 Site Areas Project, and multiple rounds of archive samples were submitted for analysis. Logs are attached for each of the cores (Attachment A).

3 RESULTS

Figure 2 and Table H1 summarize the results of testing for mercury and dioxin/furans. Dioxin/furan results are summarized using the toxic equivalents quotient (TEQ) basis. The analytical data package and the data validation report are included in Attachments B and C, respectively.

- Within the northwest quadrant (cores WWCC-01 to WWCC-04), a consistent layer of poorly graded sandy sediment containing shell debris was encountered at an average elevation of -34.25 feet MLLW. This sand layer coincides with the dredger's observation of hard dredging at approximately -34 feet. All samples collected from within this layer were free of anthropogenic contamination. Mercury results from that layer were below natural background levels (< 0.2 milligram per kilogram [mg/kg]), as were the dioxin/furan TEQ levels (<4 nanograms TEQ/kg). Based on the shallower depth of clean native sediment in this area, a revision to the planned dredge prism was implemented.
- In the northeast quadrant (cores WWCC-05 to WWCC-10), sand layers were not encountered above elevations of approximately -40 feet MLLW. Samples collected from elevations shallower than -40 feet exceeded the mercury Sediment Quality Standard (0.41 mg/kg). This was consistent with the planned dredging neat-line elevation for this area (-40 feet MLLW plus applicable overdredge allowances). Therefore, no changes to the dredging prism for the northeastern quadrant were warranted.

4 DREDGE PRISM REDESIGN

Based on the results of the supplemental coring program, Ecology provided the Port of Bellingham with approval to modify the dredge prism in the northwestern portion of

Unit 1C. That approval was provided by electronic mail on January 25, 2016. The adjustments to the dredge prism included the following:

- Anchor QEA revised the planned neat-line dredge elevation in the northwestern quadrant from -36 feet MLLW to -34.5 feet MLLW (plus applicable overdredge allowances). This avoided unnecessary dredging-related disturbances associated with removal of this clean native material.
- The boundary between the -34.5 feet MLLW area and the slope transition to -40 feet MLLW was also moved 20 feet to the east (from Station 32+00 to 31+80) to coincide with the inner-most edge of the shallow sand layer as seen on Figure 3.

The foregoing change represented a reduction in planned dredging of approximately 1,600 cubic yards in comparison to the previous plan.

TABLES

Table H1
Analytical Results – Mercury and Dioxin/Furan TEQ

		Task	WWP1_Construct	WWP1_Construct	WWP1_Construct	WWP1_Construct	WWP1_Construct
		Location ID	WWCC-01	WWCC-01	WWCC-02	WWCC-02	WWCC-03
		Sample ID	WWCC-01-A-160114	WWCC-01-B-160114	WWCC-02-A-160114	WWCC-02-B-160114	WWCC-03-A-160115
		Sample Date	1/14/2016	1/14/2016	1/14/2016	1/14/2016	1/15/2016
		Depth	-32.2 - -33.2 ft MLLW	-33.2 - -34.2 ft MLLW	-34.8 - -35.9 ft MLLW	-35.9 - -36.9 ft MLLW	-33 - -34 ft MLLW
		Sample Type	N	N	N	N	N
		Matrix	SE	SE	SE	SE	SE
		X	1239556.314	1239556.314	1239588.973	1239588.973	1239634.372
		Y	641283.016	641283.016	641238.215	641238.215	641354.986
		SQAPP Screening Value					
Metals (mg/kg)							
Mercury	SW7471A	0.41	**9.6**	**0.0072 J**	**0.06**	0.0193 U	**48.5**
Dioxin Furans (ng/kg)							
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 1/2)		4	--	**0.08671245 J**	**1.30843 J**	0.0438 U	--
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 0)		4	--	**0.039283 J**	**1.26888 J**	0.0438 U	--

Notes:

Detected concentration is greater than SQAPP screening level

Non-detected concentration is above one or more identified screening levels

Bold = Detected result

J = Estimated value

U = Compound analyzed, but not detected above detection limit

UJ = Compound analyzed, but not detected above estimated detection limit

FD = field duplicate

J = estimated value

mg/kg = milligrams per kilogram

N = normal sample

ng/kg = nanograms per kilogram

SQAPP = Sampling and Quality Assurance Project Plan

TEQ = Toxic Equivalents Quotient

U = compound analyzed, but not detected above detection limit

USEPA = U.S. Environmental Protection Agency

1 Totals and TEQs are lab reported and calculated.

Table H1
Analytical Results – Mercury and Dioxin/Furan TEQ

		Task	WWP1_Construct	WWP1_Construct	WWP1_Construct	WWP1_Construct	WWP1_Construct
		Location ID	WWCC-03	WWCC-03	WWCC-04	WWCC-04	WWCC-05
		Sample ID	WWCC-03-B-160115	WWCC-03-C-160115	WWCC-04-A-160114	WWCC-04-B-160114	WWCC-05-A-160115
		Sample Date	1/15/2016	1/15/2016	1/14/2016	1/14/2016	1/15/2016
		Depth	-34 - -35 ft MLLW	-35 - -35.2 ft MLLW	-33 - -34 ft MLLW	-34 - -35 ft MLLW	-39.5 - -40.3 ft MLLW
		Sample Type	N	N	N	N	N
		Matrix	SE	SE	SE	SE	SE
		X	1239634.372	1239634.372	1239673.612	1239673.612	1239702.716
		Y	641354.986	641354.986	641318.741	641318.741	641427.896
		SQAPP Screening Value					
Metals (mg/kg)							
Mercury	SW7471A	0.41	**7.8**	0.0095 U	**0.48**	**0.0126 J**	**2.81**
Dioxin Furans (ng/kg)							
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 1/2)		4	--	**0.3068385 J**	--	**0.143188 J**	**47.6506 J**
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 0)		4	--	**0.210261 J**	--	**0.056404 J**	**47.6506 J**

Notes:

Detected concentration is greater than SQAPP screening level

Non-detected concentration is above one or more identified screening levels

Bold = Detected result

J = Estimated value

U = Compound analyzed, but not detected above detection limit

UJ = Compound analyzed, but not detected above estimated detection limit

FD = field duplicate

J = estimated value

mg/kg = milligrams per kilogram

N = normal sample

ng/kg = nanograms per kilogram

SQAPP = Sampling and Quality Assurance Project Plan

TEQ = Toxic Equivalents Quotient

U = compound analyzed, but not detected above detection limit

USEPA = U.S. Environmental Protection Agency

1 Totals and TEQs are lab reported and calculated.

Table H1
Analytical Results – Mercury and Dioxin/Furan TEQ

		Task	WWP1_Construct	WWP1_Construct	WWP1_Construct	WWP1_Construct	WWP1_Construct
		Location ID	WWCC-06	WWCC-06	WWCC-06	WWCC-07	WWCC-07
		Sample ID	WWCC-06-B-160114	WWCC-06-C-160114	WWCC-06-D-160114	WWCC-07-A-160115	WWCC-07-B-160115
		Sample Date	1/14/2016	1/14/2016	1/14/2016	1/15/2016	1/15/2016
		Depth	-38.3 - -39.3 ft MLLW	-39.3 - -40.3 ft MLLW	-40.3 - -41.3 ft MLLW	-38.3 - -39 ft MLLW	-39 - -40 ft MLLW
		Sample Type	N	N	N	N	N
		Matrix	SE	SE	SE	SE	SE
		X	1239759.337	1239759.337	1239759.337	1239782.841	1239782.841
		Y	641403.075	641403.075	641403.075	641506.208	641506.208
		SQAPP Screening Value					
Metals (mg/kg)							
Mercury	SW7471A	0.41	**3.21**	**0.44**	0.0154 U	**4.4**	**2.93**
Dioxin Furans (ng/kg)							
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 1/2)		4	--	--	**0.234269 J**	--	**58.51 J**
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 0)		4	--	--	**0.159524 J**	--	**58.51 J**

Notes:

Detected concentration is greater than SQAPP screening level

Non-detected concentration is above one or more identified screening levels

Bold = Detected result

J = Estimated value

U = Compound analyzed, but not detected above detection limit

UJ = Compound analyzed, but not detected above estimated detection limit

FD = field duplicate

J = estimated value

mg/kg = milligrams per kilogram

N = normal sample

ng/kg = nanograms per kilogram

SQAPP = Sampling and Quality Assurance Project Plan

TEQ = Toxic Equivalents Quotient

U = compound analyzed, but not detected above detection limit

USEPA = U.S. Environmental Protection Agency

1 Totals and TEQs are lab reported and calculated.

Table H1
Analytical Results – Mercury and Dioxin/Furan TEQ

		Task	WWP1_Construct	WWP1_Construct	WWP1_Construct	WWP1_Construct	WWP1_Construct
		Location ID	WWCC-08	WWCC-08	WWCC-09	WWCC-09	WWCC-09
		Sample ID	WWCC-08-B-160114	WWCC-08-C-160114	WWCC-09-A-160115	WWCC-09-B-160115	WWCC-09-C-160115
		Sample Date	1/14/2016	1/14/2016	1/15/2016	1/15/2016	1/15/2016
		Depth	-39.3 - -40.3 ft MLLW	-40.3 - -41.3 ft MLLW	-41.5 - -42.5 ft MLLW	-42.5 - -43.5 ft MLLW	-44 - -45 ft MLLW
		Sample Type	N	N	N	N	N
		Matrix	SE	SE	SE	SE	SE
		X	1239821.373	1239821.373	1239839.486	1239839.486	1239839.486
		Y	641463.288	641463.288	641564.530	641564.530	641564.530
		SQAPP Screening Value					
Metals (mg/kg)							
Mercury	SW7471A	0.41	**0.48**	**0.06**	0.014 U	**0.0242 J**	**0.05**
Dioxin Furans (ng/kg)							
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 1/2)		4	--	**0.53451055 J**	**0.20629 J**	--	--
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 0)		4	--	**0.51163 J**	**0.006035 J**	--	--

Notes:

Detected concentration is greater than SQAPP screening level

Non-detected concentration is above one or more identified screening levels

Bold = Detected result

J = Estimated value

U = Compound analyzed, but not detected above detection limit

UJ = Compound analyzed, but not detected above estimated detection limit

FD = field duplicate

J = estimated value

mg/kg = milligrams per kilogram

N = normal sample

ng/kg = nanograms per kilogram

SQAPP = Sampling and Quality Assurance Project Plan

TEQ = Toxic Equivalents Quotient

U = compound analyzed, but not detected above detection limit

USEPA = U.S. Environmental Protection Agency

1 Totals and TEQs are lab reported and calculated.

Table H1
Analytical Results – Mercury and Dioxin/Furan TEQ

		Task	WWP1_Construct	WWP1_Construct
		Location ID	WWCC-10	WWCC-59
		Sample ID	WWCC-10-A-160115	WWCC-59-A-160115
		Sample Date	1/15/2016	1/15/2016
		Depth	-39.7 - -40.2 ft MLLW	-41.5 - -42.5 ft MLLW
		Sample Type	N	FD
		Matrix	SE	SE
		X	1239896.040	1239839.486
		Y	641532.899	641564.530
		SQAPP Screening Value		
Metals (mg/kg)				
Mercury	SW7471A	0.41	**1.33**	**0.0128 J**
Dioxin Furans (ng/kg)				
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 1/2)		4	**34.9316 J**	--
Total Dioxin/Furan TEQ 2005 (Mammal) (U = 0)		4	**34.9316 J**	--

Notes:

Detected concentration is greater than SQAPP screening level

Non-detected concentration is above one or more identified screening levels

Bold = Detected result

J = Estimated value

U = Compound analyzed, but not detected above detection limit

UJ = Compound analyzed, but not detected above estimated detection limit

FD = field duplicate

J = estimated value

mg/kg = milligrams per kilogram

N = normal sample

ng/kg = nanograms per kilogram

SQAPP = Sampling and Quality Assurance Project Plan

TEQ = Toxic Equivalents Quotient

U = compound analyzed, but not detected above detection limit

USEPA = U.S. Environmental Protection Agency

1 Totals and TEQs are lab reported and calculated.

Table H2
Analytical Results – Dioxin/Furan Congeners

		WWP1_Construct WWCC-01 WWCC-01-B-160114 1/14/2016 -33.2 - -34.2 ft MLLW N SE 1239556.314 641283.016	WWP1_Construct WWCC-02 WWCC-02-A-160114 1/14/2016 -34.8 - -35.9 ft MLLW N SE 1239588.973 641238.215	WWP1_Construct WWCC-02 WWCC-02-B-160114 1/14/2016 -35.9 - -36.9 ft MLLW N SE 1239588.973 641238.215	WWP1_Construct WWCC-03 WWCC-03-C-160115 1/15/2016 -35 - -35.2 ft MLLW N SE 1239634.372 641354.986	WWP1_Construct WWCC-04 WWCC-04-B-160114 1/14/2016 -34 - -35 ft MLLW N SE 1239673.612 641318.741	WWP1_Construct WWCC-05 WWCC-05-A-160115 1/15/2016 -39.5 - -40.3 ft MLLW N SE 1239702.716 641427.896
Dioxin Furans (ng/kg)							
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	E1613B	0.035 U	0.0586 U	0.0259 U	0.0577 U	0.0318 U	**1.98**
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	E1613B	**0.0292 J**	**0.259 J**	0.0438 U	**0.0748 J**	0.0577 U	**5.95**
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B	0.0447 U	**0.582 J**	0.0578 U	0.0755 U	0.0616 U	**9.2**
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B	0.0505 U	**1.53**	0.0618 U	0.274 U	**0.193 J**	**53.9**
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B	**0.0777 J**	**0.921 J**	0.0618 U	**0.239 J**	**0.0473 J**	**18**
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	E1613B	0.898 U	**32.2**	0.773 U	5.48 U	4.06 U	**1340**
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	E1613B	11.4 U	**278**	7.82 U	45.4 U	37.3 U	**13200 J**
Total Tetrachlorodibenzo-p-dioxin (TCDD)	E1613B	**0.165 J**	**22.5 J**	**0.282 J**	**0.715 J**	**0.311 J**	**333 J**
Total Pentachlorodibenzo-p-dioxin (PeCDD)	E1613B	**0.0293 J**	**22 J**	**0.0454 J**	**0.878 J**	**0.376 J**	**312 J**
Total Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B	**0.567 J**	**34.8 J**	**0.383 J**	**3.05 J**	**1.43 J**	**624**
Total Heptachlorodibenzo-p-dioxin (HpCDD)	E1613B	**2.05 J**	**74.3 J**	**1.89 J**	**12.3 J**	**9.41 J**	**2950**
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	E1613B	0.0272 U	**0.676 J**	0.0279 U	0.0457 U	0.0258 U	**21.9**
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	E1613B	**0.0583 J**	**0.197 J**	0.0299 U	**0.0835 J**	**0.0616 J**	**9.72 J**
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	E1613B	0.0428 U	**0.176 J**	0.0299 U	**0.298 J**	**0.0417 J**	**7.09**
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B	0.033 U	**0.467 J**	0.0299 U	0.0596 U	0.0974 UJ	**28.2 J**
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B	0.0311 U	**0.199 J**	0.0299 U	0.0577 U	**0.0358 J**	**8.46**
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	E1613B	0.101 U	0.205 U	0.0717 U	0.0897 U	0.0865 U	**7.36**
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B	0.033 U	**0.322 J**	0.0299 U	0.0596 U	0.0378 U	**11.1**
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	E1613B	0.231 U	**6.61**	0.0737 U	**1.77**	**1.38 J**	**351**
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	E1613B	**0.0564 J**	**0.364 J**	0.0618 U	0.0855 U	**0.0636 J**	**20.3**
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	E1613B	0.863 U	**21.1**	0.282 U	**6.52**	4.56 U	**1390**
Total Tetrachlorodibenzofuran (TCDF)	E1613B	**0.0754 J**	**3.04 J**	**0.0659 J**	**0.117**	**0.126**	**129 J**
Total Pentachlorodibenzofuran (PeCDF)	E1613B	**0.0578 J**	**2.77 J**	0.0299 U	**1.34 J**	**0.337 J**	**144 J**
Total Hexachlorodibenzofuran (HxCDF)	E1613B	**0.253 J**	**8.63 J**	**0.0711 J**	**1.55 J**	**1.64 J**	**464 J**
Total Heptachlorodibenzofuran (HpCDF)	E1613B	**0.683 J**	**23.7 J**	**0.186 J**	**6.18**	**4.99 J**	**1430 J**

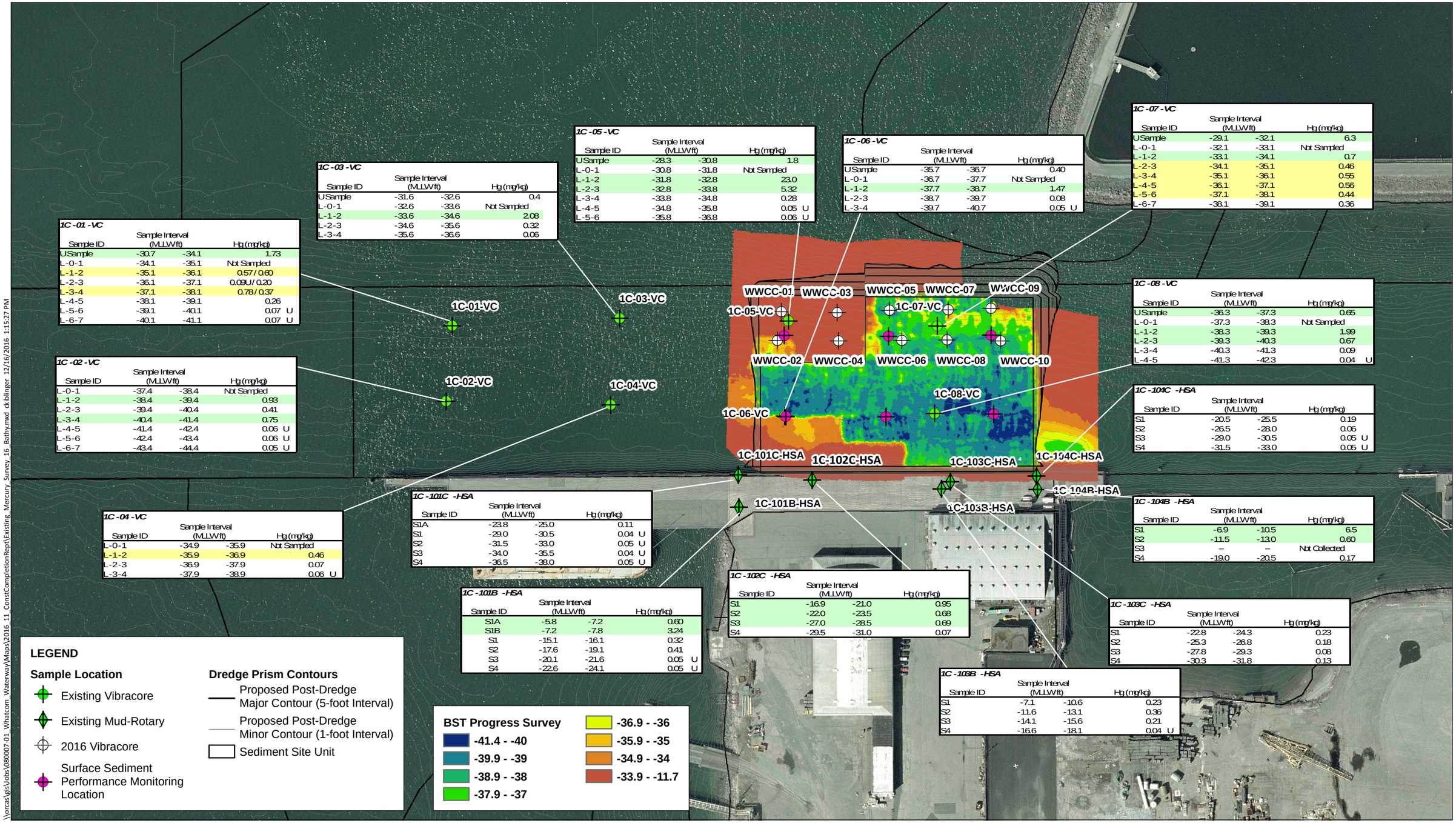
Notes:
Bold = Detected result
J = Estimated value
U = Compound analyzed, but not detected above detection limit
UJ = Compound analyzed, but not detected above estimated detection limit

Table H2
Analytical Results – Dioxin/Furan Congeners

		WWP1_Construct WWCC-06 WWCC-06-D-160114 1/14/2016 -40.3 - -41.3 ft MLLW N SE 1239759.337 641403.075	WWP1_Construct WWCC-07 WWCC-07-B-160115 1/15/2016 -39 - -40 ft MLLW N SE 1239782.841 641506.208	WWP1_Construct WWCC-08 WWCC-08-C-160114 1/14/2016 -40.3 - -41.3 ft MLLW N SE 1239821.373 641463.288	WWP1_Construct WWCC-09 WWCC-09-A-160115 1/15/2016 -41.5 - -42.5 ft MLLW N SE 1239839.486 641564.530	WWP1_Construct WWCC-10 WWCC-10-A-160115 1/15/2016 -39.7 - -40.2 ft MLLW N SE 1239896.040 641532.899
Dioxin Furans (ng/kg)						
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	E1613B	0.0333 U	**2.4**	**0.177 J**	0.099 U	**1.4 J**
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	E1613B	**0.0902 J**	**7.04**	**0.196 J**	0.111 U	**5.42**
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B	**0.1 J**	**9.87**	**0.177 J**	0.182 U	**12.2**
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B	0.245 U	**68.3**	0.0497 U	0.194 U	**42.8**
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B	**0.169 J**	**21.7**	**0.264 J**	0.194 U	**19**
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	E1613B	4.38 U	**1630**	2.76 U	2.01 U	**958**
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	E1613B	39.2 U	**17000 J**	15.3 U	28.9 U	**8810 J**
Total Tetrachlorodibenzo-p-dioxin (TCDD)	E1613B	**1.48 J**	**345 J**	**7.72 J**	**0.142 J**	**551 J**
Total Pentachlorodibenzo-p-dioxin (PeCDD)	E1613B	**1.34 J**	**327**	**5.25 J**	0.111 U	**525**
Total Hexachlorodibenzo-p-dioxin (HxCDD)	E1613B	**2.99 J**	**681**	**6.79 J**	**0.762 J**	**834 J**
Total Heptachlorodibenzo-p-dioxin (HpCDD)	E1613B	**10.2 J**	**3640**	**5.72 J**	**5.06 J**	**2160**
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	E1613B	**0.0667 J**	**25.6**	**0.292 J**	0.0871 U	**20.9**
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	E1613B	**0.116 J**	**11.3 J**	**0.156 J**	0.125 U	**4.92 J**
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	E1613B	0.0471 U	**9.13**	**0.111 J**	0.129 U	**3.94**
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B	**0.129 J**	**35.7 J**	**0.0869 J**	0.123 U	**14.2 J**
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B	**0.0725 J**	**11.7**	**0.0895 J**	0.121 U	**5.06**
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	E1613B	0.171 U	**10**	0.0775 U	0.143 U	**4.06**
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	E1613B	0.049 U	**16**	**0.0676 J**	0.127 U	**7.41**
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	E1613B	**0.982**	**405**	**0.295 J**	**0.533 J**	**171**
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	E1613B	**0.135 J**	**22.9**	0.0636 U	0.218 U	**9.64**
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	E1613B	**3.18**	**1420**	0.717 U	**2.35**	**632**
Total Tetrachlorodibenzofuran (TCDF)	E1613B	**0.239 J**	**145 J**	**5.35 J**	0.0871 U	**96.9 J**
Total Pentachlorodibenzofuran (PeCDF)	E1613B	**0.322 J**	**185 J**	**1.44 J**	0.129 U	**81.5 J**
Total Hexachlorodibenzofuran (HxCDF)	E1613B	**1.44 J**	**610 J**	**0.804 J**	**0.126 J**	**251 J**
Total Heptachlorodibenzofuran (HpCDF)	E1613B	**3.4 J**	**1570 J**	**0.718 J**	**1.4 J**	**656**

Notes:
Bold = Detected result
J = Estimated value
U = Compound analyzed, but not detected above detection limit
UJ = Compound analyzed, but not detected above estimated detection limit

FIGURES



1C -01 -VC

Sample ID	Sample Interval (MLLW ft)		Hg (mg/kg)
U Sample	-30.7	-34.1	1.73
L-0-1	-34.1	-35.1	Not Sampled
L-1-2	-35.1	-36.1	0.57 / 0.60
L-2-3	-36.1	-37.1	0.09U / 0.20
L-3-4	-37.1	-38.1	0.78 / 0.37
L-4-5	-38.1	-39.1	0.26
L-5-6	-39.1	-40.1	0.07 U
L-6-7	-40.1	-41.1	0.07 U

1C -02 -VC

Sample ID	Sample Interval (MLLW ft)		Hg (mg/kg)
L-0-1	-37.4	-38.4	Not Sampled
L-1-2	-38.4	-39.4	0.93
L-2-3	-39.4	-40.4	0.41
L-3-4	-40.4	-41.4	0.75
L-4-5	-41.4	-42.4	0.06 U
L-5-6	-42.4	-43.4	0.06 U
L-6-7	-43.4	-44.4	0.05 U

1C -03 -VC

Sample ID	Sample Interval (MLLW ft)		Hg (mg/kg)
U Sample	-31.6	-32.6	0.4
L-0-1	-32.6	-33.6	Not Sampled
L-1-2	-33.6	-34.6	2.08
L-2-3	-34.6	-35.6	0.32
L-3-4	-35.6	-36.6	0.06

1C -04 -VC

Sample ID	Sample Interval (MLLW ft)		Hg (mg/kg)
L-0-1	-34.9	-35.9	Not Sampled
L-1-2	-35.9	-36.9	0.46
L-2-3	-36.9	-37.9	0.07
L-3-4	-37.9	-38.9	0.06 U

