Appendix A
Monitoring Equipment Photographs

Photograph A1
Groundwater Monitoring Piezometer Installation at a Groundwater Monitoring Location Using Geoprobe Drilling Rig

Note: New groundwater piezometers were installed at Sites 007, 004, and 086.

Photograph A2
Groundwater Monitoring Piezometer Well Development Via Surging, Bailing, and/or Pumping

Photograph A3
Completed Groundwater Monitoring Piezometer with Cover Removed Showing In-Situ Rugged Troll 200 Data Logger Cable and Coupler

Photograph A4
Completed Groundwater Monitoring Piezometer with Cover Installed

Photograph A5
Perforated Galvanized Steel Pipe and Drive Point Used to Construct the Stilling Wells at the River Monitoring Locations and Oxbow Pond Monitoring Locations

Photograph A6
Typical Stilling Well Installation at a River Monitoring Location Along the Chehalis River

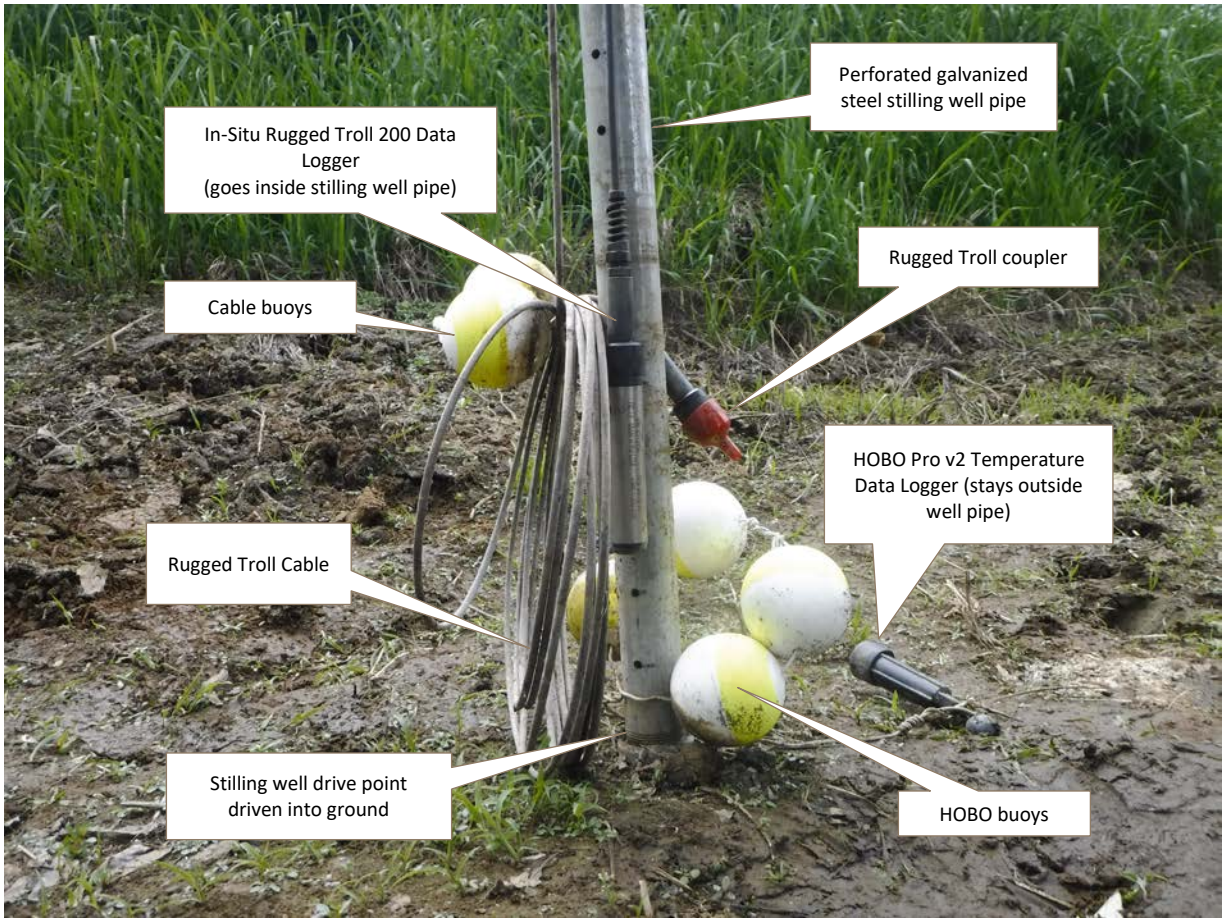
Note: A monitoring location benchmark is visible in the foreground.

Photograph A7
A River Monitoring Location Stilling Well as Viewed from the Chehalis River

Photograph A8
Data Collection at a River Monitoring Location

Note: Data logger cable from stilling well is pulled out of well riser and connected to a Rugged Reader portable field computer. Survey equipment for manually measuring water elevation in river is shown at the right.

Photograph A9
Typical Monitoring Setup at an Oxbow Monitoring Location



Note: Two Oxbow Monitoring Locations were installed at each monitoring site.

Photograph A10
Typical Oxbow Monitoring Location Configuration When Surface Water Is Present

Photograph A11
Typical Installation of an in-Situ BaroTroll Barometric Pressure Data Logger

Note: These were installed at Sites 007, 004, 068, and 086.

Photograph A12
River Flow Measurement Using an Acoustic Doppler Current Profiler Mounted on a Small Boat

Appendix B
Groundwater Monitoring Well Logs

Site 007 - Groundwater Well Log

Please print, sign and return to the Department of Ecology

RESOURCE PROTECTION WELL REPORT

CURRENT Notice of Intent No. RE12487

(SUBMIT ONE WELL REPORT PER WELL INSTALLED)

Construction/Decommission *("x" in box)* 303-16-11 92

☒ Construction
☐ Decommission

ORIGINAL INSTALLATION Notice of Intent Number:

Type of Well *("x in box)*
☒ Resource Protection
☐ Geotech Soil Boring

Property Owner Weyerhauser Pe Ell Tree Farm

Site Address 1098 Muller Rd.

Consulting Firm Anchor QEA, LLC

City Pe Ell County Lewis

Unique Ecology Well IDTag No. BHV-137

Location SE 1/4-1/4 NE 1/4 Sec 4 Twn 12N R 5W

EWM ☐ or WWM ☒

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

Lat/Long (s, t, r still REQUIRED) Lat Deg _____ Min _____ Sec _____

Long Deg _____ Min _____ Sec _____

Tax Parcel No.016431000000

☒ Driller ☐ Engineer ☐ Trainee

Name (Print Last, First Name) King, Kyle

Driller/Engineer /Trainee Signature

Cased or Uncased Diameter 2" Static Level 10.3'

Driller or Trainee License No. 3220

Work/Decommission Start Date 3/4/2016

If trainee, licensed driller's Signature and License Number:

Work/Decommission Completed Date 3/4/2016

Construction Design		Well Data	Formation Description	
0 – 1 ft	8" flush monument set in concrete	5004-GML	0 – 8.5 ft	Silty and Some Gravel
0.5 – 11 ft	2" PVC riser	2" piezometer well to 21 ft.	8.5 – 21 ft	Sandy Gravel
11 – 21 ft	2" PVC prepack screen threaded, 0.001 slot	Borehole diameter: 4"		
		8" flush monument: 0 – 1 ft.		
		Bentonite Seal: 1 – 10 ft.		
		Filter Pack: 10 – 21 ft.		

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OCT 25 2016
WA State Department of Ecology (SWRO)

SCALE: 1"= ____ PAGE ____ OF ____

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report

ECY 050-12 (Rev 02-2011) To request ADA accommodation including materials in a format for the visually impaired, call Ecology Water Resources Program at 360-407-6872. Persons with impaired hearing may call Washington Relay Service at 711. Persons with speech disability may call TTY at 877-833-6341.

Site 004 - Groundwater Well Log

Please print, sign and return to the Department of Ecology

RESOURCE PROTECTION WELL REPORT

CURRENT Notice of Intent No. RE12486

(SUBMIT ONE WELL REPORT PER WELL INSTALLED)

Construction/Decommission *("x" in box)* 303-16-1192

☒ Construction
☐ Decommission

ORIGINAL INSTALLATION Notice of Intent Number:

Type of Well *("x in box)*
☒ Resource Protection
☐ Geotech Soil Boring

Consulting Firm Anchor QEA, LLC

Unique Ecology Well IDTag No. BHV-136

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☒ Driller ☐ Engineer ☐ Trainee
Name (Print Last, First Name) King, Kyle
Driller/Engineer /Trainee Signature
Driller or Trainee License No. 3220

If trainee, licensed driller's Signature and License Number:

Property Owner Thomas Christin

Site Address 602-798 Meskill Rd.

City Chehalis County Lewis

Location SE 1/4-1/4 SW 1/4 Sec 3 Twn 13N R 4W

EWM ☐ or WWM ☒

Lat/Long (s, t, r still REQUIRED) Lat Deg _____ Min _____ Sec _____
Long Deg _____ Min _____ Sec _____

Tax Parcel No.

Cased or Uncased Diameter 2" Static Level 12'

Work/Decommission Start Date 3/2/2016

Work/Decommission Completed Date 3/3/2016

Construction Design		Well Data	Formation Description	
0 – 1 ft	8" flush monument set in concrete	5007-GML	0 – 8 ft	Silty Gravel
0.5 – 17.5 ft	2" PVC riser	2" piezometer well to 23 ft.	8 – 23 ft	Sandy Gravel
17.5 – 22.5 ft	2" PVC prepack screen threaded, 0.001 slot	Borehole diameter: 4"		
		8" flush monument: 0 – 1 ft.		
		Bentonite Seal: 1 – 16.5 ft.		
		Filter Pack: 16.5 – 23 ft.		

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Site 068 - Groundwater Well Log
HOLT DRILLING, INC.

Resource Protection Well Report

113177

Project Name Chehalis Facility Plan

Well Identification # MW-3/Tag# ABO432

Drilling Method 4" ASA

Driller Michael Reynolds

License # 2442

Date 10-4-01

County Lewis, SE ¼ SE ¼

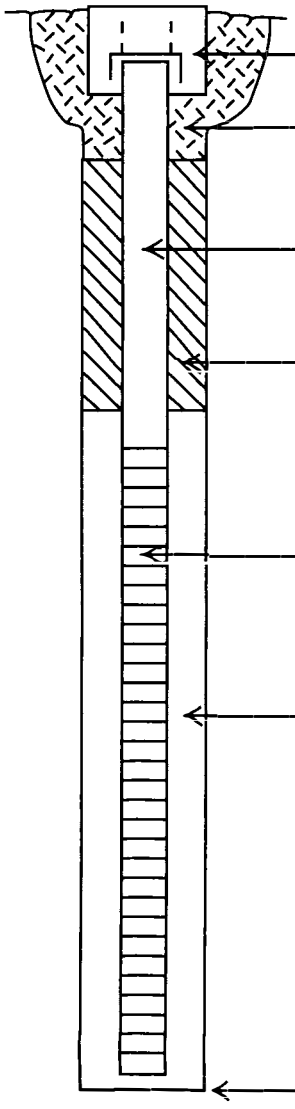
Section 36 T. 13N R. 3W

Street Address Farm Fields off of Hwy 6

Start Card R55192

Consulting Firm Robinson & Noble

AS-BUILT



WELL DATA

MONUMENT TYPE 6" Stick-up / 2.5' Above Ground

CONCRETE SURFACE SEAL 1.5 ft.

PVC BLANK 2 "x 19.5'

BACKFILL 13.5 ft.

TYPE Bentonite

PVC SCREEN 2 "x 10'

SLOT SIZE .020

TYPE PVC

GRAVEL PACK 12 ft.

MATERIAL 10/20 Silica

WELL DEPTH 27.0 '

FORMATION DESCRIPTION

0 - 20 ft. Lt Brn. Silty Fine Sand

20 - 27 ft. Brn. Med. Sand w/ Scattered Sm Gravels

- ft.

- ft.

- ft.

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Washington State
Department of Ecology

REMARKS 3-3"x7' Steel bollards placed & concreted around monument

Signature Michael J. Reynolds

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

D15332 FDB/D41029 EPS

Site 086 - Groundwater Well Log

Please print, sign and return to the Department of Ecology

RESOURCE PROTECTION WELL REPORT

CURRENT Notice of Intent No. RE13028

(SUBMIT ONE WELL REPORT PER WELL INSTALLED)

Construction/Decommission *("x" in box)* 303-16-1192

☒ Construction
☐ Decommission

ORIGINAL INSTALLATION Notice of Intent Number:

Type of Well *("x in box)*
☒ Resource Protection
☐ Geotech Soil Boring

Consulting Firm Anchor QEA, LLC

Unique Ecology Well IDTag No. B HV143

Property Owner Washington Dept. of Fish and Wildlife

Site Address 5993 US Hwy. 12

City Oakville County Grays Harbor

Location SW 1/4-1/4 SW 1/4 Sec 34 Twn 17N R 5W

EWM ☐ or WWM ☒

Lat/Long (s, t, r still REQUIRED) Lat Deg ____ Min ____ Sec ____

Long Deg ____ Min ____ Sec ____

Tax Parcel No. 022434036001

Cased or Uncased Diameter 2" Static Level 10 . 68 '

Work/Decommission Start Date 6/28/2016

Work/Decommission Completed Date 6/28/2016

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☒ Driller ☐ Engineer ☐ Trainee

Name (Print Last, First Name) King, Kyle

Driller/Engineer /Trainee Signature

Driller or Trainee License No. 3220

If trainee, licensed driller's Signature and License Number:

Construction Design		Well Data	Formation Description	
0 – 2 ft	8" flush monument set in concrete	5086-GML	0 – 10 ft	Silt
0 – 15 ft	2" PVC riser	2" piezometer well to 25 ft.	10 – 13.5 ft	Silty Sand
15 – 25 ft	2" PVC prepack screen threaded, 0.001 slot	Borehole diameter: 4"	13.5 – 25 ft	Gray Sand/River Rock
		8" flush monument: 0 – 1 ft.		
		Bentonite Seal: 2 – 12.5 ft.		
		Filter Pack: 12.5 – 25 ft.		