1C -05 -VC

Sample ID	Sample Interval (MLLW ft)		Hg (mg/kg)
U Sample	-28.3	-30.8	1.8
L-0-1	-30.8	-31.8	Not Sampled
L-1-2	-31.8	-32.8	23.0
L-2-3	-32.8	-33.8	5.32
L-3-4	-33.8	-34.8	0.28
L-4-5	-34.8	-35.8	0.05 U
L-5-6	-35.8	-36.8	0.06 U

1C -06 -VC

Sample ID	Sample Interval (MLLW ft)		Hg (mg/kg)
U Sample	-35.7	-36.7	0.40
L-0-1	-36.7	-37.7	Not Sampled
L-1-2	-37.7	-38.7	1.47
L-2-3	-38.7	-39.7	0.08
L-3-4	-39.7	-40.7	0.05 U

1C -07 -VC

Sample ID	Sample Interval (MLLW ft)		Hg (mg/kg)
U Sample	-29.1	-32.1	6.3
L-0-1	-32.1	-33.1	Not Sampled
L-1-2	-33.1	-34.1	0.7
L-2-3	-34.1	-35.1	0.46
L-3-4	-35.1	-36.1	0.55
L-4-5	-36.1	-37.1	0.56
L-5-6	-37.1	-38.1	0.44
L-6-7	-38.1	-39.1	0.36

1C -08 -VC

Sample ID	Sample Interval (MLLW ft)		Hg (mg/kg)
U Sample	-36.3	-37.3	0.65
L-0-1	-37.3	-38.3	Not Sampled
L-1-2	-38.3	-39.3	1.99
L-2-3	-39.3	-40.3	0.67
L-3-4	-40.3	-41.3	0.09
L-4-5	-41.3	-42.3	0.04 U

1C -104C -HSA

Sample ID	Sample Interval (MLLW ft)		Hg (mg/kg)
S1	-20.5	-25.5	0.19
S2	-26.5	-28.0	0.06
S3	-29.0	-30.5	0.05 U
S4	-31.5	-33.0	0.05 U

1C -101C -HSA

Sample ID	Sample Interval (MLLW ft)		Hg (mg/kg)
S1A	-23.8	-25.0	0.11
S1	-29.0	-30.5	0.04 U
S2	-31.5	-33.0	0.05 U
S3	-34.0	-35.5	0.04 U
S4	-36.5	-38.0	0.05 U

1C -101B -HSA

Sample ID	Sample Interval (MLLW ft)		Hg (mg/kg)
S1A	-5.8	-7.2	0.60
S1B	-7.2	-7.8	3.24
S1	-15.1	-16.1	0.32
S2	-17.6	-19.1	0.41
S3	-20.1	-21.6	0.05 U
S4	-22.6	-24.1	0.05 U

1C -102C -HSA

Sample ID	Sample Interval (MLLW ft)		Hg (mg/kg)
S1	-16.9	-21.0	0.95
S2	-22.0	-23.5	0.68
S3	-27.0	-28.5	0.69
S4	-29.5	-31.0	0.07

1C -103C -HSA

Sample ID	Sample Interval (MLLW ft)		Hg (mg/kg)
S1	-22.8	-24.3	0.23
S2	-25.3	-26.8	0.18
S3	-27.8	-29.3	0.08
S4	-30.3	-31.8	0.13

1C -103B -HSA

Sample ID	Sample Interval (MLLW ft)		Hg (mg/kg)
S1	-7.1	-10.6	0.23
S2	-11.6	-13.1	0.36
S3	-14.1	-15.6	0.21
S4	-16.6	-18.1	0.04 U

1C -104B -HSA

Sample ID	Sample Interval (MLLW ft)		Hg (mg/kg)
S1	-6.9	-10.5	6.5
S2	-11.5	-13.0	0.60
S3	–	–	Not Collected
S4	-19.0	-20.5	0.17

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NOTES:

1. 2008 Mercury results presented as mg/kg, see tables 17a & 17b for testing results.
2. Station 1C-102B-HSA was not sampled due to refusal.
3. Results of duplicate analyses are averaged to assess compliance with numeric screening levels.
4. Sample intervals presented as Mean Lower Low Water (MLLW) elevation.
5. Sediment Site Units and boundaries source: Figure 4-6, Cleanup Action Plan, Whatcom Waterway Site, September 2007.
6. BST stations 1C-101B-HSA and 1C-101C-HSA included co-located mud-rotary and diver core sampling.
7. Horizontal datum: Washington State Plane North, NAD 27/98.
8. Aerial photo taken in 2004.

Feet
0 75 150 225 300

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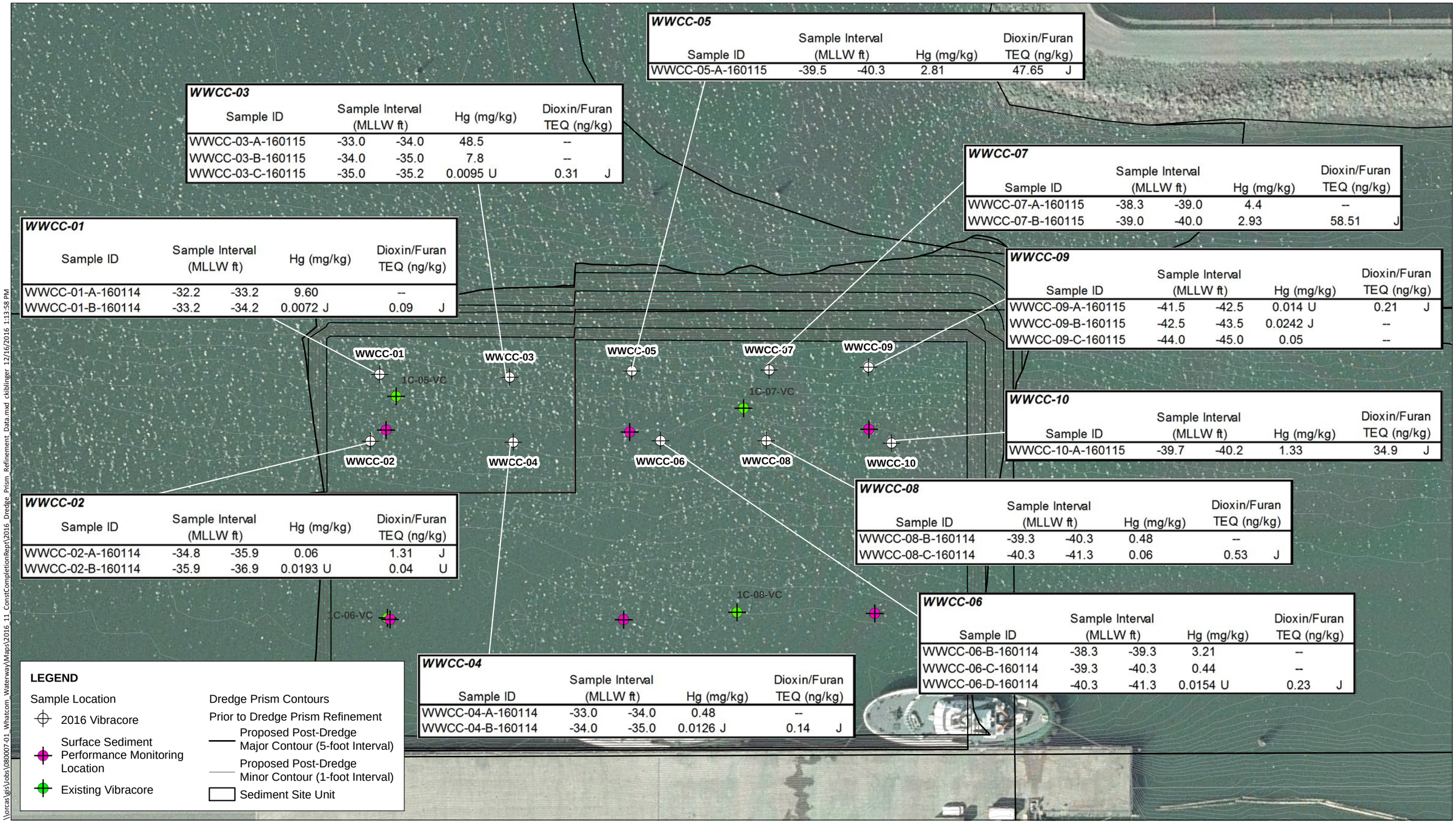
Figure 1
Existing Mercury Analytical Data and Progress Survey 16 Bathymetry
Appendix H - Supplemental Coring Program for BST
As-Built Report
Whatcom Waterway Cleanup in Phase 1 Site Areas



WWCC-05

Sample ID	Sample Interval (MLLW ft)		Hg (mg/kg)	Dioxin/Furan TEQ (ng/kg)
WWCC-05-A-160115	-39.5	-40.3	2.81	47.65 J

WWCC-03

Sample ID	Sample Interval (MLLW ft)		Hg (mg/kg)	Dioxin/Furan TEQ (ng/kg)
WWCC-03-A-160115	-33.0	-34.0	48.5	--
WWCC-03-B-160115	-34.0	-35.0	7.8	--
WWCC-03-C-160115	-35.0	-35.2	0.0095 U	0.31 J

WWCC-07

Sample ID	Sample Interval (MLLW ft)		Hg (mg/kg)	Dioxin/Furan TEQ (ng/kg)
WWCC-07-A-160115	-38.3	-39.0	4.4	--
WWCC-07-B-160115	-39.0	-40.0	2.93	58.51 J

WWCC-01

Sample ID	Sample Interval (MLLW ft)		Hg (mg/kg)	Dioxin/Furan TEQ (ng/kg)
WWCC-01-A-160114	-32.2	-33.2	9.60	--
WWCC-01-B-160114	-33.2	-34.2	0.0072 J	0.09 J

WWCC-09

Sample ID	Sample Interval (MLLW ft)		Hg (mg/kg)	Dioxin/Furan TEQ (ng/kg)
WWCC-09-A-160115	-41.5	-42.5	0.014 U	0.21 J
WWCC-09-B-160115	-42.5	-43.5	0.0242 J	--
WWCC-09-C-160115	-44.0	-45.0	0.05	--

WWCC-10

Sample ID	Sample Interval (MLLW ft)		Hg (mg/kg)	Dioxin/Furan TEQ (ng/kg)
WWCC-10-A-160115	-39.7	-40.2	1.33	34.9 J

WWCC-02

Sample ID	Sample Interval (MLLW ft)		Hg (mg/kg)	Dioxin/Furan TEQ (ng/kg)
WWCC-02-A-160114	-34.8	-35.9	0.06	1.31 J
WWCC-02-B-160114	-35.9	-36.9	0.0193 U	0.04 U

WWCC-08

Sample ID	Sample Interval (MLLW ft)		Hg (mg/kg)	Dioxin/Furan TEQ (ng/kg)
WWCC-08-B-160114	-39.3	-40.3	0.48	--
WWCC-08-C-160114	-40.3	-41.3	0.06	0.53 J

WWCC-04

Sample ID	Sample Interval (MLLW ft)		Hg (mg/kg)	Dioxin/Furan TEQ (ng/kg)
WWCC-04-A-160114	-33.0	-34.0	0.48	--
WWCC-04-B-160114	-34.0	-35.0	0.0126 J	0.14 J

WWCC-06

Sample ID	Sample Interval (MLLW ft)		Hg (mg/kg)	Dioxin/Furan TEQ (ng/kg)
WWCC-06-B-160114	-38.3	-39.3	3.21	--
WWCC-06-C-160114	-39.3	-40.3	0.44	--
WWCC-06-D-160114	-40.3	-41.3	0.0154 U	0.23 J

LEGEND

Sample Location
- 2016 Vibracore
- Surface Sediment Performance Monitoring Location
- Existing Vibracore

Dredge Prism Contours
Prior to Dredge Prism Refinement
- Proposed Post-Dredge Major Contour (5-foot Interval)
- Proposed Post-Dredge Minor Contour (1-foot Interval)
- Sediment Site Unit

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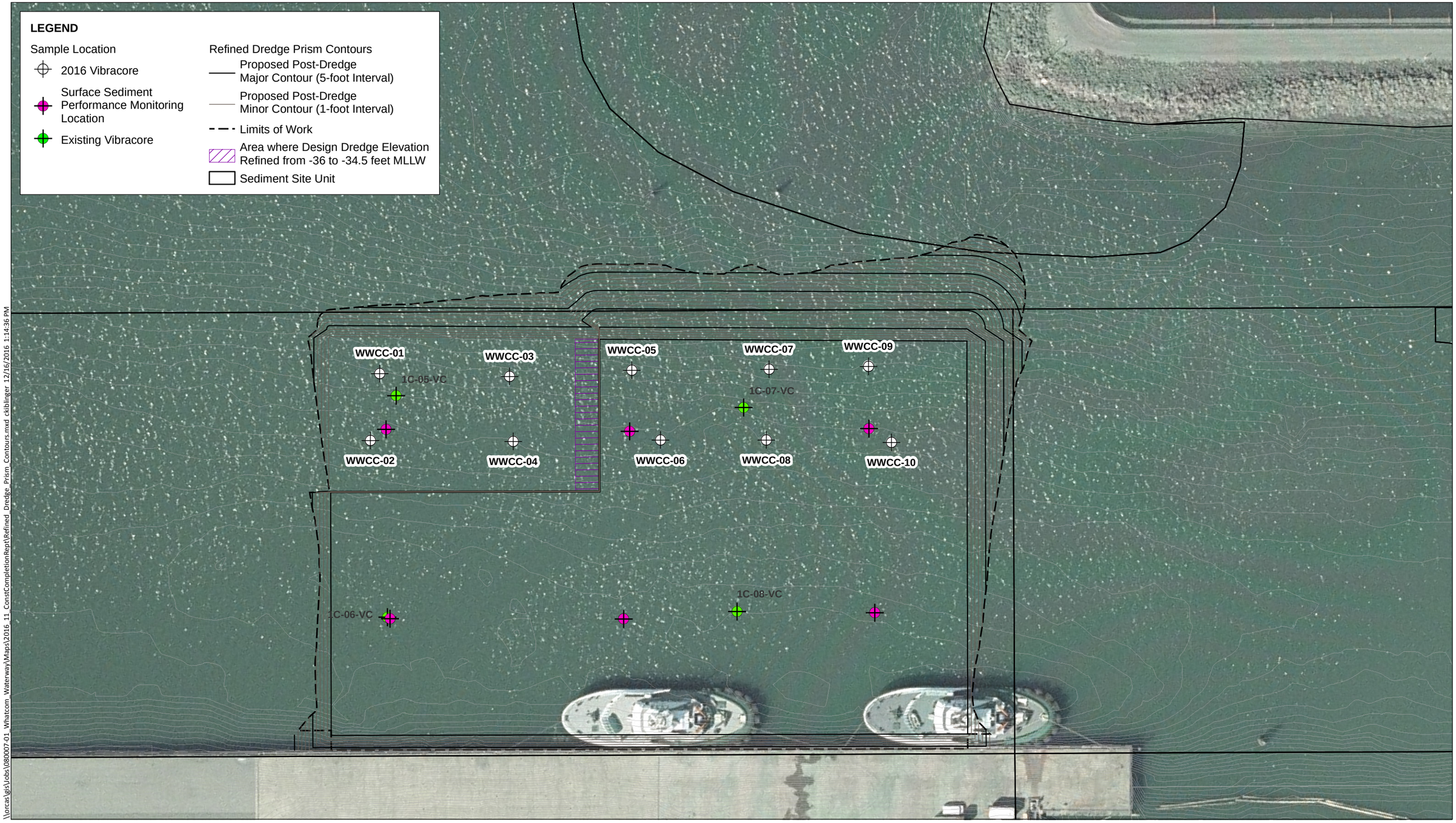
NOTES:
1. Horizontal Datum: WA State Plane North NAD 83 (Feet)
2. Sample intervals presented as Mean Lower Low Water (MLLW) elevation.
3. Toxic equivalency (TEQ) values were calculated for the validated dioxin/furan congeners using the 2005 World Health Organization's toxic equivalency factors for mammals. Undetected congeners were assigned a concentration equal to 1/2 the detection limit (ND=1/2).
4. Aerial photo is 2004.

Feet
0 75 150

Figure 2
2016 Dredge Prism Refinement Analytical Data
Appendix H - Supplemental Coring Program for BST
As-Built Report
Whatcom Waterway Cleanup in Phase 1 Site Areas



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NOTES:
1. Horizontal Datum: WA State Plane North NAD 83 (Feet).
2. Aerial photo is 2004.

Feet
0 75 150

Figure 3
Refined Dredge Prism Contours
Appendix H - Supplemental Coring Program for BST
As-Built Report
Whatcom Waterway Cleanup in Phase 1 Site Areas

ATTACHMENT A
SEDIMENT CORE LOGS

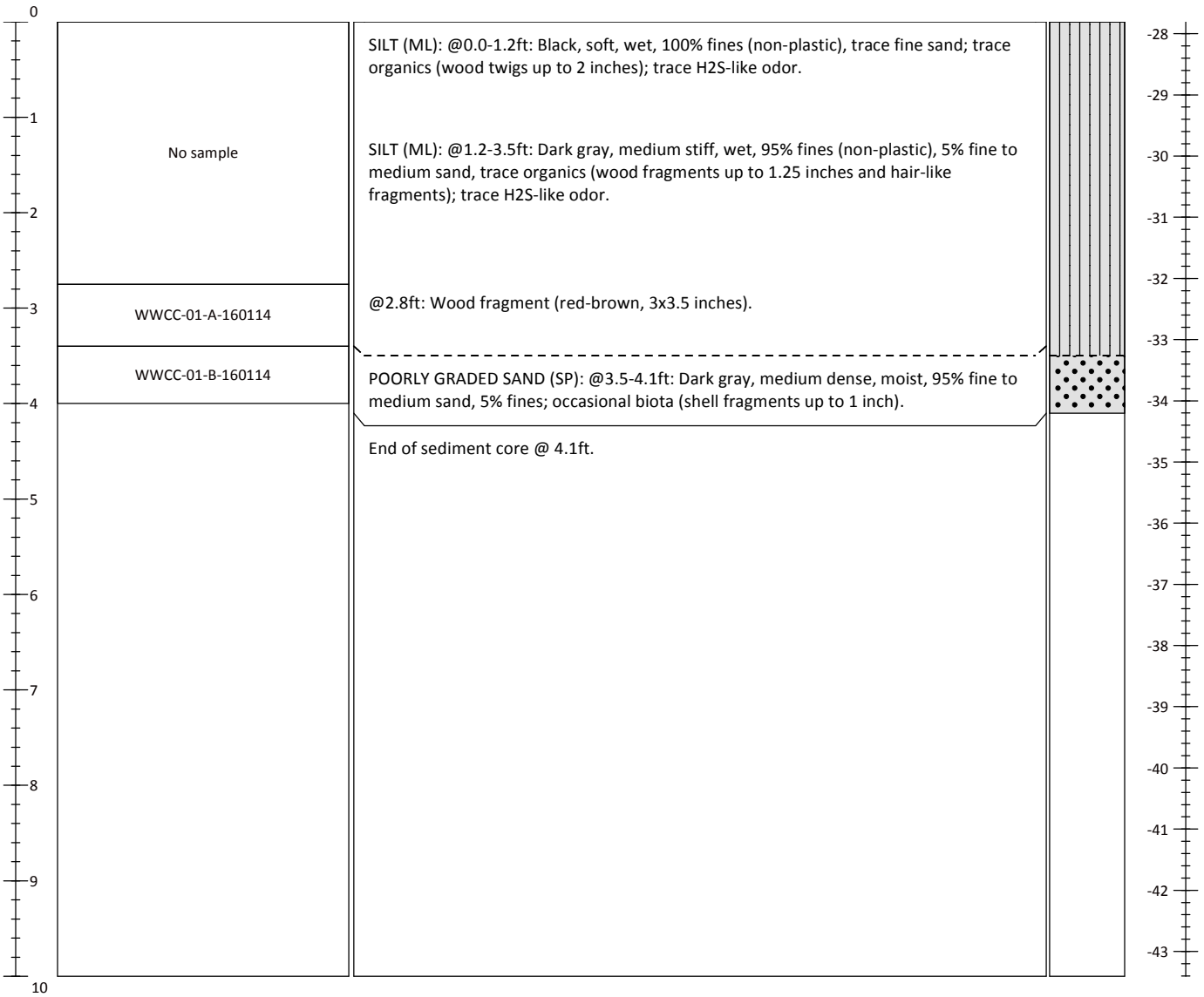
Sediment Core Log

Sheet 1 of 1

WWCC-01

Project: **Whatcom Waterway**	Estimated Mudline Elevation (ft, MLLW): **-27.9**	Method/Core Diameter: **Vibracore/4.0"**
Project #: **080007-01.04**	Tidal Elevation (MLLW): **+8.8**	Penetration Depth (ft): **7.0**
Client: **Port of Bellingham**	Lead Line: **-36.7**	Field Recovery Length (ft): **4.46**
Collection Date: **1/13/2016**	Northing: **48 44.76672 N** Easting: **122 29.69001 W**	Process Date: **1/14/2016**
Contractor: **Marine Sampling Services**	Horizontal Datum: **NAD83 WA SP N Feet**	Percent Recovery: **64%**
Logged By: **LH**	Vertical Datum: **MLLW (feet)**	Location: **Bellingham, WA**

Recovered Depth (ft)	Samples	Soil Description	Graphic Log (Expanded Depth (ft))	Estimated Mudline Elevation (feet, MLLW)
0–2.8	No sample	SILT (ML): @0.0-1.2ft: Black, soft, wet, 100% fines (non-plastic), trace fine sand; trace organics (wood twigs up to 2 inches); trace H2S-like odor. SILT (ML): @1.2-3.5ft: Dark gray, medium stiff, wet, 95% fines (non-plastic), 5% fine to medium sand, trace organics (wood fragments up to 1.25 inches and hair-like fragments); trace H2S-like odor.		
2.8–3.5	WWCC-01-A-160114	@2.8ft: Wood fragment (red-brown, 3x3.5 inches).		
3.5–4.1	WWCC-01-B-160114	POORLY GRADED SAND (SP): @3.5-4.1ft: Dark gray, medium dense, moist, 95% fine to medium sand, 5% fines; occasional biota (shell fragments up to 1 inch).		
		End of sediment core @ 4.1ft.		



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Notes: 1. Tidal elevations were provided by American Construction from their on-site tide gauge.
2. The core catcher was not retained during sampling so the field recovery length does not match the recovered depth.

Sediment Core Log

Sheet 1 of 1

WWCC-02

Project: **Whatcom Waterway**	Estimated Mudline Elevation (ft, MLLW): **-34.8**	Method/Core Diameter: **Vibracore/4.0"**
Project #: **080007-01.04**	Tidal Elevation (MLLW): **+5.9**	Penetration Depth (ft): **7.0**
Client: **Port of Bellingham**	Lead Line: **-40.7**	Field Recovery Length (ft): **5.58**
Collection Date: **1/14/2016**	Northing: **48 44.75947 N** Easting: **122 29.68165 W**	Process Date: **1/14/2016**
Contractor: **Marine Sampling Services**	Horizontal Datum: **NAD83 WA SP N Feet**	Percent Recovery: **80%**
Logged By: **LH**	Vertical Datum: **MLLW (feet)**	Location: **Bellingham, WA**

Recovered Depth (ft)	Samples	Soil Description Samples and descriptions are in recovered depths. Classification scheme: USCS	Graphic Log (Expanded Depth (ft))	Estimated Mudline Elevation (feet, MLLW)
0 – 1	WWCC-02-A-160114	POORLY GRADED SAND (SP): @0.0-5.1ft: Dark gray, loose, wet, 95% fine to medium sand, 5% fines; trace biota (shell fragments up to 1 inch).		-35 – -36
1 – 2	WWCC-02-B-160114	@0.8ft: Same as above but medium dense, moist.		-36 – -37
2 – 5	No sample	@2.5ft: Two large biota shell fragments (light brown up to 2x3 inches). @4.2ft: Same as above but occasional biota (light brown shell fragments up to 1 inch).		-37 – -41
5 – 10		End of sediment core @ 5.1ft.		-41 – -47

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Notes: 1. Tidal elevations were provided by American Construction from their on-site tide gauge.
2. The core catcher was not retained during sampling so the field recovery length does not match the recovered depth.

Sediment Core Log

WWCC-03

Sheet 1 of 1

Project: **Whatcom Waterway**	Estimated Mudline Elevation (ft, MLLW): **-27.7**	Method/Core Diameter: **Vibracore/4.0"**
Project #: **080007-01.04**	Tidal Elevation (MLLW): **+5.1**	Penetration Depth (ft): **8.0**
Client: **Port of Bellingham**	Lead Line: **-32.8**	Field Recovery Length (ft): **6.33**
Collection Date: **1/14/2016**	Northing: **48 44.77883 N** Easting: **122 29.67099 W**	Process Date: **1/15/2016**
Contractor: **Marine Sampling Services**	Horizontal Datum: **NAD83 WA SP N Feet**	Percent Recovery: **79%**
Logged By: **LH**	Vertical Datum: **MLLW (feet)**	Location: **Bellingham, WA**

Recovered Depth (ft)	Samples	Soil Description	Graphic Log (Expanded Depth (ft))	Estimated Mudline Elevation (feet, MLLW)
0–4	No sample	SILT (ML): @0.0-5.8ft: Dark gray, very soft, wet, 95% fines (non-plastic), 5% fine sand; trace H2S-like odor. @0.3ft: Same as above but dark gray to black, soft; occasional organics (wood fibers and fragments); trace H2S-like odor. @1.7ft: Same as above but dark gray, moist, no odor.		
4–5	WWCC-03-A-160115	@4.7-5.0ft: Pocket of black SILT (ML); trace petroleum-like odor.		
5–6	WWCC-03-B-160115	@5.2-5.8ft: Grades from SILT (ML) to SAND (SP); occasional biota (shell fragments).		
6	WWCC-03-C-160115	POORLY GRADED SAND (SP): @5.8-6.1ft: Dark gray, very dense, moist, 95% fine to medium sand, 5% fines; moderate biota (shell fragments).		
		End of sediment core @ 6.1ft.		