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OCT 25 2016
WA State Department of Ecology (SWRO)

SCALE: 1"= ____ PAGE ____ OF ____

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Appendix C
Water Elevation Graphs

Figure C-1. Site 007 Water Elevations and Rainfall Amounts

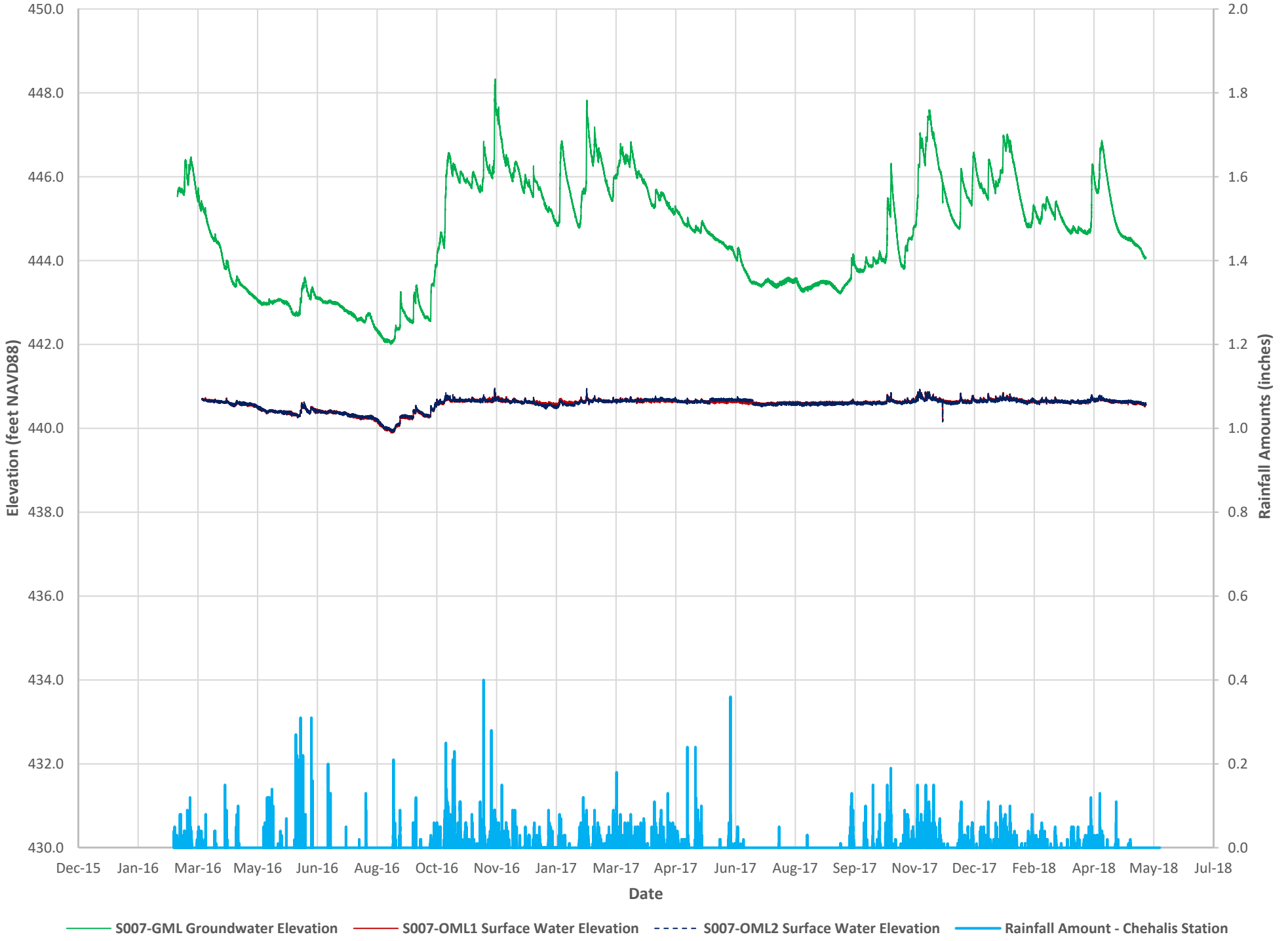
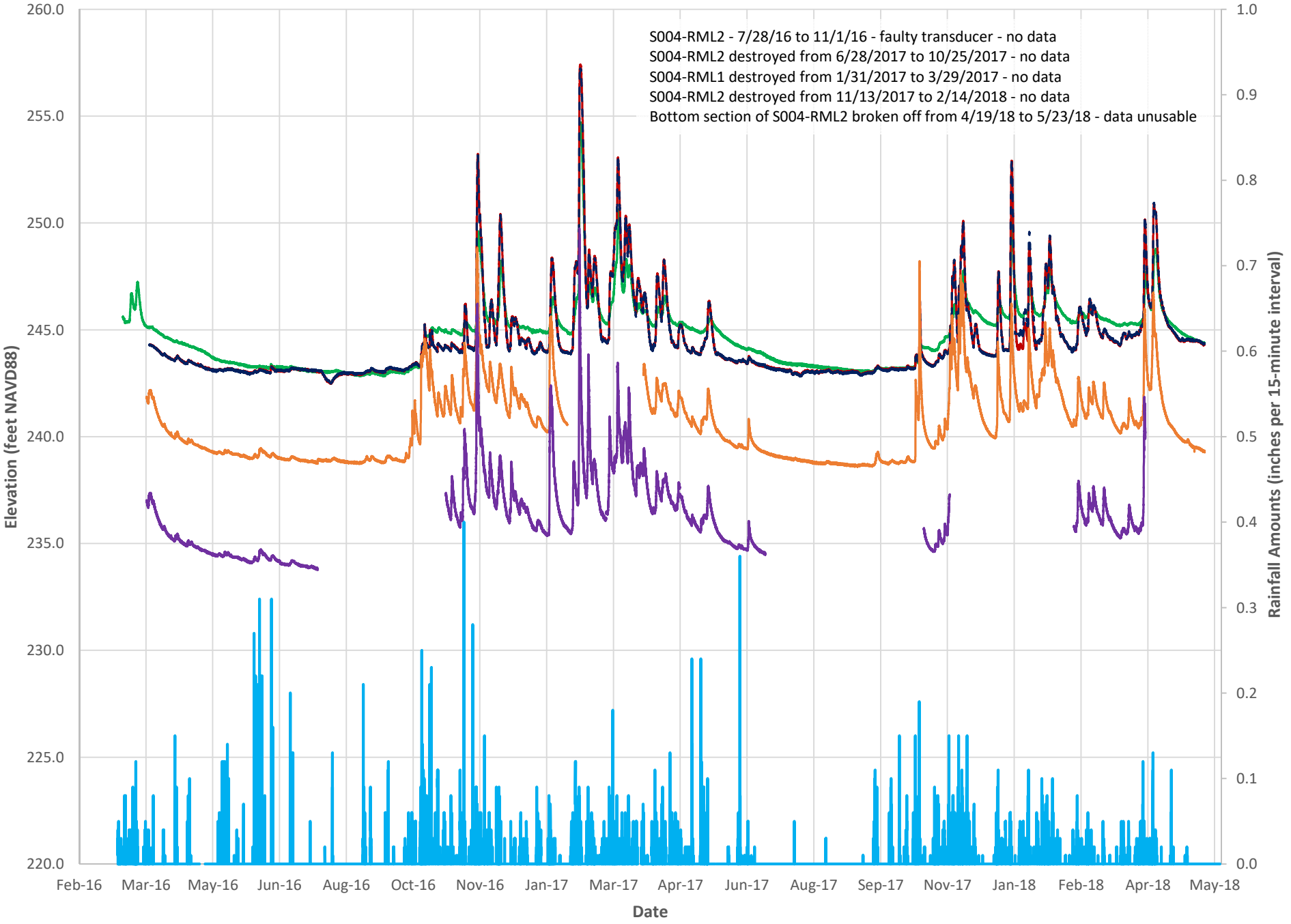


Figure C-2a. Site 004 Water Elevations and Rainfall Amounts



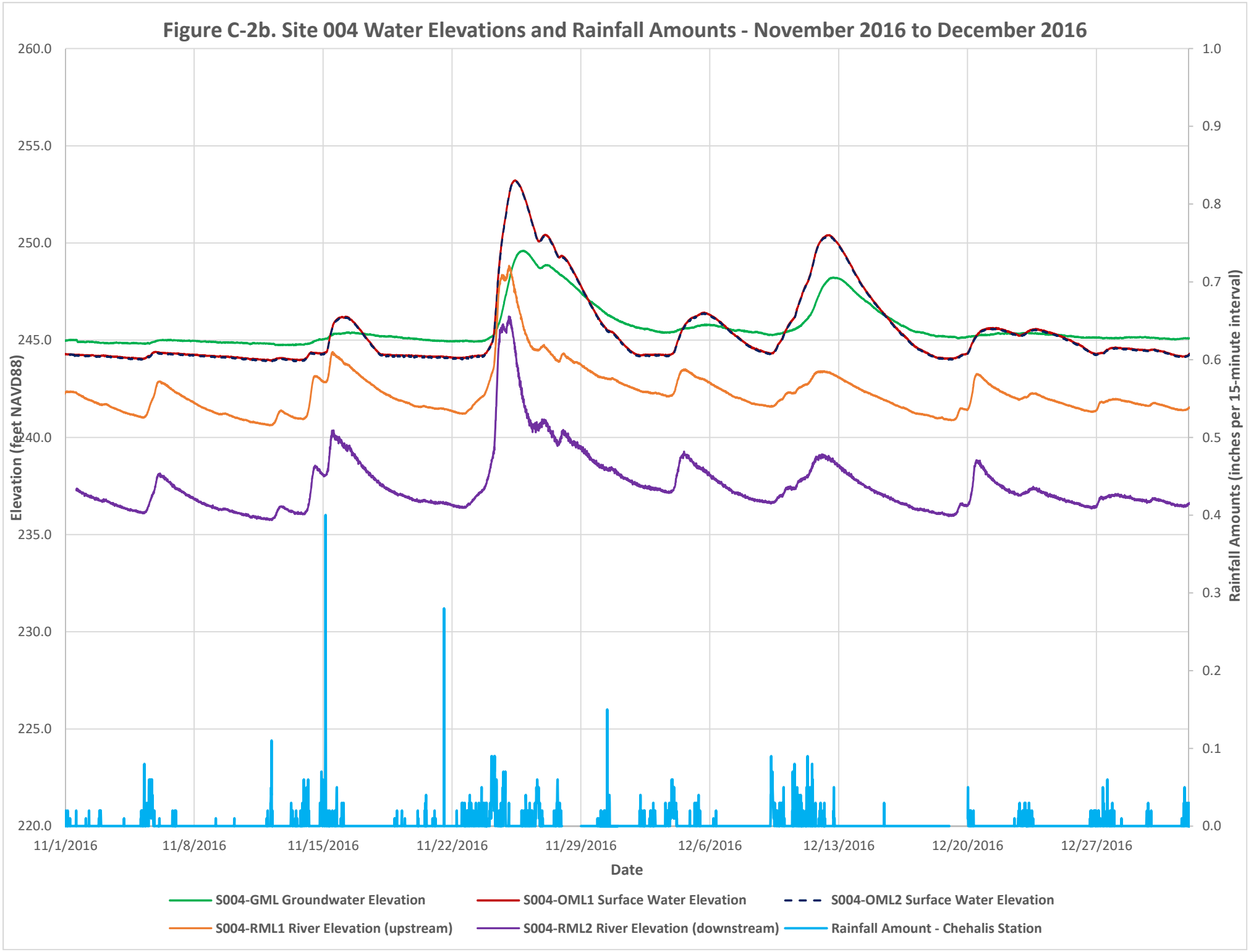


Figure C-2b. Site 004 Water Elevations and Rainfall Amounts - November 2016 to December 2016
Elevation (feet NAVD88)
Rainfall Amounts (inches per 15-minute interval)
260.0
255.0
250.0
245.0
240.0
235.0
230.0
225.0
220.0
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
11/1/2016
11/8/2016
11/15/2016
11/22/2016
11/29/2016
12/6/2016
12/13/2016
12/20/2016
12/27/2016
Date
S004-GML Groundwater Elevation
S004-OML1 Surface Water Elevation
S004-OML2 Surface Water Elevation
S004-RML1 River Elevation (upstream)
S004-RML2 River Elevation (downstream)
Rainfall Amount - Chehalis Station

Figure C-2c. Site 004 Water Elevations and Rainfall Amounts - October 2017 to November 2017

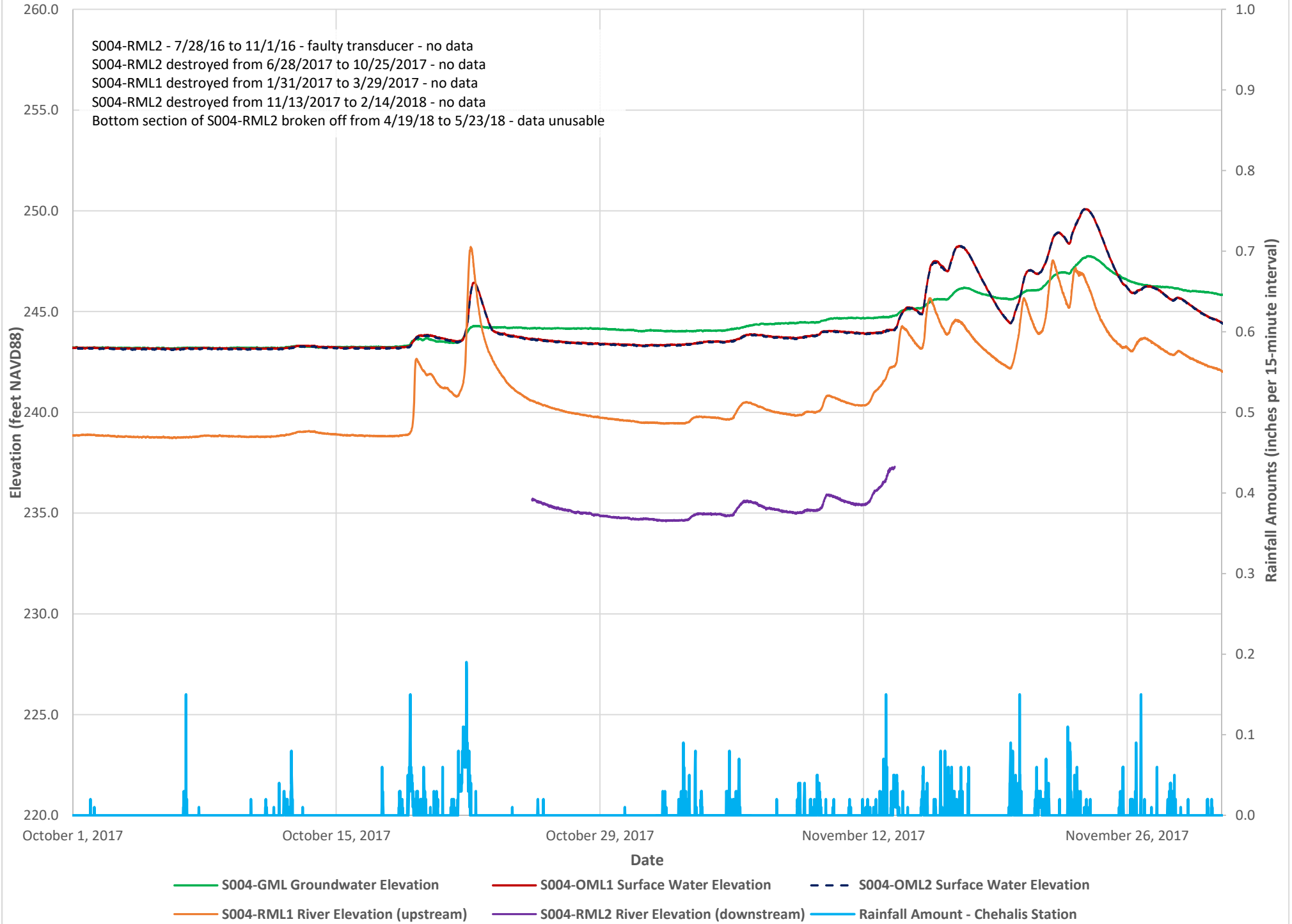


Figure C-2d. Site 004 Water Elevations and Rainfall Amounts - January 2018 to February 2018