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Estimated Mudline Elevation scale: -28, -29, -30, -31, -32, -33, -34, -35, -36, -37, -38, -39, -40

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Notes: 1. Tidal elevations were provided by American Construction from their on-site tide gauge.
2. The core catcher was not retained during sampling so the field recovery length does not match the recovered depth.

Sediment Core Log

Sheet 1 of 1

WWCC-04

Project: **Whatcom Waterway**	Estimated Mudline Elevation (ft, MLLW): **-29.4**	Method/Core Diameter: **Vibracore/4.0"**
Project #: **080007-01.04**	Tidal Elevation (MLLW): **+6.4**	Penetration Depth (ft): **7.0**
Client: **Port of Bellingham**	Lead Line: **-35.8**	Field Recovery Length (ft): **4.83**
Collection Date: **1/13/2016**	Northing: **48 44.77301 N** Easting: **122 29.66104 W**	Process Date: **1/14/2016**
Contractor: **Marine Sampling Services**	Horizontal Datum: **NAD83 WA SP N Feet**	Percent Recovery: **69%**
Logged By: **LH**	Vertical Datum: **MLLW (feet)**	Location: **Bellingham, WA**

Recovered Depth (ft)	Samples	Soil Description	Graphic Log (Expanded Depth (ft))	Estimated Mudline Elevation (feet, MLLW)
0–2	No sample	SILT (ML): @0.0-3.1ft: Dark gray, soft, wet, 100% fines (non-plastic), trace fine sand; trace organics (wood fibers and fragments); moderate H2S-like odor. @1.5ft: Same as above but medium stiff, moist; occasional organics (wood fibers and fragments up to 2 inches); occasional biota (shell fragments up to 1.5 inches).		
2–3	WWCC-04-A-160114			
3–4	WWCC-04-B-160114	POORLY GRADED SAND (SP): @3.1-4.65ft: Dark gray, dense, moist, 100% fine to medium sand, trace fines; moderate biota (white shell fragments up to 1.5x1.5 inches). @3.85-4.2ft: Same as above but sand is fine, no biota. @4.2-4.65ft: Same as above but substantial biota (light brown shell fragments up to 0.5 inches).		
4–5	WWCC-04-C-160114			
5–10		End of sediment core @ 4.65ft.		

0 1 2 3 4 5 6 7 8 9 10

-30 -31 -32 -33 -34 -35 -36 -37 -38 -39 -40 -41 -42 -43

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Notes: 1. Tidal elevations were provided by American Construction from their on-site tide gauge.
2. The core catcher was not retained during sampling so the field recovery length does not match the recovered depth.

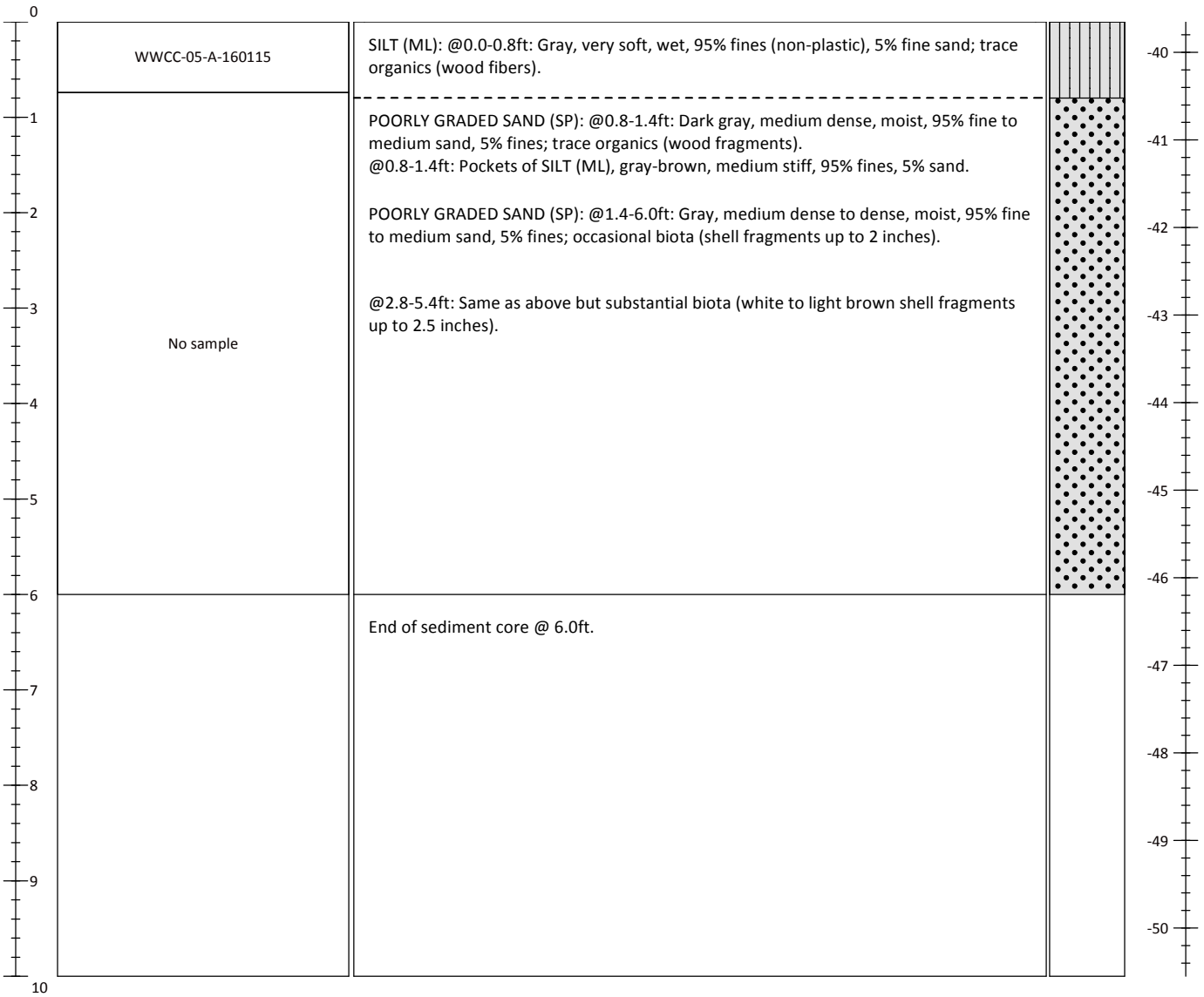
Sediment Core Log

Sheet 1 of 1

WWCC-05

Project: **Whatcom Waterway**	Estimated Mudline Elevation (ft, MLLW): **-39.5**	Method/Core Diameter: **Vibracore/4.0"**
Project #: **080007-01.04**	Tidal Elevation (MLLW): **+8.3**	Penetration Depth (ft): **7.0**
Client: **Port of Bellingham**	Lead Line: **-47.8**	Field Recovery Length (ft): **6.42**
Collection Date: **1/14/2016**	Northing: **48 44.79106 N** Easting: **122 29.65439 W**	Process Date: **1/15/2016**
Contractor: **Marine Sampling Services**	Horizontal Datum: **NAD83 WA SP N Feet**	Percent Recovery: **92%**
Logged By: **LH**	Vertical Datum: **MLLW (feet)**	Location: **Bellingham, WA**

Recovered Depth (ft)	Samples	Soil Description	Graphic Log (Expanded Depth (ft))	Estimated Mudline Elevation (feet, MLLW)
0 – 1	WWCC-05-A-160115	SILT (ML): @0.0-0.8ft: Gray, very soft, wet, 95% fines (non-plastic), 5% fine sand; trace organics (wood fibers).		
1 – 6	No sample	POORLY GRADED SAND (SP): @0.8-1.4ft: Dark gray, medium dense, moist, 95% fine to medium sand, 5% fines; trace organics (wood fragments). @0.8-1.4ft: Pockets of SILT (ML), gray-brown, medium stiff, 95% fines, 5% sand. POORLY GRADED SAND (SP): @1.4-6.0ft: Gray, medium dense to dense, moist, 95% fine to medium sand, 5% fines; occasional biota (shell fragments up to 2 inches). @2.8-5.4ft: Same as above but substantial biota (white to light brown shell fragments up to 2.5 inches).		
6 – 10		End of sediment core @ 6.0ft.		



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Notes: 1. Tidal elevations were provided by American Construction from their on-site tide gauge.
2. The core catcher was not retained during sampling so the field recovery length does not match the recovered depth.

Sediment Core Log

Sheet 1 of 1

WWCC-06

Project: **Whatcom Waterway**	Estimated Mudline Elevation (ft, MLLW): **-38.0**	Method/Core Diameter: **Vibracore/4.0"**
Project #: **080007-01.04**	Tidal Elevation (MLLW): **+6.2**	Penetration Depth (ft): **7.0**
Client: **Port of Bellingham**	Lead Line: **-44.2**	Field Recovery Length (ft): **5.75**
Collection Date: **1/13/2016**	Northing: **48 44.78718 N** Easting: **122 29.64018 W**	Process Date: **1/14/2016**
Contractor: **Marine Sampling Services**	Horizontal Datum: **NAD83 WA SP N Feet**	Percent Recovery: **82%**
Logged By: **LH**	Vertical Datum: **MLLW (feet)**	Location: **Bellingham, WA**

Recovered Depth (ft)	Samples	Soil Description	Graphic Log (Expanded Depth (ft))	Estimated Mudline Elevation (feet, MLLW)
0	WWCC-06-A-160114	SILT (ML): @0.0-0.3ft: Dark brown, very soft, wet, 95% fines (non-plastic), 5% fine sand; trace H2S-like odor.		
1	WWCC-06-B-160114	SILT (ML): @0.3-1.2ft: Dark gray-olive, medium stiff, moist, 95% fines (non-plastic), 5% fine sand; trace organics (wood fibers).		-39
2	WWCC-06-C-160114	POORLY GRADED SAND (SP): @1.2-5.0ft: Dark gray, dense, moist, 95% fine to medium sand, 5% fines; occasional biota (white and light brown shell fragments up to 1 inch).		-40
3	WWCC-06-D-160114	@3.0-3.3ft: Pocket of substantial biota (light brown, shell fragments, clam-like up to 2 inches).		-41
4	No sample			-42
5		End of sediment core @ 5.0ft.		-43
6				-44
7				-45
8				-46
9				-47
10				-48
				-49
				-50

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Notes: 1. Tidal elevations were provided by American Construction from their on-site tide gauge.
2. The core catcher was not retained during sampling so the field recovery length does not match the recovered depth.

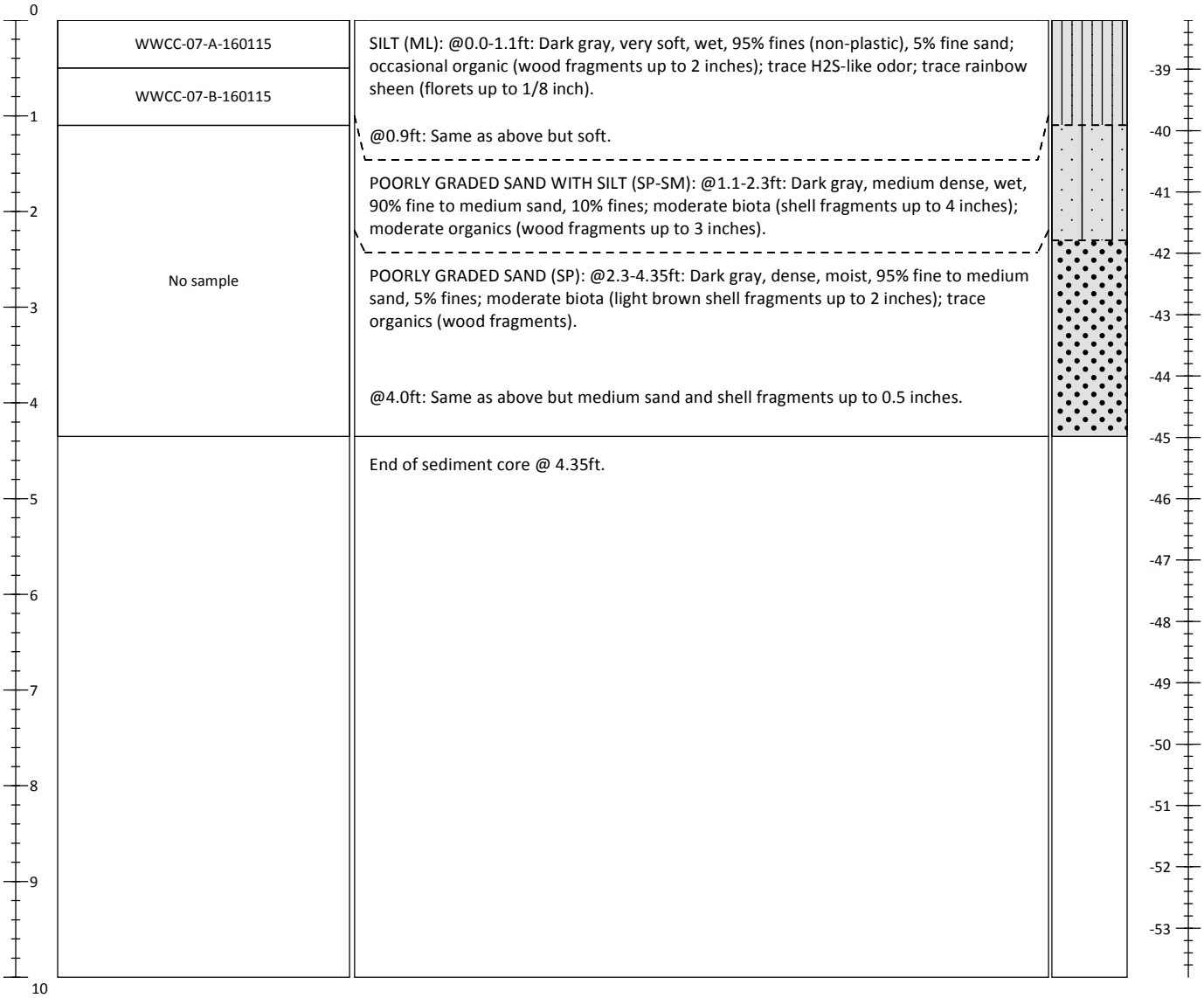
Sediment Core Log

Sheet 1 of 1

WWCC-07

Project: **Whatcom Waterway**	Estimated Mudline Elevation (ft, MLLW): **-38.3**	Method/Core Diameter: **Vibracore/4.0"**
Project #: **080007-01.04**	Tidal Elevation (MLLW): **+9.5**	Penetration Depth (ft): **7.0**
Client: **Port of Bellingham**	Lead Line: **-47.8**	Field Recovery Length (ft): **4.5**
Collection Date: **1/14/2016**	Northing: **48 44.80422 N** Easting: **122 29.63489 W**	Process Date: **1/15/2016**
Contractor: **Marine Sampling Services**	Horizontal Datum: **NAD83 WA SP N Feet**	Percent Recovery: **64%**
Logged By: **LH**	Vertical Datum: **MLLW (feet)**	Location: **Bellingham, WA**

Recovered Depth (ft)	Samples	Soil Description	Graphic Log (Expanded Depth (ft))	Estimated Mudline Elevation (feet, MLLW)
0 – 1	WWCC-07-A-160115 WWCC-07-B-160115	SILT (ML): @0.0-1.1ft: Dark gray, very soft, wet, 95% fines (non-plastic), 5% fine sand; occasional organic (wood fragments up to 2 inches); trace H2S-like odor; trace rainbow sheen (florets up to 1/8 inch). @0.9ft: Same as above but soft.		
1 – 4	No sample	POORLY GRADED SAND WITH SILT (SP-SM): @1.1-2.3ft: Dark gray, medium dense, wet, 90% fine to medium sand, 10% fines; moderate biota (shell fragments up to 4 inches); moderate organics (wood fragments up to 3 inches). POORLY GRADED SAND (SP): @2.3-4.35ft: Dark gray, dense, moist, 95% fine to medium sand, 5% fines; moderate biota (light brown shell fragments up to 2 inches); trace organics (wood fragments). @4.0ft: Same as above but medium sand and shell fragments up to 0.5 inches.		
4 – 10		End of sediment core @ 4.35ft.		



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Notes: 1. Tidal elevations were provided by American Construction from their on-site tide gauge.
2. The core catcher was not retained during sampling so the field recovery length does not match the recovered depth.

Sediment Core Log

WWCC-08

Sheet 1 of 1

Project: **Whatcom Waterway**	Estimated Mudline Elevation (ft, MLLW): **-39.1**	Method/Core Diameter: **Vibracore/4.0"**
Project #: **080007-01.04**	Tidal Elevation (MLLW): **+6.7**	Penetration Depth (ft): **7.0**
Client: **Port of Bellingham**	Lead Line: **-45.8**	Field Recovery Length (ft): **5.1**
Collection Date: **1/13/2016**	Northing: **48 44.79730 N** Easting: **122 29.62508 W**	Process Date: **1/14/2016**
Contractor: **Marine Sampling Services**	Horizontal Datum: **NAD83 WA SP N Feet**	Percent Recovery: **73%**
Logged By: **LH**	Vertical Datum: **MLLW (feet)**	Location: **Bellingham, WA**

Recovered Depth (ft)	Samples	Soil Description	Graphic Log (Expanded Depth (ft))	Estimated Mudline Elevation (feet, MLLW)
0 – 1	WWCC-08-A-160114	SILT (ML): @0.0-0.65ft: Dark gray-olive, very soft, wet, 95% fines (non-plastic), 5% fine to medium sand.		
1 – 2	WWCC-08-B-160114	SILT (ML): @0.65-1.1ft: Dark gray-olive, soft, wet 95% fines (non-plastic), 5% fine sand; trace organics (wood fibers).		
2 – 3	WWCC-08-C-160114	POORLY GRADED SAND (SP): @1.1-4.8ft: Dark gray-brown, medium dense, moist, 95% fine to medium sand, 5% fines; occasional biota (shell fragments up to 1 inch). @1.9-2.4ft: Pockets of SILTY SAND (SM).		
3 – 4	No sample	@2.6-2.9ft: Substantial biota (shell fragments).		
4 – 5		@3.65ft: Same as above @ 1.1ft but medium sand, trace fine gravel (subrounded).		
5 – 10		End of sediment core @ 4.8ft.		

Estimated Mudline Elevation (feet, MLLW): -40, -41, -42, -43, -44, -45, -46, -47, -48, -49, -50, -51, -52

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ANCHOR QEA
720 Olive Way
Seattle, WA 98101
(206) 903-9130

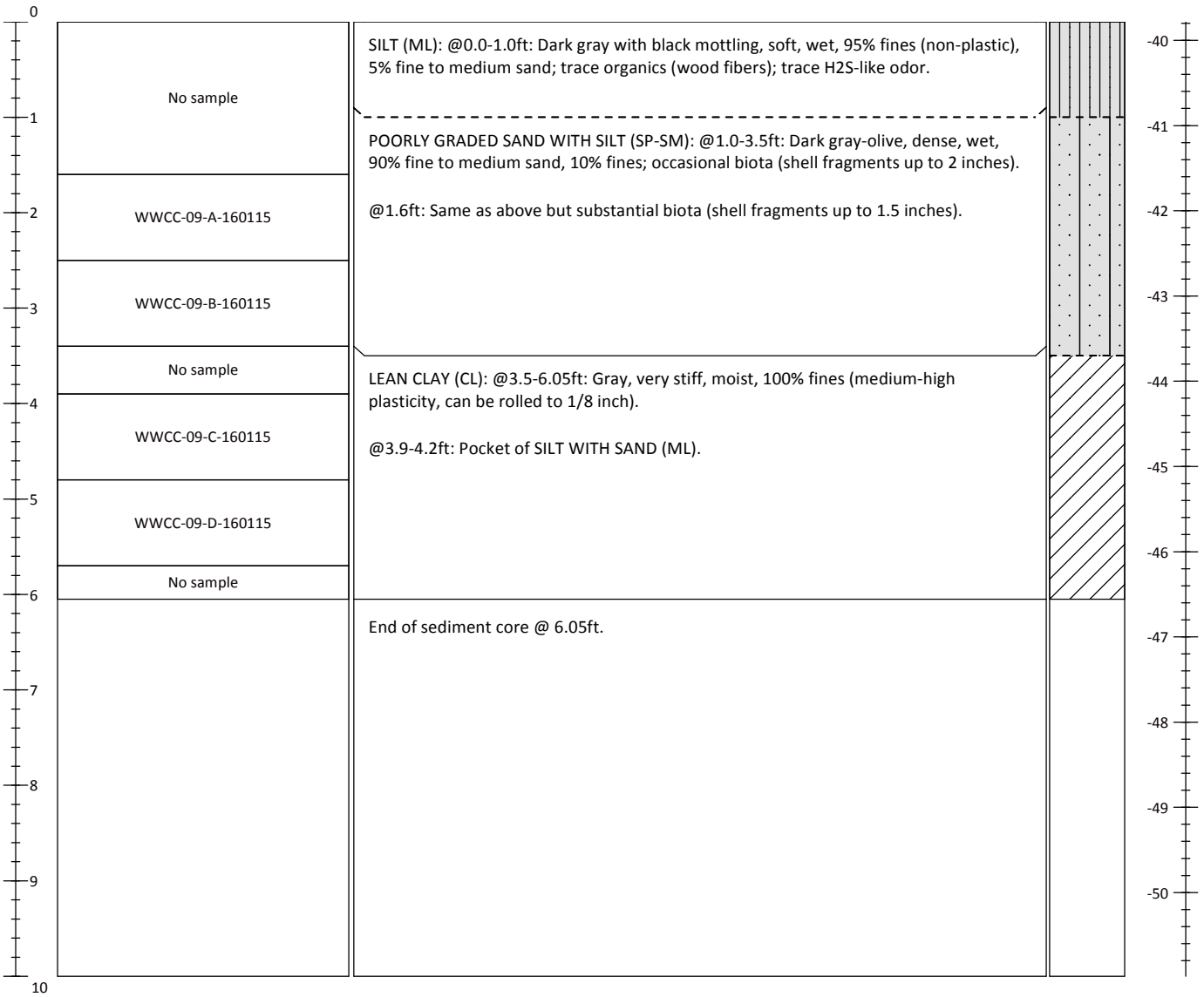
Notes: 1. Tidal elevations were provided by American Construction from their on-site tide gauge.
2. The core catcher was not retained during sampling so the field recovery length does not match the recovered depth.

Sediment Core Log

WWCC-09

Sheet 1 of 1

Project: **Whatcom Waterway**	Estimated Mudline Elevation (ft, MLLW): **-39.9**	Method/Core Diameter: **Vibracore/4.0"**
Project #: **080007-01.04**	Tidal Elevation (MLLW): **+6.9**	Penetration Depth (ft): **7.0**
Client: **Port of Bellingham**	Lead Line: **-46.8**	Field Recovery Length (ft): **6.25**
Collection Date: **1/14/2016**	Northing: **48 44.81401 N** Easting: **122 29.62112 W**	Process Date: **1/15/2016**
Contractor: **Marine Sampling Services**	Horizontal Datum: **NAD83 WA SP N Feet**	Percent Recovery: **89%**
Logged By: **LH**	Vertical Datum: **MLLW (feet)**	Location: **Bellingham, WA**



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Notes: 1. Tidal elevations were provided by American Construction from their on-site tide gauge.
2. The core catcher was not retained during sampling so the field recovery length does not match the recovered depth.

Sediment Core Log

Sheet 1 of 1

WWCC-10

Project: **Whatcom Waterway**	Estimated Mudline Elevation (ft, MLLW): **-39.7**	Method/Core Diameter: **Vibracore/4.0"**
Project #: **080007-01.04**	Tidal Elevation (MLLW): **+10.1**	Penetration Depth (ft): **7.0**
Client: **Port of Bellingham**	Lead Line: **-49.8**	Field Recovery Length (ft): **5.67**
Collection Date: **1/14/2016**	Northing: **48 44.80901 N** Easting: **122 29.60689 W**	Process Date: **1/15/2016**
Contractor: **Marine Sampling Services**	Horizontal Datum: **NAD83 WA SP N Feet**	Percent Recovery: **81%**
Logged By: **LH**	Vertical Datum: **MLLW (feet)**	Location: **Bellingham, WA**

Recovered Depth (ft)	Samples	Soil Description Samples and descriptions are in recovered depths. Classification scheme: USCS	Graphic Log (Expanded Depth (ft))	Estimated Mudline Elevation (feet, MLLW)
0	WWCC-10-A-160115	SILT (ML): @0.0-1.0ft: Dark gray, very soft, wet, 100% fines (non-plastic), trace sand.		-40
1		SILT (ML): @1.0-4.25ft: Dark gray, soft to medium stiff, moist, 100% fines (non-plastic); trace organics (wood fibers).		-41
2				-42
3	No sample			-43
4				-44
5		POORLY GRADED SAND (SP): @4.35-5.5ft: Gray, medium dense, moist, 95% fine to medium sand, 5% fines; occasional biota (white shell fragments up to 1 inch).		-45
6		End of sediment core @ 5.5ft.		-46
7				-47
8				-48
9				-49
10				-50
				-51
				-52

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(206) 903-9130

Notes: 1. Tidal elevations were provided by American Construction from their on-site tide gauge.
2. The core catcher was not retained during sampling so the field recovery length does not match the recovered depth.

ATTACHMENT B
ANALYTICAL DATA PACKAGES

(Provided Separately)

ATTACHMENT C
DATA VALIDATION MEMOS

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Whatcom Waterway

LDC Report Date: April 23, 2016

Parameters: Mercury

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): AUH2

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
WWCC-01-34-35	AUH2A	Sediment	01/14/16
WWCC-01-35-36	AUH2B	Sediment	01/14/16
WWCC-04-34-35	AUH2C	Sediment	01/14/16
WWCC-04-35-36	AUH2D	Sediment	01/14/16
WWCC-06-38-39	AUH2E	Sediment	01/14/16
WWCC-06-39-40	AUH2F	Sediment	01/14/16
WWCC-08-39-40	AUH2G	Sediment	01/14/16
WWCC-07-39.3-40	AUH2H	Sediment	01/15/16
WWCC-03-34-35	AUH2I	Sediment	01/15/16
WWCC-03-35-36	AUH2J	Sediment	01/15/16
WWCC-09-42.5-43.5	AUH2K	Sediment	01/15/16
WWCC-09-43.5-44.5	AUH2L	Sediment	01/15/16
WWCC-09-45-46	AUH2M	Sediment	01/15/16
WWCC-59-42.5-43.5	AUH2N	Sediment	01/15/16
WWCC-01-34-35MS	AUH2AMS	Sediment	01/14/16
WWCC-01-34-35DUP	AUH2ADUP	Sediment	01/14/16

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines (CLPNFG) for Inorganic Superfund Data Review (January 2010). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Mercury by Environmental Protection Agency (EPA) SW 846 Method 7471A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Instrument Calibration

Initial and continuing calibrations were performed as required by the method.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

III. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

IV. Field Blanks

No field blanks were identified in this SDG.

V. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) sample analysis was performed on an associated project sample. For WWCC-01-34-35MS, no data were qualified for Mercury percent recoveries (%R) outside the QC limits since the parent sample results were greater than 4X the spike concentration.

VI. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

VIII. Field Duplicates

Samples WWCC-09-42.5-43.5 and WWCC-59-42.5-43.5 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (mg/Kg)		RPD
	WWCC-09-42.5-43.5	WWCC-59-42.5-43.5	
Mercury	0.0072	0.0128	56

IX. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

X. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Whatcom Waterway
Mercury - Data Qualification Summary - SDG AUH2

No Sample Data Qualified in this SDG

Whatcom Waterway
Mercury - Laboratory Blank Data Qualification Summary - SDG AUH2

No Sample Data Qualified in this SDG

LDC #: 36153J4c
SDG #: AUH2
Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 2A B

Date: 4/19/16
Page: 1 of 1
Reviewer: JD
2nd Reviewer: a

METHOD: Mercury (EPA SW 846 Method 7471A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	1/14-15/16
II.	Instrument Calibration	~~A~~	
III.	Laboratory Blanks	A	
IV.	Field Blanks	N	
V.	Matrix Spike/Matrix Spike Duplicates	A	MS=(15)=Hg 74%
VI.	Duplicate sample analysis	A	DUP
VII.	Laboratory control samples	A	LCS
VIII.	Field Duplicates	SW	FD=(11,14)
IX.	Sample Result Verification	N	
X.	Overall Assessment of Data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	WWCC-01-34-35	AUH2A	Sediment	01/14/16
2	WWCC-01-35-36	AUH2B	Sediment	01/14/16
3	WWCC-04-34-35	AUH2C	Sediment	01/14/16
4	WWCC-04-35-36	AUH2D	Sediment	01/14/16
5	WWCC-06-38-39	AUH2E	Sediment	01/14/16
6	WWCC-06-39-40	AUH2F	Sediment	01/14/16
7	WWCC-08-39-40	AUH2G	Sediment	01/14/16
8	WWCC-07-39.3-40	AUH2H	Sediment	01/15/16
9	WWCC-03-34-35	AUH2I	Sediment	01/15/16
10	WWCC-03-35-36	AUH2J	Sediment	01/15/16
11	WWCC-09-42.5-43.5	AUH2K	Sediment	01/15/16
12	WWCC-09-43.5-44.5	AUH2L	Sediment	01/15/16
13	WWCC-09-45-46	AUH2M	Sediment	01/15/16
14	WWCC-59-42.5-43.5	AUH2N	Sediment	01/15/16
15	WWCC-01-34-35MS	AUH2AMS	Sediment	01/14/16
16	WWCC-01-34-35DUP	AUH2ADUP	Sediment	01/14/16
17				
18				
19				

LDC#: 36153J4c

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JD
2nd Reviewer: a

METHOD: Metals (EPA Method 6010B/7000)

Y N NA Were field duplicate pairs identified in this SDG?
Y N NA Were target analytes detected in the field duplicate pairs?

Analyte	Concentration (mg/Kg)		RPD
	11	14	
Mercury	0.0072	0.0128	56

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Whatcom Waterway

LDC Report Date: April 20, 2016

Parameters: Dioxins/Dibenzofurans

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): AUH5

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
WWCC-01-B-160114	AUH5B	Sediment	01/14/16
WWCC-04-B-160114	AUH5D	Sediment	01/14/16

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review (September 2011). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for unlabeled compounds and less than or equal to 35.0% for labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were within the QC limits for unlabeled compounds and labeled compounds with the following exceptions:

Date	Compound	Concentration (Limits)	Associated Samples	Affected Compound	Flag	A or P
10/15/15	1,2,3,4,7,8-HxCDF	56.905 pg (45-56)	WWCC-04-B-160114	1,2,3,4,7,8-HxCDF Total HxCDF	J (all detects) J (all detects)	P
10/15/15	1,2,3,4,7,8-HxCDF	56.905 pg (45-56)	WWCC-01-B-160114	1,2,3,4,7,8-HxCDF Total HxCDF	NA	-

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled compounds and labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
MB-011916	01/19/16	1,2,3,4,7,8-HxCDF	0.0310 pg/g	All samples in SDG AUH5
		2,3,4,6,7,8-HxCDF	0.0222 pg/g	
		1,2,3,7,8,9-HxCDF	0.0880 pg/g	
		1,2,3,4,7,8-HxCDD	0.0458 pg/g	
		1,2,3,4,6,7,8-HpCDF	0.207 pg/g	
		1,2,3,4,6,7,8-HpCDD	1.21 pg/g	
		OCDF	1.28 pg/g	
		OCDD	18.3 pg/g	
		Total TCDD	0.0728 pg/g	
		Total PeCDD	0.0326 pg/g	
		Total HxCDD	0.444 pg/g	
		Total HpCDD	2.76 pg/g	
		Total HxCDF	0.169 pg/g	
		Total HpCDF	0.544 pg/g	

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
WWCC-01-B-160114	1,2,3,7,8,9-HxCDF	0.101 pg/g	0.101U pg/g
	1,2,3,4,6,7,8-HpCDF	0.231 pg/g	0.231U pg/g
	1,2,3,4,6,7,8-HpCDD	0.898 pg/g	0.898U pg/g
	OCDF	0.863 pg/g	0.863U pg/g
	OCDD	11.4 pg/g	11.4U pg/g
	Total TCDD	0.165 pg/g	0.165J pg/g
	Total PeCDD	0.0293 pg/g	0.0293J pg/g
	Total HxCDD	0.567 pg/g	0.567J pg/g
	Total HpCDD	2.05 pg/g	2.05J pg/g
	Total HxCDF	0.253 pg/g	0.253J pg/g
	Total HpCDF	0.683 pg/g	0.683J pg/g
WWCC-04-B-160114	1,2,3,4,7,8-HxCDF	0.0974 pg/g	0.0974U pg/g
	2,3,4,6,7,8-HxCDF	0.0378 pg/g	0.0378U pg/g
	1,2,3,7,8,9-HxCDF	0.0865 pg/g	0.0865U pg/g
	1,2,3,4,6,7,8-HpCDD	4.06 pg/g	4.06U pg/g
	OCDF	4.56 pg/g	4.56U pg/g
	OCDD	37.3 pg/g	37.3U pg/g
	Total TCDD	0.311 pg/g	0.311J pg/g
	Total HxCDD	1.43 pg/g	1.43J pg/g
	Total HpCDD	9.41 pg/g	9.41J pg/g

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Ongoing Precision Recovery

Ongoing precision recovery (OPR) samples were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Internal Standards

All internal standard recoveries (%R) were within QC limits.

XI. Compound Quantitation

All compound quantitations were within validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG AUH5	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to ICV %D and results reported by the laboratory as EMPCs, data were qualified as estimated in two samples.

Due to laboratory blank contamination, data were qualified as estimated or not detected in two samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

Whatcom Waterway
Dioxins/Dibenzofurans - Data Qualification Summary - SDG AUH5

Sample	Compound	Flag	A or P	Reason
WWCC-04-B-160114	1,2,3,4,7,8-HxCDF Total HxCDF	J (all detects) J (all detects)	P	Initial calibration verification (%D)
WWCC-01-B-160114 WWCC-04-B-160114	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A	Compound quantitation (EMPCs)

Whatcom Waterway
Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG AUH5

Sample	Compound	Modified Final Concentration	A or P
WWCC-01-B-160114	1,2,3,7,8,9-HxCDF 1,2,3,4,6,7,8-HpCDF 1,2,3,4,6,7,8-HpCDD OCDF OCDD Total TCDD Total PeCDD Total HxCDD Total HpCDD Total HxCDF Total HpCDF	0.101U pg/g 0.231U pg/g 0.898U pg/g 0.863U pg/g 11.4U pg/g 0.165J pg/g 0.0293J pg/g 0.567J pg/g 2.05J pg/g 0.253J pg/g 0.683J pg/g	A
WWCC-04-B-160114	1,2,3,4,7,8-HxCDF 2,3,4,6,7,8-HxCDF 1,2,3,7,8,9-HxCDF 1,2,3,4,6,7,8-HpCDD OCDF OCDD Total TCDD Total HxCDD Total HpCDD	0.0974U pg/g 0.0378U pg/g 0.0865U pg/g 4.06U pg/g 4.56U pg/g 37.3U pg/g 0.311J pg/g 1.43J pg/g 9.41J pg/g	A

LDC #: 36153K21 **VALIDATION COMPLETENESS WORKSHEET** Date: 04/4/16
SDG #: AUH5 Stage 2B Page: 1 of
Laboratory: Analytical Resources, Inc. Reviewer:
2nd Reviewer:

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A/SW	≤ 20/35 ICV: QC limits
IV.	Continuing calibration	A	QC limits
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Matrix spike/Matrix spike duplicates	N	C.S.
VIII.	Laboratory control samples	A	OPR
IX.	Field duplicates	N	
X.	Internal standards	A	
XI.	Compound quantitation RL/~~LOQ/LODs~~	SW	
XII.	Target compound identification	N	
XIII.	System performance	N	
XIV.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	WWCC-01-B-160114	AUH5B	Sediment	01/14/16
2	WWCC-04-B-160114	AUH5D	Sediment	01/14/16
3				
4				
5				
6				
7				
8				
9				
10				

Notes:

	MB-011916						

VALIDATION FINDINGS WORKSHEET

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

A. 2,3,7,8-TCDD	F. 1,2,3,4,6,7,8-HpCDD	K. 1,2,3,4,7,8-HxCDF	P. 1,2,3,4,7,8,9-HpCDF	U. Total HpCDD
B. 1,2,3,7,8-PeCDD	G. OCDD	L. 1,2,3,6,7,8-HxCDF	Q. OCDF	V. Total TCDF
C. 1,2,3,4,7,8-HxCDD	H. 2,3,7,8-TCDF	M. 2,3,4,6,7,8-HxCDF	R. Total TCDD	W. Total PeCDF
D. 1,2,3,6,7,8-HxCDD	I. 1,2,3,7,8-PeCDF	N. 1,2,3,7,8,9-HxCDF	S. Total PeCDD	X. Total HxCDF
E. 1,2,3,7,8,9-HxCDD	J. 2,3,4,7,8-PeCDF	O. 1,2,3,4,6,7,8-HpCDF	T. Total HxCDD	Y. Total HpCDF

Notes:_____

LDC #: 36153K21

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Reviewer: 9m
2nd Reviewer: CL

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?

Y (N) N/A Were results within the QC limits for the method?

#	Date	Standard ID	Compound	Finding (Limit: pg)	Associated Samples	Qualifications
	10/15/15	15101510	K	56.905 (45-56)	all	Jdets/P (+X) (2 = det)

LDC #: 36153K21

VALIDATION FINDINGS WORKSHEET
Blanks

Page: 1 of 1
Reviewer: [signature]
2nd Reviewer: [signature]

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Were all samples associated with a method blank?
(Y) N N/A Was a method blank performed for each matrix and whenever a sample extraction was performed?
(Y) N N/A Was the method blank contaminated?

Blank extraction date: 01/19/16 **Blank analysis date:** 01/21/16

Conc. units: pg/g **Associated samples:** all

Compound	Blank ID	Sample Identification								
	MB-011916	5x	1	2						
K	0.0310	0.155		0.0974* /U						
M	0.0222	0.111		0.0378* /U						
N	0.0880	0.440	0.101* /U	0.0865 /U						
C	0.0458	0.229								
O	0.207	1.04	0.231 /U							
F	1.21	6.05	0.898 /U	4.06 /U						
Q	1.28	6.40	0.863 /U	4.56 /U						
G	18.3	91.5	11.4 /U	37.3 /U						
R	0.0728	0.364	0.165* /J	0.311* /J						
S	0.0326	0.163	0.0293* /J							
T	0.444*	2.22	0.567* /J	1.43* /J						
U	2.76	13.8	2.05 /J	9.41 /J						
X	0.169*	0.845	0.253* /J							
Y	0.544	2.72	0.683* /J							

*EMPC

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
All contaminants within five times the method blank concentration were qualified as not detected, "U".

LDC #: 36153L21

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported RLs

Reviewer:
2nd Reviewer:

METHOD: GC/MS Dioxins/Dibenzofurans (Method 1613B)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N ~~N/A~~ Were the correct internal standard (IS), quantitation ions and relative response factors (RRF) used to quantitate the compound?
Y N ~~N/A~~ Compound quantitation and RLs were adjusted to reflect all sample dilutions and dry weight factors (if necessary).

#	Date	Compound	Finding	Associated Samples	Qualifications
			EMPC results	all	Jdets/A

Comments: ~~See sample calculation verification worksheet for recalculations~~

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Whatcom Waterway

LDC Report Date: February 25, 2016

Parameters: Dioxins/Dibenzofurans

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): AUK5

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
WWCC-06-D-160114	AUK5A	Sediment	01/14/16
WWCC-05-A-160115	AUK5B	Sediment	01/15/16
WWCC-08-C-160114	AUK5C	Sediment	01/14/16
WWCC-02-A-160114	AUK5D	Sediment	01/14/16
WWCC-02-B-160114	AUK5E	Sediment	01/14/16
WWCC-07-B-160115	AUK5F	Sediment	01/15/16
WWCC-03-C-160115	AUK5G	Sediment	01/15/16
WWCC-09-A-160115	AUK5H	Sediment	01/15/16
WWCC-10-A-160115	AUK5I	Sediment	01/15/16
WWCC-06-D-160114DUP	AUK5ADUP	Sediment	01/14/16

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review (September 2011). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Dioxins/Dibenzofurans by Environmental Protection Agency (EPA) Method 1613B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. HRGC/HRMS Instrument Performance Check

Instrument performance was checked at the required frequency.

Retention time windows were established for all homologues. The chromatographic resolution between 2,3,7,8-TCDD and peaks representing any other unlabeled TCDD isomer was less than or equal to 25%.

The static resolving power was at least 10,000 (10% valley definition).

III. Initial Calibration and Initial Calibration Verification

A five point initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20% for unlabeled compounds and less than or equal to 35% for labeled compounds.

The ion abundance ratios for all PCDDs/PCDFs were within method and validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were within the QC limits for unlabeled compounds and labeled compounds with the following exceptions:

Date	Compound	Concentration (Limits)	Associated Samples	Affected Compound	Flag	A or P
10/15/15	1,2,3,4,7,8-HxCDF	56.905 pg (45-56)	WWCC-06-D-160114 WWCC-05-A-160115 WWCC-08-C-160114 WWCC-02-A-160114 WWCC-07-B-160115 WWCC-10-A-160115	1,2,3,4,7,8-HxCDF Total HxCDF	J (all detects) J (all detects)	P
10/15/15	1,2,3,4,7,8-HxCDF	56.905 pg (45-56)	WWCC-02-B-160114 WWCC-03-C-160115 WWCC-09-A-160115	1,2,3,4,7,8-HxCDF Total HxCDF	NA	-

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration results were within the QC limits for unlabeled compounds and labeled compounds.

The ion abundance ratios for all PCDDs and PCDFs were within method and validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
MB-012816	01/28/16	1,2,3,7,8,9-HxCDF 1,2,3,6,7,8-HxCDD 1,2,3,4,6,7,8-HpCDF 1,2,3,4,6,7,8-HpCDD OCDF OCDD Total TCDD Total HxCDD Total HpCDD Total HxCDF Total HpCDF	0.0700 pg/g 0.0980 pg/g 0.0520 pg/g 1.24 pg/g 0.430 pg/g 9.96 pg/g 0.0734 pg/g 0.975 pg/g 3.42 pg/g 0.0704 pg/g 0.163 pg/g	All samples in SDG AUK5

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
WWCC-06-D-160114	1,2,3,7,8,9-HxCDF 1,2,3,6,7,8-HxCDD 1,2,3,4,6,7,8-HpCDD OCDD Total HxCDD Total HpCDD	0.171 pg/g 0.245 pg/g 4.38 pg/g 39.2 pg/g 2.99 pg/g 10.2 pg/g	0.171U pg/g 0.245U pg/g 4.38U pg/g 39.2U pg/g 2.99J pg/g 10.2J pg/g
WWCC-08-C-160114	1,2,3,7,8,9-HxCDF 1,2,3,4,6,7,8-HpCDD OCDF OCDD Total HpCDD Total HpCDF	0.0775 pg/g 2.76 pg/g 0.717 pg/g 15.3 pg/g 5.72 pg/g 0.718 pg/g	0.0775U pg/g 2.76U pg/g 0.717U pg/g 15.3U pg/g 5.72J pg/g 0.718J pg/g
WWCC-02-A-160114	1,2,3,7,8,9-HxCDF	0.205 pg/g	0.205U pg/g

Sample	Compound	Reported Concentration	Modified Final Concentration
WWCC-02-B-160114	1,2,3,7,8,9-HxCDF	0.0717 pg/g	0.0717U pg/g
	1,2,3,4,6,7,8-HpCDF	0.0737 pg/g	0.0737U pg/g
	1,2,3,4,6,7,8-HpCDD	0.773 pg/g	0.773U pg/g
	OCDF	0.282 pg/g	0.282U pg/g
	OCDD	7.82 pg/g	7.82U pg/g
	Total TCDD	0.282 pg/g	0.282J pg/g
	Total HxCDD	0.383 pg/g	0.383J pg/g
	Total HpCDD	1.89 pg/g	1.89J pg/g
	Total HxCDF	0.0711 pg/g	0.0711J pg/g
	Total HpCDF	0.186 pg/g	0.186J pg/g
WWCC-03-C-160115	1,2,3,7,8,9-HxCDF	0.0897 pg/g	0.0897U pg/g
	1,2,3,6,7,8-HxCDD	0.274 pg/g	0.274U pg/g
	1,2,3,4,6,7,8-HpCDD	5.48 pg/g	5.48U pg/g
	OCDD	45.4 pg/g	45.4U pg/g
	Total HxCDD	3.05 pg/g	3.05J pg/g
	Total HpCDD	12.3 pg/g	12.3J pg/g
WWCC-09-A-160115	1,2,3,4,6,7,8-HpCDD	2.01 pg/g	2.01U pg/g
	OCDD	28.9 pg/g	28.9U pg/g
	Total TCDD	0.142 pg/g	0.142J pg/g
	Total HxCDD	0.762 pg/g	0.762J pg/g
	Total HpCDD	5.06 pg/g	5.06J pg/g
	Total HxCDF	0.126 pg/g	0.126J pg/g

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates/Duplicate Sample Analyses

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Ongoing Precision & Recovery Samples

Ongoing precision and recovery (OPR) samples were reviewed for each matrix as applicable. The percent recoveries (%R) were within the QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Internal Standards

All internal standard recoveries (%R) were within QC limits.

XI. Compound Quantitation

All compound quantitations were within validation criteria with the following exceptions:

Sample	Compound	Flag	A or P
All samples in SDG AUK5	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A

Sample	Finding	Flag	A or P
WWCC-05-A-160115 WWCC-08-C-160114 WWCC-02-A-160114 WWCC-07-B-160115 WWCC-10-A-160115	All compounds flagged "X" due to DiPhenylEther interference	J (all detects)	P

Sample	Compound	Finding	Criteria	Flag	A or P
WWCC-05-A-160115 WWCC-07-B-160115 WWCC-10-A-160115	OCDD	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects)	P

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to ICV %D, results reported by the laboratory as EMPCs, DiPhenylEther Interference, and results exceeding the calibration range, data were qualified as estimated in nine samples.

Due to laboratory blank contamination, data were qualified as not detected or estimated in six samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

Whatcom Waterway
Dioxins/Dibenzofurans - Data Qualification Summary - SDG AUK5

Sample	Compound	Flag	A or P	Reason
WWCC-06-D-160114 WWCC-05-A-160115 WWCC-08-C-160114 WWCC-02-A-160114 WWCC-07-B-160115 WWCC-10-A-160115	1,2,3,4,7,8-HxCDF Total HxCDF	J (all detects) J (all detects)	P	Initial calibration verification (%D)
WWCC-06-D-160114 WWCC-05-A-160115 WWCC-08-C-160114 WWCC-02-A-160114 WWCC-02-B-160114 WWCC-07-B-160115 WWCC-03-C-160115 WWCC-09-A-160115 WWCC-10-A-160115	All compounds reported as estimated maximum possible concentration (EMPC).	J (all detects)	A	Compound quantitation (EMPC)
WWCC-05-A-160115 WWCC-08-C-160114 WWCC-02-A-160114 WWCC-07-B-160115 WWCC-10-A-160115	All compounds flagged "X" due to DiPhenylEther interference	J (all detects)	P	Compound quantitation (DiPhenylEther interference)
WWCC-05-A-160115 WWCC-07-B-160115 WWCC-10-A-160115	OCDD	J (all detects)	P	Compound quantitation (exceeded range)

Whatcom Waterway
Dioxins/Dibenzofurans - Laboratory Blank Data Qualification Summary - SDG AUK5

Sample	Compound	Modified Final Concentration	A or P
WWCC-06-D-160114	1,2,3,7,8,9-HxCDF 1,2,3,6,7,8-HxCDD 1,2,3,4,6,7,8-HpCDD OCDD Total HxCDD Total HpCDD	0.171U pg/g 0.245U pg/g 4.38U pg/g 39.2U pg/g 2.99J pg/g 10.2J pg/g	A
WWCC-08-C-160114	1,2,3,7,8,9-HxCDF 1,2,3,4,6,7,8-HpCDD OCDF OCDD Total HpCDD Total HpCDF	0.0775U pg/g 2.76U pg/g 0.717U pg/g 15.3U pg/g 5.72J pg/g 0.718J pg/g	A
WWCC-02-A-160114	1,2,3,7,8,9-HxCDF	0.205U pg/g	A

Sample	Compound	Modified Final Concentration	A or P
WWCC-02-B-160114	1,2,3,7,8,9-HxCDF 1,2,3,4,6,7,8-HpCDF 1,2,3,4,6,7,8-HpCDD OCDF OCDD Total TCDD Total HxCDD Total HpCDD Total HxCDF Total HpCDF	0.0717U pg/g 0.0737U pg/g 0.773U pg/g 0.282U pg/g 7.82U pg/g 0.282J pg/g 0.383J pg/g 1.89J pg/g 0.0711J pg/g 0.186J pg/g	A
WWCC-03-C-160115	1,2,3,7,8,9-HxCDF 1,2,3,6,7,8-HxCDD 1,2,3,4,6,7,8-HpCDD OCDD Total HxCDD Total HpCDD	0.0897U pg/g 0.274U pg/g 5.48U pg/g 45.4U pg/g 3.05J pg/g 12.3J pg/g	A
WWCC-09-A-160115	1,2,3,4,6,7,8-HpCDD OCDD Total TCDD Total HxCDD Total HpCDD Total HxCDF	2.01U pg/g 28.9U pg/g 0.142J pg/g 0.762J pg/g 5.06J pg/g 0.126J pg/g	A

LDC #: 35882B21 **VALIDATION COMPLETENESS WORKSHEET** Date: 2-20-16
SDG #: AUK5 Stage 2B Page: 1 of 1
Laboratory: Analytical Resources, Inc. Reviewer: YM
2nd Reviewer: a

METHOD: HRGC/HRMS Dioxins/Dibenzofurans (EPA Method 1613B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A, A	
II.	HRGC/HRMS Instrument performance check	A	
III.	Initial calibration/ICV	A, SW	≤20/35 ICV QC limits
IV.	Continuing calibration	A	QC limits
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Matrix spike/Matrix spike duplicates /DUP	N/A	C.S / D=1+10 (all <5xRL)
VIII.	Laboratory control samples	A	OPR
IX.	Field duplicates	N	
X.	Internal standards	A	
XI.	Compound quantitation RL/~~LOQ/LODs~~	SW	
XII.	Target compound identification	N	
XIII.	System performance	N	
XIV.	Overall assessment of data	A	

Note: A = Acceptable ND = No compounds detected D = Duplicate SB=Source blank
N = Not provided/applicable R = Rinsate TB = Trip blank OTHER:
SW = See worksheet FB = Field blank EB = Equipment blank

	Client ID	Lab ID	Matrix	Date
1	WWCC-06-D-160114	AUK5A	Sediment	01/14/16
2	WWCC-05-A-160115	AUK5B	Sediment	01/15/16
3	WWCC-08-C-160114	AUK5C	Sediment	01/14/16
4	WWCC-02-A-160114	AUK5D	Sediment	01/14/16
5	WWCC-02-B-160114	AUK5E	Sediment	01/14/16
6	WWCC-07-B-160115	AUK5F	Sediment	01/15/16
7	WWCC-03-C-160115	AUK5G	Sediment	01/15/16
8	WWCC-09-A-160115	AUK5H	Sediment	01/15/16
9	WWCC-10-A-160115	AUK5I	Sediment	01/15/16
10	WWCC-06-D-160114DUP	AUK5ADUP	Sediment	01/14/16
11				
12				
13				
14				
15	MB-012816			

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Whatcom Waterway

LDC Report Date: April 23, 2016

Parameters: Mercury

Validation Level: Stage 2B

Laboratory: Analytical Resources, Inc.