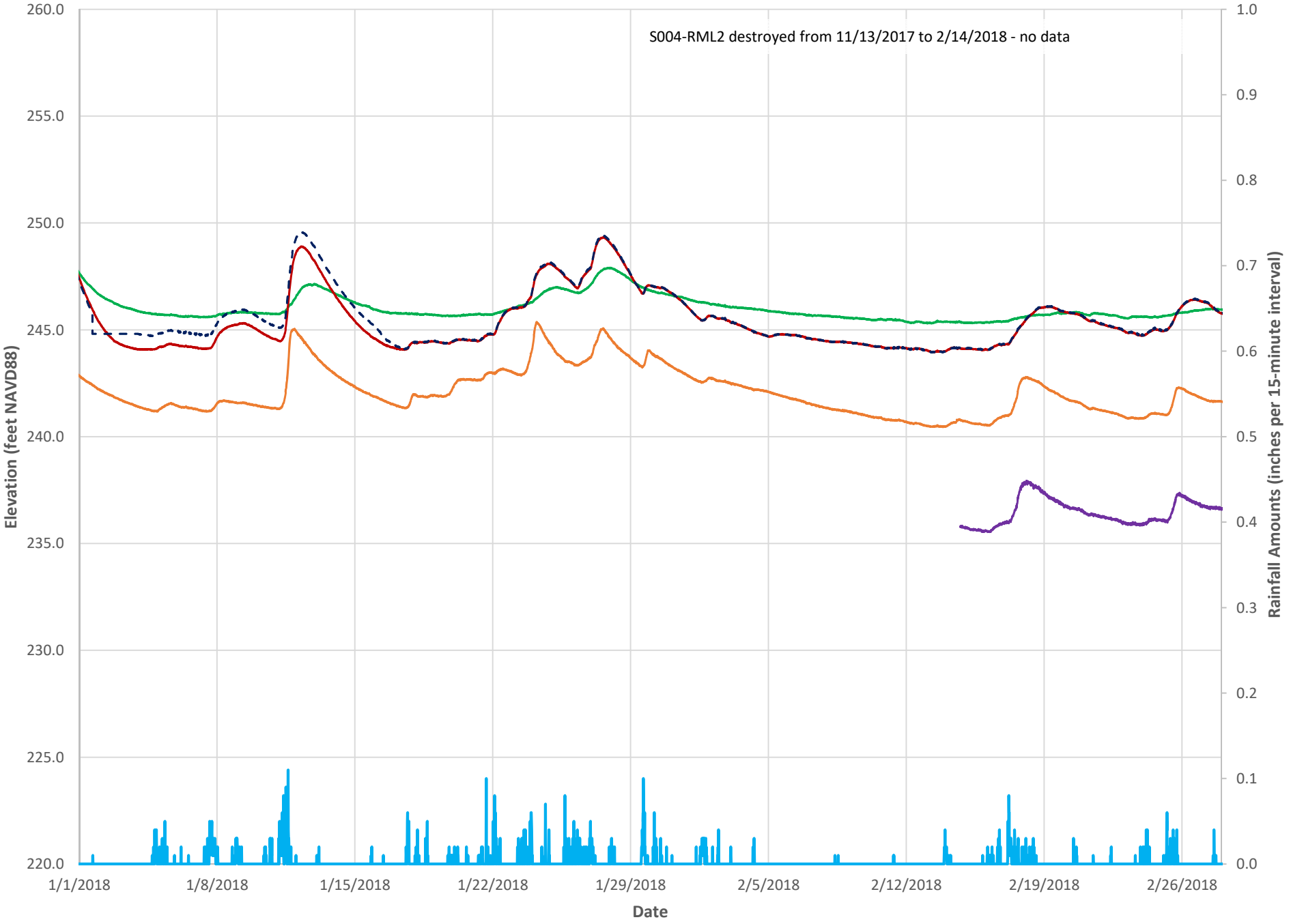


Figure C-3a. Site 068 Water Elevations and Rainfall Amounts

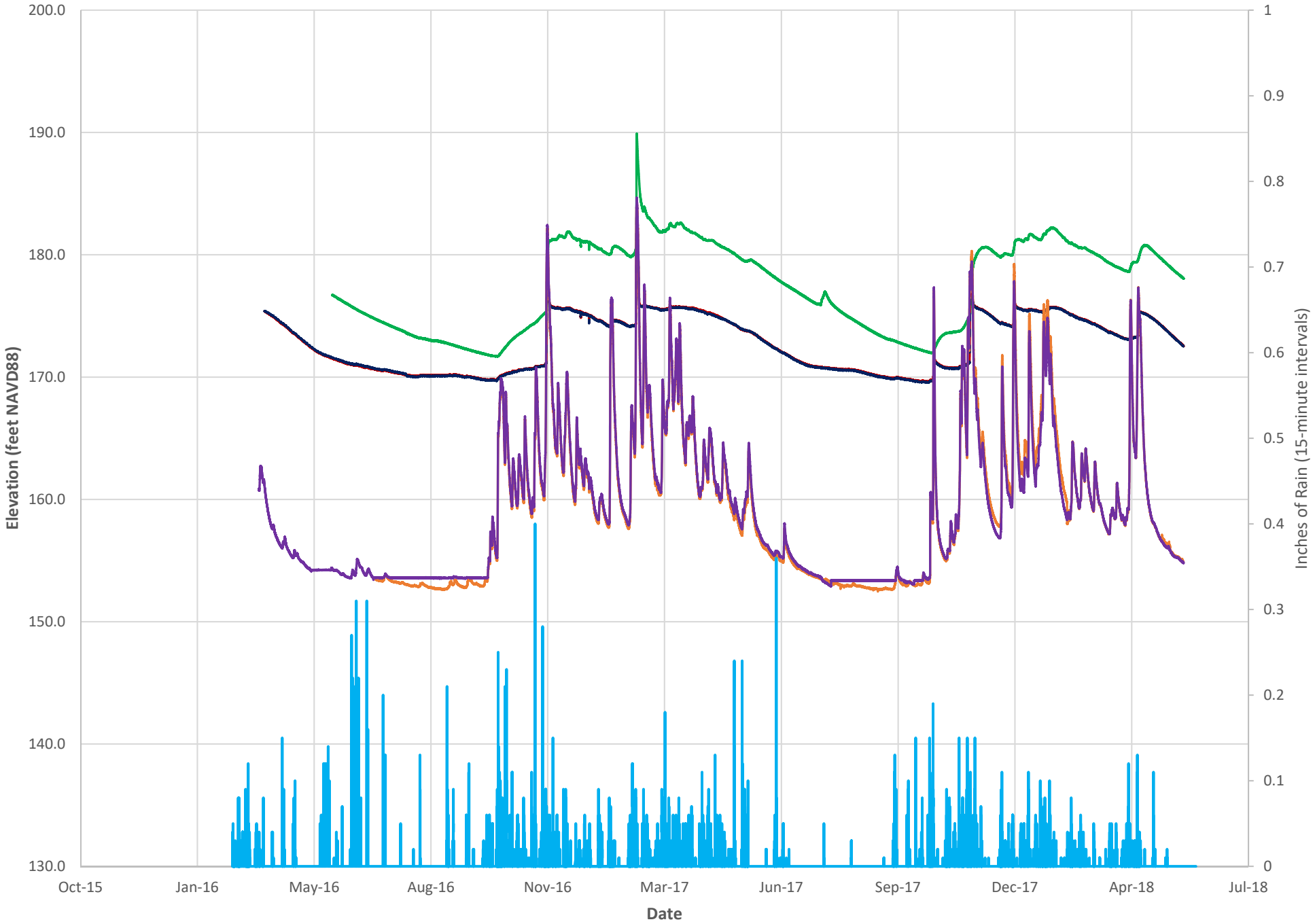


Figure C-3b. Site 068 Water Elevations and Rainfall Amounts - November 2016 to December 2016

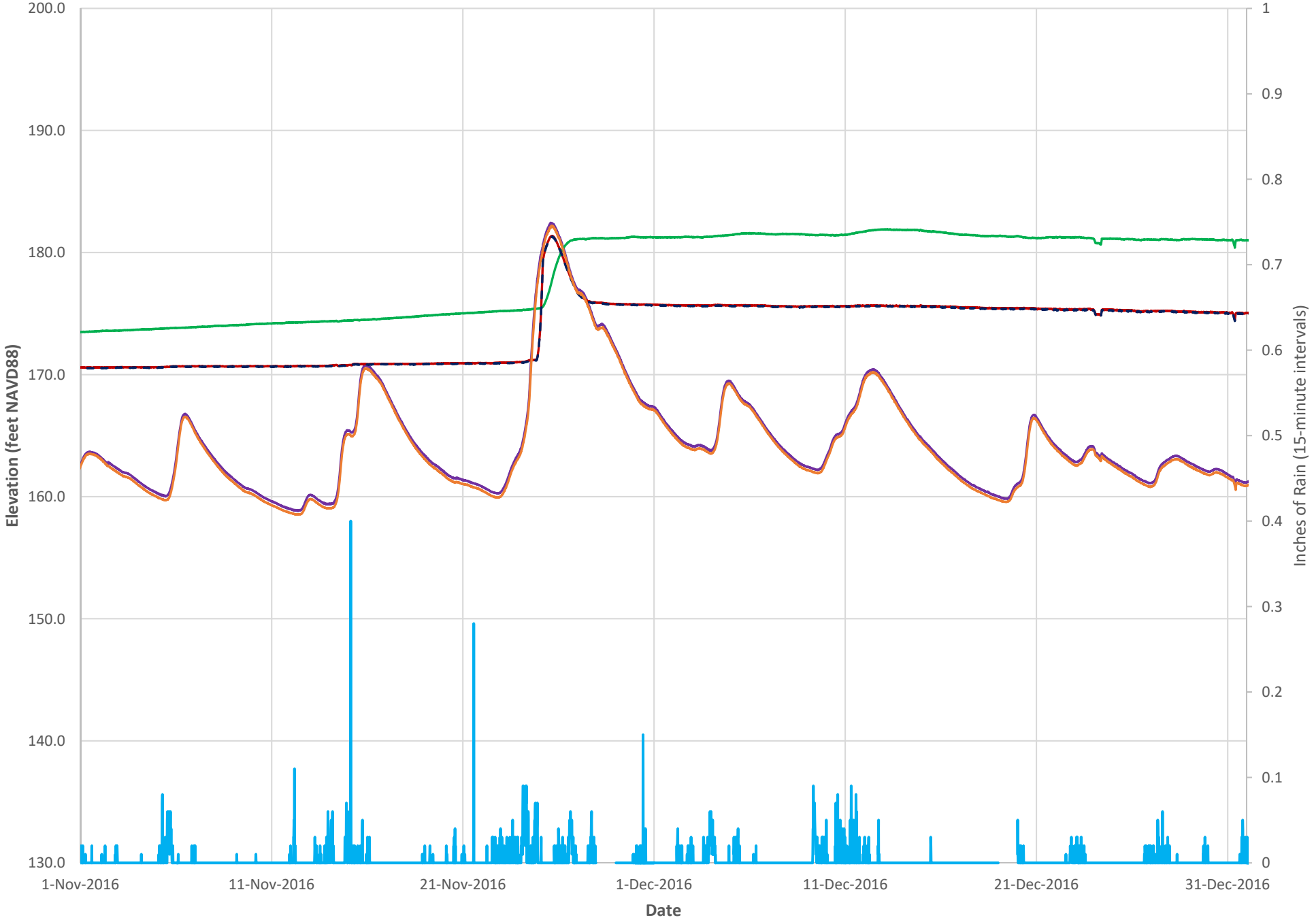


Figure C-3c. Site 068 Water Elevations and Rainfall Amounts - February 2017

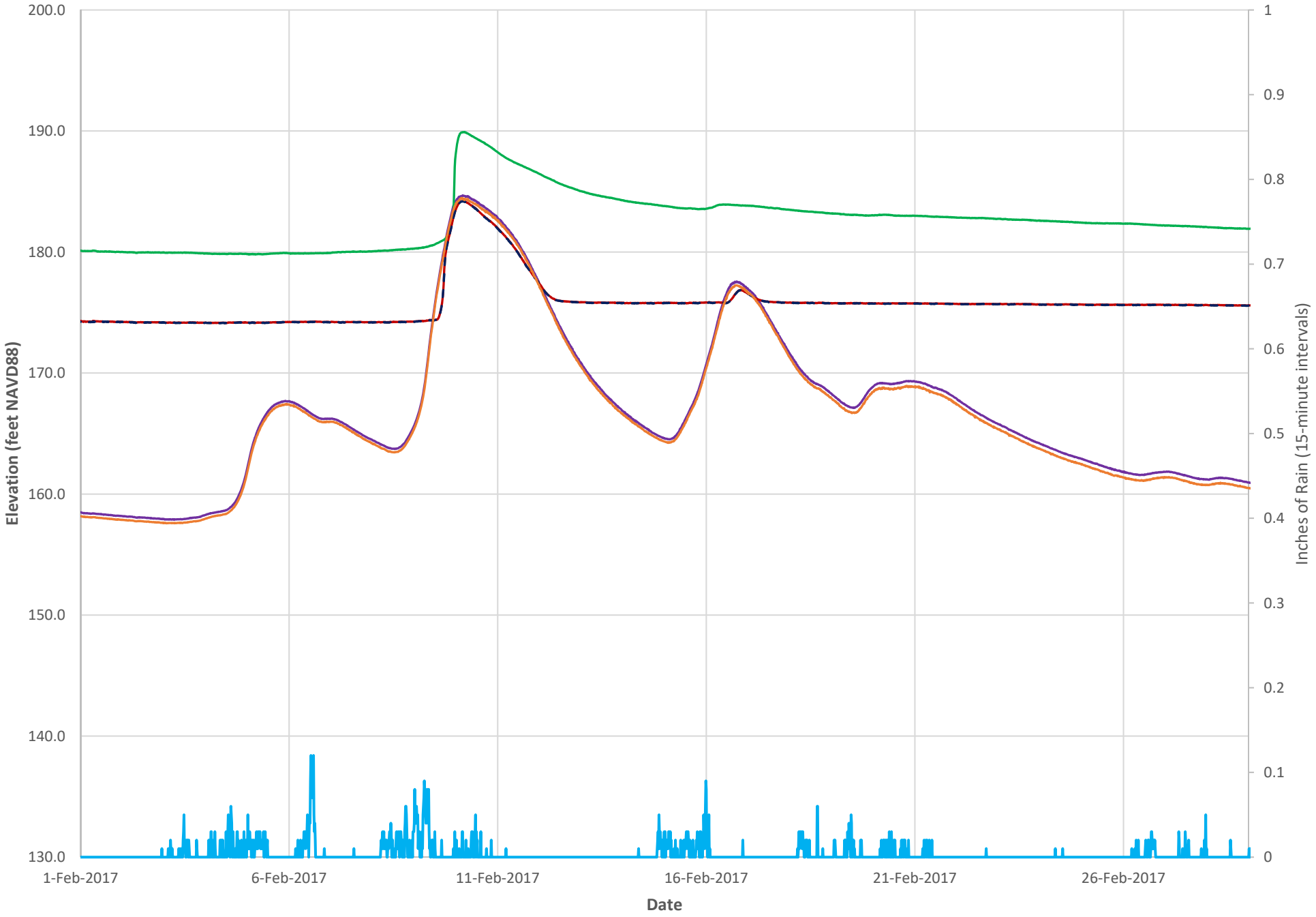


Figure C-3d. Site 068 Water Elevations and Rainfall Amounts - November 2017 to December 2017