Sample Delivery Group (SDG): AUK6

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
WWCC-08-C-160114	AUK6A	Sediment	01/14/16
WWCC-02-A-160114	AUK6B	Sediment	01/14/16
WWCC-02-B-160114	AUK6C	Sediment	01/14/16
WWCC-07-B-160115	AUK6D	Sediment	01/15/16
WWCC-06-D-160115	AUK6E	Sediment	01/14/16
WWCC-05-A-160115	AUK6F	Sediment	01/15/16
WWCC-03-C-160115	AUK6G	Sediment	01/15/16
WWCC-09-A-160115	AUK6H	Sediment	01/15/16
WWCC-10-A-160115	AUK6I	Sediment	01/15/16
WWCC-08-C-160114MS	AUK6AMS	Sediment	01/14/16
WWCC-08-C-160114DUP	AUK6ADUP	Sediment	01/14/16

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines (CLPNFG) for Inorganic Superfund Data Review (January 2010). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Mercury by Environmental Protection Agency (EPA) SW 846 Method 7471A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Instrument Calibration

Initial and continuing calibrations were performed as required by the method.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

III. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Analyte	Maximum Concentration	Associated Samples
PB (prep blank)	Mercury	0.0100 mg/Kg	All samples in SDG AUK6

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Final Concentration
WWCC-02-B-160114	Mercury	0.0193 mg/Kg	0.0193U mg/Kg
WWCC-06-D-160115	Mercury	0.0154 mg/Kg	0.0154U mg/Kg
WWCC-03-C-160115	Mercury	0.0095 mg/Kg	0.0095U mg/Kg
WWCC-09-A-160115	Mercury	0.0140 mg/Kg	0.0140U mg/Kg

IV. Field Blanks

No field blanks were identified in this SDG.

V. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits.

VI. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

VIII. Field Duplicates

No field duplicates were identified in this SDG.

IX. Sample Result Verification

Raw data were not reviewed for Stage 2B validation.

X. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to laboratory blank contamination, data were qualified as not detected in four samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Based upon the data validation all other results are considered valid and usable for all purposes.

Whatcom Waterway
Mercury - Data Qualification Summary - SDG AUK6

No Sample Data Qualified in this SDG

Whatcom Waterway
Mercury - Laboratory Blank Data Qualification Summary - SDG AUK6

Sample	Analyte	Modified Final Concentration	A or P
WWCC-02-B-160114	Mercury	0.0193U mg/Kg	A
WWCC-06-D-160115	Mercury	0.0154U mg/Kg	A
WWCC-03-C-160115	Mercury	0.0095U mg/Kg	A
WWCC-09-A-160115	Mercury	0.0140U mg/Kg	A

LDC #: 36153M4c

SDG #: AUK6

Laboratory: Analytical Resources, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 4/19/17

Page: 1 of 1

Reviewer: JD

2nd Reviewer:

METHOD: Mercury (EPA SW 846 Method 7471A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A	
II.	Instrument Calibration	A	
III.	Laboratory Blanks	SW	
IV.	Field Blanks	N	
V.	Matrix Spike/Matrix Spike Duplicates	A	MS
VI.	Duplicate sample analysis	A	DUP
VII.	Laboratory control samples	A	LCS
VIII.	Field Duplicates	N	
IX.	Sample Result Verification	N	
X	Overall Assessment of Data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	WWCC-08-C-160114	AUK6A	Sediment	01/14/16
2	WWCC-02-A-160114	AUK6B	Sediment	01/14/16
3	WWCC-02-B-160114	AUK6C	Sediment	01/14/16
4	WWCC-07-B-160115	AUK6D	Sediment	01/15/16
5	WWCC-06-D-160115	AUK6E	Sediment	01/14/16
6	WWCC-05-A-160115	AUK6F	Sediment	01/15/16
7	WWCC-03-C-160115	AUK6G	Sediment	01/15/16
8	WWCC-09-A-160115	AUK6H	Sediment	01/15/16
9	WWCC-10-A-160115	AUK6I	Sediment	01/15/16
10	WWCC-08-C-160114MS	AUK6AMS	Sediment	01/14/16
11	WWCC-08-C-160114DUP	AUK6ADUP	Sediment	01/14/16
12				
13				
14				
15				

Notes:

LDC #: 36153M4c

VALIDATION FINDINGS WORKSHEET
PB/ICB/CCB QUALIFIED SAMPLES

Reviewer: JD
2nd Reviewer:

METHOD: Metals (EPA SW 864 Method 6010/6020/7000) Soil preparation factor applied:____
Sample Concentration units, unless otherwise noted: mg/kg Associated Samples: All

					Sample Identification									
Analyte	**Maximum PB[a] (mg/Kg)**	**Maximum PB[a] (ug/L)**	**Maximum ICB/CCB[a] (ug/L)**	**Blank Action Limit**	3	5	7	8						
Hg	0.0100			0.0500	0.0193	0.0154	0.0095	0.0140						

Samples with analyte concentrations within five times the associated ICB, CCB or PB concentration are listed above with the identifications from the Validation Completeness Worksheet. These sample results were qualified as not detected, "U".
Note : a - The listed analyte concentration is the highest ICB, CCB, or PB detected in the analysis of each element.

APPENDIX I
PHYSICAL TESTING DATA

PHYSICAL TESTING DATA
AS-BUILT REPORT FOR THE WHATCOM WATERWAY CLEANUP IN PHASE 1 SITE AREAS

Prepared for
Port of Bellingham

Prepared by
Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, Washington 98101

September 2018

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2 IMPORTED MATERIAL TESTING I-1

2.1 Structural Fill Material Testing I-1

2.2 Engineered Sediment Cap Material Testing I-2

3 BULKHEAD PILECAP TESTING I-2

3.1 Weld Coupon Test I-2

3.2 Pilecap Concrete Testing I-2

4 UPLAND CONCRETE TESTING I-3

List of Attachments

Attachment A Imported Structural Fill Sieve Analysis

Attachment B Imported Structural Fill Proctor Test

Attachment C Imported Structural Fill Nuclear Gauge Test (for Compaction)

Attachment D Imported Cap Material – Type 1 Sand and Residuals Management Cover Sieve Analysis

Attachment E Imported Cap Material – Type 2 Sand Sieve Analysis

Attachment F Imported Cap Material – Type 1 Filter Sieve Analysis

Attachment G Imported Cap Material – Type 2 Filter Sieve Analysis

Attachment H Imported Cap Material – Armor Rock Aggregate Source Approval Report

Attachment I Cutoff Wall Weld Coupon Test

Attachment J ECWW Pilecap Concrete Testing

Attachment K WCWW Pilecap Concrete Testing

Attachment L MSB Pilecap Concrete Testing

Attachment M WMSW Pilecap Concrete Testing

Attachment N LCW Replacement Concrete Slab Concrete Testing

LIST OF ACRONYMS AND ABBREVIATIONS

ECWW	East Central Waterfront Wall
LCW	The Landings at Colony Wharf
MSB	Maple Street Bulkhead
Project	Whatcom Waterway Cleanup in Phase 1 Site Areas Project
rebar	reinforcing bar
WCWW	West Central Waterfront Wall
WMSW	West Maple Street Wall
WSDOT	Washington State Department of Transportation

1 INTRODUCTION

This appendix documents the various physical tests conducted on construction materials during the Whatcom Waterway Cleanup in Phase 1 Site Areas Project (Project). Specifically, this appendix documents the physical testing of the following:

- Sieve analyses for the imported material used in the engineered sediment cap
- Sieve analysis, proctor test, and compaction testing for imported structural fill
- Field welding for the Central Waterfront cutoff wall
- Concrete testing for the construction of the cutoff wall pilecap and replacement concrete slabs adjacent to the cutoff wall

2 IMPORTED MATERIAL TESTING

Physical testing was completed on soil to confirm that the imported materials met the material specification of the design. Physical testing completed on imported soils is summarized in the following sections.

2.1 Structural Fill Material Testing

Structural fill was required for upland backfill in various locations. Imported structural fill underwent a sieve analysis, a proctor test, and nuclear gauge test for compaction, described as follows:

- A **sieve analysis** was conducted for the imported structural fill source (Attachment A); the sieve analysis passed the substantive requirements of the material specification.
- A **proctor test**—used for measuring density with moisture—was conducted on the imported structural fill prior to its use as backfill in the former barge ramp area on the Central Waterfront Site (Attachment B); the test was used as the basis for determining the appropriate compaction effort required.
- A **nuclear gauge compaction test** was conducted on the imported structural fill that was used as backfill in the former barge ramp area on the Central Waterfront Site (Attachment C). The nuclear gauge test was conducted at multiple locations—two within the former barge ramp area and three within backfill against the cutoff wall (e.g., sheet pile wall); all passed the required criteria.

2.2 Engineered Sediment Cap Material Testing

Various imported materials were required for the construction of the different engineered sediment cap types; sieve analyses were conducted for the different material types and an aggregate source approval report was obtained for the source material.

- **Type 1 Sand and Residuals Management Cover Materials:** A sieve analysis was conducted for the imported material (Attachment D); the material was approved for use as both the Type 1 Sand and the Residuals Management Cover.
- **Type 2 Sand:** A sieve analysis was conducted for the imported sand (Attachment E); the material was approved for use.
- **Type 1 Filter:** A sieve analysis was conducted for the imported material (Attachment F); the material was approved for use.
- **Type 2 Filter:** A sieve analysis was conducted for the imported material (Attachment G); the material was approved for use.
- **Armor Rock:** A Washington State Department of Transportation (WSDOT) Aggregate Source Approval Report was submitted for the imported armor rock (Attachment H); the material was approved for use.

3 BULKHEAD PILECAP TESTING

Physical testing was completed on field welding and the concrete placement to confirm that the imported materials met the specifications of the design. Physical testing completed on the cutoff wall bulkhead pilecap is summarized in the following sections.

3.1 Weld Coupon Test

Physical testing of field welding was conducted to confirm that welding processes met the specifications of the design. A weld coupon test was completed to verify that the steel reinforcing bar (rebar) was correctly welded to the steel sheetpile cutoff wall (Attachment I); the test passed the required criteria.

3.2 Pilecap Concrete Testing

Concrete testing was completed for the concrete pilecap construction on the cutoff bulkhead, described as follows:

- **East Central Waterfront Wall (ECWW):** Concrete inspection and testing were conducted prior to and during the concrete placement for the ECWW pilecap (Attachment J); the pre-concrete pour inspection met the design and the concrete testing met the required specifications.
- **West Central Waterfront Wall (WCWW):** Concrete inspection and testing were conducted prior to and during the concrete placement for each of the west and east halves of the WCWW pilecap (Attachment K); the pre-concrete pour inspections met the design and the concrete testing met the required specifications.
- **Maple Street Bulkhead (MSB):** Concrete inspection and testing were conducted prior to and during the concrete placement for each of the west and east halves of the MSB pilecap (Attachment L); the pre-concrete pour inspections met the design and the concrete testing met the required specifications.
- **West Maple Street Wall (WMSW):** Concrete inspection and testing were conducted prior to and during the concrete placement for the WMSW pilecap (Attachment M); the pre-concrete pour inspection met the design and the concrete testing met the required specifications.

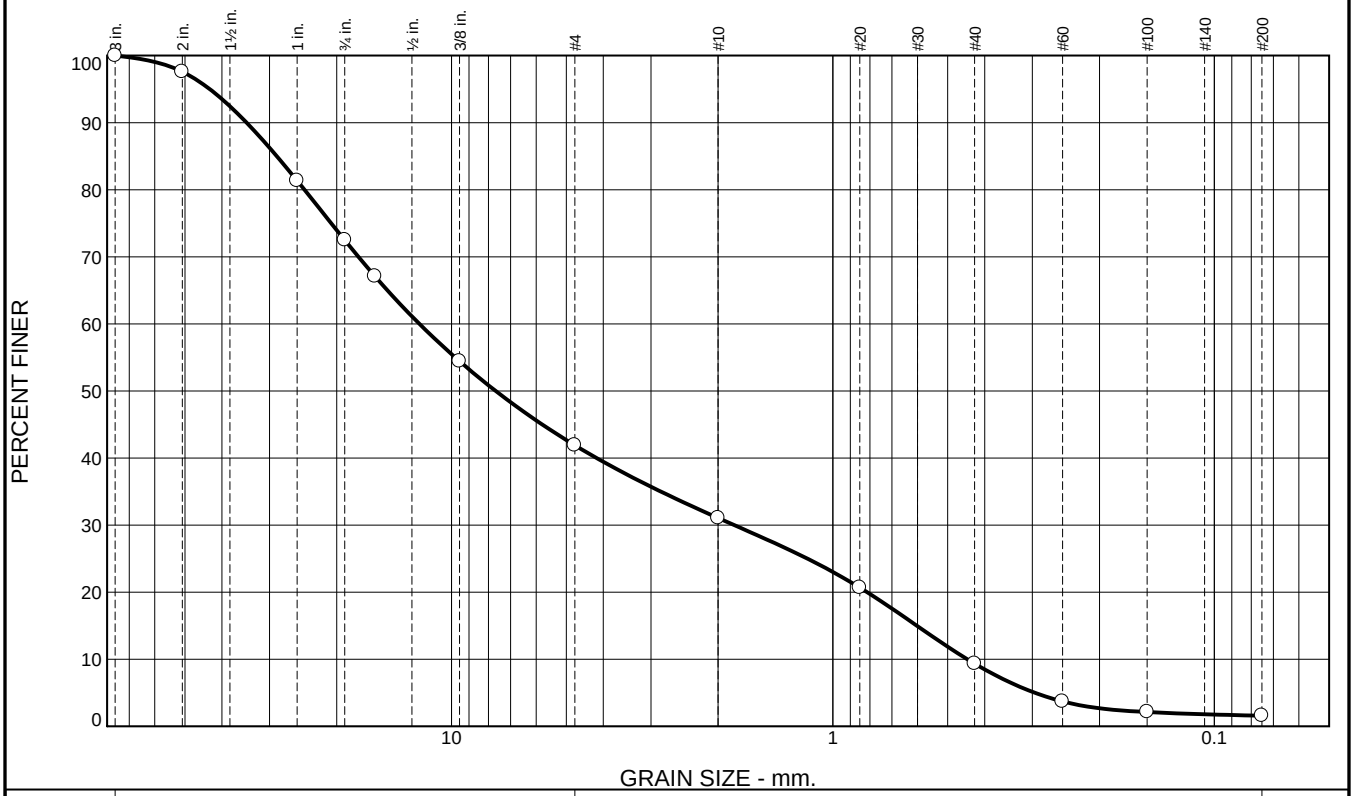
4 UPLAND CONCRETE TESTING

Concrete testing was completed for the replacement concrete slab construction adjacent to the ECWW, described as follows:

- **Concrete Slab:** Concrete testing was conducted during the concrete placement for the replacement concrete slab near the ECWW pilecap (Attachment N); the concrete testing met the required specifications.

ATTACHMENT A
IMPORTED STRUCTURAL FILL SIEVE ANALYSIS

Sieve Analysis Test Report - C136/C117



% +3"	% Gravel		% Sand			% Fines
	Coarse	Fine	Coarse	Medium	Fine	Silt
0	28	30	11	22	7	2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100		
2"	98		
1"	81		
3/4"	72		
5/8"	67		
3/8"	54		
#4	42		
#10	31		
#20	21		
#40	9		
#60	4		
#100	2		
#200	1.6		

* (no specification provided)

Material Description

Structural Fill
poorly graded gravel with sand

Atterberg Limits

PL= NP LL= NV PI=

Coefficients

D_{90}= 34.4488 D_{85}= 28.7159 D_{60}= 12.1407
D_{50}= 7.6575 D_{30}= 1.8148 D_{15}= 0.6026
D_{10}= 0.4443 C_u= 27.33 C_c= 0.61

Classification

USCS= GP AASHTO=

Remarks

Specification was not provided by client.

Location: Granite - Singer Pit - sampled at site stockpile
Sample Number: 7412

Date: 3-21-16

GEOTEST
741 Marine Drive
Bellingham, WA 98225
www.GeoTest-inc.com

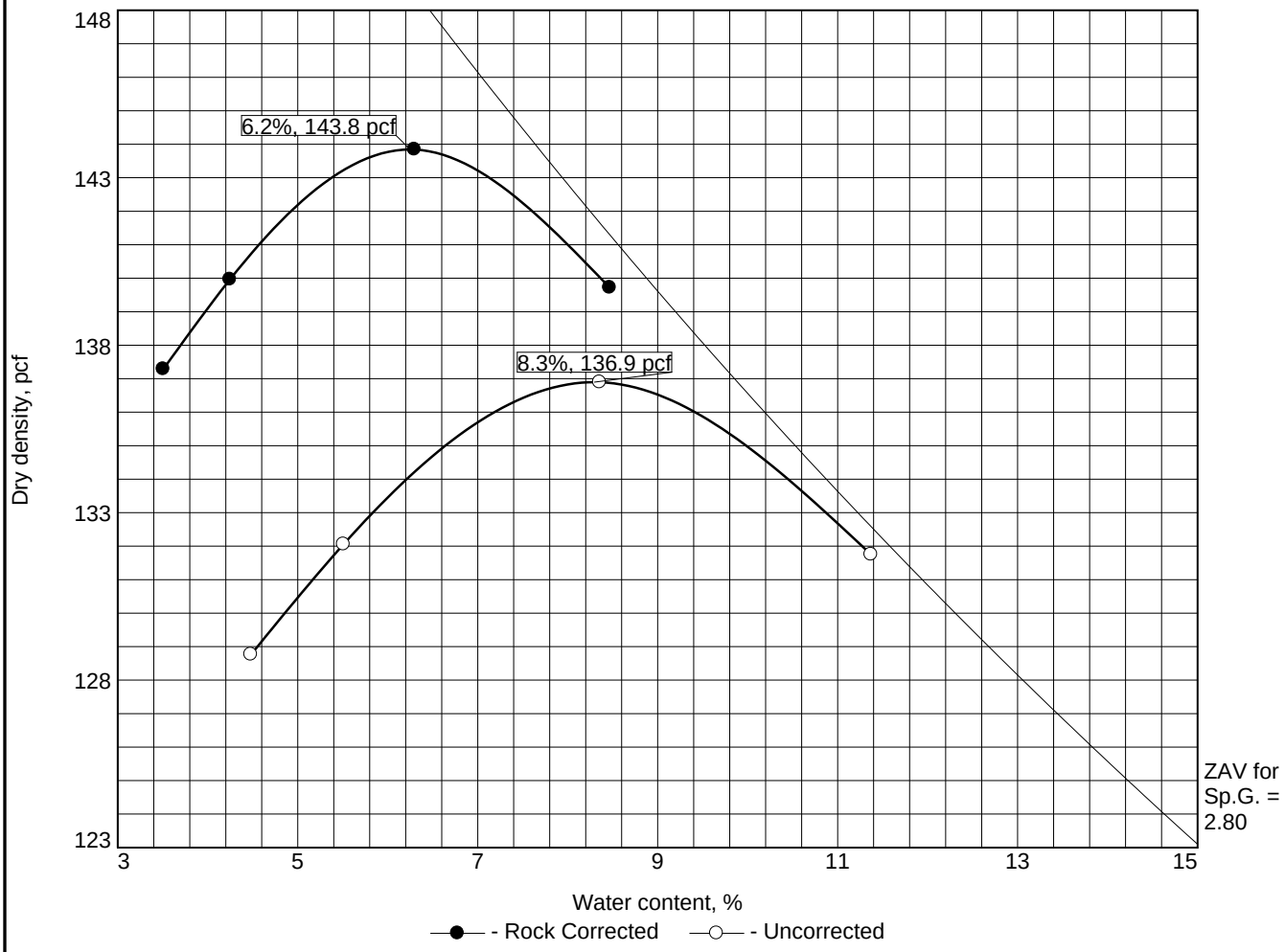
Client: Strider Construction Company
Project: Whatcom Waterway Phase I

Project No: 16-0015 **Figure** SP001

Tested By: MC **Checked By:** DL

ATTACHMENT B
IMPORTED STRUCTURAL FILL PROCTOR TEST

Moisture-Density (Proctor) Test Report



Test specification: ASTM D 1557-12 Method C Modified
ASTM D 4718-87 Oversize Corr. Applied to Each Test Point

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
	GP				NV		28	1.6

ROCK CORRECTED TEST RESULTS	UNCORRECTED	MATERIAL DESCRIPTION
Maximum dry density = 143.8 pcf	136.9 pcf	Structural Fill poorly graded gravel with sand
Optimum moisture = 6.2 %	8.3 %	

Project No. 16-0015 **Client:** Strider Construction Company
Project: Whatcom Waterway Phase I
Date: 3-22-16
○ **Loc.:** Granite - Singer Pit - sampled at site stockpile **Sample No.:** 7412

GEOTEST 761 Marine Drive Bellingham, WA 98225 www.GeoTest-Inc.com

Remarks:
SPG: assumed

Figure SP001

Tested By: MC **Checked By:** DL

ATTACHMENT C
IMPORTED STRUCTURAL FILL NUCLEAR GAUGE TEST (FOR COMPACTION)

GeoTest

741 Marine Drive, Bellingham, WA 98225 www.geotest-inc.com
20611 67th Ave. NE. Unit A. Arlington, WA 98223
phone: (360) 733.7318 toll free: (888) 251.5276 fax: (360) 733.7418

FIELD DENSITY/MOISTURE REPORT
Nuclear Gauge * ASTM D6938

PROJECT: Whatcom Waterway Phase I - Strider Construction
JOB #: 16-0015
ADDRESS: Bellingham, WA
REPORT #: FD001
PERMIT #:
DATE: 3/21/2016
CLIENT: Strider Construction Co.
PAGE #: 1 of 1
CONTRACTOR: Strider Construction Co.
INSPECTOR: Sean Rogerson

Compaction Of: Structural Fill for Site Backfill

Field Data:

Test #	Location	Depth/ Elev (ft)	DT/ BS (in)	Wet Density (pcf)	Field Moisture (%)	Dry Density (pcf)	Lab #	Compaction % Attained	Compaction % Required	Pass/ Fail
1	Barge Ramp Backfill	TOG	DT/12	143.3	5.2	136.2	1	**95**	90	P
2	Barge Ramp Backfill	-2	DT/12	140.3	4.2	134.6	1	**94**	90	P
3	Sheet Pile Wall Backfill, East of Barge Ramp	-2	DT/12	139.4	4.7	133.1	1	**93**	90	P
4	Sheet Pile Wall Backfill, South of Barge Ramp	-2	DT/12	138.7	5.3	131.7	1	**92**	90	P
5	Sheet Pile Wall Backfill, North of Barge Ramp	-2	DT/12	139.4	4.8	133.1	1	**93**	90	P

Lab Sample #	Soil Type	Source	Max. Dry Density (pcf)	Optimum Moisture (%)	Retained On #4 (%)	Test Method
1-7412	PGG w/ Sand	Granite - Singer	143.8	6.2	58	ASTM D1557/D4718
2-			0.0			None
3-			0.0			None

Gauge Make/Model/Serial#: Troxler 3440P / 60560 M/D Standard Count: 694 / 2527

Comments: TOG - Top of Grade

GeoTest was on site as requested to perform compaction testing on structural fill at the above-mentioned locations.

All tests met the compaction requirement of 90% per project specifications division 02 11 00 section 3.04D.

COPIES: Strider Construction Co. Anchor QEA

Reviewed by

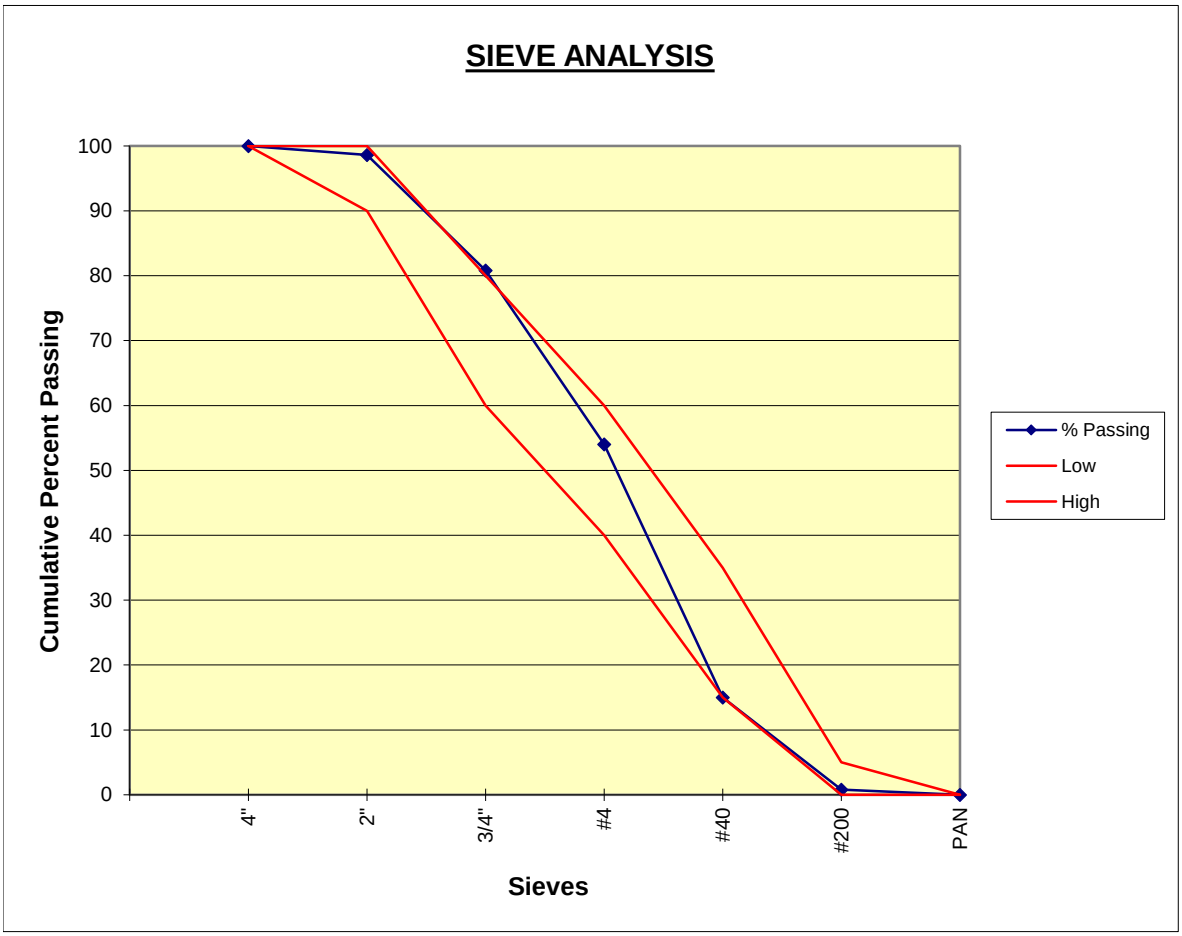
ATTACHMENT D
IMPORTED CAP MATERIAL – TYPE 1
SAND AND RESIDUALS MANAGEMENT COVER SIEVE ANALYSIS

COWDEN
GRAVEL & READY MIX

COWDEN F-160
TYPE 1 SAND & RESIDUAL COVER

Sample:	**DREDGE**
Date:	**1-Jun-15**

Sieve	Weight Retained	Percent Retained	Cumulative % Retained	Cumulative % Passing	ASTM C 33 Low	ASTM C 33 High
4"				**100.00**	**100**	**100**
2"				**98.60**	**90**	**100**
3/4"				**80.8**	**60**	**80**
#4				**54**	**40**	**60**
#40				**15**	**15**	**35**
#200				**0.78**	**0**	**5**
PAN				**0.00**	**0**	**0**
Total	0.0					



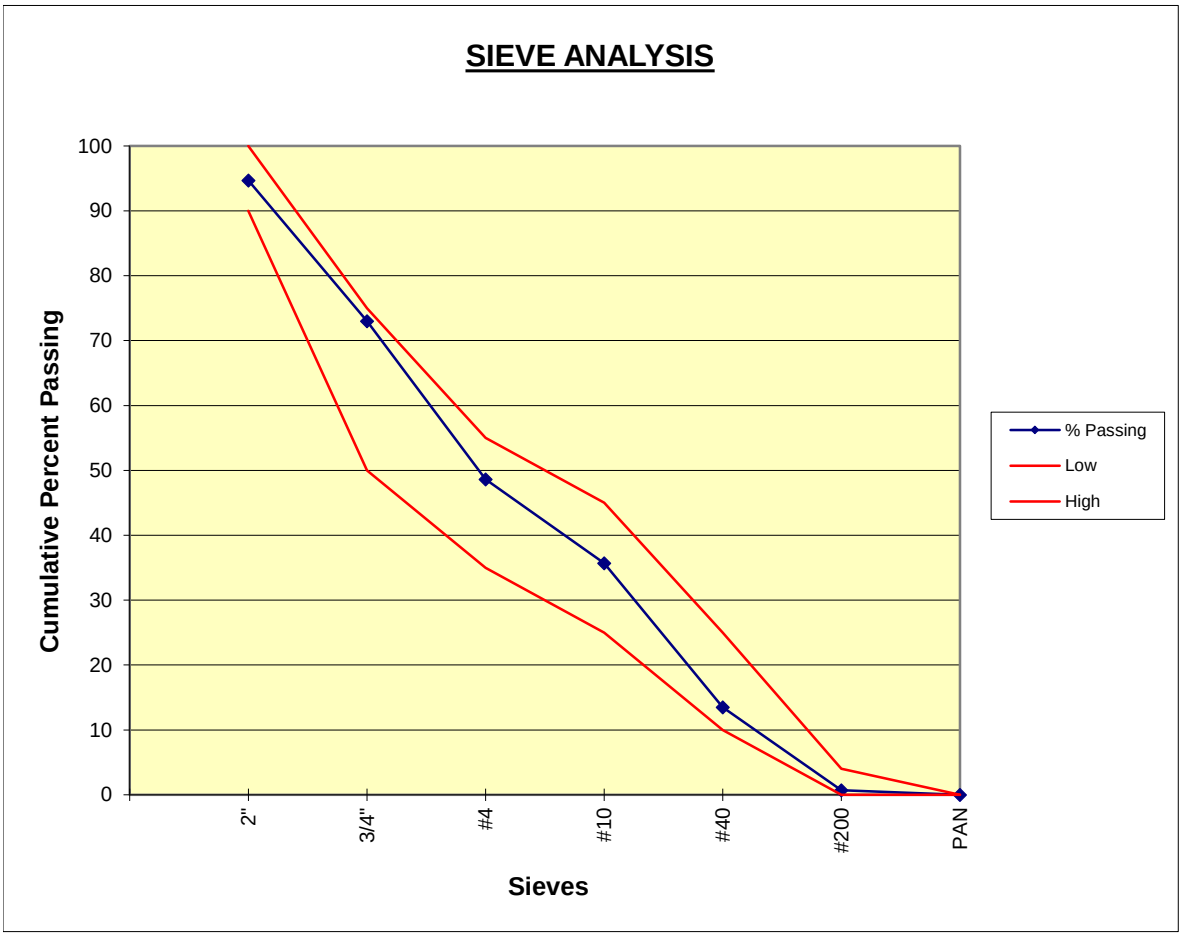
ATTACHMENT E
IMPORTED CAP MATERIAL – TYPE 2
SAND SIEVE ANALYSIS

COWDEN
GRAVEL & READY MIX

COWDEN F-160
TYPE 2 SAND

Sample:	**Dredge + 10% Cobble**
Date:	**3-Aug-15**

Sieve	Weight Retained	Percent Retained	Cumulative % Retained	Cumulative % Passing	ASTM C 33 Low	ASTM C 33 High
2"				**94.70**	**90**	**100**
3/4"				**73.00**	**50**	**75**
#4				**48.6**	**35**	**55**
#10				**35.7**	**25**	**45**
#40				**13.5**	**10**	**25**
#200				**0.70**	**0**	**4**
PAN				**0.00**	**0**	**0**
Total	0.0					



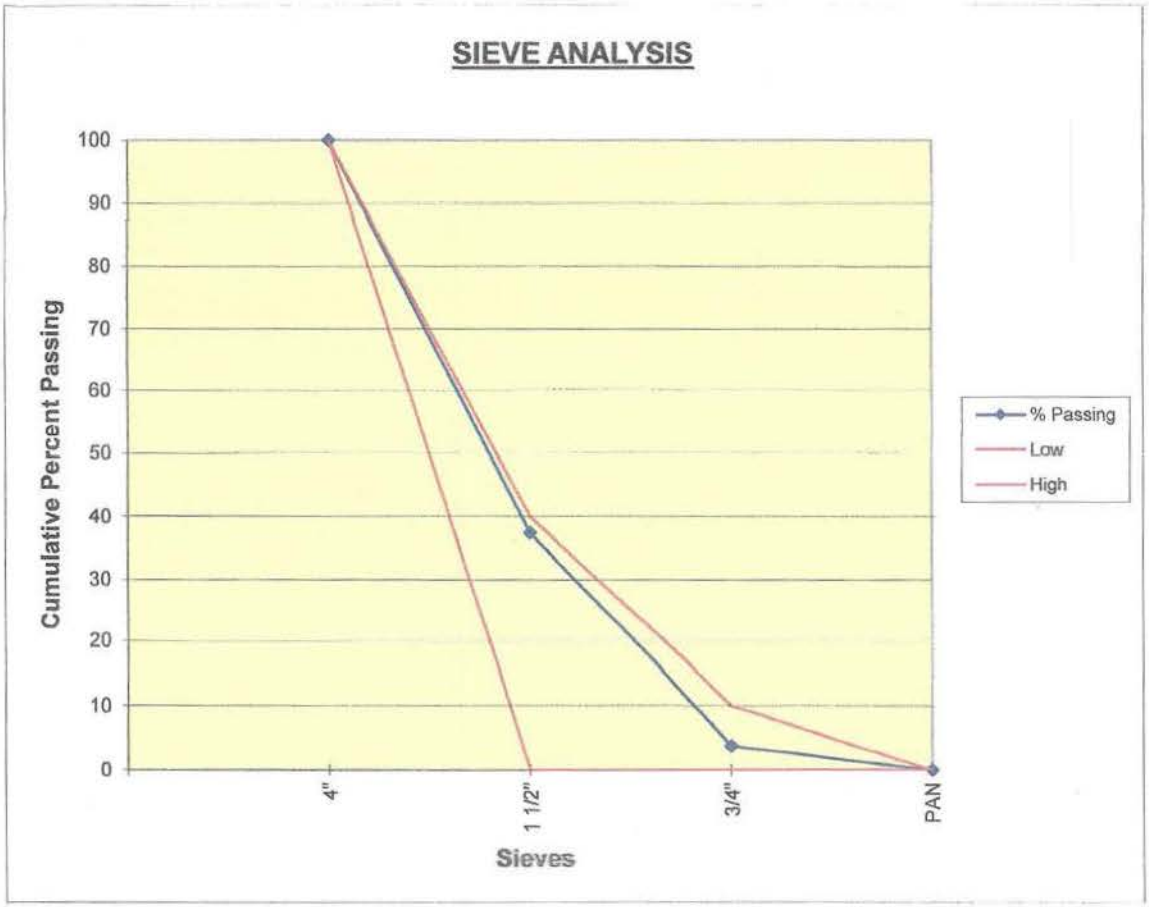
ATTACHMENT F
IMPORTED CAP MATERIAL – TYPE 1
FILTER SIEVE ANALYSIS

COWDEN
GRAVEL & READY MIX

COWDEN F-136
TYPE 1 FILTER (COBBLES)

Sample:	COBBLES
Date:	1-Jun-15

Sieve	Weight Retained	Percent Retained	Cumulative % Retained	Cumulative % Passing	ASTM C 33 Low	ASTM C 33 High
4"				100.00	100	100
1 1/2"				37.45	0	40
3/4"				3.83	0	10
PAN				0.00	0	0
Total	0.0					



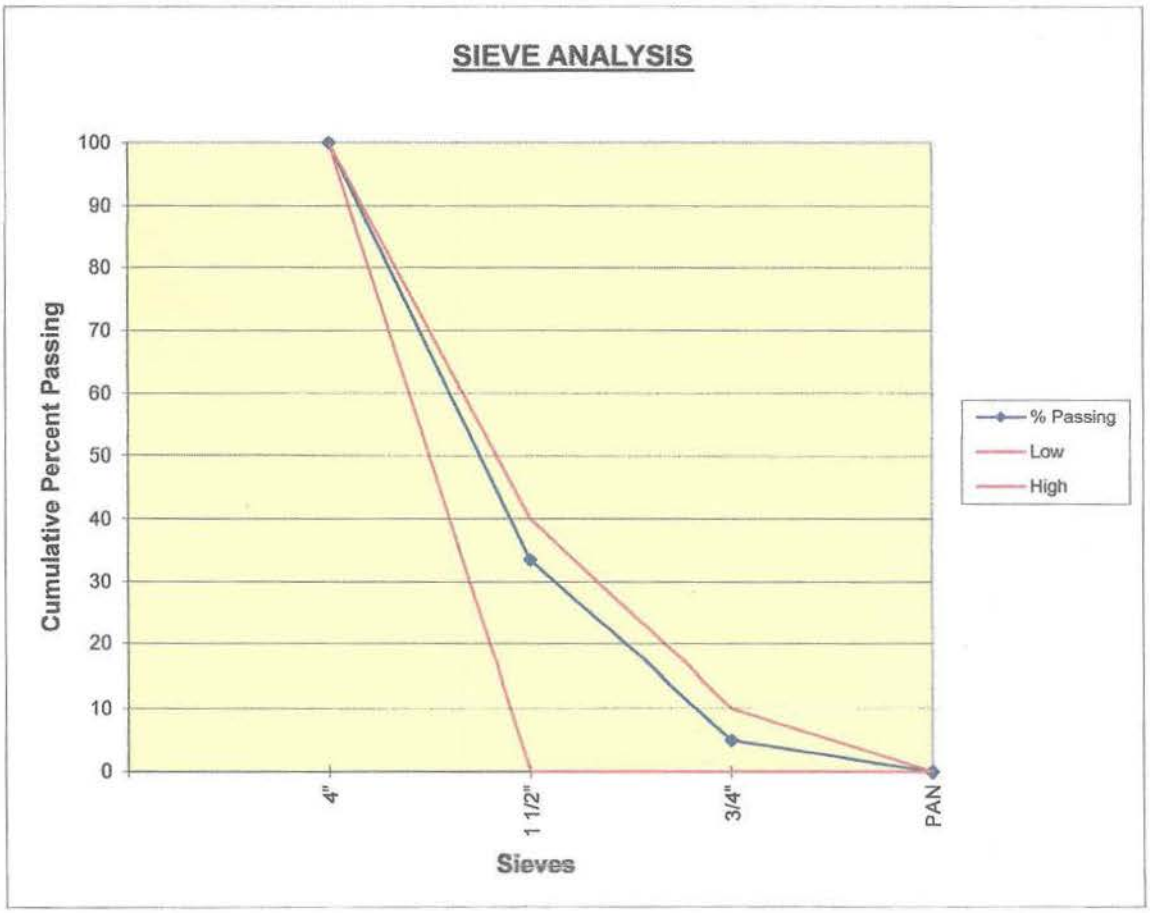
3463 Cedarville Road, Bellingham, WA 98226 • (360) 592-4200 • Fax (360) 592-4302
www.cowdeninc.com

COWDEN
GRAVEL & READY MIX

COWDEN F-180
TYPE 1 FILTER (COBBLES)

Sample:	COBBLES
Date:	1-Jun-15

Sieve	Weight Retained	Percent Retained	Cumulative % Retained	Cumulative % Passing	ASTM C 33 Low	ASTM C 33 High
4"				100.00	100	100
1 1/2"				33.50	0	40
3/4"				5.00	0	10
PAN				0.00	0	0
Total	0.0					



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www.cowdeninc.com

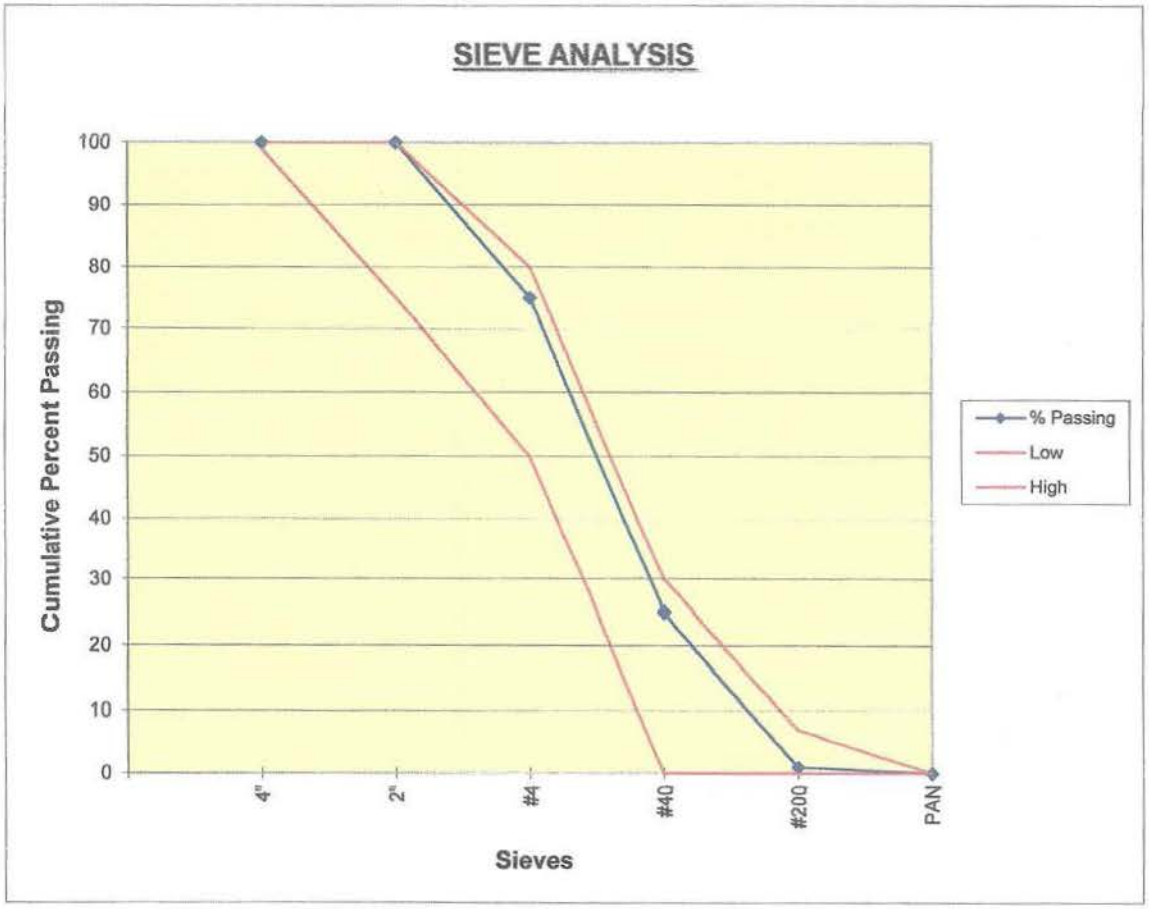
ATTACHMENT G
IMPORTED CAP MATERIAL – TYPE 2
FILTER SIEVE ANALYSIS

COWDEN
GRAVEL & READY MIX

COWDEN F-160
TYPE 2 FILTER (BORROW)

Sample:	BORROW
Date:	1-Jun-15

Sieve	Weight Retained	Percent Retained	Cumulative % Retained	Cumulative % Passing	ASTM C 33 Low	ASTM C 33 High
4"				100.00	99	100
2"				100.00	75	100
#4				75.00	50	80
#40				25.00	0	30
#200				1.00	0	7
PAN				0.00	0	0
Total	0.0					



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www.cowdeninc.com

ATTACHMENT H
IMPORTED CAP MATERIAL – ARMOR ROCK AGGREGATE SOURCE APPROVAL REPORT

Washington State Department of Transportation

WSDOT MATERIALS LAB

06/30/2015

Aggregate Source Approval Report

Owner: Cowden, Inc.
Lessee: Siper Quarry LLC
Located in: SW 1/4 SE 1/4 Section 15 T39N R4E

Aggregate Source: QS-F-207
Known as: Siper Quarry
County: Whatcom

Remarks:
RR, QS & RRW tested 05/28/2015..LA=12 / Deg= 48 / Bulk SSD=2.907 / BSG=2.888 / App. SG= 2.945 / Abs.=0.67...Approved for 1 year. Expiration Date: 05/28/2016..GSW.

Pit Run Materials:
At the discretion of the Project Engineer, preliminary samples for Gradation and Sand Equivalent tests may be performed to determine if the material does in fact meet the specification for the intended use:

Backfill for Rock Wall	Backfill for Sand Drains	Bedding Material for Rigid Pipe
Bedding Material for Thermoplastic Pipe	Foundation Material for Classes A, B or C	Gravel Backfill for Drains and Drywells
Gravel Backfill for Foundation Class B	Gravel Backfill for Pipe Zone Bedding	Gravel Backfill for Walls
Gravel Borrow	Sand Drainage Blanket	Select or Common Borrow

No Preliminary Tests are required to be performed by the State Materials Lab

Gravel Base: Test Date: Expiration Date:
Drainage: R Value: Swell Pressure:

Contact the Regional Materials Office to request PRELIMINARY SAMPLES be acquired. Evaluation and approval of this site as a source of GRAVEL BASE is required prior to use.

Mineral Agg. and Surfacing: Test Date: 06/13/2014 Expiration Date: 06/13/2019

Absorption: 0.54	Apparent Sp. G.: 2.924	Bulk Sp. G. (SSD): 2.894	Bulk Sp. G.: 2.878
Deg: 38	LA: 13		

Currently approved as a source of aggregate for:

ATB	Ballast	BST Crushed Cover Stone
BST Crushed Screenings	Crushed Surfacing Base Course	Crushed Surfacing Key Stone
Crushed Surfacing Top Course	Gravel Backfill for Foundation Class A	HMA Other Courses
HMA Wearing Course	Maintenance Rock	Permeable Ballast

Acceptance tests need to be performed as necessary.

Portland Cement Concrete Aggregates: Test Date: Expiration Date:

ASR - 14 Day :	ASR - One Year:	CCA Absorption:	CCA Sp.G:
FCA Absorption:	FCA Organics:	FCA Sp. G:	LA:
Mortar Strength:	Petrographic Analysis:		

Contact the Regional Materials Office to request PRELIMINARY SAMPLES be acquired. Evaluation and approval of this site as a source of AGGREGATES for PCC is required prior to use.

Riprap and Quarry Spalls: Test Date: Expiration Date:

Please see Remarks for Riprap and Quarry Spalls results.

Contact the Regional Materials Office to request PRELIMINARY SAMPLES be acquired. Evaluation and approval of this site as a source of RIP RAP AND QUARRY SPALLS is required prior to use.

ATTACHMENT I
CUTOFF WALL WELD COUPON TEST

741 Marine Drive, Bellingham, WA 98225 www.geotest-inc.com
20611 67th Ave. NE. Unit A. Arlington, WA 98223
phone: (360) 733.7318 toll free: (888) 251.5276 fax: (360) 733.7418

Inspection Report

PROJECT:	Whatcom Waterway Phase I - Strider Construction	**JOB #:**	16-0015
ADDRESS:	Bellingham, WA	**REPORT #:**	IR001
PERMIT #:		**DATE:**	1/13/2016
CLIENT:	Strider Construction Co.	**PAGE #:**	1 of 1
CONTRACTOR:	Strider Construction Co.	**INSPECTOR:**	Dan Weaver

INSPECTION OF: Weld Coupon for Test Assembly Sheet Pile to #9 A-706 Reinforcing Steel By FCAW Process in the Vertical up Position 3G / A 5/16" Flare J Fillet Weld 6" Long

GeoTest was on site to perform a visual weld inspection for the above test coupon. The test piece was done in same manner as the production welding. The sample was taken to Mistras for macro-etch testing. The testing of the sample will be done in accordance with the requirements on specification 32000 3.04 section D and the AWS D1.4.

Completed Weld Test Coupon

COPIES: Strider Construction Co. Anchor QEA

Reviewed by

ATTACHMENT J
ECWW PILECAP CONCRETE TESTING

GeoTest

741 Marine Drive, Bellingham, WA 98225 www.geotest-inc.com
20611 67th Ave. NE. Unit A. Arlington, WA 98223
phone: (360) 733.7318 toll free: (888) 251.5276 fax: (360) 733.7418

Concrete Inspection & Compressive Strength Test Report

PROJECT:	Whatcom Waterway Phase I - Strider Construction	**JOB #:**	16-0015
ADDRESS:	Bellingham, WA	**REPORT #:**	CB001
PERMIT #:		**DATE:**	2/1/2016
CLIENT:	Strider Construction Co.	**PAGE #:**	1 of 1
CONTRACTOR:	Strider Construction Co.	**INSPECTOR:**	Dan Weaver

Placement Location: Pile Cap at East Central Waterfront Wall

Sample Location: 1st Truck, 10 Cubic Yard Load

Field Data:

				Eq. No.
Supplier	Cowden Gravel & Ready Mix	Slump, in. (C143)	5.50	13
Mix #	5000PSI40	Air Content, % (C231)	5.8	4
Mix Description	6.5 Sk, Slag Ash, WRA, HRWRA, AE & 3/4" Agg.	Unit Weight, pcf (C138)	N/T	
Truck/Ticket #	7 / 117734	Air Temperature,°F	39	
Strength Required	4000 psi at 28 days	Mix Temperature,°F (C1064)	53	C31
Quantity Placed, cy	40	Field Cure Temperature, °F	nt	
Time Batched	8:22 AM	Water Added on Job, gals	10	
Time Sampled	9:15 AM	Water Requested by	CRM	

Laboratory Data:

Lab No.	Test Age (Days)	Test Date	Total Load (lbs)	Area (in²)	Compressive Strength (psi)	Remarks
51898	4	02-05	38370	12.57	**3050**	TYPE 5:
51899	7	02-08	48080	12.69	**3790**	TYPE 5:
51900	28	02-29	72520	12.63	**5740**	TYPE 5:
51901	28	02-29	76980	12.63	**6100**	TYPE 5:
51902	28	02-29	67700	12.63	**5360**	TYPE 3:
51903	Hold	00-00	0	0.00	**0**	

Reinforcement Inspection	Yes	n/a: not applicable	Specimen Size	4" X 8"
Reinforcement Conforms	Yes	n/t: not tested	Test Reference	ASTM C31/C39

Comments: Reinforcing steel, embeds and anchor bolts were previously inspected and were found to conform with the approved and revised details. Concrete was placed directly from truck chute and was internally vibrated.