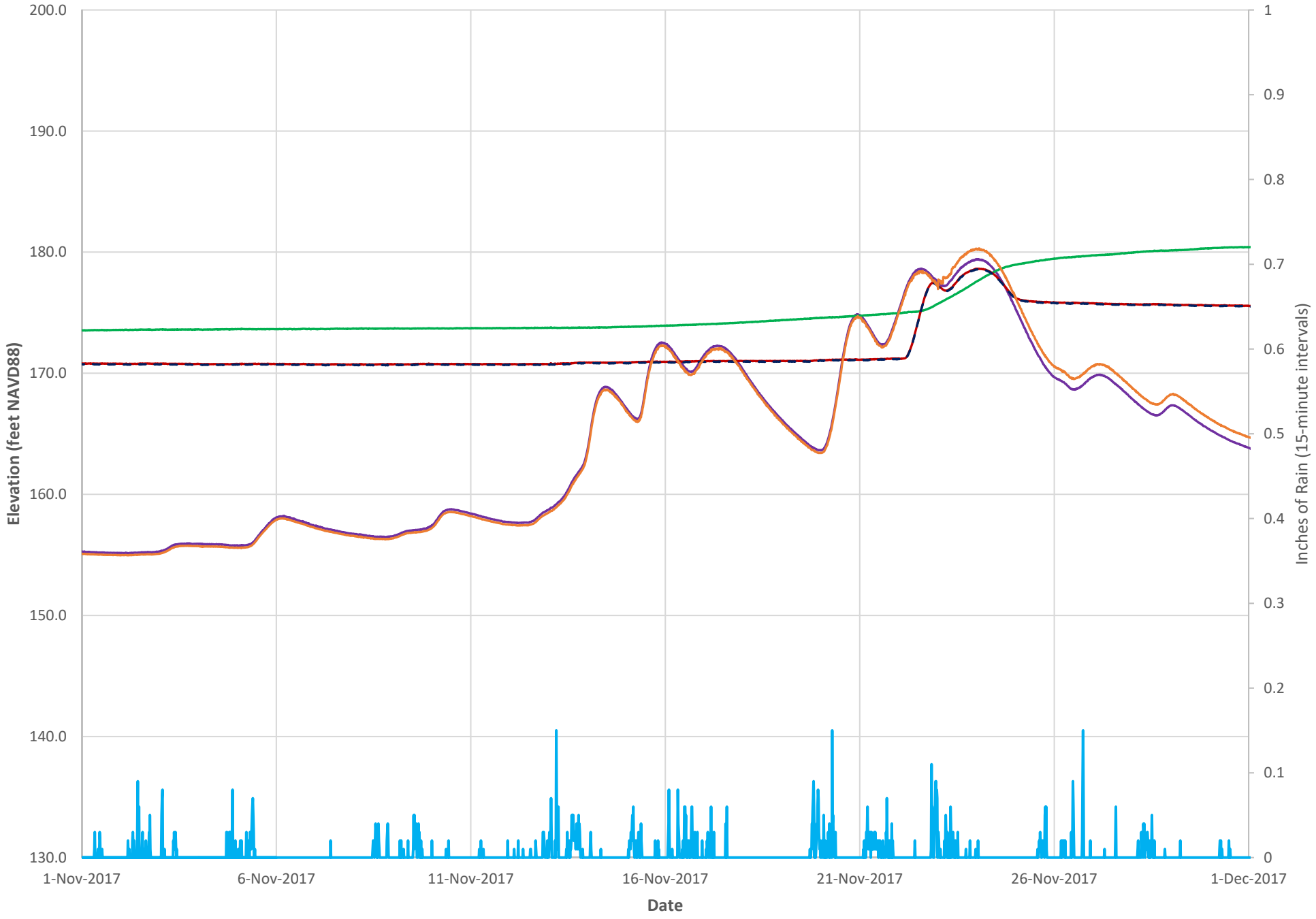


Figure C-4a. Site 020 Water Elevations and Rainfall Amounts

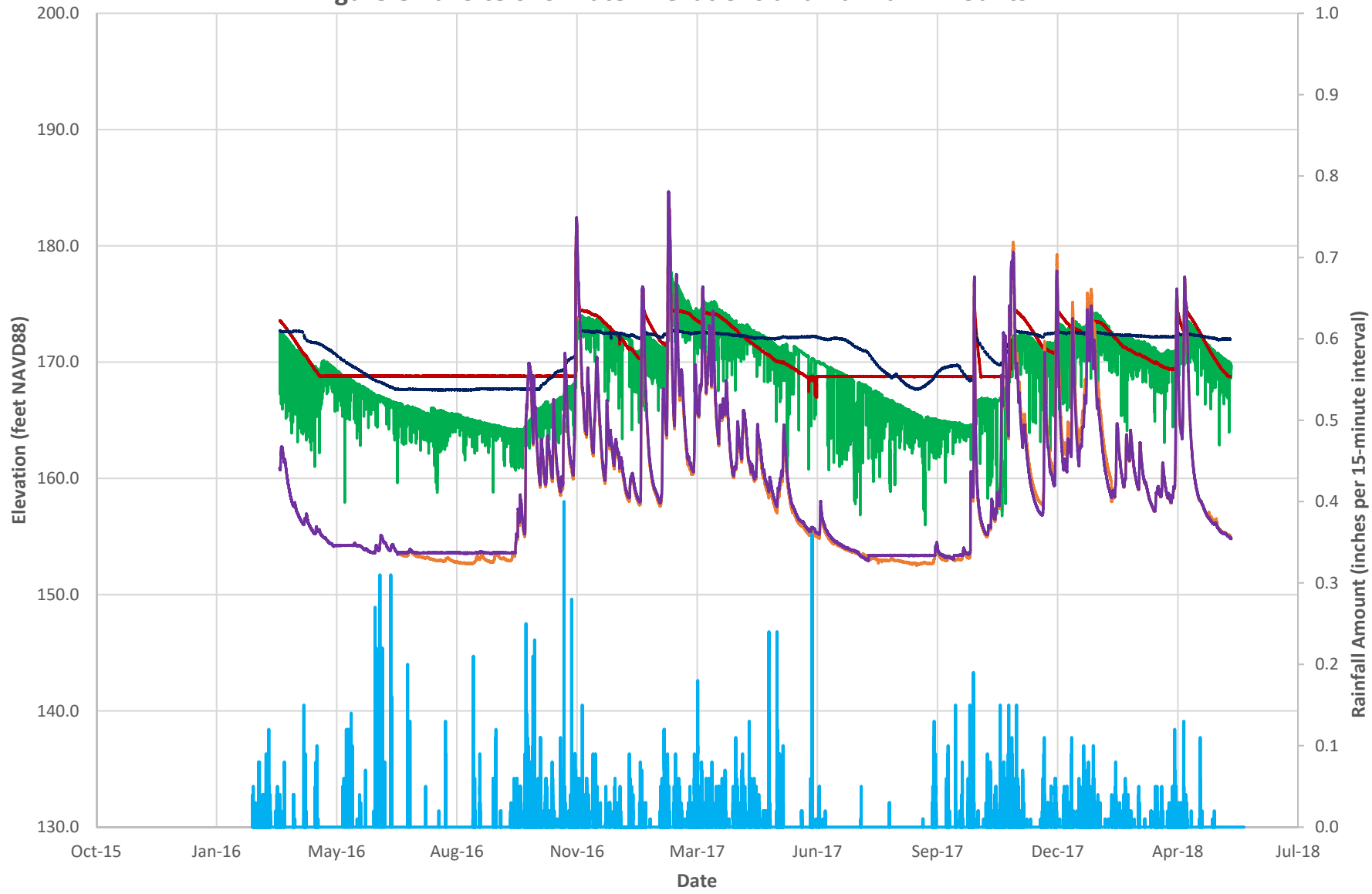
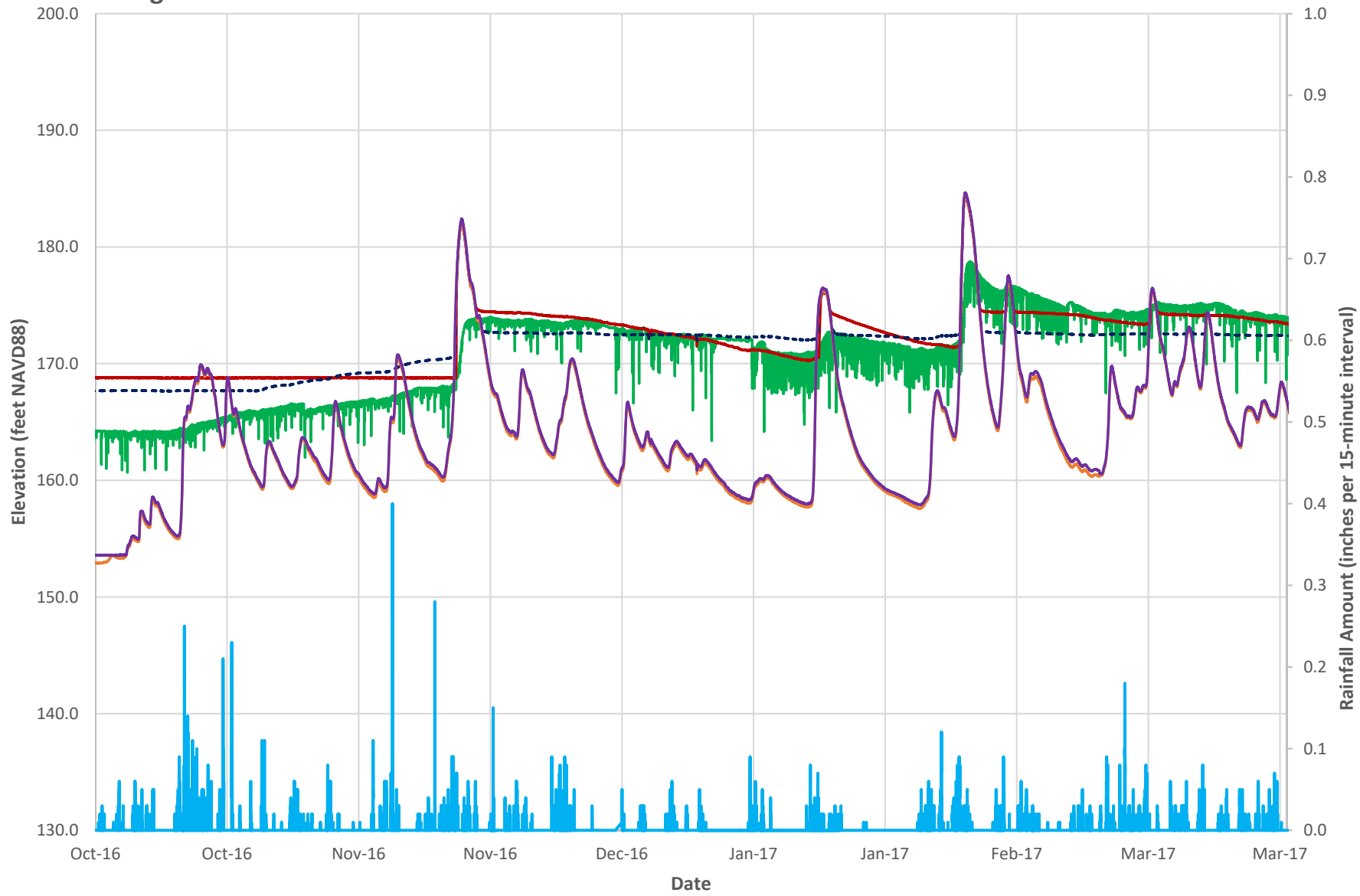


Figure C-4b. Site 020 Water Elevations and Rainfall Amounts - October 2016 to March 2017



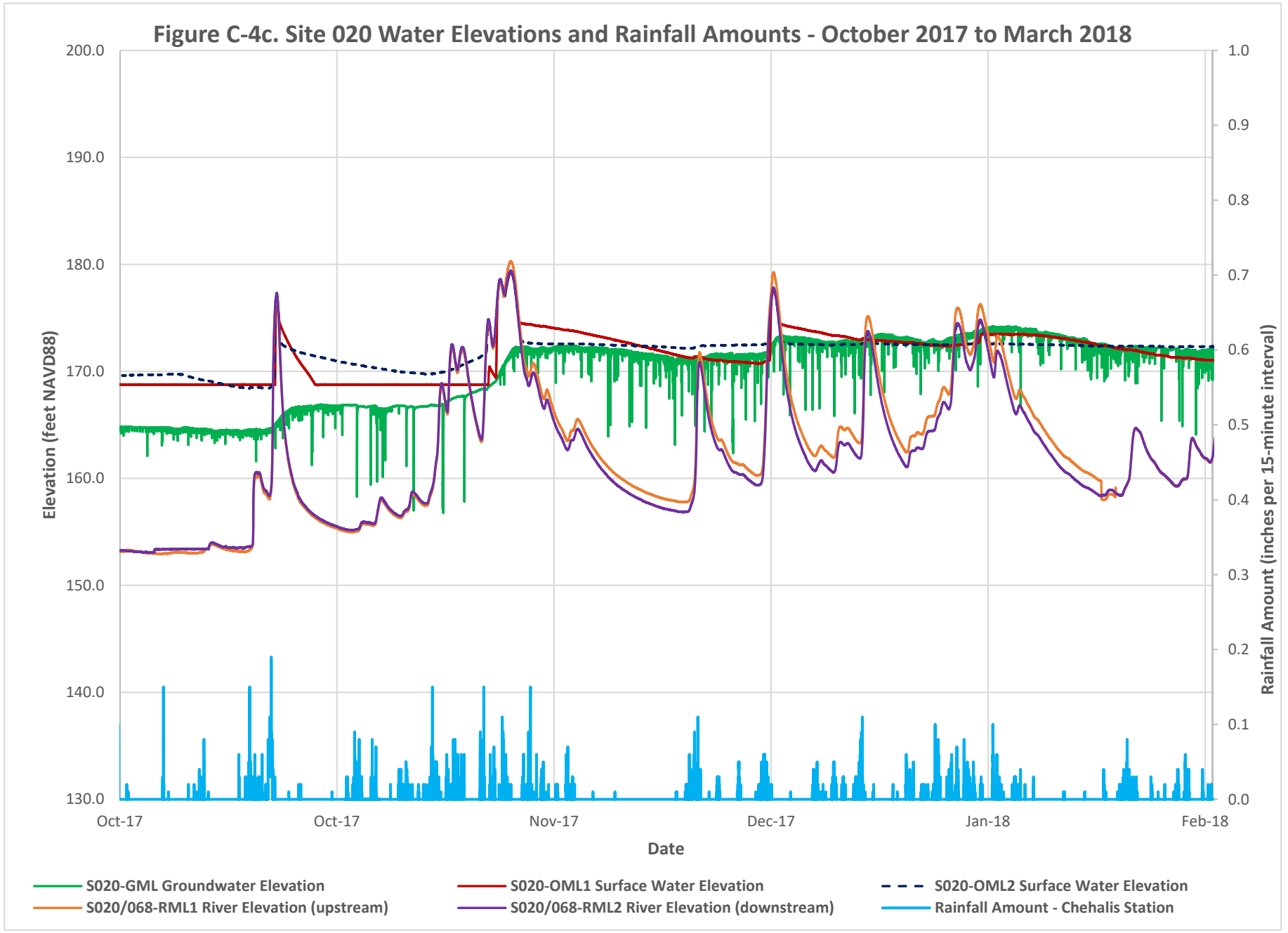


Figure C-4c. Site 020 Water Elevations and Rainfall Amounts - October 2017 to March 2018
Elevation (feet NAVD88)
200.0
190.0
180.0
170.0
160.0
150.0
140.0
130.0
Rainfall Amount (inches per 15-minute interval)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Oct-17
Oct-17
Nov-17
Dec-17
Jan-18
Feb-18
Date
S020-GML Groundwater Elevation
S020-OML1 Surface Water Elevation
S020-OML2 Surface Water Elevation
S020/068-RML1 River Elevation (upstream)
S020/068-RML2 River Elevation (downstream)
Rainfall Amount - Chehalis Station