COPIES: Strider Construction Co. Anchor QEA

Reviewed by

ATTACHMENT K
WCWW PILECAP CONCRETE TESTING

GeoTest

741 Marine Drive, Bellingham, WA 98225 www.geotest-inc.com
20611 67th Ave. NE. Unit A. Arlington, WA 98223
phone: (360) 733.7318 toll free: (888) 251.5276 fax: (360) 733.7418

Concrete Inspection & Compressive Strength Test Report

PROJECT:	Whatcom Waterway Phase I Cleanup	**JOB #:**	15-0589
ADDRESS:	Bellingham, WA	**REPORT #:**	CB001
PERMIT #:	BLD15-00218	**DATE:**	3/22/2016
CLIENT:	Anchor QEA	**PAGE #:**	1 of 1
CONTRACTOR:	American Construction	**INSPECTOR:**	Joseph Schmidt

Placement Location: West Central Wall Pile Cap at 145' West End

Sample Location: 3rd Truck, Mid Load

Field Data:

				Eq. No.
Supplier	Cowden Gravel & Ready Mix	Slump, in. (C143)	3.75	131
Mix #	5000PSI40	Air Content, % (C231)	4.7	9
Mix Description	6.5 Sack, 0.40 W/C Ratio, w/ Air	Unit Weight, pcf (C138)	NT	
Truck/Ticket #	4 / 98289	Air Temperature,°F	65.1	
Strength Required	4000 psi at 28 days	Mix Temperature,°F (C1064)	73.6	18-15
Quantity Placed, cy	~50	Field Cure Temperature, °F	58-71	
Time Batched	12:01 PM	Water Added on Job, gals	10	
Time Sampled	1:00 PM	Water Requested by	Strider	

Laboratory Data:

Lab No.	Test Age (Days)	Test Date	Total Load (lbs)	Area (in²)	Compressive Strength (psi)	Remarks
53765	3	03-25	33580	12.57	**2670**	TYPE 5:
53766	7	03-29	47910	12.63	**3790**	TYPE 5:
53767	28	04-19	68950	12.57	**5490**	TYPE 5:
53768	28	04-19	68950	12.57	**5490**	TYPE 5:
53769	28	04-19	69980	12.57	**5570**	TYPE 3:
53770	Hold	00-00	0	0.00	**0**	

Reinforcement Inspection	NT	n/a: not applicable	Specimen Size	4" X 8"
Reinforcement Conforms	NT	n/t: not tested	Test Reference	ASTM C31/C39

Comments: GeoTest was onsite as requested to perform concrete testing and cast concrete test cylinders.

Reinforcement was inspected on 3/17/16 and was found to conform. See GeoTest's Inspection Report #IR003, dated 3/17/16 for reinforcement inspection details.

Concrete was placed via chute, mechanically consolidated and was hand finished.

COPIES: Anchor QEA

Reviewed by

GeoTest

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Concrete Inspection & Compressive Strength Test Report

PROJECT:	Whatcom Waterway Phase I - Strider Construction	**JOB #:**	16-0015
ADDRESS:	Bellingham, WA	**REPORT #:**	CB002
PERMIT #:		**DATE:**	3/31/2016
CLIENT:	Strider Construction Co.	**PAGE #:**	1 of 1
CONTRACTOR:	Strider Construction Co.	**INSPECTOR:**	Dan Weaver

Placement Location: West Central Bulkhead Pile Cap Wall East Half

Sample Location: 1st Truck 11 Cubic Yards

Field Data:

				Eq. No.
Supplier	Cowden Gravel & Ready Mix	Slump, in. (C143)	4.25	13
Mix #	5000PSI40	Air Content, % (C231)	4.9	4
Mix Description	6.5 Sack, AE, WRA, HRWRA, Hot Water & Slag Ash	Unit Weight, pcf (C138)	NT	
Truck/Ticket #	8 / 119230	Air Temperature,°F	60	
Strength Required	4000 psi at 28 days	Mix Temperature,°F (C1064)	72	C31
Quantity Placed, cy	53	Field Cure Temperature, °F	NT	
Time Batched	11:41 AM	Water Added on Job, gals	10	
Time Sampled	12:27 PM	Water Requested by	Cowden	

Laboratory Data:

Lab No.	Test Age (Days)	Test Date	Total Load (lbs)	Area (in²)	Compressive Strength (psi)	Remarks
54227	7	04-07	45640	12.63	**3610**	TYPE 5:
54228	28	04-28	61090	12.75	**4790**	TYPE 3:
54229	28	04-28	60850	12.75	**4770**	TYPE 5:
54230	28	04-28	59960	12.75	**4700**	TYPE 5:
54231	Hold	00-00	0	0.00	**0**	

Reinforcement Inspection	Yes	n/a: not applicable	Specimen Size	4" X 8"
Reinforcement Conforms	Yes	n/t: not tested	Test Reference	ASTM C31/C39

Comments: GeoTest was on site to perform reinforced concrete special inspection at the above location. The reinforcing steel was inspected on previous date and was found to conform. Concrete was placed directly from truck chute and was internally vibrated.

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ATTACHMENT L
MSB PILECAP CONCRETE TESTING

GeoTest

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Concrete Inspection & Compressive Strength Test Report

PROJECT:	Whatcom Waterway Phase I Cleanup	**JOB #:**	15-0589
ADDRESS:	Bellingham, WA	**REPORT #:**	CB002
PERMIT #:	BLD15-00218	**DATE:**	4/27/2016
CLIENT:	Anchor QEA	**PAGE #:**	1 of 3
CONTRACTOR:	American Construction	**INSPECTOR:**	Waine Aynes

Placement Location: Maple Street Bulk Head Wall

Sample Location: Mid Load First Truck / ~ W4 First Lift

Field Data:

				Eq. No.
Supplier	Cowden Gravel & Ready Mix	Slump, in. (C143)	5.50	34
Mix #	5000PSI40	Air Content, % (C231)	4.5	6
Mix Description	3/4 Agg. 6.5 SK Mid Range & High Range & Air	Unit Weight, pcf (C138)	NT	
Truck/Ticket #	3 / 120069	Air Temperature,°F	58	
Strength Required	4000 psi at 28 days	Mix Temperature,°F (C1064)	71	602
Quantity Placed, cy	10	Field Cure Temperature, °F	NT	
Time Batched	8:48 AM	Water Added on Job, gals	25	
Time Sampled	9:45 AM	Water Requested by	Cowden QC	

Laboratory Data:

Lab No.	Test Age (Days)	Test Date	Total Load (lbs)	Area (in²)	Compressive Strength (psi)	Remarks
55241	7	05-04	48950	12.63	**3880**	TYPE 5:
55242	28	05-25	0	12.50	**0**	sample damaged
55243	28	05-25	70080	12.50	**5610**	TYPE 5:
55244	28	05-25	67470	12.50	**5400**	TYPE 5:
55245	Hold	00-00	0	0.00	**0**	

Reinforcement Inspection	Yes	n/a: not applicable	Specimen Size	4" X 8"
Reinforcement Conforms	Yes	n/t: not tested	Test Reference	ASTM C31/C39

Comments: GeoTest was onsite to inspect the reinforcing steel. The reinforcing steel was in place and was found to conform with detail S22. All the laps, size, grade, cover, clearances, quantity and spacing were found to conform with the approved criteria.

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GEOTEST

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Concrete Inspection & Compressive Strength Test Report

PROJECT:	Whatcom Waterway Phase I Cleanup	**JOB #:**	15-0589
CLIENT:	Anchor QEA	**REPORT #:**	CB002
CONTRACTOR:	American Construction	**PAGE #:**	2 of 3

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Concrete Inspection & Compressive Strength Test Report

PROJECT:	Whatcom Waterway Phase I Cleanup	**JOB #:**	15-0589
CLIENT:	Anchor QEA	**REPORT #:**	CB002
CONTRACTOR:	American Construction	**PAGE #:**	3 of 3

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Concrete Inspection & Compressive Strength Test Report

PROJECT:	Whatcom Waterway Phase I - Strider Construction	**JOB #:**	16-0015
ADDRESS:	Bellingham, WA	**REPORT #:**	CB003
PERMIT #:		**DATE:**	5/10/2016
CLIENT:	Strider Construction Co.	**PAGE #:**	1 of 3
CONTRACTOR:	Strider Construction Co.	**INSPECTOR:**	Waine Aynes

Placement Location: Maple St. Bulk Head

Sample Location: ~ W4.5 From Pump Hose, Mid Load

Field Data:

				Eq. No.
Supplier	Cowden Gravel & Ready Mix	Slump, in. (C143)	6.50	34
Mix #	5000PSI40	Air Content, % (C231)	4.9	6
Mix Description	6.5 Sack, AE, WRA, HRWR	Unit Weight, pcf (C138)	NT	
Truck/Ticket #	8 / 120530	Air Temperature,°F	71	
Strength Required	4000 psi at 28 days	Mix Temperature,°F (C1064)	68	13-15
Quantity Placed, cy	66	Field Cure Temperature, °F	55-98	
Time Batched	7:23 AM	Water Added on Job, gals	25	
Time Sampled	8:25 AM	Water Requested by	Driver	

Laboratory Data:

Lab No.	Test Age (Days)	Test Date	Total Load (lbs)	Area (in²)	Compressive Strength (psi)	Remarks
55710	7	05-17	45160	12.57	**3590**	TYPE 5:
55711	28	06-07	66260	12.63	**5250**	TYPE 5:
55712	28	06-07	67320	12.63	**5330**	TYPE 5:
55713	28	06-07	66910	12.63	**5300**	TYPE 5:
55714	Hold	00-00	0	0.00	**0**	

Reinforcement Inspection	Yes	n/a: not applicable	Specimen Size	4" X 8"
Reinforcement Conforms	Yes	n/t: not tested	Test Reference	ASTM C31/C39

Comments: GeoTest was on site for the placement of concrete in the bulk head. The reinforcing steel was verified and all clearances were correct prior to placement of concrete; placement was from W4.5-W6. Placement was done with a 37 meter pump truck and was consolidated using a mechanical vibrator.

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GEOTEST

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Concrete Inspection & Compressive Strength Test Report

PROJECT:	Whatcom Waterway Phase I - Strider Construction	**JOB #:**	16-0015
CLIENT:	Strider Construction Co.	**REPORT #:**	CB003
CONTRACTOR:	Strider Construction Co.	**PAGE #:**	2 of 3

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Concrete Inspection & Compressive Strength Test Report

PROJECT:	Whatcom Waterway Phase I - Strider Construction	**JOB #:**	16-0015
CLIENT:	Strider Construction Co.	**REPORT #:**	CB003
CONTRACTOR:	Strider Construction Co.	**PAGE #:**	3 of 3

ATTACHMENT M
WMSW PILECAP CONCRETE TESTING

GeoTest

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Concrete Inspection & Compressive Strength Test Report

PROJECT:	Whatcom Waterway Phase I - Strider Construction	**JOB #:**	16-0015
ADDRESS:	Bellingham, WA	**REPORT #:**	CB004
PERMIT #:		**DATE:**	5/25/2016
CLIENT:	Strider Construction Co.	**PAGE #:**	1 of 1
CONTRACTOR:	Strider Construction Co.	**INSPECTOR:**	Zach Click

Placement Location: Maple Street Wall

Sample Location: Mid Load, 1st Truck

Field Data: **Eq. No.**

Supplier	Cowden Gravel & Ready Mix	Slump, in. (C143)	5.50	
Mix #	5000PSI40	Air Content, % (C231)	5.2	
Mix Description	6.5 Sack, Air, HRWRA, Slag Ash	Unit Weight, pcf (C138)	NT	
Truck/Ticket #	7 / 121069	Air Temperature,°F	70	
Strength Required	4000 psi at 28 days	Mix Temperature,°F (C1064)	75	
Quantity Placed, cy	16	Field Cure Temperature, °F	65.3-85.5	
Time Batched	11:29 AM	Water Added on Job, gals	15	
Time Sampled	12:15 PM	Water Requested by	Contractor	

Laboratory Data:

Lab No.	Test Age (Days)	Test Date	Total Load (lbs)	Area (in²)	Compressive Strength (psi)	Remarks
56296	7	06-01	43930	12.69	**3460**	TYPE 5:
56297	28	06-22	65440	12.63	**5180**	TYPE 5:
56298	28	06-22	65340	12.63	**5170**	TYPE 5:
56299	28	06-22	62230	12.63	**4930**	TYPE 5:
56300	Hold	00-00	0	0.00	**0**	

Reinforcement Inspection	Yes	n/a: not applicable	Specimen Size	4" X 8"
Reinforcement Conforms	Yes	n/t: not tested	Test Reference	ASTM C31/C39

Comments: GeoTest was on site as requested to test concrete placed for the Maple Street wall.

Reinforcement was inspected on the previous date and was found to conform to the provided specifications.

Concrete was placed via truck chute and was mechanically consolidated.

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ATTACHMENT N
LCW REPLACEMENT CONCRETE SLAB
CONCRETE TESTING

GeoTest

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Concrete Inspection & Compressive Strength Test Report

PROJECT:	Whatcom Waterway Phase I - Strider Construction	**JOB #:**	16-0015
ADDRESS:	Bellingham, WA	**REPORT #:**	CB005
PERMIT #:		**DATE:**	6/17/2016
CLIENT:	Strider Construction Co.	**PAGE #:**	1 of 1
CONTRACTOR:	Strider Construction Co.	**INSPECTOR:**	Dan Weaver

Placement Location: Paving Concrete Slab Section at Gangway and Dock Entrance

Sample Location: 1st Truck, 10 Cubic Yard Load

Field Data:

				Eq. No.
Supplier	Cowden Gravel & Ready Mix	Slump, in. (C143)	3.50	13
Mix #	5000PSI40	Air Content, % (C231)	4.4	4
Mix Description	6.5 Sack, AE, Slag Ash & 3/4" Agg.	Unit Weight, pcf (C138)	NT	
Truck/Ticket #	10 / 121863	Air Temperature,°F	50	
Strength Required	4000 psi at 28 days	Mix Temperature,°F (C1064)	70	C31
Quantity Placed, cy	57	Field Cure Temperature, °F		
Time Batched	7:25 AM	Water Added on Job, gals	0	
Time Sampled	8:15 AM	Water Requested by		

Laboratory Data:

Lab No.	Test Age (Days)	Test Date	Total Load (lbs)	Area (in²)	Compressive Strength (psi)	Remarks
57079	7	06-24	49230	12.50	**3940**	TYPE 2:
57080	10	06-27	52420	12.50	**4190**	TYPE 3:
57081	28	07-15	72450	12.69	**5710**	
57082	28	07-15	68470	12.69	**5400**	TYPE 3:
57083	Hold	00-00	0	0.00	**0**	

Reinforcement Inspection	NT	n/a: not applicable	Specimen Size	4" X 8"
Reinforcement Conforms	NT	n/t: not tested	Test Reference	ASTM C31/C39

Comments: GeoTest was on site to sample and test concrete placed at the above locations. The concrete was placed via a 47 meter boom pump and a vibratory screed was used. Sample was taken at the pump hopper.

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APPENDIX J
DISPOSAL DOCUMENTATION

DISPOSAL DOCUMENTATION
AS-BUILT REPORT FOR THE WHATCOM WATERWAY CLEANUP IN PHASE 1 SITE AREAS

Prepared for
Port of Bellingham

Prepared by
Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, Washington 98101

September 2018

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1 INTRODUCTION J-1

2 MATERIALS GENERATED AND REMOVED FROM PROJECT SITE J-1

3 DISPOSAL PERMITS AND USE AUTHORIZATIONS J-2

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5 COMPLIANCE WITH PERMITS AND REGULATIONS J-4

List of Attachments

Attachment A Certificate of Disposal

LIST OF ACRONYMS AND ABBREVIATIONS

ASB	aerated stabilization basin
Ecology	Washington State Department of Ecology
GP West	Georgia-Pacific West, Inc.
NPDES	National Pollutant Discharge Elimination System
Port	Port of Bellingham
POTW	Public-Owned Treatment Works
Project	Whatcom Waterway Cleanup in Phase 1 Site Areas Project
TTD	transload, transport, and disposal
WDP	NPDES Waste Discharge Permit

1 INTRODUCTION

This appendix provides an overview of disposal activities and requirements implemented as part of the Whatcom Waterway Cleanup in Phase 1 Site Areas Project (Project). The following elements are included in this appendix:

1. A description of the different categories of materials that were generated and then removed for disposal
2. An overview of disposal permits and use authorizations that were required to complete the work
3. A summary of Contractor-implemented measures and practices for disposal of the materials
4. A discussion of the means and methods (including tracking) for compliance with permits and regulations

2 MATERIALS GENERATED AND REMOVED FOR DISPOSAL

Tracking and disposal activities were managed separately for the following media:

- **Soil:** Upland and shoreline soils were generated as part of shoreline soil/debris removal, excavation associated with construction of the containment wall (constructed at Central Waterfront Site shoreline), structure removal activities, and layback of the shoreline slope at the former clarifier location at the GP West Site. These soils were evaluated for suitability for re-use or landfill disposal through completion of environmental and physical testing.
- **Sediment:** Sediment and debris entrained in the sediment were generated by completion of dredging activities within the Inner Waterway and Outer Waterway areas.
- **Debris:** Debris (e.g., treated timber, sediment- or soil-impacted debris or refuse) was generated by completion of activities described above for the generation of soil material. Additionally, some debris material was segregated from dredged material depending on the nature and size of debris.
- **Construction-generated water:** Construction water was collected from upland/shoreline excavation areas and dredged sediment water was generated at the sediment offloading facility.

Some materials (i.e., concrete and scrap metal) were also generated during the Project and were stockpiled for re-use or recycled. The Port of Bellingham (Port) collected intact concrete debris and crushed the material for stockpiling on the GP West Site for future use. The Contractor hauled scrap metal to a recycling facility.

3 DISPOSAL PERMITS AND USE AUTHORIZATIONS

The Contractor managed the disposal of soil, sediment, debris, and construction-generated water from the Project effective June 25, 2015,[1] through the completion of the Project. Disposal permits were utilized and use authorizations were obtained for the media as summarized below:

- **Soil:** Project-generated soil determined unsuitable for reuse was disposed of in an approved, permitted Subtitle D landfill.[2]
- **Sediment:** Dredged sediment was disposed of at an approved, permitted Subtitle D landfill.[3]
- **Debris:** Project-generated debris was managed in the same manner as soil; see above.
- **Upland construction-generated water:** Upland construction-generated water, such as stormwater and excavation dewatering water, was collected, pre-treated, and conveyed to the Port's aerated stabilization basin (ASB) in accordance with the National Pollutant Discharge Elimination System (NPDES) Waste Discharge Permit (WDP) WA0001091 and a Non-Routine Discharge Approval[4] from the Washington State Department of Ecology (Ecology).
- **Sediment offloading facility construction-generated water:** Construction-generated water, such as dredged sediment water and sediment contact-stormwater, was collected, pre-treated, and discharged in accordance with the sediment offloading

[1] Contractor received written Notice to Proceed from the Port on June 25, 2015.
[2] Chelan-Douglas Health District Combined Operating Permit for Municipal Solid Waste Landfilling and Solid Waste Handling Facility, Greater Wenatchee Regional Landfill and Recycling Center.
[3] State of Oregon Department of Environmental Quality Solid Waste Disposal Site Permit No. 391 issued to Waste Management Disposal Services of Oregon, Inc. at the Columbia Ridge Landfill and Recycling Center.
[4] Ecology approved a request for the non-routine discharge of on-site construction-generated waters to the ASB, by letter, on June 2, 2015. The approval is a requirement of the WDP WA0001091.

facility's transload, transport, and disposal (TTD) work plan. The work plan included an approval to utilize Marine Vacuum Service, in accordance with a King County Waste Discharge Permit[5], for treatment, testing, and discharge to the County Public-Owned Treatment Works (POTW).

4 CONTRACTOR-IMPLEMENTED DISPOSAL MEASURES AND PRACTICES

Disposal of the generated materials described in Sections 2 and 3 was managed by the Contractor with various measures and practices as described below. The specific methods of material tracking for disposal are described in Section 5.

- **Soil:** Project-generated soil determined unsuitable for reuse was loaded into truck and trailer combinations and hauled to an approved, permitted Subtitle D landfill. Loading occurred either during excavation (direct loading) or at the designated staging and stockpiling areas, which were managed for impacted soil containment and water management. The Contractor provided weight tickets for all material transported to the landfill.
- **Sediment:** Dredged material (sediment and debris) was direct-loaded into barges , transported to a permitted upland offloading facility (located on the Duwamish River in Seattle, Washington), stabilized for upland transportation, and then transloaded onto railcars for transport to and disposal at the approved, permitted Subtitle D landfill. Material was tracked for transport and disposal via collection of barge displacement measurement and weight tickets for rail cars traveling from the offloading facility to the landfill.
- **Debris:** Project-generated debris was generally loaded into sealed containers that were then loaded onto trucks for disposal at the approved, permitted Subtitle D landfill. Loading occurred at the designated staging and stockpiling areas, which were managed for impacted debris. The Contractor provided weight tickets for all material transported to the landfill.
- **Upland construction-generated water:** Upland construction-generated water was managed separately from non-contact stormwater and was generally collected and then pre-treated using temporary pre-treatment systems to reduce turbidity and remove oils

[5] King County Department of Natural Resources and Parks Industrial Waste Program Waste Discharge Permit No. 7676-05, issued to Marine Vacuum Services.

and sheens prior to discharge into the Port's ASB. The temporary pre-treatment systems included weir tanks, oil absorbent floating booms, and an oil/water separator. The systems were operated by the Contractor with monitoring by the Contractor and the Port's construction management support staff.

- **Sediment offloading facility construction-generated water:** Dredged sediment water (collected from the transport barges) and contact stormwater at the approved offloading facility was collected and pre-treated in a temporary purpose-built treatment system utilizing settling tanks, weir tanks, multiple series of canister bag filters, a pressure sand filter process, a granular activated carbon vessel process, and surge tanks. The system was operated by the Contractor at the offloading facility with periodic oversight by the Port's construction management support staff. The pre-treated water was monitored for compliance with permit requirements prior to loading the treated water into sealed trucks and delivery of the treated water to a third-party operator for further treatment, monitoring, and discharge into the King County POTW.

5 COMPLIANCE WITH PERMITS AND REGULATIONS

Permit and regulation compliance for disposal of the materials generated as part of the Project varied by media and specific requirements associated with the various receiving facilities.

- **Soil:** generated soil transported for landfill disposal was determined as unsuitable for re-use by either direct observation[6] or by chemical analyses.[7] Material segregation and tracking was conducted to minimize the potential for material cross-contamination and to ensure that all unsuitable soil reached the approved, permitted Subtitle D landfill. Soil material was tracked using Contractor-generated truck tickets for all material transported to the landfill facility. The Port used these truck tickets to establish measurement and payment for completed work. The landfill facility did not reject soil or raise a non-compliance issue during the course of the Project.

[6] Criteria for determining unsuitability for on-site reuse included one or a combination of: the presence of a sheen or a strong petroleum odor or geotechnical unsuitability (e.g., excessive amounts of organics, clay content, debris).

[7] Chemical analyses were compared against established cleanup levels or screening levels for unrestricted land use for unsaturated soils.

- A total of 9,899.46 tons of unsuitable soil was generated as part of implementation of the Project and taken to the landfill facility for final disposal. A breakdown of soil disposal by month is provided in Table J1.

Table J1
Bid Item 7: Upland Excavation, Handling, and Off-site Landfill Disposal – Pay Quantity Summary

Month	Pay Quantity (tons)
September 2015	219.48
October 2015	499.61
November 2015	1088.62
December 2015	1730.48
January 2016	4044.16
February 2016	2014.59
March 2016	42.15
April 2016	260.37
Total:	**9,899.46**

- **Sediment:** Dredged sediment (and dredge debris) was tracked from the dredge source to the landfill to ensure that all material reached the approved, permitted Subtitle D landfill. Tracking the material was completed in multiple fashions; barge displacement measurements were collected to determine the approximate tonnage of dredge material loaded onto the barge prior to the barge departing the Site and upon arrival at the offloading facility to account for no loss of material during in-water transport to the offloading facility. Railcar load tickets were then generated as cars were loaded at the offloading facility and were also obtained upon delivery of the rail cars at the landfill. The landfill did not reject sediment or raise a non-compliance issue during the course of the Project.
  - A total of 171,807.9 tons of dredge material[8] (sediment and dredge debris) was generated as part of implementation of the Project and taken to the landfill facility

[8] Reported tonnage also includes weight of material added to the dredge material for stabilization before transport.

for final disposal. A copy of the final Certificate of Disposal is provided as Attachment A to this appendix.

- **Debris:** Debris was segregated and tracked to minimize the potential for material cross-contamination and to ensure that all debris transported for disposal reached the approved, permitted Subtitle D landfill. Debris material was tracked using Contractor-generated truck tickets for all material transported to the landfill facility. The Port used these truck tickets to establish measurement and payment for completed work. The landfill did not reject debris or raise a non-compliance issue during the course of the Project.
  - A total of 62.57 tons of debris were generated as part of implementation of the Project and taken to the landfill facility for final disposal. A breakdown of debris disposal by month is provided in Table J2.

Table J2
Bid Item 8: Shoreline Debris Removal, Handling, and Off-site Landfill Disposal – Pay Quantity Summary

Month	Pay Quantity (tons)
August 2015	24.92
September 2015	6.44
October 2015	11.44
November 2015	1.66
December 2015	36.75
January 2016	0.00
February 2016	18.03
March 2016	0.00
April 2016	-36.66
Total:	**62.57**

Notes:
1. The final quantity for Bid Item 8 was reconciled during the April 2016 pay estimate to account for material that was reclassified during the course of the Project.