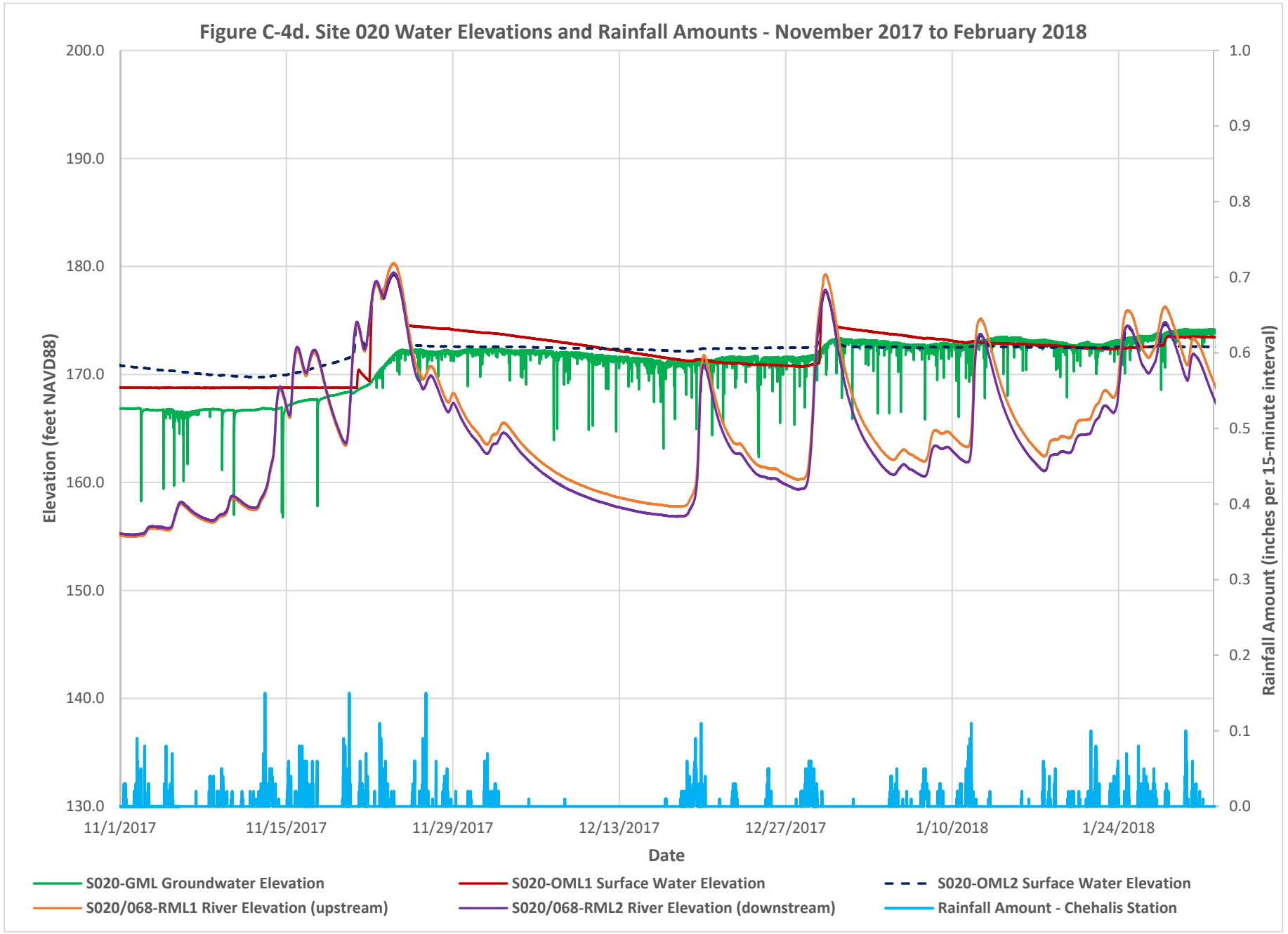


Figure C-4d. Site 020 Water Elevations and Rainfall Amounts - November 2017 to February 2018
Elevation (feet NAVD88)
200.0
190.0
180.0
170.0
160.0
150.0
140.0
130.0
Rainfall Amount (inches per 15-minute interval)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
11/1/2017
11/15/2017
11/29/2017
12/13/2017
12/27/2017
1/10/2018
1/24/2018
Date
S020-GML Groundwater Elevation
S020-OML1 Surface Water Elevation
S020-OML2 Surface Water Elevation
S020/068-RML1 River Elevation (upstream)
S020/068-RML2 River Elevation (downstream)
Rainfall Amount - Chehalis Station

Figure C-5a. Site 086 Water Elevations and Rainfall Amounts

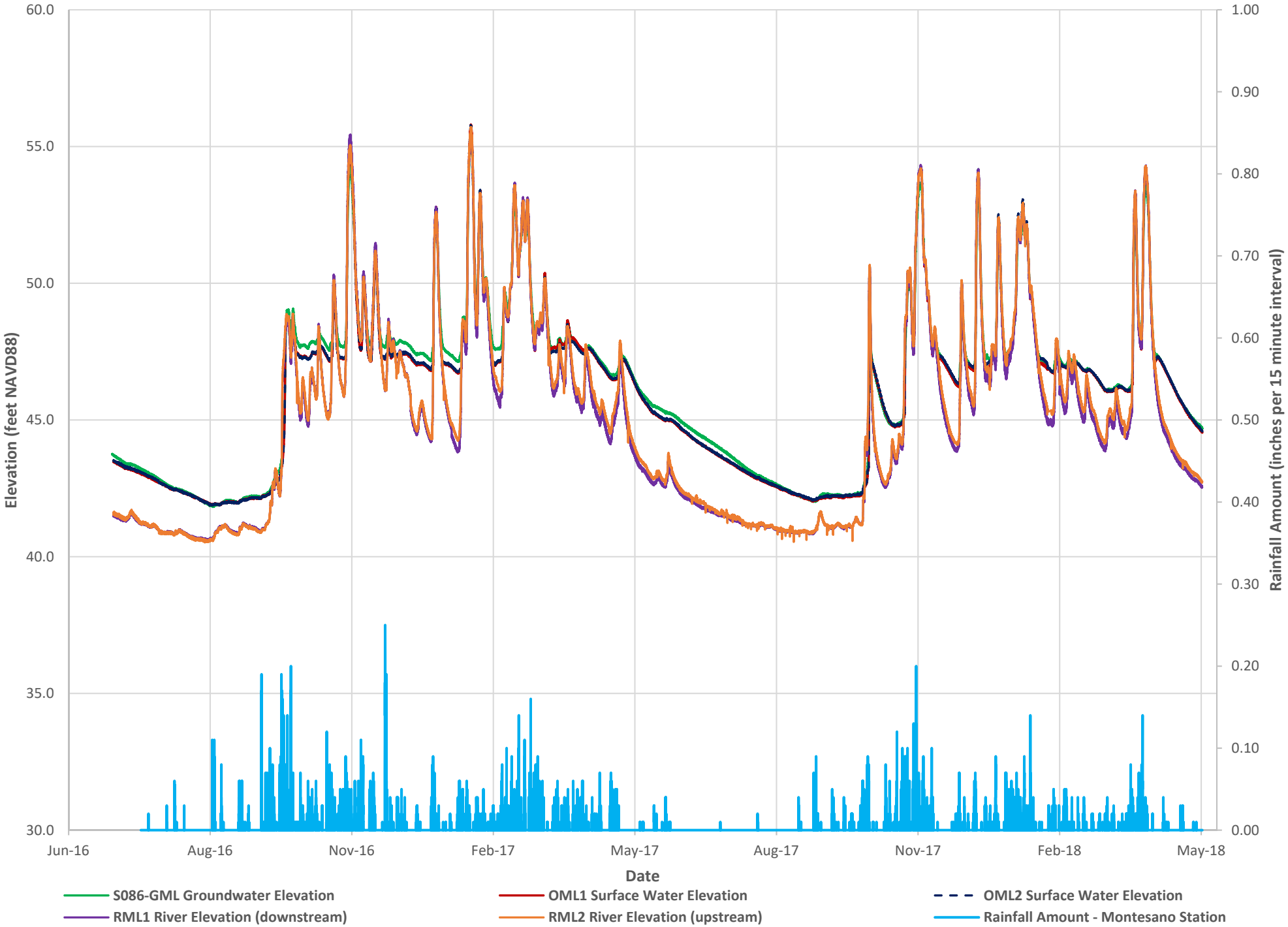
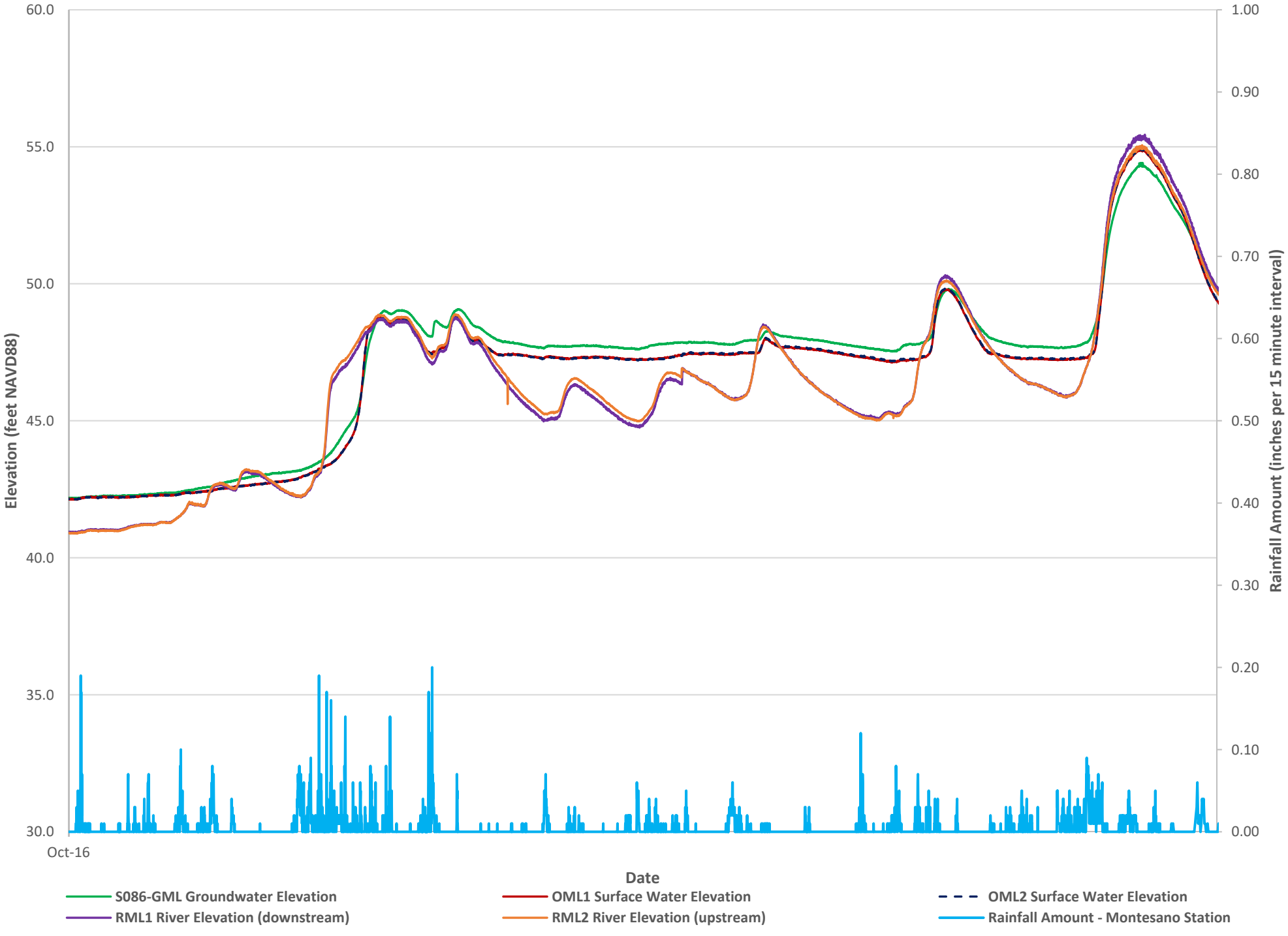


Figure C-5b. Site 086 Water Elevations and Rainfall Amounts - October 2016 to November 2016