- **Upland construction-generated water:** Upland construction-generated water was monitored by the Contractor and the Port's construction management staff. Ecology staff conducted site inspections to identify compliance with permit requirements and

to verify that best management practices were performing as intended. No discharge occurred from the ASB to waters of the State during or following the completion of the Project. No compliance issues occurred or were identified during or following completion of the Project.

- **Sediment offloading facility construction-generated water:** Dredged sediment water (collected from the transport barges) and contact stormwater at the approved offloading facility were monitored by the Contractor and the Port's construction management support staff. Ecology staff also conducted site inspections at the offloading facility to identify compliance with facility permit requirements. Treated water test results were reviewed by the Contractor for compliance with permit requirements both at the offloading facility and following further treatment at the third-party treatment facility prior to discharge into the King County POTW. Test results were also provided to King County as part of permit requirements and to document appropriate conditions for disposal of the treated water. No compliance issues were raised by King County during the Project.
  - Quantities of offloading facility construction-generated water were not calculated for the purposes of material tracking associated with the Project. The acceptability for their handling, treatment, and disposal is documented through coordination with the Contractor (and subcontractor) reporting to King County.

ATTACHMENT A
CERTIFICATE OF DISPOSAL

WASTE MANAGEMENT

March 23, 2016

Port of Bellingham
1801 Reoder Avenue
Bellingham, Washington 98226

CERTIFICATE OF DISPOSAL

Waste Management, Inc. dba Columbia Ridge Landfill has received Dewatered Dredge Sediments with Petroleum for ultimate disposal Columbia Ridge Landfill.

Dates of Disposed:	**9/25/2015-3/18/2016**
Profile #:	**119375OR**
Total Tons:	**171,807.9**
Waste Type:	**Dewatered Dredge Sediments with Petroleum**

I certify, on behalf of the above listed facility, that the above-described non hazardous waste was managed in compliance with all applicable laws.

K. Castner

Kristin Castner
Waste Management
Waste Approvals Manager – PNW

APPENDIX K
STORMWATER MEASURES SUMMARY

STORMWATER MEASURES SUMMARY AS-BUILT REPORT FOR THE WHATCOM WATERWAY CLEANUP IN PHASE 1 SITE AREAS

Prepared for

Port of Bellingham

Prepared by

Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, Washington 98101

September 2018

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3 STORMWATER MANAGEMENT K-1

4 CONTRACTOR-IMPLEMENTED BMPS K-3

5 PROJECT CLOSEOUT K-4

LIST OF ACRONYMS AND ABBREVIATIONS

ASB	aerated stabilization basin
BMP	best management practice
CSGP	Construction Stormwater General Permit (by Ecology)
Ecology	Washington State Department of Ecology
EPP	Environmental Protection Plan
GP West	Georgia-Pacific West, Inc.
NOT	Notice of Termination
NPDES	National Pollutant Discharge Elimination System
Port	Port of Bellingham
Project	Whatcom Waterway Cleanup in Phase 1 Site Areas Project
SWPPP	Stormwater Pollution Prevention Plan
TESC	Temporary Erosion and Sediment Control
WDP	NPDES Waste Discharge Permit

1 INTRODUCTION

This appendix summarizes stormwater management procedures as implemented during completion of the Whatcom Waterway Cleanup in Phase 1 Site Areas Project (Project).

2 STORMWATER PERMITS AND USE AUTHORIZATIONS

Prior to the start of construction, the Port of Bellingham (Port) obtained coverage under the National Pollutant Discharge Elimination System (NPDES) Construction Stormwater General Permit (CSGP).[1] This coverage was transferred from the Port to the Contractor on July 17, 2015. As required by the Contract, the Contractor managed the Project stormwater beginning June 25, 2015,[2] through the completion of the Project and termination of the CSGP. The Contractor submitted a Notice of Termination (NOT) of the CSGP on July 6, 2016.

In addition to coverage under the CSGP, the Port obtained from the Washington State Department of Ecology (Ecology) a non-routine discharge approval[3], under their NPDES Waste Discharge Permit (WDP)[4], to manage contact stormwater, construction dewatering, and other construction-generated water using existing conveyance and treatment facilities. These facilities included stormwater drainage lines, the main pump sump and pump station, and the aerated stabilization basin (ASB).[5] No discharges occurred from the ASB to Bellingham Bay during the course of the Project.

3 STORMWATER MANAGEMENT

As required by the CSGP, WDP, and the Contract, the Contractor developed and implemented an Environmental Protection Plan (EPP), which included a Stormwater Pollution Prevention Plan (SWPPP) and Temporary Erosion and Sediment Control (TESC)

[1] CSGP No. WAR302834; coverage obtained on April 16, 2015.
[2] Contractor received written Notice to Proceed from the Port on June 25, 2015.
[3] Ecology approved a request for non-routine discharge of construction-generated water to the ASB, by letter, on June 2, 2015.
[4] NPDES Waste Discharge Permit WA0001091; issued on December 17, 2014; modified on November 12, 2015.
[5] The ASB is the secondary treatment facility of the former GP West Mill Site and continues to be utilized as a stormwater detention pond.

Plan. The SWPPP and TESC Plan provided best management practices (BMPs) including operational and engineering controls to minimize erosion, prevent sediment migration, and prevent stormwater pollution. BMPs implemented by the Contractor are discussed in the following section.

For work on the GP West Site, stormwater management under the WDP required the Contractor to utilize portions of the existing stormwater system with the following procedures:

- Non-contact stormwater that did not infiltrate was collected and conveyed using the existing catch basins and stormwater piping to the Dockside Pump Station, which conveys stormwater to the ASB.
- Contact stormwater (e.g., stormwater that contacted impacted soil and debris stockpiles) was managed separately. This contact stormwater collected in a temporary purpose-built contained basin designated for impacted material stockpiling. The contact stormwater was pre-treated[6] prior to its discharge into the ASB in accordance with the WDP non-routine discharge approval.

Stormwater management activites at the Central Waterfront Site included the following procedures:

- Non-contact stormwater generally infiltrated the pervious areas.
- Non-contact stormwater on impervious areas was managed with contact stormwater, which involved pre-treatment[7] prior to its discharge into the ASB in accordance with the WDP non-routine discharge approval.

Stormwater solids managed during the Project were collected and disposed of in an approved Subtitle D landfill along with contaminated soils and sediments generated during the Project.

[6] The temporary water pre-treatment system at the former GP West Mill Site work area included a multi-cell weir tank with oil absorbent booms.

[7] The temporary water pre-treatment system at the Central Waterfront Site work areas included a settling tank with oil absorbent booms, an oil/water separator, and a surge tank.

4 CONTRACTOR-IMPLEMENTED BMPS

The Contractor implemented its TESC Plan and SWPPP during the Project. BMPs implemented by the Contractor included, but were not limited to, the following:

- Pavement sweeping: Conducted as needed, on both the Central Waterfront Site and GP West Site work areas, as well as haul routes beyond the work areas. The sweepings were collected, added to the impacted soil stockpiles, and transported to an approved Subtitle D landfill.
- Catch basin inserts: Deployed on the existing catch basins along C Street on the Central Waterfront Site and on the GP West Site work areas where the majority of soil and material stockpiling and haul vehicle activity occurred. Catch basin inserts were maintained as needed.
- Stockpile covering: Implemented as necessary to contain soils or materials that would remain unworked for an extended period of time.
- Use of stabilized construction entrances: Two types of stabilized construction entrances were utilized during the Project. Rumble strips were installed at the west end of C Street, which was the entrance to the north staging and stockpiling area and the Central Waterfront Site work areas. A temporary wash off and stabilized entrance pad was constructed at the west end of the GP West Site. Haul vehicles used this pad as needed to manage sediment track-out from the work areas. Accumulated sediment at these entrances was collected, added to the impacted soil stockpiles, and transported to an approved Subtitle D landfill.
- Use of silt fencing: A silt fence was installed along the top of slope at the west end of the Central Waterfront Site work areas where shoreline debris removal and grading activities occurred. The silt fence was maintained and modified, as needed, to remain operational and functional.

The Contractor regularly inspected stormwater conditions, maintained BMPs, and adjusted operations or BMPs as necessary to manage stormwater in accordance with the stormwater management requirements.

The Contractor managed submittals to Ecology as required by the CSGP.

The Port and Anchor QEA also regularly inspected work areas and stormwater management measures.

Ecology staff reviewed the Contractor-developed SWPPP and conducted site visits during the Project. During a pre-construction site visit and review of the Contractor's SWPPP, Ecology provided feedback on BMPs proposed by the Contractor to manage soil loading and track-out of sediment. These BMPs were implemented during the Project.

No enforcement actions occurred during the course of the Project.

5 PROJECT CLOSEOUT

Following completion of construction, the following closeout activities were completed:

- The Contractor cleaned sediment from catch basins and completed a final sweeping of paved areas at the Central Waterfront Site and GP West Site work areas, and haul routes beyond the work areas.
- Except for installing new catch basin inserts along the designated haul route on the GP West Site, all other temporary BMPs were removed by the Contractor.
- The staging and stockpile areas were cleaned to their pre-construction condition.
- The temporary water pre-treatment systems were decontaminated and removed from the work areas.
- As required by the CSGP, the Contractor submitted a NOT application, and coverage under the CSGP was terminated on August 12, 2016.

APPENDIX L
DEMOBILIZATION DOCUMENTATION

DEMOBILIZATION DOCUMENTATION AS-BUILT REPORT FOR THE WHATCOM WATERWAY CLEANUP IN PHASE 1 SITE AREAS

Prepared for

Port of Bellingham

Prepared by

Anchor QEA, LLC

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September 2018

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4 LAFARGE FACILITY L-4

LIST OF ACRONYMS AND ABBREVIATIONS

ASB	aerated stabilization basin
BMP	best management practice
GP West	Georgia-Pacific West, Inc.
NPDES	National Pollutant Discharge Elimination System
Port	Port of Bellingham
Project	Whatcom Waterway Cleanup in Phase 1 Cleanup Site Areas Project
SSA	staging and stockpiling area

1 INTRODUCTION

This appendix documents certain demobilization activities conducated at the conclusion of the Whatcom Waterway Cleanup in Phase 1 Site Areas Project (Project). Specifically, this appendix documents the work conducted to remove staging and stockpiling areas (SSAs) used for management of debris and contaminated media, and work conducted to restore conditions at the facility used for offloading of contaminated sediments prior to rail transport and landfill disposal.

2 GP WEST SITE WORK AREAS

Four SSAs, temporary stormwater facilities, and designated haul routes were established on the GP West Site for various work activities as described below.

- **GP West Site SSA:** This SSA included several material-specific designated stockpile locations established on top of existing asphalt pavement areas. The stockpiles were used for management of imported soils and rock, impacted soils, potentially impacted soils, treated wood debris, metal debris, concrete debris, and other debris. A temporary containment basin was constructed for the temporary stockpiling of treated wood debris, potentially impacted soils, and impacted soils. This containment basin was built to isolate impacted materials from non-impacted materials and to manage contact stormwater runoff separately from non-contact stormwater runoff.
- **South Shoreline SSA:** This SSA included several material-specific designated stockpile locations that were established on top of existing asphalt pavement areas and former concrete foundations. The stockpiles were used for management of concrete debris, metal debris, and other debris resulting primarily from the demolition of the former clarifier structure.
- **Cap Material Barge Loading SSA:** This SSA was an extension of the GP West Site SSA, and was used for the temporary stockpiling of clean imported engineered cap materials in support of the in-water engineered cap construction. The stockpiles were established on top of existing asphalt pavement areas, and the cap materials included sands, cobbles, and armor rock. A temporary conveyor system assembled on the former GP Dock was used to load the clean imported cap materials onto barges for the in-water cap construction work.

- **Log Pond Area SSA:** This SSA was also an extension of the GP West Site SSA, and was used for the temporary stockpiling of clean imported engineered cap materials in support of the engineered cap construction work in the Log Pond Area. The stockpiles were established on top of existing asphalt pavement areas and the cap materials included sands, cobbles, and armor rock.
- **Temporary Stormwater Facilities:** The temporary stormwater facilities included minor modifications to the existing stormwater system at the GP West Site and the operation of a water pretreatment system for contact stormwater and soil dewatering. Modifications to the stormwater system included the temporary plugging of an existing catch basin to isolate contact stormwater and soil dewatering from non-contact stormwater that was managed separately using the existing stormwater system.
- **Haul routes on the GP West Site:** The haul routes were used to transport equipment, materials, and supplies to and from work areas and SSAs and to transport materials and supplies to and from the Site. The main haul routes used during the Project occurred along existing asphalt paved travel ways. Various best management practices (BMPs) were used to minimize erosion and sediment track-out. BMPs included a stabilized construction entrance/wash pad, pavement sweeping, installation of catch basin inserts, stockpile containment, and proper stormwater management.

Cleanup and demobilization of the affected work areas at the GP West Site occurred over the duration of the Project as individual work activities were completed. See below for a brief description of the cleanup and demobilization activities at the various SSAs and haul routes.

- **GP West Site SSA:** Demobilization at this SSA was conducted following final disposition of materials stockpiled in the SSA. The stockpile areas were cleaned and swept. The temporary containment basin[1] was deconstructed, and the SSA was returned to its pre-construction condition.

[1] The temporary containment basin was constructed on top of existing concrete pavement and the perimeter was constructed of concrete jersey barriers that were sealed along the bottom and sides. The low point in the basin allowed for the collection of contact stormwater and soil dewatering and contains a stormwater catch basin that was modified (temporarily plugged) for the duration of the project to enable the Contractor to isolate material dewatering and contact stormwater separately from other stormwater runoff.

- **South Shoreline SSA:** Once all stockpiled materials were removed from the SSA, these areas were swept and returned to their pre-construction condition.
- **Cap Material Barge Loading SSA:** This SSA was cleaned up and demobilized following the completion of the in-water engineered cap construction. Demobilization of this SSA involved removing the conveyor from the dock, removing remaining materials, and sweeping the pavement surfaces.
- **Log Pond Area SSA:** Demobilization of this SSA was completed following completion of the engineered cap construction work in the Log Pond Area. The asphalt pavement areas were swept and returned to their pre-construction condition.
- **Temporary Stormwater Facilities:** The temporary stormwater facilities were demobilized following the cleanup and demobilization of the temporary containment basin in the GP West Site SSA. The temporary modifications to the stormwater system were removed and the pretreatment system was disassembled, cleaned, and removed.
- **Haul Routes on the GP West Site:** The haul routes were swept clean and select catch basin inserts were replaced to match the pre-construction condition.

3 CENTRAL WATERFRONT SITE WORK AREAS

One SSA, a temporary water pretreatment system, and designated haul routes were established on the Central Waterfront Site.

- **Central Waterfront Site SSA:** This SSA was established for the temporary staging and stockpiling of non-contaminated equipment, material, and supplies. The SSA was established on top of existing gravel surfaces.
- **Temporary Water Pretreatment System:** This system was assembled to manage contact stormwater and excavation dewatering. The system comprised three tanks, above-ground piping, and a series of pumps. The pretreated water was discharged into the Port of Bellingham's (Port's) aerated stabilization basin (ASB) in accordance with the National Pollutant Discharge Elimination System (NPDES) Waste Discharge Permit Non-Routine Discharge Approval by the Washington State Department of Ecology.[2]

[2] NPDES Waste Discharge Permit No. WA0001091; approval for non-routine discharge was provided by letter, dated June 2, 2015.

- **Haul routes on the Central Waterfront Site:** The haul routes were used to transport equipment, materials, and supplies to and from work areas and SSA and to transport materials and supplies to and from the Site. The main haul routes used during the Project occurred along gravel surfaces, except for traversing C Street and the concrete pavements along the east portion of the work areas. Various BMPs were used to minimize erosion and sediment track-out. BMPs included stabilized construction entrances, pavement sweeping, installation of catch basin inserts, stockpile containment, and proper stormwater management.

Similar to the GP West Site work areas, the Central Waterfront Site work areas were cleaned and demobilized following completion of associated work elements:

- **Central Waterfront Site SSA:** Demobilization at this SSA was completed following the completion of pilecap construction and the replacement concrete slabs at the east end of the work area. Demobilization of this SSA involved final grading of the gravel-surfaced areas, pavement sweeping, and removal of temporary erosion and sediment controls.[3]
- **Temporary Water Pretreatment System:** This pretreatment system was cleaned and removed.
- **Haul Routes:** Haul routes and C Street were swept clean and were returned to their pre-construction condition.

4 LAFARGE FACILITY

Demobilization activities were completed at the sediment offloading facility (Lafarge Seattle Cement Plant) following final rail shipment of the Project sediments:

- Barges were offloaded and cleaned.
- The sediment containment vault was emptied and cleaned after all sediment was loaded into railcars.
- All loading equipment, including the waterfront crane, was cleaned after sediment was loaded into rail cars.

[3] Temporary erosion and sediment controls included a silt fence installation along the west end of the work area, stabilized construction entrances at the west end of C Street, and catch basin protections.

- All water generated during decontamination was collected, processed through the Lafarge water treatment facility, and transferred to Marine Vacuum, Inc. for final treatment and disposal.
- The Lafarge water treatment facility dedicated to treating water from Project sediment was dismantled and all solid material was loaded into rail cars.
- The bermed dredge material offload and handling area was cleaned and all solid material was loaded into rail cars.

APPENDIX M
CONSTRUCTION PHOTOGRAPHS

CONSTRUCTION PHOTOGRAPHS

AS-BUILT REPORT FOR THE WHATCOM WATERWAY CLEANUP IN PHASE 1 SITE AREAS

Prepared for

Port of Bellingham

Prepared by

Anchor QEA, LLC

720 Olive Way, Suite 1900

Seattle, Washington 98101

September 2018

LIST OF ACRONYMS AND ABBREVIATIONS

BST	Bellingham Shipping Terminal
ECWW	East Central Waterfront Wall
GP	Georgia-Pacific
GP West	Georgia-Pacific West, Inc.
MSB	Maple Street Bulkhead
SSA	staging and stockpiling area
WCWW	West Central Waterfront Wall

CONSTRUCTION PHOTOGRAPH INDEX

No.	Photographed Area	Construction Activity
1.	GP West; South shoreline, Central Ave Pier	Pre-removal of shoreline debris and structures
2.	GP West; South shoreline, aerial	Demolition of clarifier
3.	GP West; South shoreline, bulkhead	Demolition and removal of steel sheetpile bulkhead
4.	GP West; South shoreline, bulkhead	Removal of steel sheetpile bulkhead
5.	GP West; South shoreline, bulkhead	Post-removal of timber bulkhead
6.	GP West; South shoreline	Capping of south shoreline
7.	GP West; South shoreline, clarifier area	Capping of clarifier area
8.	GP West; South shoreline, west of Central Ave Pier	Capping of south shoreline
9.	GP West; South shoreline, west of Central Ave Pier	Post-capping of south shoreline
10.	GP West; South shoreline, aerial	Post-capping of south shoreline and clarifier area
11.	GP West; Foam tank area, waterside	Pre-removal of shoreline debris and structures
12.	GP West; Foam tank area, GP Dock	Post-removal of debris and structures, during construction of replacement stormwater conveyance
13.	GP West; Foam tank area, GP Dock	Capping of foam tank area shoreline
14.	GP West; Former GP West SSA, containment cell	Pre-construction condition of the containment cell
15.	GP West; Former GP West SSA, containment cell	Stockpiling of impacted soil and debris
16.	GP West; Former GP West SSA, stockpile	Stockpiling of concrete debris
17.	GP West; Former GP West SSA, stockpile	Concrete reduction and sorting
18.	GP West; Former GP West SSA, containment cell	Cleanup of containment cell during demobilization
19.	GP West; Former GP West SSA, weight scale	Material management
20.	GP West; Former GP West SSA, weight scale	Material management
21.	GP West; Log pond area, shoreline	Removal of shoreline debris
22.	GP West; Log pond area, shoreline	Removal of shoreline debris
23.	GP West; Log pond area, aerial	Dredging
24.	GP West; Log pond area, shoreline	Capping of shoreline
25.	GP West; Log pond area, shoreline	Capping of shoreline

No.	Photographed Area	Construction Activity
26.	GP West; Log pond area, aerial	Capping of shoreline
27.	GP West; Log pond area	Water quality monitoring operations
28.	GP West; cap material stockpile	Stockpiling of imported cap materials
29.	Inner Waterway; ECWW	Dredging along Central Waterfront bulkhead
30.	Inner Waterway; ECWW	Silt curtain deployment
31.	Inner Waterway; aerial	Dredging in Inner Waterway
32.	Inner Waterway; WCWW	Dredging in Inner Waterway
33.	Inner Waterway; WCWW	Capping in Inner Waterway
34.	Inner Waterway	Water quality monitoring operations
35.	BST Area from Log Pond Area	Dredging in BST area
36.	BST Area	Capping in BST area
37.	Dredge sediment transload facility	Unloading dredge sediment from barge
38.	Dredge sediment transload facility	Loading railcars with dredge sediment
39.	Central Waterfront; MSB	Demolition of barge ramp
40.	Central Waterfront; MSB	Backfill of barge ramp area
41.	Central Waterfront; WCWW	Sheetpile wall installation
42.	Central Waterfront; Chevron Pier	Demolition and removal of the former Chevron Pier
43.	Central Waterfront; WCWW	Post-demolition of the former Chevron Pier
44.	Central Waterfront; WCWW	WCWW relief excavation for dredging
45.	Central Waterfront; WCWW	Backfill of WCWW after dredging and capping
46.	Central Waterfront; MSB fender system	MSB fender system construction
47.	Central Waterfront; WCWW	WCWW concrete pilecap construction
48.	Central Waterfront; WCWW, monopile dolphins	Monopile dolphin installation
49.	Central Waterfront; WCWW, monopile dolphins	Monopile dolphin installation
50.	Central Waterfront; WCWW	WCWW concrete pilecap construction

Photograph 1: South shoreline before removal of shoreline debris and structures. Facing west.

Photograph 2: South shoreline after demolition of the clarifier and before removal of the timber bulkhead. Facing southwest.

Photograph 3: South shoreline during removal of the steel sheetpile bulkhead. Facing west.

Photograph 4: South shoreline during removal of the steel sheetpile bulkhead. Facing east.

Photograph 5: South shoreline following removal of the steel sheetpile bulkhead and timber bulkhead. Facing east.

Photograph 6: South shoreline during capping. Facing east.

Photograph 7: South shoreline during capping of former clarifier area. Facing west.

Photograph 8: South shoreline during capping. Facing east.

Photograph 9: South shoreline after capping.
Facing east.

Photograph 10: South shoreline after capping.
Facing west.

Photograph 11: Foam tank area before removal of shoreline debris and structures. Facing west.

Photograph 12: Foam tank area stormwater conveyance replacement. Facing east.

Photograph 13: Foam tank area during capping.
Facing east.

Photograph 14: Former GP West SSA containment cell during mobilization.
Facing southwest.

Photograph 15: Former GP West SSA containment cell during construction. Facing southeast.

Photograph 16: Former GP West SSA stockpile of concrete debris from Central Waterfront work areas. Facing south.

Photograph 17: Former GP West SSA concrete reduction and sorting. Facing south.

Photograph 18: Former GP West SSA containment cell after cleanup during demobilization. Facing north.

Photograph 19: Temporary weight scale at the Former GP West SSA. Facing south.

Photograph 20: Temporary weight scale at the Former GP West SSA. Facing southeast.

Photograph 21: Log Pond Area shoreline debris removal. Facing east.

Photograph 22: Log Pond Area dolphin and piling removal. Facing northeast.

Photograph 23: Log Pond Area dredging operations. Facing east.

Photograph 24: Log Pond Area shoreline capping. Facing northeast.

Photograph 25: Log Pond Area shoreline capping.
Facing northeast.

Photograph 26: Log Pond Area shoreline after capping.
Facing east.

Photograph 27: Log Pond Area water quality monitoring operations. Facing north.

Photograph 28: Cap material stockpiling area on the GP West site. Facing north.

Photograph 29: Inner Waterway dredging operations; debris booms deployed. Facing east.

Photograph 30: Inner Waterway silt curtain deployment. Facing south.

Photograph 31: Inner Waterway dredging operations. Facing west.

Photograph 32: Inner Waterway dredging operations. Facing south.

Photograph 33: Inner Waterway capping operations. Facing southwest.

Photograph 34: Inner Waterway water quality monitoring operations. Facing northeast.

Photograph 35: BST Area dredging operations.
Facing northwest.

Photograph 36: BST capping operations.
Facing northeast.

Photograph 37: Dredge sediment barge unloading operations. Facing east.

Photograph 38: Dredge sediment railcar loading operations. Facing north.

Photograph 39: Central Waterfront barge ramp demolition at the Maple Street Bulkhead. Facing south.

Photograph 40: Central Waterfront backfilled barge ramp at the Maple Street Bulkhead. Facing south.

Photograph 41: Central Waterfront sheetpile installation: West Central Waterfront Wall. Facing west.

Photograph 42: Central Waterfront demolition of Former Chevron Pier area. Facing west.

Photograph 43: Central Waterfront: Post-demolition of the former Chevron Pier. Facing west.

Photograph 44: Central Waterfront: Relief excavation prior to dredging along WCWW. Facing east.

Photograph 45: Central Waterfront: WCWW backfilled after dredging and capping. Facing east.

Photograph 46: Central Waterfront: MSB with fender system. Facing west.

Photograph 47: Central Waterfront: WCWW concrete pilecap construction. Facing west.

Photograph 48: Central Waterfront: WCWW concrete pilecap. Facing west.

Photograph 49: Central Waterfront: Monopile dolphin construction. Facing west.

Photograph 50: Central Waterfront: Monopile dolphin construction. Facing west.