Appendix D
Temperature Graphs

Figure D-1a. Site 007 Water Temperatures and Daily High and Low Temperatures

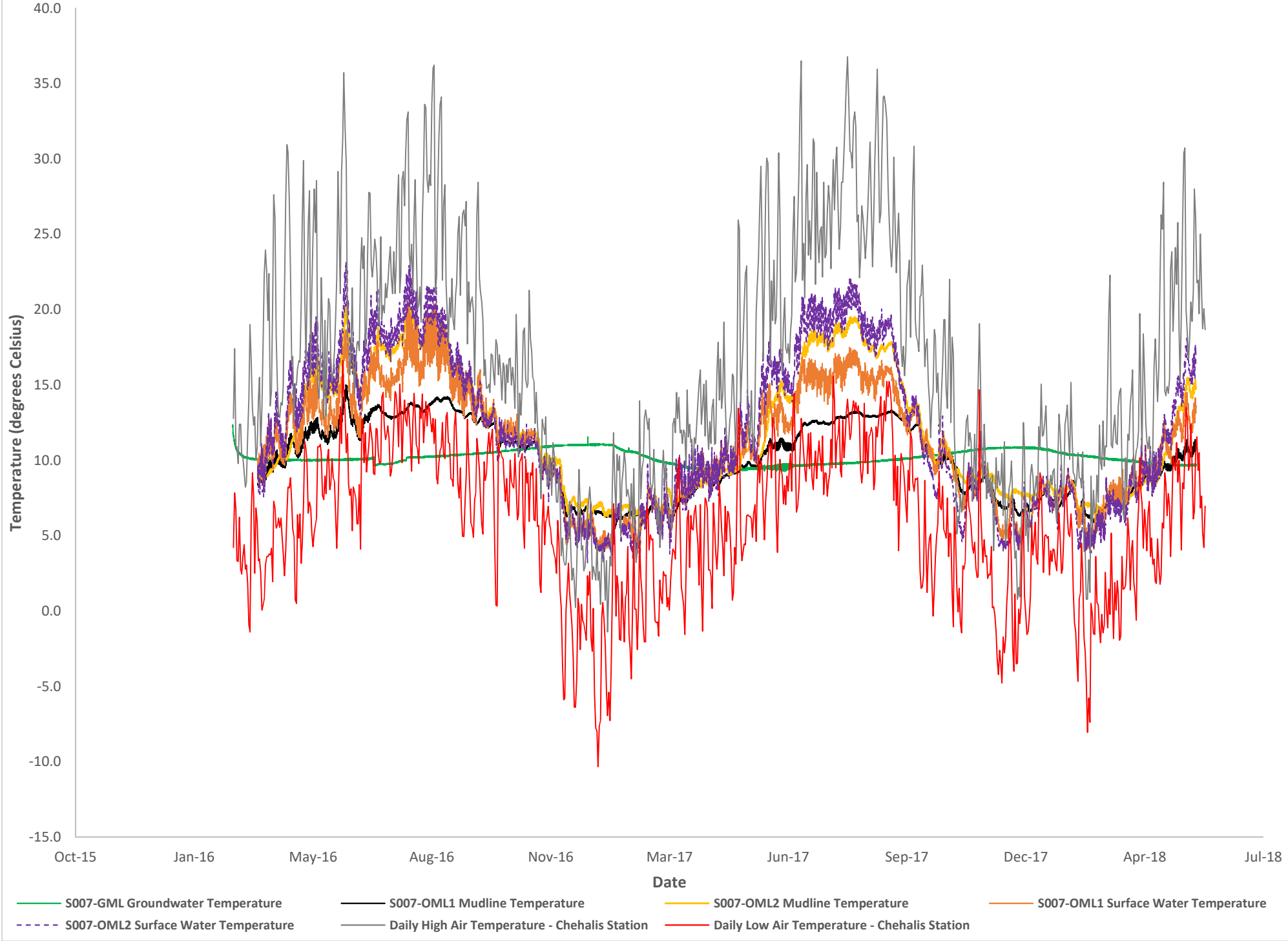


Figure D-1b. Site 007 Mudline Temperatures and Daily High and Low Temperatures

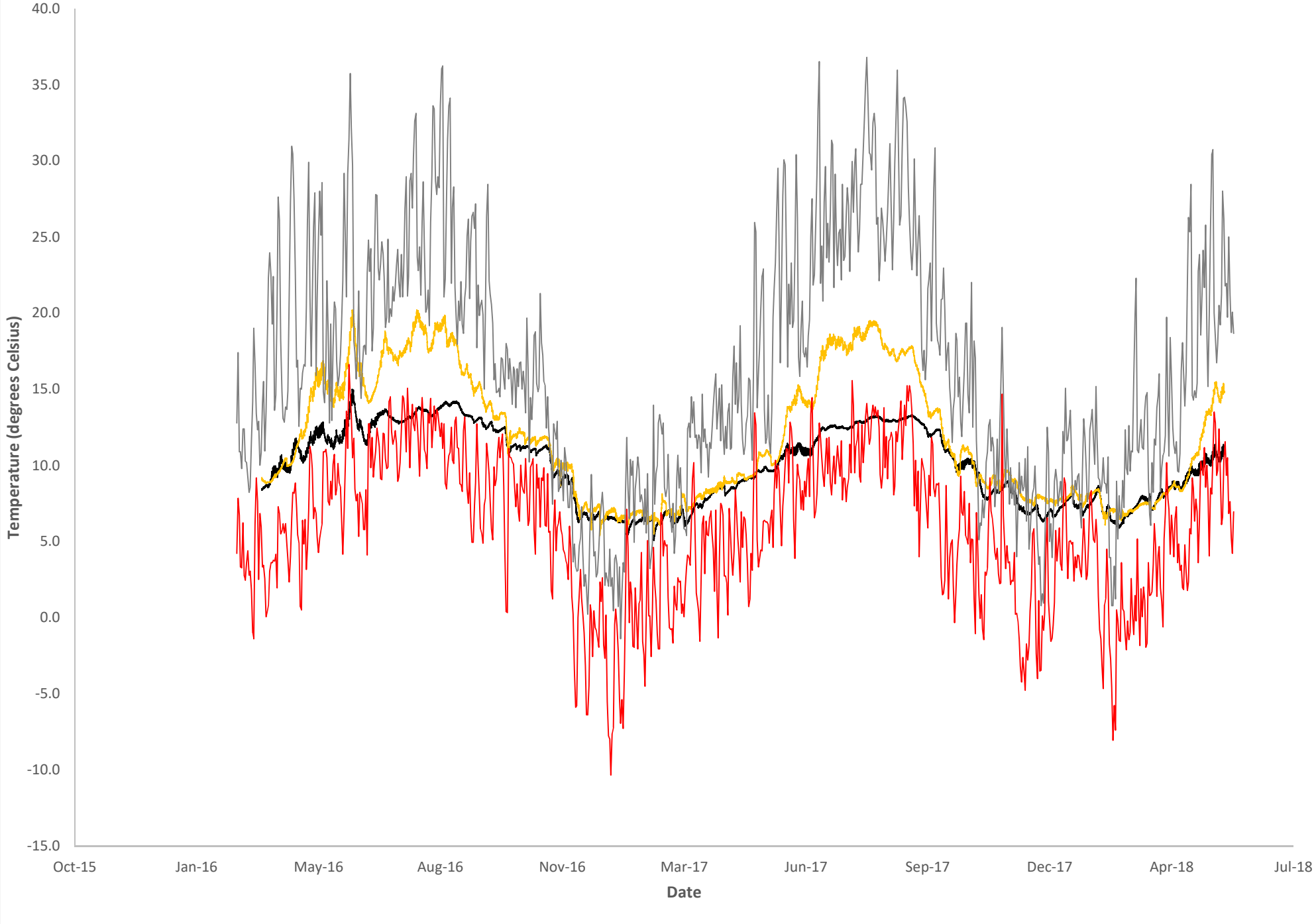


Figure D-2a. Site 004 Water Temperatures and Daily High and Low Temperatures

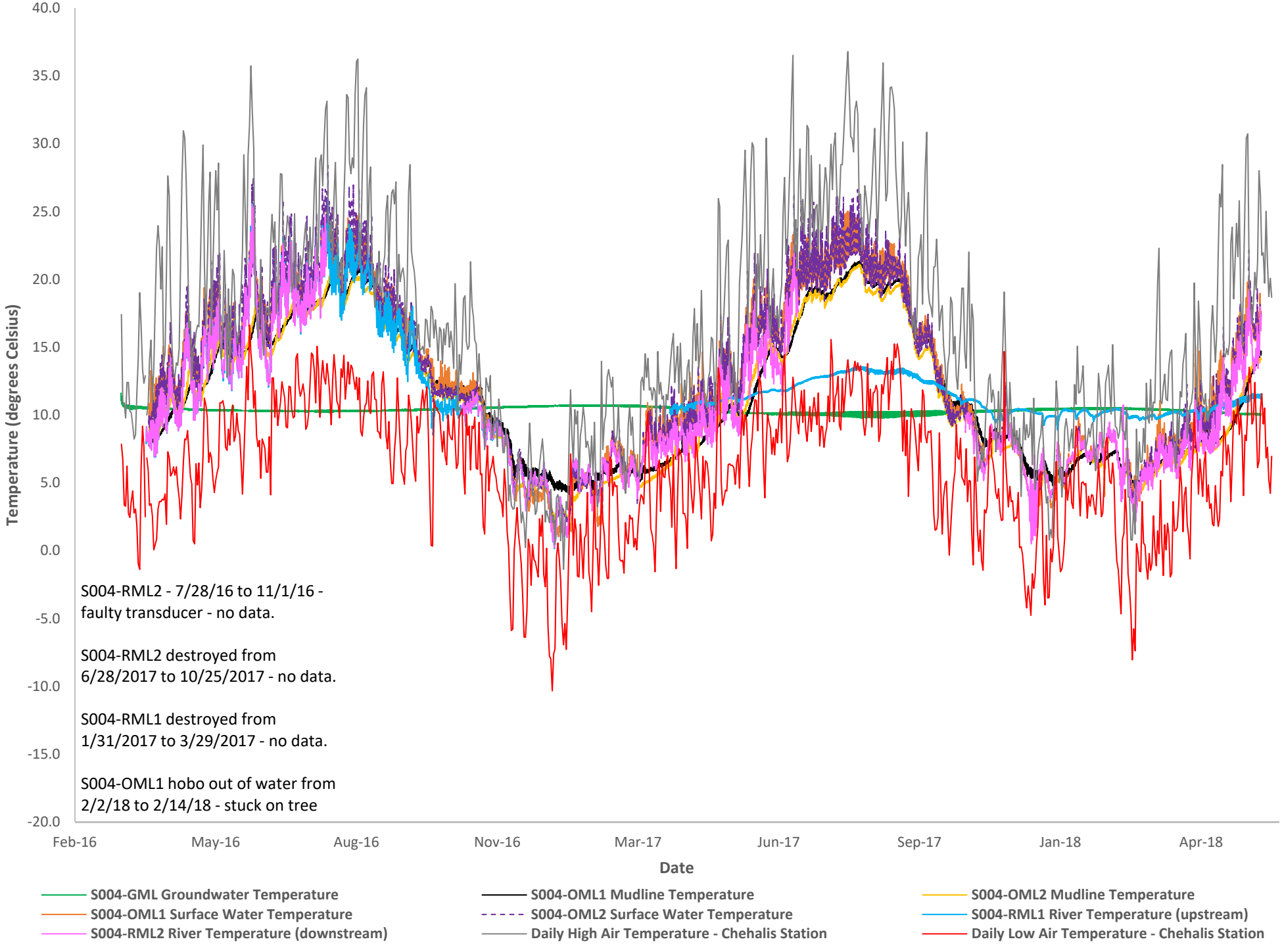


Figure D-2b. Site 004 Mudline Temperatures and Daily High and Low Temperatures

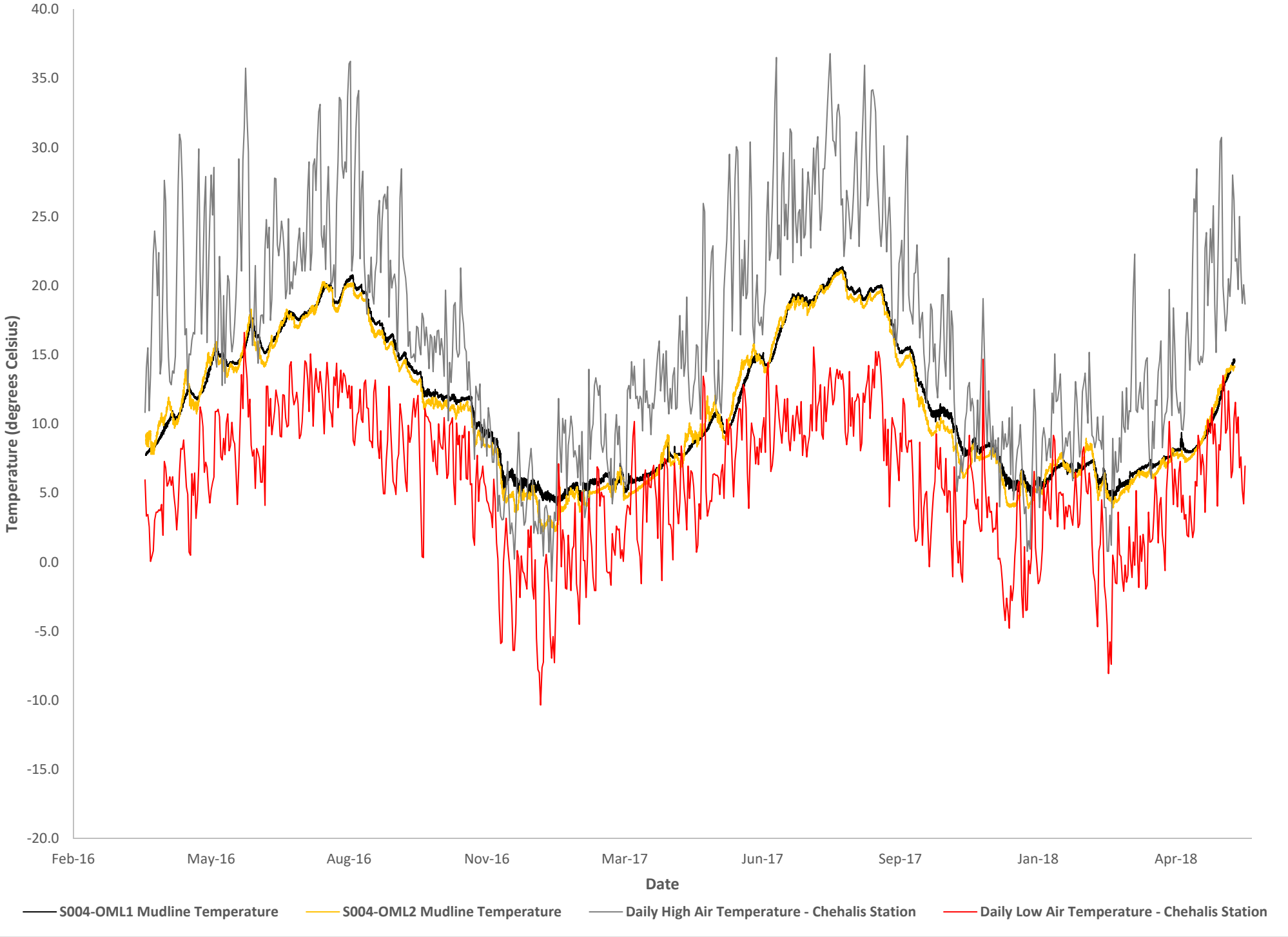


Figure D-3a. Site 068 Water Temperatures and Daily High and Low Temperatures

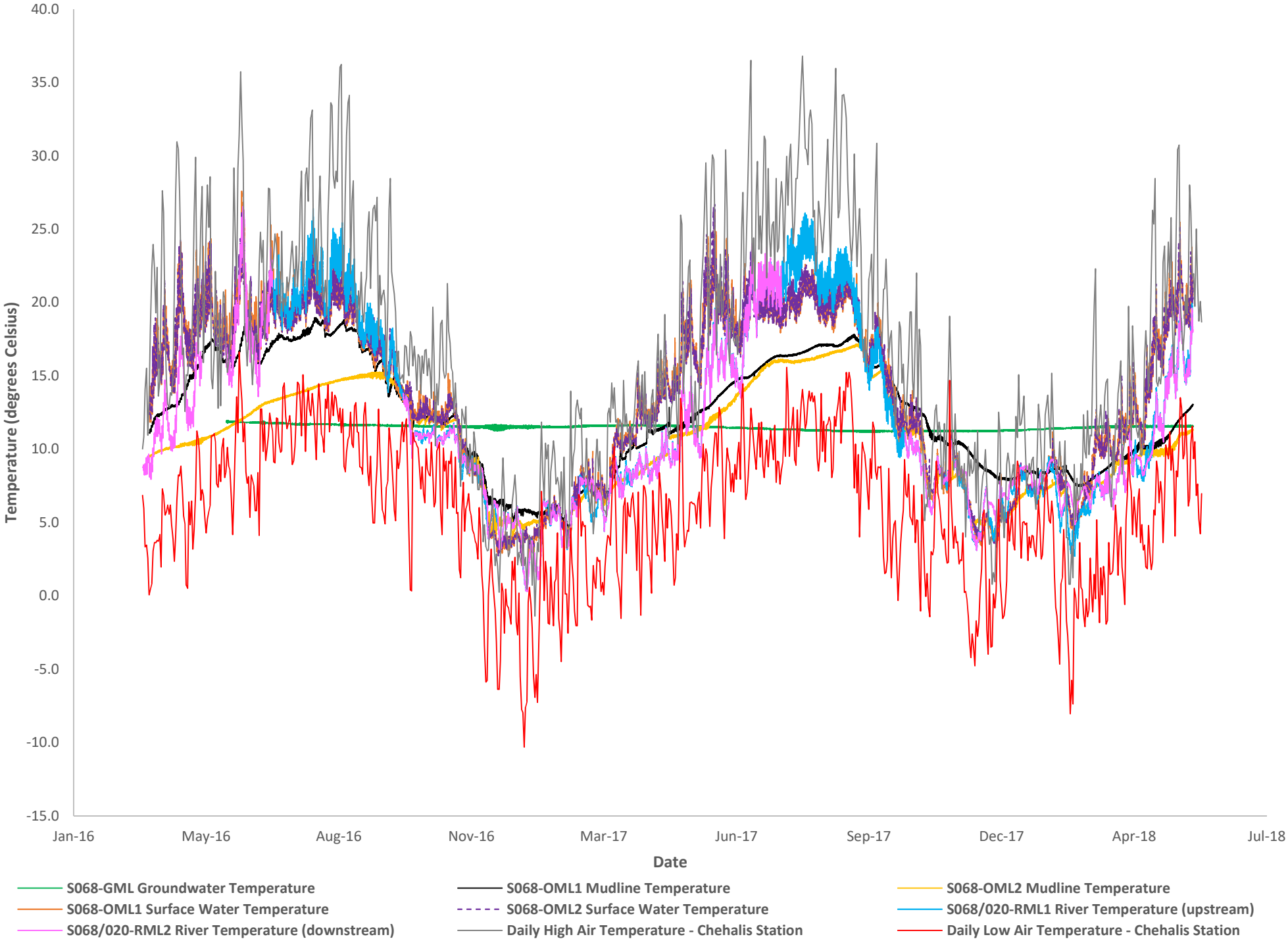


Figure D-3b. Site 068 Mudline Temperatures and Daily High and Low Temperatures

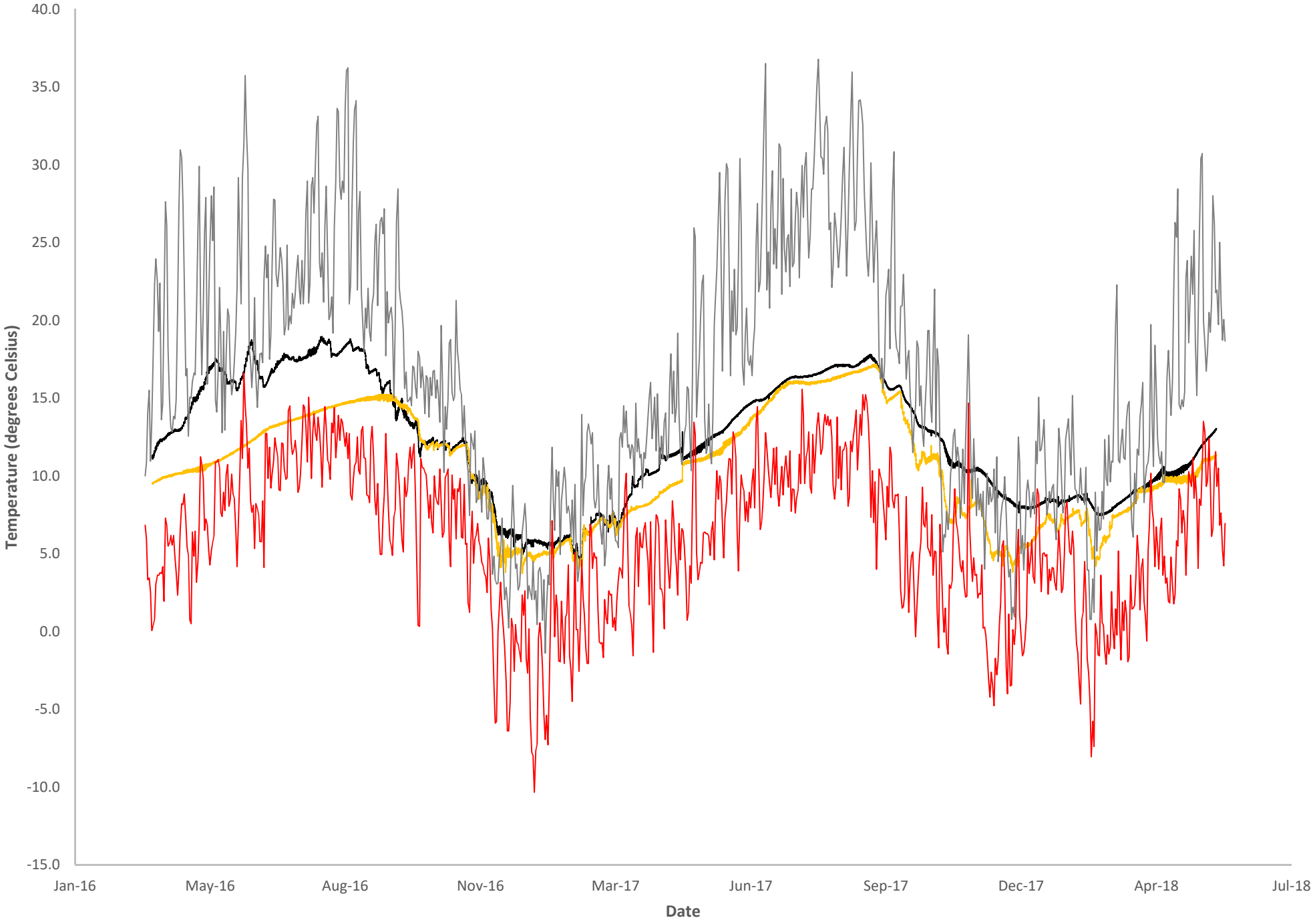


Figure D-4a. Site 020 Water Temperatures and Daily High and Low Temperatures

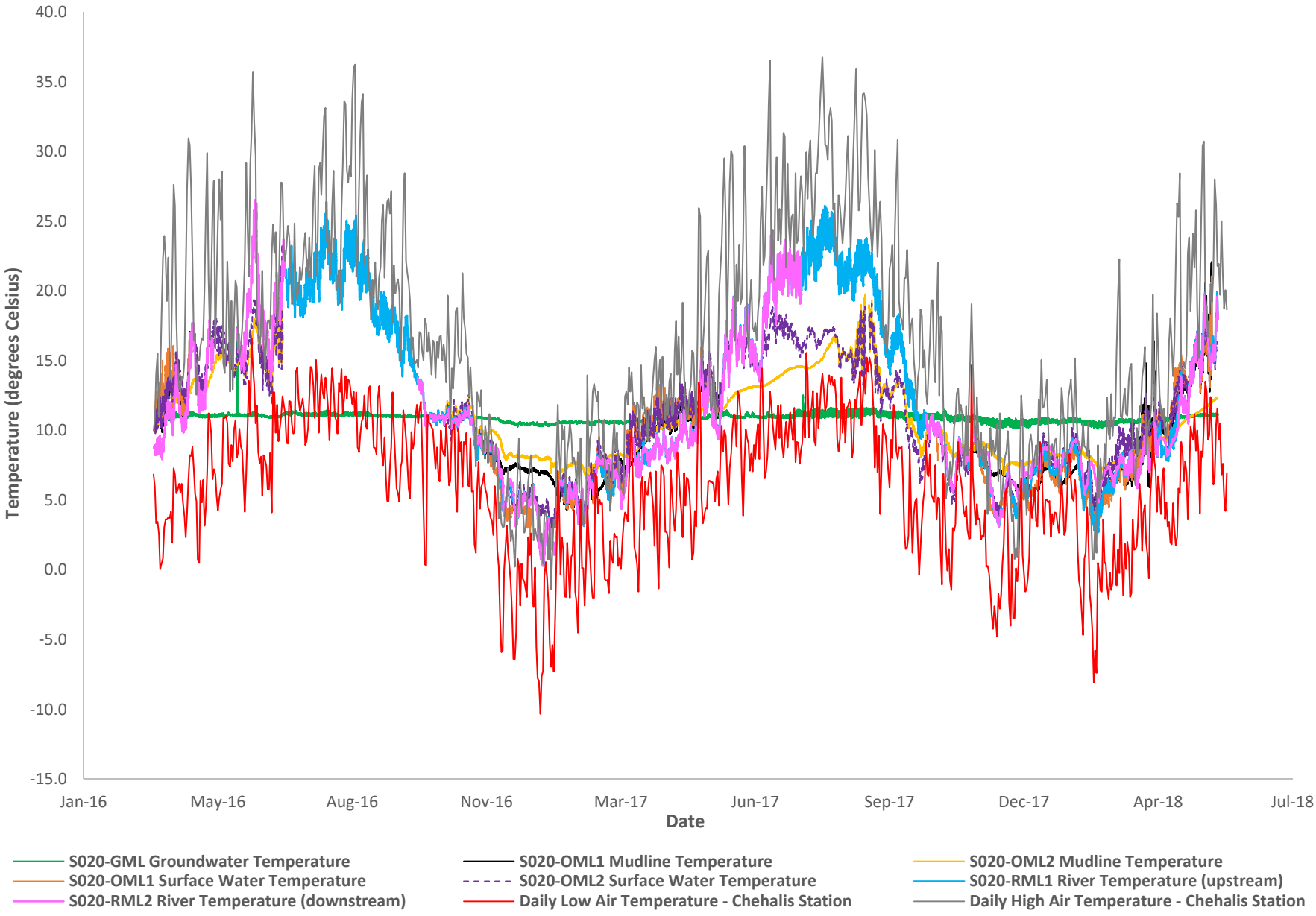


Figure D-4b. Site 020 Mudline Temperature and Daily High and Low Temperatures

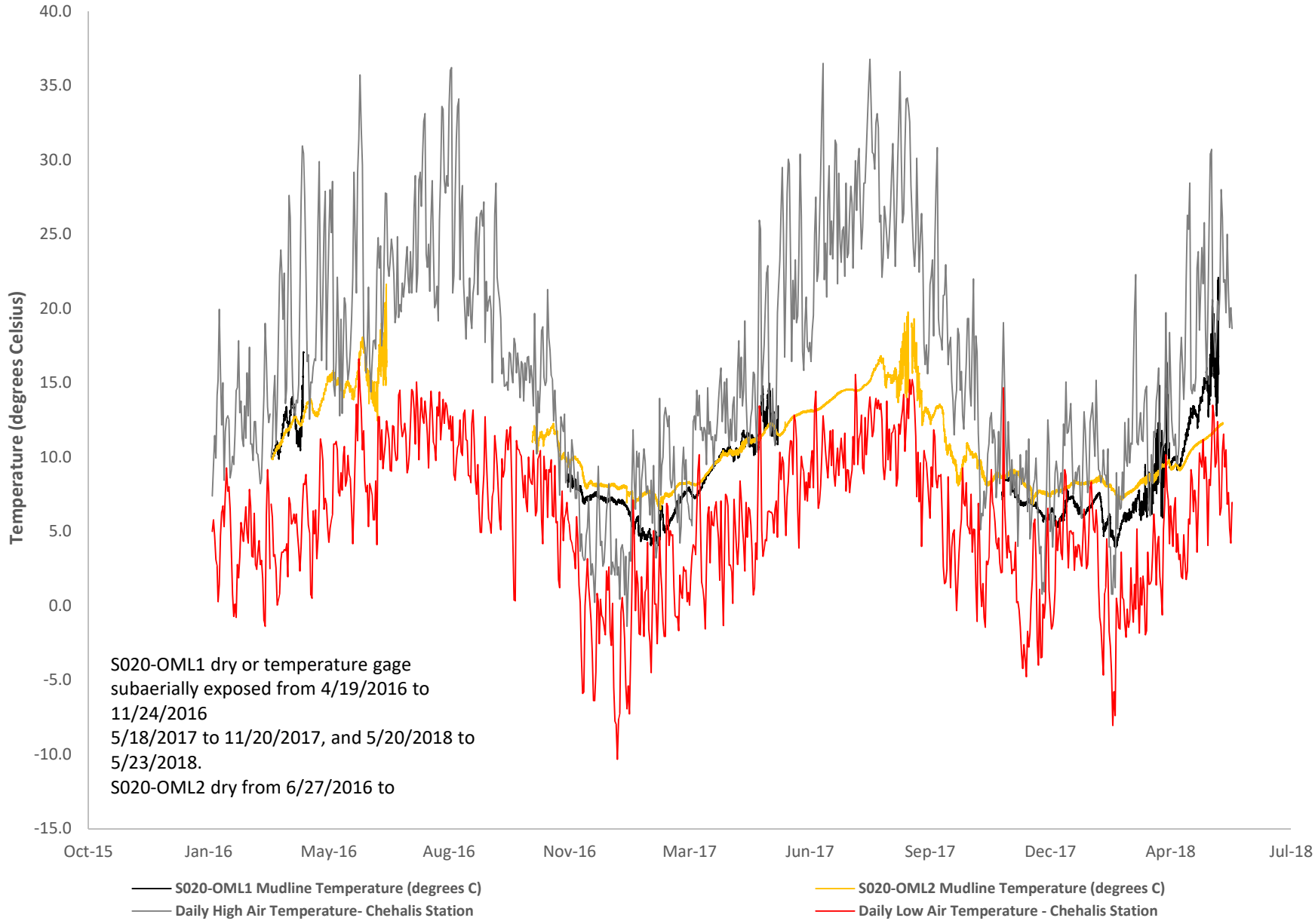


Figure D-5a. Site 086 Water Temperatures and Daily High and Low Temperatures

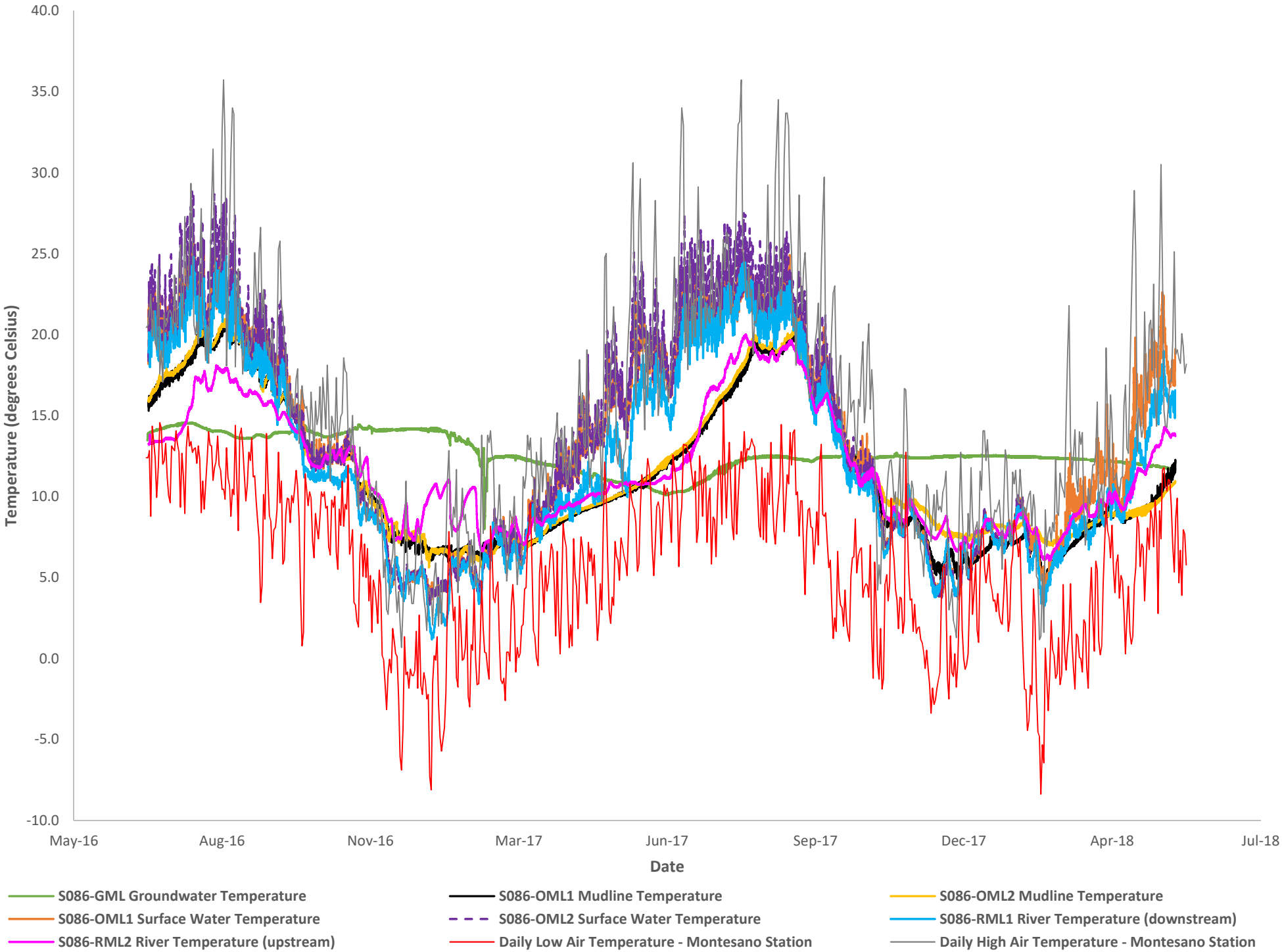
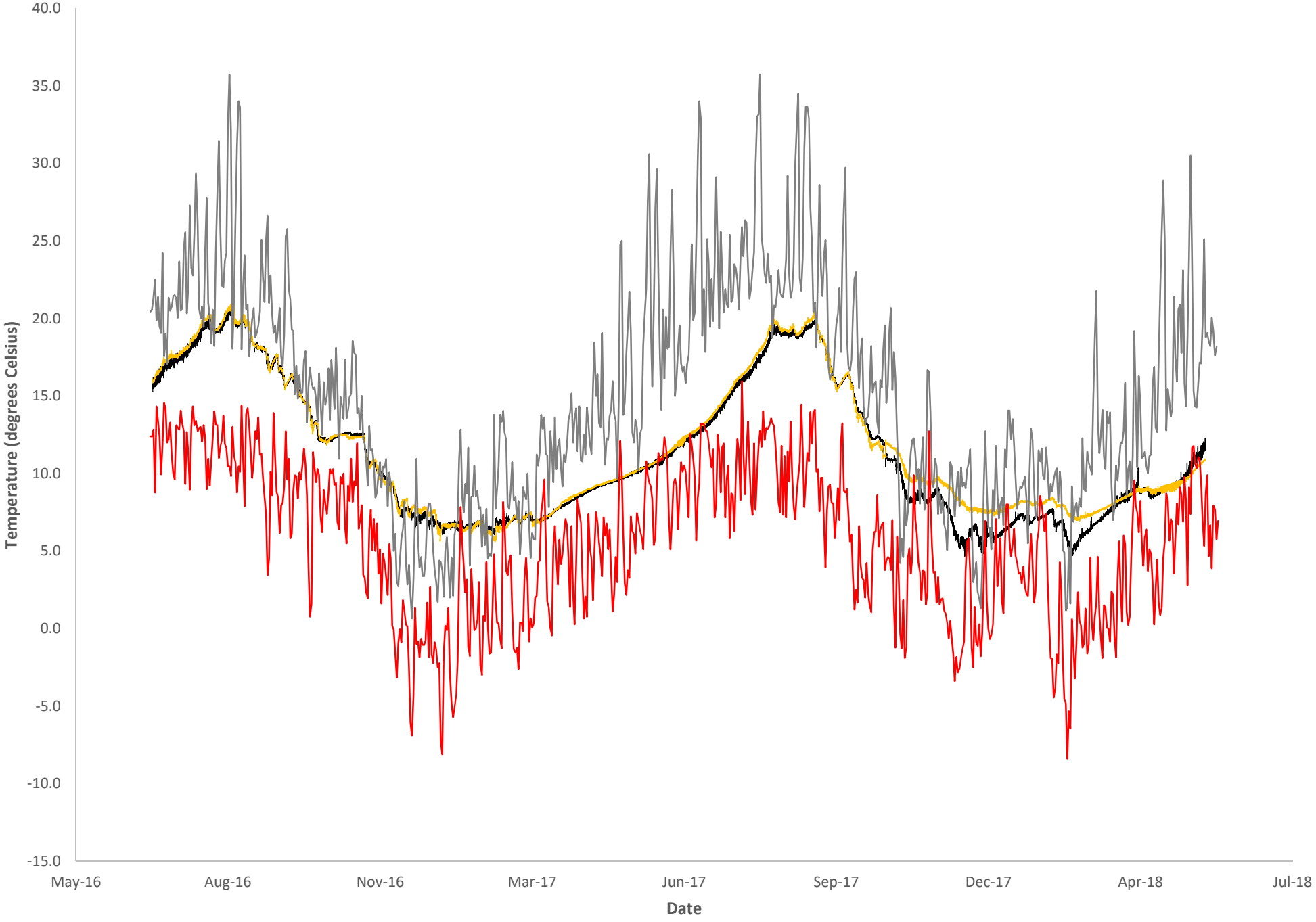


Figure D-5b. Site 086 Mudline Temperatures and Daily High and Low Temperatures



Appendix E
Chehalis River Gaining and Losing Reach Map

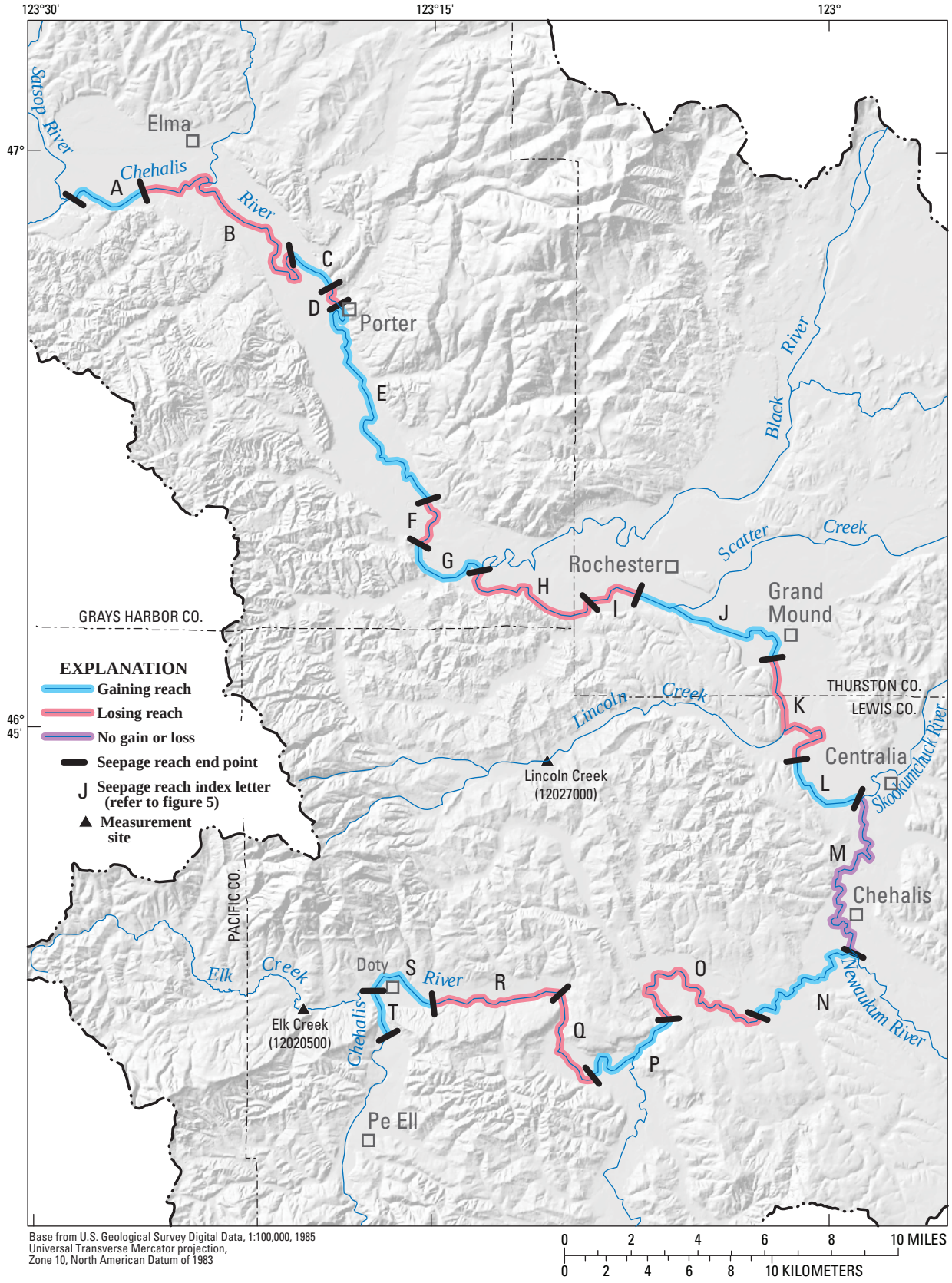


Figure 4. Discharge gains and losses in reaches along the Chehalis River, Washington.

Appendix F
Acoustic Doppler Current Profiler Flow Survey Results

ACOUSTIC DOPPLER CURRENT PROFILER FLOW SURVEY RESULTS

Table F-1
Chehalis River Acoustic Doppler Current Profiler Discharge Measurements and Water Level Elevations on April 24, 2017

LOCATION	TRANSECT ID	DATE	TIME	TOTAL DISCHARGE (CFS)	TOTAL DISCHARGE DIFFERENCE FROM AVERAGE	AVERAGE DISCHARGE (CFS)	FLOW SPEED (FEET PER SECOND)	FLOW SPEED DIFFERENCE FROM AVERAGE	AVERAGE FLOW SPEED (FEET PER SECOND)	TIME	WATER LEVEL AT SITES 020 AND 068 RML2 (UPSTREAM) FEET (NAVD88)	WATER LEVEL AT SITES 020 AND 068 RML1 (DOWNSTREAM) FEET (NAVD88)	ADNA GAGE (NO. 12021800)			
													WATER LEVEL ELEVATION FEET (NAVD88)*	TOTAL DISCHARGE (CFS)	AVERAGE DISCHARGE (CFS)	AVERAGE DISCHARGE DIFFERENCE BETWEEN TRANSECTS AND GAGE
Central transects between Sites 020 and 068	2003	4/24/2017	11:23	1,851	101%	1,830	2.21	99%	2.24	11:30	161.51	161.37	196.10	1,800	1,817	101%
	2004		11:27	1,803	99%		2.24	100%								
	2005		11:32	1,855	101%		2.33	104%								
	2006		11:37	1,774	97%		2.22	99%								
	2007		11:41	1,881	103%		2.29	102%		11:45	161.53	161.38	196.13	1,820		
	2008		11:46	1,824	100%		2.21	98%								
	2010		11:55	1,823	100%		2.21	98%		12:00	161.56	161.36	196.14	1,830		
Downstream transects between Sites 020 and 068	4000	4/24/2017	12:38	1,907	100%	1,905	2.30	99%	2.33	12:45	161.68	161.56	196.14	1,830	1,857	103%
	4001		12:43	1,859	98%		2.48	106%								
	4002		12:47	1,928	101%		2.33	100%								
	4003		12:55	1,876	98%		2.28	98%		13:00	161.72	161.59	196.15	1,840		
	4004		13:00	1,937	102%		2.29	98%								
	4006		13:08	1,925	101%		2.31	99%		13:15	161.75	161.57	196.21	1,900		
Washington Route 603 bridge transects	5000	4/24/2017	15:38	2,119	102%	2,084	2.22	105%	2.12	15:45	162.30	161.89	196.41	2,080	2,120	98%
	5003		15:55	2,012	97%		2.05	97%		16:00	162.35	161.90	196.44	2,110		
	5004		15:58	2,143	103%		2.05	97%								
	5006		16:05	2,046	98%		2.09	99%								
	5007		16:09	2,061	99%		2.22	105%		16:15	162.41	161.97	196.50	2,170		
	5008		16:13	2,123	102%		2.08	98%								

Notes:
*Conversion from the gage's native datum (NVGD29) to North American Vertical Datum of 1988 (NAVD88) is +3.40 feet: https://www.ngs.noaa.gov/cgi-bin/VERTCON/vert_con.prl